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HANDBOOK OF NATURAL PRODUCTS

VOLUME 5: DITERPENOIDS, TRITERPENOIDS, SESTERTERPENOIDS, TETRATERPENOIDS, AND CAROTENOIDS

Edited by Hailin Qin, Dequan Yu

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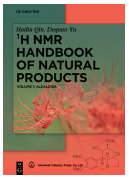

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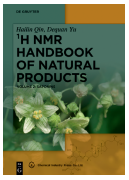

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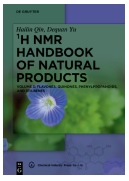

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^{1}H NMR Handbook of Natural Products

Volume 5: Diterpenoids, Triterpenoids, Sesterterpenoids, Tetraterpenoids, and Carotenoids

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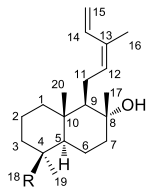
10 Diterpenoids

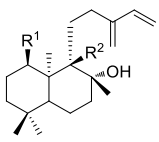
10.1 Labdane-type diterpenoids

Table 10-1-1: Compounds, MFs, and test solvents of labdane-type diterpenoids **10-1-1**~**10-1-30**.

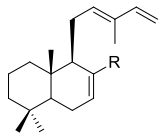
No.	Compounds	MFs	Test solvents	References
10-1-1	*cis*-19-hydroxyabienol	$C_{20}H_{34}O_2$	–	[1]
10-1-2	8*α*-hydroxy-12*Z*,14-labdadien-19-al	$C_{20}H_{32}O_2$	–	[1]
10-1-3	*ent*-labda-13(16),14-dien-8*α*-ol	$C_{20}H_{34}O$	$CDCl_3$	[2]
10-1-4	*ent*-labda-13(16),14-dien-1*β*,8*α*-diol	$C_{20}H_{34}O_2$	$CDCl_3$	[2]
10-1-5	*ent*-8*α*,9*β*-dihydroxylabda-13(16),14-dien-1-one	$C_{20}H_{32}O_3$	$CDCl_3$	[2]
10-1-6	labda-7,12(*E*),14-triene	$C_{20}H_{32}$	$CDCl_3$	[3]
10-1-7	labda-7,12(*E*),14-triene-17-al	$C_{20}H_{30}O$	$CDCl_3$	[3]
10-1-8	labda-7,12(*E*),14-triene-17-ol	$C_{20}H_{32}O$	$CDCl_3$	[3]
10-1-9	labda-7,12(*E*),14-triene-17-oic acid	$C_{20}H_{30}O_2$	$CDCl_3$	[3]
10-1-10	8*α*-hydroxy-11*E*,13*Z*-labdadien-15-al	$C_{20}H_{32}O_2$	$CDCl_3$	[4]
			CD_3COCD_3	[4]
10-1-11	8*α*,19-dihydroxylabd-13*E*-en-15-oic acid	$C_{20}H_{34}O_4$	$CDCl_3$	[5]
10-1-12	labda-8,14-dien-13-ol	$C_{20}H_{34}O$	$CDCl_3$	[6]
10-1-13	labda-7,14-dien-9,13-diol	$C_{20}H_{34}O_2$	$CDCl_3$	[6]
10-1-14	13-hydroxy-7-oxo-labda-8,14-diene	$C_{20}H_{32}O_2$	$CDCl_3$	[6]
10-1-15	physacoztomatin	$C_{20}H_{34}O_2$	$CDCl_3$	[7]
10-1-16	–	$C_{23}H_{38}O_6$	$CDCl_3$	[8]
10-1-17	–	$C_{23}H_{38}O_5$	$CDCl_3$	[8]
10-1-18	–	$C_{23}H_{36}O_6$	$CDCl_3$	[8]
10-1-19	–	$C_{25}H_{38}O_6$	$CDCl_3$	[8]
10-1-20	–	$C_{23}H_{36}O_5$	$CDCl_3$	[8]
10-1-21	–	$C_{23}H_{34}O_5$	$CDCl_3$	[8]
10-1-22	(8*S**)-hydroperoxy-(13*S**)-hydroxy-9(11),14-labdadiene	$C_{20}H_{34}O_3$	C_6D_6	[9]
10-1-23	(8*S**,13*S**)-dihydroxy-9(11),14-labdadiene	$C_{20}H_{34}O_2$	$CDCl_3$	[9]
10-1-24	(13*S**)-hydroxy-7,9(11),14-labdatriene	$C_{20}H_{32}O$	C_6D_6	[9]
10-1-25	1*α*,5*α*,8*α*-trihydroxy-13*E*-labden-12-one	$C_{20}H_{34}O_4$	$CDCl_3$	[10]
10-1-26	5*α*,8*α*-dihydroxy-13*E*-labden-12-one	$C_{20}H_{34}O_3$	$CDCl_3$	[10]
10-1-27	vitetrifolin I	$C_{20}H_{34}O_3$	$CDCl_3$	[11]
10-1-28	spicatanoic acid	$C_{17}H_{24}O_3$	$CDCl_3$	[12]
10-1-29	13,14,15,16-tetranorlabdane-8*α*,12,14-triol	$C_{16}H_{30}O_3$	$CDCl_3$	[5]
10-1-30	agallochin B	$C_{20}H_{33}ClO_3$	$CDCl_3$	[13]



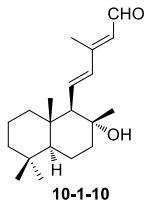
10-1-1 R = CH_2OH
10-1-2 R = CHO



	R^1	R^2
10-1-3	H	H
10-1-4	OH	H
10-1-5	=O	OH



10-1-6 R = Me
10-1-7 R = CHO
10-1-8 R = CH_2OH
10-1-9 R = COOH



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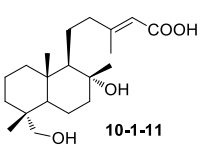

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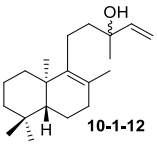

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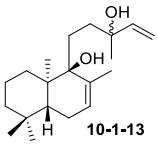

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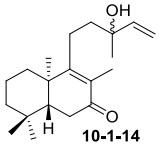

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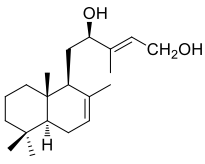

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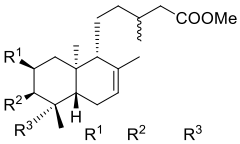
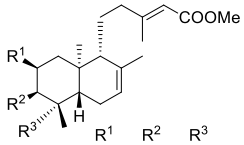
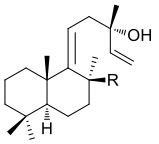


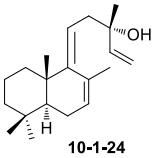
	R1	R2	R3
10-1-16	OH	OH	CH_2OAc
10-1-17	H	OAc	CH_2OH
10-1-18	OAc	OH	CHO



	R1	R2	R3
10-1-19	OAc	OAc	Me
10-1-20	H	OAc	CH_2OH
10-1-21	H	OAc	CHO



10-1-22 R = OOH
10-1-23 R = OH



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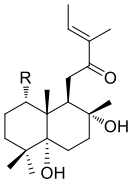
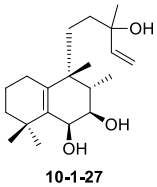


10-1-25 R = OH
10-1-26 R = H



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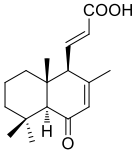

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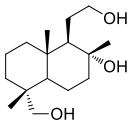

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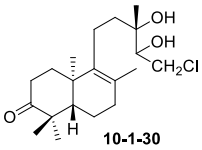

10-1-30

Table 10-1-2: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-1**~**10-1-4**.

H	10-1-1	10-1-2	10-1-3	10-1-4
1	α 0.99 m, β 1.71 m	α 1.00 m, β 1.74 m	1.67 m, 0.90 m	3.62 br s
2	α 1.55 m	α 1.62 m	1.39 m	2.00 tdd(14.5, 4.0, 2.5)
	β 1.44 m	β 1.48 m	1.59 m	1.45 m
3	α 0.96 m	α 1.03 m	1.13 m	1.60 m
	β 1.77 m	β 2.12 m	1.38 m	1.14 ddd(13.5, 4.0, 3.0)
5	1.11 dd(12.3, 2.0)	1.30 dd(12.3, 2.0)	0.86 m	1.30 dd(11.5, 2.5)
6	α 1.74 m, β 1.30 m	α 1.96 m, β 1.63 m	1.50 m	1.52 m
7	α 1.40 m	α 1.45 m	1.48 m	1.70 dt(13.0, 3.0)
	β 1.85 dt(12.1, 3.0)	β 1.93 m	1.74 m	1.49 m
9	1.33 m	1.36 dd(6.4, 4.5)	0.87 m	1.54 m
11	2.20 m, 2.43 m	2.19 m, 2.43 m	1.56 m, 1.46 m	1.53 m
12	5.49 t(7.4)	5.49 br t(7.6)	2.24 td(14.5, 5.5)	2.46 m
			2.19 td(14.5, 5.5)	2.34 m

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Table 10-1-2 (continued)

H	10-1-1	10-1-2	10-1-3	10-1-4
14	6.88 ddd(17.3, 10.8, 0.8)	6.85 dd(17.3, 10.8)	6.35 dd(17.5, 10.5)	6.36 dd(17.5, 11.0)
15	5.21 d(17.3) 5.12 d(10.8)	5.21 br d(17.3) 5.13 br d(10.8)	5.22 d(17.5) 5.04 d(10.5)	5.28 d(17.5) 5.06 d(11.0)
16	1.80 br s	1.80 br s	5.00 s, 4.99 s	5.03 br s, 5.01 br s
17	1.18 s	1.22 s	1.15 s	1.19 s
18	3.44 d(11.1), 3.69 d(11.1)	9.73 s	0.86 s	0.89 s
19	0.98 s	1.02 s	0.81 s	0.83 s
20	0.83 s	0.71 s	0.93 s	0.94 s

Table 10-1-3: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-5**~**10-1-7**.

H	10-1-5	10-1-6	10-1-7
1		1.00 ddd(13.4, 3.4, 3.4) 1.85 m	1.00 dd(13.1, 3.7, 3.7) 1.90 ddd(13.1, 3.0, 5.2)
2	2.03 m, 2.98 ddd(14.0, 13.0, 5.5)	1.45 m, 1.53 m	1.40 m, 1.50 m
3	1.62 td(14.0, 4.5), 1.76 m	1.41 m, 1.16 ddd(13.1, 3.7, 3.7)	1.43 m, 1.16 m
5	2.09 dd(12.0, 2.5)	1.19 dd(12.2, 4.9)	1.13 dd(12.5, 4.3)
6	1.43 m, 1.77 m	1.87 m, 1.97 m	2.18 m, 2.34 m
7	1.39 m, 1.88 td(13.5, 4.0)	5.42 ddd(4.0, 1.5, 1.5)	6.83 ddd(5.8, 2.1, 2.1)
9		1.89 m	2.31 m
11	1.78 m 1.99 m	2.11 ddd(16.5, 7.6, 7.6) 2.29 ddd(16.5, 1.8, 4.0)	2.47 ddd(16.8, 2.1, 6.4) 2.62 ddd(16.8, 7.0, 7.0)
12	2.30 td(13.0, 3.5), 2.56 td(13.0, 4.5)	5.51 br t(6.7)	5.44 br t(6.7)
14	6.34 dd(17.5, 11.0)	6.35 dd(17.4, 10.7)	6.29 dd(17.4, 10.9)
15	5.34 d(17.5), 5.04 d(11.0)	4.89 d(10.7), 5.04 d(17.4)	4.84 d(10.9), 5.00 d(17.4)
16	5.00 s, 4.97 s	1.74 s	1.70 s
17	1.22 s	1.60 s	9.37 s
18	0.93 s	0.88 s	0.91 s
19	1.06 s	0.86 s	0.86 s
20	1.44 s	0.79 s	0.79 s

Table 10-1-4: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-8**~**10-1-10**.

H	10-1-8	10-1-9	10-1-10 ($CDCl_3$)	10-1-10 (CD_3COCD_3)
1	1.01 ddd(13.1, 3.7, 3.7) 1.89 m	1.01 ddd(12.5, 3.4, 3.4) 1.87 ddd(12.5, 5.2, 3.7)	–	–
2	1.45 m, 1.53 m	1.41 d(2.5), 1.50 m	–	–
3	1.16 ddd(13.4, 3.7, 3.7) 1.40 m	1.15 ddd(14.0, 3.1, 3.1) 1.42 m	–	–

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Table 10-1-4 (continued)

H	10-1-8	10-1-9	10-1-10 ($CDCl_3$)	10-1-10 (CD_3COCD_3)
5	1.23 dd(12.5, 4.9)	1.17 dd(12.2, 4.3)	–	–
6	1.90 m	2.03 dddd(19.2, 12.2, 4.3, 2.1)	–	–
	2.05 m	2.19 dddd(19.2, 6.1, 4.3, 2.1)		
7	5.75 ddd(5.2, 2.5, 2.5)	6.90 ddd(6.1, 2.1, 2.1)	–	–
9	2.07 m	2.37 m	1.96 d(10.2)	1.95 d(10.0)
11	2.33 br d(16.5)	2.30 br dd(16.8, 6.1)	6.25~6.29	6.45 dd(15.6, 10.0)
	2.15 ddd(16.5, 8.2, 8.2)	2.58 ddd(16.8, 7.3, 7.3)		
12	5.55 br t(6.7)	5.47 br t(6.4)	6.25~6.29	6.29 d(15.6)
14	6.34 dd(17.4, 10.7)	6.31 dd(17.4, 10.9)	5.90 d(8.4)	5.81 d(8.0)
15	4.91 d(10.7), 5.06 d(17.4)	4.84 d(10.9), 5.00 d(17.4)	10.09 d(8.4)	10.12 d(8.0)
16	1.75 s	1.67 s	2.27 s	2.33 s
17	3.86 d(12.8)		1.23 s	1.23 s
	4.05 ddd(12.8, 1.8, 0.9)			
18	0.87 s	0.89 s	0.80 s	0.83 s
19	0.85 s	0.86 s	0.87 s	0.88 s
20	0.77 s	0.82 s	0.95 s	1.00 s

Table 10-1-5: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-11**~**10-1-14**.

H	10-1-11	10-1-12	10-1-13	10-1-14
1	*α* 0.98 br t(12.4)	1.78 dt(13.3, 3.5)	1.56	ax 1.35
	β 1.67 m	1.11 td(13.3, 4.5)	1.18 td(12.7, 4.0)	eq 1.91 br d(13.3)
2	*α* 1.45 m, *β* 1.57 m	1.58, 1.38	1.76, 1.46	ax 1.65, eq 1.58
3	*α* 1.42 m, *β* 1.25 m	1.11 td(13.3, 4), 1.38	1.20, 1.31	ax 1.21, eq 1.48 br d(13.7)
5	1.28 m	1.08 dd(12.6, 1.9)	1.75 dd(14.0, 4.5)	1.65 dd(13.8, 3.8)
6	*α* 1.57 m	1.98	1.85	ax 2.35 t(14.2)
	β 1.26 m	1.86	2.03	eq 2.48 dd(14.2, 3.8)
7	*α* 1.44 m, *β* 1.86 m	1.89	5.50 br s	
9	1.12 m			
11	*α* 1.67 m, *β* 1.42 m	1.95, 1.6	1.90	2.26 t(8.9)
12	*α* 2.33 m, *β* 2.22 m	1.55	2.09, 1.89	1.58, 1.68
14	5.72 br s	5.82 dd(17.2, 10.7)	6.02 dd(17.5, 10.9)	5.94 dd(17.3, 10.8)
15		5.20 dd(17.2, 1.1)	5.05 dd(17.5, 1.3)	5.26 dd(17.3, 1.1)
		5.05 dd(10.7, 1.1)	4.92 dd(10.9, 1.3)	5.13 dd(10.8, 1.1)
16	2.18 br s	1.27 s	1.36 s	1.34 s
17	1.16 s	1.52 s	1.78 d(1.5)	1.74 s
18	0.74 s	0.80 s	0.87 s	0.88 s
19	*α* 3.43 d(10.7)	0.85 s	0.85 s	0.91 s
	β 3.12 d(10.7)			
20	0.84 s	0.91 s	0.78 s	1.08 s

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Table 10-1-6: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-15**~**10-1-17**.

H	10-1-15	10-1-16	10-1-17
1	1.85 br d(13) 1.04 ddd(13, 13, 4)	*α* 1.84 dd(12.5, 4.5) *β* 1.50 br dd(12.5, 12.5)	–
2	1.54 m, 1.48 m	4.01 ddd(12.5, 4.5, 2.5)	*α* 1.84 ddd(15, 15, 4, 2), *β* 1.73 m
3	1.41 br d(13) 1.18 ddd(13, 13, 4)	3.78 br d(2.5)	5.15 dd(2)
5	1.25 dd(12, 5)	1.73 dd(12, 5)	1.73 m
6	2.00 m, 1.88 m	1.85~2.0 m	1.87~2.0 m
7	5.42 br s	5.37 br s	5.37 br s
9	2.02 m	–	–
11	1.54 m, 1.42 m	–	
12	4.13 dd(10, 2)	–	
14	5.66 tdq(6.5, 1, 1)	2.34 dd(15, 6), 2.12 dd(15, 8)	2.33 dd(15, 6), 2.13 dd(15, 8)
15	4.23 dd(12.5, 6.5) 4.20 dd(12.5, 6.5)		
16	1.71 br s	0.96 d(6.5)	0.96 d(6.5)
17	1.69 s	1.65 br s	1.66 br s
18	0.88 s	1.11 s	0.98 s
19	0.86 s	4.18 d(11), 4.03 d(11)	3.84 br d(11.5), 3.60 br d(11.5)
20	0.74 s	0.80 s	0.75 s
OMe		3.65 s	3.66 s
OAc		2.06 s	2.06 s

Table 10-1-7: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-18**~**10-1-21**.

H	10-1-18	10-1-19	10-1-20	10-1-21
1	*α* 1.85 dd(12.5, 4.5) *β* 1.55 br dd(12.5, 12.5)	*α* 1.78 dd(12.5, 4.5) *β* 1.58 m	–	–
2	5.10 ddd(12.5, 4.5, 2.5)	5.22 ddd(12.5, 4.5, 2.5)	*α* 1.83 dddd(15.0, 15.0, 3.5, 2.5) *β* 1.73 m	*α* 1.83 dddd(15.0, 15.0, 3.5, 2.5) *β* 1.75 dddd(15, 3.5, 3.5, 3.5)
3	4.11 br s	5.05 d(2.5)	5.16 dd(3.5, 2.5)	5.38 dd(3.5, 2.5)
5	1.97 dd(12, 5)	1.58 m	1.75 dd(12.5, 5)	1.95 dd(12.5, 5)
6	*α* 2.16 m *β* 2.22 br d(5)	1.90 br s	1.85~2.0 m	*α* 2.23 br dd(16, 12.5) *β* 2.18 br d(16, 5)
7	5.41 br s	5.44 br s	5.40 br s	5.44 br s
9	1.75 br s	1.83 br s	–	–
14	2.33 dd(15, 6) 2.11 dd(15, 8)	5.68 br q(1.5)	5.68 br q(1.5)	5.67 br q(1.5)
16	0.94 d(6.5)	2.18 d(1.5)	2.18 d(1.5)	2.17 d(1.5)
17	1.67 br s	1.72 br s	1.70 br s	1.72 br s

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Table 10-1-7 (continued)

H	10-1-18	10-1-19	10-1-20	10-1-21
18	1.19 s	1.07 s	0.98 s	1.04 s
19	9.82 s	0.87 s	3.83 br d(11.5) 3.60 br d(11.5)	9.84 s
20	0.72 s	0.89 s	0.76 s	0.67 s
OMe	3.69 s	3.69 s	3.68 s	3.68 s
OAc	2.09 s	2.10 s, 2.00 s	2.06 s	2.07 s

Table 10-1-8: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-22**~**10-1-24**.

H	10-1-22	10-1-23	10-1-24
1	1.25 ddd(13.7, 13.7, 4.7), 1.92 br d	1.14 m, 1.87 d-like(11.4)	1.46~1.53 m, 1.77 br t-like
2	1.43 dq(14.0, 3.6), 1.51~1.67 m	1.44~1.79 m	1.46~1.53 m, 1.56 m
3	1.04 ddd(13.2, 13.2, 2.8) 1.34 d(13.2, 1.4)	1.07 ddd(13.5, 13.5, 4.0) 1.39 br d-like	1.10 ddd(13.5, 13.5, 3.3) 1.33 m
5	1.15 dd(11.5, 8.2)	1.21 dd(11.4, 8.4)	1.36 dd(11.0, 5.8)
6	1.51~1.67 m	1.44~1.79 m	1.91 br t, 2.06 m
7	1.51~1.67 m, 2.98 t-like	1.44~1.79 m, 2.02 q(10.9)	5.49 br s
11	5.47 dd(12.5, 4.1)	5.34 dd(10.6, 6.2)	5.45 t(7.4)
12	1.82 dd(14.0, 4.1) 3.56 dd(14.0, 12.4)	2.23 dd(13.9, 6.2) 3.12 dd(13.9, 10.6)	2.47 dd(15.4, 8.0) 2.59 dd(15.4, 6.3)
14	5.64 dd(17.3, 10.7)	5.90 dd(17.2, 10.9)	5.83 dd(17.3, 10.7)
15	4.97 dd(10.7, 1.4) 5.01 dd(17.3, 1.4)	5.07 dd(10.9, 1.8) 5.19 dd(17.2, 1.8)	4.99 dd(10.7, 1.6) 5.25 dd(17.3, 1.6)
16	1.01 s	1.32 s	1.18 s
17	1.39 d(0.8)	1.43 s	2.03 s
18	0.86 s	0.91 s	0.85 s
19	0.79 s	0.82 s	0.76 s
20	1.28 d(0.8)	1.15 s	1.02 s

Table 10-1-9: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-25**~**10-1-27**.

H	10-1-25	10-1-26	10-1-27
1	3.39 ddd(3.3, 3.3, 3.3) 5.85 dd(3.3, 1.4, OH)	ax 1.55 ddd(13.2, 13.2, 3.9) eq 0.94 br d(13.2)	1.96 m
2	ax 2.04 m, eq 1.69 m	ax 1.65~1.72 m, eq 1.42 m	1.62 m
3	ax 2.04 m eq 1.05 m	ax 1.65~1.72 m eq 1.10 br d(15.1)	1.50 m

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Table 10-1-9 (continued)

H	10-1-25	10-1-26	10-1-27
5	5.30 d(2.5, OH)	2.58 br s(OH)	
6	ax 1.56 dddd(14.0, 12.6, 4.4, 2.5) eq 1.64 m	ax 1.65~1.72 m	4.10 d(3.6)
7	ax 2.09 dddq(14.3, 12.6, 4.4, 1.1) eq 1.64 m	ax 2.13 ddd(14.0, 14.0, 4.9) eq 1.65~1.72 m	3.45 dd(10.7, 3.6)
8	1.16 br s(OH)	2.56 br s(OH)	1.73 dq(10.7, 7.3)
9	3.04 dd(5.8, 3.3)	3.10 dd(5.5, 4.4)	
11	3.21 dd(17.9, 3.3), 2.38 dd(17.9, 5.8)	2.72 dd(17.3, 4.4), 2.76 dd(17.3, 5.5)	1.36 m, 1.43 m
12			1.12 m, 1.44 m
14	7.05 qq(7.1, 1.1)	6.81 qq(6.9, 1.1)	5.82 dd(17.3, 10.7)
15	1.89 dq(7.1, 1.1)	1.86 dq(6.9, 1.1)	5.18 dd(17.3, 1.1) 5.06 dd(10.7, 1.1)
16	1.81 q(1.1)	1.77 t(1.1)	1.23 s
17	1.19 d(1.1)	1.13 s	1.08 d(7.3)
18	1.00 s	0.89 s	1.18 s
19	0.99 s	0.99 s	1.06 s
20	0.89 s	1.01 s	1.01 s

Table 10-1-10: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-28**~**10-1-30**.

H	10-1-28	10-1-29	10-1-30
1	1.52 m	α 0.93 br t(11.0), β 1.66 m	2.05 m, 1.72 m
2	1.44 m	α 1.46 m, β 1.51 m	2.53 m, 2.46 m
3	1.22 m	α 1.21 m, β 1.43 m	
5	2.09 s	1.29 m	1.68 d(5.0)
6		α 1.57 m, β 1.29 m	2.00 m, 2.12 m
7	5.85 s	α 1.39 dd(12.5, 10.5) β 1.89 br d(10.5)	1.95 m, 2.02 m
9	3.01 d(7.0)	1.33 m	
11	6.94 dd(15.8, 9.8)	1.64 m	1.48 m, 1.52 m
12	6.01 d(15.8)	α 3.78 m, β 3.46 m	1.56 m, 1.62 m
14			3.63 dd(10, 2)
15			3.56 dd(10.8, 10) 3.73 dd(10.8, 2)
16			1.16 s
17	1.79 s	1.19 s	1.58 s
18	1.16 s	0.73 s	1.06 s
19	1.13 s	3.43 d(11.0), 3.09 d(11.0)	1.02 s
20	1.01 s	0.83 s	1.02 s
OAc		2.07 s, 2.10 s	

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Table 10-1-11: Compounds, MFs, and test solvents of labdane-type diterpenoids **10-1-31**~**10-1-59**.

No.	Compounds	MFs	Test solvents	References
10-1-31	henrilabdane A	$C_{20}H_{32}O_4$	CD_3COCD_3	[14]
10-1-32	henrilabdane C	$C_{20}H_{30}O_4$	C_5D_5N	[14]
10-1-33	henrilabdane B	$C_{20}H_{32}O_4$	CD_3OD	[14]
10-1-34	methyl-*ent*-labd-8(17)-en-18-oic acid-15-oate	$C_{21}H_{34}O_4$	$CDCl_3$	[15]
10-1-35	juniperexcelsic acid	$C_{22}H_{32}O_4$	$CDCl_3$	[16]
10-1-36	15-oxolabda-8(17),11(*Z*),13(*E*)-trien-19-oic acid	$C_{20}H_{28}O_3$	$CDCl_3$	[17]
10-1-37	15-oxolabda-8(17),11(*Z*),13(*Z*)-trien-19-oic acid	$C_{20}H_{28}O_3$	$CDCl_3$	[17]
10-1-38	3-acetoxy-2-hydroxy-labda-8(17),12(*E*),14-triene	$C_{22}H_{34}O_3$	$CDCl_3$	[18]
10-1-39	2,3-dihydroxy-labda-8(17),12(*E*),14-triene	$C_{20}H_{32}O_2$	$CDCl_3$	[18]
10-1-40	2*α*,3*α*-dihydroxy-labda-8(17),12(13),14(15)-triene	$C_{20}H_{32}O_2$	$CDCl_3$	[19]
10-1-41	crotonadiol	$C_{20}H_{34}O_2$	$CDCl_3$	[20]
10-1-42	*ent*-labd-8(17),13*E*-dien-15-ol	$C_{20}H_{34}O$	$CDCl_3$	[21]
10-1-43	16-oxo-8(17),12(*E*)-labdadien-15-oic acid	$C_{20}H_{30}O_3$	$CDCl_3$	[22]
10-1-44	8(17),12(*E*)-labdadien-15,16-dial	$C_{20}H_{30}O_2$	$CDCl_3$	[22]
10-1-45	19-acetoxy-2*α*,7*α*,15-tirhydroxylabda-8(17),(13*Z*)-diene	$C_{22}H_{36}O_5$	$CDCl_3$	[23]
10-1-46	15,19-diacetoxy-2*α*,7*α*-dihydroxylabda-8(17),(13*Z*)-diene	$C_{24}H_{38}O_6$	$CDCl_3$	[23]
10-1-47	19-acetoxy-2*α*,7*α*-dihydroxylabda-8(17),(13*Z*)-dien-15-al	$C_{22}H_{34}O_5$	$CDCl_3$ C_6D_6	[23] [23]
10-1-48	–	$C_{22}H_{34}O_5$	$CDCl_3$	[23]
10-1-49	19-acetoxy-7*α*,15-dihydroxylabda-8(17),(13*Z*)-dien-2-one	$C_{22}H_{34}O_5$	$CDCl_3$	[23]
10-1-50	2*α*,7*α*,15,19-tetrahydroxy-*ent*-labda-8(17),(13*Z*)-diene	$C_{20}H_{34}O_4$	CD_3OD	[23]
10-1-51	methyl-2*β*-hydroxy-9-*epi*-*ent*-labda-8(17),13(*E*)-dien-15-oate	$C_{21}H_{34}O_3$	$CDCl_3$	[24]
10-1-52	2*β*-hydroxy-9-*epi*-*ent*-labda-8(17),13(*E*)-dien-15-al	$C_{20}H_{32}O_2$	$CDCl_3$	[24]
10-1-53	methyl-2*β*-hydroxy-9-*epi*-*ent*-labda-8(17),13(*Z*)-dien-15-oate	$C_{21}H_{34}O_3$	$CDCl_3$	[24]
10-1-54	2*β*-hydroxy-9-*epi*-*ent*-labda-8(17),13(*Z*)-dien-15-al	$C_{20}H_{32}O_2$	$CDCl_3$	[24]
10-1-55	*ent*-labda-8(17),13-diene-15,16,19-triol	$C_{20}H_{34}O_3$	C_5D_5N	[25]
10-1-56	3,15,19-trihydroxy-*ent*-labda-8(17),13-dien-16-oic acid	$C_{20}H_{32}O_5$	C_5D_5N	[25]
10-1-57	3,19-dihydroxy-14,15,16-trinor-*ent*-labda-8(17),11-dien-13-oic acid	$C_{17}H_{26}O_4$	C_5D_5N	[25]
10-1-58	13,14,15,16-tetranor-*ent*-labd-8(17)-ene-3,12,19-triol	$C_{16}H_{28}O_3$	C_5D_5N	[25]
10-1-59	19-acetoxy-2*α*,7*α*-dihydroxylabda-14,15-dinorlabd-8(17)-en-13-one	$C_{20}H_{32}O_5$	$CDCl_3$	[23]

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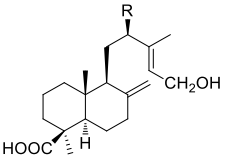
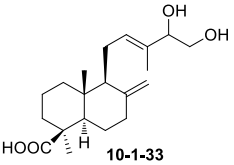


10-1-31 R = OH
10-1-32 R = =O



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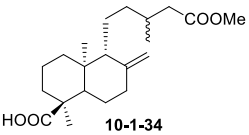

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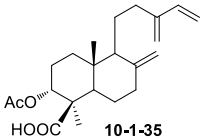

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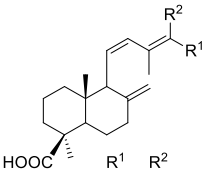
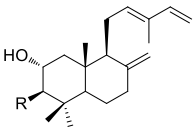
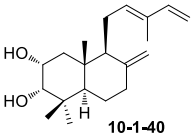


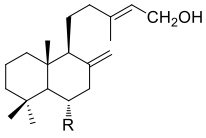
10-1-36 CHO H
10-1-37 H CHO



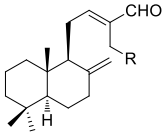
10-1-38 R = OAc
10-1-39 R = OH



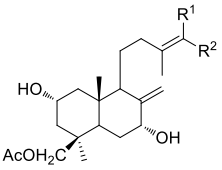
10-1-40



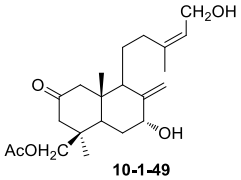
10-1-41 R = OH
10-1-42 R = H



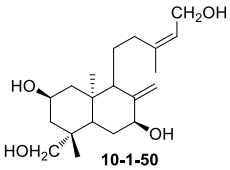
10-1-43 R = COOH
10-1-44 R = CHO



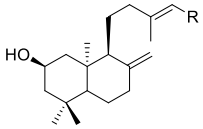
	R^1	R^2
10-1-45	CH_2OH	H
10-1-46	CH_2OAc	H
10-1-47	CHO	H
10-1-48	H	CHO



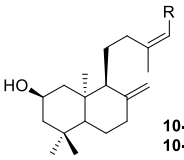
10-1-49



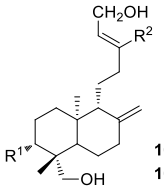
10-1-50



10-1-51 R = COOMe
10-1-52 R = CHO



10-1-53 R = COOMe
10-1-54 R = CHO



	R^1	R^2
10-1-55	H	CH_2OH
10-1-56	OH	COOH

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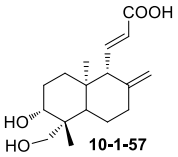
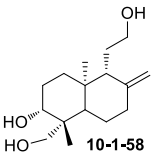
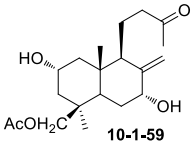


10-1-57



10-1-58



10-1-59

Table 10-1-12: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-31**~**10-1-34**.

H	10-1-31	10-1-32	10-1-33	10-1-34
1	1.18 m(ov), 1.82 m(ov)	1.14 ddd(14.0, 11.5, 4.0) 1.82 m	1.12 m(ov), 1.86 m(ov)	–
2	1.46 m, 1.86 m	1.54 m, 2.22 m(ov)	1.47 m, 1.84 m(ov)	–
3	1.08 ddd(13.0, 11.5, 4.0) 2.13 m(ov)	1.08 ddd(13.5, 13.5, 4.0) 2.09 m(ov)	1.09 ddd(13.5, 13.0, 4.0) 2.06 m(ov)	–
5	1.41 d(11.5)	1.42 d(11.0)	1.33 dd(12.0, 2.5)	–
6	2.03 m, 1.93 m(ov)	2.28 m(ov), 2.14 m(ov)	1.92 m(ov)	–
7	1.95 m(ov), 2.41 m	2.44 d(13.0), 2.41 m	1.83 m(ov), 2.32 m	
9	2.13 dd(11.5, 4.0)	2.85 d(10.0)	1.69 br d(10.0)	–
11	1.50 m, 1.63 m	2.71 d(15.0) 3.22 dd(15.0, 10.0)	1.98 m(ov), 2.25 m	–
12	3.95 d(10.0)		5.33 t(6.5)	–
14	5.53 t(6.5)	5.53 t(6.5)	3.90 dd(10.0, 7.0)	–
15	4.09 d(6.0)	4.68 d(5.5)	3.42 m	–
16	1.64 s	1.89 s	1.56 s	0.95 d(6.6)
17	4.51 s, 4.86 s	4.50 s, 4.80 s	4.43 s, 4.77 s	4.50 br s, 4.83 br s
19	1.21 s	1.34 s	1.15 s	1.14 s
20	0.64 s	0.92 s	0.61 s	0.70 s
OMe				3.66 s

Table 10-1-13: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-35**~**10-1-37**.

H	10-1-35	10-1-36	10-1-37
1	–	α 1.11 m, β 1.47 m	α 1.12 m, β 1.49 m
2	–	α 1.47 m, β 1.82 m	α 1.49 m, β 1.80 m
3	5.29 t(2.5), 2.09 s(OAc)	α 1.11 m, β 2.19 m	α 1.11 m, β 2.19 m
5	–	1.36 dd(12.3, 3.0)	1.36 dd(12.5, 3.0)
6	–	α 2.00 m, β 1.92 m	α 1.98 m, β 1.91 m
7α		α 2.48 m, β 2.06 m	α 2.47 m, β 2.04 m
9	–	2.49 m	2.50 m
11	–	6.34 dd(15.5, 10.0)	6.24 dd(10.0, 15.5)
12	–	6.20 d(15.5)	7.06 d(10.0)
14	6.36 dd(17.5, 10.5)	5.91 d(8.0)	5.85 d(8.0)
15	5.21 br d(17.5), 5.06 br d(10.5)	10.12 d(8.0)	10.17 d(8.0)
16	5.00 br s, 4.99 br d	2.29 d(1.0)	2.11 s
17	4.89 br s, 4.59 br s	4.44 d(1.5), 4.78 d(1.5)	4.44 d(1.5), 4.81 d(1.5)
19	1.21 s	1.28 s	1.28 s
20	0.60 s	0.79 s	0.79 s

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Table 10-1-14: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-38**~**10-1-40**.

H	10-1-38	10-1-39	10-1-40
1	1.29 dd(12.1, 12.1) 2.21 dd(4.3, 12.1)	1.18 dd(12.5, 11.7) 2.10 dd(12.5, 4.6)	1.21 m, 2.11 dd(12.4, 4.3)
2	3.81 ddd(11.6, 10.1, 4.3)	3.69 ddd(11.7, 9.6, 4.3)	3.70 ddd(11.3, 9.8, 4.2)
3	4.55 d(10.1), 2.15 s(OAc)	3.02 d(9.6)	3.02 d(9.6)
5	1.29 dd(12.8, 2.4)	1.19 dd(12.5, 2.7)	1.19 br d(12.3)
6	1.41 dddd(12.8, 12.8, 12.8, 4.3)	1.40 dddd(12.5, 12.5, 12.5, 4.3)	1.38 dddd(12.9, 12.8, 12.8, 4.1)
	1.72 dddd(12.8, 2.6, 5.2, 5.2)	1.71 m	1.69 m
7	2.02 ddd(13.1, 13.1, 4.9)	1.99 m, 2.39 ddd(12.8, 4.0, 2.4)	1.99 ddd(12.9, 12.8, 4.7)
	2.41 ddd(13.1, 4.3, 2.4)		2.39 m
9	1.80 br d(10.4)	1.76 br d(10.7)	1.73 m
11	2.19 m, 2.36 m	2.17 dd(11.0, 6.7), 2.34 br dd(11.0, 5.5)	2.19 dd(10.9, 7.0), 2.37 m
12	5.40 dd(6.4, 6.4)	5.38 dd(6.1, 6.1)	5.26 t(6.4)
14	6.32 dd(17.4, 11.0)	6.29 dd(17.4, 11.0)	6.73 dd(17.3, 10.8)
15	4.89 d(11.0), 5.05 d(17.4)	4.86 d(11.0), 5.02 d(17.4)	5.08 d(10.8), 5.17 d(17.3)
16	1.75 d(0.9)	1.72 d(0.9)	1.76 s
17	4.51 br d(1.5), 4.87 br d(1.5)	4.47 br d(1.2), 4.85 br d(1.2)	4.50 br s, 4.86 br s
18	0.87 s	0.80 s	0.80 s
19	0.90 s	1.01 s	1.02 s
20	0.80 s	0.78 s	0.78 s

Table 10-1-15: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-41**~**10-1-44**.

H	10-1-41	10-1-42	10-1-43	10-1-44
1	1.83 m	–	ax 1.08 ddd(12.7, 12.7, 4.0) eq 1.72 m	ax 1.06 ddd(12.5, 12.5, 4.2) eq 1.69 m
2	1.48 m, 1.53 m	–	1.59 m, 1.53 m	1.56 m, 1.52 m
3	–	–	ax 1.42 m, eq 1.21 m	ax 1.42 m, eq 1.20 m
5	1.14 d(10.7)	–	1.14 dd(12.6, 2.6)	1.13 dd(12.6, 2.7)
6	3.83 br dt(10.7, 4.9)	–	ax 1.35 m, eq 1.74 m	ax 1.35 m, eq 1.75 m
7	α 2.04 br t(12.0) β 2.68 dd(12.1, 4.9)	–	ax 2.03 ddd(13.0, 12.8, 5.0) eq 2.42 m	ax 2.03 ddd(13.0, 12.8, 4.6) eq 2.42 ddd(13.0, 4.6, 2.4)
9	1.64 br d(11.8)	–	1.92 dd(11.0, 3.1)	1.90 dd(11.0, 3.1)
11	–	–	2.56 ddd(16.9, 6.6, 3.1) 2.38 ddd(16.9, 11.0, 6.6)	2.58 ddd(16.9, 6.5, 3.1) 2.38 ddd(16.9, 11.0, 6.5)
12	1.92 br dt(14.0, 8.0) 2.17 m	–	6.70 t(6.6)	6.76 t(6.5)
14	5.38 br t(6.9)	5.41 t(7.4)	ax 3.34 d(16.5), eq 3.40 d(16.5)	ax 3.39 d(17.1), eq 3.46 d(17.1)

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Table 10-1-15 (continued)

H	10-1-41	10-1-42	10-1-43	10-1-44
15	4.15 d(6.9)	4.17 d(7.4)		9.40 s
16	1.72 s	1.68 s	9.37 s	9.63 s
17	4.61 br s, 4.90 br s	4.46 s, 4.82 s	4.39 d(1.0), 4.86 d(1.2)	4.36 d(< 1.0), 4.86 d(< 1.0)
18	1.19 s	0.87 s	0.89 s	0.89 s
19	1.02 s	0.80 s	0.83 s	0.82 s
20	0.72 s	0.68 s	0.75 s	0.73 s

Table 10-1-16: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-45**~**10-1-47**.

H	10-1-45	10-1-46	10-1-47 ($CDCl_3$)	10-1-47 (C_6D_6)
1	2.06 m, 0.94 dd(11.5)	0.97 dd(9.5, 9.5), 2.10 m	0.93 m, 2.06 m	0.74 dd(11, 11), 1.99 m
2	3.90 m	3.90 m	3.88 m	3.57 m
3	0.99 dd(12), 2.03 m	1.02 dd(10.5, 10.5), 2.07 m	0.98 m, 2.04 m	0.84 dd(10.5, 10.5), 1.95 m
5	1.27 dd(4)	1.29 m	1.22 m	1.14 m
6	2.16 m, 1.28 m	1.31 m, 2.21 m	1.26 m, 2.17 m	1.40 m, 2.03 m
7	3.90 m	3.90 m	3.88 m	3.57 m
9	1.53 dd(10.1)	1.56 dd(10.0, 10.0)	1.55 dd(10.2, 10.2)	1.29 dd(10.5, 10.5)
11	1.64 m, 1.53 m	1.60 m, 1.67 m	1.63 m, 1.75 m	1.31 m, 1.39 m
12	2.06 m, 1.23 m	1.26 m, 2.09 m	2.48 m, 2.65 m	2.33 m, 2.41 m
14	5.40 t(7)	5.36 dd(7.0, 6.9)	5.88 d(8.1)	5.85 d(8.1)
15	4.03 br d(7)	4.47 dd(12.3, 7.2) 4.54 dd(12.6, 7.5)	9.78 d(8.1)	9.90 d(8.1)
16	1.71 br s	1.75 br s	1.95 br s	1.44 br s
17	5.26 br s, 4.76 br s	4.78 br s, 5.28 br s	4.76 br s, 5.32 br s	4.58 br s, 5.45 br s
18	4.14 d(11.1) 3.75 d(11.1)	3.77 d(11.1) 4.18 d(11.1)	3.74 d(11.2) 4.15 d(11.2)	3.72 d(11.1) 4.19 d(11.1)
19	1.03 s	1.06 s	1.03 s	0.89 s
20	0.70 s	0.73 s	0.72 s	0.55 s
OAc	2.03 s	2.04 s, 2.05 s	2.03 s	1.69 s

Table 10-1-17: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-48**~**10-1-51**.

H	10-1-48	10-1-49	10-1-50	10-1-51
1	0.93 m, 2.06 m	2.14 d(13.5), 2.44 d(13.5)	0.89 dd(11, 11), 2.16 m	α 2.09 dd(13.4, 4.2) β 1.76 dd(13.4, 11.8)
2	3.88 m		3.79 dddd(11.5, 4)	3.89 ddt(4.2, 11.8, 11.8)
3	0.98 m, 2.04 m	2.19 d(14), 2.56 d(14)	0.93 dd(11.5, 11.5) 2.03 ddd(12, 4, 2)	α 1.78 dd(14.0, 4.2) β 0.97 dd(14.0, 11.8)
5	1.22 m	1.83 dd(13.5, 3.0)	1.28 m	–

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Table 10-1-17 (continued)

H	10-1-48	10-1-49	10-1-50	10-1-51
6	1.26 m, 2.17 m	1.39 m, 2.27 m	1.24 m, 2.10 m	–
7	3.88 m	3.99 dd(11, 5)	3.84 m	–
9	1.55 dd(10.2, 10.2)	1.77 dd(7, 1)	1.58 dd(10.5, 10.5)	–
11	1.63 m, 1.75 m	1.48 m, 1.60 m	1.55 m, 1.66 m	–
12	2.48 m, 2.65 m	1.18 m, 2.10 m	2.07 m	–
14	5.83 d(8)	5.37 dd(7.5, 7.5)	5.36 dd(7, 7)	5.68 br s
15	9.96 d(8)	4.45 dd(12.5, 7) 4.55 dd(12.5, 7)	3.95 dd(7, 12.5) 4.02 dd(7, 12.5)	
16	2.14 br s	1.74 br s	1.73 br s	2.18 d(1.2)
17	4.70 br s, 5.26 br s	4.83 br s, 5.34 br s	4.77 br s, 5.27 br s	4.92 d(1.2), 4.54 br s
18	3.76 d(11.2) 4.14 d(11.2)	3.88 d(11.5) 3.92 d(11.5)	1.02 s	0.92 s
19	1.04 s	1.15 s	3.27 d(11.2), 3.59 d(11.2)	0.85 or 0.72 s
20	0.71 s	0.74 s	0.89 s	0.85 or 0.72 s
OAc	2.02 s	2.05 s		
OMe				3.62 s

Table 10-1-18: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-52**~**10-1-55**.

H	10-1-52	10-1-53	10-1-54	10-1-55
1	*α* 2.08 dd(13.8, 4.1) *β* 1.16 dd(13.8, 11.6)	–	*α* 2.06 dd(13.7, 4.2) *β* 1.15 dd(13.7, 11.8)	1.68~1.71 m 1.03 dt(13.2, 3.6)
2	3.89 ddt (11.6, 11.4, 4.1)	3.81 ddt (11.5, 11.5, 4.1)	3.88 ddt (11.8, 11.8, 4.2)	1.59 br d(12.0) 1.41~1.44 m
3	*α* 1.77 dd(13.8, 4.1) *β* 0.97 dd(13.8, 11.4)	–	*α* 1.77 dd(14.5, 4.2) *β* 0.94 dd(14.5, 11.8)	2.21 br d(13.2) 1.00 dt(13.2, 3.6)
5	–	–	–	1.23 dd(12.0, 2.1)
6	–	–	–	1.83~1.80 m, 1.38~1.41 m
7	–	–	–	2.37 br d(12.6) 1.96 dt(12.6, 4.8)
9	–	–	–	1.73 br d(10.8)
11	–	–	–	1.83~1.85 m, 1.66~1.70
12	–	–	–	2.70 br t(12.5), 2.24~2.27 m
14	5.86 d(8.1)	5.58 br s	5.87 d(8.2)	5.96 t(6.6)
15	9.98 d(8.1)		9.81 d(8.2)	4.59 d(6.3), 4.55 d(6.3)
16	2.18 s	1.83 d(1.2)	1.98 s	4.66 br s, 4.65 br s
17	4.90 s, 4.52 s	4.85 d(1.2), 4.64 br s	4.90 s, 4.60 s	4.91 s, 4.78 s
18	0.98 s	0.89 s	0.99 s	1.18 s
19	0.88 s or 0.72 s	0.76 s or 0.65 s	0.77 s or 0.88 s	3.98 d(10.2), 3.59 d(10.2)
20	0.88 s or 0.72 s	0.76 s or 0.65 s	0.77 s or 0.88 s	0.71 s
OMe		3.60 s		

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Table 10-1-19: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-56**~**10-1-59**.

H	10-1-56	10-1-57	10-1-58	10-1-59
1	1.68 br d(12.6) 1.18 dt(12.6, 3.6)	1.37~1.41 m 1.11 dt(13.2, 3.6)	1.73~1.77 m 1.21 dt(12.8, 4.0)	1.04 m, 2.06 m
2	2.01~2.03 m 1.96 br d(12.6)	1.94 dd(12.0, 4.5) 1.87~1.91 m	2.04~2.08 m 1.89~1.95 (ov)	3.88 m
3	3.62~3.66 (ov)	3.62~3.66 (ov)	3.60~3.63 (ov)	1.00 m, 2.04 m
5	1.21 dd(12.6, 2.4)	1.19 br d(13.2)	1.24 dd(12.0, 4.4)	1.26 m
6	1.75~1.77 m 1.31~1.35 m	1.76 br d(13.2) 1.41~1.43 m	1.77~1.80 m 1.32~1.37 m	1.26 m, 2.17 m
7	2.33 br d(12.9) 1.93 dt(12.9, 3.6)	2.37 br d(13.5) 2.00 dt(13.5, 4.5)	2.35 br d(12.8, 4.0) 1.94~1.98 (ov)	3.88 m
9	1.84 br d(10.8)	2.51 br d(10.2)	1.96 br d(9.4)	1.58 dd(10.4, 10.4)
11	2.61~2.65 m 2.46~2.51 m	7.35 dd(15.6, 10.2)	1.94~1.98 (ov) 1.79~1.81 m	1.62 m, 1.88 m
12	3.15 br t(7.2)	6.25 d(15.6)	3.99~4.03 m 3.77~3.83 m	2.30 m, 2.55 m
14	7.33 t(6.3)			
15	4.26 t(6.3), 4.23 t(6.3)			
16				2.08 br s
17	4.91 s, 4.72 s	4.83 s, 4.64 s	4.89 br s, 4.69 br s	5.21 br s, 4.65 br s
18	1.49 s	1.19 s	1.48 s	1.03 s
19	3.60 d(10.9), 4.46 d(10.9)	3.63 (ov), 4.46 d(10.8)	3.60~3.63 (ov), 4.47 d(10.8)	3.77 d(11.1), 4.12 d(11.1)
20	0.70 s	0.85 s	0.72 s	0.71 s
OAc				2.03 s

Table 10-1-20: Compounds, MFs, and test solvents of labdane-type diterpenoids **10-1-60**~**10-1-68**.

No.	Compounds	MFs	Test solvents	References
10-1-60	7-hydroxy-6-oxo-7,11,13-labdatrien-16,15-olide	$C_{20}H_{26}O_4$	$CDCl_3$	[26]
10-1-61	spicatanol	$C_{20}H_{26}O_4$	$CDCl_3$	[27]
10-1-62	leoheteronin A	$C_{20}H_{28}O_3$	$CDCl_3$	[28]
10-1-63	leoheteronin C	$C_{20}H_{28}O_4$	$CDCl_3$	[28]
10-1-64	sibiricinone B	$C_{20}H_{28}O_5$	$CDCl_3$	[29]
10-1-65	*ent*-labda-8(17),13-dien-15,16-olid-19-oic-acid methyl ester	$C_{21}H_{30}O_4$	$CDCl_3$	[30]
10-1-66	12-hydroxy-labda-8(17),13-dien-15,16-olide	$C_{20}H_{30}O_3$	$CDCl_3$	[30]
10-1-67	sibiricinone A	$C_{20}H_{30}O_6$	$CDCl_3$	[29]
10-1-68	deacetylvitexilactone	$C_{20}H_{32}O_4$	$CDCl_3$	[31]

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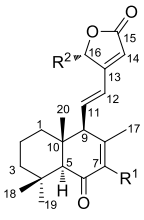
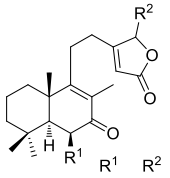
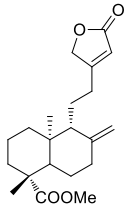


	R^1	R^2
10-1-60	OH	H
10-1-61	H	OH



	R^1	R^2
10-1-62	H	H
10-1-63	H	OH
10-1-64	OH	OH



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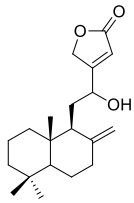
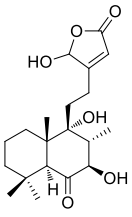
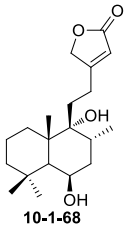


10-1-66



10-1-67



10-1-68

Table 10-1-21: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-60**~**10-1-63**.

H	10-1-60	10-1-61	10-1-62	10-1-63
1	1.59 m	1.61 m	1.91 br d(14.9)	1.85 br d(12.2)
			1.35 ddd(14.9, 12.7, 3.2)	1.30 ddd(13.0, 12.2, 3.6)
2	1.48 m	1.41 m	1.62 m	1.55 m
3	1.25 m	1.26 m	1.26 m, 1.51 br d(14.9)	1.43 br d(13.2)
				1.15 ddd(13.2, 13.1, 3.6)
5	2.09 s	2.10 s	1.71 dd(14.4, 3.7)	1.64 dd(14.2, 3.6)
6			2.40 br d(14.4), 2.52 m	2.45 dd(17.6, 3.6)
				2.30 dd(17.6, 14.2)
7		5.88 s		
9	2.94 d(7.0)	3.01 d(7.0)		
11	6.73 dd(15.8, 9.8)	6.42 dd(15.6, 9.8)	2.50 m	2.47 m
12	6.28 d(15.8)	5.91 d(15.6)	2.50 m	2.44 m, 2.47 m
14	5.88 s	6.48 s	5.93 s	5.86 s
16	4.83 s	6.28 s	4.78 d(1.5)	6.02 s
17	1.81 s		1.77 s	1.69 s
18	1.19 s		0.93 s	0.86 s
19	1.16 s		0.90 s	0.83 s
20	0.97 s		1.12 s	1.05 s
Me		0.98 s, 1.11 s		
		1.18 s, 1.80 s		

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Table 10-1-22: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-64**, **10-1-67**, and **10-1-68**.

H	10-1-64	10-1-67	10-1-68
1	1.89 m, 1.29 m	1.65 m, 1.49 m	2.28 m, 1.50 m
2	1.58 m①	1.62 m, 1.58 m	1.48 m, 0.90 m
3	1.44 m, 1.21 m	1.34 m, 1.10 m	1.35 m, 1.15 m
5	1.56 d(2.8)	2.93 s	1.36
6	4.34 d(2.8)		4.36 ddd(2.0, 2.0, 2.0)
7		3.88 d(10.7)	1.60 m, 1.48 m
8		1.88 m	2.28 m
11	1.90 t(4.8)①	1.99 m, 1.82 m	1.98 m, 1.72 m
12	2.55 t(4.8)①	2.62 m, 2.41 m	2.50 m, 1.35 m
14	5.96 s	5.89 br s	5.84 dddd(1.2, 1.2, 1.2, 1.2)
16	6.04 br s	6.03 br s	4.76 d(1.2)
17	1.84 s	1.24 d(6.5)	0.93 d(6.8)
18	1.31 s	1.28 s	0.99 s
19	1.06 s	0.99 s	1.24 s
20	1.41 s	0.90 s	1.28 s

① The means of methylene signals not resolved completely.

Table 10-1-23: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-65** and **10-1-66**.

H	10-1-65	10-1-66	H	10-1-65	10-1-66
1*α*	1.81 m	1.70 m	12	2.55 ddd(12.0, 7.7, 6.6)	4.70 dd(7.9, 6.6)
1*β*	1.06 ddd(12.2, 5.1, 2.2)	0.96 ddd(12.1, 5.0, 2.1)		2.26 ddd(12.0, 7.7, 6.6)	
2*α*	1.81 dddd(12.2, 12.2, 5.1, 2.2)	1.62 dddd(12.1, 12.1, 5.0, 2.1)			
2*β*	1.52 m	–	14	5.82 br d(1.3)	5.80 br d(1.3)
3*α*	2.18 br d(12.2)	1.42 br d(12.1)	16	4.78 d(1.4)	4.92 d(1.4)
3*β*	1.06 dt(12.2)	1.18 dt(12.1)			4.87 d(1.4)
5	1.29 dd(12.8, 2.7)	1.08 dd(12.8, 2.7)			
6*α*	2.01 dq(12.8, 3.0)	1.75 dq(12.8, 3.2)	17	4.88 br s, 4.42 br s	4.68 br s, 4.90 br s
6*β*	1.78 m	1.32 m	18	1.20 s	0.90 s
7*α*	2.41 ddd(12.8, 3.0, 2.0)	2.40 ddd(12.8, 3.2, 2.0)	19		0.81 s
7*β*	1.86 m	1.96 m	20	0.58 s	0.69 s
9	1.62 m	1.58 m	OMe	3.61 s	
11	1.81 ddd(12.0, 7.7, 6.6)	1.90 ddd(12.0, 7.9, 6.6)			
	1.63 m	1.84 m			

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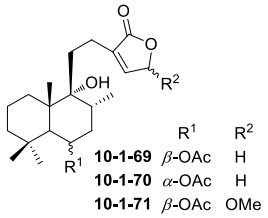
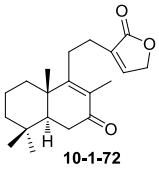
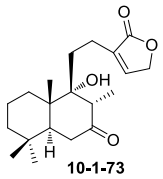
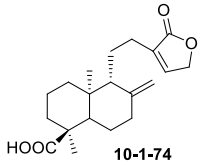
Table 10-1-24: Compounds, MFs, and test solvents of labdane-type diterpenoids **10-1-69**~**10-1-92**.

No.	Compounds	MFs	Test solvents	References
10-1-69	(*rel* 5*S*,6*R*,8*R*,9*R*,10*S*)-6-acetoxy-9-hydroxy-13(14)-labden-16,15-olide	$C_{22}H_{34}O_5$	$CDCl_3$	[32]
10-1-70	(*rel* 5*S*,6*S*,8*R*,9*R*,10*S*)-6-acetoxy-9-hydroxy-13(14)-labden-16,15-olide	$C_{22}H_{34}O_5$	$CDCl_3$	[32]
10-1-71	(*rel* 5*S*,6*R*,8*R*,9*R*,10*S*)-6-acetoxy-9-hydroxy-15-methoxy-13(14)-labden-16,15-olide	$C_{23}H_{36}O_6$	$CDCl_3$	[32]
10-1-72	leoheteronin B	$C_{20}H_{28}O_3$	$CDCl_3$	[28]
10-1-73	leoheteronin E	$C_{20}H_{30}O_4$	$CDCl_3$	[28]
10-1-74	*ent*-labd-8(17),13-dien-18-oic acid-16,15-olide	$C_{20}H_{28}O_4$	$CDCl_3$	[15]
10-1-75	19-hydroxy-8(17),13-*ent*-labdadien-15→16-lactone	$C_{20}H_{30}O_3$	$CDCl_3$	[33]
10-1-76	19-acetoxy-20-oxo-8(17),13-*ent*-labdadien-15→16-lactone	$C_{22}H_{30}O_5$	$CDCl_3$	[33]
10-1-77	8(17),13-*ent*-labdadien-15→16,19→20-dilactone	$C_{20}H_{26}O_4$	$CDCl_3$	[33]
10-1-78	curcucomosin A	$C_{20}H_{26}O_3$	$CDCl_3$	[34]
10-1-79	curcucomosin B	$C_{20}H_{28}O_3$	$CDCl_3$	[34]
10-1-80	pacovatinin A	$C_{20}H_{30}O_3$	CD_3OD	[35]
10-1-81	pacovatinin B	$C_{20}H_{30}O_4$	$CDCl_3$	[35]
10-1-82	pacovatinin C	$C_{20}H_{28}O_4$	$CDCl_3$	[35]
10-1-83	hedychilactone A	$C_{20}H_{30}O_3$	$CDCl_3$	[36]
10-1-84	hedychilactone B	$C_{20}H_{30}O_3$	$CDCl_3$	[36]
10-1-85	hedychilactone C	$C_{20}H_{28}O_4$	$CDCl_3$	[36]
10-1-86	19-hydroxy-3-oxo-*ent*-labda-8(17),11,13-trien-16,15-olide	$C_{20}H_{26}O_4$	C_5D_5N	[25]
10-1-87	3,18,19-trihydroxy-*ent*-labda-8(17),13-dien-16,15-olide	$C_{20}H_{30}O_5$	C_5D_5N	[25]
10-1-88	3β,7β,8β,12ζ,17-pentahydroxylabdan-16,15-olide	$C_{20}H_{34}O_7$	DMSO-d_6	[37]
10-1-89	aulacocarpinolide	$C_{20}H_{28}O_4$	$CDCl_3$	[38]
10-1-90	velutine C	$C_{20}H_{26}O_6$	$CDCl_3$	[39]
10-1-91	15-methoxyvelutine C	$C_{21}H_{28}O_7$	$CDCl_3$	[40]
10-1-92	isoandrographolide	$C_{20}H_{30}O_5$	$CDCl_3$	[41]









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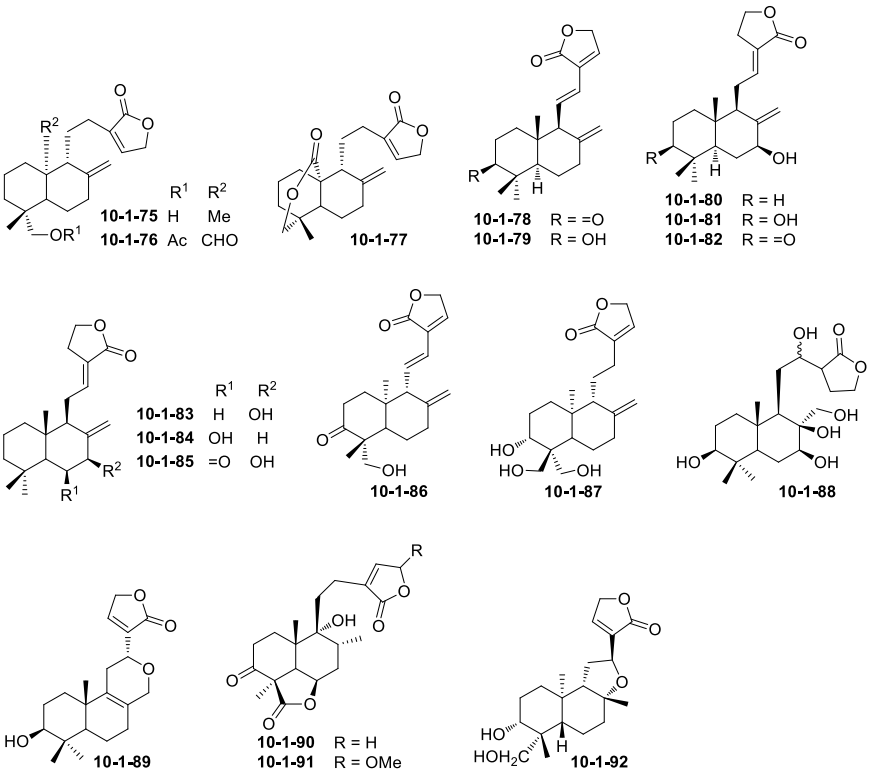

Table 10-1-25: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-69**~**10-1-71**.

H	10-1-69	10-1-70	10-1-71
1	*ca*. 1.50	*ca*. 1.50	*ca*. 1.51, *ca*. 1.44
2	*ca*. 1.63, 1.44 m	1.57, 1.47	1.61, 1.49
3	1.18 ddd(13.5, 13.5, 3.0), 1.32 m	*ca*. 1.24, 1.33 br d(13.0)	1.33 br d(13.5) 1.17 ddd(13.5, 13.5, 3.5)
5	1.67 d(2.5)	1.93 d(11.5)	*ca*. 1.64
6	5.39 ddd(2.5, 2.5, 2.5)	5.08 ddd(11.5, 11.5, 5.0)	5.38 ddd(2.5, 2.5, 2.5)
7	*ca*. 1.54, *ca*. 1.65	1.77 ddd(11.5, 5.0, 5.0) 1.41 ddd(11.5, 11.5, 11.5)	*ca*. 1.55, *ca*. 1.64
8	2.11 m	1.97 m	2.10 m
11	1.78 m, 1.85 m	*ca*. 1.66, 1.84 ddd(14.5, 10.5, 6.0)	1.75 m, 1.85 m
12	2.43 ddddd(8.0, 8.0, 1.5, 1.5, 1.5)	*ca*. 2.38	2.43 br dd(7.5, 7.5)
14	7.13 dddd(1.5, 1.5, 1.5, 1.5)	7.10 br s	6.77 ddd(1.5, 1.5, 1.5)
15	4.79 ddd(1.5, 1.5, 1.5)	4.77 br s	5.73 ddd(1.5, 1.5, 1.5)
17	0.93 d(6.5)	0.93 d(6.5)	0.92 dd(6.5, 1.5)

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Table 10-1-25 (continued)

H	10-1-69	10-1-70	10-1-71
18	1.00 s	0.90 s	1.00 s
19	0.96 s	1.04 s	0.96 s
20	1.24 s	1.00 s	1.23 s
OAc	2.05 s	2.03 s	2.04 s
OMe			3.58 s

Table 10-1-26: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-72** and **10-1-73**.

H	10-1-72	10-1-73	H	10-1-72	10-1-73
1	1.99 br d(12.2)	1.45 m	11	2.46 m	1.90 m
	1.40 ddd(12.2, 12.0, 3.9)		12	2.46 m	2.40 m
2	1.62 m	1.55 m	14	7.19 s	7.14 br s
3	1.49 br d(13.4)	1.20 m	15	4.80 s	4.78 br s
	1.23 ddd(13.4, 13.4, 4.2)		17	1.80 s	1.11 d(6.0)
5	1.72 dd(14.4, 3.7)	2.03 dd(13.9, 3.2)	18	0.93 s	0.90 s
6	2.51 dd(17.3, 3.7)	2.40 dd(13.9, 3.2)	19	0.90 s	0.88 s
	2.36 dd(17.3, 14.4)	2.29 t(13.9)	20	1.11 s	1.17 s
8		2.72 q(6.6)			

Table 10-1-27: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-74**~**10-1-77**.

H	10-1-74	10-1-75	10-1-76	10-1-77
14	7.10 q(1.8)	7.10 m	7.09 m	7.18 m
15	4.78 q(1.8)	4.75 m	4.76 m	4.78 m
17	4.59 br s, 4.89 br s	4.55 s, 4.83 s	4.63 s, 4.96 s	4.75 s, 4.96 s
18		0.95 s	0.99 s	0.92 s
19	1.13 s	3.36 d(11.0), 3.72 d(11.0)	3.75 d(10.8), 3.89 d(10.8)	4.03 dd(11.9, 0.4)
				4.19 dd(11.9, 2.1)
20	0.71 s	0.63 s	9.81 s	
OAc			2.01 s	

Table 10-1-28: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-78** and **10-1-79**.

H	10-1-78	10-1-79
1α	1.46 ddd(13.8, 13.6, 4.5)	1.11 ddd(13.4, 13.2, 3.7)
1β	1.76 ddd(13.8, 5.8, 2.9)	1.51
2α	2.24 ddd(15.3, 4.4, 3.0)	1.54
2β	2.61 ddd(15.3, 13.6, 5.8)	1.62
3		3.23 dd(11.4, 4.2)
5	1.50 dd(13.5, 1.7)	1.06 dd(12.5, 2.6)

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Table 10-1-28 (continued)

H	10-1-78	10-1-79
6*α*	1.64	1.71 ddt(13.1, 5.0, 2.6)
6*β*	1.57 dddd(13.6, 13.5, 13.3, 4.5)	1.44 dddd(13.1, 13.0, 12.5, 2.4)
7*α*	2.06 ddd(13.6, 13.3, 4.5)	2.04 ddd(13.3, 13.0, 5.0)
7*β*	2.46 ddd(13.6, 4.5, 2.5)	2.43 ddd(13.3, 2.6, 2.4)
9	2.36 d(10.1)	2.30 br d(10.1)
11	6.94 dd(15.7, 10.1)	6.88 dd(15.8, 10.1)
12	6.10 d(15.7)	6.09 d(15.8)
14	7.15 br s	7.14 br s
15	4.79 br s	4.79 br s
17	4.57 d(1.3), 4.81 d(1.3)	4.50 d(1.5), 4.76 d(1.5)
18	1.02 s	0.79 s
19	1.07 s	1.00 s
20	1.05 s	0.85 s

Table 10-1-29: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-80**~**10-1-82**.

H	10-1-80	10-1-81	10-1-82
1	1.74 m, 1.13 dt(12.8, 3.7)	1.73 m, 1.18 m	1.99 m, 1.60 m
2	1.65 m, 1.53 m	1.57 m, 1.15 m	2.64 m, 2.45 m
3	1.43 m, 1.21 m	3.28 dd(12.0, 4.3)	
5	1.23 m	1.16 m	1.71 m
6	1.26 m, 2.04 m	1.37 m, 2.13 ddd(9.5, 5.4, 2.4)	1.47 m, 2.06 ddd(9.5, 5.4, 2.4)
7	3.94 m	4.02 dd(11.3, 5.5)	4.04 m
9	1.86 m	1.79 m	1.88 m
11	2.45 m, 2.37 m	2.36 m	2.38 m
12	6.61 m	6.64 dt(9.2, 6.0)	6.65 m
14	2.93 m	2.87 m	2.88 m
15	4.38 t(7.4)	4.38 t(7.2)	4.39 t(7.2)
17	5.23 s, 4.60 s	5.22 s, 4.60 s	5.30 s, 4.66 s
18	0.85 s	0.80 s	1.05 s
19	0.92 s	1.05 s	1.14 s
20	0.75 s	0.73 s	0.91 s

Table 10-1-30: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-83**~**10-1-85**.

H	10-1-83	10-1-84	10-1-85
1	*α* 1.06 ddd(12.5, 12.5, 4.0)	*α* 1.12 ddd(13.7, 13.4, 3.7)	*α* 1.28 m
	β 1.69 br d(13)	*β* 1.72 br d(14)	*β* 1.80 ddd(12.5, 3.1, 3.1)
2	1.54 m, 1.58 m	1.52 m, 1.65 m	1.61 m
3	*α* 1.21 m	*α* 1.18 ddd(13.7, 13.4, 3.4)	*α* 1.15 ddd(13.1, 13.1, 4.3)
	β 1.45 br d(13)	*β* 1.39 br d(14)	*β* 1.42 ddd(13.1, 2.4, 2.4)
5	1.18 dd(11.9, 5.5)	1.11 d-like	2.26 br s

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Table 10-1-30 (continued)

H	10-1-83	10-1-84	10-1-85
6	α 2.11 ddd(12.8, 5.5, 2.4) β 1.29 ddd(12.8, 11.9, 11.3)	4.40 ddd(7.3, 7.0, 0.6)	
7	4.00 dd-like	2.35 m	4.49 br s
9	1.81 br d(11)	1.93 br d(11)	2.39 br d(11)
11	2.29 m, 2.40 m	2.28 m, 2.38 m	2.36 m, 2.50 m
12	6.68 m	6.72 m	6.75 m
14	2.88 m	2.88 m	2.91 m
15	4.39 t-like	4.39 t-like	4.42 t-like
17	4.58 br s, 5.20 br s	4.67 br s, 5.00 br s	4.67 br s, 5.44 br s
Me	0.72 s, 0.83 s, 0.92 s	1.02 s, 1.05 s, 1.22 s	0.67 s, 1.00 s, 1.26 s

Table 10-1-31: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-86**~**10-1-88**.

H	10-1-86	10-1-87	10-1-88
1	1.76~1.79 m 1.44 dt(14.0, 4.0)	1.72~1.76 m 1.21 dt(12.9, 4.2)	1.45 (ov) 0.8 (ov)
2	2.84 dt(14.4, 4.0), 2.44~2.40 m	2.16~2.25 m, 2.09~2.13 (ov)	1.40 (ov)
3		4.41 br d(10.8)	3.00 m
5	1.63~1.67 (ov)	2.05 br d(13.6)	0.80 (ov)
6	1.72~1.75 m, 1.63~1.67 (ov)	2.09~2.13 (ov), 1.51~1.53 m	1.55 (ov)
7	2.35~2.38 m, 2.05 br t(13.6)	2.36 br d(12.6), 2.02~2.04 m	3.11 (ov)
9	2.45 br d(10.0)	1.72 br s	0.95 d(10.2)
11	7.21 dd(16.0, 10.0)	1.78~1.82 m, 1.63~1.66 m	1.85 m, 1.10 m
12	6.25 d(16.0)	2.51 br t(12.6), 2.16 br d(12.6)	3.55 m
13			2.85 ddd(3.8, 3.8, 3.8)
14	7.31 t(2.0)	7.15 br s	2.30 m, 2.15 m
15	4.79 br s	4.70 br s	4.25 m, 4.15 m
16	4.91 d(2.0)	4.92 br s	
17	4.81 d(2.0)	4.74 br s	3.80 d(11.4), 3.81 d(11.4)
18	1.44 s	4.83 d(10.9), 4.17 d(10.9)	0.92 s
19	4.26 d(10.8), 3.79 d(10.8)	4.61 d(10.9), 3.91 d(10.9)	0.70 s
20	1.19 s	0.79 s	0.90 s

Table 10-1-32: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-89**~**10-1-92**.

H	10-1-89	10-1-90	10-1-91	10-1-92
1	1.20 m, 1.72 m	2.20 ddd(13.3, 11.3, 4.3) 1.60 ddd(13.0, 9.9, 4.4)	2.18 ddd(14.8, 12.1, 5.9) 1.60	1.53 m, 2.20 m
2	1.61 m, 1.77 m	2.44~2.60	2.54~2.62 (ov)	1.77 m
3	3.23 dd(11.6, 4.2)			3.44 d(9.3)
5	1.15 dd(12.6, 1.8)	–	2.79 d(4.3)	0.98 m
6	1.52 m, 1.76 m	–	4.61 t(5.1)	1.53 m, 1.44 m

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Table 10-1-32 (continued)

H	10-1-89	10-1-90	10-1-91	10-1-92
7	1.89 m	2.81 d(4.4)	2.08 (ov), 1.76 (ov)	1.77 m, 1.04 m
8		4.62 t(5.1)	2.03 (ov)	
9				1.53 m
11	1.89 m, 2.42 m	1.80, 2.09 dd(1.44, 5.8)	1.65 (ov), 81 (ov)	2.43 dd(8.3, 4.6) 2.01 dd(8.3, 4.6)
12	4.24 dd(9.8, 1.2)	2.04, 1.80	2.51~2.41 (ov)	4.68 t(4.6)
14	7.39 tt(1.5, 1.5)	2.49	6.78 br s	7.29 s
15	4.82 t(1.5), 4.83 d(1.8)	–	5.73 br s, 3.58 s(OMe)	4.81 s
16		7.14 br s		
17	4.06 ABd(15.3) 4.03 ABd(15.3)	4.80 d(1.4)	0.96 d(5.1)	1.10 s
18	1.02 s		1.46 s	1.25 s
19	1.02 s	–		3.36 d(10.8), 4.26 d(10.8)
20	0.83 s	–	0.89 s	0.95 s

Table 10-1-33: Compounds, MFs, and test solvents of labdane-type diterpenoids **10-1-93**~**10-1-111**.

No.	Compounds	MFs	Test solvents	References
10-1-93	9-hydroxy hedychenone	$C_{20}H_{26}O_3$	$CDCl_3$	[26]
10-1-94	7-hydroxy hedichinal	$C_{20}H_{24}O_4$	$CDCl_3$	[12]
10-1-95	15,16-epoxy-*ent*-labd-8(17),13(16),14-trien-18-oic acid	$C_{20}H_{28}O_3$	$CDCl_3$	[15]
10-1-96	15,16-epoxy-*ent*-labda-8(17),13(16),14-trien-19-ol	$C_{20}H_{30}O_2$	$CDCl_3$	[21]
10-1-97	methyl 15,16-epoxy-*ent*-labda-8(17),13(16),14-trien-19-oate	$C_{21}H_{30}O_3$	$CDCl_3$	[21]
10-1-98	15,16-epoxy-*ent*-labda-8(17),13(16),14-trien-19-al	$C_{20}H_{28}O_2$	$CDCl_3$	[21]
10-1-99	methyl 15,16-epoxy-12-oxo-*ent*-labda-8(17),13(16),14-trien-19-oate	$C_{21}H_{28}O_4$	$CDCl_3$	[21]
10-1-100	kellermanoldione	$C_{20}H_{26}O_4$	$CDCl_3$	[42]
10-1-101	kellermandiolone	$C_{20}H_{28}O_4$	$CDCl_3$	[42]
10-1-102	19-hydroxygaleopsin	$C_{22}H_{32}O_6$	$CDCl_3$	[43]
10-1-103	15,16-epoxy-8(17),13(16),14-*ent*-labdatrien-20,19-olide	$C_{20}H_{26}O_3$	$CDCl_3$	[44]
10-1-104	15,16-epoxy-12-oxo-8(17),13(16),14-labdatrien-20,19-olide	$C_{20}H_{24}O_4$	$CDCl_3$	[45]
10-1-105	potamogetonyde	$C_{22}H_{30}O_4$	$CDCl_3$	[46]
10-1-106	potamogetonol	$C_{22}H_{32}O_4$	$CDCl_3$	[46]
10-1-107	vitetrifolin H	$C_{22}H_{34}O_4$	$CDCl_3$	[11]
10-1-108	leopersin E	$C_{22}H_{28}O_7$	$CDCl_3$	[47]
10-1-109	3α-hydroxymarrubiin	$C_{20}H_{28}O_5$	$CDCl_3$	[40]
10-1-110	peregrinine	$C_{20}H_{26}O_5$	$CDCl_3$	[39]
10-1-111	(*E*)-labda-8(17),12,14-trien-15(16)-olide	$C_{20}H_{28}O_2$	$CDCl_3$	[48, 49]

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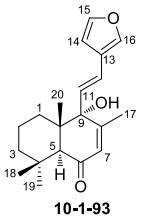

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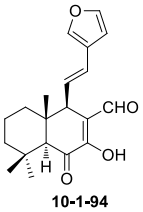

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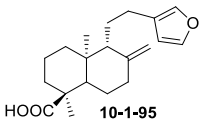

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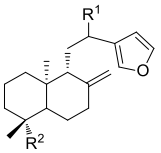
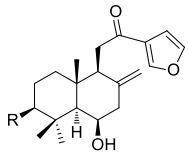


	R^1	R^2
10-1-96	H	CH_2OH
10-1-97	H	COOMe
10-1-98	H	CHO
10-1-99	=O	COOMe



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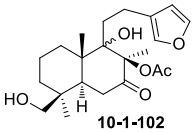
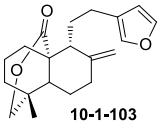
10-1-101 R = OH



10-1-102



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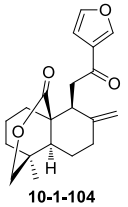

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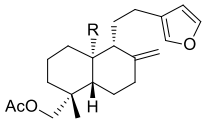
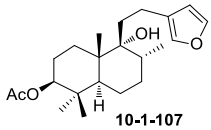
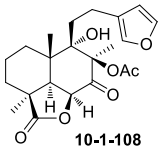


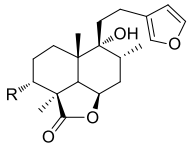
10-1-105 R = CHO
10-1-106 R = CH_2OH



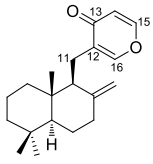
10-1-107



10-1-108



10-1-109 R = OH
10-1-110 R = =O



10-1-111

Table 10-1-34: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-93**, **10-1-94**, **10-1-100**, and **10-1-101**.

H	10-1-93	10-1-94	10-1-9-100	10-1-9-101
1	1.51 m	1.54 m	1.86 ddd(13, 6, 3) 1.63 td(13, 4, 6)	1.30, 1.56
2	1.31 m	1.42 m	2.74 dd(15, 6) 2.34 ddd(15, 4.6, 3)	1.67
3	1.38 m	1.26 m		3.20 dd(10.8, 4.6)
5	2.78 s	2.21 s	1.63 d(1.8)	1.15 d(2)
6			4.38 br dd(5, 3)	4.41 br s
7	5.82 s		2.54 br dd(14) 2.39 dd(14, 3.2)	2.47 br d(13) 2.36 dd(13, 3)
9		3.01 d(7.0)	2.75	2.64 br d(10)

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Table 10-1-34 (continued)

H	10-1-93	10-1-94	10-1-9-100	10-1-9-101
11	6.71 dd(15.8, 9.8)	5.77 dd(15.8, 9.8)	3.12 dd(17.4, 10.4) 2.79 dd(17.4, 3.4)	3.02 dd(17, 10) 2.74 dd(17, 3.5)
12	6.02 d(15.8)	6.37 d(15.8)		
14	7.39 s	7.37 s	6.79 dd(1.9, 0.8)	6.75 dd(1.9, 0.8)
15	7.48 s	7.45 s	7.47 dd(1.9, 1.5)	7.42 dd(1.9, 1.5)
16	6.52 s	6.52 s	8.12 dd(1.5, 0.8)	8.01 dd(1.5, 0.8)
17	1.86 s	9.81 s	4.96 br s, 4.73 br s	4.88 br s, 4.64 br s
18	1.22 s	1.21 s	1.42 s	1.17 s
19	1.19 s	1.14 s	1.22 s	1.10 s
20	1.09 s	0.99 s	1.27 s	1.06 s

Table 10-1-35: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-95**~**10-1-99**.

H	10-1-95	10-1-96	10-1-97	10-1-98	10-1-99
14	6.25 dd(1.6, 0.9)	6.25 dd(1.9, 0.9)	6.28 dd(1.9, 0.9)	6.24 dd(1.9, 1.0)	6.78 dd(1.8, 0.9)
15	7.34 t(1.6)	7.35 dd(1.9, 1.3)	7.35 dd(1.9, 1.4)	7.38 dd(1.9, 1.2)	7.43 dd(1.8, 1.4)
16	7.19 br s	7.20 dd(1.3, 0.9)	7.20 dd(1.4, 0.9)	7.20 dd(1.3, 0.9)	8.13 dd(1.4, 0.9)
17	4.59 br s, 4.87 br s	4.56 s, 4.86 s	4.58 s, 4.48 s	4.60 s, 4.95 s	4.38 s, 4.78 s
18		0.97 s	1.17 s	1.01 s	1.20 s
19	1.15 s	3.43 d(11.5), 3.74 d(11.5)	3.60 s(COOMe)	9.78 s	3.63 s(COOMe)
20	0.72 s	0.66 s	0.51 s	0.60 s	0.59 s

Table 10-1-36: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-102**~**10-1-104**.

H	10-1-102	10-1-103	10-1-104
1	1.47 (ov)	1.25 (ov), 2.30 (ov)	ax 1.48 m, eq 2.80 m
2	1.49~1.55 (ov)	1.40 (ov), 1.70 (ov)	ax 1.68 m, eq 1.74 m
3	0.99~1.72 (ov)	1.44 (ov), 1.65 (ov)	ax 1.48 m, eq 1.68 m
5	1.89 (14.2, 2.2)	1.45 (ov)	1.66 m
6	2.69 dd(14.2, 11.9) 2.45 dd(11.9, 2.2)	1.40 (ov), 2.10 (ov)	ax 1.30 dddd(13.2, 13.2, 13.2, 4.4) eq 2.10 m
7		1.90, 2.51 (ov)	ax 2.22 ddd(13.2, 13.2, 4.4) eq 2.45 ddd(13.2, 4.4, 2.4)
9		1.78 (ov)	2.85 dd(8.8, 3.4)

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Table 10-1-36 (continued)

H	10-1-102	10-1-103	10-1-104
11	2.10 (ov)	2.12 (ov), 2.50 (ov)	3.35 dd(18.1, 3.4), 3.80 dd(18.1, 8.8)
12	2.50 (ov)	2.15 (ov), 2.60 (ov)	
14	6.31 br s	6.27 dd(1.6, 0.9)	6.81 d(1.5)
15	7.39 br s	7.34 dd(1.6, 1.3)	7.44 dd(1.5, 1.5)
16	7.27 br s	7.20 dd(1.3, 0.9)	8.20 br s
17	1.50 s	4.84 br s, 4.96 br s	4.80 s, 4.62 s
18	3.57 d(10.9), 3.69 d(10.9)	0.91 s	0.94 s
19	1.01 s	3.98 d(11.9), 4.17 dd(11.9, 2.1)	4.05 d(11.7), 4.21 dd(11.7, 2.4)
20	1.23 s		
OAc	2.09 s		

Table 10-1-37: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-105**~**10-1-108**.

H	10-1-105	10-1-106	10-1-107	10-1-108
1	ax 0.73 ddd(12.0, 12.0, 3.4) eq 2.47 m	ax 0.85 ddd(13.5, 13.5, 4.8) eq 2.04 m	1.52 m, 1.72 m	1.45 (ov)
2	ax 1.40 m, eq 1.47 m	ax 1.50 m, eq 1.52 m	1.64 m, 1.72 m	1.53 (ov)
3	ax 1.06 ddd(12.1, 12.1, 4.7) eq 1.68 m	ax 1.05 ddd(13.2, 13.2, 4.6) eq 1.74 m	4.48 dd(11.1, 4.5)	1.33~2.21 (ov)
5	1.63 m	1.40 dd(13.3, 3.2)	1.60 m	2.98 d(6.4)
6	ax 2.04 m, eq 2.13 m	ax 1.69 m, eq 1.89 m	1.38 m, 1.68 m	4.99 d(6.4)
7	ax 2.20 m eq 2.64 ddd(12.3, 3.2, 3.2)	ax 2.07 m eq 2.50 m	1.36 m, 1.50 m	
8			1.76 m	
9	1.83 br d(11.3)	1.73 m		
11	1.50 m, 1.72 m	1.67 m, 1.87 m	1.64 m, 1.84 m	1.82-2.15 (ov)
12	2.24 m, 2.52 m	2.23 m, 2.60 m	2.44 m	2.60 (ov)
14	6.20 br s	6.27 br s	6.26 br s	6.27 dd(1.7, 0.9)
15	7.30 br s	7.36 br s	7.33 br s	7.38 t(1.7)
16	7.15 br s	7.21 br s	7.20 br s	7.25 m
17	4.61 br s, 4.93 br s	4.81 br s, 4.95 br s	0.90 d(7.6)	1.93 s
18	0.96 s	0.99 s	0.86 s	
19	3.72 d(11.2), 3.88 d(11.2)	4.28 d(11.2), 3.98 d(11.2)	0.86 s	1.31 s
20	9.80 s	3.66 d(12.2), 3.74 d(12.2)	0.95 s	0.72 s
OAc	1.99 s	2.05 s	2.03 s	2.14 s

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Table 10-1-38: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-109**~**10-1-111**.

H	10-1-109	10-1-110	10-1-111
1	1.41 (ov), 1.83 (ov)	2.17 ddd(13.3, 11.3, 4.3) 1.65 ddd(13.0, 9.9, 4.4)	*α* 1.18 ddd(13, 13, 4) *β* 1.88 m
2	1.55 (ov), 1.81 (ov)	2.06~2.44 (ov)	*α* 1.53 m *β* 1.60 ddddd(13, 13, 13, 3, 3)
3	4.53 dd(12.5, 4.3)		*α* 1.20 br ddd(13, 13, 4) *β* 1.41 dddd(13, 3, 3, 2)
5	2.35 d(4.7)	2.76 d(4.4)	1.17 dd(13, 3)
6	4.75 dd(5.8, 5.5)	4.58 t(5.1)	*α* 1.76 dddd(13, 5, 3, 3) *β* 1.36 dddd(13, 13, 13, 4)
7	1.69 (ov), 2.13 (ov)	1.80 (ov), 2.08 (ov)	*α* 1.99 br ddd(13, 13, 5) *β* 2.38 ddd(13, 4, 2)
8	2.08 (ov)	2.04 (ov)	
9			2.01 br d(12)
11	1.75 (ov), 1.87 (ov)	1.73~1.90 (ov)	2.45 ddd(16, 12, 1), 2.69 ddd(16, 2, 1)
12	2.51 dd(9.0, 7.8)	2.44~2.54 (ov)	7.52 ddd(1, 1, 1)
14	6.25 br s	6.23 br s	7.67 dd(6, 1)
15	7.34 br s	7.31 br s	6.31 d(6)
16	7.21 br s	7.19 br s	
17	0.94 d(6.6)	0.95 d(6.5)	4.46 br d(1), 4.82 br d(1)
18			0.82 s
19	1.28 s	1.46 s	0.88 s
20	1.01 s	0.87 s	0.78 s

Table 10-1-39: Compounds, MFs, and test solvents of labdane-type diterpenoids **10-1-112**~**10-1-126**.

No.	Compounds	MFs	Test solvents	References
10-1-112	8(17),13-labdadien-12,15-olide-19-oic acid	$C_{20}H_{28}O_4$	$CDCl_3$	[4]
10-1-113	12,15-epoxy-8(17),13-labdadien-18-oic acid	$C_{20}H_{30}O_3$	$CDCl_3$	[4]
10-1-114	12,15-epoxylabda-8(17),12,14-trien-16-al	$C_{20}H_{28}O_2$	$CDCl_3$	[50]
10-1-115	16-acetoxy-12(*R*),15-epoxy-15*β*-hydroxylabda-8(17),13(16)-diene	$C_{22}H_{34}O_4$	$CDCl_3$	[50]
10-1-116	negundoin B	$C_{21}H_{32}O_5$	$CDCl_3$	[51]
10-1-117	negundoin C	$C_{21}H_{32}O_4$	$CDCl_3$	[51]
10-1-118	4,5-dehydro-6-oxo-18-norgrindelic acid	$C_{19}H_{26}O_4$	$CDCl_3$	[52]
10-1-119	methyl-4*β*-hydroxy-6-oxo-19-norgrindeloate	$C_{20}H_{30}O_5$	$CDCl_3$	[52]
10-1-120	18-hydroxy-6-oxogrindelic acid	$C_{20}H_{30}O_5$	$CDCl_3$	[52]
10-1-121	methyl grindelate	$C_{21}H_{34}O_3$	$CDCl_3$	[53]
10-1-122	vitexifolin D	$C_{19}H_{30}O_4$	$CDCl_3$	[54]
10-1-123	vitexifolin E	$C_{20}H_{32}O_4$	$CDCl_3$	[54]
10-1-124	8*α*,13*S*-epoxylabdane-14*S*,15-diol	$C_{20}H_{36}O_3$	$CDCl_3$	[53]
10-1-125	11-hydroxy-8(17),12(*E*)-labdadien-15,16-dial 11,15-hemiacetal	$C_{20}H_{30}O_3$	$CDCl_3$	[22]
10-1-126	8*β*,17-epoxy-11,15-epoxy-15-acetoxy-12-labden-16-al	$C_{22}H_{32}O_5$	$CDCl_3$	[55]

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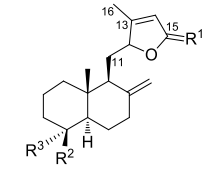
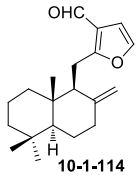


	R^1	R^2	R^3
10-1-112	O	COOH	Me
10-1-113	H_2	Me	COOH



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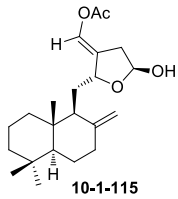

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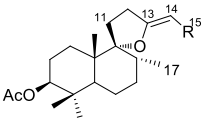
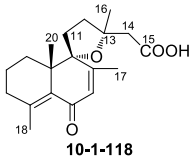


10-1-116 R = COOH
10-1-117 R = CHO



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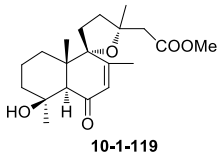

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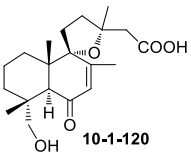

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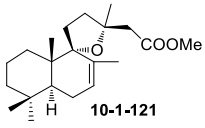

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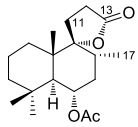

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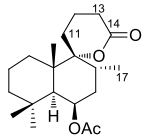

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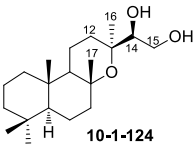

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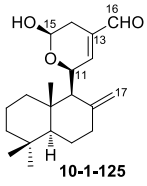

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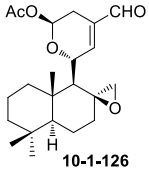

10-1-126

Table 10-1-40: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-112**~**10-1-115**.

H	10-1-112	10-1-113	10-1-114	10-1-115
1	–	–	1.19 m, 1.74 m	1.02 dt(12.6, 3.6), 1.67 m
2	–	–	1.53 m, 1.60 m	1.47 m, 1.56 m
3	–	–	1.23 m, 1.43 m	1.20 dt(13.4, 4.1), 1.40 m
5	–	–	1.21 m	1.15 dd(12.6, 2.5)
6	–	–	1.36 m, 1.76 m	1.34 m, 1.75 m
7	–	–	2.02 dt(13.0, 4.6) 2.36 ddd(13.0, 4.1, 2.4)	2.03 dt(13.0, 4.7) 2.41 ddd(11.8, 4.0, 2.4)
9	–	–	2.44 dd(10.3, 3.8)	1.78 m
11	–	–	3.08 dd(15.7, 3.8) 3.15 dd(15.7, 10.3)	1.61 m, 1.80 m

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Table 10-1-40 (continued)

H	10-1-112	10-1-113	10-1-114	10-1-115
12	4.85 d(11.6)	4.11 dd(7.6, 4.0)		4.73 m
14	5.75 br s	5.57 m	6.66 d(2.0)	2.68 dd(16.1, 4.6), 2.74 br d(16.3)
15		4.65 dd(16.0, 4.0) 4.27 dd(16.0, 1.2)	7.26 d(2.0)	5.60 d(4.6)
16	2.08 s	1.77 s	10.02 s	7.12 d(1.4)
17	4.93 br s, 4.42 br s	4.84 br s, 4.50 br s	4.59 s, 4.78 s	4.65 s, 4.87 s
18		1.13 s	0.84 s	0.80 s
19	1.24 s		0.91 s	0.89 s
20	0.59 s	0.70 s	0.81 s	0.70 s
OAc				2.17 s

Table 10-1-41: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-116**~**10-1-119**.

H	10-1-116	10-1-117	10-1-118	10-1-119
1	1.37 m	1.40 m	1.55 m, 1.95 m	1.55 m, 1.70 m
2	1.70 m	1.73 m	1.55 m, 1.70 m	1.70 m
3	4.48 dd(12.0, 4.2)	4.46 dd(12.0, 4.2)	2.13 m	1.80 m, 1.28 m
5	1.58 m	1.59 m		2.91 s
6	1.63 m, 1.40 m	1.63 m, 1.42 m		
7	1.56 m, 1.35 m	1.60 m, 1.43 m	5.90 br s	5.73 br s
8	1.79 m	1.85 m		
11	2.09 m, 1.80 m	2.16 m, 1.87 m	2.00 m, 2.21 m	2.00 m, 2.20 m
12	3.14 m, 3.02 m	3.11 m, 3.05 m	1.98 m, 2.21 m	2.05 m, 2.30 m
14	5.29 s	5.61 d(7.8)	2.50 d(14.0), 2.64 d(14.0)	2.59 d(14.0), 2.75 d(14.0)
15		9.54 d(7.8)		3.68 s(COOMe)
16			1.39 s	1.41 s
17	0.78 d(6.6)	0.78 d(6.6)	2.04 s	1.99 br s
18	0.87 s	0.87 s		
19	0.89 s	0.89 s	2.04 s	1.36 s
20	0.96 s	0.98 s	1.05 s	1.10 s
OAc	2.05 s	2.04 s		

Table 10-1-42: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-120**~**10-1-122**.

H	10-1-120	10-1-121	10-1-122
1	1.58 m, 1.80 m	1.86 m, 2.20 m	*ca*. 1.30, 1.38 dddd(12.5, 3.5, 3.5, 1.0)
2	1.75 m, 2.10 m	1.50 m	*ca*. 1.48, 1.57 ddddd(12.5, 12.5, 12.5, 3.5, 3.5)
3	2.05 m	1.41 m	*ca*. 1.32, *ca*. 1.26
5	2.98 s	1.63 dd(11.8, 5.1)	1.91 d(11.5)
6		1.59 m, 1.35 m	5.13 ddd(11.5, 11.5, 5.0)

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Table 10-1-42 (continued)

H	10-1-120	10-1-121	10-1-122
7	5.76 br s	5.51 m	*ca*. 1.85, *ca*. 1.48
8			1.99 m
11	2.05 m, 2.18 m	–	2.19 ddd(13.5, 11.5, 7.5), *ca*. 1.85
12	1.98 m, 2.25 m	1.82 ddd(12.0, 4.6, 2.1), 2.02 m	2.56 ddd(19.0, 11.5, 7.5)
			2.49 ddd(19.0, 11.5, 5.5)
14	2.65 d(14.0), 2.52 d(14.0)	2.75 d(15.0), 2.61 d(14.4)	
15		3.65 s(COOMe)	
16	1.44 s	1.33 s	
17	2.02 s	1.76 s	0.89 d(6.5)
18	1.06 s	0.87 s	0.90 s
19	3.55 d(12.0), 3.31 d(12.0)	0.90 s	1.04 s
20	0.97 s	0.81 s	1.00 s
OAc			2.03 s

Table 10-1-43: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-123**~**10-1-126**.

H	10-1-123	10-1-124	10-1-125	10-1-126
1	*ca*. 1.51	1.58 m	ax 1.25 ddd(12.9, 12.9, 3.5)	–
	1.12 ddd(12.5, 12.5, 3.5)	0.87 m	eq 1.80 m	
2	*ca*. 1.63, *ca*. 1.51	1.61 m, 1.38 m	1.55 m, 1.64 m	–
3	1.31 ddd(13.0, 5.0, 3.0)	1.43 m	ax 1.19 m, eq 1.44 m	–
	1.19 ddd(13.0, 13.0, 3.5)	1.14 td(13.2, 3.0)		
5	1.75 d(2.5)	0.95 dd(12.5, 2.5)	1.09 dd(12.7, 2.9)	1.10 dd(12.3, 2.5)
6	5.43 ddd(2.5, 2.5, 2.5)	1.65 m, 1.23 td(12.2, 3.5)	ax 1.37 m, eq 1.72 m	–
7	1.90 ddd(14.5, 13.5, 2.5)	1.77 dt(12.0, 3.5)	ax 2.00 ddd(13.0, 13.0, 7.3)	–
	ca. 1.51	1.40 m	eq 2.36 ddd(13.0, 4.7, 2.4)	
8	2.14 m			
9		1.49 m	2.19 br d(2.6)	–
11	1.99 ddd(13.5, 13.5, 5.5)	1.49 m	5.52 dd(2.6, 2.6)	4.80 br s
	1.71 m			
12	*ca*. 1.84, *ca*. 1.82	1.47 m, 2.15 m	6.44 t(2.6)	7.20 br s

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Table 10-1-43 (continued)

H	10-1-123	10-1-124	10-1-125	10-1-126
13	2.54 m 2.18 ddd(17.0, 12.5, 5.5)			
14		3.45 ddd(5.7, 5.4, 3.5) 2.89 d(5.4, OH)	ax 2.69 dd(15.6, 8.6) eq 3.33 dd(15.6, 5.3)	2.40 dd(17.8, 3.5) 2.55 m
15		3.75 dd(11.2, 2.5) 3.61 ddd(11.2, 8.7, 3.0) 2.75 br d(8.7, OH)	5.48 dd(8.6, 5.3)	6.38 d(4.4)
16		1.13 s	9.39 s	
17	0.94 d(6.5)	1.28 s	4.79 d(1.4), 4.83 br s	2.25 d(4.5), 2.26 d(4.5)
18	1.00 s	0.80 s	0.87 s	0.92 s
19	0.98 s	0.86 s	0.84 s	1.05 s
20	1.28 s	0.80 s	0.98 s	1.22 s
OAc	2.05 s			2.10 s

Table 10-1-44: Compounds, MFs, and test solvents of labdane-type diterpenoids **10-1-127**~**10-1-144**.

No.	Compounds	MFs	Test solvents	References
10-1-127	agallochin A	$C_{20}H_{33}ClO_3$	$CDCl_3$	[13]
10-1-128	6*α*-acetoxymanoyl oxide	$C_{22}H_{36}O_3$	$CDCl_3$	[56]
10-1-129	1*R*,11*S*-dihydroxy-8*R*,13*R*-epoxylabd-14-ene	$C_{20}H_{34}O_3$	$CDCl_3$	[57]
10-1-130	*ent*-1*β*-hydroxy-3-oxomanoyl oxide	$C_{20}H_{32}O_3$	$CDCl_3$	[58]
10-1-131	*ent*-1*β*,3*α*-dihydroxymanoyl oxide	$C_{20}H_{34}O_3$	$CDCl_3$	[58]
10-1-132	*ent*-3-oxomanoyl oxide	$C_{20}H_{32}O_2$	$CDCl_3$	[58]
10-1-133	*ent*-3*α*-hydroxymanoyl oxide	$C_{20}H_{34}O_2$	$CDCl_3$	[58]
10-1-134	plectrornatin B	$C_{22}H_{34}O_5$	$CDCl_3$	[59]
10-1-135	1*α*,6*β*,7*β*-triacetoxy-8,13*R**-epoxy-14-labden-11-one	$C_{26}H_{38}O_8$	$CDCl_3$	[60]
10-1-136	1*α*,6*β*,7*β*-triacetoxy-9-hydroxy-8,13*R**-epoxy-14-labden-11-one	$C_{26}H_{38}O_9$	$CDCl_3$	[60]
10-1-137	*ent*-1,2-dehydro-3-oxomanoyl oxide	$C_{20}H_{30}O_2$	$CDCl_3$	[58]
10-1-138	*ent*-1,2-dehydro-12*α*-hydroxy-3-oxomanoyl oxide	$C_{20}H_{30}O_3$	$CDCl_3$	[58]
10-1-139	1,2-dehydro-3,7-dioxo-manoyl oxide	$C_{20}H_{28}O_3$	$CDCl_3$	[61]
10-1-140	1,2-dehydro-7*β*-hydroxy-3-oxo-manoyl oxide	$C_{20}H_{30}O_3$	$CDCl_3$	[61]
10-1-141	(8*S**,13*S**)-epoxy-9(11),14-labdadiene	$C_{20}H_{32}O$	C_6D_6	[9]
10-1-142	3,7-dioxo-manoyl oxide	$C_{20}H_{30}O_3$	$CDCl_3$	[61]
10-1-143	3*β*-hydroxy-7-oxo-manoyl oxide	$C_{20}H_{32}O_3$	$CDCl_3$	[61]
10-1-144	agallochin E	$C_{19}H_{30}O_3$	$CDCl_3$	[13]

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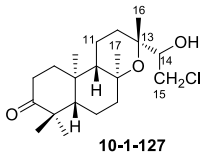

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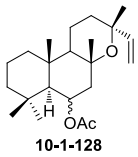
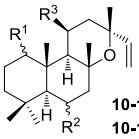
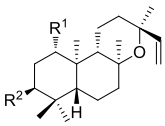


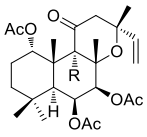
10-1-128



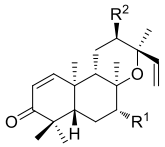
	R^1	R^2	R^3
10-1-129	β-OH	H	OH
10-1-134	α-OH	β-OAc	=O



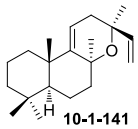
	R^1	R^2
10-1-130	OH	=O
10-1-131	OH	OH
10-1-132	H	=O
10-1-133	H	OH



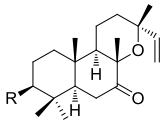
10-1-135 R = H
10-1-136 R = OH



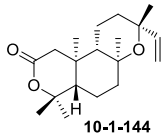
	R^1	R^2
10-1-137	H	H
10-1-138	H	OH
10-1-139	=O	H
10-1-140	OH	H



10-1-141



10-1-142 R = =O
10-1-143 R = OH



10-1-144

Table 10-1-45: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-127**~**10-1-130**.

H	10-1-127	10-1-128	10-1-129	10-1-130
1	1.83 m, 1.45 m	1.57 m, 1.45 m	3.48 dd(4.5, 11.0)	3.89 t(6)
2	2.42 m, 2.58 m	1.49 dt(16, 6), 1.67 m	1.63 m, 1.73 m	2.36 dd(15, 5), 2.92 dd(15, 8)
3		1.16 dt(16), 1.37 dt(16)	1.26 m 1.39 dt(13.5, 3.5)	
5	1.48 m	1.32 d(11.0)	0.83 m	1.49 m
6	1.62 m, 1.42 m	5.08 ddd(11.5, 11, 4.5)	1.47 m, 1.85 m	1.50 m, 1.54 m
7	1.46 m, 1.87 m	2.11 dd(11.5, 12.0) 1.87 dd(4.5, 12.0)	1.49 m, 1.64 m	1.35 m, 1.50 m
9	1.53 m	1.78 m	1.54 d(5.5)	1.52 m
11	1.48 m, 1.60 m	1.55 m, 1.42 m	4.37 dt(9.0, 6.0)	1.55 m, 2.18 m
12	1.58 m, 2.01 m	1.52 m	2.02 dd(14.0, 9.0) 2.27 dd(14.0, 8.5)	1.54 m, 1.56 m
14	3.84 dd(8, 2)	5.86 dd(17.5, 11.0)	5.89 dd(17.0, 10.5)	5.87 dd(18, 11)
15	3.45 dd(9.5, 8) 3.58 dd(9.5, 2)	4.83 dd(11.0, 1.5) 5.03 dd(17.0, 1.5)	4.95 dd(11.0, 1.5) 5.19 dd(17.0, 1.5)	4.93 dd(11, 2) 5.15 dd(18, 2)
16	1.09 s	1.23 s	1.24 s	1.28 s

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Table 10-1-45 (continued)

H	10-1-127	10-1-128	10-1-129	10-1-130
17	1.35 s	1.39 s	1.16 s	1.33 s
18	1.09 s	0.86 s	0.85 s	1.08 s
19	1.03 s	0.87 s	0.80 s	1.04 s
20	0.92 s	1.00 s	1.48 s	0.86 s
OAc		2.00 s		

Table 10-1-46: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-131**~**10-1-133**.

H	10-1-131	10-1-132	10-1-133
1	3.84 dd(11, 5)	1.45 m, 1.86 m	1.32 m, 1.35 m
2	1.80 m, 1.84 m	2.43 m, 2.53 m	1.58 m, 1.94 m
3	3.50 t(3)		3.41 d(2)
5	1.42 m	1.50 m	1.42 m
6	1.44 m, 1.58 m	1.05 m, 1.08 m	1.30 m, 1.57 m
7	1.76 m, 1.88 m	1.48 m, 1.86 m	1.49 m, 1.83 dt(12, 3)
9	1.68 m	1.40 m	1.44 m
11	1.70 m, 2.16 m	0.91 m, 1.84 m	1.42 m, 1.62 m
12	1.70 m	1.66 m, 1.80 m	1.61 m, 1.77 m
14	5.87 dd(18, 11)	5.87 dd(14, 9)	5.87 dd(18, 11)
15	4.92 dd(11, 2)	4.93 dd(11, 2)	4.90 dd(11, 2)
	5.13 dd(18, 2)	5.15 dd(18, 2)	5.11 dd(17, 2)
16	1.25 s	1.29 s	1.28 s
17	1.30 s	1.34 s	1.30 s
18	0.92 s	1.09 s	0.95 s
19	0.83 s	1.03 s	0.83 s
20	0.86 s	0.91 s	0.80 s

Table 10-1-47: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-134**~**10-1-136**.

H	10-1-134	10-1-135	10-1-136
1	4.42 dd(3.4, 2.5)	1.97 s(OAc), 5.50 t(2.7)	2.02 s(OAc), 5.56 m
2	*α* 1.47 m	*α* 1.91 m	*α* 1.63 m
	β 2.09 dddd(14.6, 13.5, 3.9, 2.5)	*β* 1.73 qd(12.3, 3.6)	*β* 2.06 m
3	*α* 1.64 ddd(14.6, 13.5, 3.6)	*α* 1.47 m	*α* 1.17 m
	β 1.09 ddd(14.6, 3.9, 2.5)	*β* 1.14 td(13.4, 3.3)	*β* 1.57 m
5	1.50 d(2.7)	1.62 d(2.2)	2.43 d(2.9)
6	5.57 ddd(3.4, 2.9, 2.7)	2.09 s(OAc), 5.75 dd(3.7, 2.4)	2.10 s(OAc), 5.81 dd(4.6, 2.9)
7	*α* 1.88 dd(14.6, 3.4)	5.11 d(4.0)	5.55 d(4.6)
	β 2.23 dd(14.6, 2.9)	2.08 s(OAc)	2.03 s(OAc)
9	3.43 s	3.33 s	4.74 s(OH)

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Table 10-1-47 (continued)

H	10-1-134	10-1-135	10-1-136
12	*α* 2.63 d(18.1)	*α* 2.60 d(18.8)	*α* 2.44 d(16.5)
	β 2.70 d(18.1)	*β* 2.66 d(18.8)	*β* 3.15 d(16.5)
14	5.94 dd(17.4, 10.7)	5.95 dd(17.4, 10.8)	5.92 dd(17.2, 10.7)
15	5.04 dd(10.7, 0.9)	5.07 dd(11.4, 0.9)	4.94 dd(10.7, 1.0)
	5.15 dd(17.4, 0.9)	5.28 dd(17.4, 0.9)	5.21 dd(17.2, 1.0)
16	1.28 s	1.23 s	1.35 s
17	1.47 s	1.52 s	1.64 s
18	0.97 s	0.99 s	1.05 s
19	0.95 s	0.96 s	0.97 s
20	1.37 s	1.45 s	1.53 s
OAc	2.04 s	1.97 s, 2.09 s, 2.08 s	2.02 s, 2.10 s, 2.03 s

Table 10-1-48: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-137**~**10-1-140**.

H	10-1-137	10-1-138	10-1-139	10-1-140
1	7.10 d(10)	7.13 d(10)	7.06 d(10.8)	7.06 d(10.2)
2	5.86 d(10)	5.88 d(10)	5.93 d(10.8)	5.86 d(10.2)
5	1.78 m	1.85 dd(12, 3)	2.12 dd(14.4, 2.4)	1.85 m
6	1.52 m, 1.70 m	1.52 m, 1.72 m	*α* 2.44 dd(14.4, 2.4)	*α* 1.87 m
			β 2.80 t(14.4)	*β* 1.54 dt(13.8, 12.0)
7	1.53 m, 1.92 m	1.58 m, 1.92 m		3.69 dd(12.0, 4.8)
9	1.62 m	2.09 dd(9, 6)	2.02 dd(11.4, 4.8)	1.51 m
11	1.70 m, 1.84 m	1.94 m, 1.98 m	1.91 m	*α* 1.83 m, *β* 1.77 m
12	1.72 m, 1.90 m	3.80 dd(7, 4)	*α* 1.84 m, *β* 1.91 m	*α* 1.69 m, *β* 1.86 m
14	5.89 dd(18, 11)	5.81 dd(17, 11)	5.92 dd(17.4, 10.8)	5.85 dd(17.4, 10.8)
15	4.94 dd(11, 1)	5.26 dd(11, 2)	5.23 dd(17.4, 1.2)	5.14 dd(17.4, 1.2)
	5.16 dd(17, 2)	5.44 dd(18, 2)	4.99 dd(10.8, 1.2)	4.94 dd(10.8, 1.2)
16	1.32 s	1.39 s	1.36 s	1.30 s
17	1.38 s	1.38 s	1.57 s	1.35 s
18	1.16 s	1.16 s	1.15 s	1.17 s
19	1.08 s	1.09 s	1.11 s	1.10 s
20	1.05 s	1.04 s	1.29 s	1.05 s

Table 10-1-49: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-141**~**10-1-144**.

H	10-1-141	10-1-142	10-1-143	10-1-144
1	*α* 1.16 ddd(13.7, 13.7, 4.1)	*α* 1.43 ddd(13.2, 10.8, 6.6)	*α* 1.01 m	2.66 d(16)
	β 1.84 m	*β* 1.94 ddd(13.2, 7.2, 3.6)	*β* 1.68 m	1.93 d(16)
2	*α* 1.38 m	*α* 2.44 ddd(16.2, 6.6, 3.6)	*α* 1.72 m	
	β 1.53 tt(13.7, 13.7, 3.3)	*β* 2.62 ddd(16.2, 10.8, 7.2)	*β* 1.66 m	
3	*α* 1.04 ddd(13.7, 13.7, 3.8)		3.24 dd(11.4, 4.2)	
	β 1.33 dddd(13.7, 3.3, 3.3, 1.6)			

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Table 10-1-49 (continued)

H	10-1-141	10-1-142	10-1-143	10-1-144
5	1.30 dd(11.8, 8.0)	1.85 dd(14.4, 3.0)	1.28 br d(14.4)	1.6 m
6	*α* 1.58 m, *β* 1.42 m	2.35 dd(14.4, 3.0)	2.42 br d(14.4)	1.46 m
		2.74 t(14.4)	2.63 t(14.4)	1.6 m
7	*α* 1.83 dd(13.2, 9.6)			1.48 m
	β 2.08 q-like			1.84 m
9		1.76 m	1.65 m	1.26 m
11	5.48 dd(8.5, 3.0)	*α* 1.69 m, *β* 1.76 m	1.64 m	1.56 m, 1.42 m
12	*α* 2.20 dd(15.7, 3.0)	*α* 1.76 m	*α* 1.72 m	1.52 m
	β 2.04 dd(15.7, 8.5)	*β* 1.83 m	*β* 1.80 m	2.27 m
14	5.70 dd(17.0, 10.4)	5.91 dd(16.8, 10.2)	5.91 dd(17.4, 10.8)	6.00 dd(18, 11)
15	4.98 dd(10.4, 2.2)	5.21 br d(17.4)	5.20 br d(17.4)	4.94 d(11)
	5.26 dd(17.0, 2.2)	4.96 br d(10.8)	4.95 br d(10.8)	5.00 d(18)
16	1.36 s	1.33 s	1.31 m	1.14 s
17	1.40 d(0.8)	1.54 s	1.48 m	1.25 s
18	0.85 s	1.05 s	0.81 s	1.43 s
19	0.78 s	1.07 s	0.96 s	1.32 s
20	1.10 d(0.8)	1.17 s	1.02 s	0.89 s

Table 10-1-50: Compounds, MFs, and test solvents of labdane-type diterpenoids **10-1-145**~**10-1-162**.

No.	Compounds	MFs	Test solvents	References
10-1-145	negundoin E	$C_{22}H_{36}O_5$	$CDCl_3$	[51]
10-1-146	*rel*-(5*S*,6*R*,8*R*,9*R*,10*S*,13*S*,16*S*)-6-acetoxy-9,13-epoxy-16-methoxy-labdan-15,16-olide	$C_{23}H_{36}O_6$	$CDCl_3$	[32]
10-1-147	*rel*-(5*S*,6*R*,8*R*,9*R*,10*S*,13*S*)-6-acetoxy-9,13-epo-xy-15-methoxy-labdan-16,15-olide	$C_{23}H_{36}O_6$	$CDCl_3$	[32]
10-1-148	*rel*-(5*S*,8*R*,9*R*,10*S*,13*S*,15*S*,16*R*)-9,13:15,16-die-poxy-15,16-dimethoxy-labdane	$C_{22}H_{38}O_4$	$CDCl_3$	[32]
10-1-149	leoheteronone A	$C_{23}H_{36}O_6$	$CDCl_3$	[62]
10-1-150	leoheteronone B	$C_{20}H_{32}O_4$	$CDCl_3$	[62]
10-1-151	leopersin D	$C_{20}H_{30}O_5$	$CDCl_3$	[47]
10-1-152	15*β*-methoxyfaciculatin	$C_{23}H_{32}O_8$	$CDCl_3$	[63]
10-1-153	15*α*-methoxyfaciculatin	$C_{23}H_{32}O_8$	$CDCl_3$	[63]
10-1-154	leopersin H	$C_{20}H_{30}O_6$	$CDCl_3$	[64]
10-1-155	marrubiglobosin	$C_{20}H_{30}O_5$	$CDCl_3$	[65]
			C_6D_6	[65]
10-1-156	otostegin A	$C_{22}H_{32}O_5$	$CDCl_3$	[66]
10-1-157	19-acetoxypregaleopsin	$C_{24}H_{34}O_7$	$CDCl_3$	[67]
10-1-158	13(*R*)-9*α*,13*α*-epoxylabda-6*β*(19),16(15)-diol dilactone	$C_{20}H_{28}O_5$	$CDCl_3$	[31]
10-1-159	cyllenin A	$C_{20}H_{30}O_5$	$CDCl_3$	[31]
10-1-160	9*α*,13*R*-15,16-bisepoxy-15*β*-methoxy-3-oxo-labdan-6*β*,19-olide	$C_{21}H_{30}O_6$	$CDCl_3$	[40]
10-1-161	13*R*-preperegrinine	$C_{20}H_{26}O_5$	$CDCl_3$	[40]
10-1-162	13*S*-preperegrinine	$C_{20}H_{26}O_5$	$CDCl_3$	[40]

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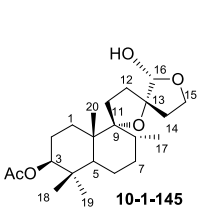
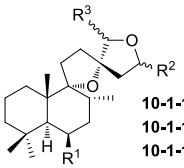
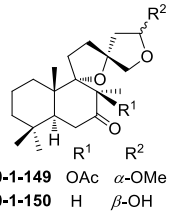


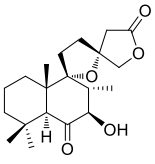
10-1-145



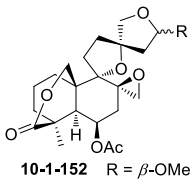
	R^1	R^2	R^3
10-1-146	OAc	=O	β-OMe
10-1-147	OAc	α-OMe	=O
10-1-148	H	α-OMe	α-OMe



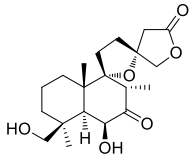
	R^1	R^2
10-1-149	OAc	α-OMe
10-1-150	H	β-OH



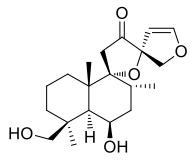
10-1-151



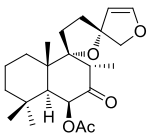
10-1-152 R = β-OMe
10-1-153 R = α-OMe



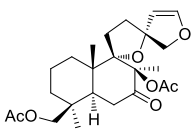
10-1-154



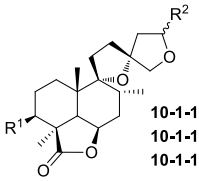
10-1-155



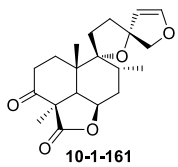
10-1-156



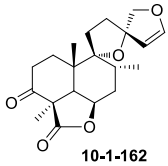
10-1-157



	R^1	R^2
10-1-158	H	=O
10-1-159	H	α-OH
10-1-160	=O	OMe



10-1-161



10-1-162

Table 10-1-51: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-145**~**10-1-147**.

H	10-1-145	10-1-146	10-1-147
1	1.37 m, 1.59 m	*ca*. 1.32, 1.42 dddd(12.0, 3.0, 3.0, 3.0)	1.32 m, *ca*. 1.81
2	1.55 m, 1.68 m	*ca*. 1.63 1.51 ddddd(13.0, 3.0, 3.0, 3.0, 3.0)	*ca*. 1.54, *ca*. 1.60
3	4.40 dd(11.4, 4.4)	*ca*. 1.32, 1.17 ddd(13.5, 13.5, 3.0)	*ca*. 1.27, 1.20 ddd(13.5, 13.5, 4.0)
5	1.45 m	1.45 d(3.0)	1.50 d(3.0)
6	1.50 m, 1.33 m	5.38 ddd(3.0, 3.0, 3.0)	5.38 ddd(3.0, 3.0, 3.0)
7	1.38 m	*ca*. 1.62, 1.48 ddd(14.0, 3.0, 3.0)	*ca*. 1.54, 1.63 ddd(14.0, 14.0, 3.0)
8	1.68 m	*ca*. 2.13	*ca*. 2.13
11	1.71 m, 2.02 m	*ca*. 2.10, 1.72 ddd(13.5, 9.0, 2.5)	*ca*. 1.82, *ca*. 2.30
12	1.87 m	2.48 ddd(13.5, 9.0, 2.5) 1.86 ddd(13.5, 9.0, 9.0)	*ca*. 2.11, *ca*. 2.30
14	1.80 m, 2.31 m	2.67 d(17.5), 2.83 d(17.5)	2.15 dd(13.5, 5.5), 2.59 dd(13.5, 3.5)

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Table 10-1-51 (continued)

H	10-1-145	10-1-146	10-1-147
15	3.71 m, 4.04 m		5.45 dd(5.5, 3.5), 3.53 s(OMe)
16	4.68 s	5.33 s, 3.52 s(OMe)	
17	0.81 d(6.6)	0.83 d(6.5)	0.84 d(6.5)
18	0.80 s	0.98 s	0.97 s
19	0.79 s	0.95 s	0.93 s
20	0.85 s	1.22 s	1.23 s
OAc	1.97 s	2.04 s	2.04 s

Table 10-1-52: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-148**~**10-1-151**.

H	10-1-148	10-1-149	10-1-150	10-1-151
1	–	1.42 m	1.40 m	1.48 (ov)
2	–	1.57 m	1.55 m	1.59 (ov)
3	–	1.33 m	1.40 m, 1.10 m	1.06~1.37 (ov)
5	–	1.65 dd(14.2, 2.4)	1.90 m	2.67 s
6	–	2.42 dd(14.2, 11.9) 2.26 dd(11.9, 2.4)	2.36 dd(14.2, 3.6) 2.25 m	
7	–			3.81 dd(11.1, 3.6) 3.69 d(3.6, OH)
8	1.69 m		2.61 q(6.8)	1.88 (ov)
11	2.03 m 1.61 ddd(13.0, 9.5, 2.5)	1.90 m, 2.16 m	1.80 m, 2.20 m	1.90~2.19 (ov)
12	1.90 ddd(13.0, 9.5, 2.5) 1.80 ddd(13.0, 9.5, 9.5)	2.11 t(5.1)	2.15 m	2.12~2.24 (ov)
14	2.39 dd(13.0, 6.0) 2.09 dd(13.0, 6.0)	2.07 m, 2.16 m	2.10 m, 2.27 m	2.60~3.00 d(17.0)
15	4.93 dd(6.0, 6.0) 3.42 s(OMe)	3.29 s(OMe),4.85 t(4.9)	5.48 d(5.1)	
16	4.25 s, 3.44 s(OMe)	3.49 d(8.1), 3.82 d(8.1)	3.83 d(8.7), 3.87 d(8.7)	4.26~4.45 d(9.1)
17	0.80 d(6.5)	1.25 s	0.95 d(6.8)	1.14 d(6.5)
18	0.79 s	0.76 s	0.81 s	1.28 s
19	0.86 s	0.82 s	0.84 s	0.98 s
20	0.86 s	1.12 s	1.06 s	0.87 s
OAc		1.99 s		

Table 10-1-53: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-152**~**10-1-154** and **10-1-156**.

H	10-1-152	10-1-153	10-1-154	10-1-156
1	1.68 m, 1.78 m	1.71 m, 1.84 m	1.35 (ov)	1.58 m
2	1.78 m	1.84 m	1.51 (ov)	1.41 m
3	1.56 m, 1.95 m	1.55 m, 1.85 m	1.17~1.50 (ov)	1.42 m, 1.34 m

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Table 10-1-53 (continued)

H	10-1-152	10-1-153	10-1-154	10-1-156
5	2.05 dd(6.3, 1.5)	2.06 dd(6.3, 1.5)	1.65 d(1.8)	1.76 d(2.4)
6	5.20 ddd(6.3, 3.4)	5.20 ddd(6.3, 3.4, 2.7)	4.12 d(1.8)	5.36 d(2.4)
7	1.62 dd(15.4, 2.7)	1.60 dd(15.3, 2.7)		
	2.62 dd(15.4, 3.4)	2.66 dd(15.3, 3.4)		
8			3.60 q(6.6)	3.30 q(6.5)
11	1.46 ddd(14.5, 9.6, 6.0)	1.46 ddd(14.0, 9.3, 4.6)	1.92~2.24 (ov)	2.27 m
	1.74 m	1.79 m		1.83 m
12	2.11 ddd(12.5, 6.0, 3.0)	1.72 m	2.10 (ov)	2.04 m, 2.19 m
	2.10 ddd(12.5, 9.6, 6.5)	2.14 ddd(14.3, 4.6, 4.4)		2.04 m
14	*α* 2.33 dd(13.5, 5.6)	2.06 dd(13.0, 3.0)	2.45 d(17.1)	5.08 d(2.6)
	β 1.87 dd(13.5, 2.3)		2.82 d(17.1)	
15	5.11 dd(5.6, 2.3)	5.00 dd(5.5, 3.0)		6.40 d(2.6)
	3.35 s(OMe)	3.38 s(OMe)		
16	*α* 3.95 d(9.3)	*α* 3.95 d(8.8)	4.17 d(9.2)	4.44 d(10.5)
	β 3.78 d(9.3)	*β* 3.61 d(8.8)	4.32 d(9.2)	4.03 d(10.5)
17	2.36 d(3.8)	2.37 d(3.8)	0.96 d(6.6)	0.98 d(6.5)
	2.66 d(3.8)	2.64 d(3.8)		
18			3.20 d(11.6), 4.18 d(11.6)	1.06 s
19	1.15 s	1.16 s	1.02 s	0.99 s
20	3.99 dd(11.5, 1.5)	3.97 dd(11.5, 1.5)	1.45 s	1.41 s
	5.07 dd(11.5, 2.0)	5.10 dd(11.5, 1.9)		
OAc	2.03 s	2.03 s		2.07 s
OH			4.83 br s, 6.29 br s	

Table 10-1-54: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-155**, **10-1-157**, and **10-1-158**.

H	10-1-155 (C_6D_6)	10-1-155 ($CDCl_3$)	10-1-157	10-1-158
1	0.88 m, 1.67 m	–	1.45 (ov), 1.69 (ov)	1.24 m
2	1.00 m, 1.33 m	–	1.60 (ov), 1.70 (ov)	1.78 m, 1.50 m
3	1.08 m, 1.24 m	–	1.15 (ov), 1.66 (ov)	2.11 m, 1.42 m
5	1.63 br s	1.64 br s	1.81 dd(14.3, 2.6)	2.08 m
6	4.20 m	4.24 m	*α* 2.41 dd(11.7, 2.6)	4.70 m
			β 2.53 dd(14.3, 11.7)	
7	*α* 1.73 dt(13.6, 3.2)	–		2.08 m
	β 1.50 dt(13.6, 3.2)			1.61 m
8	2.21 m	2.34 m	2.06 s(OAc)	2.18 m
11	1.95 d(18.3)	2.34 d(18.6)	2.10 (ov)	2.08 m
	2.41 d(18.3)	2.86 d(18.6)	2.26 (ov)	1.83 m
12	–	–	2.14 (ov)	2.10 m
14	4.78 d(2.6)	5.01 d(2.4)	5.10 d(2.6)	2.56 d(17.2), 2.83 d(17.2)
15	6.23 d(2.6)	6.59 d(2.4)	6.41 d(2.6)	
16	4.26 d(10.4)	4.33 d(10.3)	4.04 d(10.6)	4.40 d(9.2)
	4.58 d(10.4)	4.47 d(10.3)	4.48 d(10.6)	4.22 d(9.2)

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Table 10-1-54 (continued)

H	10-1-155 (C_6D_6)	10-1-155 ($CDCl_3$)	10-1-157	10-1-158
17	0.49 d(6.8)	0.68 d(6.8)	1.33 s	0.86 d(6.4)
18	2.98 d(11.1) 4.14 d(11.1)	3.21 d(11.2) 4.26 d(11.2)	3.84 d(11.0) 4.20 d(11.0) 2.03 s(OAc)	
19	0.93 s	1.07 s	0.97 s	1.29 s
20	1.17 s	1.30 s	1.16 s	1.05 s
OAc			2.06 s, 2.03 s	

Table 10-1-55: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-159**~**10-1-162**.

H	10-1-159	10-1-160	10-1-161	10-1-162
1	1.52 m, 1.28 m	1.95 (ov), 1.64 (ov)	2.11 (ov), 1.65 (ov)	1.93 (ov), 1.64 (ov)
2	1.70 m, 1.48 m	2.51~2.57 (ov)	2.50~2.62 (ov)	2.50~2.60 (ov)
3	2.10 m, 1.42 m			
5	1.91 d(3.6)	2.61 d(4.7)	2.58 d(4.3)	2.63 d(4.7)
6	4.68 dd(4.4, 3.6)	4.57 t(5.1)	4.56 t(5.1)	4.58 t(5.1)
7	2.08 m, 1.62 m	2.09 (ov), 1.70 (ov)	2.05 (ov), 1.74 (ov)	2.09 (ov), 1.74 (ov)
8	2.08 m	2.04 (ov)	2.05 (ov)	2.02 (ov)
11	2.08 m, 1.78 m	2.04 (ov), 1.88 (ov)	2.07 (ov), 1.78 (ov)	2.04 (ov), 1.87 (ov)
12	2.09 m, 1.92 m	2.15 (ov), 1.90 (ov)	2.15-2.00 (ov)	2.21 (ov), 1.96 (ov)
14	2.09 m, 2.26 br d(12.0)	2.18~2.13 (ov)	5.13 d(2.4)	5.10 d(2.4)
15	5.42 m	4.97 dd(5.9, 3.5) 3.38 s(OMe)	6.48 d(2.4)	6.49 d(2.4)
16	3.71 d(7.2), 4.21 d(7.2)	3.60 d(8.6), 3.91 d(8.6)	4.09 d(10.6), 4.44 d(10.6)	4.04 d(10.2), 4.39 d(10.2)
17	0.87 d(5.2)	0.85 d(6.2)	0.88 d(6.3)	0.94 d(6.2)
19	1.26 s	1.44 s	1.44 s	1.44 s
20	1.04 s	0.90 s	0.89 s	0.91 s

Table 10-1-56: Compounds, MFs, and test solvents of labdane-type diterpenoids **10-1-163**~**10-1-173**.

No.	Compounds	MFs	Test solvents	References
10-1-163	excoecarin S	$C_{20}H_{32}O_6$	DMSO-d_6	[68]
10-1-164	*ent*-12,15-dioxo-3,4-*seco*-4,8,13-labdatrien-3-oic acid	$C_{20}H_{30}O_4$	$CDCl_3$	[69]
10-1-165	*ent*-12,15-epoxy-3,4-*seco*-4,8,12,14-labdatetra-en-3-oic acid	$C_{20}H_{28}O_3$	$CDCl_3$	[69]
10-1-166	*ent*-15-*nor*-14-oxo-3,4-*seco*-4,8,12(*E*)-labdatrien-3-oic acid	$C_{19}H_{28}O_3$	$CDCl_3$	[69]
10-1-167	chapecoderin B	$C_{20}H_{30}O_4$	C_6D_6	[70]
10-1-168	chapecoderin C	$C_{20}H_{28}O_3$	C_6D_6	[70]
10-1-169	chapecoderin A	$C_{20}H_{30}O_4$	$CDCl_3$	[70]

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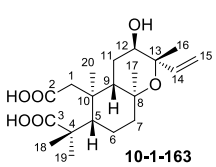
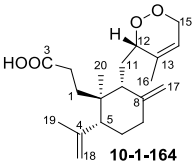
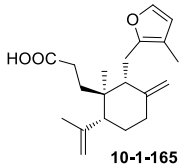
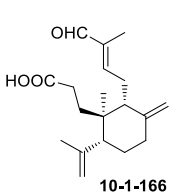
Table 10-1-56 (continued)

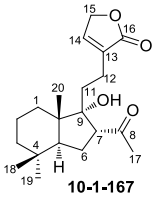
No.	Compounds	MFs	Test solvents	References
10-1-170	secoinfuscadione	$C_{20}H_{34}O_3$	$CDCl_3$	[9]
10-1-171	infuscadiol	$C_{20}H_{34}O_3$	$CDCl_3$	[9]
			C_5D_5N	[9]
10-1-172	neopallavicinin	$C_{20}H_{26}O_4$	$CDCl_3$	[71]
10-1-173	pallavicinin	$C_{20}H_{26}O_4$	$CDCl_3$	[72]

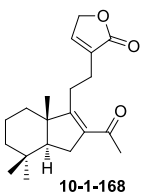


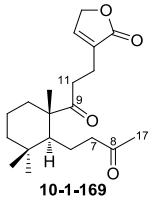


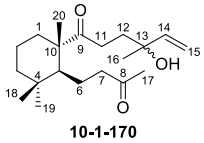


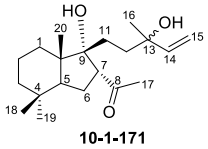


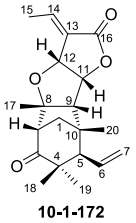












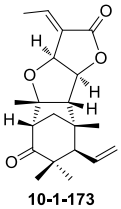


Table 10-1-57: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-163**~**10-1-166**.

H	10-1-163	10-1-164	10-1-165	10-1-166
1	2.24 d(18.3)	1.71 dd(16, 4)	1.70~1.82 m	1.86 dd(12.0, 4.4)
	2.45 d(18.3)	1.66 m		1.71 m
2		2.77 ddd(16, 12.4, 5.2)	2.55 dd(11.6, 5.2)	2.52 dd(12.8, 5.6)
		2.45 ddd(16, 12.4, 4.0)		2.23 dd(12.8, 5.2)
5	2.54 dd(10.0, 5.5)	2.31 dd(12.4, 4.0)	2.32 dd(12.4, 3.6)	2.28 dd(12.4, 4.4)
6	1.45 m	1.66 m, 1.62 m	1.62 m	1.62 m
7	1.29 ddd(11.7, 11.0, 5.0)	2.36 ddd(12.8, 3.6, 2.4)	2.33 dd(12.4, 3.6)	2.41 dt(12.8, 2.4)
	1.61 ddd(11.7, 3.0, 3.0)	2.03 dt(12.8, 4.8)	2.03 dd(12.4, 4.8)	2.02 dd(12.8, 4.8)
9	2.67 dd(12.0, 5.5)	2.30 t(10.8)	2.50 dd(9.5, 5.6)	2.07 dd(10.0, 6.0)

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Table 10-1-57 (continued)

H	10-1-163	10-1-164	10-1-165	10-1-166
11	1.45 m	1.88 dd(10.8, 14.4)	2.73 dd(15.6, 10.8)	2.48 m
	1.70 ddd(12.5, 12.5, 5.0)	1.77 (ov)	2.61 dd(15.6, 2.0)	
12	3.84 ddd(5.5, 5.3, 5.0)	4.16 d(8)		6.38 t(6.0)
14	5.98 dd(17.8, 11.1)	5.59 dd(4.0, 1.4)	6.11 d(1.6)	9.35 s
15	4.90 dd(11.1, 1.5)	4.70 dd(16, 4.0)	7.19 d(1.6)	
	5.05 dd(17.8, 1.5)	4.28 dd(16, 1.4)		
16	1.04 s	1.85 s	1.98 s	1.79 s
17	1.12 s	4.55 s, 4.92 s	4.59 s, 4.85 s	4.44 s, 4.92 s
18	1.16 s	4.87 s, 4.70 s	4.89 s, 4.73 s	4.91 s, 4.73 s
19	1.12 s	1.74 s	1.76 s	1.76 s
20	0.79 s	0.73 s	0.82 s	0.81 s
OH	4.43 d(5.3)			

Table 10-1-58: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-167**~**10-1-170**.

H	10-1-167	10-1-168	10-1-169	10-1-170
1	2.08 dd(12.7, 5.0)	1.70 td(14.0, 3.5)	1.36 m, 1.56 m	1.39 m, 1.47 m
	1.40 m	1.24 td(14.0, 3.5)		
2	1.59 m	1.59 m, 1.48 m	1.70 m, 1.60 m	1.49 m, 1.56 tt-like
3	1.17 m, 1.40 m	1.06 m, 1.37 m	1.42 m, 1.48 m	1.16~1.23 m, 1.41 m
5	2.32 dd(12.9, 8.1)	1.34 dd(12.0, 6.2)	1.72 m	1.72 t(4.7)
6	1.45 m, 1.55 m	2.11 dd(14.0, 12.0)	1.25 m, 1.32 m	1.16~1.23 m, 1.61 m
		2.09 dd(14.0, 6.2)		
7	2.60 dd(5.0, 12.2)		2.42 dd(8.2, 8.2)	2.39 tt(17.5, 5.5)
				2.44 tt(17.3, 5.5)
11	1.80 m, 1.82 m	2.94 dt(16.7, 5.1)	2.86 td(18.0, 7.2)	2.56 ddd(18.1, 7.7, 6.9)
		2.36 dt(16.7, 4.5)	2.74 td(18.0, 7.2)	2.61 ddd(18.1, 7.7, 6.3)
12	2.34 m, 2.52 td(7.0, 5.0)	2.50 m, 2.69 m	2.56 t(7.2)	1.73 ddd(14.6, 7.7, 6.3)
				1.82 ddd(14.6, 8.0, 6.9)
14	5.94 s	6.36 s	7.16 s	5.83 dd(17.3, 10.7)
15	3.80 s	3.85 s	4.75 s	5.07 dd(10.7, 1.4)
				5.23 dd(17.3, 1.4)
16				1.29 s
17	1.84 s	1.94 s	2.02 s	2.09 s
18	0.88 s	0.92 s	0.91 s	0.92 s
19	0.87 s	0.88 s	0.92 s	0.91 s
20	0.76 s	0.78 s	1.21 s	1.22 s

Table 10-1-59: ^{1}H NMR spectroscopic data of labdane-type diterpenoids **10-1-171**~**10-1-173**.

H	10-1-171 ($CDCl_3$)	10-1-171 (C_5D_5N)	10-1-172	10-1-173
1	1.34 dt(12.9, 3.3)	1.52 dt-like	1.76 dd(12.9, 4.5)	1.7 dd(13.3, 4.8)
	1.57~1.69 m	1.97~2.05 m	2.31 d(12.9)	2.23 d(13.3)
2	1.51~1.60 m	1.47 m, 1.60 m	2.72 d(4.5)	2.65 d(4.8)

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Table 10-1-59 (continued)

H	10-1-171 ($CDCl_3$)	10-1-171 (C_5D_5N)	10-1-172	10-1-173
3	*α* 1.11 ddd(13.2, 13.2, 4.9) *β* 1.40 dt(13.2, 3.6)	*α* 1.07 ddd(13.5, 13.5, 3.8) *β* 1.35 dt(13.5, 3.8)		
5	2.07 dd(12.6, 8.0)	2.29 dd(13.5, 7.4)	2.26 d(10.2)	1.78 d(10.5)
6	*α* 1.57~1.69 m *β* 1.86 q(12.6)	1.97~2.05 m 1.64 q(12.6)	5.69 dt(17.3, 10.2)	5.57 dd(16.7, 9.9)
7	2.87 dd(12.6, 4.9)	3.04 dd(11.3, 3.8)	5.02 dd(17.3, 1.8) 5.04 dd(10.2, 1.8)	4.86 dd(16.7, 1.7) 5.06 dd(9.9, 1.7)
9			2.27 d(8.7)	2.3 s
11	1.57~1.69 m	2.06~2.15 m 2.37 ddd(13.2, 13.2, 2.5)	5.18 dd(8.7, 7.1)	4.89 d(6.3)
12	1.51~1.60 m 1.57~1.69 m	1.97~2.05 m 2.06~2.15 m	5.26 br d(7.1)	5.31 br d(6.3)
14	5.86 dd(17.3, 10.7)	6.16 dd(17.3, 10.7)	7.10 qd(7.2, 1.9)	6.95 qd(7.0, 1.8)
15	5.06 dd(10.7, 1.4) 5.20 dd(17.3, 1.4)	5.17 dd(10.7, 1.9) 5.58 dd(17.3, 1.9)	1.98 d(7.2)	1.93 d(7.0)
16	1.26 s	1.48 s		
17	2.23 s	2.28 s	1.42 s	1.31 s
18	0.89 s	0.87 s	1.04 s	1.00 s
19	0.87 s	0.88 s	0.83 s	1.04 s
20	0.85 s	0.92 s	1.21 s	1.11 s
OH	4.95 s			

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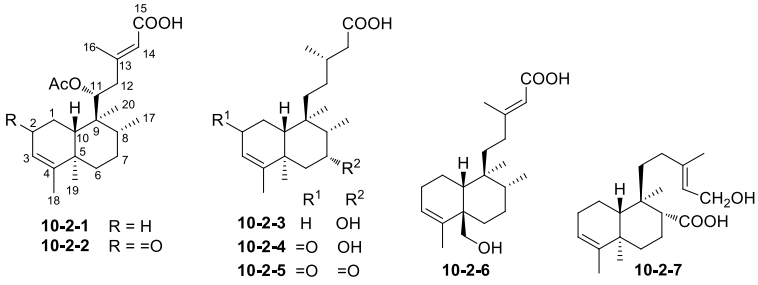
10.2 Clerodane-type diterpenoids

Table 10-2-1: Compounds, MFs, and test solvents of clerodane-type diterpenoids **10-2-1**~**10-2-25**.

No.	Compounds	MFs	Test solvents	References
10-2-1	11*R**-acetoxykolavenic acid	$C_{22}H_{34}O_4$	$CDCl_3$	[73]
10-2-2	11*R**-acetoxy-2-oxokolavenic acid	$C_{22}H_{32}O_5$	$CDCl_3$	[73]
10-2-3	(13*S*)-*ent*-7*β*-hydroxy-3-cleroden-15-oic acid	$C_{20}H_{34}O_3$	$CDCl_3$	[74]
10-2-4	*ent*-7*β*-hydroxy-2-oxo-3-cleroden-15-oic acid	$C_{20}H_{32}O_4$	$CDCl_3$	[74]
10-2-5	*ent*-2,7-dioxo-3-cleroden-15-oic acid	$C_{20}H_{30}O_4$	$CDCl_3$	[74]
10-2-6	deserticolic acid	$C_{20}H_{32}O_3$	$CDCl_3$	[75]
10-2-7	bacchasalicylic acid	$C_{20}H_{32}O_3$	$CDCl_3$	[76]
10-2-8	(–)-kolavelool	$C_{20}H_{34}O$	$CDCl_3$	[77]
10-2-9	(–)-2*β*-hydroxykolavelool	$C_{20}H_{34}O_2$	$CDCl_3$	[77]
10-2-10	13-*epi*-roseostachenol	$C_{20}H_{34}O_2$	$CDCl_3$	[77]
10-2-11	(–)-2*β*-hydroperoxykolavelool	$C_{20}H_{34}O_3$	$CDCl_3$	[77]
10-2-12	18-hydroxy-5,10-trans-cleroda-3,13*E*-dien-15-oic acid methyl ester	$C_{21}H_{34}O_3$	$CDCl_3$ C_6D_6	[78] [78]
10-2-13	17-hydroxy-3,13*E*-clerodadien-15-al	$C_{20}H_{32}O_2$	C_6D_6	[79]
10-2-14	17-hydroxy-3,13*Z*-clerodadien-15-al	$C_{20}H_{32}O_2$	C_6D_6	[79]
10-2-15	isoscoparin C	$C_{20}H_{32}O_3$	C_5D_5N	[80]
10-2-16	6*α*-hydroxy-3,12*E*,14-clerodatriene	$C_{20}H_{32}O$	$CDCl_3$	[81]
10-2-17	caseamembrin J	$C_{25}H_{36}O_5$	$CDCl_3$	[82]
10-2-18	caseamembrin K	$C_{24}H_{32}O_7$	$CDCl_3$	[82]
10-2-19	porwenin A	$C_{20}H_{32}O_4$	CD_3OD	[83]
10-2-20	6*α*,16-dihydroxycleroda-4(18),13-dien-15-oic acid	$C_{20}H_{32}O_4$	CD_3COCD_3	[84]
10-2-21	11*R**-acetoxy-3*β*-hydroxyneocleroda-4(18),13*E*-dien-15-oic acid	$C_{22}H_{34}O_5$	$CDCl_3$	[73]
10-2-22	4*α*,18*β*-epoxy-16-hydroxyclerod-13-en-15-oic acid	$C_{20}H_{32}O_4$	$CDCl_3$	[84]
10-2-23	*ent*-3*β*,4*β*-epoxyclerod-13*E*-en-15-ol	$C_{20}H_{34}O_2$	$CDCl_3$	[85]
10-2-24	3*R**,4*R**-dihydroxyclerod-13*E*-en-15-al	$C_{20}H_{34}O_3$	C_6D_6	[85]
10-2-25	3*R**,4*R**-dihydroxyclerod-13*Z*-en-15-al	$C_{20}H_{34}O_3$	C_6D_6	[85]



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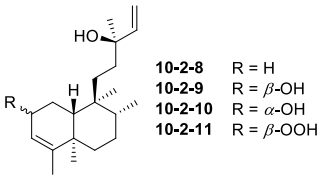

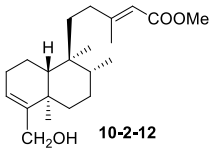

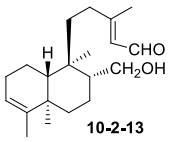

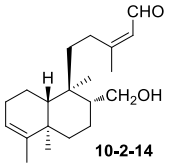

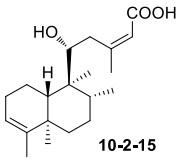

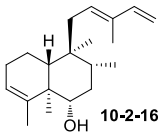

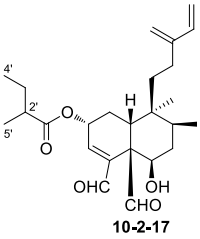

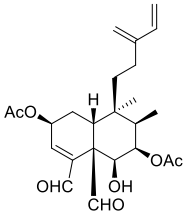

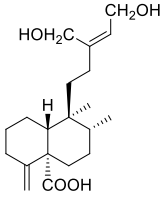

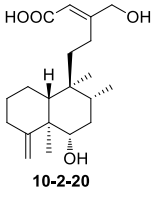

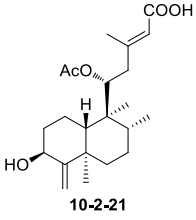

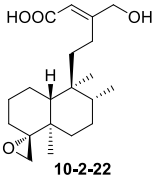

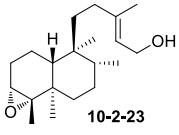

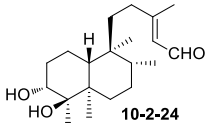

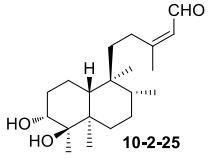

Table 10-2-2: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-1**~**10-2-4**.

H	10-2-1	10-2-2	10-2-3	10-2-4
1	*α* 1.55 m	*α* 2.50 dd(13.5, 17.5)	1.53 m	2.34 dd(3.9, 17.5)
	β 1.87 m	*β* 2.60 dd(3.6, 17.5)		2.44 dd(13.7, 17.5)
2	2.10 m, 1.99 m		1.96 m, 2.01 m	
3	5.19 br s	5.75 br s	5.11 m	5.67 d(1.3)
6	*α* 1.73 m	*α* 1.33 m	1.37 dd(3.3, 14.1)	1.50 dd(3.5, 14.0)
	β 1.19 dd(3.6, 9.2)	*β* 1.38 ddd(4.1, 12.1, 13.0)	2.07 dd(2.6, 14.1)	2.17 dd(2.8, 14.0)

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Table 10-2-2 (continued)

H	10-2-1	10-2-2	10-2-3	10-2-4
7	1.45 m	1.51 m	3.98 q(3.3)	4.06 ddd(2.8, 3.2, 3.5)
8	1.55 m	1.54 m	1.51 m	1.53 dd(3.2, 7.2)
10	1.40 m	1.98 dd(3.6, 13.5)	1.37 m	1.89 dd(3.9, 13.7)
11	5.44 dd(1.3, 9.8)	5.29 dd(2.6, 9.9)	1.28 m	1.25 m
	2.02 s(OAc)	2.01 s(OAc)		
12	2.28 m	2.30 dd(9.9, 13.2)	1.00 m	1.00 m
	2.44 d(13.2)	2.37 dd(2.6, 13.2)	1.16 ddd(5.5, 12.3)	1.09 m
13			1.84 m	1.83 m
14	5.67 br s	5.66 br s	2.14 dd(7.9, 15.1)	2.15 dd(8.7, 15.0)
			2.33 dd(6.2, 15.1)	2.29 dd(6.4, 15.0)
16	2.16 d(1.2)	2.14 d(1.3)	0.96 d(6.9)	0.95 d(6.7)
17	0.98 d(6.4)	1.01 d(5.7)	0.98 d(7.2)	1.00 d(7.2)
18	1.56 s	1.90 d(1.1)	1.59 d(1.4)	1.89 d(1.3)
19	1.05 s	1.16 s	1.26 s	1.37 s
20	0.77 s	0.87 s	0.97 s	1.05 s

Table 10-2-3: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-5**~**10-2-7**.

H	10-2-5	10-2-6	10-2-7
1	2.34 m	α 1.85 m, β 2.06 m	1.39~1.49 m, 1.56~1.64 m
2		α 2.16 m, β 2.02 m	2.01 m, 2.08 m
3	5.77 d(1.2)	5.60 br s	5.20 br s
6	2.34 m, 2.51 d(11.9)	α 1.27 m	α 1.79 dt(3.3, 13.2)
		β 1.86 m	β 1.17 ddd(3.6, 13.5, 13.5)
7		1.26 m	α 1.97 dddd(13.7, 13.7, 13.7, 3.3)
		1.37 m	β 1.69 dq(14.3, 3.6)
8	2.56 q(6.3, 12.8)	1.42 m	2.49 dd(12.9, 3.3)
10	2.46 dd(4.1, 11.2)		1.39~1.49 m
11	1.26 m, 1.41 dd(9.8, 12.6)	1.37 m, 1.67 m	1.39~1.49 m, 1.56~1.64 m
12	1.09 m, 1.26 m	2.06 m	1.84 ddd(12.9, 12.9, 4.7)
			2.10 ddd(12.9, 12.9, 3.6)
13	1.88 m		
14	2.19 dd(7.3, 15.1)	5.71 br s	5.42 br t(6.9)
	2.28 dd(6.4, 15.1)		
15			4.14 d(6.9)
16	0.98 d(6.7)	2.19 d(1.0)	1.68 s
17	0.92 d(6.3)	0.80 d(6.7)	
18	1.85 d(1.2)	1.72 d(1.2)	1.06 s
19	1.08 s	α 3.26 d(10.9), β 3.39 d(10.9)	1.59 br s
20	0.77 s	0.83 s	0.94 s

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Table 10-2-4: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-8**~**10-2-10**.

H	10-2-8	10-2-9	10-2-10
2		4.15 m	4.18 m
3	5.16 s	5.33 m	5.19 m
14	5.84 dd(17.2, 10.8)	5.93 dd(17.4, 10.7)	5.88 dd(17.4, 10.7)
15	5.07 dd(17.2, 1.5)	5.17 dd(17.4, 1.4)	5.19 dd(17.4, 1.4)
	4.99 dd(10.8, 1.5)	4.98 dd(10.7, 1.4)	5.06 dd(10.7, 1.4)
16	1.24 s	1.22 s	1.27 s
17	0.75 d(5.9)	0.79 d(6.2)	0.77 d(5.9)
18	1.54 d(1.5)	1.62 t(1.2)	1.60 t(1.5)
19	0.95 s	0.94 s	0.97 s
20	0.68 s	0.73 s	0.73 s

Table 10-2-5: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-11**~**10-2-13**.

H	10-2-11	10-2-12 ($CDCl_3$)	10-2-12 (C_6D_6)	10-2-13
1	2.20 br d(16.2) 1.45 dd(16.2, 3.4)	α 1.81, β 2.03	α 1.59, β 1.85	1.25~1.56 m
2	4.40 m, 10.19 br s(OOH)	α 2.15, β 2.20	α 2.01, β 1.97	1.88 m, 1.97 br d(16.2)
3	5.20 m	5.63 br s	5.50 br s	5.20 br s
6	1.35 m, 1.63 m	α 2.09 br dt(13.9, 3, 3) β 1.16 dd(13.9, 4.1)	2.09 br d(13.9) 1.02 dd(13.9, 4.4)	1.07 ddd(14.3, 14.3, 4.9) 1.64~1.68 m
7	1.38 m	α 1.24, β 1.29	α 1.19, β 1.17	1.20~1.23 m, 1.64~1.68 m
8	1.35 m	1.44	1.22	1.25~1.56 m
10	1.70 m	1.33 d(7.2)	1.13 d(10.8)	1.20~1.23 m
11	1.40 m, 1.70 m	1.36, 1.62	1.24, 1.45	1.25~1.56 m
12	1.65 m	1.99, 2.01	1.77, 1.79	1.63 m 1.80 ddd(12.4, 12.4, 5.2)
14	6.01 dd(17.3, 10.8)	5.69 br s	5.88 br s	5.91 dd(8.0, 1.1)
15	5.22 dd(17.3, 1.0) 5.00 dd(10.8, 1.0)	3.69 s(COOMe)	3.48 s(COOMe)	9.91 d(8.0)
16	1.31 s	2.18 s	2.26 s	1.59 s
17	0.81 d(5.3)	0.77 d(7.2)	0.66 d(5.8)	3.00 t(10.2) 3.41 dd(10.2, 4.4)
18	1.63 t(1.4)	4.23 d(13.2) 4.12 d(13.2)	4.05 dd(13.2, 1.3) 3.92 d(13.2)	1.59 d(1.1)
19	0.97 s	1.14 s	1.11 s	0.96 s
20	0.78 s	0.78 s	0.72 s	0.60 s

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Table 10-2-6: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-14**~**10-2-17**.

H	10-2-14	10-2-15	10-2-16	10-2-17
1	1.25~1.43 m	1.82 (ov), 1.90 (ov)	1.53~1.63 m	*α* 1.88 m, *β* 2.02 m
2	1.91 m, 1.97 br d(16.2)	1.56 (ov)	*α* 2.02 br d(17.9), *β* 1.89 m	5.66 m
3	5.20 br s	5.16 br s	5.22 br s	6.92 br s
6	*α* 1.08 ddd(12.4, 12.4, 3.3) *β* 1.62~1.70 m	*α* 1.58 (ov), *β* 1.10 (ov)	3.53 dt(10.2, 4.9)	4.04 t(7.5)
7	1.20 m, 1.62~1.70 m	1.23~1.33 (ov)	*α* 1.47 ddd(13.5, 13.5, 11.3) *β* 1.53~1.63 m	1.84 m
8	1.25~1.43 m	1.32 (ov)	1.53~1.63 m	1.75 m
10	1.23 br s(11.8)	1.51 (ov)	1.30 dd(11.8, 2.2)	2.33 m
11	1.25~1.43 m	4.02 dd(2.8, 12.0)	2.14 dd(15.7, 8.0) 2.20 dd(15.7, 8.0)	1.27 m, 1.39 m
12	1.89 ddd(13.2, 13.2, 5.2) 2.26 ddd(12.4, 12.4, 4.7)	*α* 2.39 t(9.8) *β* 2.16 (ov)	5.42 t(8.0)	1.90 m
14	5.80 dd(7.4, 1.4)	5.89 s	6.37 dd(17.9, 11.0)	6.31 dd(17.6, 10.7)
15	9.96 d(7.4)		4.93 d(11.0), 5.07 d(17.9)	5.03 d(10.7), 5.17 d(17.6)
16	1.48 d(1.4)	1.90 s	1.75 s	5.02 s, 4.98 s
17	3.01 dd(10.4, 6.9) 3.42 dd(10.4, 5.2)	0.72 d(6.3)	0.86 d(6.3)	0.91 d(7.4)
18	1.59	0.96 s	1.83 s	10.33 s
19	0.95 s	1.52 s	1.02 s	9.37 s
20	0.58 s	1.00 s	0.76 s	0.96 s
2′				2.42 m
3′				1.72 m, 1.54 m
4′				0.96 t(7.5)
5′				1.19 d(7.5)

Table 10-2-7: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-18**~**10-2-21**.

H	10-2-18	10-2-19	10-2-20	10-2-21
1	*α* 1.93 m, *β* 2.02 m	1.63 m, 2.30 m	1.33 m, 1.46 m	*α* 1.71 m, *β* 1.93 m
2	5.66 br s	1.93 m	1.83 m	2.27 m, 1.31 m
3	6.96 d(3)	2.17 br d(13.4) 2.56 m	2.01 m 2.24 td(13.2, 4.6)	4.33 dd(5.6, 11.7)
6	5.06 d(10.5)	1.30 m, 2.51 m	3.81 dd(7.9, 9.6)	1.58 m
7	3.89 t(10.5)	1.50 m	1.57 m	1.50 m
8	1.67 m	1.58 m	1.69 m	1.52 m

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Table 10-2-7 (continued)

H	10-2-18	10-2-19	10-2-20	10-2-21
10	2.43 dd(10.3)	1.33 dd(12.8, 3.1)	1.15 dd(2.6, 7.5)	1.13 dd(1.8, 12.2)
11	1.28 m, 1.42 m	1.46 m, 1.56 m	1.32 m, 1.47 m	5.35 dd(1.7, 10.5) 2.00 s(OAc)
12	1.94 m	1.88 m, 2.24 m	2.33 m	2.27 m
14	6.34 dd(17.5, 10.6)	5.45 t(6.7)	5.96 br s	5.65 br s
15	5.20 d(17.6) 5.05 d(10.5)	4.13 d(6.7)		
16	5.02 s, 4.98 s	4.09 s	4.10 br s	2.12 d(1.1)
17	0.97 d(7.3)	0.82 d(6.1)	0.85 d(6.6)	0.99 d(5.6)
18	10.43 s	4.76 br s, 4.78 br s	4.58 d(1.2), 4.89 d(1.2)	4.74 br s, 4.95 d(1.6)
19	9.22 s		1.05 s	1.09 s
20	1.03 s	0.75 s	0.70 s	0.77 s
2-OAc	2.03 s			
7-OAc	2.10 s			

Table 10-2-8: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-22**~**10-2-25**.

H	10-2-22	10-2-23	10-2-24	10-2-25
1	1.92 m	1.08~1.18 m (ov)	1.11~1.17 m (ov) 1.49~1.56 m (ov)	1.13~1.45 m (ov) 1.47~1.63 m (ov)
2	1.40 m	1.38~1.47 m (ov), 2.00 br d	1.43 m, 1.97 tt-like	1.98 dddd(13.7, 13.7, 4.6, 3.7) 1.13~1.45 m (ov)
3	1.02 m	2.71 s	3.21 br s	3.19 br s
6	1.50 m	1.08~1.18 m (ov) 1.38~1.47 m (ov)	1.22~1.33 m (ov) 1.49~1.56 m (ov)	1.13~1.45 m (ov) 1.47~1.63 m (ov)
7	2.30 m, 2.50 m	1.24~1.36 m (ov)	1.22~1.33 m (ov), 1.38 m	1.13~1.45 m (ov)
8	1.37 m	1.24~1.36 m (ov)	1.22~1.33 m (ov)	1.13~1.45 m (ov)
10	1.27 m	0.82 d(11.0)	1.74~1.79 m (ov)	1.79 dd(12.5, 2.2)
11	1.38 m	1.24~1.36 m (ov)	1.11~1.17 m (ov) 1.22~1.33 m (ov)	1.13~1.45 m (ov)
12	2.13 m	1.63 ddd(12.5, 12.5, 5.1) 1.80 ddd(13.2, 13.2, 5.1)	1.74~1.79 m (ov)	2.03 ddd(12.5, 12.5, 4.4) 2.18 ddd(12.5, 12.5, 5.1)
14	6.00 br s	5.42 br t	5.89 d(7.8)	5.79 dd(8.1, 1.2)
15		4.00 d(6.6)	9.88 d(7.8)	10.03 d(7.6)
16	4.20 br s	1.50 s	1.54 s	1.43 d(1.0)
17	0.83 d(6.4)	0.74 d(5.9)	0.68 d(6.6)	0.68 d(6.6)
18	2.40 d(4.4) 3.08 dd(4.4, 2.0)	1.15 s	1.15 s	1.14 d(1.0)
19	1.13 s	1.10 s	1.01 s	1.02 s
20	0.72 s	0.60 s	0.67 s	0.64 s

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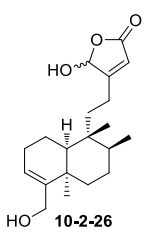
Table 10-2-9: Compounds, MFs, and test solvents of clerodane-type diterpenoids **10-2-26**~**10-2-44**.

No.	Compounds	MFs	Test solvents	References
10-2-26	(5*R*,8*S*,9*R*,10*S*)-*cis*-cleroda-3,13-dien-16,18-dihydroxy-15-oic acid-15,16-olide	$C_{20}H_{30}O_4$	$CDCl_3$	[86]
10-2-27	6*α*,16,18-trihydroxycleroda-3(4),13(14)-dien-15,16-olide	$C_{20}H_{30}O_5$	CD_3COCD_3	[87]
10-2-28	16-hydroxycleroda-3-en-15,16-olide-3-one	$C_{20}H_{30}O_4$	$CDCl_3$	[88]
10-2-29	16-acetoxy-cleroda-3,13-dien-15,16-olide	$C_{22}H_{32}O_4$	$CDCl_3$	[89]
10-2-30	salvidivin A	$C_{23}H_{28}O_{10}$	$CDCl_3$-CD_3OD (1:1)	[90]
10-2-31	salvidivin C	$C_{23}H_{28}O_{10}$	CD_3OD	[90]
10-2-32	15*ξ*-methoxy-cleroda-3,12-dien-18-carboxy-15,16-olide	$C_{21}H_{30}O_5$	C_5D_5N	[91]
10-2-33	(–)-methyl-16-hydroxy-19-*nor*-2-oxo-*cis*-cleroda-3,13-dien-15,16-olide-20-oate	$C_{20}H_{26}O_6$	$CDCl_3$	[92]
10-2-34	12(*S*),16*ξ*-dihydroxycleroda-3,13-dien-15,16-olide	$C_{20}H_{30}O_4$	$CDCl_3$	[93]
10-2-35	12(*S*)-hydroxy-16*ξ*-methoxycleroda-3,13-dien-15,16-olide	$C_{21}H_{32}O_4$	$CDCl_3$	[93]
10-2-36	12(*S*)-hydroxycleroda-3,13-dien-15,16-olide	$C_{20}H_{30}O_3$	CD_3OD	[93]
10-2-37	16*ξ*-hydroxycleroda-3,11(*E*),13-trien-15,16-olide	$C_{20}H_{28}O_3$	C_5D_5N CD_3OD	[93] [93]
10-2-38	1*β*,12-epoxy-16-hydroxy-*cis*-*ent*-cleroda-13-en-15,16:18*α*,6*α*-diolide	$C_{20}H_{26}O_6$	$CDCl_3$	[94]
10-2-39	barbatin C	$C_{20}H_{28}O_5$	$CDCl_3$	[95]
10-2-40	marrubiagenine	$C_{20}H_{28}O_4$	$CDCl_3$	[96]
10-2-41	13,14-dihydro-marrubiagenine	$C_{20}H_{30}O_4$	$CDCl_3$	[96]
10-2-42	scutedrummonin	$C_{20}H_{30}O_4$	$CDCl_3$	[97]
10-2-43	3*β*,12(*S*)-dihydroxycleroda-4(18),13-dien-15,16-olide	$C_{20}H_{30}O_4$	$CDCl_3$	[93]
10-2-44	scutalpin N	$C_{29}H_{36}O_8$	$CDCl_3$	[98]



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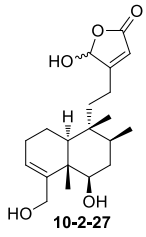

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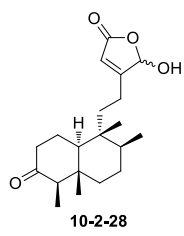

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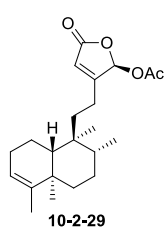

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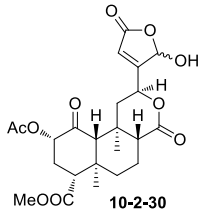

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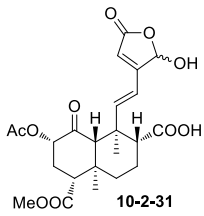

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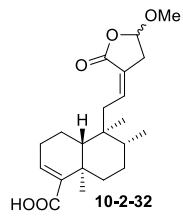

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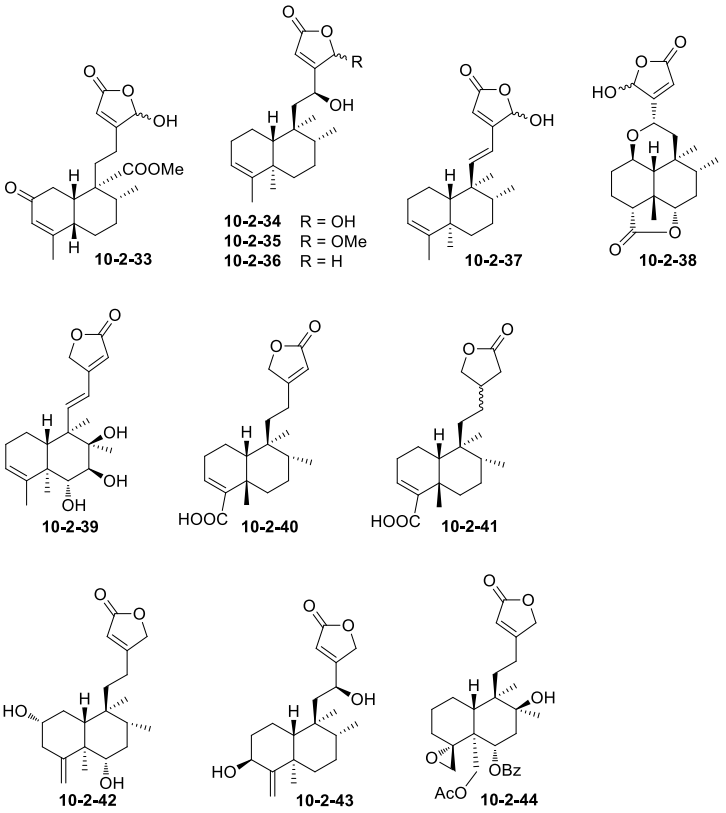

Table 10-2-10: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-26**~**10-2-29**.

H	10-2-26	10-2-27	10-2-28	10-2-29
1	*α* 1.77 (ov), *β* 2.04 m	*α* 1.53 m, *β* 1.59 m	2.05 m, 2.14 m	1.48 m
2	*α* 2.23 br t(9.6) *β* 2.16 br d(9.6)	2.10 m	1.61 m	1.95 m, 2.07 br d(15)
3	5.65 br s	5.46 t(3.2)		5.13 br s
4			1.96 m	
6	*α* 1.28 m *β* 2.13 br dt(13.8, 3.0)	3.58 t(8.1)	1.31 m 1.76 m	1.18 td(12.5, 6) 1.73 dt(12.5, 3)
7	*α* 1.16 (ov), *β* 1.34 (ov)	1.52 m	1.56 m	1.45 m
8	1.46 m	1.63 m	1.60 m	1.45 m
10	1.34 (ov)	1.28 dd(1.7, 11.9)	1.77 m	1.30 dd(10, 4)
11	1.51 td(13.2, 1.8) 1.80 (ov)	1.57 m	1.49 m	1.53 ddd(14.5, 13, 4) 1.64 ddd(14.5, 13, 5)
12	2.23 (ov), 2.38 m	2.15 m, 2.27 m	2.33 m	2.09 dddd(16, 13, 5, 1) 2.29 dddd(16, 13, 4, 1)
14	5.88 s	5.82 s	5.84 br s	5.94 q(1)

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Table 10-2-10 (continued)

H	10-2-26	10-2-27	10-2-28	10-2-29
16	6.03 s	6.08 s	5.99 br s	6.84 s, 2.18 s(OAc)
17	0.77 d(7.2)	0.80 d(6.6)	0.88 d(4.0)	0.82 d(6.5)
18	4.13 d(13.2), 4.24 d(13.2)	3.95 d(12.6), 4.10 d(12.6)	0.91 d(6.5)	1.59 dt(2, 1.5)
19	1.14 s	1.04 s	0.77 s	1.01 s
20	0.84 s	0.71 s	0.86 s	0.77 s

Table 10-2-11: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-30**, **10-2-31**, and **10-2-36**.

H	10-2-30	10-2-31	10-2-36
1			α 1.44 m
			β 1.83 dd(12.5, 6.8)
2	5.20 dd(7.3, 12.2)	5.19 dd(7.1, 12.2)	α 1.95 dddq(17.6, 4.6, 4.6, 1.4)
	2.18 s(OAc)	2.09 s(OAc)	β 2.08 ddddq(17.6, 9.3, 6.8, 2.9, 1.5)
3	2.27 q-like(13.2)	2.15 q-like(13.0)	5.17 br s
	2.34 ddd(3.9, 7.6, 13.2)	2.29 ddd(3.5, 7.2, 13.1)	
4	2.90 dd(3.7, 13.2)	3.01 dd(3.4, 13.4)	
	3.74 s(COOMe)	3.70 s(COOMe)	
6	1.68 br t(12.5)	1.73 m	α 1.74 ddd(12.8, 3.2, 3.2)
	1.79 br dd(2.9, 10.0)		β 1.24 ddd(12.8, 12.8, 4.5)
7	1.62 br dt(2.9, 13.2)	1.78 br ddd(3.2, 3.4, 11.1)	1.47 m
	2.12 br d(10.5)	1.95 br ddt(5.9, 12.5, 12.7)	
8	2.36 br dd(2.7, 11.5)	2.42 br s	1.60 dqd(11.2, 6.7, 4.6)
10	2.45 s	2.81 br s	1.72 dd(11.8, 1.5)
11	1.68 br t(12.5), 2.45 br s	6.50 d(16.3)	1.53 dd(15.9, 1.8), 1.89 dd(16.4, 8.4)
12	5.49 br s	6.33 br d(16.3)	4.71 dd(8.4, 1.8)
14	6.10 br s	5.92 s	5.93 dt(1.8, 1.2)
16	6.18 br s	6.13 s	4.96 d(1.8)
17			0.83 d(6.7)
18			1.58 m
19	1.11 s	1.05 s	1.04 s
20	1.43 s	1.56 s	0.78 s

Table 10-2-12: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-32**~**10-2-35**.

H	10-2-32	10-2-33	10-2-34	10-2-35
1	1.54 m, 1.64 m	2.60 dd(10.1, 2.6)	1.77 m, 1.48 m	–
2	1.29 m, 1.32 m		2.10 br	–
3	6.91 br s	5.86 s	5.19 s	5.20 br s
5		2.28 m		
6	1.31 m, 2.77 br d(13.6)	1.75 m	1.74 m, 1.22 m	–
7	1.30 m, 2.21 m	1.67 m, 1.90 m	1.39~1.51 m	–
8	1.32 m	2.20 m	1.50 m	1.53 m

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Table 10-2-12 (continued)

H	10-2-32	10-2-33	10-2-34	10-2-35
10	1.29 m	2.40 m	1.60 m	–
11	2.13 m, 2.22 m	2.05 m	1.87 m, 1.49 m	–
12	6.96 br s	2.09 m	4.72 d(8.0)	4.71 br d(8.0)
14	2.84 d(17.2) 3.10 dd(17.2, 6.4)	5.83 s	6.01 s	6.07 d(0.9)
16	5.64 d(6.4) 3.46 s(OMe)	6.08 br s	6.13 br	5.71 d(0.9) 3.59 s(OMe)
17	0.75 d(5.6)	1.13 d(7.2)	0.80 d(6.1)	0.81 d(6.1)
18		2.00 s	1.58 s	1.59 br s
19	1.45 s		1.01 s	1.02 s
20	0.73 s	3.68 s(COOMe)	0.75 s	0.76 s

Table 10-2-13: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-37**, **10-2-38**, and **10-2-41**.

H	10-2-37(C_5D_5N)	10-2-37(CD_3OD)	10-2-38	10-2-41
1	1.42 m	1.44 m	3.66 dt(3.5, 11.5)	–
2	1.89 m	1.81 m	α 1.59(ov), β 1.86(ov)	2.30~1.80 m(ov)
3	5.22 s	5.18 s	α 2.10(ov), β 2.20(ov)	6.82 t(4.3)
4			2.37 dd(2.5, 11.2)	
6			4.23 d(8.5)	–
7	1.37 m	1.52 m	α 1.78(ov), β 2.15(ov)	–
8	1.37 m	1.48	1.53(ov)	1.25 m(ov)
10	1.30~1.43 m	1.38 m	1.51(ov)	1.30 m(ov)
11	6.52 d(16.4)	6.29 s	α 1.82(ov), β 1.90(ov)	–
12	6.39 d(16.4)	6.29 s	4.91 dd(6.0, 9.3)	–
13				2.4 m(ov)
14	6.22 s	5.93 s	6.06 s	2.20 ddd(16.5, 8.3, 1.0) 2.70 dd(16.6, 8.2)
16	6.74 s	6.27 s	6.06 s	3.92 t(12.5) 4.45 dd(10.4, 8.3)
17	0.72 d(4.5)	0.76 d(4.5)	0.88 d(6.6)	0.72 d(6.2)
18	1.58 br s	1.60 br s		
19	0.96 s	1.06 s	1.40 s	1.22 s
20	0.86 s	0.98 s	0.91 s	0.80 s

Table 10-2-14: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-39**, **10-2-40**, and **10-2-42**~**10-2-44**.

H	10-2-39	10-2-40	10-2-42	10-2-43	10-2-44
1	1.28 m, 1.55 m	1.85~2.05 m(ov)	–	1.92 m, 1.54	–
2	2.01 m	2.35 dd(12.0, 4.3) 2.10 m(ov)	3.56 tt(11, 5.5)	2.15~2.25 m	–

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Table 10-2-14 (continued)

H	10-2-39	10-2-40	10-2-42	10-2-43	10-2-44
3	5.22 br s	6.83 t(4.3)	–	4.33 dd(11.6, 5.4)	–
6	3.75 d(9.2)	2.60 m(ov)	3.87 dd(10.3, 5.1)	1.58 m	5.17 dd
		0.95 m(ov)		1.18 dd(12.8, 4.3)	(10.2, 4.8)
7	3.62 d(9.2)	2.35 m(ov)	–	1.54 m	–
8		1.50 m(ov)	–	1.54 m	
10	2.09 dd(1.6, 12.8)	1.40 m(ov)	–	1.38 dd(12.1, 2.1)	2.42 m
11	6.39 d(16.8)	–	–	1.88 dd(15.6, 8.0)	–
				1.47 dd(15.6, 1.1)	
12	6.30 d(16.8)	2.20~2.40 m(ov)	–	4.73 br d(8.0)	3.02 m
14	5.91 br s	5.82 t(2.0)	5.84 q(1.6)	5.90 dd(3.0, 1.7)	5.81 m
16	4.92 dd(1.2, 16.4)	4.72 t(2.0)	4.73 d(1.6)	4.86 dd(1.9, 1.9)	4.76 br s
	5.06 dd(1.2, 16.4)				
17	1.23 s	0.75 d(6.2)	0.87 d(6.0)	0.80 d(5.6)	1.12 s
18	1.42 s		4.90 br s	4.91 d(1.2)	2.26 d(4.0)
			4.78 br s	4.72 s	3.06 dd(4.0, 2.2)
19	1.03 s	1.25 s	1.04 s	1.05 s	4.49 d(12.2)
					4.73 d(12.2)
					2.11 s(OAc)
20	1.12 s	0.82 s	0.81 s	0.76 s	0.92 s
2′, 6′					7.99 dd(8.5, 1.4)
3′, 5′					7.39 t(7.7)
4′					7.52 tt(8.5, 1.4, 7.7)

Table 10-2-15: Compounds, MFs, and test solvents of clerodane-type diterpenoids **10-2-45**~**10-2-57**.

No.	Compounds	MFs	Test solvents	References
10-2-45	(4*aR*,5*S*,6*R*,8*aR*)-5-[2-(2,5-dihydro-5-methoxy-2-oxofuran-3-yl)ethyl]-3,4,4*a*,5,6,7,8,8*a*-octahydro-5,6,8*a*-trimethylnaphthalene-1-carboxylic acid	$C_{21}H_{30}O_5$	$CDCl_3$	[99]
10-2-46	(4*aR*,5*S*,6*R*,8*aR*)-5-[2-(2,5-dihydro-2-oxofuran-3-yl)ethyl]-3,4,4*a*,5,6,7,8,8*a*-octahydro-5,6,8*a*-trimethylnaphthalene-1-carboxylic acid	$C_{20}H_{28}O_4$	$CDCl_3$	[99]
10-2-47	(5*R**,7*S**,8*S**,9*S**,10*R**)-7*α*-acetoxycleroda-3,13-dien-15,16-olide-18-oic acid	$C_{22}H_{30}O_6$	–	[100]
10-2-48	(–)-6*β*-hydroxy-5*β*,8*β*,9*β*,10*α*-cleroda-3,13-dien-16,15-olid-18-oic acid	$C_{20}H_{28}O_5$	$CDCl_3$	[101]
10-2-49	–	$C_{21}H_{30}O_6$	–	[102]
10-2-50	ballatenolide A	$C_{21}H_{28}O_5$	$CDCl_3$	[99]
10-2-51	7*β*,12:8*β*,12-diepoxy-15-hydroxy-*cis*-*ent*-cleroda-13-en-16,15:18*α*,6*α*-diolide	$C_{20}H_{24}O_7$	$CDCl_3$	[94]

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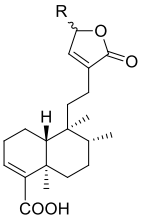
Table 10-2-15 (continued)

No.	Compounds	MFs	Test solvents	References
10-2-52	1*α*-acetoxy-8*β*,12-epoxy-15-hydroxy-*cis*-*ent*-clero-da-13-en-16,15:18*α*,6*α*-diolide	$C_{22}H_{28}O_8$	$CDCl_3$	[94]
10-2-53	teucrasiolide	$C_{26}H_{30}O_{11}$	$CDCl_3$	[103]
10-2-54	salvidivin B	$C_{23}H_{28}O_{10}$	$CDCl_3$-CD_3OD (1:1)	[90]
10-2-55	salvidivin D	$C_{23}H_{28}O_{10}$	CD_3OD	[90]
10-2-56	solidagoic acid C	$C_{20}H_{28}O_4$	$CDCl_3$	[104]
10-2-57	solidagoic acid E	$C_{20}H_{28}O_5$	$CDCl_3$	[104]



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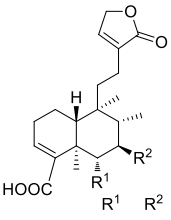
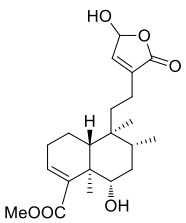
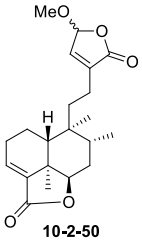
10-2-46 R = H



	R1	R2
10-2-47	H	OAc
10-2-48	OH	H



10-2-49



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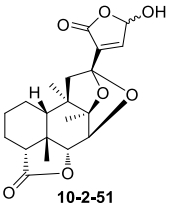

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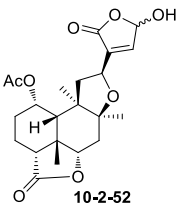

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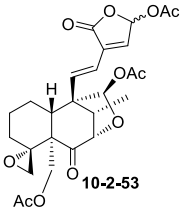

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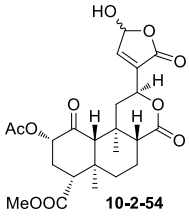

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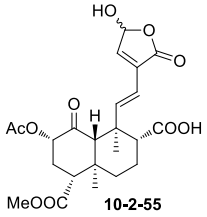
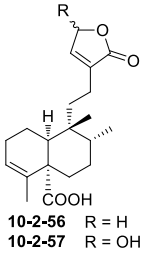


10-2-55



10-2-56 R = H
10-2-57 R = OH

Table 10-2-16: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-45**~**10-2-48**.

H	10-2-45	10-2-46	10-2-47	10-2-48
1	0.73 (ov)	0.74 (ov)	1.71 br dd(12, 7, 1) 1.53 ddd(12, 11, 5)	1.50 m 1.69 m

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Table 10-2-16 (continued)

H	10-2-45	10-2-46	10-2-47	10-2-48
2	2.20~2.31 m	2.39~2.43 m	2.35 dddd(20, 5, 4.5, 1)	2.20 m
			2.28 dddd(20, 11, 7, 3)	2.29 m
3	6.83 br t(2.1)	6.83 br t(3.1)	6.89 dd(4.5, 3)	6.84 dd(4.5, 3.0)
6	2.30 m	1.13~2.32 m	*α* 2.78 dd(12, 4)	3.63 dd(11.0, 4.8)
	1.12 dd(5.5, 12)		*β* 1.16 t(12)	
7	1.40~1.51 m (ov)	1.37~1.50 m (ov)	4.99 ddd(12, 11, 4)	1.43 m, 1.62 m
			2.04 s(OAc)	
8	1.44 (ov)	1.59~1.69 m	1.64 dq(11, 6.5)	1.59 m
10	1.30 br d(11.5)	1.31 br d(11.5)	1.42 dd(12, 1)	1.36 d(13)
11	1.40~1.50 (ov)	1.42~1.53 m (ov)	1.67 br t(13)	1.52 ddd(14.0, 13.0, 4.6)
			1.51 br t(13)	1.68 ddd(14.0, 13.0, 4.6)
12	2.01 br t(14)	2.01 br t(12.5)	2.18 br t(13)	2.01 ddd(13.0, 4.6, 1.6)
	2.18 m	2.15 br t(13)	2.07 br t(13)	2.15 ddd(13.0, 4.6, 1.6)
14	6.73 br s	7.07 br s	7.08 tt(1.5, 1.5)	7.15 t(1.5)
15	5.69 br s	4.74 d(1.5)	4.76 q(1.5)	4.77 d(1.5)
	3.55 s(OMe)			
17	0.79 d(6)	0.80 d(7)	0.84 d(6.5)	0.82 d(6.6)
19	1.21 s	1.22 s	1.33 s	1.21 s
20	0.73 s	0.74 s	0.84 s	0.76 s

Table 10-2-17: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-49**~**10-2-52**.

H	10-2-49	10-2-50	10-2-51	10-2-52
1	1.42~1.78 m	1.50~1.67 m (ov)	*α* 1.01 (ov), *β* 1.67 (ov)	4.90 br s, 2.01 s(OAc)
2	*α* 2.32 m	2.43~2.49 m	*α* 1.44 (ov)	*α* 1.60 (ov)
	β 2.16~2.24 m		*β* 1.92 (ov)	*β* 1.76 (ov)
3	6.78 t(3.5)	6.46 br s	*α* 1.70 (ov), *β* 2.15 (ov)	2.00~2.20 (ov)
4			2.33 dd(2.5, 5.2)	2.47 d(11.0)
6	3.62 dd(10.0, 3.0)	3.69 dd(3.5, 7.5)	4.61 d(3.3)	4.14 (ov)
	5.10 br s(OH)			
7	1.42~1.78 m	1.99~2.03 m	4.10 d(3.3)	2.40 (ov)
8	1.42~1.78 m	1.78 m		
10	1.30 dd(10.0, 3.0)	1.43 br d(12)	1.69 (ov)	1.93 (ov)
11	1.42~1.78 m	1.44~1.60 m (ov)	*α* 1.98 (ov)	*α* 2.10 (ov)
		2.10 ddd(4.8, 11.6)	*β* 2.58 (ov)	*β* 2.63 dd(13.7, 6.2)
12	*α*2.16~2.24 m	2.15~2.21 m		4.67 br s
	β 2.04 m			
14	6.84 br s	6.75 t(1.4)	7.37 s	6.72 s
15	6.08 br s	5.70 br s	6.41 s	5.99 br s
	3.94 br s(OH)	3.56 s(OMe)		
17	0.82 d(7.0)	0.96 d(6.5)	1.43 s	1.29 s
18	3.78 s(COOMe)			
19	1.21 s	1.01 s	1.57 s	1.29 s
20	0.78 s	0.86 s	1.08 s	0.98 s

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Table 10-2-18: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-53**~**10-2-55**.

H	10-2-53	10-2-54	10-2-55
1	*α* 1.66 qd(12.7, 3.4), *β* 1.83 m		
2	*α* 1.93 m, *β* 1.38 m	5.20 dd(7.6, 12.5), 2.15 s(OAc)	5.20 dd(7.2, 12.6), 2.08 s(OAc)
3	*α* 2.43 ddd(13.6, 13.0, 4.7)	2.25 q-like(12.9)	2.15 q-like(12.9)
	β 1.04 ddd(13.6, 3.4, 2.1)	2.31 dt(3.7, 7.6)	2.28 ddd(3.5, 7.2, 12.9)
4		2.92 dd(3.7, 13.2), 3.73 s(COOMe)	3.02 dd(3.5, 13.3), 3.70 s(COOMe)
6		1.68 br t(12.2), 1.79 br dt(3.1, 13.1)	1.72 br d(7.3)
7	4.28 br s	1.61 br dt(3.5, 13.3)	1.75 br dd(3.4, 13.4)
		2.12 br dd(3.2, 13.7)	1.94 m
8	2.25 qd(7.1, 0.5)	2.35 br dd(3.4, 10.5)	2.41 dd(2.9, 12.5)
10	2.00 dd(12.7, 1.4)	2.47 s	2.81 s
11	6.90 d(16.9)	1.68 br t(12.2), 2.46 dd(5.7, 13.4)	6.72 d(16.2)
12	6.15 d(16.9)	5.40 dd(5.7, 11.8)	6.13 d(16.2)
14	7.00 br s	7.20 br s	7.03 s
15	6.94 br s	6.18 br s	6.04 br s
17	1.25 d(7.1)		
18	2.35 d(5.1), 3.06 dd(5.1, 2.1)		
19	4.81 d(11.4), 5.23 d(11.4)	1.10 s	1.06 s
20	6.31 s	1.43 s	1.55 s
OAc	2.15 s, 2.11 s, 2.07 s		

Table 10-2-19: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-56** and **10-2-57**.

H	10-2-56	10-2-57	H	10-2-56	10-2-57
1	1.51 (ov), 1.73 br d(12.6)	1.50 (ov), 1.71 br d(12.3)	12	2.13 td(13.9, 3.7)	2.09 (ov)
2	2.08 (ov)	2.06		2.45 br t(13.8)	2.40 br t(14.2)
3	5.50 br s	5.48 br s	14	7.13 s	6.84 s
6	1.40 td(13.3, 4.5), 2.31 (ov)	1.40 (ov), 2.29 (ov)	15	4.72 s	6.03 s
7	1.32 (ov), 1.59 (ov)	1.33 m, 1.61 (ov)	17	0.79 d(6.5)	0.80
8	1.63 (ov)	1.64 (ov)	18	1.54 s	1.52 s
10	2.32 (ov)	2.28 (ov)	20	0.96 s	0.93 s
11	1.34 (ov), 1.55 (ov)	1.40 (ov), 1.62 (ov)			

Table 10-2-20: Compounds, MFs, and test solvents of clerodane-type diterpenoids **10-2-58**~**10-2-69**.

No.	Compounds	MFs	Test solvents	References
10-2-58	baccharіol	$C_{20}H_{24}O_6$	$CDCl_3$	[105]
10-2-59	7-keto-*neo*-clerodan-3,13-dien-18,19:15,16-diolide	$C_{20}H_{24}O_5$	$CDCl_3$	[105]
10-2-60	7-oxo-*ent*-clerod-3-en-15,16:18,19-diolide	$C_{20}H_{26}O_5$	$CDCl_3$	[105]

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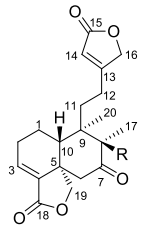
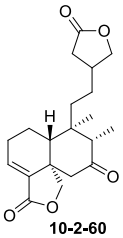
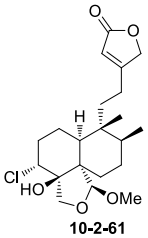
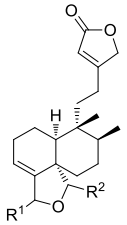
Table 10-2-20 (continued)

No.	Compounds	MFs	Test solvents	References
10-2-61	gutierolide	$C_{21}H_{31}ClO_5$	$CDCl_3$	[106]
			C_5D_5N	[106]
10-2-62	amphiacrolide A	$C_{20}H_{26}O_4$	$CDCl_3$	[106]
			C_5D_5N	[106]
10-2-63	amphiacrolide B	$C_{20}H_{26}O_4$	$CDCl_3$	[106]
			C_5D_5N	[106]
10-2-64	amphiacrolide C	$C_{20}H_{28}O_4$	$CDCl_3$	[106]
			C_5D_5N	[106]
10-2-65	amphiacrolide D	$C_{20}H_{28}O_5$	$CDCl_3$	[106]
			C_5D_5N	[106]
10-2-66	–	$C_{20}H_{26}O_5$	$CDCl_3$	[106]
10-2-67	amphiacrolidelacetate	$C_{23}H_{32}O_7$	$CDCl_3$	[107]
10-2-68	gaudichanolide A	$C_{20}H_{26}O_6$	C_5D_5N	[108]
10-2-69	gaudichanolide B	$C_{20}H_{26}O_5$	C_5D_5N	[108]

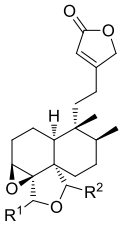








	R^1	R^2
10-2-62	H	=O
10-2-63	=O	H
10-2-64	H	OH



	R^1	R^2
10-2-65	H	OH
10-2-66	H	=O
10-2-67	OMe	OAc

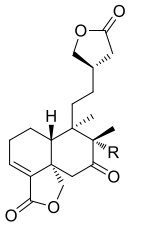


Table 10-2-21: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-58**~**10-2-60**.

H	10-2-58	10-2-59	10-2-60
1	1.21 m, 1.61 m	1.68 m	1.70 m
2	2.34 m, 2.49 m	2.25 m, 2.48 m	2.25 m, 2.50 m
3	6.84 dd(7.3, 2.1)	6.80 dd(7.3, 2.1)	6.84 dd(7.3, 2.1)
6	2.49 d(12.1), 3.14 dd(12.1, 2.1)	2.30 m, 2.65 d(12.5)	2.32 m, 2.70 d(12.8)

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Table 10-2-21 (continued)

H	10-2-58	10-2-59	10-2-60
8	2.63 s(OH)	2.53 q(6.7)	2.53 q(6.7)
10	2.99 d(12.2)	2.33 m	2.31 m
11	1.73 m, 1.95 m	1.65 m, 1.78 m	1.35 m, 1.50 m
12	2.34 m, 3.10 m	2.30 m, 2.40 m	1.35 m, 1.50 m
13			2.51 m
14	5.83 t(1.5)	5.84 t(1.8)	2.19 dd(17.4, 7.6) 2.69 d(17.4, 8.2)
16	4.75 d(1.5)	4.73 s	3.93 dd(9.2, 7.3) 4.46 dd(9.2, 7.3)
17	1.32 s	0.95 d(6.7)	0.97 d(6.7)
19	3.88 dd(8.2, 2.1), 3.99 d(8.2)	3.87 dd(8.2, 2.1), 3.94 d(8.2)	3.89 dd(8.2, 2.1), 3.98 d(8.2)
20	0.61 s	0.62 s	0.61 s

Table 10-2-22: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-61** and **10-2-66**.

H	10-2-61 ($CDCl_3$)	10-2-61 (C_5D_5N)	10-2-66
1	α 1.78 dddd(13.0, 3.6, 3.6, 2.5) β 1.52 m	α 1.66 dddd(13.6, 3.7, 3.7, 3.7) β 1.43 dq(13.3, 13.3, 13.3, 3.1)	1.35~1.56 m
2	α 1.63 dq(13.0, 13.0, 13.0, 3.2) β 2.17 dddd(13.0, 4.8, 3.4, 3.4)	α 1.75 dq(13., 13.0, 13.0, 3.3) β 2.12 dddd(13.3, 4.8, 3.5, 3.5)	α 1.71 m β 2.19 dddd(14.8, 2.9, 2.9, 2.4)
3	3.97 dd(12.7, 5.0)	4.26 dd(12.8, 5.0)	3.33 br s
6	α 1.99 dt(14.3, 4.8, 4.8, 0.9) β 1.50 hm	α 2.28 m β 1.58 ddd(14.3, 10.6, 5.9)	α 1.84 m β 2.02 m
7	α 1.70 hm, β 1.43 m	α 1.79 m, β 1.35 m	α 1.79 m, β 1.33 m
8	1.53 hm	1.54 hm	2.44 m
10	1.46 hm	1.58 hm	1.57 m
11	1.87 dt(13.4, 13.4, 4.6) 1.48 hm	1.88 dt(13.6, 13.6, 4.2) 1.44 hm	1.81 m 1.43 ddd(14.0, 11.7, 4.8)
12	2.41 ddd(16.0, 12.7, 4.0) 2.32 ddd(16.0, 12.6, 3.8)	2.28 m, 2.41 ddd(16.3, 12.8, 3.7)	2.48 m, 2.43 m
14	5.84 m	6.01 m	5.82 m
16	4.75 d(1.6)	4.78 dd(17.3, 1.4) 4.77 dd(17.3, 1.4)	4.77 dd(17.4, 1.7) 4.74 dd(17.4, 1.7)
17	0.99 d(7.2)	0.92 d(7.1)	0.85 d(6.9)
18	α 4.30 d(10.6), β 3.95 d(10.6)	α 4.54 d(10.2), β 4.22 d(10.2)	α 3.92 d(10.5), β 4.41 d(10.5)
19	5.03 s	5.25 s	
OMe	3.38 s	3.32 s	
20	0.92 s	0.81 s	0.83 s
OH	4.10 s		

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Table 10-2-23: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-62** and **10-2-67**.

H	10-2-62 ($CDCl_3$)	10-2-62 (C_5D_5N)	10-2-67
1	*α* 1.78 m	*α* 1.60 m	1.38 m, 1.48 m
	β 1.63 dddd(14.0, 10.2, 10.2, 5.1)	*β* 1.46 dddd(13.0, 11.3, 11.3, 5.2)	
2	*α* 1.98 m	*α* 1.85 hm	*α* 2.16 dddd(14.6, 2.9, 2.9, 2.5)
	β 2.12 br dm(18.0, 3.7, 3.7, 3.7, 3.7)	*β* 1.94 br d(17.9, 3.6, 3.6, 3.6, 3.6)	*β* 1.63 m
3	5.77 br s	5.62 br s	3.59 br s(4.3)
6	*α* 1.85 dddd(13.9, 5.4, 2.0, 0.8)	*α* 1.75 ddd(14.5, 6.3, 3.1)	*α* 1.58 m
	β 1.79 m	*β* 1.62 ddd(14.2, 12.3, 5.8)	*β* 1.89 m
7	*α* 1.92 m(12.9, 12.9, 5.9, 5.9)	*α* 1.85 m	*α* 1.84 m
	β 1.33 ddt(13.8, 5.8, 5.8, 2.7)	*β* 1.19 ddt(13.9, 6.2, 6.2, 2.8)	*β* 1.37 m
8	2.00 hm	2.05 ddq(6.3, 6.3, 6.3)	1.53 m
10	1.71 dd(11.7, 2.7)	1.71 dd(11.8, 3.5)	1.46 m
11	1.37 m, 2.45 m	1.38 m, 2.40 m	1.29 ddd(13.8, 12.0, 5.0), 1.51 m
12	2.45 m, 2.38 m	2.36 m, 2.34 m	2.20 m, 2.26 m
14	5.82 m	5.99 m	5.79 m
16	4.74 dd(17.6, 1.7), 4.81 dd(17.6, 1.7)	4.79 dd(17.4, 1.7), 4.83 dd(17.4, 1.4)	4.68 d(1.6)
17	0.96 d(7.2)	0.86 d(7.1)	0.91 d(6.9)
18	*α* 4.48 ddd(10.8, 1, 0.8)	*α* 4.45 d(10.8)	6.38 s, 3.36 s(OMe)
	β 4.81 dddd(10.9, 2.8, 2.8, 2.1)	*β* 4.79 dddd(10.9, 2.8, 2.8, 2.0)	
19			4.94 s, 2.09 s(OAc)
20	0.95 s	0.83 s	0.84 s

Table 10-2-24: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-63** and **10-2-68**.

H	10-2-63 ($CDCl_3$)	10-2-63 (C_5D_5N)	10-2-68
1	*α* 1.92 br d(13.9)	*α* 1.69 br d(13.0)	1.83 m
	β 1.73 dddd(13.3, 13.3, 11.3, 5.7)	*β* 1.53 dddd(13.2, 13.2, 11.5, 5.6)	1.01 m
2	*α* 2.12 dddd(20.2, 11.1, 6.3, 2.8)	*α* 1.95 m	2.17 m
	β 2.39 dddd(20.1, 5.7, 4.4, 1.4)	*β* 2.17 dddd(20.2, 5.6, 4.1, 1.3)	
3	6.80 dd(3.5, 3.5)	6.82 dd(3.5, 3.5)	6.87 dd(7.0, 2.4)
6	*α* 1.55 hm, *β* 1.62 hm	1.45 m	2.85 s
7	*α* 1.95 tt(14.2, 11.9, 5.7, 5.7)	*α* 1.93 m	
	β 1.43 dddd(14.5, 3.4, 3.4, 3.2)	*β* 1.20 dddd(14.4, 3.2, 3.2, 3.2)	
8	1.62 m	1.45 m	
10	1.39 dd(13.1, 2.6)	1.30 dd(12.9, 2.3)	2.49 m
11	1.51 dd(9.8, 7.2)	1.45 m	1.61 m
12	2.36 m, 2.33 m	2.27 m, 2.25 m	1.97 m, 1.68 m
13			2.42 m

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Table 10-2-24 (continued)

H	10-2-63 ($CDCl_3$)	10-2-63 (C_5D_5N)	10-2-68
14	5.81 m	6.03 m	2.71 dd(16.7, 7.9) 2.31 dd(16.7, 8.6)
16	4.73 d(1.8)	4.84 dd(17.5, 1.6) 4.82 dd(17.5, 1.8)	4.41 t(8.6) 3.96 t(8.6)
17	1.07 d(7.4)	0.94 d(7.5)	1.53 s
19	α 3.74 dd(8.0, 1.8) β 4.56 d(8.0)	α 3.80 dd(8.1, 1.6) β 4.73 d(8.1)	4.20 d(8.3) 4.05 d(8.3)
20	0.98 s	0.83 s	0.79 s

Table 10-2-25: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-64** and **10-2-69**.

H	10-2-64 ($CDCl_3$)	10-2-64 (C_5D_5N)	10-2-69
1	α 1.78 m(11.9, 4.3, 2.1) β 1.63 m	α 1.75 br dm(12.8, 2.5, 2.5, 2.5) β 1.62 m	1.09 m 1.60 m
2	α 2.00 br d(16.8) β 2.06 br d(16.8)	1.95~2.08 m	2.07 m 2.23 m
3	5.61 br s	5.57 br s	6.87 dd(7.4, 2.0)
6	α 1.51 m β 1.58 ddd(13.5, 13.5, 4.3)	1.63 m	2.33 m 2.87 d(17.5)
7	α 1.91 tt(13.8, 13.8, 4.9, 4.9) β 1.31 dddd(10.7, 3.6, 3.6, 3.6)	α 2.00 tt(13.0, 13.0, 5.5, 5.5) β 1.26 dq(14.1, 3.6, 3.6, 3.6)	
8	1.52 m	1.50 m	2.66 m
10	1.67 d(13.6)	1.97 dd(12.8, 3.5)	2.07 m
11	1.85 dt(12.9, 12.9, 3.4) 1.37 dt(13.2, 13.2, 4.9)	2.01 ddd(13.0, 13.0, 4.1) 1.42 ddd(13.1, 13.1, 4.7)	1.29 m
12	2.52 ddd(15.5, 12.2, 2.5) 2.28 ddd(16.3, 12.9, 4.4)	2.61 ddd(15.7, 12.2, 3.1) 2.26 ddd(16.2, 13.0, 4.3)	1.29 m
13			2.33 m
14	5.76 m	5.95 m	2.66 m, 2.23 m
16	4.69 s	4.78 d(1.4)	4.33 m, 3.81 t(8.0)
17	1.04 d(7.4)	1.02 d(7.4)	1.13 d(6.7)
18	α 4.22 dddd(11.4, 1.1, 1.1, 1.1) β 4.34 dddd(11.4, 2.9, 2.9, 2.3)	α 4.39 dddd(11.3, 1.8, 1.8, 1.4) β 4.48 dddd(11.3, 2.9, 2.9, 2.4)	4.74 d(8.0) 4.33 m
19	5.45 s	5.80 s	0.88 s
20	0.92 s	0.88 s	
OH	3.92 br s		

Table 10-2-26: ^{1}H NMR spectroscopic data of clerodane-type diterpenoid **10-2-65**.

H	10-2-65 ($CDCl_3$)	10-2-65 (C_5D_5N)
1	α 1.35 m, β 1.46 m	α 1.35 br d(13.1) β 1.55 dq(13.0, 13.0, 13.0, 3.7)
2	α 1.64 dt(11, 11, 5), β 2.07 br d(14.5)	α 1.70 dt(14.0, 14.0, 4.0), β 2.04 br d(13.0)

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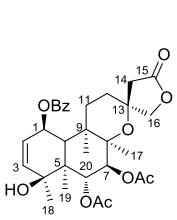
Table 10-2-26 (continued)

H	10-2-65 ($CDCl_3$)	10-2-65 (C_5D_5N)
3	3.26 s	3.36 s
6	α 1.49 m, β 1.84 m	α 1.71 br d(14.1), β 2.03 m
7	α 1.86 m, β 1.35 m	α 1.94 tt(13.7, 13.7, 5.2, 5.2), β 1.27 m(13.4, 3.2)
8	1.49 m	1.48 br q(7.0)
10	1.64 dd(11, 3)	1.96 dd(12.9, 3)
11	1.40 dt(13.3, 13.3, 4.8), 1.74 dt(13.1, 13.1, 3.8)	1.43 dt(13.2, 13.2, 4.6), 1.84 dt(13.1, 13.1, 3.8)
12	2.30 ddd(15.9, 12.7, 4.5), 2.47 ddd(16.1, 12.9, 3.0)	2.30 ddd(16.2, 12.9, 4.0), 2.52 ddd(15.9, 12.8, 3.1)
14	5.78 br s	5.97 m(1.4)
16	4.72 d(1.2)	4.78 d(1.6)
17	0.97 d(7.2)	0.92 d(7.2)
18	α 3.96 d(9.7), β 3.82 d(9.7)	α 4.21 d(9.5), β 4.04 d(9.5)
19	5.52 d(2.4)	5.92 s
20	0.84 s	0.79 s
OH	4.24	

Table 10-2-27: Compounds, MFs, and test solvents of clerodane-type diterpenoids **10-2-70**~**10-2-83**.

No.	Compounds	MFs	Test solvents	References
10-2-70	barbatellarine A	$C_{31}H_{38}O_{10}$	$CDCl_3$	[109]
10-2-71	scutebarbatine F	$C_{30}H_{37}NO_9$	$CDCl_3$	[110]
10-2-72	scutebarbatine W	$C_{33}H_{37}NO_8$	$CDCl_3$	[111]
10-2-73	scutehenanine H	$C_{33}H_{37}NO_9$	$CDCl_3$	[112]
10-2-74	scutalpin G	$C_{31}H_{38}O_{10}$	$CDCl_3$	[113]
10-2-75	–	$C_{27}H_{36}O_9$	$CDCl_3$	[114]
10-2-76	hastifolin B	$C_{29}H_{36}O_6$	$CDCl_3$	[115]
10-2-77	scutorientalin D	$C_{28}H_{40}O_{10}$	$CDCl_3$	[116]
10-2-78	hastifolin D	$C_{29}H_{38}O_7$	$CDCl_3$	[115]
10-2-79	scutorientalin B	$C_{26}H_{39}ClO_8$	$CDCl_3$	[117]
10-2-80	hastifolin F	$C_{29}H_{36}O_5$	$CDCl_3$	[115]
10-2-81	barbatin B	$C_{34}H_{38}O_8$	$CDCl_3$	[95]
10-2-82	scuteselerin	$C_{29}H_{40}O_{10}$	$CDCl_3$	[118]
10-2-83	–	$C_{26}H_{36}O_9$	$CDCl_3$	[117]



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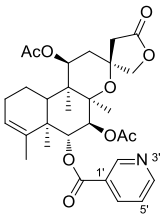

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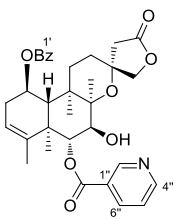

10-2-72

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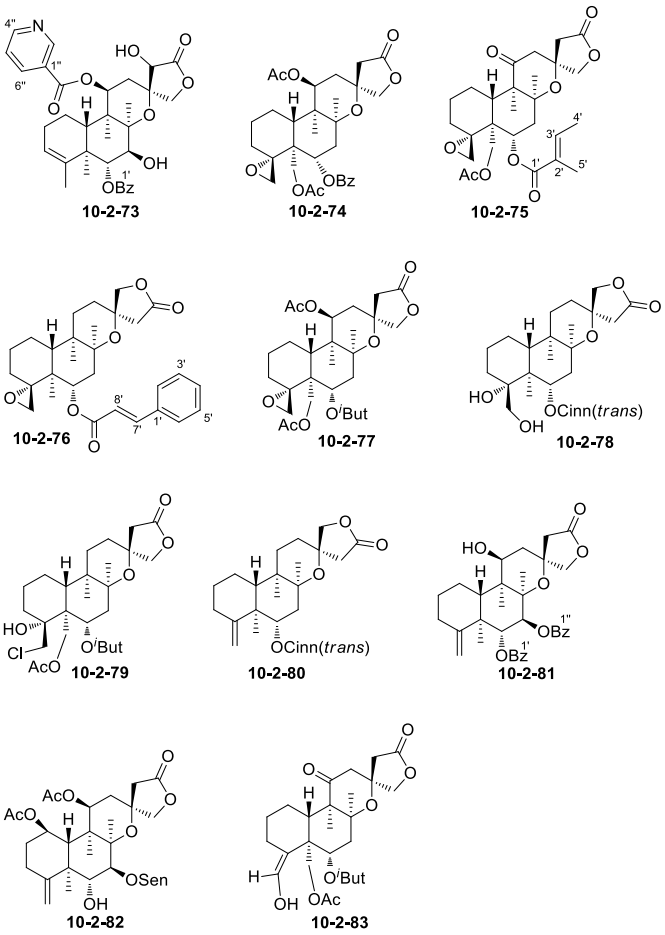

Table 10-2-28: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-70**~**10-2-73**.

H	10-2-70	10-2-71	10-2-72	10-2-73
1	5.86 br d(10.2)	1.61 m, 2.03 m	5.77 ddd(9.1, 6.4, 5.4)	1.76 m, 2.03 m
2	5.64 dd(10.2, 1.8)	2.19 m	2.19 m, 2.72 m	2.68 m
3	5.50 d(10.2)	5.32 br s	5.34 br s	5.31 br s
6	5.90 d(10.8)	5.42 d(10.4)	5.43 d(10.0)	5.33 d(10.0)
7	5.26 d(10.8)	5.25 d(10.4)	3.69 dd(12.0, 10.0)	3.72 d(10.0)
10	3.32 d(10.2)	2.71 dd(3.0, 12.4)	2.68 d(9.1)	2.46 dd(2.4, 12.2)
11	*α* 2.00 dt(3.0, 14.0)	5.80 dd(3.9, 11.8)	1.59 m, 2.05 m	6.05 dd(3.9, 12.0)
	β 1.70 dt(3.0, 14.0)			

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Table 10-2-28 (continued)

H	10-2-70	10-2-71	10-2-72	10-2-73
12	*α* 1.53 td(3.6, 14.0) *β* 2.27 td(3.0, 14.0)	1.75 m, 2.06 m	1.56 m, 2.15 m	2.09 m, 2.35 m
14	*α* 2.62 d(18.0) *β* 3.05 d(18.0)	2.53 d(17.6), 3.14 d(17.6)	2.57 d(17.0), 2.76 d(17.0)	4.49 s
16	4.13 s	4.13 d(8.5), 4.28 d(8.5)	4.24 d(9.1), 4.34 d(9.1)	4.26 d(8.7), 4.30 d(8.7)
17	1.16 s	1.12 s	1.40 s	1.72 s
18	1.20 s	1.68 s	1.67 br s	1.61 s
19	1.30 s	1.37 s	1.44 s	1.38 s
20	1.10 s	1.10 s	1.10 s	1.14 s
2′	7.93 d(7.8)	9.17 br s	7.97 d(7.8)	8.07 m
3′	7.44 t(7.8)		7.47 t(7.8)	7.48 m
4′	7.58 t(7.8)	8.83 br d(4.5)	7.60 t(7.8)	7.57 br t(7.7)
5′	7.44 t(7.8)	7.45 dd(4.5, 7.8)	7.47 t(7.8)	7.48 m
6′	7.93 d(7.8)	8.26 br d(7.8)	7.97 d(7.8)	8.07 m
2″			9.26 br d(1.8)	9.22 br s
4″			8.79 dd(4.9, 1.8)	8.85 br d(4.5)
5″			7.42 br dd(7.8, 4.9)	7.44 dd(4.5, 7.6)
6″			8.32 ddd(7.8, 1.8, 1.8)	8.29 br d(7.6)
OAc	2.02 s(6-OAc) 2.08 s(7-OAc)	2.02 s, 2.10 s		
OH			2.07 d(12.0)	

Table 10-2-29: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-74**~**10-2-76**.

H	10-2-74	10-2-75	10-2-76
1	*α* 1.63 dddd(13.7, 12.6, 12.4, 3.9) *β* 2.31 dddd(12.4, 4.3, 3.1, 2.0)	*α* 1.74 m (ov), *β* 1.00 m (ov)	0.88 m, 1.55 m
2	*α* 1.96 m *β* 1.47 ddddd(13.7, 13.2, 13.1, 4.3, 4.3)	*α* 1.95 m (ov) *β* 1.42 br qt(13.0, 13.0, 13.0, 4.2, 4.2)	1.40 m, 1.96 m
3	*α* 2.02 m *β* 1.04 ddd(13.4, 4.3, 3.1)	*α* 2.10 tdd(13.0, 13.0, 4.2, 2.4) *β* 1.08 ddd(13.0, 4.2, 2.1)	*α* 2.15 m, *β* 0.98 m
6	5.33 br dd(11.5, 6.4)	5.36 dd(11.4, 5.0)	5.18 dd(11.3, 4.9)
7	*α* 1.95 dd(11.5, 13.9), *β* 1.86 dd(13.9, 6.4)	*α* 1.95 dd(11.4, 14.3), *β* 1.74 m	1.73 m, 1.82 m
10	2.39 dd(12.6, 3.1)	2.48 dd(12.9, 2.9)	2.03 m
11	5.36 dd(13.2, 4.2)		1.74 m, 1.54 m

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Table 10-2-29 (continued)

H	10-2-74	10-2-75	10-2-76
12	*α* 2.04 dd(13.2, 13.1) *β* 1.88 t(13.1, 4.2)	*α* 2.76 d(14.8) *β* 2.64 d(14.8)	1.68 m, 1.59 m
14	2.57 d(17.3), 3.00 d(17.3)	*α* 2.65 d(17.1), *β* 3.09 d(17.1)	2.73 d(16.8), 2.60 d(16.8)
16	4.21 d(9.0), 4.39 d(9.0)	*α* 4.18 d(9.0), *β* 4.12 d(9.0)	4.29 d(8.9), 4.15 d(8.9)
17	1.27 s	1.04 s	1.23 s
18	3.10 dd(3.9, 2.2), 2.25 d(3.9)	3.10 dd(2.4, 4.1), 2.30 d(4.1)	3.25 dd(3.9, 2.4), 2.39 d(3.9)
19	4.66 br d(12.2), 4.75 d(12.2)	4.56 d(12.2), 4.60 d(12.2)	1.37 s
20	0.97 s	1.02 s	0.90 s
2′	7.97 dd(8.3, 1.3)		7.51 m
3′	7.38 td(8.3, 7.7)	6.78 qq(7.1, 1.4)	7.36 m
4′	7.50 tt(1.3, 7.7)	1.76 dq(7.1, 1.0)	7.36 m
5′	7.38 td(8.3, 7.7)	1.80 dq(1.4, 1.0)	7.36 m
6′	7.97 dd(8.3, 1.3)		7.51 m
7′			7.62 d(16.0)
8′			6.39 d(16.0)
OAc	2.08 s, 2.03 s	2.09 s	

Table 10-2-30: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-78**~**10-2-81**.

H	10-2-78	10-2-79	10-2-80	10-2-81
1	1.47 m, 0.91 m	–	1.55 m, 0.85 m	1.82 m, 2.46 m
2	1.73 m, 1.28 m	–	1.90 m, 1.30 m	1.47 m, 2.06 m
3	*α* 1.79 m *β* 1.53 m	–	*α* 2.27 td(13.7, 4.6) *β* 2.10 br d(13.7)	2.13 m, 2.29 m
6	5.47 dd(11.1, 4.6)	5.38 dd(11.3, 4.7)	5.47 dd(11.5, 4.6)	5.70 d(10.6)
7	1.81 m 1.90 dd(13.3, 4.6)	–	2.00 dd(13.5, 4.6) 1.80 dd(13.5, 11.5)	5.61 d(10.6)
10	2.02 m	2.16 dd(3.2, 12.1)	1.87 m	2.38 dd(2.0, 12.4)
11	1.73 m, 1.52 m	–	1.71 m, 1.56 m	4.34 dd(3.8, 12.0)
12	1.71 m, 1.62 m	–	1.72 m, 1.57 m	1.57 m, 2.14 m
14	2.61 d(16.7), 2.75 d(16.7)	2.44 d(17.2), 2.87 d(17.2)	2.60 d(16.8), 2.73 d(16.8)	2.84 d(17.2), 3.03 d(17.2)
16	4.14 d(8.9), 4.31 d(8.9)	4.16 d(8.8), 4.25 d(8.8)	4.13 d(9.0), 4.29 d(9.0)	4.23 d(9.2), 4.39 d(9.2)
17	1.22 s	1.17 s	1.22 s	1.12 s
18	3.79 d(11.2), 3.89 d(11.2)	4.00 s	4.43 br s, 4.58 br s	4.60 br s
19	1.35 s	4.68 d(13.1), 4.90 d(13.1)	1.27 s	1.43 s

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Table 10-2-30 (continued)

H	10-2-78	10-2-79	10-2-80	10-2-81
20	0.90 s	0.89 s	0.88 s	1.58 s
2′	7.50 m	2.45 sept(6.9, 6.9)	7.50 m	7.91 m
3′	7.40 m	1.13 d(6.9)	7.36 m	7.55 m
4′	7.40 m	1.15 d(6.9)	7.36 m	7.42 br t(7.7)
5′	7.40 m		7.36 m	7.55 m
6′	7.50 m		7.50 m	7.91 m
7′	7.66 d(16.0)		7.62 d(16.0)	
8′	6.39 d(16.0)		6.39 d(16.0)	
2″				7.94 m
3″				7.63 m
4″				7.48 br t(7.7)
5″				7.63 m
6″				7.94 m
OAc		2.10 s		

Table 10-2-31: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-77**, **10-2-82**, and **10-2-83**.

H	10-2-77	10-2-82	10-2-83
1	*α* 1.57 qd(13.0, 3.5) *β* 2.27 m (ov)	5.44 dt(2.5, 2.5)	–
2	*α* 1.96 m, *β* 1.47 qt(13.0, 4.2)	–	–
3	*α* 2.1 m (ov), *β* 1.06 m	–	–
6	5.08 dd(11.5, 5.0)	4.18 dd(4.5, 10)	5.23 dd(11.3, 4.8)
7	*α* 1.82 dd(14.0, 11.5) *β* 1.68 dd(14.0, 5.0)	5.18 d(10)	*α* 1.74 dd(11.3) *β* 1.59 dd(4.8)
10	2.30 m (ov)	2.40 d(5.5)	–
11	5.34 dd(13.0, 4.2)	5.41 dd(4, 13)	
12	*α* 2.03 dd(13.5, 4.2) *β* 1.82 br t(13.0, 13.5)	*α* 1.79 dd(4, 13) *β* 2.36 t(13)	2.70 d(12.9), 2.29 d(12.9)
14	*α* 2.55 d(17.2), *β* 2.94 d(17.2)	2.84 d(17), 2.68 d(17)	2.48 d(17.2), 2.90 d(17.2)
16	*α* 4.38 d(8.9), *β* 4.19 d(8.9)	4.28 d(9.5), 4.16 d(9.5)	4.14 d(8.8), 4.26 d(8.8)
17	1.25 s	1.36 s	1.19 s
18	2.26 d(4.0), 3.01 dd(4.0, 2.3)	5.15 br s, 4.85 br s	6.42 br s, 2.78 s(OH)
19	4.48 d(12.2), 4.71 d(12.2)	1.30 s	4.41 d(12.3), 4.75 d(12.3)
20	0.94 s	1.15 s	1.03 s
2′	2.40 sept(7.0, 7.0)	5.81 sept(2)	2.56 sept(6.9, 6.9)
3′	1.12 d(7.0)	2.20 br d(2)	1.20 d(6.9)
4′	1.16 d(7.0)	1.94 br d(2)	1.22 d(6.9)
OAc	2.08 s(11-OAc)2.11 s(19-OAc)	1.97 s, 2.03 s	1.98 s

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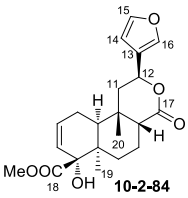
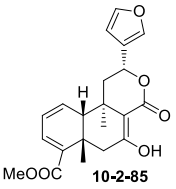
Table 10-2-32: Compounds, MFs, and test solvents of clerodane-type diterpenoids **10-2-84**~**10-2-95**.

No.	Compounds	MFs	Test solvents	References
10-2-84	*epi*-cordatine	$C_{21}H_{26}O_6$	–	[119]
10-2-85	crotomacrine	$C_{21}H_{22}O_6$	$CDCl_3$	[120]
10-2-86	15,16-epoxy-1,3,13(16),14-clerodatetraene-17,12:18,6-diolide	$C_{20}H_{20}O_5$	$CDCl_3$	[121]
10-2-87	12-*epi*-methyl-barbascoate	$C_{21}H_{26}O_5$	$CDCl_3$	[122]
10-2-88	furocrotinsulolide A	$C_{20}H_{28}O_5$	CD_3OD	[123]
10-2-89	bafoudiosbulbin F	$C_{21}H_{24}O_8$	DMSO-d_6	[124]
10-2-90	bafoudiosbulbin G	$C_{23}H_{26}O_{10}$	DMSO-d_6	[124]
10-2-91	antadiosbulbin A	$C_{21}H_{24}O_8$	CD_3OD	[125]
			$CDCl_3$	[125]
10-2-92	peniankerine	$C_{19}H_{22}O_5$	$CDCl_3$	[126]
10-2-93	bafoudiosbulbin C	$C_{21}H_{22}O_7$	CD_3OD	[127]
10-2-94	bafoudiosbulbin B	$C_{20}H_{20}O_8$	C_5D_5N	[124]
10-2-95	diosbulbin E	$C_{19}H_{22}O_6$	$CDCl_3$	[125]



10-2-84



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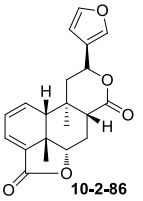
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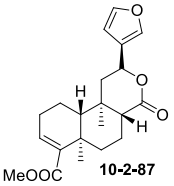

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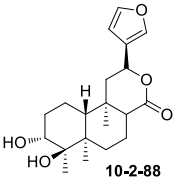

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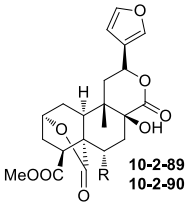
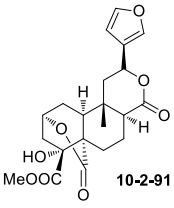


10-2-89 R = H
10-2-90 R = OAc



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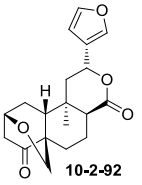
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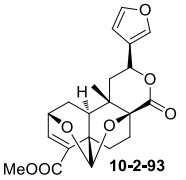

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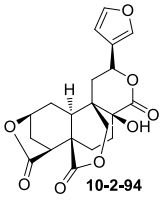

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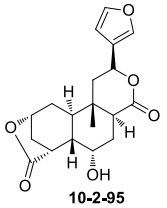

10-2-95

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Table 10-2-33: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-84**~**10-2-86**.

H	10-2-84	10-2-85	10-2-86
1	ax 1.96 m eq 2.24 dddd(18.5, 6.4, 4.7, 1.8)	6.27 ddd(9.3, 5.4, 3.2)	6.03 dd(5.8, 9.2)
2	5.94 ddd(9.9, 4.7, 2.7)	6.15 dd(9.3, 2.1)	6.43 ddd(1.3, 5.3, 9.2)
3	5.62 m	6.95 d(5.4)	6.93 d(5.3)
4	3.43 br s(OH)		
6	ax 1.61 ddd(13.3, 13.4, 5.0)	*α* 3.21 d(18.7)	4.50 dd(7.4, 10.6)
	eq 1.32 m	*β* 2.54 d(18.7)	
7	ax 1.86 dddd(13.4, 13.4, 13.2, 4.5)	12.78 s(OH)	*α* 1.36 ddd(10.6, 13.2, 14.1)
	eq 1.97 m		*β* 2.90 ddd(2.3, 7.4, 14.1)
8	2.61 dd(13.4, 6.2)		2.18 dd(2.3, 13.2)
10	2.10 dd(10.6, 6.4)	2.46 dd(3.2, 2.1)	2.27 dd(1.3, 5.8)
11	ax 1.82 dd(15.4, 12.5)eq 2.46 dd(15.4, 5.1)	*α* 1.69 t(12.8)	*α* 2.28 dd(4.1, 13.2)
		β 2.34 dd(12.8, 4.0)	*β* 1.88 dd(12.4, 13.2)
12	5.65 dd(12.5, 5.1)	5.68 dd(12.8, 4.0)	5.38 dd(4.1, 12.4)
14	6.39 dd(2.0, 0.7)	6.45 d(1.5)	6.42 dd(0.8, 1.7)
15	7.40 dd(2.0, 1.4)	7.43 d(1.5)	7.43 dd(1.7, 1.7)
16	7.43 br s	7.50 br s	7.46 dd(0.8, 1.7)
18	3.79 s(COOMe)	3.78 s(COOMe)	
19	1.25 s	1.27 s	1.21 s
20	1.11 s	1.45 s	1.00 s

Table 10-2-34: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-87**~**10-2-90**.

H	10-2-87	10-2-88	10-2-89	10-2-90
1	1.65 m	1.53~1.74 m	1.60 m	1.67 dd(13.9, 5.6)
		1.37 dd(12.5, 4.0)	1.90 m	2.28 br t(13.9)
2	2.35 m	1.98 br t(4.0), 1.74~1.53 m	4.84 br t(4.8)	4.82 br t(4.1)
3	6.63 m	3.47 br s	2.20 m	2.10 (ov)
				2.20 br d(14.6)
4			2.88 dd(10.8, 8.6)	3.55 dd(10.5, 4.5)
6	2.55 m	1.53~1.74 m	1.84 m	5.05 dd(3.9, 1.8)
	1.17 dd(13.0, 3.3)	1.48 br d(12.1)	1.97 m	1.80 s(OAc)
7	1.75 m	1.91 dd(13.7, 3.1)	1.52 m	1.93 dd(14.5, 1.8)
		1.58 br t(13.7)	2.16 m	2.48 dd(14.5, 4.1)
8	2.16 m	2.19 dd(11.7, 2.7)	6.20 s(OH)	6.16 s(OH)
10	1.28 dd(13.0, 6.0)	1.78 br d(12.1)	1.89 dd(11.1, 7.9)	2.64 dd(11.8, 5.5)
11	2.40 d(6.0)	2.36 dd(13.7, 5.5)	1.60 dd(14.3, 12.9)	1.75 dd(14.8, 3.4)
	1.60 m	1.68 dd(13.7, 11.0)	2.21 dd(14.3, 3.9)	2.10 (ov)
12	5.53 dd(11.0, 6.0)	5.53 dd(11.0, 5.5)	5.47 dd(12.9, 3.9)	5.69 dd(12.6, 3.2)

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Table 10-2-34 (continued)

H	10-2-87	10-2-88	10-2-89	10-2-90
14	6.42 br s	6.52 br s	6.51 br s	6.55 br s
15	7.42 t(1.7)	7.46 br s	7.64 br s	7.65 br s
16	7.45 br s	7.56 s	7.68 br s	7.72 br s
18	3.70 s(COOMe)	1.20 s	3.68 s(COOMe)	3.63 s(COOMe)
19	1.33 s	1.15 s		
20	1.10 s	1.03 s	0.81 s	1.17 s

Table 10-2-35: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-91** and **10-2-92**.

H	10-2-91(CD_3OD)	10-2-91($CDCl_3$)	10-2-92
1	2.32 dddd(13.4, 11.2, 5.2, 2.1)	2.31 m	α 1.55 dd(13.6, 6.3)
	1.63 dd(13.4, 8.2)	1.57 dd(13.3, 8.8)	β 2.42 m
2	4.88 dd(5.2, 5.2)	4.90 dd(5.2, 5.2)	4.35 m
3	2.77 d(14.8)	2.70 ddd(14.9, 1.1, 1.1)	α 2.29 d(19)
	2.13 ddd(14.8, 5.2, 2.1)	2.26 m	β 2.78 ddd(19.3, 3, 3)
4		3.45 s(OH)	
6	ax 2.06 ddd(15.1, 14.5, 5.0)	ax 2.14 m	α 1.96 ddd(14, 4, 2)
	eq 2.62 ddd(15.1, 3.9, 3.0)	eq 2.34 m	β 0.88 ddd(14, 14, 4.5)
7	ax 1.56 dddd(14.8, 14.5, 12.4, 3.9)	ax 1.44 dddd(14.2, 14.2, 12.0, 3.2)	α 2.04 dddd(14, 14, 4.5, 4.5)
	eq 1.91 dddd(14.8, 5.0, 3.0, 3.0)	eq 2.04 ddd(14.2, 4.8, 3.2, 3.2)	β 2.36 dddd(14.3, 4, 2, 2)
8	2.78 dd(12.4, 3.0)	2.48 dd(12.0, 3.2)	2.42 m
10	2.20 dd(11.2, 8.2)	2.09 m	2.28 dd(11.1, 6.3)
11	ax 1.86 dd(14.5, 12.0)	ax 1.83 dd(14.1, 11.0)	α 1.75 dd(14.6, 12.3)
	eq 2.07 dd(14.5, 6.3)	eq 1.94 dd(14.1, 6.4)	β 2.08 dd(14.6, 3.9)
12	5.50 dd(12.0, 6.3)	5.33 dd(11.0, 6.4)	5.46 dd(12.3, 3.9)
14	6.48 dd(1.8, 0.8)	6.37 dd(1.9, 0.9)	6.42 m
15	7.48 dd(1.8, 1.6)	7.40 dd(1.9, 1.7)	7.42 m
16	7.56 ddd(1.6, 0.9, 0.8)	7.42 ddd(1.7, 0.9, 0.9)	7.47 m
17			3.63 d(9.4), 3.69 d(9.4)
18	3.80 s(COOMe)	3.83 s(COOMe)	0.94 s
20	0.90 s	0.83 s	

Table 10-2-36: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-93**~**10-2-95**.

H	10-2-93	10-2-94	10-2-95
1	2.21~2.26 m	2.30 (ov)	ax 1.42 ddd(13.2, 12.5, 0.7)
	1.34~1.36 m	1.95 m	eq 2.12 br d(13.2)
2	4.64 (ov)	4.88 m	4.92 br dd(5.3, 5.0)

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Table 10-2-36 (continued)

H	10-2-93	10-2-94	10-2-95
3	7.44 d(5.5)	2.16 m, 2.51 m	ax 1.78 br d(11.7) eq 2.53 dddd(11.7, 5.5, 5.3, 1.9)
4		3.46 dd(12.5, 7.3)	2.68 br dd(5.4, 1.5)
5			1.72 ddd(12.4, 2.0, 1.5)
6	1.34 (ov), 2.88 br d(14.5)	2.10 m, 2.30 (ov)	4.23 ddd(2.6, 2.6, 2.0) 2.35 br s(OH)
7	2.03~2.10 m, 2.41~2.43 m	2.42 m, 3.10 m	ax 1.75 ddd(14.6, 12.2, 2.6) eq 2.14 br dd(14.6, 2.6)
8			3.20 dd(12.2, 3.6)
10	1.65 br d(5.5)	2.60 br d(9.8)	2.39 ddd(12.5, 12.4, 5.5)
11	2.40 dd(13.5, 12.5) 1.62 dd(13.5, 4.0)	*α* 1.70 dd(14.1, 3.4) *β* 2.70 dd(14.1, 12.7)	ax 1.77 dd(15.0, 11.2) eq 2.13 dd(15.0, 6.1)
12	5.55 dd(12.5, 4.0)	5.50 dd(12.7, 3.4)	5.36 dd(11.2, 6.1)
14	6.54 br s	6.57 dd(1.7, 0.7)	6.39 dd(1.7, 1.0)
15	7.49 t(1.5)	7.51 d(1.7)	7.40 dd(1.7, 1.7)
16	7.59 br s	7.70 d(0.7)	7.44 dd(1.7, 1.0)
18	3.80 s(COOMe)		
19	4.62 (ov)		
20	0.75 s	4.72 d(13.7), 4.55 d(13.7)	0.98 s

Table 10-2-37: Compounds, MFs, and test solvents of clerodane-type diterpenoids **10-2-96**~**10-2-107**.

No.	Compounds	MFs	Test solvents	References
10-2-96	12(*S*)-15,16-epoxy-19-hydroxy-*neo*-cleroda-13(16),14-dien-18,6*α*:20,12-diolide	$C_{20}H_{24}O_6$	CD_3OD	[128]
10-2-97	kinalborin C	$C_{20}H_{24}O_6$	$CDCl_3$	[129]
10-2-98	6*β*-[2-methylbut-2(*Z*)-enoyl]-3*α*,4*α*,15,16-*bis*-epoxy-8*β*,10*βH*-*ent*-cleroda-13(16),14-dien-20,12-olide	$C_{25}H_{32}O_6$	$CDCl_3$	[130]
10-2-99	10*β*-hydroxy-6-oxo-3*α*,4*α*,15,16-*bis*-epoxy-8*βH*-cleroda-13(16),14-dien-20,12-olide	$C_{20}H_{24}O_6$	$CDCl_3$	[130]
10-2-100	croblongifolin	$C_{28}H_{30}O_9$	$CDCl_3$	[131]
10-2-101	sandrasin B	$C_{20}H_{26}O_8$	$CDCl_3$	[132]
10-2-102	sandrasin A	$C_{24}H_{30}O_{10}$	$CDCl_3$	[132]
10-2-103	5*β*-hydroxy-*cis*-dehydrocrotonin	$C_{19}H_{22}O_5$	$CDCl_3$	[133]
10-2-104	cascarillin C	$C_{22}H_{30}O_5$	CD_3OD	[134]
10-2-105	teulolin A	$C_{20}H_{26}O_7$	$CDCl_3$-CD_3OD (3:1)	[135]
10-2-106	teuluteumin B	$C_{23}H_{32}O_8$	CD_3OD	[136]
10-2-107	teulolin B	$C_{20}H_{26}O_7$	$CDCl_3$-CD_3OD (3:1)	[135]

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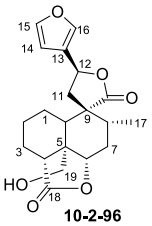
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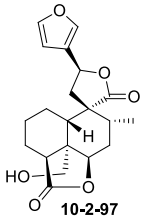
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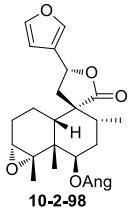
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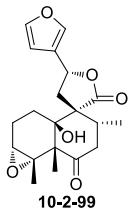
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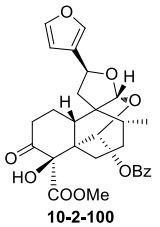
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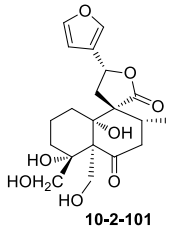
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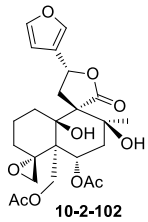
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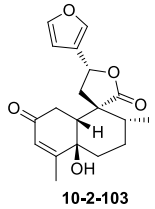
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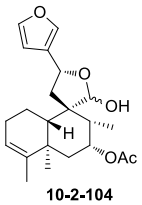
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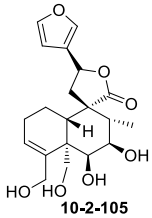
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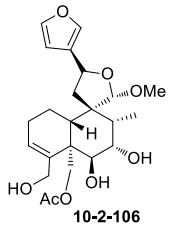
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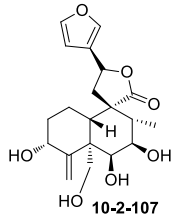
10-2-107

Table 10-2-38: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-96**~**10-2-99**.

H	10-2-96	10-2-97	10-2-98	10-2-99
1	1.49 m, 2.16 m	1.66, 2.11	1.46 m, 1.81 m (ov)	2.01 m, 2.15 m (ov)
2	1.58 m, 1.83 m	1.47	1.80 m (ov), 2.20 m	2.03 m (ov), 2.15 m (ov)
3	1.58 m, 2.05 m	1.83	2.98 br s	3.05 br s
4	2.39 (ov)	1.72		
6	3.53 dd(2.9, 10.5)	4.61 br s	5.80 t(6.1)	
7	1.69 dt(4.0, 4.5)	2.09, 2.27	2.34 ddd(6.1, 10.5, 14.4)	2.88 dd(13.3, 15.4)
	2.12 m		1.67 m (ov)	2.35 dd(4.6, 15.4)
8	1.77 m	1.94	2.18 m	2.12 m
10	1.89 dd(8.6, 12.5)	3.13 dd(6.8, 2.4)	1.61 m (ov)	
11	2.38 (ov)	2.35, 2.45	2.47 m	2.03 m (ov), 3.36 dd(7.2, 13.0)
	2.56 dd(8.2, 14.2)			
12	5.49 t(8.7)	5.36 dd(9.6, 8.0)	5.35 t(7.6)	5.50 t(7.2)
14	6.49 s	6.38 br s	6.41 t(1.0)	6.40 t(1.2)
15	7.56 s	7.46 br s	7.46 t(1.0)	7.45 br s

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Table 10-2-38 (continued)

H	10-2-96	10-2-97	10-2-98	10-2-99
16	7.61 s	7.44 br s	7.48 br s	7.45 br s
17	1.03 d(6.4)	1.05 d(6.8)	1.07 d(6.7)	1.14 d(6.8)
18			1.34 s	1.46 s
19	4.28 d(10.9)	3.68	1.41 s	1.44 s
	4.66 d(10.9)	4.35		
3′			6.05 qq(1.4, 7.1)	
4′			2.04 dq(1.4, 7.1)	
5′			1.95 dq(1.4, 1.4)	

Table 10-2-39: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-100**~**10-2-103**.

H	10-2-100	10-2-101	10-2-102	10-2-103
1	2.24 m, 3.20 dt(5.2, 13.7)		1.18, 2.20	*α* 2.58 dd(9.5, 17)
				β 3.34 dd(5.3, 17)
2	2.56 ddd(1.5, 5.2, 15.2)		1.80, 2.05	
	3.09 ddd(6.7, 13.1, 15.2)			
3			1.75, 1.90	5.88 s
6	1.24 m, 1.80		5.42 dd(12, 5)	1.16 m
7	1.68 m, 2.24 m	*α* 3.55 t(13)	*α* 2.75 t(12.5)	1.6~1.8 m
		β 2.28 dd(2.5, 13)	*β* 1.72 dd(12.5, 5)	
8	1.81 m	1.58		2.02 m
10	2.24 m			2.26 m
11	2.22 dd(7.3, 14)	*α* 2.78 dd(9, 15)	*α* 3.12 dd(9, 15)	*α* 2.30 dd(9.5, 13.2)
	2.30 dd(8.5, 13.7)	*β* 1.85 dd(8.5, 15)	*β* 2.52 dd(9, 15)	*β* 2.85 dd(7.3, 13.8)
12	5.01 t(7.8)	5.41 t(8.5)	5.38 br t(9.0)	5.33 t(7.2)
14	6.26 dd(0.9, 1.8)	6.40 d(1.2)	6.33 d(1.2)	6.42 br s
15	7.33 dd(1.8, 1.5)	7.39 d(1.2)	7.41 d(1.2)	7.43 s
16	7.31 dd(0.9, 1.5)	7.47 d(1.2)	7.47 d(1.2)	7.47 s
17	0.99 d(6.1)	1.00 d(7)	1.20 s	1.15 d(7.3)
18	3.78 s(OMe)	3.70 d(11)	2.40 d(3.5)	2.01 s
		3.86 d(11)	3.02 d(3.5)	
19	6.53 s	3.78 d(12.5)	4.40 br d(13)	
		3.98 d(12.5)	5.20 br d(13)	
20	5.28 s			
OAc			1.92 s, 2.03 s	
2′	7.85 dd(1.5, 8.2)			
3′	7.42 dd(7.9, 8)			
4′	7.53 ddt(1.2, 1.5, 7.3)			
5′	7.42 d(8)			
6′	7.85 dd(1.5, 8.2)			
OH	4.15 s			

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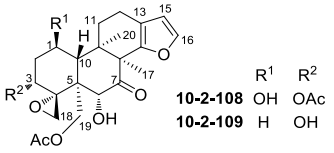
Table 10-2-40: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-104**~**10-2-107**.

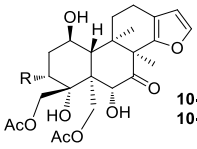
H	10-2-104	10-2-105	10-2-106	10-2-107
1	2.04 m	1.65 m	ax 2.36 (ov), eq 1.86 (ov)	1.50~1.95 (ov)
2	1.85 m, 2.00 m	2.15 (ov)	ax 2.03 (ov) eq 2.17 dt(10.1, 5.3)	1.80 (ov)
3	5.22 br s	5.67 br s	5.95 d(3.4)	4.25 d(4.3)
6	2.17 dd(14.6, 2.6) 1.47 dd(14.6, 3.4)	4.00 m	4.14 d(3.2)	3.79 d(1.8)
7	5.03 ddd(3.4, 3, 2.8)	3.84 dd(1.8, 10.7)	3.72 t(3.0)	3.54 dd(1.8, 8.8)
8	1.66 dd(7.3, 3)	1.82 m(6.7, 10.7)	1.82 qd(7.2, 3.0)	2.01 (ov)
10	1.62 br s	2.05 (ov)	2.23 d(11.9)	2.21 (ov)
11	2.64 dd(13.3, 7.2) 1.92 dd(13.3, 8.9)	2.34 t(8.3)	1.81 dd(12.9, 10.3) 2.35 (ov)	2.35 m
12	5.08 dd(8.9, 7.2)	5.29 t(8.3)	4.91 dd(10.2, 7.2)	5.33 t(8.7)
14	6.63 br s	6.26 br s	6.50 m	6.29 br s
15	7.40 br s	7.29 br s	7.48 t(1.6)	7.32 br s
16	7.45 br s	7.32 br s	7.52 d(0.7)	7.35 br s
17	1.13 d(7.3)	0.96 d(6.7)	1.11 d(7.3)	0.95 d(6.5)
18	1.59 m	4.00 m	3.99 d(12.0), 4.37 d(12.0)	5.42 br s, 4.84 br s
19	1.27 s	3.60 d(11.6) 4.75 d(11.6)	4.33 d(11.7) 4.54 d(11.8)	3.25 d(8.3) 4.75 d(8.3)
20	5.85 s		5.36 s, 3.25 s(OMe)	
OAc	2.06 s		2.02 s	

Table 10-2-41: Compounds, MFs, and test solvents of clerodane-type diterpenoids **10-2-108**~**10-2-113**.

No.	Compounds	MFs	Test solvents	References
10-2-108	alysine A	$C_{24}H_{30}O_9$	$CDCl_3$	[137]
10-2-109	alysine C	$C_{22}H_{28}O_7$	$CDCl_3$	[137]
10-2-110	alysine B	$C_{26}H_{34}O_{11}$	$CDCl_3$	[137]
10-2-111	3-deacetylalysine B	$C_{24}H_{32}O_{10}$	$CDCl_3$	[137]
10-2-112	alysine D	$C_{22}H_{28}O_7$	$CDCl_3$	[138]
10-2-113	alysine E	$C_{24}H_{32}O_9$	$CDCl_3$	[138]



	R^1	R^2
10-2-108	OH	OAc
10-2-109	H	OH



10-2-110 R = OAc
10-2-111 R = OH

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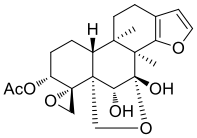
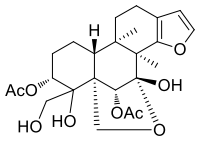


10-2-112



10-2-113

Table 10-2-42: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-108**~**10-2-110**.

H	10-2-108	10-2-109	10-2-110
1	4.45 ddd(3.5, 11, 12)		4.39 ddd(5, 10, 11)
2	*α* 2.28 m		*α* 2.42 m
	β 1.92 dddd(2, 3.5, 11, 15)		*β* 1.92 ddd(3.5, 13, 14.5)
3	4.59 t(2)	3.36 t(3)	5.29 t(3)
6	3.80	3.70 s	3.92
10	2.31 d(11)	2.30	2.40 d(10)
11	2.55		2.01, 2.42
12	1.61, 2.84		1.61, 2.84
15	6.24 d(2)	6.22 d(2)	6.22 d(2.0)
16	7.37 d(2)	7.25 d(2)	7.38 d(2.0)
17	1.34 s	1.37 s	1.42 s
18	3.08 d(3), 2.62 d(3)	2.58 d(3.5), 3.13 d(3.5)	4.22 d(12.5), 4.06 d(12.5)
19	4.27 d(12), 4.68 d(12)	4.49 d(12.5), 4.61 d(12.5)	4.41 d(13.5), 5.15 d(13.5)
20	1.14 s	1.02 s	1.21 s
OAc	2.02 s, 2.06 s	2.02 s	1.99 s, 2.05 s, 2.08 s

Table 10-2-43: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-111**~**10-2-113**.

H	10-2-111	10-2-112	10-2-113
1	4.47 ddd(5, 11, 12)	*α* 1.50 m	*α* 1.68 dddd(4, 10, 10, 10.5)
		β 1.78 m	*β* 1.77 ddd(4, 6, 10)
2	*α* 2.42 dt(2, 12)	*α* 1.52 m	*α* 1.58 m
	β 1.92 ddd(3.5, 11, 12)	*β* 2.04 m	*β* 1.87 dddd(2.5, 6, 10, 10)
3	4.09 t(2)	4.45 t(2.5)	5.18 t(3)
6	3.92	2.95 d(1.5)	4.30 br s
10	2.45 dd(5, 12)	2.33 dd(4, 10.5)	2.35 dd(3.5, 10)
11	1.95, 2.50	1.40 m	1.44 m
12	1.60, 2.84	1.38 m, 1.62 m	1.40 m, 1.58 m
15	6.22	6.10 d(2)	6.14 d(2)
16	7.35	7.31 d(2)	7.31 d(2)
17	1.42 s	1.34 s	1.34 s
18	4.16 d(12.5), 4.02 d(12.5)	2.78 d(3.5), 3.14 d(3.5)	4.11 d(11), 4.53 d(11)
19	4.37 d(13.5), 5.15 d(13.5)	4.18 d(11), 4.26 d(11)	4.24 d(11), 4.32 d(11)
20	1.23 s	1.21 s	1.15 s
OAc	1.96 s, 2.02 s	2.10 s	2.01 s, 2.13 s

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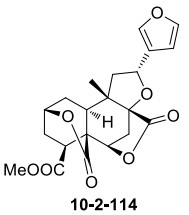
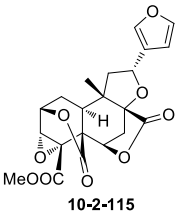
Table 10-2-44: Compounds, MFs, and test solvents of clerodane-type diterpenoids **10-2-114**~**10-2-118**.

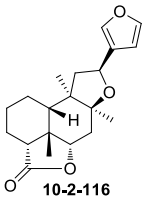
No.	Compounds	MFs	Test solvents	References
10-2-114	bafoudiosbulbin D	$C_{21}H_{22}O_8$	$CDCl_3$	[127]
10-2-115	bafoudiosbulbin E	$C_{21}H_{20}O_9$	$CDCl_3$	[127]
10-2-116	8*β*,12:15,16-diepoxy-*cis*-*ent*-cleroda-13(16),14-dien-18*α*,6*α*-olide	$C_{20}H_{26}O_4$	$CDCl_3$	[94]
10-2-117	1*β*,12:15,16-diepoxy-*cis*-*ent*-cleroda-13(16),14-dien-18*α*,6*α*-olide	$C_{20}H_{26}O_4$	$CDCl_3$	[94]
10-2-118	1*β*,16:15,16-diepoxy-*cis*-*ent*-cleroda-12,14-dien-18*α*,6*α*-olide	$C_{20}H_{26}O_4$	$CDCl_3$	[94]



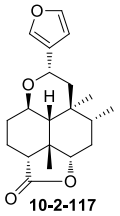
10-2-114



10-2-115



10-2-116



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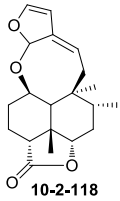

10-2-118

Table 10-2-45: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-114**~**10-2-118**.

H	10-2-114	10-2-115	10-2-116	10-2-117	10-2-118
1	2.32 (ov)	2.43~2.47 m	*α* 1.34 (ov)	3.69 dt(3.6, 10.0)	4.07 ddd
	1.74~1.78 m	1.69~1.74 m	*β* 1.80 (ov)		(2.5, 7.5, 10.0)
2	4.94 br t(4.5)	5.04 ddd(5.5, 3.5, 3.0)	*α* 1.30 (ov)	*α* 1.62 (ov)	*α* 1.67 (ov)
			β 1.65 (ov)	*β* 1.81 (ov)	*β* 2.00 (ov)
3	2.32 (ov)	4.22 d(3.5)	*α* 1.71 (ov)	*α* 2.00 (ov)	*α* 1.35 (ov)
			β 1.90 (ov)	*β* 2.21 (ov)	*β* 2.11 (ov)
4	3.16 dd(11.0, 8.0)		2.30 t(7.0)	2.33 dd(2.5, 11.2)	2.51 t(9.6)
6	5.17 d(6.0)	5.60 br d(6.0)	4.40 dd(3.6, 8.0)	4.19 d(8.5)	4.21 dd(2.2, 8.0)
7	2.66 dd(12.5, 6.0)	2.79 dd(12.5, 6.0)	*α* 2.02 (ov)	*α* 1.71 (ov)	*α* 1.63 (ov)
	1.96 (ov)	2.17 br d(12.5)	*β* 2.24 (ov)	*β* 2.10 (ov)	*β* 2.13 (ov)
8				1.49 (ov)	1.60 (ov)
10	2.43 br d(8.5)	2.34 dd(9.5, 8.5)	1.70 (ov)	1.50 (ov)	2.01 (ov)
11	2.14 dd(11.5, 10.5)	2.17 dd(11.5, 10.5)	*α* 1.89 dd(6.0, 12.5)	*α* 1.80 (ov)	*α* 2.15 dd(14.0, 10.0)
	1.99 (ov)	2.00 dd(11.5, 5.5)	*β* 2.20 (ov)	*β* 1.94 d(13.0)	*β* 2.24 dd(14.0, 8.0)
12	5.30 dd(10.5, 5.5)	5.28 dd(10.5, 5.5)	4.85 dd(6.0, 9.3)	5.10 d(7.0)	5.46 ddd(1.8, 8.0, 10.0)

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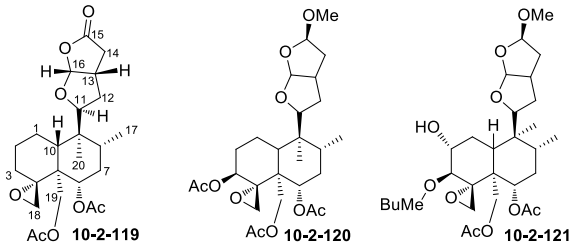
Table 10-2-45 (continued)

H	10-2-114	10-2-115	10-2-116	10-2-117	10-2-118
14	6.91 br s	6.90 d(1.0)	6.33 s	6.21 s	5.50 dd(1.8, 2.6)
15	7.41 t(1.5)	7.42 br d(1.5)	7.37 s	7.33 s	6.72 d(2.6)
16	7.58 br s	7.59 br s	7.36 s	7.24 s	5.90 s
17			1.31 s	0.85 d(6.6)	0.93 d(6.6)
18	3.82 s(COOMe)	3.89 s(COOMe)			
19			1.31 s	1.37 s	1.31 s
20	1.30 s	1.23 s	1.14 s	0.76 s	0.75 s

Table 10-2-46: Compounds, MFs, and test solvents of clerodane-type diterpenoids **10-2-119**~**10-2-129**.

No.	Compounds	MFs	Test solvents	References
10-2-119	–	$C_{24}H_{34}O_8$	$CDCl_3$	[139]
10-2-120	14,15-dihydro-15β-methoxy-3-epicaryoptin	$C_{27}H_{40}O_{10}$	$CDCl_3$	[140]
10-2-121	lupulin A	$C_{30}H_{46}O_{11}$	$CDCl_3$	[141]
10-2-122	3β-hydroxyajugavensin B	$C_{29}H_{42}O_{10}$	$CDCl_3$	[142]
10-2-123	hativene A	$C_{29}H_{44}O_{11}$	–	[143]
10-2-124	hativene B	$C_{29}H_{44}O_{11}$	–	[143]
10-2-125	hativene C	$C_{29}H_{44}O_{11}$	–	[143]
10-2-126	areptin B	$C_{29}H_{40}O_{10}$	$CDCl_3$	[144]
10-2-127	clerodendrin E	$C_{30}H_{40}O_{12}$	$CDCl_3$	[145]
10-2-128	jodrellin A	$C_{24}H_{32}O_8$	–	[146]
10-2-129	ajugapyrin A	$C_{27}H_{38}O_9$	$CDCl_3$	[147]



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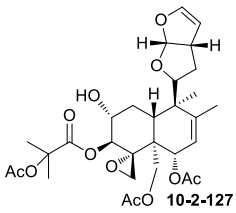
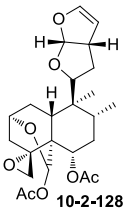
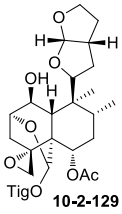


10-2-127



10-2-128



10-2-129

Table 10-2-47: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-119**~**10-2-121**.

H	10-2-119	10-2-120	10-2-121
2	–	–	3.61 ddd(9.8, 8.8, 5.4)
3	–	5.28 m	5.22 d(9.8)
6	4.67 dd(11.7, 4.4)	4.76 dd(11.1, 4.6)	4.68 dd(11.4, 4.8)
11	4.11 dd(11.5, 5.1)	4.03 m	4.37 dd(11.5, 5.7)
13	3.18 m	3.02 m	2.81 m
14	2.39 dd(3.9, 18.7) 2.89 dd(10.7, 18.7)	–	–
15		5.12 d(5)	4.96 d(5.6)
15-OMe		3.34 s	3.32 s
16	6.04 d(5.7)	5.73 d(5.4)	5.81 d(5.3)
17	0.86 d(6.4)	0.89 d(6.4)	0.92 s
18	2.20 d(3.9), 2.97 d(3.9)	2.61 d(4.0), 2.84 d(4.0)	2.79 d(12.3), 2.55 d(12.3)
19	4.36 d(12.2), 4.97 d(12.2)	4.37 d(12), 4.79 d(12)	4.78 d(12.3), 4.40 d(12.3)
20	0.94 s	0.93 s	0.88 d(6.2)
OAc	1.93 s, 2.09 s	1.95 s, 1.99 s, 2.13 s	2.12 s, 1.93 s

Table 10-2-48: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-122**~**10-2-125**.

H	10-2-122	10-2-123	10-2-124	10-2-125
1	5.79 ddd	ax 1.75 m, eq 2.60 m	ax 1.74 m, eq 2.59 m	ax 1.90 m, eq 2.45 m
2	2.46 ddd, 1.82	3.63 m	3.61 m	4.11 m
3	4.24 dd	5.20 d(9.7)	5.20 d(9.8)	5.38 d(3.4)
6	4.82 dd(11.3, 4.6)	4.67 dd(11.8, 4.5)	4.67 dd(11.4, 4.5)	4.76 m
7	1.68, 1.49	ax 1.65 m, eq 1.47 m	ax 1.60 m, eq 1.45 m	ax 1.60 m, eq 1.45 m
8	1.86	1.48 m	1.45 m	1.44 m
10	2.31 d(7.6)	1.70 m	1.70 m	2.21 m
11	4.45 dd(10.7, 6.4)	3.99 dd(11.6, 4.1)	4.37 dd(11.3, 5.7)	4.37 m
12	2.03, 1.43	1.50 m, 1.75 m	1.60 m, 1.74 m	1.57 m, 1.91 m
13	2.65 m	2.97 m	2.78 m	2.83 m
14	2.04, 1.57	1.65 m, 2.17 m	1.75 m, 2.23 m	1.78 m, 2.20 m
15	3.77 m	5.08 d(4.7)	4.95 d(5.7)	4.95 d(5.7)
15-OMe		3.31 s	3.31 s	3.30 s
16	5.55 d(5.2)	5.72 d(5.3)	5.80 d(5.4)	5.79 d(5.2)

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Table 10-2-48 (continued)

H	10-2-122	10-2-123	10-2-124	10-2-125
17	0.88 d(6.7)	0.85 d(6.1)	0.87 d(6.3)	0.87 d(6.6)
18	2.98 d(4.3)	2.55 d(4.1)	2.56 d(4.3)	2.66 d(4.1)
	2.94 d(4.3)	2.78 d(4.1)	2.80 d(4.3)	2.94 d(4.1)
19	5.03 d(12.8)	4.40 d(12.3)	4.40 d(12.2)	4.44 d(12.6)
	4.18 d(12.8)	4.76 d(12.3)	4.76 d(12.2)	4.71 d(12.6)
20	0.89 s	0.94 s	0.92 s	0.93 s
2′		2.52 m	2.51 m	2.50 m
3′	6.81 qq(7.0, 1.5)	1.13 d(7.1)	1.13 d(7.0)	1.12 d(7.0)
4′	1.82 d(7.0)	1.13 d(7.1)	1.13 d(7.0)	1.12 d(7.0)
5′	1.86 br s			
6-OAc	1.94 s	1.92 s	1.92 s	1.93 s
19-OAc	2.10 s	2.11 s	2.11 s	2.10 s

Table 10-2-49: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-126**~**10-2-129**.

H	10-2-126	10-2-127	10-2-128	10-2-129
1	5.78 ddd(4.0, 4.8, 8.0)	2.66 m	ax 1.59 dd(14.4, 11.5)	3.97 br t(3.2, 2.4)
			eq 2.35 ddd(14.6, 7.7, 4.7)	1.63 br s(OH)
2	*α* 1.67 (ov)	3.64 m	4.18 m	4.40 m
	β 2.45 ddd(4.8, 7.2, 10.2)			
3	4.32 dd(4.1, 7.2)	5.47 d(11.5)	ax 1.76 dd(14.3, 2.8)	*α* 2.27 dt(2.7)
			eq 2.52 dt(14.3)	*β* 1.67 m
6	4.79 dd(4.8, 12.4)	5.23 br s	4.63 dd(11.6, 4.6)	4.64 dd(11.5, 4.8)
7	*α* 1.72 (ov)	5.03 br s	ax 1.71~1.66 m	
	β 2.01 t(4.8)		eq 1.40 ddd(12.8, 4.5, 2.7)	
8	1.52(6.1)		1.65~1.61 m	–
10	2.21 d(8.0)	–	2.03 dd(11.4, 4.3)	1.97 d(2.4)
11	4.28 ddd(11.7, 5.0)	4.08 dd(5.0, 11.0)	3.99 dd(11.7, 4.6)	4.08 dd(5.7, 10.9)
12			1.85 td(11.9, 8.4)	
			1.71~1.66 m	
13	3.31 (2.5, 2.1, 6.2)	3.47 br t(6.5)	3.53 m	2.83 m
14	4.70 t(2.5)	4.79 t(2.2)	4.81 t(2.6)	
15	6.36 dd(2.1, 2.5)	6.44 t(2.2)	6.45 t(2.5)	3.86 m
16	5.87 d(6.2)	6.06 d(6.0)	6.01 d(6.2)	5.63 d(5.1)
17	0.89 d(6.1)	1.68 br s	0.89 d(6.5)	0.89 d(6.2)
18	2.91 d(4.4)	2.67 d(4.0)	2.42 d(4.4)	2.88 d(4.5)
	3.02 d(4.4)	2.84 d(4.0)	2.99 d(4.4)	3.09 d(4.5)
19	4.17 br d(12.3)	4.61 d(12.1)	6.74 s	6.77 s
	5.02 d(12.3)	4.45 d(12.1)		
20	0.94 s	1.24 s	1.17 s	1.19 s
3′	6.77 qq(6.9, 1.3)	1.49 s		7.06 qq(7.1, 1.2)
4′	1.81 m			1.87 m
5′	1.84 m			1.81 m
Me		1.57 s		
OAc	2.11 s, 1.95 s	2.13 s, 2.09 s, 2.01 s	2.13 s, 1.96 s	1.79 s

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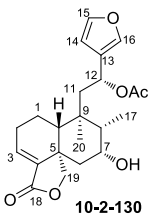
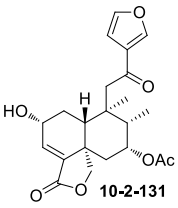
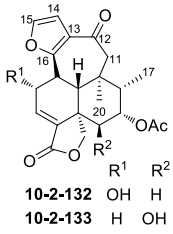
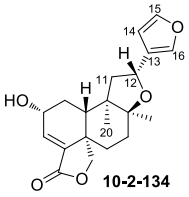
Table 10-2-50: Compounds, MFs, and test solvents of clerodane-type diterpenoids **10-2-130**~**10-2-141**.

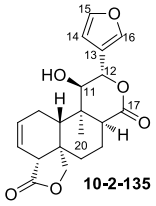
No.	Compounds	MFs	Test solvents	References
10-2-130	salvisplendin C	$C_{22}H_{28}O_6$	$CDCl_3$	[148]
10-2-131	2*α*-hydroxy-7*α*-acetoxy12-oxo-15:16-epoxy-neoclerodan-3,13(16),14-trien-18:19-olide	$C_{22}H_{26}O_7$	$CDCl_3$	[149]
10-2-132	slavisousolide	$C_{22}H_{24}O_7$	$CDCl_3$	[149]
10-2-133	isosalvisousolide	$C_{22}H_{24}O_7$	$CDCl_3$	[150]
10-2-134	salvisplendin D	$C_{20}H_{24}O_5$	$CDCl_3$-CD_3OD (1:1)	[148]
10-2-135	salvisplendin A	$C_{20}H_{22}O_6$	$CDCl_3$	[148]
10-2-136	salvisplendin B	$C_{20}H_{20}O_6$	$CDCl_3$-CD_3OD (1:1)	[148]
10-2-137	*ent*-(5*R*,9*R*)-15,16-epoxy-10*S*-hydroxycleroda-3,7,13(16),14-tetraene-17,12*S*:18,19-diolide	$C_{20}H_{20}O_6$	$CDCl_3$	[151]
10-2-138	polystachyne D	$C_{20}H_{22}O_6$	CD_3COCD_3-C_6D_6 (1:1)	[152]
10-2-139	polystachyne E	$C_{20}H_{20}O_6$	$CDCl_3$	[152]
10-2-140	polystachyne A	$C_{20}H_{22}O_5$	$CDCl_3$	[152]
10-2-141	polystachyne C	$C_{20}H_{22}O_6$	$CDCl_3$	[152]

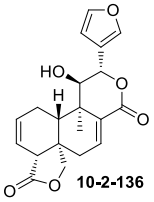


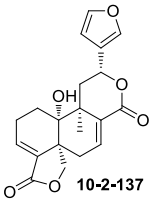


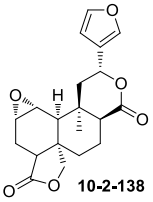


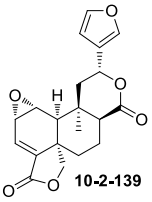


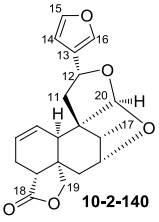












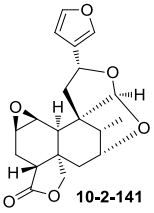


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Table 10-2-51: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-130**~**10-2-132**.

H	10-2-130	10-2-131	10-2-132
1	1.08 qd(12.5, 4.0) 1.50 dddd(12.5, 4.8, 2.0, 0.6)		3.11 t(9.3)
2	2.28 dddd(18.1, 7.4, 4.0, 2.2) 2.02 dddd(18.1, 12.5, 4.8, 2.2)	4.52 br dd(8.0, 4.0)	4.72 dd(9.3, 1.5)
3	6.68 dd(7.4, 2.2)	6.6 br s ($W_{1/2}$ = 4)	6.68 d(1.5)
6	2.31 dd(14.1, 2.4) 1.39 ddd(14.1, 3.6, 2.2)		α 2.38 dd(15, 2.2) β 1.55 ddd(15, 4.0, 2.0)
7	4.08 ddd(3.7, 3.6, 2.4)	5.26 dt(4, 2), 2.1 s(OAc)	5.3 dt(4, 2.2), 2.13 s(OAc)
8	1.69 qd(7.1, 3.7)		1.68 dq(7, 4.0)
10	1.84 dd(12.5, 0.6)		2.28 d(9.3)
11	1.77 dd(16.0, 3.2), 2.20 dd(16.0, 8.2)	2.72 d(16), 2.98 d(16)	2.54 d(15.1), 3.04 d(15.1)
12	5.80 dd(8.2, 3.2), 1.99 s(OAc)		
14	6.40 dd(1.8, 0.9)	6.75 d(1.6)	6.79 d(2)
15	7.38 t(1.8)	7.47 t(1.6)	7.47 d(2)
16	7.41 dd(1.8, 0.9)	8.1 br s	
17	1.15 d(7.1)	0.94 d(7.2)	1.04 d(7)
19	3.86 dd(7.6, 2.2) 5.27 d(7.6)	4.82 d(8) 4.0 dd(8, 2)	4.96 d(8.3) 4.11 dd(8.3, 2.0)
20	0.85 s	0.91 s	0.90 s

Table 10-2-52: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-133**~**10-2-135**.

H	10-2-133	10-2-134	10-2-135
1	3.07 dt(10.5, 2.5)	1.23 ddd(13.3, 12.9, 10.3) 2.01 dddd(13.3, 4.9, 1.2, 0.6)	2.03 ddddd(16.0, 12.4, 2.7, 2.5, 2.0) 2.70 ddddd(16.0, 5.6, 4.0, 2.4, 1.2)
2	α 3.28 ddd(18, 8, 2.5) β 2.56 ddd(18, 10.5, 2.5)	4.46 ddd(10.3, 4.9, 1.4)	5.96 dddd(10.0, 5.6, 2.4, 2.0)
3	7.06 dd(8, 2.5)	6.60 dd(1.4, 1.2)	5.53 dtd(10.0, 2.7, 1.2)
4			2.74 ddt(2.7, 2.5, 2.4)
6	4.02 d(3)	1.71 ddd(14.5, 4.7, 2.2) 1.50 tdd(14.5, 5.6, 2.0)	1.81 dtd(14.6, 4.0, 1.0) 1.26 dddd(14.6, 13.8, 4.0, 1.6)
7	5.15 dd(4.5, 3) 2.14 s(OAc)	1.76 ddd(14.5, 13.3, 4.7) 1.94 ddd(13.3, 5.6, 2.2)	1.87 ddt(14.6, 13.8, 4.0) 2.36 dtd(14.6, 4.0, 3.0)
8	2.04 dq(7, 4.5)		2.43 ddd(4.0, 3.0, 1.0)
10	3.02 d(10.5)	2.05 dd(12.9, 0.6)	2.09 dd(12.4, 4.0)
11	2.96 d(14.5) 2.63 d(14.5)	1.94 dd(13.3, 10.3) 2.45 dd(13.3, 6.9)	3.51 d(10.4)
12		5.01 dd(10.3, 6.9)	5.15 d(10.4)
14	6.66 d(2)	6.36 dd(1.6, 0.8)	6.43 dd(1.8, 8.0)
15	7.33 d(2)	7.38 m	7.41 t(1.8)
16		7.38 m	7.52 dd(1.8, 0.8)
17	1.05 d(7)	1.18 s	
19	4.12 d(9), 4.96 d(9)	4.00 dd(8.2, 2.0), 4.38 d(8.2)	4.20 d(9.1), 4.22 dd(9.1, 1.6)
20	0.90 s	0.84 s	1.07 s

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Table 10-2-53: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-136**~**10-2-138**.

H	10-2-136	10-2-137	10-2-138
1	2.06 ddddd(18.0, 12.1, 2.8, 2.7, 2.2) 2.21 ddddd(18.0, 7.8, 5.3, 2.8, 1.2)	1.65 t(6.5)	3.02 dd(3.8, 2.2)
2	6.03 ddt(10.0, 7.8, 2.2)	2.36 m	2.91 ddd(3.8, 2.4, 1.2)
3	5.58 dtd(10.0, 2.8, 1.2)	6.78 t(3.6)	2.1~2.3 m
4	2.91 tdd(2.8, 2.7, 2.2)		2.06~2.2 m
6	2.63 dd(19.3, 5.8)	2.76 dd(20.8, 4.4)	α 1.6~1.8 m
	2.27 ddd(19.3, 2.3, 2.0)	2.19 ddd(20.8, 1.6, 1.1)	β 2.06~2.2 m
7	7.03 dd(5.8, 2.3)	6.42 t(3.7)	1.6~1.8 m
8			2.25-2.4 m
10	2.78 dd(12.1, 5.3)		1.71 br d(2.2)
11	3.92 d(2.7)	2.59 dd(25.5, 2.2)	α 2.17 dd(14.4, 7.5)
		1.63 dd(15.5, 12.3)	β 1.73 dd(14.4, 7.5)
12	5.38 dd(2.7, 1.6)	4.85 dd(12.3, 2.2)	5.47 t(7.5)
14	6.44 dd(1.6, 0.7)	6.32 d(1.5)	6.37 dd(1.8, 0.9)
15	7.44 t(1.6)	7.29 br s	7.32 t(1.8)
16	7.46 td(1.6, 0.7)	7.36 t(1.7)	7.45 m
19	4.29 dd(8.8, 2.0)	4.38 dd(8.3, 1.1)	α 4.22 d(8.4)
	4.03 d(8.8)	4.08 d(8.3)	β 3.52 d(8.4)
20	0.83 s	1.07 s	1.06 s

Table 10-2-54: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-139**~**10-2-141**.

H	10-2-139	10-2-140	10-2-141
1	3.41 dd(3.6, 2.7)	5.48 br d(9.9)	3.14 br d(4.5)
2	3.51 dd(3.6, 2.4)	5.94 ddd(9.9, 5.4, 2.7)	3.31 m(4.5, 3)
3	6.98 d(2.4)	α 2.4 m, β 2.1 m	α 2.4 m, β 2.01 m
4		2.33 dd(14.4, 5)	2.4 m
6	1.5~1.7 m	α 1.79 dd(14.2, 4.4)	α 2.16 dd(14.1, 3.9)
		β 1.30	β 1.51 br d(14.1)
7	α 2.27, β 1.5~1.7 m	4.45 d(4.4)	4.42 dd(3.9, 1.2)
8	2.57 d(3.3)	1.97 q(7.2)	2.42 q(7)
10	1.68 br s	2.68 br s	2.24 s
11α	2.29 d(16)	1.88 dd(13.2, 7.5)	1.89 dd(13, 7.5)
11β	2.90 dd(16, 7.5)	2.66 dd(13.2, 7.5)	2.81 dd(13, 7.6)
12	5.76 br d(7.5)	5.28 t(7.5)	5.29 t(7.6)
14	6.41 dd(1.6, 1)	6.33 dd(1.7, 0.8)	6.32 dd(1.8, 0.9)
15	7.49 t(1.6)	7.41 t(1.7)	7.41 t(1.7)
16	7.42 m	7.37 m	7.37 m
17		1.28 d(7.2)	1.36 d(7)
19α	3.36 dd(9, 1)	4.04 dd(8, 2)	4.20 dd(9, 1)
19β	4.42 d(9)	4.85 d(8)	4.53 d(9)
20	1.28 s	5.24 s	5.33 s

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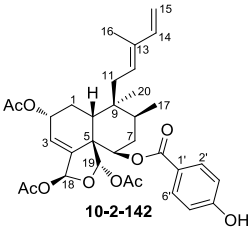
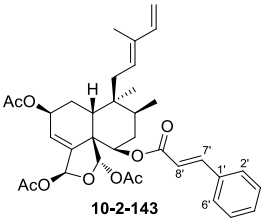
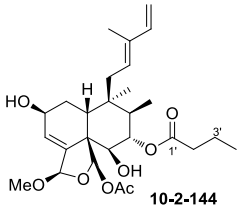
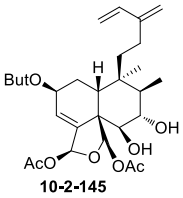
Table 10-2-55: Compounds, MFs, and test solvents of clerodane-type diterpenoids **10-2-142**~**10-2-149**.

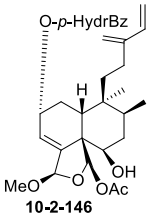
No.	Compounds	MFs	Test solvents	References
10-2-142	caseobliquin A	$C_{33}H_{40}O_{10}$	CD_3OD	[153]
10-2-143	caseobliquin B	$C_{35}H_{42}O_9$	CD_3OD	[153]
10-2-144	casearin V	$C_{27}H_{40}O_8$	$CDCl_3$	[154]
10-2-145	caseanigrescen B	$C_{28}H_{40}O_9$	C_6D_6	[155]
10-2-146	intrapetacin A	$C_{30}H_{38}O_8$	$CDCl_3$	[156]
10-2-147	heteroscyphone A	$C_{22}H_{32}O_7$	$CDCl_3$	[157]
10-2-148	heteroscyphone B	$C_{22}H_{32}O_6$	$CDCl_3$	[157]
10-2-149	heteroscyphone C	$C_{22}H_{32}O_5$	$CDCl_3$	[157]

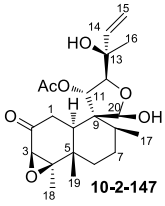


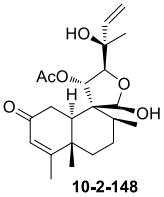












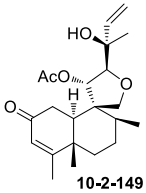


Table 10-2-56: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-142**~**10-2-146**.

H	10-2-142	10-2-143	10-2-144	10-2-145	10-2-146
1	1.84 m, 1.89 m	1.99 m, 2.09 m	1.82 m, 1.98 m	1.84 (ov)	2.32 m, 1.78 m
2	5.54 m	4.41 m	4.39 br s	5.53 br s	5.80 m
2-OAc	2.07 s	1.90 s			
3	5.95 br s	6.06 d(4.0)	6.11 d(3.6)	6.15 d(2.8)	6.11 br s

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Table 10-2-56 (continued)

H	10-2-142	10-2-143	10-2-144	10-2-145	10-2-146
6	5.34 dd(4.5, 12.0)	5.11 dd(4.5, 12.0)	3.59 d(10.8)	3.64 m	4.04 dd(11.9, 3.9)
7	1.78 m, 1.89 m	1.78 m, 1.93 m	4.95 t(10.8)	3.55 m	1.89 m, 1.69 m
8	2.04 m	–	1.81 m	1.70 (ov)	1.78 m
10	2.58 dd(3.0, 14.0)	2.57 dd(3.5, 14.4)	2.37 dd(13.8, 3.0)	2.46 dd(5.6, 11.6)	2.42 dd(13.8, 2.9)
11	1.80 m	2.33 dd(8.8, 17.5)	1.61 m	1.37 (ov)	1.25 m
	2.29 dd(8.0, 17.0)		2.48 dd(9.6, 16.2)	1.69 (ov)	1.49 m
12	5.54 m	5.58 m	5.28 d(8.4)	2.08 m, 2.19 m	2.09 m
14	6.43 dd(17.5, 11.0)	6.41 dd(10.5, 17.5)	6.59 dd(10.8, 17.4)	6.37 dd(11, 17.4)	6.44 dd(17.7, 11.2)
15	4.93 d(11.0)	4.92 d(10.5)	5.08 d(10.8)	4.88 d(11)	5.23 d(17.7)
	5.09 d(17.5)	5.10 d(17.5)	5.15 d(17.4)	5.10 d(17.4)	5.06 d(11.2)
16	1.67 s	1.67 s	1.77 s	5.09 s, 5.23 s	5.04 s, 4.94 s
17	0.97 d(7.0)	0.97 d(7.0)	0.88 d(6.6)	1.12 d(6.4)	0.93 d(6.5)
18	6.39 t(1.5)	6.49 t(1.5)	5.44 s	7.11 s	5.48 m
	2.03 s(OAc)	2.05 s(OAc)	3.41 s(OMe)	1.64 s(OAc)	3.43 s(OMe)
19	6.67 s	6.67 s	6.52 s	6.76 s	6.43 s
19-OAc	1.95 s	1.94 s	1.96 s	1.70 s	1.92 s
20	0.92 s	0.91 s	0.84 s	0.76 s	0.97 s
2′	6.83 d(9.0)	7.63 m	2.29 t(7.2)	1.88 m	7.69 d(9.0)
3′	7.97 d(9.0)	7.40 m	1.62 m	1.45 m	6.87 d(9.0)
4′		7.40 m	0.92 t(7.2)	0.72 t(7.4)	
5′	7.97 d(9.0)	7.40 m			6.87 d(9.0)
6′	6.83 d(9.0)	7.63 m			7.69 d(9.0)
7′		7.80 d(16.0)			
8′		6.48 d(16.0)			
OH					5.89 br s

Table 10-2-57: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-147**~**10-2-149**.

H	10-2-147	10-2-148	10-2-149
3	5.73 s	5.74 s	5.67 s
11	5.91 d(5), 1.98 s(OAc)	5.59 d(6), 2.02 s(OAc)	6.15 d(6.0), 2.04 s(OAc)
12	3.81 d(5)	3.68 d(7)	4.04 d(6.0)
14	5.79 dd(17, 11)	5.80 dd(17, 11)	5.94 dd(17, 11)
15	5.14 d(11), 5.47 d(17)	5.13 dd(11, 1), 5.38 dd(17, 11)	5.13 d(11), 5.49 d(17)
16	1.44 s	1.44 s	1.31 s
17	1.05 d(7)	1.09 d(6)	1.36 d(7)
18	1.86 s	1.85 s	1.99 s
19	1.16 s	0.91 s	1.54 s
20	5.25 s	6.44 d(6)	3.92 d(10), 4.00 d(10)

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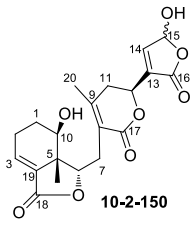
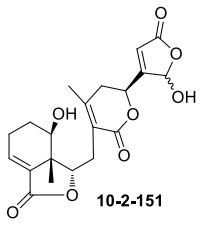
Table 10-2-58: Compounds, MFs, and test solvents of clerodane-type diterpenoids **10-2-150**~**10-2-173**.

No.	Compounds	MFs	Test solvents	References
10-2-150	jamesoniellide K	$C_{20}H_{22}O_8$	–	[158]
10-2-151	jamesoniellide L	$C_{20}H_{22}O_8$	–	[158]
10-2-152	salvianduline B	$C_{22}H_{22}O_8$	$CDCl_3$	[151]
10-2-153	jamesoniellide H	$C_{20}H_{24}O_6$	$CDCl_3$	[159]
10-2-154	jamesoniellide I	$C_{20}H_{22}O_6$	$CDCl_3$	[159]
10-2-155	jamesoniellide J	$C_{21}H_{28}O_6$	$CDCl_3$	[159]
10-2-156	dugesin A	$C_{20}H_{18}O_5$	$CDCl_3$	[160]
10-2-157	dugesin B	$C_{20}H_{14}O_5$	$CDCl_3$	[160]
10-2-158	methyl dodovisate A	$C_{21}H_{26}O_3$	C_5D_5N	[161]
			$CDCl_3$	[161]
10-2-159	methyl dodovisate B	$C_{21}H_{26}O_4$	C_5D_5N	[161]
			$CDCl_3$	[161]
10-2-160	methyl dodonate A	$C_{21}H_{28}O_4$	$CDCl_3$	[162]
10-2-161	methyl dodonate B	$C_{21}H_{28}O_5$	$CDCl_3$	[162]
10-2-162	–	$C_{21}H_{26}O_4$	$CDCl_3$	[162]
10-2-163	–	$C_{21}H_{24}O_5$	$CDCl_3$	[162]
10-2-164	methyl dodonate C	$C_{21}H_{26}O_5$	$CDCl_3$	[162]
10-2-165	–	$C_{21}H_{24}O_5$	$CDCl_3$	[162]
10-2-166	–	$C_{21}H_{24}O_4$	$CDCl_3$	[162]
10-2-167	dodonolide	$C_{20}H_{24}O_3$	$CDCl_3$	[162]
10-2-168	dunniana acid A	$C_{20}H_{32}O_4$	$CDCl_3$	[163]
10-2-169	scaparvin A	$C_{20}H_{24}O_4$	$CDCl_3$	[164]
10-2-170	scaparvin B	$C_{20}H_{24}O_4$	$CDCl_3$	[164]
10-2-171	crotinsulactone	$C_{16}H_{26}O_4$	CD_3OD	[123]
10-2-172	18-hydroxyaylthonic acid	$C_{16}H_{26}O_4$	C_5D_5N	[165]
10-2-173	18-oxo-aylthonic acid	$C_{16}H_{24}O_4$	C_5D_5N	[165]



10-2-150



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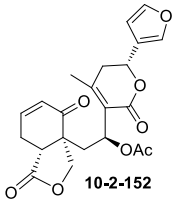

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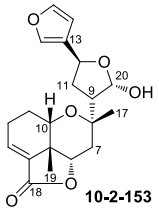

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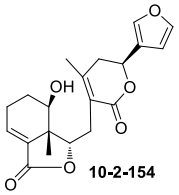

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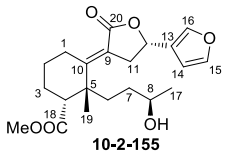

10-2-155

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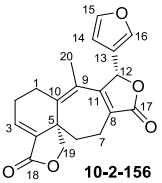
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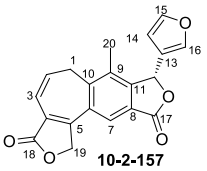
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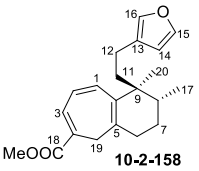
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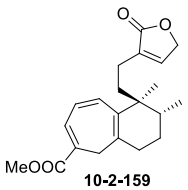
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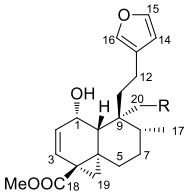
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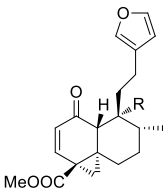
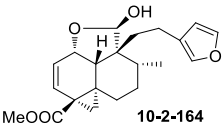
10-2-161 R = OH


10-2-162 R = Me
10-2-163 R = CHO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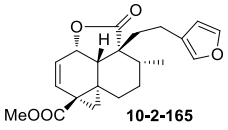
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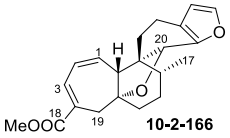
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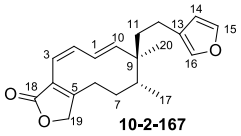
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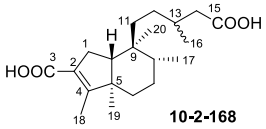
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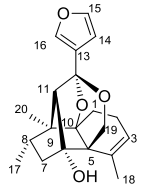
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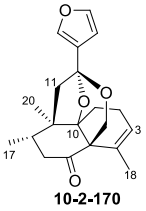
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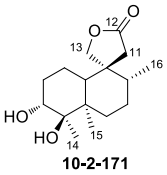
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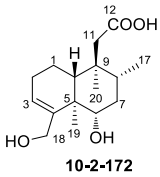
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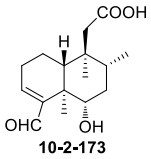
10-2-173

Table 10-2-59: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-150**~**10-2-153**.

H	10-2-150	10-2-151	10-2-152	10-2-153
1	1.78 m, 2.00 m	1.78 m, 2.00 m	6.08 dq(10.3, 1.1)	1.91 m
2	2.35 ddd(1.8, 3.7, 7.3) 2.43 m	2.35 ddd(1.8, 3.7, 7.3) 2.43 m	6.92 ddd(10.3, 5.4, 2.3)	2.28 m
3	6.93 dd(3.7, 3.7)	6.92 dd(3.8, 3.8)	2.97 dd(20.3, 5.3) 2.77 ddd(20.3, 7.0, 2.7)	6.90 dd(3.3, 3.6)
4			3.07 d(6.7)	

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Table 10-2-59 (continued)

H	10-2-150	10-2-151	10-2-152	10-2-153
6	4.64 dd(7.3, 7.3)	4.64 dd(7.3, 7.3)	2.59 dd(14.7, 11.0) 2.01 dd(14.7, 2.2)	4.54 dd(6.9, 10.0)
7	2.73 br s	2.73 br s	5.70 dd(11.0, 2.2) 1.97 s(OAc)	*α* 1.19 dd(10.0, 13.3) *β* 1.97 dd(6.9, 13.3)
9				2.24 m
10	4.14 dd(2.3, 4.5)	4.14 dd(2.3, 4.5)		3.96 dd(2.8, 3.3)
11	2.84 dd(4.5, 16.5) 3.21 dd(9.1, 16.5)	2.84 dd(4.5, 16.5) 3.21 dd(9.1, 16.5)	2.68 dd(18.0, 11.9) 2.38 dd(18.0, 3.6)	*α* 2.11 m(5.0, 11.2) *β* 1.75 dd(10.9, 11.2)
12	5.27 dd(4.5, 9.1)	5.38 br s	5.25 dd(11.8, 3.6)	5.13 dd(5.0, 10.9)
14	7.19 br s	6.09 s	6.37 d(2.0)	6.35 dd(1.2, 1.5)
15	6.12 br s		7.37 t(1.5)	7.39 br s
16		6.20 br s	7.42 br s	7.39 br s
17				1.27 s
19	1.24 s	1.24 s	4.78 d(9.0) 3.97 d(9.0)	1.23 s
20	2.30 s	2.30 s	2.04 s	5.52 d(3.0) 2.67 br s(OH)

Table 10-2-60: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-154**~**10-2-157**.

H	10-2-154	10-2-155	10-2-156	10-2-157
1	*α* 1.84 m *β* 2.05 m	*α* 1.96 m *β* 4.31 ddd(3.0, 3.1, 15.1)	2.05 m, 2.92 m	3.17 dd(7.0, 13.6) 3.05 dd(7.0, 13.6)
2	2.43 m	*α* 1.70 m, *β* 1.60 m	2.48 m, 2.30 m	5.98 td(7.0, 9.6)
3	6.96 t(3.6)	*α* 2.05 dd(6.1, 12.4) *β* 1.76 m	7.07 dd(2.4, 6.2)	6.52 d(9.6)
4		2.71 dd(5.4, 5.6)		
6	4.56 dd(4.3, 9.7)	1.83 m, 1.55 m	2.04 m, 2.30 m	
7	2.63 m	1.29 m	2.70 m, 2.30 m	7.78 br s
8		3.69 m		
10	4.21 br s			
11	*α* 2.75 ddd(2.0, 7.7, 14.3) *β* 3.24 ddd(2.0, 6.6, 14.3)	*α* 3.00 ddd(3.1, 6.8, 15.7) *β* 3.56 ddd(2.5, 7.6, 15.7)		
12	5.43 dd(6.6, 7.7)	5.34 dd(6.8, 7.6)	6.23 br s	6.43 br s
14	6.36 d(0.8)	6.40 dd(0.8, 1.8)	6.52 br s	6.04 br s
15	7.39 br s	7.42 dd(1.5, 1.8)	7.60 br s	7.35 br s
16	7.43 d(0.8)	7.47 dd(0.8, 1.5)	7.80 br s	7.51 br s
17		1.16 d(6.3)		
18		3.66 s(OMe)		
19	1.28 s	1.30 s	4.82 d(7.2) 3.70 d(7.2)	5.39 d(17.5) 5.34 d(17.5)
20	2.34 t(2.0)		1.89 s	2.24 br s

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Table 10-2-61: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-158** and **10-2-159**.

H	10-2-158(C_5D_5N)	10-2-158($CDCl_3$)	10-2-159(C_5D_5N)	10-2-159($CDCl_3$)
1	7.04 d(11.2)	6.95 d(11.7)	7.05 d(11.5)	6.96 d(11.5)
2	6.63 dd(11.7, 5.6)	6.57 dd(11.7, 5.4)	6.62 dd(11.5, 5.5)	6.59 dd(11.5, 5.6)
3	7.19 d(5.6)	7.08 d(5.4)	7.19 m	7.11 m
6	2.44 m, 2.32 m	2.43 m, 2.31 m	2.43 m, 2.36 m	2.45 m, 2.33 m
7	1.40 m, 1.38 m	1.53 m, 1.43 m	1.38 m, 1.31 m	1.56 m, 1.44 m
8	1.69 m	1.77 m	1.76 m	1.78 m
11	1.82 m	1.78 m	1.83 m	1.82 m
12	2.32 m, 2.04 m	2.26 m, 1.96 m	2.22 m, 1.98 m	2.20 m, 1.93 m
14	6.43 s	6.23 s	7.14 m	7.10 m
15	7.59 s	7.33 s	4.72 br s	4.78 m
16	7.47 s	7.17 s		
17	0.77 d(5.9)	0.89 d(6.4)	0.81 d(6.6)	0.92 d(6.8)
18	3.68 s(COOMe)	3.80 s(COOMe)	3.68 s(COOMe)	3.80 s(COOMe)
19	2.84 m, 1.69 m	2.31 m, 1.76 m	2.90 m, 2.36 m	2.77 m, 2.27 m
20	0.87 s	0.91 s	0.86 s	0.93 s

Table 10-2-62: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-160**~**10-2-163**.

H	10-2-160	10-2-161	10-2-162	10-2-163
1	4.47 dd(6.3, 4.2)	4.34 dd(6.6, 3.6)		
2	5.75 dd(9.9, 6.3)	5.80 dd(10, 6.6)	5.73 d(10.2)	5.81 d(10.2)
3	6.46 d(9.9)	6.47 d(10)	7.25 d(10.2)	7.36 d(10.2)
6	1.56 m	1.62 m, 1.50 m	1.70 m, 1.58 m	1.95 m, 1.60 m
7	1.42 m	1.40 m	1.58 m	1.70 m
8	1.62 m	1.68 m	1.70 m	1.80 m
10	1.68 d(4.2)	1.76 d(3.6)	2.65 s	2.97 s
11	1.93 ddd(14.7, 12.9, 4.2)	2.03 td(14.4, 3.6)	2.86 ddd(14.1, 12.9, 5)	2.65 m
	1.78 ddd(14.7, 12.9, 5.4)	1.71 m	1.58 m	2.35 m
12	2.43 td(14.7, 5.4)	2.38 td(14.4, 4.6)	2.37 td(12.9, 4.5)	2.45 m
	2.31 td(14.7, 4.2)	2.22 td(14.4, 3.6)	2.20 td(12.9, 5)	2.30 m
14	6.27 dd(1.7, 0.9)	6.25 br s	6.28 br s	6.27 br s
15	7.35 t(1.7)	7.32 t(1.5)	7.32 t(1.5)	7.36 br s
16	7.22 br s	7.21 br s	7.21 m	7.24 br s
17	0.87 d(6.0)	0.95 d(6.9)	0.90 d(6.6)	1.06 d(6.6)
18	3.72 s(COOMe)	3.70 s(COOMe)	3.78 s(COOMe)	3.79 s(COOMe)
19	1.94 d(4.5)	1.90 d(4.2)	2.15 d(4.5)	2.21 d(4.8)
	1.59 d(4.5)	1.71 d(4.2)	0.85 d(4.5)	1.06
20	1.15 s	4.14 d(12)	0.97 s	9.81 s
		3.41 d(12)		

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Table 10-2-63: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-164**~**10-2-167**.

H	10-2-164	10-2-165	10-2-166	10-2-167
1	4.68 dd(6.3, 3.9)	4.93 dd(6.5, 4.2)	6.41 dd(12, 5.5)	5.78 dd(17, 2.4)
2	5.63 dd(10, 6.3)	5.68 dd(9.9, 6.5)	5.81 ddd(12, 5.5, 2)	6.30 dd(11.4, 2.4)
3	6.66 d(10)	6.87 d(9.9)	6.76 d(5.5)	6.03 d(11.4)
6	1.50 m, 1.85 m	1.45~1.65 m, 1.8~1.94 m	1.5~1.8 m	2.20 m
7	1.42 m, 1.82 m	1.45~1.65 m, 1.8~1.94 m	1.5~1.8 m	1.60 m, 1.76 br
8	2.00 m	2.07 qd(6.9, 3.3)	1.78 br q(6.5)	1.54 m
10	2.13 d(3.9)	2.28 d(4.2)	2.35 dd(5.5, 2)	5.85 d(17)
11	1.7~2.1 m	1.95 ddd(15, 11.2, 6) 2.16 ddd(15, 11, 6.5)	1.83 dd(15, 6.5) 2.11 ddd(15, 11, 8)	1.42 m, 1.64 m
12	2.37 td(14, 6.0) 2.44 d(14, 4.5)	2.46~2.62 m	2.47 dd(17, 8) 2.64 dddd(17, 11, 6.5, 2)	2.26 m
14	6.27 br s	6.26 dd(1.8, 0.9)	6.06 d(2)	6.23 br s
15	7.35 br s	7.37 t(1.8)	7.30 dd(2, 0.5)	7.32 t(1.5)
16	7.25 br s	7.24 br s		7.17 br s
17	1.05 d(6.6)	1.38 d(6.9)	0.90 d(6.5)	0.87 d(6.5)
18	3.73 s(COOMe)	3.75 s(COOMe)	3.75 s(COOMe)	
19	1.35, 1.66 d(3.6)	1.25 d(4.2), 1.64 d(4.2)	2.45 d(13.5), 2.73 d(13.5)	4.62 d(17.5), 4.73 d(17.5)
20	5.51 s		4.78 s	1.04 s

Table 10-2-64: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-168**~**10-2-171**.

H	10-2-168	10-2-169	10-2-170	10-2-171
1	2.27 d(8.5)	1.87 m	α 1.47 ddd(13.6, 11.7, 6.2) β 2.12 dd(14.1, 5.6)	1.48 br d(13.4) 1.62~1.77 m
2		2.17 m	α 2.07 m, β 2.30 m	2.05 br t(14.0), 1.62~1.77 m
3		5.69 br s	5.83 br s	3.50 br s
6	1.57 m	3.38 s(OH)		1.62~1.77 m, 1.36~1.52 m
7	1.48 m	α 1.55 dd(12.0, 4.8) β 2.13 t(12.0)	α 2.36 dd(15.8, 12.5) β 2.44 dd(15.8, 4.9)	1.36~1.52 m
8	1.45 m	2.06 ddq(12.0, 7.2, 4.8)	2.64 ddq(12.5, 7.0, 4.9)	1.36~1.52 m
10	1.59 m			1.93 br d(12.1)
11	1.18 m 1.29 m	2.47 s	α 2.26 d(14.1), β 2.46 d(14.1)	2.15 d(18.5) 2.87 d(18.5)
12	1.29 m			
13	1.88 m			4.25 d(10.0), 4.19 d(10.0)
14	2.36 dd(15.0, 6.5) 2.17 m	6.48 br s	6.42 br s	1.19 s
15		7.40 br s	7.38 t(1.5)	0.94 s
16	0.96 d(6.6)	7.51 br s	7.50 br s	0.92 d(6.0)

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Table 10-2-64 (continued)

H	10-2-168	10-2-169	10-2-170	10-2-171
17	0.75 d(5.9)	0.95 d(7.2)	1.11 d(7.0)	
18	1.98 s	1.82 s	1.98 br s	
19	0.86 s	α 3.99 d(9.0)	α 4.21 d(12.3)	
		β 3.94 d(9.0)	β 4.28 d(12.3)	
20	0.80 s	1.07 s	1.21 s	

Table 10-2-65: ^{1}H NMR spectroscopic data of clerodane-type diterpenoids **10-2-172** and **10-2-173**.

H	10-2-172	10-2-173	H	10-2-172	10-2-173
1	α 1.77 m, β 2.10 m	α 1.55 m, β 1.87 m	10	2.05 m	1.82 m
2	α 2.16 m	α 2.11 m	11	α 2.52 d(13.6)	2.51 m
	β 2.30 m	β 2.31 m		β 2.62 d(13.6)	
3	5.66 br s	6.64 d(3.2)	17	1.00 d(6.7)	0.98 d(6.7)
6	3.98 t(4.3)	3.71 dd(11.1, 4.5)	18	4.41 d(12.7), 4.56 d(12.7)	9.42 s
7	1.82 m	1.72 m	19	1.80 s	1.21 s
8	2.40 m	2.36 m	20	0.79 s	0.73 s

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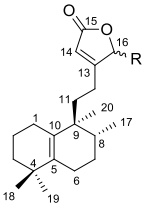
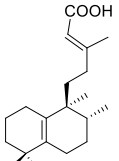
10.3 Halimane-type diterpenoids

Table 10-3-1: Compounds, MFs, and test solvents of halimane-type diterpenoids **10-3-1**~**10-3-22**.

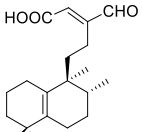
No.	Compounds	MFs	Test solvents	References
10-3-1	16-hydroxy-*ent*-halima-5(10),13-dien-16,15-olide	$C_{20}H_{30}O_3$	$CDCl_3$	[166]
10-3-2	*ent*-halima-5(10),13*E*-dien-15-oic acid	$C_{20}H_{32}O_2$	$CDCl_3$	[166]
10-3-3	16-oxo-*ent*-halima-5(10),13*E*-dien-15-oic acid	$C_{20}H_{30}O_3$	$CDCl_3$	[166]
10-3-4	*ent*-halima-5(10),13-dien-16,15-olide	$C_{20}H_{30}O_2$	$CDCl_3$	[166]
10-3-5	3*ξ*-hydroxy-5(10),13*E*-halimadien-15-al	$C_{20}H_{32}O_2$	C_6D_6	[167]
10-3-6	pseudoeluterin B	$C_{24}H_{34}O_6$	$CDCl_3$	[168]
10-3-7	6-[2-(furan-3-yl)-2-oxoethyl]-1,5,6-trimethyl-10-oxatri-cyclo[7.2.1.0^{2,7}]dodec-2(7)-en-11-one	$C_{20}H_{24}O_4$	$CDCl_3$	[169]
10-3-8	6-[2-(furan-3-yl)ethyl]-1,5,6-trimethyl-10-oxatricyclo[7.2.1.0^{2,7}]dodec-2(7)-en-11-one	$C_{20}H_{26}O_3$	$CDCl_3$	[169]
10-3-9	5-[2-(furan-3-yl)ethyl]-1,5,6-trimethyl-1,2,3,4,5,6,7,8-octahydronaphthalene-1-carboxylic acid	$C_{20}H_{28}O_3$	$CDCl_3$	[169]
10-3-10	3*β*,5*β*,16*α*-trihydroxyhalima-13(14)-en-15,16-olide	$C_{20}H_{32}O_5$	CD_3OD	[170]
10-3-11	*ent*-8*S*,12*S*-epoxy-7*R*,16-dihydroxyhalima-5(10),13-dien-15,16-olide	$C_{20}H_{28}O_5$	$CDCl_3$	[171]
10-3-12	(13*R*)-13-hydroxy-1(10),14-*ent*-halimadien-18-oic acid	$C_{20}H_{32}O_3$	$CDCl_3$	[172]
10-3-13	(2*S*,13*R*)-2,13-dihydroxy-1(10),14-*ent*-halimadien-18-oic acid	$C_{20}H_{32}O_4$	CD_3OD	[172]
10-3-14	(13*R*)-2-oxo-13-hydroxy-1(10),14-*ent*-halimadien-18-oic acid	$C_{20}H_{30}O_4$	CD_3OD	[172]
10-3-15	methyl 9-(furan-3-yl)-2,7,13-trimethyl-4-oxo-10-oxatricyclo-[5.3.3.0^{1,6}]trideca-5,8-diene-2-carboxylate	$C_{21}H_{24}O_5$	$CDCl_3$	[169]
10-3-16	2-oxo-*ent*-haliman-1(10),7-dien-15-oic acid	$C_{20}H_{30}O_3$	$CDCl_3$	[173]
10-3-17	*ent*-halima-1(10),13*E*-dien-15-oic acid	$C_{20}H_{32}O_2$	$CDCl_3$	[166]
10-3-18	*ent*-halima-1(10),13-dien-16,15-olide	$C_{20}H_{30}O_2$	$CDCl_3$	[166]
10-3-19	*seco*-chiliolidic acid	$C_{20}H_{26}O_5$	$CDCl_3$	[174]
10-3-20	*seco*-chiliolide alcohol	$C_{20}H_{28}O_4$	$CDCl_3$	[174]
10-3-21	tessmannic acid	$C_{20}H_{30}O_3$	$CDCl_3$	[175]
10-3-22	methyltessmannoate	$C_{21}H_{32}O_3$	$CDCl_3$	[175]



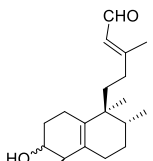
10-3-1 R = OH
10-3-4 R = H



10-3-2



10-3-3



10-3-5

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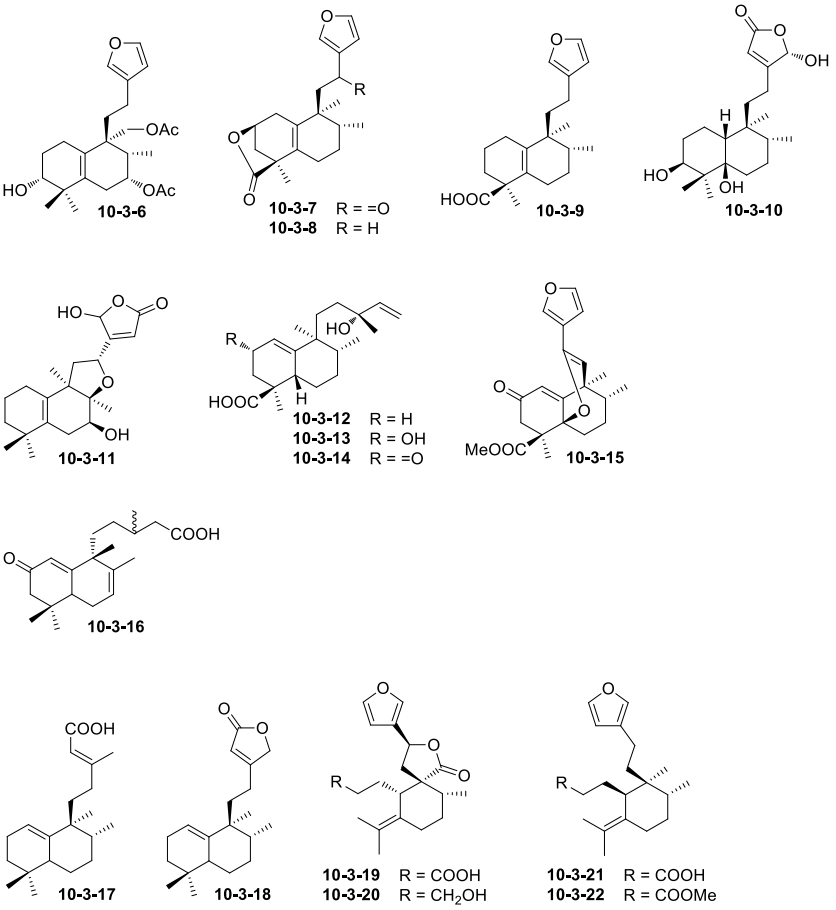

Table 10-3-2: ^{1}H NMR spectroscopic data of halimane-type diterpenoids **10-3-1**~**10-3-4**, **10-3-17**, and **10-3-18**.

H	10-3-1	10-3-2	10-3-3	10-3-4	10-3-17	10-3-18
1					5.33 t(3.8)	5.38 t(3.7)
14	5.83 s	5.68 s	6.45 br s	5.83 s	5.67 s	5.81 s
16	6.00 m	2.17 s	9.54 s	4.74 s	2.16 s	4.71 s
17	0.86 d(4.0) 0.85 d(4.0)	0.85 d(7.3)	0.88 d(6.8)	0.86 d(6.3)	0.82 d(6.4)	0.84 d(6.4)
18	0.97 s	0.96 s	0.96 s	0.97 s	0.89 s	0.87 s
19	0.99 s	0.98 s	0.98 s	0.99 s	0.84 s	0.85 s
20	0.87 s	0.83 s	0.81 s	0.87 s	0.91 s	0.94 s

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Table 10-3-3: ^{1}H NMR spectroscopic data of halimane-type diterpenoids **10-3-5**~**10-3-8**.

H	10-3-5	10-3-6	10-3-7	10-3-8
1	1.60 m	2.10	2.33 dd(17.9, 2.7)	2.39~2.45 m
	1.87~1.92 m	2.05	2.40 dddd(17.9, 2.8, 2.8, 2.5)	
2	1.45~1.54 m	1.81, 1.76	4.76 ddd(6.0, 2.8, 2.7)	4.81 ddd(5.5, 2.8, 2.5)
3	3.24 dd(10.7, 4.2)	3.52 dd(6.6, 2.2)	1.93 d(11.0), 2.13 dd(11.0, 6.0)	1.96 d(11.0)
				2.13 dd(11.0, 5.5)
6	1.87~1.92 m, 1.82 m	2.29, 2.15	2.10~2.19 m	1.99~2.21 m
7	1.26~1.37 m	5.22 m	1.42~1.49 m, 1.74~1.81 m	1.38~1.46 m, 1.61~1.65 m
		2.07 s(OAc)		
8	1.26~1.37 m	2.28	2.01~2.08 m	1.67~1.76 m
11	1.23 m	1.98 dt(13.2, 4.4)	2.74 d(15.5), 2.85 d(15.5)	1.58~1.59 m, 1.67~1.76 m
		1.72		
12	1.72 m	2.55 dt(13.2, 4.4)		1.99~2.21 m
	1.45~1.54 m	2.37 dt(13.2, 4.4)		2.27~2.35 m
14	5.91 dd(7.8, 1.2)	6.29 s	6.73 dd(2.0, 1.0)	6.24 s
15	9.91 d(7.8)	7.34 s	7.41 dd(2.0, 1.5)	7.33 dd(1.5, 1.5)
16	1.57 d(1.2)	7.24 s	7.95 dd(1.5, 0.5)	7.19 d(1.0)
17	0.72 d(6.8)	0.89 d(7.3)	0.86 d(7.0)	0.88 d(7.0)
18	1.04 s	1.03 s		
19	1.00 s	1.05 s	1.32 s	1.31 s
20	0.71 s	4.22 d(11.0)	1.07 s	0.90 s
		4.12 d(11.0)		
		2.06 s(OAc)		

Table 10-3-4: ^{1}H NMR spectroscopic data of halimane-type diterpenoids **10-3-9**~**10-3-12**.

H	10-3-9	10-3-10	10-3-11	10-3-12
1	1.89~2.02 m, 2.07~2.17 m	1.29 m, 1.55 m	α 2.02 m, β 1.90 m	5.27 br s
2	1.74~1.81 m	1.62 m	1.62 m	2.05 m
		2.01 tt(14.0, 4.0)		
3	1.64~1.69 m, 1.89~2.02 m	3.48 t(2.8)	α 1.52 m, β 1.45 m	α 1.28 m, β 1.40 m
5				2.64 dd(12.4, 2.3)
6	1.34~1.44 m, 1.89~2.02 m	1.33 m, 1.72 m	α 2.13 dd(11.4, 10.5)	α 1.24 m, β 1.31 m
			β 2.33 dd(10.5, 5.4)	
7	1.50~1.56 m	1.37 m, 1.68 m	3.56 dd(10.5, 5.4)	1.44 m
8	1.74~1.81 m	1.47 m		1.56 m
10		1.85 dd(12.2, 1.8)		

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Table 10-3-4 (continued)

H	10-3-9	10-3-10	10-3-11	10-3-12
11	1.64~1.69 m	1.52 m, 1.66 m	*α* 2.43 dd(12.7, 5.5)	2.22 ddd(12.4, 12.4, <2)
			β 1.80 dd(12.7, 10.8)	1.33 m
12	2.07~2.17 m, 2.33~2.40 m	2.34 br s	4.44 dd(10.8, 5.5)	0.99 m
14	6.26 dd(0.8, 0.8)	5.88 s	6.06 s	5.78 dd(10.9, 17.5)
15	7.34 dd(1.5, 1.5)			5.21 dd(17.5, 0.7)
				5.03 dd(10.8, 0.7)
16	7.20 s	6.04 s	6.11 s	1.28 s
17	0.87 d(7.0)	0.82 d(6.4)	1.29 s	0.74 d(6.8)
18		1.19 s	1.04 s	
19	1.30 s	1.13 s	1.00 s	1.16 s
20	0.86 s	0.80 s	1.12 s	0.82 s

Table 10-3-5: ^{1}H NMR spectroscopic data of halimane-type diterpenoids **10-3-13**~**10-3-16**.

H	10-3-13	10-3-14	10-3-15	10-3-16
1	5.94 d(5.7)	5.71 s	5.90 s	6.20 s
2	4.76 ddd(5.5, 4.5, <2)			
3	*α* 2.05 dd(11.5, 5.3)	*α* 2.69 d(15.8)	2.38 d(16.3)	
	β 2.14 dd(11.3, 4.8)	*β* 2.16 d(15.8)	2.39 d(16.3)	
5	2.22 dd(12.4, 4.8)	3.2 dd(12.9, 4.2)		
6	*α* 1.71 m, *β* 1.44 m	1.42 m	1.89 dd(13.3, 4.8)	2.0 m
			2.34 dd(13.3, 4.8)	
7	1.33 m	1.82 m	1.37~1.41 m	5.50 m
			2.12~2.20 m	
8	1.64 m	1.77 m	1.92~1.97 m	
11	2.05 ddd(12.6, 12.6, 3.9)	2.34 ddd(12.6, 12.6, 3.0)	4.80 s	
	1.35 ddd(12.6, 12.6, 3.9)	1.33 ddd(12.4, 12.4, 3.0)		
12	1.16 ddd(12.6, 12.6, 3.9)	0.89 m		
	1.09 ddd(12.6, 12.6, 3.9)			
14	5.82 dd(10.9, 17.4)	5.83 dd(11.0, 17.4)	6.40 dd(0.8, 0.8)	2.21 dd(16.0, 8.0)
				2.38 dd(16.0, 8.0)
15	5.14 dd(17.5, 1.5)	5.16 dd(17.4, 1.6)	7.33 dd(1.8, 1.8)	
	4.99 dd(10.8, 1.5)	4.99 dd(11, 1.6)		
16	1.20 s	1.25 s	7.47 d(1.0)	1.05 d(6.0)
17	0.83 d(6.9)	0.81 d(7.1)	0.88 d(7.0)	1.70 br s
18			3.54 s(COOMe)	1.12 s
19	1.18 s	1.18 s	1.42 s	1.20 s
20	0.92 s	0.98 s	1.17 s	1.00 s

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Table 10-3-6: ^{1}H NMR spectroscopic data of halimane-type diterpenoids **10-3-19**~**10-3-22**.

H	10-3-19	10-3-20	10-3-21	10-3-22
1	2.12 m, 2.04 m	1.82 m, 1.74 m	1.84 m, 1.79 m	1.84 m
2	2.22 m	1.50 m, 1.38 m	2.21 m, 2.15 m	2.18 m, 2.11 m
3		3.61 m		3.64 s(COOMe)
6	2.17 m, 2.43 br t(5.6)	2.17 m, 2.44 m	1.80 m, 2.48 m	1.80 m, 2.46 d(12.6)
7	1.72 m, 1.51 m	1.69 m, 1.51 m	1.24 m, 1.41 m	1.20 m, 1.41 m
8	1.72 s	1.74 s	1.79 m	1.80 m
10	2.92 dd(11.6, 3.1)	2.88 dd(11.0, 3.4)	2.67 dd(11.3, 4.0)	2.64 d(11.5)
11	2.02 m, 2.46 dd(13.0, 6.0)	2.50 dd(12.9, 6.0) 2.01 dd(12.9, 11.0)	1.42 m, 1.50 m	1.41 m, 1.51 m
12	5.37 dd(10.5, 6.0)	5.34 dd(10.3, 6.0)	2.30 m	2.30 br d(8.0)
14	6.41 dd(1.7, 0.6)	6.40 dd(1.8, 0.9)	6.23 d(0.9)	6.21 s
15	7.42 t(1.7)	7.42 t(1.8)	7.32 dd(1.8, 1.5)	7.33 s
16	7.47 br t(0.6)	7.47 br s	7.17 dd(1.5, 0.9)	7.17 s
17	1.33 d(6.7)	1.34 d(6.8)	0.97 s	0.90 s
18	1.71 d(1.8)	1.73 d(2.0)	1.68	1.66 d(1.7)
19	1.73 d(1.0)	1.74 d(1.0)	1.69 s	1.68 br s
20			0.79 d(6.8)	0.78 d(6.9)

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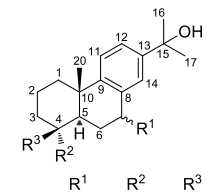
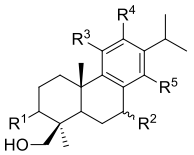
10.4 Abietane-type diterpenoids

Table 10-4-1: Compounds, MFs, and test solvents of abietane-type diterpenoids **10-4-1**~**10-4-17**.

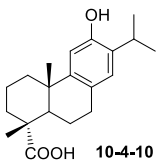
No.	Compounds	MFs	Test solvents	References
10-4-1	angustanoic acid F	$C_{20}H_{28}O_3$	–	[176]
10-4-2	angustanol	$C_{20}H_{30}O_2$	–	[176]
10-4-3	7α,15-dihydroxyabieta-8,11,13-trien-18-al	$C_{20}H_{28}O_3$	$CDCl_3$	[177]
10-4-4	15,18-dihydroxyabieta-8,11,13-trien-7-one	$C_{20}H_{28}O_3$	$CDCl_3$	[177]
10-4-5	18-*nor*-4,15-dihydroxyabieta-8,11,13-trien-7-one	$C_{19}H_{26}O_3$	$CDCl_3$	[177]
10-4-6	triptobenzene L	$C_{20}H_{30}O_2$	$CDCl_3$	[178]
10-4-7	triptobenzene M	$C_{20}H_{28}O_3$	$CDCl_3$	[178]
10-4-8	triptobenzene N	$C_{20}H_{26}O_3$	$CDCl_3$	[178]
10-4-9	triptonediol	$C_{21}H_{30}O_4$	$CDCl_3$	[178]
10-4-10	12-hydroxydehydroabietic acid	$C_{20}H_{28}O_3$	$CDCl_3$	[179]
10-4-11	fortunin B	$C_{24}H_{34}O_5$	$CDCl_3$	[180]
10-4-12	fortunin C	$C_{22}H_{34}O_4$	$CDCl_3$	[180]
10-4-13	fortunin D	$C_{22}H_{34}O_4$	$CDCl_3$	[180]
10-4-14	fortunin E	$C_{20}H_{28}O_4$	$CDCl_3$	[180]
10-4-15	fortunin J	$C_{20}H_{30}O_3$	$CDCl_3$	[180]
10-4-16	7β-hydroxyabieta-8,11,13-trien-19-al	$C_{20}H_{28}O_2$	$CDCl_3$	[181]
10-4-17	abieta-6,8,11,13-tetraene-3β,12-diol	$C_{20}H_{28}O_2$	$CDCl_3$	[182]



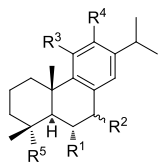
	R^1	R^2	R^3
10-4-1	H	Me	COOH
10-4-2	H	Me	CH_2OH
10-4-3	α-OH	CHO	Me
10-4-4	=O	CH_2OH	Me
10-4-5	=O	OH	Me



	R^1	R^2	R^3	R^4	R^5
10-4-6	β-OH	H	H	H	H
10-4-7	=O	H	H	OH	H
10-4-8	=O	=O	H	H	H
10-4-9	=O	H	OH	H	OMe



10-4-10



	R^1	R^2	R^3	R^4	R^5
10-4-11	OAc	β-OH	H	OAc	Me
10-4-12	OH	β-OMe	OH	OMe	Me
10-4-13	OH	α-OMe	OH	OMe	Me
10-4-14	OH	=O	H	OH	CH_2OH

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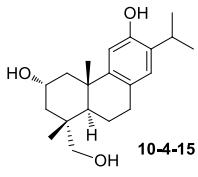

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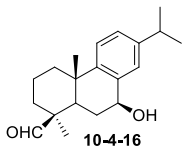
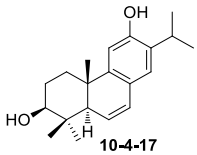


10-4-16



10-4-17

Table 10-4-2: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-1**~**10-4-4**.

H	10-4-1	10-4-2	10-4-3	10-4-4
1*α*	1.39	1.43	1.49 m	1.53 m
1*β*	2.29	2.32	2.35 ddd(3.5, 3.5, 13.0)	2.33 ddd(3.5, 3.5, 13.0)
2*α*	1.62	1.63	1.84 m	1.76 m
2*β*	2.03	1.68	1.84 m	1.81 m
3*α*	1.08	1.02	1.51 ddd(5.0, 13.5, 13.5)	1.59 ddd(3.8, 13.3, 13.3)
3*β*	2.26	1.82	1.38 dt(3.0, 3.0, 13.5)	1.38 ddd(3.8, 3.8, 13.3)
5	1.57	1.51	2.34 dd(2.0, 13.0)	2.26 dd(5.3, 12.7)
6	2.05, 2.19	1.72, 1.99	1.46 m, 2.06 m	2.65 m
7	2.81 2.91 dd(5.6, 16)	2.83 2.93 dd(5.6, 16.2)	4.79 dd(1.5, 4.5)	
11	7.22 s	7.23 s	7.26 d(8.5)	7.34 d(8.5)
12	7.22 s	7.23	7.38 dd(8.5, 2.0)	7.68 dd(2.0, 8.5)
14	7.16 s	7.15 s	7.46 d(2.0)	7.99 d(2.0)
16	1.56 s	1.56 s	1.57 s	1.54 s
17	1.56 s	1.56 s	1.58 s	1.55 s
18	1.33 s	1.05 s	9.30 s	3.13 d(11.5), 3.46 d(11.5)
19		3.56 dd(0.8, 10.9) 3.86 d(10.9)	1.17 s	0.93 s
20	1.11 s	1.18 s	1.19 s	1.25 s

Table 10-4-3: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-5**~**10-4-7**.

H	10-4-5	10-4-6	10-4-7
1	1.57 m 2.33 ddd(2.5, 2.5, 12.5)	1.54 ddd(3.5, 13.3, 13.3) 2.34 ddd(3.4, 3.4, 13.3)	2.05 m 2.38 ddd(4.6, 8.4, 13.2)
2	*α* 1.85 d-quint (3.0, 13.5) *β* 1.69 dddt(3.0, 13.5, 13.5, 13.5)	1.91 m, 2.01 m	2.58 dt(7.9, 16.0) 2.70 m
3	*α* 1.45 ddd(3.0, 13.5, 13.5) *β* 1.93 ddd(3.0, 3.0, 13.5)	3.53 dd(4.4, 11.7)	
5	2.13 dd(4.0, 14.5)	1.46 dd(1.2, 12.3)	2.13 dd(2.1, 12.9)
6	*α* 3.00 dd(4.0, 18.0) *β* 2.63 dd(14.5, 18.0)	1.66 m 1.97 m	1.63 m 1.86 m
7		2.83 m, 2.92 m	2.76 m 2.87 ddd(1.3, 5.6, 12.2)
11	7.36 d(8.5)	7.15 d(8.2)	6.62 s

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Table 10-4-3 (continued)

H	10-4-5	10-4-6	10-4-7
12	7.73 dd(2.0, 8.5)	6.99 d(8.2)	
14	8.08 d(2.0)	6.89 s	6.85 s
15		2.81 sept (6.9)	3.13 sept (6.9)
16	1.58 s	1.22 d(6.9)	1.25 d(6.9)
17	1.59 s	1.22 d(6.9)	1.25 d(6.9)
18		1.32 s	1.35 s
19	1.30 s	3.43 d(11.2), 4.33 d(11.2)	3.52 d(11.3), 4.07 d(11.3)
20	1.21 s	1.16 s	1.24 s

Table 10-4-4: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-8**~**10-4-11**.

H	10-4-8	10-4-9	10-4-10	10-4-11
1	2.09 m, 2.65 m	2.04 m, 3.08 m	α 1.50 m, β 2.20 m	α 1.46 m β 2.14 dd(5.5, 11.7)
2	2.71 m, 2.79 m	2.40 m 2.76 ddd(6.5, 11.0,15.4)	α 1.74 m, β 1.79 m	1.53 m
3			α 1.79 m, β 1.70 m	α 1.62 m, β 1.68 m
5	2.51 dd(4.0, 14.0)	2.21 br d(12.6)	2.21 dd(2.2. 12.5)	1.75 d(11.7)
6	2.76 m, 2.83 m	1.47 m, 1.84 m	α 1.52 m, β 1.82 m	5.63 dd(5.3, 11.7)
7		2.55 m, 3.10 m	2.83 m	4.69 br d(5.3)
11	7.30 d(8.1)		6.62 s	6.84 s
12	7.44 dd(1.7, 8.1)	6.41 s		
14	7.90 d(1.7)		6.83 s	7.36 s
15	2.94 sept(6.9)	3.24 sept(6.4)	3.10 sept(6.9)	2.95 sept(6.8)
16	1.25 d(6.9)	1.17 d(6.4)	1.24 d(6.9)	1.19 d(6.8)
17	1.25 d(6.9)	1.18 d(6.4)	1.22 d(6.9)	1.21 d(6.8)
18	1.24 s	1.42 s		1.08 s
19	3.69 d(11.1), 4.02 d(11.1)	3.44 d(11.5), 4.18 d(11.5)	1.27 s	1.02 s
20	1.41 s	1.30 s	1.20 s	1.26 s
OAc				2.18 s, 2.32 s

Table 10-4-5: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-12**~**10-4-14**.

H	10-4-12	10-4-13	10-4-14
1	α 1.34 dd(4.1, 13.9) β 3.07 ddd(4.1, 4.6, 13.9)	α 1.30 ddd(4.6, 13.6, 13.6) β 3.01 ddd(4.6, 4.6, 13.6)	1.36 dd(12.8) 2.17 br d(12.8)
2	α 1.51 dd(4.6, 13.6) β 1.68 ddd(3.0, 12.0, 13.6)	α 1.49 ddd(4.6, 4.6, 13.6) β 1.56 ddd(3.3, 3.3, 13.6)	1.81 m

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Table 10-4-5 (continued)

H	10-4-12	10-4-13	10-4-14
3	*α* 1.28 ddd(3.0, 12.0, 14.7) *β* 1.48 br d(14.7)	*α* 1.54 dd(3.3, 11.3) *β* 1.72 dd(3.3, 11.3)	1.47 dd(11.6, 13.9) 1.67 d(13.9)
5	1.53 d(11.1)	1.86 d(10.3)	2.04 d(12.7)
6	4.25 dd(8.8, 11.1)	4.19 br d(10.3)	4.50 d(12.7)
7	4.47 d(8.8)	4.15 d(3.8)	
11			6.74 s
14	6.85 s	6.71 s	7.93 s
15	3.20 sept(6.8)	3.22 sept(6.8)	3.19 sept(7.5)
16	1.24 d(6.8)	1.25 d(6.8)	1.23 d(7.5)
17	1.24 d(6.8)	1.25 d(6.8)	1.25 d(7.5)
18	1.23 s	1.20 s	1.16 s
19	1.21 s	1.18 s	3.23 d(11.6), 3.56 d(11.6)
20	1.43 s	1.35 s	1.32 s
OMe	3.27 s, 3.46 s	3.61 s, 3.76 s	

Table 10-4-6: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-15**~**10-4-17**.

H	10-4-15	10-4-16	10-4-17
1	1.26 br d(10.2), 2.51 br d(10.2)	1.34 ddd(4, 13, 13), 2.23 (ov)	*α* 1.74 m, *β* 2.12 m
2	4.04 dddd(4.3, 4.5, 11.3, 11.3)	1.63 m, 1.74 m	*α* 1.87 m, *β* 1.79 m
3	1.47 d(12.0), 1.68 dd(3.3, 12.0)	2.23 (ov)	3.36 br dd(4.4, 11.2)
5	1.65 dd(4.7, 11.0)	2.00 (ov)	2.09 dd(3.2, 2.7)
6	1.61 dd(8.2, 10.4), 1.80 dd(4.7, 10.4)	2.01 (ov), 2.58 dd(7, 13)	5. 86 dd(9.8, 2.7)
7	2.51 dd(4.7, 8.2)	4.81 dd(7, 10)	6.53 dd(9.8, 3.2)
11	6.67 s	7.15 d(8)	6.56 s
12		7.08 dd(2, 8)	
14	6.76 s	7.41 d(2)	6.90 s
15	3.18 sept(6.4)	2.87 sept(7)	3.13 sept(7.0)
16	1.17 d(6.4)	1.22 d(7)	1.26 d(7.0)
17	1.18 d(6.4)	1.22 d(7)	1.23 d(7.0)
18	0.89 s	1.09 s	1.02 s
19	3.13 d(10.8), 3.44 d(10.8)	9.79 s	1.08 s
20	1.22 s	1.09 s	1.01 s

Table 10-4-7: Compounds, MFs, and test solvents of abietane-type diterpenoids **10-4-18**~**10-4-41**.

No.	Compounds	MFs	Test solvents	References
10-4-18	fortunin F	$C_{20}H_{26}O_4$	$CDCl_3$	[180]
10-4-19	fortunin H	$C_{20}H_{28}O_3$	$CDCl_3$	[180]
10-4-20	fortunin I	$C_{21}H_{30}O_3$	$CDCl_3$	[180]
10-4-21	(+)-8,11,13,15-abietatetraene	$C_{20}H_{28}$	$CDCl_3$	[183]
10-4-22	pachyphyllone	$C_{20}H_{28}O_3$	$CDCl_3$	[184]

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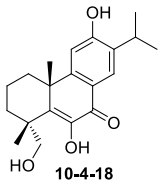
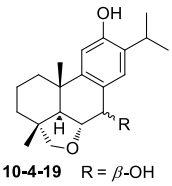
Table 10-4-7 (continued)

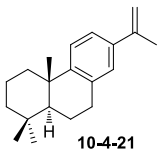
No.	Compounds	MFs	Test solvents	References
10-4-23	deoxocarnosol 12-methyl ether	$C_{21}H_{30}O_3$	$CDCl_3$	[185]
10-4-24	16-hydroxycarnosol	$C_{20}H_{26}O_5$	$CDCl_3$	[186]
10-4-25	12-*O*-methyl carnosol	$C_{21}H_{28}O_4$	$CDCl_3$	[187]
10-4-26	columbaridione	$C_{20}H_{24}O_5$	$CDCl_3$	[187]
10-4-27	epirosmanol	$C_{20}H_{26}O_5$	CD_3COCD_3	[188]
10-4-28	isorosmanol	$C_{20}H_{26}O_5$	CD_3COCD_3	[188]
10-4-29	3β,20-epoxy-12-methoxy-abieta-8,11,13-triene-3α,11-diol	$C_{21}H_{30}O_4$	$CDCl_3$	[182]
10-4-30	13β,14β-epoxyabiet-7-en-19,6β-olide	$C_{20}H_{28}O_3$	$CDCl_3$	[181]
10-4-31	*ent*-17-hydroxyabieta-8(14),13(15)-dien-16-al	$C_{20}H_{30}O_2$	$CDCl_3$	[189]
10-4-32	angustanoic acid H	$C_{20}H_{28}O_4$	$CDCl_3$	[176]
10-4-33	angustanoic acid A	$C_{20}H_{28}O_2$	$CDCl_3$	[176]
10-4-34	angustanal	$C_{20}H_{28}O$	$CDCl_3$	[176]
10-4-35	angustanoic acid B	$C_{20}H_{28}O_4$	$CDCl_3$	[176]
10-4-36	angustanoic acid C	$C_{20}H_{28}O_4$	$CDCl_3$	[176]
10-4-37	epipalustric acid	$C_{20}H_{30}O_2$	$CDCl_3$	[176]
10-4-38	4-*epi*-palustric acid-9α,13α-endoperoxide	$C_{20}H_{30}O_4$	$CDCl_3$	[176]
10-4-39	angustanoic acid D	$C_{20}H_{30}O_5$	$CDCl_3$	[176]
10-4-40	*rel*-(1*R*,4a*R*,5*R*,8*R*)-methyl-7-(1-(methoxycarbonyl)vinyl)-5,8-diacetoxy-1,2,3,4*a*,5,6,7,8,9,10,10*a*-dode-cahydro-1,4*a*-dimethyl-2-oxophenanthrene-1-carboxylate	$C_{26}H_{34}O_9$	$CDCl_3$	[190]
10-4-41	adenanthin L	$C_{22}H_{32}O_6$	C_5D_5N	[191]



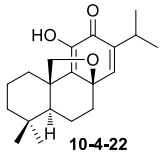
10-4-18



10-4-19 R = β-OH
10-4-20 R = α-OMe



10-4-21



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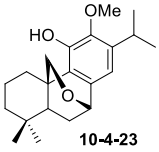
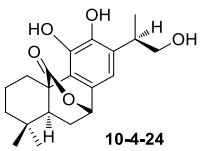
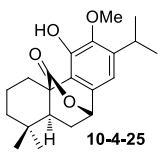


10-4-23



10-4-24



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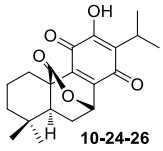

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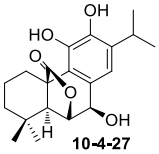
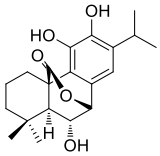


10-4-27



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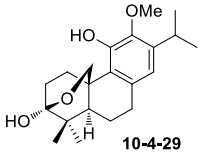

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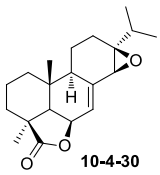

10-4-30

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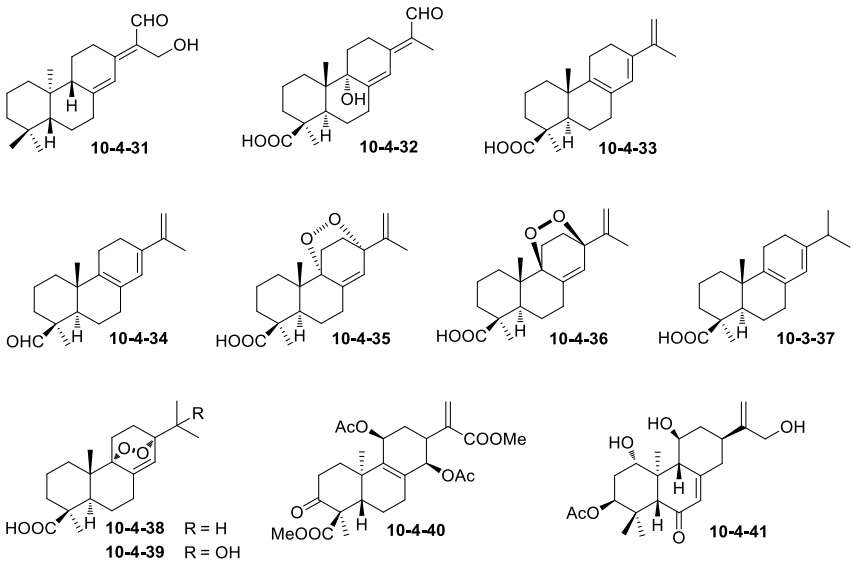

Table 10-4-8: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-18**~**10-4-21**.

H	10-4-18	10-4-19	10-4-20	10-4-21
1	1.54 m	1.29 dd(12.7)	1.44 dd(4.1, 13.0)	1.46 br s
	2.24 ddd(4.2, 9.6, 12.8)	1.98 br d(12.7)	2.03 br d(13.0)	
2	1.75 m	1.51 m	1.75 m	1.75 m
3	1.86 m, 1.96 m	1.56 br d(12.4)	1.30 dd(4.1, 10.4)	
		1.63 dd(13.3)	1.82 dd(4.1, 10.4)	
5		1.68 d(12.7)	2.14 d(12.2)	2.28 br s
6		4.38 dd(7.0, 12.7)	4.17 dd(3.8 12.2)	1.89 m
7		5.10 d(7.0)	4.46 d(3.8)	2.88 ddd(1.7, 7.2, 16.4)
				2.94 ddd(1.7, 7.2,16.4)
11	6.88 s	7.03 s	6.57 s	7.21 d(8.0)
12				7.23 dd(1.7, 8.0)
14	8.02 s	8.08 s	7.05 s	7.14 d(1.7)
15	3.16 sept(7.0)	3.69 sept(7.3)	3.15 sept(6.3)	
16	1.28 d(7.0)	1.36 d(7.3)	1.25 d(6.3)	5.01 br s, 5.32 br s
17	1.30 d(7.0)	1.37 d(7.3)	1.26 d(6.3)	2.12 s
18	3.35 d(11.5)	3.47 d(7.4)	3.51 d(6.7)	0.93 s
	4.25 d(11.5)	3.74 d(7.4)	3.77 d(6.7)	
19	1.28 s	1.07 s	1.17 s	1.19 s
20	1.50 s	1.11 s	1.11 s	0.97 s

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Table 10-4-9: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-22**~**10-4-24**.

H	10-4-22	10-4-23	10-4-24
1	α 1.85 m, β 2.56 td(3.8, 13.9)	2.06 m, 2.65 m	2.50 td, 2.89 br d(13.4)
2	1.61, 1.83 (ov)		1.76~1.94 m
3	1.34 m	1.45 m	1.76~1.94 m
5	1.65 m		1.76~1.94 m
6	1.61, 1.83 (ov)	2.06 m	2.20 sext
7	1.47 m, 2.18 dd(2.0, 6.0)	4.71 dd(1.8, 3.7)	5.34, 5.36 dd(1.0, 4.0)
14	6.78 s	6.62 s	6.51 s
15	2.95 sept(6.8)	3.24 sept(7)	3.14 sext(7.3)
16	1.09 d(6.8)	1.21 d(7)	3.76 t(9.3), 4.02 dd(3.0, 9.3)
17	1.09 d(6.8)	1.22 d(7)	1.33 d(7.3)
18	0.96 s	0.85 s	0.91 s
19	1.01 s	1.15 s	0.86 s
20	3.69 d(8.0)	3.08 dd(1.7, 8.5)	
	4.54 d(8.0)	4.32 d(8.5)	
OMe		3.77 s	

Table 10-4-10: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-25** and **10-4-26**.

H	10-4-25	10-4-26
1α	2.46 ddd(4.4, 13.9, 14.2)	2.31 ddd(4.4, 13.8, 14.1)
1β	2.88 dddd(1.7, 3.2, 4.9, 14.2)	2.71 dddd(1.5, 3.3, 3.3, 14.1)
2α	1.65 ddddd(3.6, 4.4, 4.9, 4.9, 13.9)	1.65 ddddd(3.2, 3.3, 3.3, 4.4, 14.1)
2β	1.98 ddddd(3.2, 3.3, 13.6, 13.9, 13.9)	1.92 ddddd(3.2, 3.3, 13.8, 13.8, 14.1)
3α	1.30 ddd(3.6, 13.2, 13.6)	1.25 ddd(3.3, 13.2, 13.8)
3β	1.54 dddd(1.7, 3.3, 4.9, 13.2)	1.55 dddd(1.5, 3.2, 3.2, 13.2)
5	1.74 dd(5.7, 10.6)	1.69 dd(5.9, 10.6)
6α	2.22 ddd(4.0, 5.7, 13.7)	2.24 ddd(4.2, 5.9, 14.1)
6β	1.88 ddd(1.7, 10.6, 13.7)	1.84 ddd(1.5, 10.6, 14.1)
7	5.38 dd(1.7, 4.0)	5.80 dd(1.5, 4.2)
11	5.98 s(OH)	
14	6.66 s	
15	3.22 sept(6.8)	3.18 sept(7.1)
16	1.21 d(6.8)	1.22 d(7.1)
17	1.21 d(6.8)	1.22 d(7.1)
18	0.86 s	0.90 s
19	0.91 s	0.87 s
OMe	3.75 s	

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Table 10-4-11: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-27** and **10-4-28**.

H	10-4-27	10-4-28	H	10-4-27	10-4-28
6	3.74 br s	4.34 t(4.3)	17	1.17 d(7.2)	1.20 d(6.6)
7	4.72 br s	5.16 d(4.3)	18	0.92 s	0.92 s
14	7.05 s	6.81 s	19	1.04 s	1.03 s
16	1.17 d(7.2)	1.20 d(6.6)			

Table 10-4-12: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-29**~**10-4-33**.

H	10-4-29	10-4-30	10-4-31	10-4-32	10-4-33
1	*α* 1.45 tt(3.3, 12.5)	1.18 m, 1.50 (ov)		*α* 1.45 m	*α* 1.08 m
	β 3.34 td(5.7, 12.5)			*β* 1.75 m	*β* 1.88 m
2	*α* 2.23 m	1.49 (ov), 1.68 (ov)		*α* 1.57 m	*α* 1.53 m
	β 1.84 td(3.3, 12.5)			*β* 1.84 m	*β* 1.90 m
3		1.45 (ov)		*α* 1.10 m	*α* 1.06 m
		2.09 br dd(14, 2)		*β* 2.17 m	*β* 2.21 m
5	1.61 m	1.71 d(5)		2.11 m	1.39 m
6	*α* 1.79 m, *β* 1.61 m	4.87 dd(2, 5)		*α* 1.98 m, *β* 1.90 m	*α* 2.04 m, *β* 1.87 m
7	2.66 m	6.14 dd(2, 4)		*α* 2.56 td(5.5, 13.9)	*α* 2.05 m
	2.77 br dt(3.0, 14.7)			*β* 2.38 m	*β* 2.13 m
9		1.68 (ov)			
11	6.02 d(1.7, OH)	1.35 m		*α* 1.78 m, *β* 1.83 m	*α* 2.02 m, *β* 2.14 m
12	3.74 s(OMe)	1.59 (ov)		*α* 2.38 m	*α* 2.19 m
		2.01 dt(12, 3)		*β* 3.24 dt(2.0, 14.8)	*β* 2.39 m
14	6.49 s	3.20 s	6.98 s	6.42 s	5.81 s
15	3.17 sept(6.9)	1.62 sept(7)			
16	1.21 d(6.9)	0.97 d(7)	9.41 s	10.19 s	4.93 s, 5.07 s
17	1.20 d(6.9)	0.93 d(7)	3.87 s	1.82 d(1.3)	1.94 s
18	1.11 s	1.27 s	1.02 s	1.31 s	1.28 s
19	1.05 s		0.81 s		
20	4.69 br d(8.8)	0.79 s	1.02 s	0.79 s	0.97 s
	3.95 dd(2.7, 8.8)				
OMe	3.74 s				

Table 10-4-13: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-34**~**10-4-37**.

H	10-4-34	10-4-35	10-4-36	10-4-37	H	10-4-34	10-4-35	10-4-36	10-4-37
1*α*	1.11	1.48	1.57	1.09	11*α*	2.12	2.18	2.37	1.99
1*β*	1.87	1.86	1.70	1.86	11*β*	2.12	1.50	1.47	2.04
2*α*	1.55	1.52	1.58	1.51	12*α*	2.20	2.15	2.22	2.01
2*β*	1.82	1.85	1.78	1.88	12*β*	2.40	1.66	1.57	1.99
3*α*	1.04	1.09	1.08	1.03	14	5.80 s	6.18 d(2.3)	6.17 s	5.43 s
3*β*	2.19	2.13	2.25	2.19	15				2.29 sept(6.8)

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Table 10-4-13 (continued)

H	10-4-34	10-4-35	10-4-36	10-4-37	H	10-4-34	10-4-35	10-4-36	10-4-37
5	1.50	1.94	1.48	1.37	16	4.94 s	5.00 d(1.4)	5.00 s	1.02 d(6.8)
						5.08 s	5.07 s	5.07 s	
6*α*	1.65	1.94	1.80	1.84	17	1.94 s	1.83 d(0.9)	1.84 s	1.02 d(6.8)
6*β*	2.07	2.38	2.23	2.01	18	1.06 s	1.25 s	1.29 s	1.27 s
7*α*	2.19	2.47	2.29	2.08	20	0.92 s	1.09 s	1.07 s	0.94 s
7*β*	2.21	2.62	2.85	2.08					

Table 10-4-14: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-38**~**10-4-41**.

H	10-4-38	10-4-39	10-4-40	10-4-41
1	*α* 1.46, *β* 1.84	*α* 1.48, *β* 1.83	1.79 m, 2.06 m	4.49 (ov)
2	*α* 1.52	*α* 1.53	2.44 m	2.20~2.39 (ov)
	β 1.84	*β* 1.84	2.61 ddd(2.8, 3.2, 6.2)	
3	*α* 1.09, *β* 2.12	*α* 1.09, *β* 2.14		4.92 br s, 2.06 s(OAc)
5	1.93	1.91	2.78 d(2.5)	2.86 s
6	*α* 1.91, *β* 2.35	*α* 1.92, *β* 2.38	1.34 m, 1.79 m	
7	*α* 2.40, *β* 2.60	*α* 2.50, *β* 2.63	2.18 m, 2.41 m	5.99 s
9				2.71 d(8.8)
11	*α* 1.49, *β* 1.96	*α* 2.17, *β* 1.50	5.63 t(6.6), 2.04 s(OAc)	4.00 m
12	*α* 1.45	*α* 2.17	1.94 ddd(6.1, 12.0, 13.1)	1.90 q(11.9)
	β 2.13	*β* 1.50	2.20 m	2.60 (ov)
13			3.01 td(2.5, 12.0)	2.37 (ov)
14	6.11 d(2.0)	6.32 d(2.2)	5.33 d(2.5), 2.01 s(OAc)	2.62 (ov), 2.28 (ov)
15	1.91 sept(6.9)			4.45 (ov)
16	0.98 d(6.9)	1.29 s	3.77 s(OMe)	
17	0.98 d(6.9)	1.30 s	5.55 s, 6.30 s, 3.74 s(OMe)	5.45 s, 5.08 s
18	1.25 s	1.26 s		1.30 s
19			1.39 s	1.45 s
20	1.06 s	1.08 s	1.22 s	1.26 s

Table 10-4-15: Compounds, MFs, and test solvents of abietane-type diterpenoids **10-4-42**~**10-4-49**.

No.	Compounds	MFs	Test solvents	References
10-4-42	sibiriquinone A	$C_{19}H_{20}O_2$	$CDCl_3$	[192]
10-4-43	sibiriquinone B	$C_{19}H_{22}O_2$	$CDCl_3$	[192]
10-4-44	tanshinone IIA	$C_{19}H_{18}O_3$	$CDCl_3$	[193]
10-4-45	tanshinone I	$C_{18}H_{12}O_3$	$CDCl_3$	[193]
10-4-46	cryptotanshinone	$C_{19}H_{20}O_3$	$CDCl_3$	[193]
10-4-47	15,16-dihydrotanshinone I	$C_{18}H_{14}O_3$	$CDCl_3$	[193]
10-4-48	6*α*-hydroxy-11,12-dioxo-8,13-abieta-diene	$C_{20}H_{28}O_3$	$CDCl_3$	[194]
10-4-49	miltionone II	$C_{19}H_{20}O_4$	$CDCl_3$	[195]

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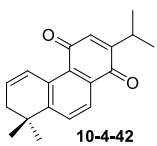
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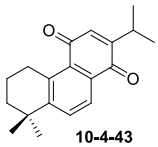
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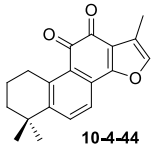
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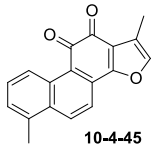
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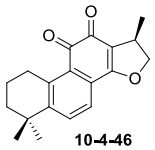
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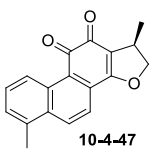
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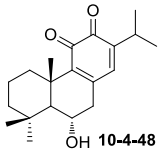
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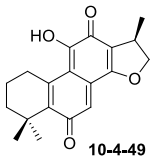
10-4-49

Table 10-4-16: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-42**~**10-4-45**.

H	10-4-42	10-4-43	10-4-44	10-4-45
1	7.87 d(10.2)	3.17 t(6.4)	3.19 t(6.5)	9.26 d(9.0)
2	6.33 m	1.80 m	1.79 m	7.56 dd(2.0, 7.0)
3	2.28 dd(1.8, 4.5)	1.65 m	1.66 m	7.36 d(7.0)
6	7.50 d(7.8)	7.59 d(7.9)	7.63 d(8.0)	8.32 d(9.0)
7	7.12 d(7.8)	7.11 d(7.9)	7.55 d(8.0)	7.83 d(9.0)
12	7.09 s	7.07 s		
15	3.02 sept(6.9)	3.02 sept(6.9)	7.22 d(1.0)	7.31 d(0.5)
16	1.17 d(6.9)	1.16 d(6.9)		
17	1.17 d(6.9)	1.16 d(6.9)	2.26 s	2.30 d(1.0)
18	1.29 s	1.30 s	1.31 s	2.70 s
19	1.29 s	1.30 s	1.31 s	

Table 10-4-17: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-46**~**10-4-49**.

H	10-4-46	10-4-47	10-4-48	10-4-49
1	3.22 t(5.1)	9.31 d(8.7)	2.65 dt(1.5, 2, 14)	2.86 m
2	1.80 m	7.58 dd(6.9, 8.7)	–	1.82 m
3	1.66 m	7.41 d(6.9)	–	–
6	7.64 d(8.1)	8.32 d(8.4)	3.65 ddd(3.5, 11, 12)	
7	7.49 d(8.1)	7.77 d(8.7)	–	7.59 s
14			6.45 br s	
15	4.37 dd(6.0, 9.3) 4.89 t(9.6)	4.44 dd(4.6, 9.6) 4.98 t(8.1)	2.98 sept(7)	3.61 m($W_{1/2}$=18 Hz)
16	3.60 m	3.66 m	1.10 d(7)	α 4.75 t(9.2) β 4.20 dd(7.1, 9.2)
17	1.36 d(6.6)	1.42 d(6.6)	1.10 d(7)	1.35 d(7.2)
18	1.31 s	2.71 s	0.90 s	1.31 s
19	1.31 s		0.90 s	1.33 s
20			1.35 s	
OH				7.27 s

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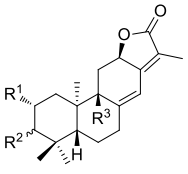
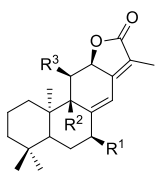
Table 10-4-18: Compounds, MFs, and test solvents of abietane-type diterpenoids **10-4-50**~**10-4-71**.

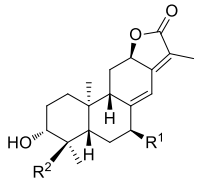
No.	Compounds	MFs	Test solvents	References
10-4-50	helioscopinolide A	$C_{20}H_{28}O_3$	$CDCl_3$	[196]
10-4-51	helioscopinolide B	$C_{20}H_{28}O_3$	$CDCl_3$	[197]
10-4-52	helioscopinolide C	$C_{20}H_{26}O_4$	$CDCl_3$	[196]
10-4-53	helioscopinolide D	$C_{20}H_{26}O_4$	$CDCl_3$	[196]
10-4-54	helioscopinolide E	$C_{20}H_{26}O_3$	$CDCl_3$	[196]
10-4-55	helioscopinolide F	$C_{20}H_{26}O_3$	$CDCl_3$	[197]
10-4-56	helioscopinolide H	$C_{20}H_{28}O_4$	$CDCl_3$	[197]
10-4-57	jolkinolide E	$C_{20}H_{28}O_2$	$CDCl_3$	[197]
10-4-58	7*β*-hydroxy-*ent*-abieta-8(14),13(15)-dien-12*α*,16-olide	$C_{20}H_{28}O_3$	$CDCl_3$	[198]
10-4-59	7*β*,9*β*-dihydroxy-*ent*-abieta-8(14),13(15)-dien-12*α*,16-olide	$C_{20}H_{28}O_4$	$CDCl_3$	[198]
10-4-60	*ent*-11*α*-hydroxyabieta-8(14),13(15)-dien-16,12*α*-olide	$C_{20}H_{28}O_3$	–	[189]
10-4-61	18-hydroxyhelioscopinolide A	$C_{20}H_{28}O_4$	$CDCl_3$	[199]
10-4-62	18-oxohelioscopinolide A	$C_{20}H_{26}O_4$	$CDCl_3$	[199]
10-4-63	3*α*,7*β*-dihydroxy-*ent*-abieta-8(14),13(15)-dien-16,12-olide	$C_{20}H_{28}O_4$	CD_3COCD_3	[200]
10-4-64	helioscopinolide I	$C_{20}H_{24}O_4$	$CDCl_3$	[197]
10-4-65	helioscopinolide L	$C_{19}H_{24}O_5$	$CDCl_3$	[197]
10-4-66	3,4,18*β*-cyclopropa-7*β*,17-dihydroxy-*ent*-abieta-8(14),13(15)-dien-16,12-olide	$C_{20}H_{26}O_4$	$CDCl_3$	[200]
10-4-67	7-oxo-*ent*-abieta-5,8(14),13(15)-trien-12,16-olide	$C_{20}H_{24}O_3$	$CDCl_3$	[201]
10-4-68	7*β*,17-dihydroxy-*ent*-abieta-8(14),13(15)-dien-12,16-olide	$C_{20}H_{28}O_4$	$CDCl_3$	[201]
10-4-69	langduin B	$C_{20}H_{28}O_6$	C_5D_5N	[202]
10-4-70	7*β*,11*β*,12*β*-trihydroxy-*ent*-abieta-8(14),13(15)-dien-16,12-olide	$C_{20}H_{28}O_5$	$CDCl_3$-CD_3OD	[203]
10-4-71	*ent*-12-hydroxy-12(*R*)-abieta-8(14),13(15)-dien-16,12-olide	$C_{20}H_{28}O_3$	$CDCl_3$	[204]



	R^1	R^2	R^3
10-4-50	H	*α*-OH	H
10-4-51	H	*β*-OH	H
10-4-52	=O	*α*-OH	H
10-4-53	H	=O	OH
10-4-54	H	=O	H
10-4-55	=O	H	H
10-4-56	H	*α*-OH	OH
10-4-57	H	H	H



	R^1	R^2	R^3
10-4-58	OH	H	H
10-4-59	OH	OH	H
10-4-60	H	H	OH



	R^1	R^2
10-4-61	H	CH_2OH
10-4-62	H	CHO
10-4-63	*β*-OH	Me

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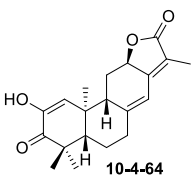
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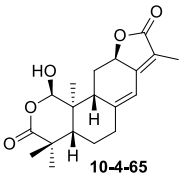
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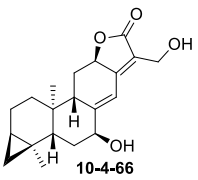
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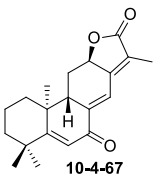
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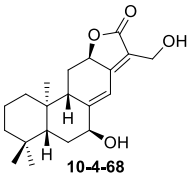
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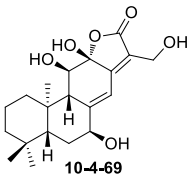
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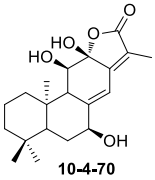
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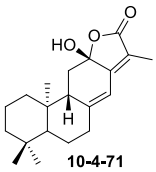
10-4-71

Table 10-4-19: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-50** and **10-4-51**.

H	10-4-50	10-4-51	H	10-4-50	10-4-51
1	ax 1.26 m	1.6~1.7 m	7eq	2.54 ddd(2.6, 4.2, 13.5)	2.49 ddd(2.2, 4.1, 13.5)
	eq 1.97 ddd(3.9, 3.9, 13.2)		9	2.18 d(3.6)	2.29 d(8.8)
2	ax 1.64 m	ax 1.95 m	11	1.52 ddd(8.6, 13.5, 13.5)	ax 1.50 ddd(8.8, 13.5, 13.5)
	eq 1.77 dddd(3.9, 3.9, 4.3, 13.2)	eq 1.67 m			
				2.56 dd(6.2, 13.5)	eq 2.56 dd(6.1, 13.5)
3	3.29 dd(4.3, 11.6)	3.48 dd(2.0, 3.0)	12	4.87 ddq(1.7, 6.2, 13.5)	4.86 ddq(1.5, 6.1, 13.5)
	3.50 s(OH)				
5	1.17 dd(2.6, 12.6)	1.64 dd(2.6, 12.9)	14	6.29 m	6.25 br s
6ax	1.47 dddd(4.2, 12.6, 13.2, 13.5)	1.41 dddd(4.1, 12.9, 12.9, 12.9)	17	1.84 d(1.7)	1.81 d(1.5)
			18	1.05 s	0.98 s
6eq	1.87 dddd(2.6, 2.6, 5.6, 13.2)	1.72 m	19	0.84 s	0.86 s
			20	0.94 s	0.93 s
7ax	2.21 ddd(5.6, 13.5, 13.5)	2.22 ddd(5.2, 12.9, 13.5)			

Table 10-4-20: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-52**~**10-4-54**.

H	10-4-52	10-4-53	10-4-54
1ax	2.39 dd(1.4, 12.4)	2.38 m	1.5~1.7 m
1eq	2.74 d(12.4)	1.85 m	2.2~2.3 m

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Table 10-4-20 (continued)

H	10-4-52	10-4-53	10-4-54
2		2.5~2.6 m	ax 2.65 ddd(6.4, 12.6, 15.7) eq 2.48 ddd(3.6, 5.7, 15.7)
3	3.98 dd(1.4, 5.0), 3.45 s(OH)		
5	1.83 dd(2.7, 12.5)	2.47 dd(3.3, 12.9)	1.5~1.7 m
6ax	1.53 dddd(4.1, 12.5, 13.3, 13.5)	1.53 dddd(4.3, 12.9, 13.1, 13.8)	1.5~1.7 m
6eq	1.99 m	1.77 m	1.82 m
7ax	2.31 m	2.78 dddd(2.3, 5.3, 13.8, 13.8)	2.2~2.3 m
7eq	2.61 ddd(2.5, 4.1, 13.7)	2.35 m	2.5~2.6 m
9	2.51 d(8.7)	3.49 s(OH)	2.27 d(8.7)
11ax	1.62 ddd(8.7, 13.4, 13.7)	1.39 dd(13.0, 13.6)	1.5~1.7 m
11eq	2.43 dd(6.2, 13.7)	3.11dd(6.2, 13.6)	2.5~2.6 m
12	4.85 ddq(l.8, 6.2, 13.4)	4.90 ddq(1.8, 6.2, 13.0)	4.89 ddq(1.7, 6.3, 13.5)
14	6.37 br s	6.42 d(2.3)	6.35 br s
17	1.86 d(1.8)	1.88 d(1.8)	1.82 d(1.7)
18	1.24 s	1.16 s	1.14 s
19	0.73 s	1.08 s	1.07 s
20	0.93 s	1.10 s	1.10 s

Table 10-4-21: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-55**~**10-4-57**.

H	10-4-55	10-4-56	10-4-57
1ax	2.29 d(12.5)	1.62 m	1.08 ddd(4.5, 12.6,12.6)
1eq	2.55 dd(2.2, 12.5)	1.65 m	1.90 d(12.6)
2		ax 1.88 m, eq 1.77 m	1.4~1.6 m
3	ax 2.21 dd(2.1, 13.1)	3.30 dd(4.1, 11.4)	ax 1.18 ddd(4.6, 13.0, 13.0)
	eq 2.36 d(13.1)		eq 1.43 m
5	1.73 dd(2.5, 12.5)	1.90 dd(2.6, 12.9)	1.14 dd(2.4, 12.8)
6ax	1.47 dddd(4.0, 12.5, 13.2, 13.2)	1.41 dddd(4.1, 12.9, 13.5, 13.5)	1.36 dddd(4.1, 12.8, 13.3, 13.3)
6eq	1.95 dddd(2.5, 2.5, 5.2, 13.2)	1.79 m	1.81 dddd(2.4, 2.4, 5.1, 13.3)
7ax	2.27 ddd(5.2, 13.2, 13.6)	2.30 ddd(2.6, 4.1, 13.5)	2.18 ddd(5.1, 13.3, 13.4)
7eq	2.57 ddd(2.5, 4.0, 13.6)	2.70 dddd(2.0, 5.3, 13.5, 13.5)	2.47 ddd(2.4, 4.1, 13.4)
9	2.45 d(8.8)		2.18 d(8.7)
11ax	1.56 ddd(8.8, 13.4, 13.7)	1.32 dd(13.0, 13.5)	1.46 ddd(8.7, 13.5, 13.5)
11eq	2.41 dd(6.3, 13.7)	3.08 dd(6.1, 13.5)	2.55 dd(6.3, 13.5)
12	4.83 ddq(l.7, 6.3, 13.4)	4.87 ddq(1.8, 6.1, 13.0)	4.85 ddq(1.4, 6.3, 13.5)

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Table 10-4-21 (continued)

H	10-4-55	10-4-56	10-4-57
14	6.33 s	6.35 d(2.0)	6.24 s
17	1.83 d(1.7)	1.83 d(1.8)	1.80 d(1.4)
18	1.09 s	1.05 s	0.89 s
19	0.89 s	0.84 s	0.83 s
20	0.93 s	0.97 s	0.90 s

Table 10-4-22: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-58**~**10-4-60**.

H	10-4-58	10-4-59	10-4-60
1	ax 1.18 m, eq 1.91 m	ax 1.77 m, eq 1.61 m	–
2	ax 1.65 m, eq –	ax 1.60 m, eq –	–
3	ax –, eq 1.25 m	ax 1.55 m, eq 1.48 m	–
5	1.72 dd(2, 14)	2.03 dd(3.5, 14)	1.20 m
6	ax 1.63 ddd(2.5, 13, 13) eq 1.94 ddd(2.0, 2.5, 13)	ax 1.63 dd(14, 17.5) eq 1.99 dd(3.5, 17.5)	1.93 m
7	4.47 dd(2.5, 2.5)	4.53 br s	2.53 ddd(2.2. 3.9, 13.6)
9	2.71 br dd(1, 8.5)		2.25 m
11	ax 1.48 ddd(8.5, 13.5, 13.5) eq 2.61 dd(6.5, 13.5)	ax 1.47 dd(10.0, 17.5) eq 3.04 dd(7.0, 17.5)	4.49 d(3.3)
12	4.90 ddq(l.5, 6.2, 13)	4.85 ddq(2.0, 7.0, 10.0)	4.90 dd(1.7, 3.3)
14	6.46 d(1)	6.58 br s	6.31 br s
17	1.86 d(1.5)	1.90 d(2.0)	1.87 d(1.7)
18	0.93 s	0.97 s	0.86 s
19	0.86 s	0.96 s	0.92 s
20	0.92 s	0.90 s	0.92 s

Table 10-4-23: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-61**~**10-4-64**.

H	10-4-61	10-4-62	10-4-63	10-4-64
1	α 1.25 m β 1.99 m	α 1.33 m β 2.03 m	1.97 dt(13.2, 3.6) 1.29 ddd(13.2, 12.8, 5.2)	6.40 s
2	α 1.66 m, β 1.76 m	α 1.73 m, β 1.88 m	1.61 m	
3	3.71 m	3.83 dd(4.5, 11.8)	3.25 m	
5	1.38 dd(2.3, 12.4)	1.69 m	1.80 dd(13.2, 2.8)	1.98 dd(2.6, 12.6)
6	α 1.47 m β 1.68 m	α 1.31 m β 1.58 m	1.67 m 1.92 ddd(3.6, 2.8, 2.4)	ax 1.59 dddd(12.6, 13.2, 13.2, 3.8) eq 1.84 m
7	α 2.21 m β 2.50 m	α 2.25 m β 2.47 m	4.42 dd(5.6, 2.8)	ax 2.30 ddd(13.2, 13.5, 5.2) eq 2.60 ddd(13.5, 3.8, 2.3)

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Table 10-4-23 (continued)

H	10-4-61	10-4-62	10-4-63	10-4-64
9	2.24 m	2.21 m	2.72 br d(8.4)	2.46 d(3.8)
11	*α* 1.52 m	*α* 1.55 m	1.37 ddd(13.6, 13.2, 8.4)	ax 1.65 ddd(13.8, 13.5, 8.8)
	β 2.55 dd(6.2, 13.4)	*β* 2.55 dd(6.2, 13.5)		eq 2.67 dd(6.4, 13.8)
12	4.86 dd(4.8, 13.8)	4.86 dd(6.4, 13.3)	4.88 ddq(13.2, 6.0, 1.2)	4.86 ddq(1.6, 6.4, 13.5)
14	6.28 s	6.30 s	6.52 br s	6.37 s
17	1.83 s	1.83 s	1.78 d(1.2)	1.83 d(1.6)
18	3.72 m, 3.42 d(10.5)	9.43 s	0.99 s	1.24 s
19	0.89 s	1.12 s	0.80 s	1.12 s
20	0.98 s	0.98 s	0.95 s	1.13 s

Table 10-4-24: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-65**~**10-4-67**.

H	10-4-65	10-4-66	10-4-67
1	5.72 s	0.91 m, 1.74 m	1.40 ddd(13.5, 4.0), 2.14 d(13.5)
2		1.74 m, 1.98 m	1.87 m, 1.75 m
3		0.67 m	1.49 ddd(4.0, 13.5), 1.67 m
5	2.39 dd(3.0, 12.9)	1.90 dd(3.2, 13.6)	
6	ax 1.50 m, eq 1.81 m	1.74 m, 2.13 m	6.26 s
7	ax 2.24 ddd(5.0, 13.2, 13.2) eq 2.44 ddd(2.4, 3.9, 13.2)	4.45 br s (ov)	
9	2.87 d(8.5)	2.65 d(8.4)	3.02 d(8.0)
11	ax 1.53 ddd(8.5, 13.5, 13.5) eq 2.56 dd(13.5, 6.2)	1.55 ddd(8.4, 13.6, 13.6) 2.61 dd(6.0, 13.6)	1.68 m 2.70 dd(6.5, 14.5)
12	4.95 ddq(1.5, 6.2, 13.5)	4.94 dd(4.8, 13.6)	4.96 dd(5.5, 13.0)
14	6.36 br s	6.62 br s	7.46 d(2.0)
17	1.84 d(1.5)	4.45 br s(ov)	1.99 s
18	1.36 s	en 0.16 t(5.0) ex 0.49 dd(4.4, 9.2)	1.26 s
19	1.24 s	0.95 s	1.24 s
20	1.05 s	0.87 s	1.29 s

Table 10-4-25: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-68**~**10-4-71**.

H	10-4-68	10-4-69	10-4-70	10-4-71
1	1.27 ddd(14.4, 4.8) 1.47 br d(14.4)	–	1.13 m, 1.36 m	1.10 m, 1.57 m
2	1.58 m	–	1.35 m	1.40 m 1.43 ddd(4.6, 13.0, 12.8)
3	1.25 m, 1.96 m	–	1.14 m, 1.34 m	1.21 m, 1.45 m
5	1.73 br d(14.0)	–	1.38 m	1.20 dd(2.6, 12.5)
6	1.94 m	–	1.49 m, 1.78 m	1.44 m, 1.74 m

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Table 10-4-25 (continued)

H	10-4-68	10-4-69	10-4-70	10-4-71
7	4.44 br s	4.86 br s	4.25 br s	2.35 dd(6.0, 13.0) 2.53 ddd(3.0, 4.6, 13.6)
9	2.74 d(8.4)	–	2.35 d(5.7)	2.29 dd(7.4, 14.8)
11	1.49 m 2.63 dd(6.0, 13.6)	4.58 d(6.6)	3.65 d(6.6)	1.58 dd(9.7, 13.0)
12	4.97 dd(6.0, 13.6)			3.17 br s(OH)
14	6.61 s	7.31 d	6.23 d(1.4)	6.19 dd(2.0, 2.0)
17	4.42 s	5.04, 5.07 ABq(14.7)	1.65 s	1.83 s
18	0.91 s	1.11 s①	0.81 s	0.90 s
19	0.84 s	1.00 s①	0.72 s	0.86 s
20	0.91 s	1.01 s①	0.59 s	0.72 s

① The signals of methyl groups was not assigned in the original literature.

Table 10-4-26: Compounds, MFs, and test solvents of abietane-type diterpenoids **10-4-72**~**10-4-94**.

No.	Compounds	MFs	Test solvents	References
10-4-72	2-ene-1-one-8β,14β-epoxy-13,15-abiatene-16,12-olide	$C_{20}H_{24}O_4$	$CDCl_3$	[205]
10-4-73	6β-acetoxy-2-ene-1-one-8β,14β-epoxy-13,15-abiatene-16,12-olide	$C_{22}H_{26}O_6$	$CDCl_3$	[205]
10-4-74	gelomulide K	$C_{22}H_{28}O_5$	C_5D_5N	[206]
10-4-75	gelomulide L	$C_{24}H_{30}O_7$	$CDCl_3$	[206]
10-4-76	gelomulide M	$C_{24}H_{30}O_7$	C_5D_5N	[206]
10-4-77	gelomulide N	$C_{24}H_{32}O_7$	C_5D_5N	[206]
10-4-78	gelomulide O	$C_{24}H_{32}O_7$	C_5D_5N	[206]
10-4-79	gelomulide P	$C_{22}H_{30}O_6$	C_5D_5N	[206]
10-4-80	gelomulide A	$C_{22}H_{30}O_5$	$CDCl_3$	[206]
10-4-81	gelomulide G	$C_{24}H_{32}O_7$	C_5D_5N	[206]
10-4-82	3β,6β-diacetoxy-1-one-8β,14β-epoxy-13,15-abiatene-16,12-olide	$C_{24}H_{30}O_8$	$CDCl_3$	[205]
10-4-83	3β-hydroxy-1-one-8β,14β-epoxy-13,15-abiatene-16,12-olide	$C_{20}H_{26}O_5$	$CDCl_3$	[205]
10-4-84	3β-acetoxy-1-one-8β,14β-epoxy-13,15-abiatene-16,12-olide	$C_{22}H_{28}O_6$	$CDCl_3$	[205]
10-4-85	gelomulide Q	$C_{24}H_{32}O_8$	$CDCl_3$	[206]
10-4-86	gelomulide T	$C_{24}H_{32}O_8$	C_5D_5N	[206]
10-4-87	gelomulide U	$C_{22}H_{30}O_6$	C_5D_5N	[206]
10-4-88	gelomulide V	$C_{22}H_{30}O_7$	C_5D_5N	[206]
10-4-89	gelomulide W	$C_{20}H_{26}O_6$	C_5D_5N	[206]
10-4-90	gelomulide X	$C_{20}H_{28}O_5$	C_5D_5N	[206]
10-4-91	6β-acetoxy-2-ene-8β,14α-dihydroxy-1-one-13,15-abiatene-16,12-olide	$C_{22}H_{28}O_7$	$CDCl_3$	[205]
10-4-92	gelomulide R	$C_{24}H_{34}O_8$	C_5D_5N	[206]
10-4-93	gelomulide S	$C_{24}H_{34}O_8$	C_5D_5N	[206]
10-4-94	gelomulide I	$C_{20}H_{28}O_6$	$CDCl_3$	[207]

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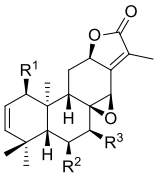
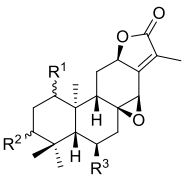
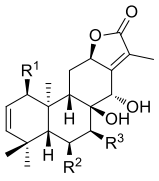


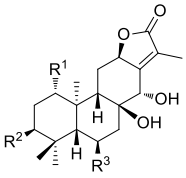
	R^1	R^2	R^3
10-4-72	=O	H	H
10-4-73	=O	OAc	H
10-4-74	OAc	H	H
10-4-75	OAc	OAc	H
10-4-76	OAc	H	OAc



	R^1	R^2	R^3
10-4-77	α-OAc	β-OAc	H
10-4-78	β-OAc	β-OAc	H
10-4-79	β-OAc	α-OH	H
10-4-80	H	β-OAc	H
10-4-81	H	β-OAc	OAc
10-4-82	= O	β-OAc	OAc
10-4-83	= O	β-OH	H
10-4-84	= O	β-OAc	H



	R^1	R^2	R^3
10-4-85	OAc	H	OAc
10-4-86	OAc	OAc	H
10-4-87	OAc	H	H
10-4-88	OH	H	OAc
10-4-89	=O	H	OH
10-4-90	OH	H	H
10-4-91	=O	OAc	H



	R^1	R^2	R^3
10-4-92	H	OAc	OAc
10-4-93	OAc	OAc	H
10-4-94	=O	OH	H

Table 10-4-27: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-72**~**10-4-74**.

H	10-4-72	10-4-73	10-4-74
1			5.28 d(6), 1.98 s(OAc)
2	5.81 d(10.4)	5.83 d(10.3)	5.93 dd(6, 10)
3	6.44 d(10.3)	6.31 d(10.4)	5.66 d(10)
5			1.80 dd(2.8, 12.8)
6		5.13 dt(11.0, 4.9)	α 1.48 ddd(4, 12.8, 14)
		2.09 s(OAc)	β 1.64 m
7			α 1.66 m, β 1.99 m
9	2.69 d(7.2)	2.66 d(7.1)	2.76 d(7.2)
11	2.70 dd(5.6, 14.0)	2.59 dd(14.2, 5.7)	α 2.30 dd(5.6, 13.4)
			β 1.55 ddd(7.2, 13.2,13.4)
12	4.83 ddd(2.1, 5.4, 7.7)	4.79 m($W_{1/2}$ = 21)	5.13 ddd(2, 5.6, 13.2)
14	3.71 s	3.85 s	3.94 s
17	1.95 d(2.0)	1.96 d(1.7)	1.95 d(2)
18	1.10 s	1.16 s	0.89 s
19	1.11 s	1.30 s	1.00 s
20	1.31 s	1.37 s	1.01 s

Table 10-4-28: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-75**~**10-4-77**.

H	10-4-75	10-4-76	10-4-77
1	5.04 d(6.4), 2.05 s(OAc)	5.35 d(6), 1.97 s(OAc)	5.23 dd(12, 4.2), 2.15 s(OAc)
2	5.81 dd(6.4, 9.6)	5.96 dd(6, 10)	α 1.88 ddd(2.4, 12, 14.4)
			β 1.58 ddd(3.6, 4.2, 14.4)
3	5.62 d(9.6)	5.69 d(10)	4.94 dd(2.4, 3.6), 2.06 s(OAc)
5	2.11 d(11)	2.38 dd(2.8, 13.6)	1.63 m

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Table 10-4-28 (continued)

H	10-4-75	10-4-76	10-4-77
6	5.06 ddd(11, 11, 5.6) 2.10 s(OAc)	*α* 1.83 ddd(2.8, 13.6,14.4) *β* 2.07 ddd(2.8, 2.8, 14.4)	1.57 m 1.58 m
7	2.03 m, 2.06 m	5.22 t(2.8), 2.10 s(OAc)	1.65 dt(13.6, 3.4), 1.98 m
9	2.56 d(6.8)	3.22 d(7.2)	2.14 d(6.8)
11*α*	2.11 dd(5.4, 13.6)	2.39 dd(6, 13.6)	2.39 dd(5.2, 13.6)
11*β*	1.42 ddd(6.8, 13.3, 13.6)	1.58 ddd(7.2, 13.3, 13.6)	1.59 ddd(6.8, 13.3, 13.6)
12	4.92 ddd(2.4, 5.4, 13.3)	5.22 ddd(2.4, 6, 13.3)	5.22 ddd(2, 5.2, 13.3)
14	3.93 s	4.33 s	3.91 s
17	1.98 d(2.4)	1.95 d(2.4)	1.95 d(2)
18	1.01 s	0.88 s	0.89 s
19	1.23 s	1.01 s	0.91 s
20	1.05 s	1.08 s	1.25 s

Table 10-4-29: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-78**~**10-4-81**.

H	10-4-78	10-4-79	10-4-80	10-4-81
1	5.13 t(3.2), 2.09 s(OAc)	5.32 t(2), 1.99 s(OAc)	1.53 m, 1.73 m	1.48 m, 1.45 m
2	*α* 2.11 dt(3.2, 16) *β* 2.38 dt(3.2, 16)	*α* 2.12 ddd(2, 12.8, 14.2) *β* 2.34 ddd(2, 4.2, 14.2)	1.76 m, 1.88 m	*α* 1.71 m *β* 1.77 m
3	4.90 t(3.2), 2.11 s(OAc)	4.00 dt(12.8)	4.71 t(2.8), 2.08 s(OAc)	4.80 t(2.8), 2.20 s(OAc)
5	1.92 dd(2.4, 12.8)	1.63 dd(12.4)	1.48 m	1.87 d(11.6)
6	*α* 1.48 m *β* 1.64 m	*α* 1.56 dt(13, 3.4) *β* 1.75 m	1.49 m, 1.70 m	5.38 ddd(5.8, 11.6, 13.4) 2.07 s(OAc)
7	*α* 1.67 m *β* 1.99 ddd(6, 14.4, 14.4)	*α* 1.69 ddd(13.6, 3.2, 3.2) *β* 1.99 m	1.67 m, 2.02 m	*α* 2.13 dd(5.8, 13.4) *β* 2.09 dd(13.4, 13.4)
9	2.76 d(7.2)	2.62 d(6.8)	2.08 d(6.8)	1.99 d(6.8)
11*α*	1.49 ddd(7.2, 13.2, 13.2)	2.25 dd(5.6, 13.6)	2.29 dd(5.6, 13.4)	2.30 dd(5.6, 13.2)
11*β*	2.17 dd(6, 13.2)	1.49 ddd(6.8, 13.2, 13.6)	1.42 ddd(6.8, 13.2,13.4)	1.45 ddd(6.8, 13.2, 13.2)
12	5.12 ddd(2.4, 6, 13.2)	5.13 ddd(2, 5.6, 13.2)	5.00 ddd(2.4, 5.6, 13.2)	5.05 ddd(2, 5.6, 13.2)
14	3.93 s	3.92 s	3.77 s	3.85 s
17	1.95 d(2.4)	1.94 d(2)	1.97 d(2.4)	1.97 d(2)
18	0.90 s	1.12 s	0.99 s	0.98 s
19	0.98 s	1.30 s	0.92 s	1.18 s
20	1.08 s	1.13 s	1.10 s	1.07 s

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Table 10-4-30: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-82**~**10-4-84**.

H	10-4-82	10-4-83	10-4-84
2	α 2.40 dd(3.5, 13.5)	α 2.31 dd(3.9, 13.9)	α 2.38 dd(3, 13.5)
	β 3.15 dd(2.9, 13.4)	β 3.24 dd(2.7, 13.0)	β 3.15 dd(3.8, 13.5)
3	4.99 t(3.0), 2.08 s(OAc)	3.91 t(3.2)	5.02 t(3.4), 2.03 s(OAc)
6	5.27 ddd(3.4, 5.4, 11.0)	1.56~1.62 m	–
	2.04 s(OAc)		
9	2.64 d(7.0)	2.67 d(7.3)	2.68 d(7.3)
11	2.51 ddd(1.2, 7.3,14.3)	2.50 dd(5.8, 14.0)	2.50 dd(5.8, 14.0)
12	4.78 ddd(2.1, 5.8, 13.0)	4.84 m($W_{1/2}$ = 23)	4.84 ddd(2, 5.4, 13)
14	3.80 s	3.70 s	3.80 s
17	1.95 d(2.1)	1.94 d(2.1)	1.94 d(1.8)
18	1.13 s	1.06 s	0.96 s
19	1.24 s	1.14 s	1.21 s
20	1.45 s	1.38 s	1.35 s

Table 10-4-31: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-85**~**10-4-87**.

H	10-4-85	10-4-86	10-4-87
1	5.01 d(6), 2.04 s(OAc)	5.35 d(6.3), 1.84 s(OAc)	5.33 d(6), 1.82 s(OAc)
2	5.75 dd(6, 10)	5.96 dd(6.3, 10)	5.93 dd(6, 10)
3	5.66 d(10)	5.61 d(10)	5.60 d(10)
5	1.96 dd(2.4, 13.6)	2.39 d(11.6)	1.92 dd(3, 12.8)
6	α 2.22 ddd(2.8, 13.6, 14)	6.08 ddd(4.6, 11.6, 11.8)	α 1.73 m
	β 1.91 ddd(2.4, 2.8, 14)	2.12 s(OAc)	β 2.38 dddd(3, 13.2, 13.2, 13.2)
7	5.17 t(2.8)	α 3.09 dd(4.6, 12.4)	α 2.11 m
	2.15 s(OAc)	β 2.26 dd(11.8, 12.4)	β 2.69 ddd(3, 3, 13.2)
9	2.28 d(8)	2.78 d(7.6)	2.75 d(8)
11α	2.27 m	2.70 dd(6.8, 13.6)	2.63 dd(6.8, 13.2)
11β	1.56 ddd(8, 12.6, 12.6)	2.13 ddd(7.6, 12.2, 13.6)	2.13 m
12	5.21 m	5.57 ddd(2, 6.8, 12.2)	5.61 ddd(2, 6.8, 13.2)
14	4.64 s	4.97 s	5.02 s
17	1.86 d(2)	1.84 d(2)	1.83 d(2)
18	0.91 s	1.07 s	0.93 s
19	0.97 s	1.34 s	1.04 s
20	1.25 s	1.59 s	1.52 s

Table 10-4-32: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-88**~**10-4-90**.

H	10-4-88	10-4-89	10-4-90
1	4.10 d(5.6)		4.12 d(6)
2	6.08 dd(5.6, 10)	5.92 d(10)	6.08 dd(6, 10)
3	5.60 d(10)	6.35 d(10)	5.60 d(10)

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Table 10-4-32 (continued)

H	10-4-88	10-4-89	10-4-90
5	2.51 dd(2, 13.2)	2.67 d(2.8, 13)	2.07 dd(3, 12.8)
6α	2.79 ddd(2, 13.2, 14)	2.91 ddd(2.2, 13.3, 13.3)	1.75 m
6β	2.14 ddd(2, 2, 14)	2.13 ddd(2.2, 2.8, 13.2)	2.49 dddd(3, 3.8, 12.8, 13.5)
7	5.89 t(2) 1.89 s(OAc)	4.47 t(2.2)	α 2.15 ddd(3.8, 13.5, 13.5) β 2.72 ddd(3, 3, 13.2)
9	3.7 d(7.6)	3.06 d(7.6)	3.46 d(7.6)
11α	2.83 dd(6.8, 12.8)	3.45 dd(6.8, 13.6)	2.87 dd(6.8, 13)
11β	2.22 ddd(7.6, 12.8, 12.8)	2.49 ddd(7.6, 12.6, 13.6)	2.32 ddd(7.6, 12.5, 13)
12	5.75 ddd(2, 6.8, 12.8)	5.65 ddd(1.6, 6.8, 12.6)	5.74 ddd(1.6, 6.8, 12.5)
14	5.12 s	5.01 s	5.08 s
17	1.80 d(2)	1.82 d(1.6)	1.86 d(1.6)
18	0.96 s	1.08 s	1.00 s
19	0.96 s	1.03 s	1.02 s
20	1.56 s	1.79 s	1.57 s

Table 10-4-33: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-91**~**10-4-94**.

H	10-4-91	10-4-92	10-4-93	10-4-94
1		α 1.60 ddd(3.4, 3.4, 12.8) β 1.40 ddd(3.4, 12.8, 13.3)	5.35 dd(5.2, 10.8) 2.08 s(OAc)	
2	5.74 d(10)	α 1.89 m β 1.71 dq(3.4, 14.8)		
3	6.29 d(10)	4.83 t(2.6), 2.09 s(OAc)	4.96 t(3.2), 1.99 s(OAc)	3.82 t(3.5)
5		2.19 d(11.2)	1.95 dd(2.8, 13)	1.76 dd(3, 13)
6	5.49 dt(3.8, 11.9)	5.97 ddd(4.6, 9, 11.2)	1.71 m	α 2.08 dddd(4, 13, 13, 13)
	2.10 s(OAc)	2.01 s(OAc)	2.22 m	β 1.53 m($W_{1/2}$ = 22)
7		α 2.27 dd(9, 13)	2.09 m	α 2.26 ddd(4, 13, 13)
		β 3.02 dd(4.6, 13)	2.67 m	β 1.62 ddd(5, 13, 13)
9	2.29 d(6.7)	2.08 d(7.6)	2.33 d(6.8)	2.34 br d(7)
11	2.71 dd(6.7, 14.4)	α 2.65 dd(6.6, 10.2)	α 3.03 dd(6.4, 15.6)	2.62 ddd(2, 6.5, 14)
		β 2.09 m	β 2.32 m	1.81 m($W_{1/2}$ = 33)
12	5.03 m($W_{1/2}$ = 21)	5.56 m	5.71 m	5.13 m($W_{1/2}$ = 25)
14	4.53 s	4.92 s	4.96 s	4.38 s
17	1.86 d(1.6)	1.89 d(2)	1.85 d(1.6)	1.84 d(1.8)
18	1.15 s	1.05 s	0.96 s	1.14, s
19	1.27 s	1.21 s	0.92 s	1.01 s
20	1.53 s	1.47 s	1.67 s	1.61 s

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Table 10-4-34: Compounds, MFs, and test solvents of abietane-type diterpenoids **10-4-95**~**10-4-105**.

No.	Compounds	MFs	Test solvents	References
10-4-95	7-oxo-*ent*-abieta-8,13(15)-dien-12α,16-olide	$C_{20}H_{26}O_3$	$CDCl_3$	[198]
10-4-96	8α,14-dihydro-7-oxojolkinolide E	$C_{20}H_{28}O_3$	$CDCl_3$	[208]
10-4-97	8α,14-dihydro-7-oxohelioscopinolide A	$C_{20}H_{28}O_4$	$CDCl_3$	[209]
10-4-98	7β-hydroxy-8α,14-dihydrojolkinolide E	$C_{20}H_{30}O_3$	$CDCl_3$	[210]
10-4-99	jolkinolide B	$C_{20}H_{26}O_4$	$CDCl_3$	[211]
10-4-100	gelomulide B	$C_{22}H_{28}O_6$	$CDCl_3$	[211]
10-4-101	16-hydroxypseudojolkinolide B	$C_{20}H_{26}O_5$	$CDCl_3$	[212]
10-4-102	ebracteolatanolide A	$C_{20}H_{28}O_4$	$CDCl_3$-DMSO-d_6	[213]
10-4-103	ebracteolatanolide B	$C_{20}H_{30}O_5$	$CDCl_3$-DMSO-d_6	[213]
10-4-104	phlogacantholide B	$C_{20}H_{28}O_4$	C_5D_5N	[214]
10-4-105	phlogacantholide C	$C_{20}H_{28}O_4$	C_5D_5N	[214]

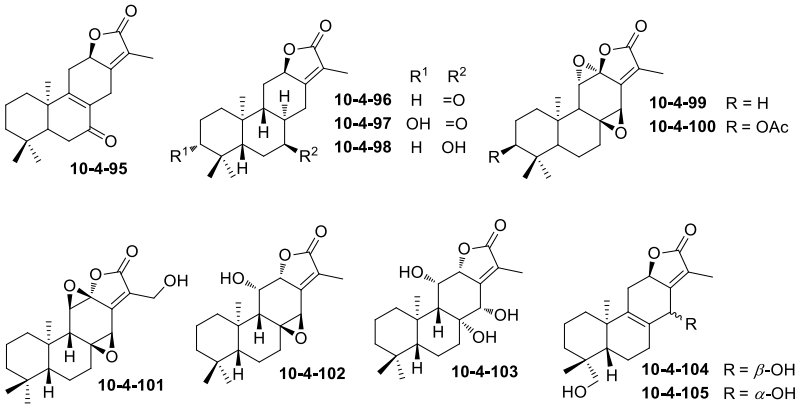

Table 10-4-35: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-95**~**10-4-98**.

H	10-4-95	10-4-96	10-4-97	10-4-98
1	ax 1.19 m, eq 1.84 m	1.72 br d(12)	–	α 1.55~1.65 m, β 0.88 m
2	ax 1.70 m, eq –		–	α 1.50~1.55 m, β 1.40~1.50 m
3	ax –, eq 1.45 m		3.24 dd(11.0, 4.5)	α 1.40~1.50 m β 1.18 ddd(4, 13, 13)
5	1.73 dd(3, 14)	1.25 dd(3.5, 14)	–	1.34 dd(4, 13.5)
6	ax 2.42 ddd(2.5, 14, 14)	α 2.48 dd(3.5, 14)	α 2.43 t(14.0)	α 1.55~1.65 m
	eq 2.57 ddd(3, 3, 14)	β 2.34 t(14)	β 2.50 dd(14.0, 3.5)	β 1.75 ddd(3, 4, 14)
7				3.98 ddd(2.5, 3, 3)
8		2.62 dt(8, 12)	2.61 dt(12.0, 8.0)	1.94 dddd(3, 5.8, 11.5, 13)

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Table 10-4-35 (continued)

H	10-4-95	10-4-96	10-4-97	10-4-98
9		1.40 m	1.37 m	1.50~1.55 m
11	ax 2.15 ddd(12, 13, 13) eq 3.13 dd(6.5, 13)	1.52 m, 2.30 m	1.51 m, 2.29 m	α 2.16 ddd(5.8, 8.2, 13.5) β 1.25~1.30 m
12	4.74 br ddq(1.5, 6.5, 13)	4.84 br t(8)	4.84 br t(8.0)	4.80 ddq (1.5, 8.2, 8.5)
14	3.28 br dq,3.40 br dd	2.82 br d(8)	2.82 br d(8.0)	α 2.50 ddq(1.5, 5.8, 19) β 2.80 br dd(11.5, 19)
17	1.85 d(1.5)	1.80 br s	1.80 br s	1.78 ddd(1.5, 1.5, 1.5)
18	0.90 s	0.88 s	1.13 s	0.84 s
19	0.94 s	0.85 s	0.87 s	0.82 s
20	1.15 s	1.11 s	0.97 s	0.89 s

Table 10-4-36: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-99**~**10-4-103**.

H	10-4-99	10-4-100	10-4-101	10-4-102	10-4-103
3	–	4.7 m($W_{1/2}$ = 8.0)			
9	2.29 br s	2.35 br s	2.27 br s	1.95 d(5.1)	1.91 d(2.9)
11	4.04 br s	4.05 d(1.5)	4.04 d(2.6)	4.12 dd(5.4, 5.1)	3.99 dd(2.9, 1.0)
12				5.55 d(5.4)	5.40 d(1.0)
14	3.68 s	3.67 s	4.07 br s	4.10 s	4.03 s
17	2.08 s	2.04 s	4.68 s	1.99 s	1.91 s
18	0.83 s①	0.83 s①	0.83 s①	0.86 s	0.83 s
19	0.85 s①	0.89 s①	0.83 s①	0.88 s	0.87 s
20	0.94 s①	0.89 s①	0.92 s①	1.08 s	1.12 s
OAc		2.07 s			
OH				3.50 br s	3.49 br s, 3.35 br s 4.24 br s

① The signals of 18-Me, 19-Me, and 20-Me were not assigned in the original literature.

Table 10-4-37: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-104** and **10-4-105**.

H	10-4-104	10-4-105	H	10-4-104	10-4-105
1	α 0.74 m, β 1.52 m	α 0.95 m, β 1.62 m	12	4.86 t(8.4)	5.32 t(8.0)
2	α 1.33 m, β 1.58 m	α 1.40 m, β 1.62 m	14	5.16 s	4.98 s
3	α 0.87 m, β 2.10 m	α 0.95 m, β 2.14 m	17	2.34 s	1.94 s
5	1.14 d(12.8)	1.27 d(12.7)	18	1.16 s	1.23 s
6	α 1.58 m, β 1.94 m	α 1.62 m, β 2.00 m	19	3.67 d(10.8) 3.96 d(10.7)	3.67 d(10.7) 3.98 d(10.7)
7	α 2.10 m, β 2.74 m	α 2.00 m, β 3.05 m	20	1.00 s	0.98 s
11	α 2.85 m, β 1.83 m	α 2.95 m, β 1.88 m			

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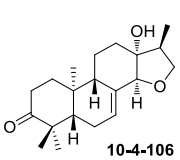
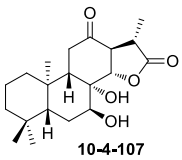
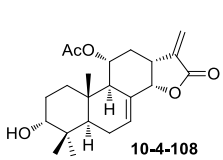
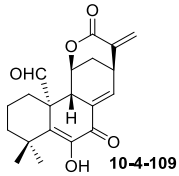
Table 10-4-38: Compounds, MFs, and test solvents of abietane-type diterpenoids **10-4-106**~**10-4-113**.

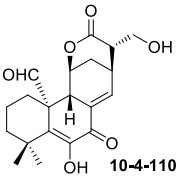
No.	Compounds	MFs	Test solvents	References
10-4-106	13α-hydroxy-14α,16-epoxy-*ent*-abieta-7-en-3-one	$C_{20}H_{30}O_3$	$CDCl_3$	[201]
10-4-107	7β,8α-dihydroxy-12-oxo-*ent*-abietan-16,14-olide	$C_{20}H_{30}O_5$	$CDCl_3$	[200]
10-4-108	taibaihenryiin C	$C_{22}H_{30}O_5$	$CDCl_3$	[215]
10-4-109	xerophilusin R	$C_{20}H_{22}O_5$	C_5D_5N	[216]
10-4-110	xerophilusin S	$C_{20}H_{24}O_6$	C_5D_5N	[216]
10-4-111	4-*epi*-hyalic acid	$C_{20}H_{28}O_4$	$CDCl_3$	[190]
10-4-112	hyalic acid	$C_{20}H_{28}O_4$	$CDCl_3$	[217]
10-4-113	16(*S*)-dihydrohyalic acid	$C_{20}H_{30}O_4$	$CDCl_3$	[217]

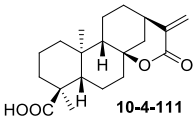


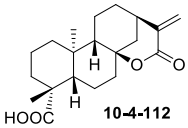












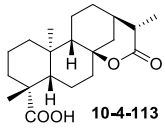


Table 10-4-39: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-106**~**10-4-109**.

H	10-4-106	10-4-107	10-4-108	10-4-109
1	1.56 m 2.13 ddd(13.5, 5.0, 4.0)	0.93 m, 1.61 m	α 1.63 m, β 1.90 (ov)	α 2.68 m, β 1.40 m
2	2.28 dt(15.0, 3.5) 2.69 td(15.0, 5.0)	1.46 m, 1.62 m	α 1.59 m, β 1.63 (ov)	1.62 (ov)
3		1.21 m, 1.53 m	3.47 t(2.5)	1.23 m
5	1.68 dd(11.5, 4.5)	1.49 m	1.80 dd(4.8, 12.1)	
6	2.04 m, 2.09 m	1.73 m 2.02 ddd(14.0, 13.2, 2.0)	α 2.02 m, β 2.09 m	10.75 br s(OH)
7	5.92 t(3.0)	3.99 br s	6.08 dd(2.2, 4.8)	
9	1.98 dd(17.5, 4.5)	1.75 m	2.40 br s	3.05 d(2.2)
11	1.66 m	2.56 t(12.8) 2.33 dd(12.8, 4.4)	5.14 t(1.6), 1.91 s(OAc)	5.14 br s
12	1.52 m, 1.63 m		α 1.71 dd(2.2, 7.3) β 2.03 m	α 1.61 (ov) β 2.12 br d(14.1)
13		3.84 t(12.1)	3.33 m	3.41 br s
14	3.89 s	4.25 d(12.1)	4.94 d(8.1)	7.15 d(6.6)
15	2.40 m	2.83 m		

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Table 10-4-39 (continued)

H	10-4-106	10-4-107	10-4-108	10-4-109
16	3.41 dd(10.5, 8.5) 4.11 t(8.5)			
17	0.96 d(7.0)	1.29 d(6.8)	6.13 d(2.2), 5.49 d(1.9)	6.40 s, 5.51 s
18	1.05 s	0.89 s	0.96 s	1.59 s
19	1.12 s	0.88 s	0.92 s	1.29 s
20	1.03 s	1.07 s	0.82 s	9.59 s

Table 10-4-40: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-110**~**10-4-113**.

H	10-4-110	10-4-111	10-4-112	10-4-113
1	*α* 2.68 m, *β* 1.38 m	1.10 m, 1.95 m	ax 0.98 m, eq –	ax 0.93 m, eq 1.91 br d(14)
2	1.61 (ov)	1.63 m	–	ax 1.84 m, eq 1.48 m
3	1.23 m	1.65 m, 1.80 m	2.21 br d(14) 1.06 td(4, 13, 13)	ax 1.04 td(4, 13, 13) eq 2.20 br d(14)
5		1.90 m	–	1.19 dd(1, 12)
6	10.71 br s(OH)	1.35 m, 1.48 m	–	–
7		1.90 m, 2.00 m	–	–
9	3.06 br s	1.70 m	–	1.27 d(8)
11	5.14 br s	1.65 m, 1.80 m	–	–
12	*α* 1.48 d(14.0) *β* 2.63 br d(14.0)	1.55 m, 1.98 m	–	–
13	3.18 br s	2.92 br s	2.93 m	1.94 br m
14	2.92 t(3.8), 7.33 d(6.8)	1.75 m, 2.35 m	2.32 dd(3, 14)	ax 2.16 ddd(1, 4, 14) eq 1.71 d(14)
16				2.49 br q(7)
17	4.25 dd(3.8, 10.5) 4.19 dd(3.8, 10.5)	5.54 s, 6.54 s	5.54 br s, 6.43 d(2)	1.35 d(7)
18	1.58 s		1.28 s	1.28 s
19	1.29 s	1.17 s		
20	9.59 s	1.07 s	0.96 s	0.95 s

Table 10-4-41: Compounds, MFs, and test solvents of abietane-type diterpenoids **10-4-114**~**10-4-122**.

No.	Compounds	MFs	Test solvents	References
10-4-114	suregadolide A	$C_{20}H_{28}O_4$	$CDCl_3$-CD_3OD	[218]
10-4-115	suregadolide B	$C_{20}H_{26}O_3$	$CDCl_3$-CD_3OD	[218]
10-4-116	suregadolide C	$C_{20}H_{28}O_5$	$CDCl_3$-CD_3OD	[219]
10-4-117	retusolide A	$C_{20}H_{26}O_4$	$CDCl_3$ DMSO-d_6	[220]
10-4-118	retusolide B	$C_{20}H_{24}O_3$	$CDCl_3$	[220]
10-4-119	retusolide C	$C_{20}H_{24}O_3$	$CDCl_3$	[220]
10-4-120	retusolide D	$C_{20}H_{24}O_4$	$CDCl_3$	[220]
10-4-121	retusolide E	$C_{20}H_{26}O_3$	$CDCl_3$	[220]
10-4-122	retusolide F	$C_{20}H_{28}O_3$	$CDCl_3$-CD_3OD	[220]

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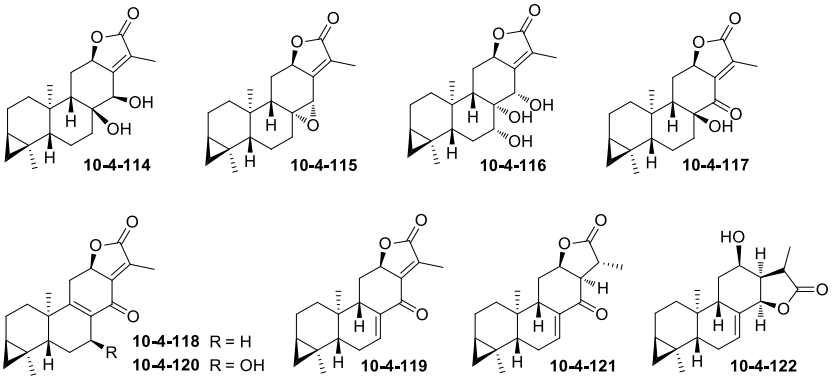

Table 10-4-42: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-114**~**10-4-116**.

H	10-4-114	10-4-115	10-4-116
1	0.55 m, 1.55 m	0.66 m, 1.40 m	0.64 m, 1.40 m
2	1.64 m, 1.84 m	1.64 m, 1.79 m	1.60 m, 1.80 m
3	0.54 ddd(6.0, 8.5, 9.0)	0.50 ddd(5.9, 9.2, 9.3)	0.60 ddd(6.1, 8.8, 9.0)
5	1.05 dd(3.2, 12.8)	1.09 dd(3.0, 13.6)	1.63 dd(2.9, 13.7)
6	1.60 m	1.19 m	1.80 dt(3.2, 13.1)
	1.82 dd(5.5, 12.0)	1.60 dd(4.5, 14.3)	2.08 dt(2.5, 13.7)
7	1.52 m, 2.25 m	1.17 m, 1.19 m	3.8 t(3.0)
9	1.39 d(7.6)	1.67 d(6.8)	1.2 br d(9.0)
11	1.50 m, 2.42 dd(6.4, 13.3)	1.20 m, 2.1 dd(5.7, 13.1)	1.38 m ($W_{1/2}$ = 14.5) 2.32 dd(9.0, 13.0)
12	5.15 ddd(1.6, 6.4,12.0)	4.18 ddd(2.3, 5.5,10.3)	5.46 ddd(1.8, 7.6, 11.3)
14	4.43 s	3.64 s	4.83 m
17	1.78 d(1.8)	1.75 d(2.0)	1.85 d(2.0)
18	−0.01 dd(4.2, 5.7)	−0.09 dd(4.6, 5.5)	en 0.054 dd(3.8, 5.8)
	0.40 dd(4.0, 9.2)	0.30 dd(4.2, 9.3)	ex 0.42 dd(4.0, 9.3)
19	0.93 s	1.1 s	1.01 s
20	1.11 s	0.8 s	1.14 s

Table 10-4-43: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-117**~**10-4-119**.

H	10-4-117($CDCl_3$)	10-4-117(DMSO-d_6)	10-4-118	10-4-119
1α	1.76 dd(5.9, 12.7)	1.72 m	1.71 dd(6.2, 12.5)	1.64 ddd(1.6, 5.1, 13.3)
1β	0.83 td(6.0, 13.4)	0.70 m	0.90 ddd(6.4, 9.0, 12.5)	0.83 td(5.2, 13.3)
2α	1.97 m	1.88 m	2.15 dd(9.0, 13.7)	2.01 tt(5.1, 13.3)
2β	1.85 m	1.70 td(13.9, 6.9)	1.90 dd(6.4, 13.7)	1.83 ddd(1.6, 5.2,13.3)
3	0.71 dt(5.7, 9.3)	0.60 m	0.74 dt(6.0, 9.3)	0.79 dd(5.1, 8.9)
5	1.28 dd(2.7, 11.0)	1.22 dd(14.3, 5.3)	1.33 dd(2.7, 12.7)	1.65 dd(5.6, 11.3)

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Table 10-4-43 (continued)

H	10-4-117($CDCl_3$)	10-4-117(DMSO-d_6)	10-4-118	10-4-119
6α	1.41 m	1.23 dm(14.3)	1.59 dddd(5.7, 11.8, 12.7, 19.1)	2.36 m
6β	1.95 m	1.77 m	2.12 m	2.55 ddd(11.2, 5.6, 2.4)
7α	2.68 dd(4.4, 12.7)	2.45 dd(13.3, 3.9)	2.59 dddd(18.2, 5.7, 3.6, 1.6)	6.97 dt(2.4, 5.3)
7β	1.43 m	1.27 m	2.30 m	
8		5.89 br s(OH)		
9	1.82 d(6.3)	1.65 d(6.3)		2.40 dd(2.7, 7.5)
11α	2.66 dd(7.7, 12.0)	2.51 m	3.21 ddd(1.6, 6.5, 15.8)	2.58 ddd(10.7, 7.1, 2.7)
11β	2.14 td(6.3, 12.0)	1.93 td(11.9, 6.3)	2.21 m	1.67 m
12	5.39 br ddq	5.44 br ddq	5.11 ddq(2.3, 6.5, 10.4)	4.98 ddq(2.2, 7.1, 11.3)
	(2.0, 7.7, 12.0)	(11.9, 7.3, 2.0)		
17	2.05 d(2.0)	1.84 d(2.0)	2.22 d(2.3)	2.24 d(2.2)
18 en	0.12 dd(4.5, 5.7)	0.07 dd(5.6, 4.1)	0.08 dd(4.4, 6.0)	0.16 dd(4.6, 5.1)
18 ex	0.55 dd(4.5, 9.3)	0.43 dd(9.2, 4.1)	0.59 dd(4.4, 9.3)	0.51 dd(4.6, 8.9)
19	1.00 s	0.91 s	1.10 s	1.06 s
20	0.85 s	0.71 s	1.20 s	0.91 s

Table 10-4-44: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-120**~**10-4-122**.

H	10-4-120	10-4-121	10-4-122
1α	1.70 m	1.59 m	1.51 ddm(3.2, 13.4)
1β	0.95 m	0.88 ddd(16.6, 11.0, 3.5)	0.70 td(5.1, 13.4)
2α	2.15 tt(6.0, 13.8)	1.96 tt(5.7, 11.0)	1.87 tt(5.4, 13.4)
2β	1.95 dd(6.2, 13.8)	1.80 m	1.69 dd(3.2, 13.4)
3	0.76 dt(9.2, 6.0)	0.77 dt(9.2, 5.7)	0.66 m
5	1.76 br d(13.9)	1.59 dd(4.7, 11.8)	1.64 dd(5.1, 12.6)
6α	1.79 td(13.8, 4.4)	2.28 m	2.08 tm(12.6)
6β	2.25 m	2.55 dm(17.6)	2.28 dm(12.6)
7	4.72 br s	7.19 m	5.99 m($W_{1/2}$ = 11.0)
9		2.23 br s	2.28 dd(3.9, 13.1)
11α	3.27 dd(6.4, 11.4)	1.41 dd(3.7, 14.6)	1.09 td(1.4, 13.1)
11β	2.29 m	2.37 dm(14.6)	1.94 dt(3.9, 13.1)
12	5.11 br ddq(2.3, 6.4, 10.1)	5.10 ddd(2.3, 3.7, 8.4)	4.13 (ov)
13		2.98 dd(7.3, 8.4)	2.23 dt(4.3, 6.6)
14			4.65 d(4.3)
15		2.82 quint(7.3)	2.72 quint(6.6)
17	2.25 d(2.3)	1.43 d(7.3)	1.35 d(6.6)
18 en	0.19 dd(4.9, 6.0)	0.17 dd(4.5, 5.7)	0.08 dd(4.5, 5.4)
18 ex	0.61 dd(4.9, 9.2)	0.50 dd(4.5, 9.2)	0.38 dd(4.5, 9.1)
19	1.11 s	1.06 s	0.98 s
20	1.20 s	0.75 s	0.67 s

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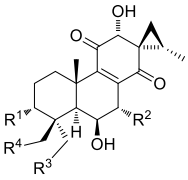
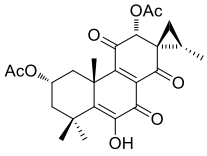
Table 10-4-45: Compounds, MFs, and test solvents of abietane-type diterpenoids **10-4-123**~**10-4-130**.

No.	Compounds	MFs	Test solvents	References
10-4-123	12-*O*-desacetylcoleon Q	$C_{20}H_{28}O_5$	CD_3COCD_3	[221]
10-4-124	7-*O*-acetyl-12-*O*-desacetyl-19-hydroxycoleon Q	$C_{22}H_{30}O_7$	CD_3COCD_3	[221]
10-4-125	18-acetoxy-12-*O*-desacetylcoleon Q	$C_{22}H_{30}O_7$	CD_3COCD_3	[221]
10-4-126	3-*O*-desacetyl-3-*O*-formylcoleon Y	$C_{23}H_{30}O_9$	CD_3COCD_3	[221]
10-4-127	3,18-di-*O*-desacety1-3,18-di-*O*-formylcoleon Y	$C_{22}H_{28}O_9$	CD_3COCD_3	[221]
10-4-128	xanthanthusin I	$C_{24}H_{28}O_8$	$CDCl_3$	[222]
10-4-129	xanthanthusin J	$C_{24}H_{28}O_8$	$CDCl_3$	[222]
10-4-130	xanthanthusin K	$C_{22}H_{24}O_6$	$CDCl_3$	[222]



	R^1	R^2	R^3	R^4
10-4-123	H	OH	H	H
10-4-124	H	OAc	H	OH
10-4-125	H	OH	OAc	H
10-4-126	OCHO	OH	OAc	H
10-4-127	OCHO	OH	OCHO	H



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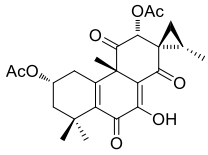

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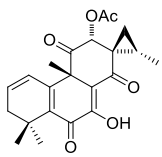

10-4-130

Table 10-4-46: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-123**~**10-4-126**.

H	10-4-123	10-4-124	10-4-125	10-4-126
3	–	–	–	4.98 m($W_{1/2}$ = 6)
5	2.29 br s($W_{1/2}$ = 4)	1.54 br s($W_{1/2}$ = 4)	1.94 br s($W_{1/2}$ = 4.1)	2.23 br s($W_{1/2}$ = 4)
6	4.20 dd(1.5, 2.5)	4.14 m($W_{1/2}$ = 6)	4.15 m($W_{1/2}$ = 6)	4.12 m($W_{1/2}$ = 5)
7	4.66 d(2.5)	5.75 d(2)	4.52 d(2)	4.56 d(2)
12	4.03 s	3.88 s	3.77 s	3.81 s
16	0.95 dd(3.5, 6.5)	0.92 dd(3.5, 7), 1.05 dd(3.5, 9)	0.92 dd(3.5, 7)	0.94 dd(3.5, 7)
	1.11 dd(3.5, 9)		1.08 dd(3.5, 9)	1.10 dd(3.5, 8.8)
17	1.26 d(6.5)	1.25 d(6.4)	1.26 d(6.6)	1.27 d(6.4)
18	1.16 s	1.04 s	3.55 d(11), 4.20 d(11)	3.98 d(11), 4.06 dd(11)
19	1.37 s	3.36 d(11.5), 4.25 d(11.5)	1.29 s	1.46 s
20	1.68 s	1.77 s	1.78 s	1.81 s
OAc		1.97 s	1.98	1.97 s
HCOO				8.12 s

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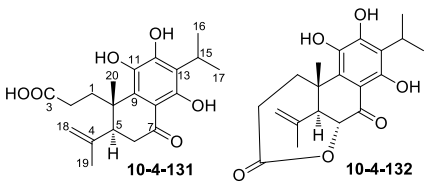
Table 10-4-47: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-127**~**10-4-130**.

H	10-4-127	10-4-128	10-4-129	10-4-130
1	–	*α* 1.85 (ov)	*α* 2.42 dd(9.6, 18.7)	6.22 d(5.6)
		β 1.97 d(6.2)	*β* 2.86 dd(5.2, 18.7)	
2	–	5.00 m	4.96 m	6.31 m
3	4.97 m($W_{1/2}$ = 7)	*α* 1.85 (ov)	*α* 1.59 dd(10.4, 12.4)	*α* 2.14 dd(4.8, 15.2)
		β 2.06 (ov)	*β* 1.81 dd(5.5, 12.4)	*β* 2.24 dd(3.2, 15.2)
5	2.24 br s($W_{1/2}$ = 4)			
6	4.17 m($W_{1/2}$ = 5)	8.83 s(OH)		
7	4.58 d(2)		11.58 s(OH)	12.37 s(OH)
12	3.85 s	5.07 s	4.80 s	5.04 s
15		1.93 m	2.25 m	2.46 m
16	0.95 dd(3.5, 7)	1.28 m	1.07 dd(4.0, 7.5)	1.15 dd(4.0, 9.2)
	1.10 dd(3.5, 9)		1.50 dd(4.0, 9.2)	1.52 dd(4.0, 7.6)
17	1.27 d(6.4)	1.10 d(6.4)	1.18 d(6.5)	1.18 d(6.0)
18	4.08 d(10.5)	1.39 s	1.39 s	1.33 s
	4.23 d(10.5)			
19	1.48 s	1.36 s	1.31 s	1.19 s
20	1.82 s	1.75 s	1.69 s	1.74 s
OAc		2.06 s, 2.03 s	1.98 s, 2.04 s	2.00 s
HCOO	8.12 s, 8.14 s			

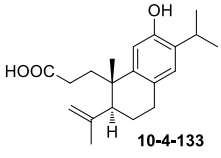
Table 10-4-48: Compounds, MFs, and test solvents of abietane-type diterpenoids **10-4-131**~**10-4-138**.

No.	Compounds	MFs	Test solvents	References
10-4-131	candesalvone B	$C_{20}H_{26}O_6$	$CDCl_3$	[223]
10-4-132	candesalvolactone	$C_{20}H_{24}O_6$	$CDCl_3$	[223]
10-4-133	*seco*-hinokiol	$C_{20}H_{28}O_3$	CD_3COCD_3	[224]
10-4-134	12-deoxy-*seco*-hinokiol methyl ester	$C_{21}H_{30}O_2$	$CDCl_3$	[225]
10-4-135	12-deoxy-11,12-dihydro-*seco*-hinokiol methyl ester	$C_{21}H_{32}O_2$	$CDCl_3$	[225]
10-4-136	callicarpic acid A	$C_{20}H_{30}O_2$	$CDCl_3$	[225]
10-4-137	9*α*-hydroxycallicarpic acid A	$C_{20}H_{30}O_3$	$CDCl_3$	[225]
10-4-138	callicarpic acid B	$C_{20}H_{26}O_4$	$CDCl_3$	[225]



10-4-131

10-4-132



10-4-133

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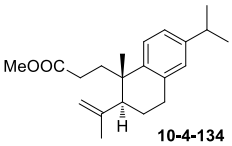

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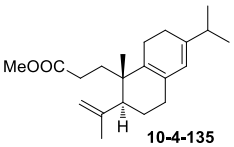

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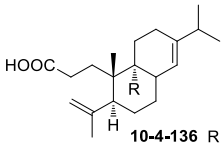
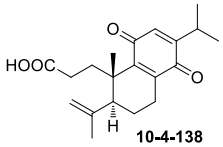


10-4-136 R = H
10-4-137 R = OH



10-4-138

Table 10-4-49: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-131**~**10-4-134**.

H	10-4-131	10-4-132	10-4-133	10-4-134
1	2.13 m	*α* 2.09 ddd(2.0, 6.1, 14.3) *β* 1.91 dt(2.0, 14.3)	1.97 (ov), 2.01 (ov)	2.11 br t(8.5)
2	2.13 m, 2.40 t(9.0)	*α* 2.43 dt(2.5, 13.6) *β* 2.57 ddd(2.0, 6.1, 15.2)	1.82 (ov) 2.24 ddd(4.7, 12.2, 15.4)	1.91 m 2.21 ddd(8.5, 8.5, 15.5)
5	2.71 m	2.62 s	2.46 dd(2.6, 11.6)	2.42 dd(3.0, 13.0)
6	2.56 d(17.0), 2.86 d(17.0)	4.49 s	1.88 (ov), 1.89 (ov)	1.79 m, 1.93 m
7			2.66 (ov), 2.71 (ov)	2.78 dd(4.0, 8.5)
11			6.73 s	7.17 d(8.0)
12				7.01 dd(2.0, 8.0)
14	13.68 s(OH)	13.54 s(OH)	6.81 s	6.87 d(2.0)
15	3.47 sept(7.0)	3.47 sept(7.0)	3.22 sept(7.0)	2.82 sept(7.0)
16	1.34 d(7.0)	1.39 d(7.0)	1.19 d(7.0)	1.22 d(7.0)
17	1.34 d(7.0)	1.38 d(7.0)	1.18 d(7.0)	1.22 d(7.0)
18	4.81 s, 5.03 s	4.88 s, 4.61 s	4.74 br s, 4.94 br s	4.71 br s, 4.95 br s
19	1.77 s	1.59 s	1.80 s	1.79 s
20	1.42 s	1.74 s	1.16 s	1.21 s
OMe				3.60 s

Table 10-4-50: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-135**~**10-4-138**.

H	10-4-135	10-4-136	10-4-137	10-4-138
1	1.80 m	1.80 m, 1.92 m	1.79 m, 1.92 m	1.86 ddd(5.2, 12.8, 12.8) 2.04 ddd(2.0, 5.2, 12.8)
2	2.10 m	2.50 ddd(1.0, 8.0, 19.0)	2.51 ddd(1.1, 8.1, 19.2)	2.58 ddd(2.0, 5.2, 18.4)
	2.36 ddd(8.2, 8.2, 15.4)	2.65 ddd(9.0, 11.5, 19.0)	2.66 ddd(9.0, 11.5, 19.2)	2.89 ddd(5.2, 12.8, 18.4)

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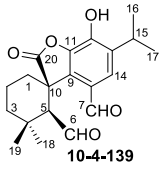
Table 10-4-50 (continued)

H	10-4-135	10-4-136	10-4-137	10-4-138
5	2.22 dd(3.0, 12.8)	2.84 dd(5.5, 12.0)	2.83 dd(5.3, 12.0)	2.20 dd(12.8, 2.8)
6	1.58 m, 1.74 m	2.16 ddd(5.0, 12.0, 19.0)	2.17 ddd(5.0, 12.0, 19.2)	2.57 m
		2.36 dd(5.5, 19.0)	2.38 dd(5.3, 19.2)	2.75 br dd(6.4, 16.8)
7	2.03 m			1.80 m, 2.17 m
9		1.93 m		
11	1.79 m	1.59 m	1.74 m	
		1.84 m	1.99 ddd(2.0, 4.5, 13.5)	
12	2.01 m, 2.10 m	2.06 dd(5.0, 17.2), 2.40 m	2.06 dd(5.1, 17.2)	7.09 s
14	5.43 s	5.82 s	5.82 s	
15	2.30 sept(7.0)	2.26 sept(7.0)	2.28 sept(6.8)	3.39 sept(6.8)
16	1.03 d(7.0)	1.02 d(7.0)	1.05 d(6.8)	1.25 d(6.8)
17	1.03 d(7.0)	1.02 d(7.0)	1.05 d(6.8)	1.25 d(6.8)
18	4.68 br s, 4.91 br s	4.79 br s, 4.86 br s	4.91 br s, 4.97 br s	4.74 br s, 4.96 br s
19	1.77 s	1.81 s	1.85 s	1.82 s
20	0.95 s	1.00 s	1.00 s	1.19 s
OMe	3.66 s			

Table 10-4-51: Compounds, MFs, and test solvents of abietane-type diterpenoids **10-4-139**~**10-4-146**.

No.	Compounds	MFs	Test solvents	References
10-4-139	rosmadial	$C_{20}H_{24}O_5$	$CDCl_3$	[226]
10-4-140	obtuanhydride	$C_{20}H_{26}O_4$	$CDCl_3$	[227]
10-4-141	7,8-*seco*-*para*-ferruginone	$C_{20}H_{28}O_3$	$CDCl_3$	[228]
10-4-142	4-hydroxysaprorthoquinone	$C_{20}H_{26}O_3$	$CDCl_3$	[228]
10-4-143	3-keto-4-hydroxysaprorthoquinone	$C_{20}H_{24}O_4$	$CDCl_3$	[228]
10-4-144	negundoin F	$C_{20}H_{32}O_2$	$CDCl_3$	[229]
10-4-145	abiesadine B	$C_{20}H_{30}O_4$	$CDCl_3$	[230]
10-4-146	abiesadine A	$C_{20}H_{30}O_4$	CD_3OD	[230]



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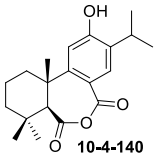
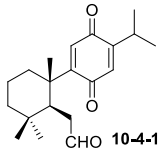
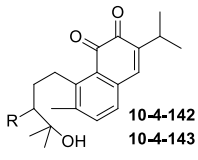


10-4-140



10-4-141



10-4-142 R = H
10-4-143 R = =O

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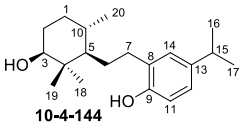
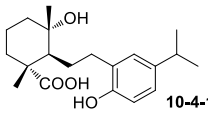
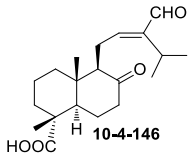


10-4-144



10-4-145



10-4-146

Table 10-4-52: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-139**~**10-4-142**.

H	10-4-139	10-4-140	10-4-141	10-4-142
1	ax 2.27 m, eq 1.70 m	α 1.24 m, β 1.98 br d(13.3)	1.31 m, 2.39 m	2.99 m
2	ax 2.10 m, eq 1.55 m	α 1.55 m, β 1.77 m	2.39 m	1.62 m
3	ax 1.90 m, eq 1.60 m	1.12 m, 1.48 m	1.51 m	1.62 m
5	4.11 s	2.72 s	2.96 m	
6	9.66 d(0.8)		2.38 m, 2.10 m	7.03 d(7.5)
7	9.77 s		9.50 s	7.34 d(7.5)
11		6.81 s	6.54 s	
14	7.40 s	7.62 s	6.42 s	7.07 s
15	3.35 sept(7)	3.13 sept(6.9)	2.95 m	2.99 m
16	1.27 d(7)	1.21 d(6.9)	1.12 d(7.0)	1.14 d(7.0)
17	1.28 d(7)	1.23 d(6.9)	1.12 d(7.0)	1.14 d(7.0)
18	1.50 s	1.06 s	0.94 s	1.21 s
19	1.28 s	1.39 s	0.87 s	1.21 s
20		1.50 s	1.17 s	2.36 s
OH		5.79 br s		

Table 10-4-53: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-143**~**10-4-146**.

H	10-4-143	10-4-144	10-4-145	10-4-146
1	3.25 m	1.08 m, 1.65 m	1.81 m, 1.94 m	1.40 m, 1.79 m
2	2.78 m	1.51 m, 1.70 m	1.68 m, 1.80 m	1.60 m
3		3.22 dd(4.2, 11.6)	1.56 m, 1.74 m	1.58 m, 1.84 m
5		0.67 m	2.53 dd(2.4, 12.0)	2.48 m
6	7.07 d(7.6)	1.39 m, 1.75 m	1.53 m	1.75 m, 1.83 m
7	7.37 d(7.6)	2.51 m	2.68 dd(5.4, 13.2)	2.30 m
		2.68 m	2.84 m	2.48 m
9				2.50 m
10		1.36 m		
11		6.67 d(8.0)	6.79 d(8.4)	2.34 m, 2.69 m
12		6.92 dd(1.8, 8.0)	6.94 dd(1.8, 8.4)	6.35 t(7.0)
14	7.07 s	6.94 d(1.8)	6.91 d(1.8)	9.19 d(1.8)
15	2.99 m	2.82 sept(7.0)	2.84 sept(7.2)	2.94 dt(1.5, 7.5)
16	1.14 d(7.0)	1.21 d(7.0)	1.22 d(7.2)	1.17 d(7.0)
17	1.14 d(7.0)	1.21 d(7.0)	1.22 d(7.2)	1.19 d(7.0)
18	1.40 s	0.98 s		
19	1.40 s	0.77 s	1.11 s	1.15 s
20	2.35 s	1.01 d(8.5)	1.01 s	0.81 s

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Table 10-4-54: Compounds, MFs, and test solvents of abietane-type diterpenoids **10-4-147**~**10-4-160**.

No.	Compounds	MFs	Test solvents	References
10-4-147	teuvincenone A	$C_{20}H_{22}O_6$	$CDCl_3$	[231]
10-4-148	teuvincenone B	$C_{20}H_{24}O_5$	$CDCl_3$	[231]
10-4-149	teuvincenone C	$C_{20}H_{22}O_5$	$CDCl_3$	[231]
10-4-150	teuvincenone D	$C_{20}H_{24}O_4$	$CDCl_3$	[231]
10-4-151	teuvincenone G	$C_{20}H_{24}O_5$	$CDCl_3$	[232]
10-4-152	teuvincenone H	$C_{20}H_{20}O_6$	$CDCl_3$	[232]
10-4-153	teuvincenone I	$C_{20}H_{18}O_6$	$CDCl_3$	[232]
10-4-154	villosin A	$C_{20}H_{26}O_4$	$CDCl_3$	[233]
10-4-155	villosin B	$C_{20}H_{26}O_5$	$CDCl_3$	[233]
10-4-156	villosin C	$C_{20}H_{24}O_6$	$CDCl_3$	[233]
10-4-157	makinin	$C_{21}H_{26}O_3$	$CDCl_3$	[234]
10-4-158	incanone	$C_{20}H_{28}O_5$	CD_3COCD_3	[235]
10-4-159	xanthanthusin F	$C_{24}H_{30}O_9$	$CDCl_3$	[222]
10-4-160	xanthanthusin G	$C_{27}H_{36}O_9$	$CDCl_3$	[222]

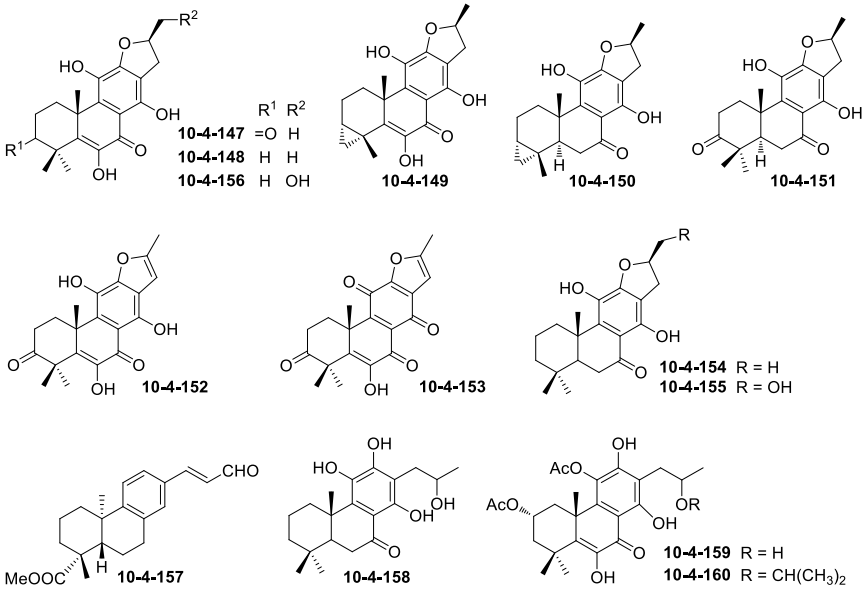

Table 10-4-55: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-147**~**10-4-149**.

H	10-4-147	10-4-148	10-4-149
1	*α* 1.86 dt(9.9, 9.9, 13.7) *β* 3.34 ddd(4.0, 6.3, 13.7)	3.06 m	*α* 0.92 (ov) *β* 2.80 br ddd(5.9, 13.4, 13.9)

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Table 10-4-55 (continued)

H	10-4-147	10-4-148	10-4-149
2	*α* 2.75 ddd(4.0, 9.9, 16.2) *β* 2.73 ddd(6.3, 9.9, 16.2)		*α* 1.88 ddt(1.6, 5.5, 13.9) *β* 2.32 br tt(5.9, 11.9, 13.9)
3			0.99 (ov)
6	6.94 s(OH)	6.94 s(OH)	6.57 s(OH)
11	4.91 s(OH)	4.73 s(OH)	4.72 s(OH)
14	12.44 s(OH)	12.60 s(OH)	12.60 s(OH)
15	*α* 3.43 dd(9.0, 15.5) *β* 2.91 dd(7.3, 15.5)	3.40 dd(9.1, 15.2) 2.88 dd(7.3, 15.2)	3.40 dd(8.7, 15.2) 2.88 dd(7.3, 15.2)
16	5.18 ddq(6.3, 7.3, 9.0)	5.14 ddq(6.6, 7.3, 9.0)	5.14 ddq(6.5, 7.3, 8.7)
17	1.55 d(6.3)	1.53 d(6.6)	1.53 d(6.5)
18	1.54 s	1.45 s	en 0.46 br dd(4.6, 5.2) ex 0.84 br dd(4.6, 8.7)
19	1.45 s	1.43 s	1.44 br s
20	1.58 s	1.66 s	1.65 br s

Table 10-4-56: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-150**~**10-4-153**.

H	10-4-150	10-4-151	10-4-152	10-4-153
1	*α* 0.89 br td(6.6, 13.0, 14.3) *β* 3.05 dd(6.6, 13.0, 14.3)	*α* – *β* 3.4 m	*α* 1.93 dt(10.0, 10.0, 13.7) *β* 3.42 ddd(4.1, 6.3, 13.7)	*α* 1.91 dt(9.8, 9.8, 13.4) *β* 3.08 ddd(4.3, 6.3, 13.4)
2	*α* 1.80 dddd(0.6, 1.7, 6.6, 14.3) *β* 2.18 tt(6.6, 13.0, 14.3)		*α* 2.78 (ov) *β* 2.76 (ov)	*α* 2.80 (ov) *β* 2.81 (ov)
3	0.72 m			
5	1.90 dd(7.9, 11.0)	2.39 dd(2.9, 14.5)		
6	*α* 2.69 dd(7.9, 15.9) *β* 2.72 dd(11.0,15.9)	2.6 (ov)	6.96 s(OH)	7.07 s(OH)
11	4.64 s(OH)	4.73 br s(OH)	5.24 s(OH)	
14	13.26 s(OH)	13.19 s(OH)	12.82 s(OH)	
15	*α* 3.35 dd(9.1, 15.3), *β* 2.83 dd(7.4, 15.3)	3.38 dd(9.0, 15.3) 2.85 dd(7.3, 15.3)	6.62 q(1.1)	6.53 q(0.9)
16	5.11 ddq(6.5, 7.4, 9.1)	5.14 ddq(6.3, 7.3, 9.0)		
17	1.50 d(6.5)	1.52 d(6.3)	2.48 d(1.1)	2.50 d(0.9)
18	en 0.13 br dd(4.3, 5.7) ex 0.53 dd(4.3, 9.3)	1.18 s	1.56 s	1.53 s
19	1.06 br s	1.17 s	1.50 s	1.49 s
20	1.38 s	1.44 br s	1.60 s	1.58 s

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Table 10-4-57: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-154**~**10-4-156**.

H	10-4-154	10-4-155	10-4-156
1	*α* 0.86 ddd(6.8, 13.0, 13.5) *β* 3.26 ddd(1.8, 6.8, 13.5)	*α* 0.89 br d(13.0) *β* 3.05 br d(13.0)	*α* 1.10 dt(13.0, 13.5) *β* 3.30 dt(6.8, 13.5)
2	*α* 1.68 dddd(0.7, 1.8, 6.8, 13.4) *β* 2.10 m	*α* 1.75 dddd(0.7, 1.8, 6.8, 13.4) *β* 2.15 dd(6.8, 13.4)	*α* 1.75 br dd(6.8, 13.4) *β* 2.20 ddd(6.8, 13.4)
3	*α* 1.00 m, *β* 0.88 m	*α* 1.10 m, *β* 0.75 m	*α* 1.10 m, *β* 0.90 br d(7.3)
5	1.78 dd(7.2, 10.7)	1.78 dd(7.2, 10.7)	1.75 dd(10.7, 7.2)
6	*α* 2.64 dd(7.2, 16) *β* 2.74 dd(10.7, 16)	*α* 2.65 dd(7.2, 16) *β* 2.70 m	6.92 s(OH)
11	4.65 s(OH)	4.64 s(OH)	4.95 s(OH)
14	13.47 s(OH)	13.26 s(OH)	12.59 s(OH)
15	*α* 3.35 dd(9.0, 15.2) *β* 2.83 dd(7.2, 15.2)	*α* 3.32 dd(9.0, 15.2) *β* 3.05 dd(7.2, 15.2)	*α* 3.30 dd(9.0, 15.2) *β* 3.00 dd(7.2, 15.2)
16	5.12 ddq(6.5, 7.2, 9.0)	5.13 ddq(6.5, 7.2, 9.0)	5.12 ddq(6.5, 7.2, 9.0)
17	1.50 d(6.5)	3.80 dd(6, 12), 3.90 dd(4, 12)	3.82 dd(6, 12), 3.88 dd(4, 12)
18	0.83 s	0.90 s	1.42 s
19	0.86 s	0.92 s	1.44 br s
20	1.35 s	1.34 s	1.65 br s

Table 10-4-58: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-157**~**10-4-160**.

H	10-4-157	10-4-158	10-4-159	10-4-160
1	1.37 dt(4.2, 12.4), 2.25 m(ov)	*α* 1.30 ddd(3.9, 13.2, 13.2) *β* 3.42 ddd(2.2, 3.3, 13.2)	*α* 2.19 dd(8.4, 14.8) *β* 2.63 dd(5.2, 14.8)	*α* 2.17 dd(8.7, 15.0) *β* 2.74 dd(5.1, 15.0)
2	1.65 m(ov), 1.98 m(ov)	1.54 m, 1.74 m	5.47 m	5.08 m
3	1.08 dt(4.2, 12.4), 2.27 m(ov)	1.25 m, 1.46 m	*α* 1.89 dd(7.2, 13.6) *β* 2.10 dd(4.4, 13.6)	*α* 1.90 dd(7.5, 14.0) *β* 2.07 dd(4.8, 14.0)
5	1.55 dd(2.5, 12.4)	1.75 dd(3.0, 15.0)		
6	1.98 m(ov), 2.15 m(ov)	*α* 2.49 dd(3.0, 17.1) *β* 2.66 dd(15.0, 17.1)		
7	2.93 ddd(2.7, 5, 16)			
11	7.32 s			
12	7.32 s			
14	7.22 s			
15	7.38 d(15.9)	2.73 dd(7.2, 14.7) 2.89 dd(2.1, 14.7)	2.98 dd(1.8, 14.8) 2.87 dd(6.8, 14.8)	2.91 m
16	6.6 dd(7.7, 15.9)	4.17 m	4.29 m	3.94 m
17	9.65 d(7.7)	1.18 d(6.3)	1.24 d(6.0)	1.18 d(5.6)
18		0.94 s	1.46 s	1.46 s
19	1.25 br s	0.96 s	1.46 s	1.46 s

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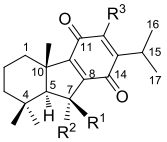
Table 10-4-58 (continued)

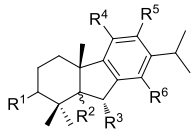
H	10-4-157	10-4-158	10-4-159	10-4-160
20	1.0 s	1.37 s	1.60 s	1.59 s
OMe	3.65 s			
OAc			2.06 s, 2.36 s	2.06 s, 2.32 s
1′				3.76 m
2′				1.21 d(6.0)
3′				1.10 d(6.0)
OH			13.00 s, 6.92 s	6.92 s, 12.89 s

Table 10-4-59: Compounds, MFs, and test solvents of abietane-type diterpenoids **10-4-161**~**10-4-174**.

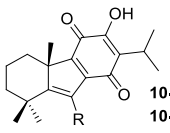
No.	Compounds	MFs	Test solvents	References
10-4-161	taiwaniaquinone A	$C_{20}H_{26}O_4$	$CDCl_3$	[236]
10-4-162	taiwaniaquinone B	$C_{20}H_{26}O_5$	CD_3COCD_3	[236]
10-4-163	taiwaniaquinone C	$C_{20}H_{26}O_5$	CD_3COCD_3	[236]
10-4-164	taiwaniaquinone E	$C_{21}H_{28}O_5$	$CDCl_3$	[237]
10-4-165	taiwaniaquinone G	$C_{20}H_{28}O_3$	$CDCl_3$	[238]
10-4-166	taiwaniaquinol A	$C_{21}H_{28}O_4$	$CDCl_3$	[236]
10-4-167	taiwaniaquinol B	$C_{20}H_{28}O_4$	$CDCl_3$	[236]
10-4-168	dichroanal A	$C_{20}H_{28}O_4$	$CDCl_3$	[239]
10-4-169	standishinal	$C_{20}H_{28}O_3$	$CDCl_3$	[240]
10-4-170	taiwaniaquinol E	$C_{20}H_{28}O_4$	$CDCl_3$	[238]
10-4-171	taiwaniaquinol F	$C_{20}H_{26}O_5$	$CDCl_3$	[238]
10-4-172	taiwaniaquinone D	$C_{20}H_{24}O_4$	$CDCl_3$	[237]
10-4-173	dichroanone	$C_{19}H_{24}O_3$	–	[239]
10-4-174	dichroanal B	$C_{20}H_{26}O_3$	C_5D_5N	[239]



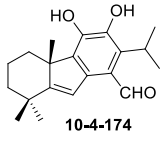
	R^1	R^2	R^3
10-4-161	H	CHO	OH
10-4-162	OH	CHO	OH
10-4-163	CHO	OH	OH
10-4-164	H	COOMe	OH
10-4-165	H	H	OMe



	R^1	R^2	R^3	R^4	R^5	R^6
10-4-166	H	α-H	CHO	OCH_2O		OH
10-4-167	H	β-H	=O	OH	OMe	OH
10-4-168	H	β-H	OH	OH	OH	CHO
10-4-169	H	α-H	OH	CHO	H	OH
10-4-170	H	α-H	=O	OH	OMe	OH
10-4-171	=O	β-H	=O	OH	OMe	OH



10-4-172 R = CHO
10-4-173 R = H



10-4-174

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Table 10-4-60: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-161**~**10-4-163**, **10-4-166**, and **10-4-167**.

H	10-4-161	10-4-162	10-4-163	10-4-166	10-4-167
5	2.13 d(11.5)	2.04 s	2.26 s	2.16 d(11)	2.10 s
6	9.84 d(4)	9.82 s	10.08 s	9.47 d(5)	
7	3.76 dd(11.5, 4)			3.77 dd(11, 5)	
15	3.12 sept(7)	3.12 sept(7)	3.14 sept(7)	3.16 sept(7)	3.25 sept(7)
16	1.17 d(7)	1.16 d(7)	1.18 d(7)	1.26 d(7)	1.36 d(7)
17	1.18 d(7)	1.16 d(7)	1.17 d(7)	1.26 d(7)	1.36 d(7)
18	0.79 s	0.78 s	1.11 s	0.89 s	0.86 s
19	1.05 s	1.20 s	1.04 s	1.06 s	1.24 s
20	1.14 s	1.49 s	1.35 s	1.10 s	1.42 s
OMe					3.78 s
OCH_2O				5.82 d(1), 5.87 d(1)	

Table 10-4-61: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-164**, **10-4-165**, **10-4-168**, and **10-4-169**.

H	10-4-164	10-4-165	10-4-168	10-4-169
1	1.58 m 2.22 br d(12.0)	1.43 m 2.23 br d(12.9)	*ca*. 1.8 m, 2.21 m	α 1.76 ddd(12.0, 12.0, 4.0) β 2.46 dt(12.0, 3.0)
2	1.62 m, 1.75 m	1.58 m, 1.74 m	*ca*. 1.8 m, 1.27 m	α 1.70 m, β 1.88 m
3	1.22 m, 1.45 m	1.12 m, 1.47 m	1.27 m, 1.54 ddd(10.4, 2.9, 2.9)	α 1.25 m, β 1.53 dt(13.5, 3.5)
5	2.13 d(11.6)	1.61 (ov)	5.25 dd(8.8, 2.0)	1.83 d(10.0)
7	3.61 d(11.6)	2.28 dd(16.8, 6.4) 2.54 dd(16.8, 6.4)	1.82 d(8.8) 5.42 d(2.0, OH)	5.40 d(10.0)
12				7.69 s
15	3.10 sept(7.0)	3.19 sept(7.2)	3.80 sept(7.1)	3.27 sept(7.0)
16	1.14 d(7.0)	1.18 d(7.2)	1.44 d(7.1)	1.24 d(7.0)
17	1.17 d(7.0)	1.21 d(7.2)	1.45 d(7.1)	1.25 d(7.0)
18	0.82 s	0.90 s	1.19 s	1.17 s
19	1.03 s	0.97 s	1.15 s	1.19 s
20	1.10 s	1.05 s	1.13 s	1.26 s
OMe	3.73 s	3.91 s		
CHO			10.40 s	10.21 s

Table 10-4-62: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-170**~**10-4-174**.

H	10-4-170	10-4-171	10-4-172	10-4-173	10-4-174
1	1.78 m, 2.40 (ov)	1.30 m, 2.45 (ov)	2.40 br d(13.0)	*ca*. 1.1 m, 2.38 br dd(13, 2)	*ca*.1.2 m, 2.91 br d(13)
2	1.66 m, 1.81 m	2.45 m	1.68 m, 1.94 m	*ca*. 1.6 m, 1.93 m	*ca*. 1.5 m, 1.94 m
3	1.18 m, 1.52 m		1.26 m, 1.72 m	*ca*. 1.1 m, 1.71 ddd(7.5, 2.5, 2.5)	1.12 m, 1.57 m

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Table 10-4-62 (continued)

H	10-4-170	10-4-171	10-4-172	10-4-173	10-4-174
5	2.45 s	2.37 s			
7				6.45 s	7.58 s
11	5.16 br s(OH)	5.33 br s(OH)			
14	8.73 s(OH)	9.40 s(OH)			
15	3.26 sept(6.6)	3.27 sept(7.2)	3.15 sept(7.1)	3.22 sept(7.0)	4.46 sept(7.1)
16	1.33 d(6.6)	1.37 d(7.2)	1.19 d(7.1)	1.24 d(7.0)	1.65 d(7.1)
17	1.37 d(6.6)	1.37 d(7.2)	1.18 d(7.1)	1.25 d(7.0)	1.65 d(7.1)
18	1.26 s	1.39 s	1.14 s	1.24 s	1.24 s
19	1.14 s	1.12 s	1.28 s	1.29 s	1.30 s
20	1.26 s	1.50 s	1.44 s	1.46 s	1.72 s
OMe	3.76 s	3.76 s			
CHO			10.38 s		10.94 s
OH				7.31 s(12-OH)	

Table 10-4-63: Compounds, MFs, and test solvents of abietane-type diterpenoids **10-4-175**~**10-4-198**.

No.	Compounds	MFs	Test solvents	References
10-4-175	pisiferanol	$C_{20}H_{30}O_2$	$CDCl_3$	[241]
10-4-176	12-deoxypisiferanol	$C_{20}H_{30}O$	$CDCl_3$	[241]
10-4-177	20*S*-hydroxypisiferanol	$C_{20}H_{30}O_3$	$CDCl_3$	[241]
10-4-178	salvicanol	$C_{21}H_{32}O_3$	$CDCl_3$	[242]
10-4-179	coulterone	$C_{21}H_{30}O_5$	$CDCl_3$	[243]
10-4-180	cyclocoulterone	$C_{21}H_{28}O_5$	$CDCl_3$	[244]
10-4-181	lanigerol	$C_{20}H_{30}O_2$	$CDCl_3$	[245]
10-4-182	1β-hydroxyisopisiferin	$C_{20}H_{28}O_2$	$CDCl_3$	[241]
10-4-183	salviasperanol	$C_{20}H_{26}O_3$	$CDCl_3$	[246]
10-4-184	5,6-dihydro-6α-hydroxysalviasperanol	$C_{20}H_{28}O_4$	$CDCl_3$	[246]
10-4-185	brussonol	$C_{20}H_{28}O_3$	$CDCl_3$	[185]
10-4-186	komaroviquinone	$C_{21}H_{28}O_5$	$CDCl_3$	[244]
10-4-187	3α-hydroxy-9(10→20)*abeo*-abieta-1,5,8,10(20),13-pentaene-7,11,12-trione	$C_{20}H_{20}O_4$	$CDCl_3$	[182]
10-4-188	2-hydroxy-9(10→20)*abeo*-abieta-1,5,8,10(20),13-pentaene-3,7,11,12-tetraone	$C_{20}H_{18}O_5$	$CDCl_3$	[182]
10-4-189	3,7-dioxo-9(10→20)*abeo*-12-norabieta-1,5,8,10(20),13-pentaene-11,13-lactone	$C_{19}H_{18}O_4$	$CDCl_3$	[182]
10-4-190	19(*R*)-acetoxy-19-deoxoicetexone	$C_{22}H_{26}O_6$	$CDCl_3$	[247]
10-4-191	5-*epi*-icetexone	$C_{20}H_{22}O_5$	$CDCl_3$	[248]
10-4-192	19-deoxyicetexone	$C_{20}H_{24}O_4$	$CDCl_3$	[249]
10-4-193	19-deoxyisoicetexone	$C_{20}H_{24}O_4$	$CDCl_3$	[249]
10-4-194	7,20-dihydroanastomosine	$C_{20}H_{22}O_5$	$CDCl_3$	[249]
10-4-195	anastomosine	$C_{20}H_{20}O_5$	$CDCl_3$	[250]
10-4-196	heudelotinone	$C_{18}H_{20}O_2$	$CDCl_3$-CD_3OD	[251]
10-4-197	faveline	$C_{18}H_{22}O_2$	$CDCl_3$	[252]
10-4-198	deoxofaveline	$C_{18}H_{24}O$	$CDCl_3$	[252]

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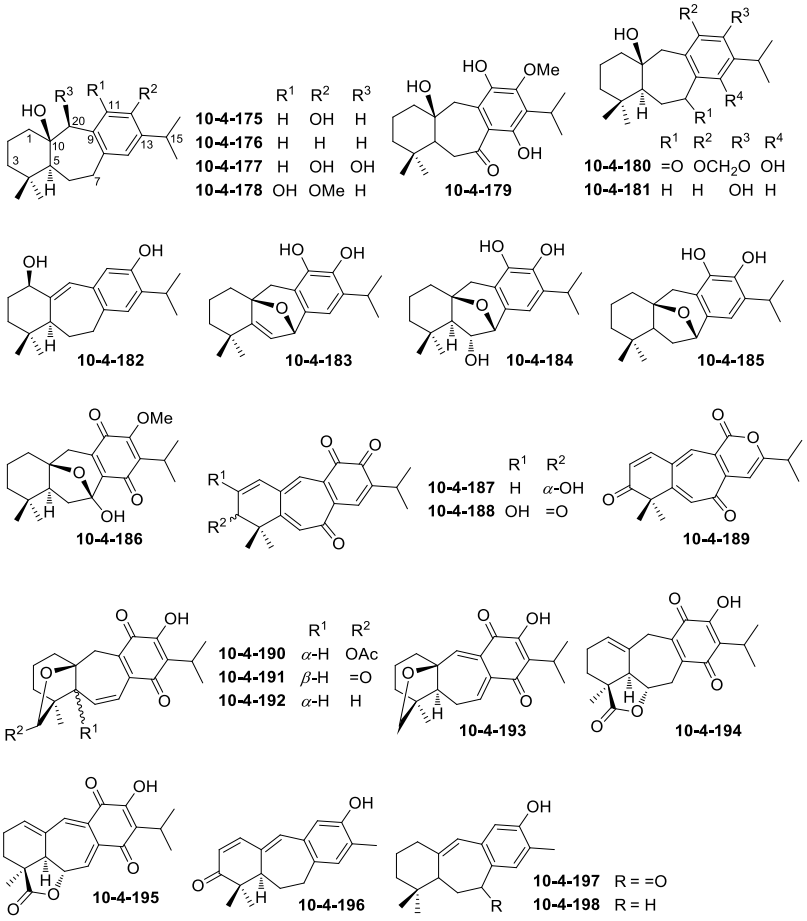

Table 10-4-64: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-175**~**10-4-178** and **10-4-181**.

H	10-4-175	10-4-176	10-4-177	10-4-178	10-4-181
5	–	–	–	–	1.56 dd(3.2, 14)
6	–	–	–	–	1.29 m, 2.05 m
7	2.70 m	2.76 m	2.46 m	2.72 m	2.67 m, 2.75 m
9			7.20 s		
11	6.77 s	6.94 s		5.61 br s(OH)	6.73 s
12		6.94 s	6.81 s		
14	6.87 s	6.96 s		6.54 s	6.89 s
15	3.22 sept(7)	2.85 sept(7)	3.23 sept(7)	3.20 sept(7)	3.18 sept(6.9)
16	1.19 d(7)	1.23 d(7)	1.19 d(7)	1.24 d(7)	1.18 d(6.9)
17	1.20 d(7)	1.23 d(7)	1.19 d(7)	1.20 d(7)	1.19 d(6.9)

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Table 10-4-64 (continued)

H	10-4-175	10-4-176	10-4-177	10-4-178	10-4-181
18	0.91 s	0.88 s	0.86 s	0.92 s	0.89 s
19	0.93 s	0.92 s	0.89 s	0.89 s	0.92 s
20	2.86 ABq(14)	2.77 ABq(14)	4.37 br s	2.51 d(14), 3.24 d(14)	2.59 d(13.9), 3.03 d(13.9)
OMe				3 74 s	

Table 10-4-65: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-179**, **10-4-180**, and **10-4-182**~**10-4-184**.

H	10-4-179	10-4-180	10-4-182	10-4-183	10-4-184
1	*α* 1.19 td(4.2, 14.7)	*α* 1.54 dd(4.3, 14)	3.86 m	–	–
	β 1.87 dt(4.2, 14.7)	*β* 1.73 br d(14)			
2		*α* 1.56 dd(14, 4)	–	–	–
		β 1.87 qt(3.4, 13.7)			
3		*α* 1.14 td(2.9, 13.8)	–	–	–
		β 1.45 br d(13.7)			
5	1.38 d(10.2)	1.43 d(9.5)	–		
6	*α* 2.63 d(18.4)	*α* 2.62 d(17.7)	–	6.04 dd(0.8, 2.1)	4.30 t(6.2)
	β 3.01 dd(10.2, 18.4)	*β* 3.00 dd(9.8, 17.7)			
7			2.50 m	5.07 d(2.1)	4.72 d(6.2)
10	1.73 s(OH)				
11	5.35 s(OH)		6.73 s		
14	12.27 s(OH)		6.76 s	6.43 s	6.54 s
15	3.35 sept(6.8)	3.40 sept(7.0)	3 24 sept(7)	3.08 sept(6.8)	3.12 sept(6.8)
16	1.41 d(6.8)	1.30 d(7.0)	1.20 d(7)	1.24 d(6.8)	1.24 d(6.8)
17	1.38 d(6.8)	1.28 d(7.4)	1.22 d(7)	1.30 d(6.8)	1.23 d(6.8)
18	0.82 s	0.86 s	0.88 s	1.02 s	1.03 s
19	0.97 s	1.00 s	0.54 s	1.12 s	1.01 s
20	2.62 d(14)	3.02 d(14.3)	6.52 br s	2.65 d(16.5)	2.43 d(16)
	3.36 d(14)	2.74 d(14.1)		2.88 d(16.5)	2.76 d(16)
OCH_2O		5.92 s, 5.94 s			
OMe	3.79 s				
OH		1.24 br s, 13.43 s		5.12 br s, 5.35 br s	5.2 br s, 5.25 br s

Table 10-4-66: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-185**~**10-4-189**.

H	10-4-185	10-4-186	10-4-187	10-4-188	10-4-189
1	*α* 1.77 m, *β* 1.98 m	1.60 (ov)	6.54 br d(9.5)	7.56 s	7.31 d(9.9)
2	1.58 m, 1.77 m	*α* 1.73 (ov), *β* 2.03 (ov)	6.29 dd(5.1, 9.5)		6.20 d(9.9)

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Table 10-4-66 (continued)

H	10-4-185	10-4-186	10-4-187	10-4-188	10-4-189
3	1.14 m, 1.50 m	*α* 1.15 dd(5.8, 11.3) *β* 1.59 (ov)	4.03 br d(5.1) 2.03 br s(OH)		
5	1.79 d(7)	1.71 t(8.2)			
6	*α* 1.87dd(7, 12) *β* 2.10 dt(7, 12)	*α* 2.30 dd(8.6, 12.8) *β* 2.04 dd(7.8, 12.8)	7.43 s	7.54 s	7.15 s
7	4.83 d(6.7)	5.99 s(OH)			
14	6.42 s		7.63 d(1.7)	7.70 d(1.7)	6.82 s
15	3.09 sept(7)	3.23 sept(7.0)	2.72 sept d(1.7, 7.0)	2.79 sept d(1.7, 7.0)	2.86 sept(7.0)
16	1.20 d(7)	1.18 d(7.3)	1.17 d(7.0)	1.22 d(7.0)	1.32 d(7.0)
17	1.21 d(7)	1.18 d(7.0)	1.19 d(7.0)	1.22 d(7.0)	1.32 d(7.0)
18	0.93 s	0.95 s	1.43 s	1.61 s	1.49 s
19	0.82 s	0.86 s	1.24 s	1.61 s	1.49 s
20	*α* 2.37 d(16), *β* 2.71 d(16)	2.26 d(19.6), 2.55 d(19.6)	6.98 s	7.33 s	7.91 s
OMe		3.98 s			

Table 10-4-67: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-190**~**10-4-193**.

H	10-4-190	10-4-191	10-4-192	10-4-193
5	2.20 dd(1.5, 4.5)	2.60 dd(3.8, 4.5)	2.30 dd(1.8, 4.8)	1.57 br d(9.6)
6	6.65 dd(4.5, 12.3)	6.40 dd(4.5, 12.3)	6.50 dd(4.8, 12)	*α* 1.98 m *β* 2.64 dd(9.6, 13.7)
7	6.75 dd(1.5, 12.3)	6.80 dd(3.8, 12.3)	6.80 dd(1.8, 12)	7.42 br dd(5.4, 9.6)
15	3.21 sept(7)	3.29 sept(6.8)	3.21 sept(6.9)	3.37 sept(7.0)
16	1.22 d(7)	1.20 d(6.8)	1.23 d(6.9)	1.25 d(7.0)
17	1.24 d(7)	1.20 d(6.8)	1.23 d(6.9)	1.26 d(7.0)
18	1.09 s	1.25 s	1.03 s	1.11 s
19	5.88 s		3.49 dd(1.8, 7.8) 3.69 d(7.8)	3.53 dd(2, 8) 3.79 d(8)
20	2.77 d(13.2) 2.85 d(13.2) 1.92 s(OAc)	2.81 d(14.3) 3.10 d(14.3)	*α* 2.58 d(13.8) *β* 2.98 d(13.8)	7.27 br s
OH		7.0 s	7.17 s	7.63 br s

Table 10-4-68: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-194**~**10-4-198**.

H	10-4-194	10-4-195	10-4-196	10-4-197	10-4-198
1	5.68 br d(4.0)	6.65 t(4)	6.99 d(9.8)	2.29 m, 2.38 m	2.16 m, 2.36 br d(14.0)
2			5.73 d(9.8)	1.65 m, 1.74 m	1.62 m
3		1.85 dt(3, 13)		1.45 m	1.40 m
5	2.36 br d(10.5)	2.60 d(11)	2.76 ddd(1.0, 5.0, 12.5)	2.36 m	2.27 m

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Table 10-4-68 (continued)

H	10-4-194	10-4-195	10-4-196	10-4-197	10-4-198
6	3.81 dt(2, 10.5)	4.73 dd(3, 11)	ax 1.78 ddt(2.5, 8.4, 12.8) eq 2.28 dddd(5.0, 9.1, 12.8)	3.02 dd(5.5, 12.5) 3.05 dd(5.0, 12.5)	1.47 br ddd(8.0, 13.0, 13.0) 2.22 m
7	*α* 2.46 ddd(2, 10.5, 15)	7.50 dd(0.4, 3)	ax 2.88 ddd(2.5, 9.1, 14.6)		2.56 dd(10.0, 13.0) 2.64 dd(8.0, 13.0)
	β 4.11 dd(2, 15)		eq 2.68 ddd(2.0, 8.4, 14.6)		
11			6.61 br s	6.61 s	6.54 s
14			6.74 br s	7.63 s	6.76 s
15	3.23 sept(7)	3.38 sept(7)	2.09 s	2.22 s	2.18 s
16	1.23 d(7)	1.25 d(7)			
17	1.23 d(7)	1.25 d(7)			
18	1.26 s	1.34 s	0.77 s	0.75 s	0.69 s
19			1.07 s	1.11 s	0.97 s
20	*α* 2.73 br d(15) *β* 4.10 d(15)	7.74 s	6.61 br s	6.19 s	6.24 s
OH	7.06 s	7.74 s	7.34 br s		

Table 10-4-69: Compounds, MFs, and test solvents of abietane-type diterpenoids **10-4-199**~**10-4-219**.

No.	Compounds	MFs	Test solvents	References
10-4-199	triptonide	$C_{20}H_{22}O_6$	$CDCl_3$	[253]
10-4-200	triptolide	$C_{20}H_{24}O_6$	$CDCl_3$	[254]
10-4-201	tripdiolide	$C_{20}H_{24}O_7$	$CDCl_3$	[255]
10-4-202	2-epitripdiolide	$C_{20}H_{24}O_7$	$CDCl_3$	[255]
10-4-203	16-hydroxytriptolide	$C_{20}H_{24}O_7$	$CDCl_3$	[255]
10-4-204	triptolidenol	$C_{20}H_{24}O_7$	$CDCl_3$	[256]
10-4-205	tripdioltonide	$C_{20}H_{24}O_6$	C_5D_5N	[253]
10-4-206	13,14-epoxide-9,11,12-trihydroxytriptolide	$C_{20}H_{26}O_7$	DMSO-d_6	[253]
10-4-207	triptriolide	$C_{20}H_{26}O_7$	DMSO-d_6	[257]
10-4-208	tripchlorolide	$C_{20}H_{25}ClO_6$	$CDCl_3$	[258]
10-4-209	neotriptetraolide	$C_{20}H_{26}O_8$	DMSO-d_6	[259]
10-4-210	triptoquinone A	$C_{20}H_{24}O_4$	$CDCl_3$	[260]
10-4-211	triptoquinone	$C_{20}H_{22}O_4$	$CDCl_3$	[261]
10-4-212	5*a*, 14-dihydroxybutenolide	$C_{20}H_{24}O_4$	$CDCl_3$	[261]
10-4-213	hypoglic acid	$C_{21}H_{28}O_4$	$CDCl_3$	[262]
10-4-214	isoneotriptophenolide	$C_{21}H_{26}O_4$	$CDCl_3$	[257]
10-4-215	triptophenolide	$C_{20}H_{24}O_3$	–	[263]
10-4-216	19-hydroxyteuvincenone F	$C_{20}H_{18}O_6$	CD_3OD	[264]
10-4-217	uncinatone	$C_{20}H_{24}O_4$	–	[265]
10-4-218	teuvincenone E	$C_{20}H_{20}O_5$	$CDCl_3$	[266]
10-4-219	16(*S*)-plectrinone A	$C_{20}H_{22}O_6$	$CDCl_3$	[266]

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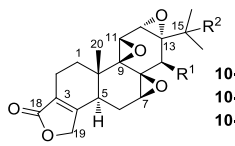
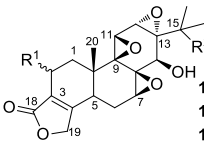
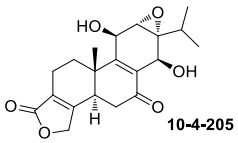


	R^1	R^2
10-4-199	=O	H
10-4-200	OH	H
10-4-204	OH	OH



	R^1	R^2
10-4-201	β-OH	Me
10-4-202	α-OH	Me
10-4-203	H	CH_2OH



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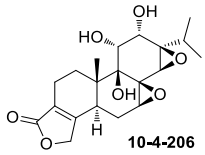
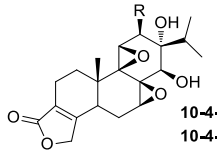
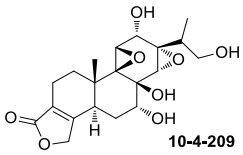


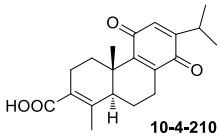
10-4-206



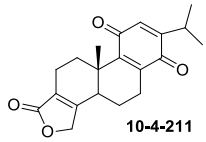
10-4-207 R = OH
10-4-208 R = Cl



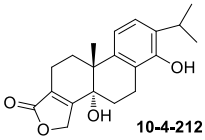
10-4-209



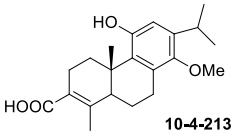
10-4-210



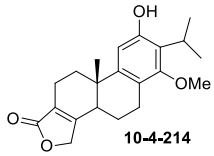
10-4-211



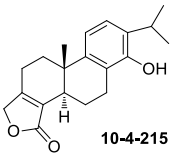
10-4-212



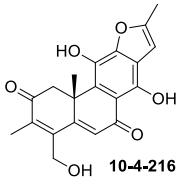
10-4-213



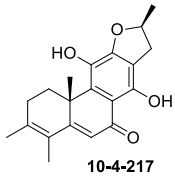
10-4-214



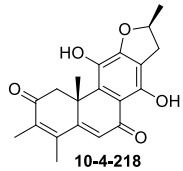
10-4-215



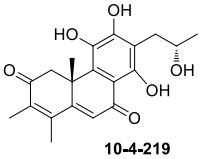
10-4-216



10-4-217



10-4-218



10-4-219

Table 10-4-70: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-199**~**10-4-203**.

H	10-4-199	10-4-200	10-4-201	10-4-202	10-4-203
1			1.71 m, 1.83 m	1.20 m, 1.94 m	1.28 m
2			4.65 t($W_{1/2}$ = 13.6)	4.59 t($W_{1/2}$ = 27.2)	1.98 m, 2.09 m
5			2.83 br d	2.83 br d	2.60 br d
6			2.20 dd(15, 5)	2.18 dd(15, 5)	1.83 dd(15, 5)
			2.50 dd(15, 5)	2.22 dd(15, 5)	2.21 dd(15, 5)

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Table 10-4-70 (continued)

H	10-4-199	10-4-200	10-4-201	10-4-202	10-4-203
7	3.46 d(5)	3.46 d(5)	3.52 d(5)	3.38 d	3.37 d(5)
11	4.00 d(3)	4.00 d(3)	4.16 d(3)	3.53 d(3)	3.92 d(3)
12	3.60 dd(3, 1)	3.60 dd(3, 1)	3.74 d(3)	3.92 d(3)	3.66 d(3)
14	2.7 d(11, OH)	3.52 dd(11, 1)	3.54 s	3.41 s	3.35 s
15			2.34 m	2.26 m	2,17 m
16	0.97 d(7)	0.97 d(7)	1.11 d	1.10 d	3.40 dd(11, 6) 3.69 dd(11, 8)
17	1.10 d(7)	1.10 d(7)	0.98 d	089 d	0.98 d(7)
19	4.78 m	4.78 m	5.04 m	4.73 m	5.30 m
20	1.22 s	1.22 s	1.10 s	1.18 s	0.96 s
OH			3.12 s(2-OH) 2.70 s(14-OH)	3.12 s(2-OH) 2.72 s(14-OH)	3.93 s(14-OH) 4.68 s(16-OH)

Table 10-4-71: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-204**~**10-4-209**.

H	10-4-204	10-4-205	10-4-206	10-4-207	10-4-208	10-4-209
1	–	1.58 m, 2.55 m	1.08 sept(6.62), 1.48 m	*α* 1.26 m, *β* 1.36 m	–	1.30 m
2	–	2.40 m, 2.43 m	2.15 br(18), 2.02 m	*α* 2.14 m, *β* 1.96 m	–	*α* 2.12 m, *β* 1.98 m
5	–	3.05 d(13.5)	2.85 br (14)	2.68 br d(7)	–	3.01 br d
6	–	2.59 d(9.52) 2.72 t(6.91)	2.02 m 1.65 t(14)	*α* 2.14 m *β* 1.85 t(14)	–	*α* 2.02 m *β* 1.60 br d(14, 2)
7	3.38 d(6.0)		3.6 d(8)	3.46 d(5)	3.39 d(6)	3.77 dd(4, 2)
11	3.92 d(3.0)	5.13 d(3)	5.02 d(4)	3.70 d(5)	3.86 d(5)	3.22 d(1.5)
12	3.59 m	3.72 d(3)	3.76 d(4)	3.82 d(5)	4.29 d(5)	4.14 dd(9, 1.5)
14	3.54 dd(15.0, 11.0)	5.49 s	3.86 s	2.94 s	2.95 d(1)	2.88 s
15		2.65 br m	2.58 br m	2.26 sept(6.9)		2.15 m
16	1.24 s	0.96 d(6.96)	1.32 d(6.5)	0.76 d(6.9)	0.78 d(7)	3.26 m, 3.35 m
17	1.32 s	1.18 d(6.96)	1.38 d(6.5)	1.88 d(6.9)	0.90 d(7)	0.87 d(7)
19	4.70 d(15.0)	4.76 m	4.62 m, 4.70 m	4.83ABq(17.7)	4.82 m	4.81 m
20	1.10 s	1.26 s	1.12 s	0.94 s	0.96 s	1.04 s
OH	2.70 s(14-OH)		3.8 s(9-OH)	4.32 br s(12-OH)		5.47 d(4, 7-OH)
	5.20 s(15-OH)		4.17 d(5.2, 11-OH) 5.23 d(7.3, 14-OH)	4.60 br s(13-OH)		5.39 s(8-OH) 4.67 d(9, 12-OH) 4.62 t(16-OH)

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Table 10-4-72: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-210**~**10-4-215**.

H	10-4-210	10-4-211	10-4-212	10-4-213	10-4-214	10-4-215
1	1.41 m, 2.77 m	1.47 m, 3.10 m	*α* 1.98~2.15 m *β* 2.31 ddd(13, 6)	2.36~2.40 m	–	1.61 m
2	2.42~2.63 m	2.39 m	*α* 2.55 br d(16) *β* 2.39 m	2.61~2.66 m	–	2.44 m
5	2.22~2.26 m	2.60 br d(10)		2.20 m	–	
6	1.56 m 2.22~2.26 m	1.69 m, 1.87 m	*α* 1.98~2.15 m *β* 2.23 ddd(14, 9, 9)	1.57~1.65 m	–	1.95 m
7	2.39 ddd(20.5, 11.2, 6.8) 2.80 ddd(20.5, 6.4, 1.0)	2.48 ddd(12, 8, 4) 2.78 dd(12, 8)	2.80~3.02 m	3.01~3.11 m	–	2.83 t(6)
11			6.91 d(8)		6.47 s	6.95 d(8)
12	6.38 d(1.0)	6.40 s	7.08 d(8)	6.39 s		7.03 d(8)
15	3.01 sept d (6.8, 1.0)	3.00 sept d (7, 1)	3.08 sept (7)	3.24 m	3.22 sept (6.9)	3.05 m
16	1.12 d(6.8)	1.10 d(7)	1.25 d(7)	1.16 d(6.84)	1.16 d(6.9)	1.24 d(6.8)
17	1.12 d(6.8)	1.10 d(7)	1.27 d(7)	1.16 d(6.84)	1.16 d(6.9)	1.24 d(6.8)
18						4.79 m
19	2.12 s	4.72 br d(16) 4.81 br d(16)	4.90 ABq(17)	2.17 s	4.80 m	
20	1.18 s	1.14 s	1.09 s	1.18 s	1.14 s	1.01 s
OMe				3.69 s	3.67 s	
14-OH			4.80 s			

Table 10-4-73: ^{1}H NMR spectroscopic data of abietane-type diterpenoids **10-4-216**~**10-4-219**.

H	10-4-216	10-4-217	10-4-218	10-4-219
1	2.54 d(17.2), 4.37 d(17.1)	*α* 1.57 m *β* 3.23 m	*α* 2.43 d(17.1) *β* 4.17 d(17.1)	*α* 2.43 d(17.1) *β* 4.19 d(17.1)
2		*α* 2.21 m, *β* 2.51 m		
5		6.22 s		
6	6.80 s		6.53 s	6.53 s
15	6.58 s	*α* 3.40 dd(15.15, 7.4) *β* 2.89 dd(15.15, 8.8)	*α* 3.42 dd(15.2, 7.4) *β* 2.90 dd(15.2, 8.8)	*α* 3.07 m *β* 2.87 m
16		5.12 ddq(8.8, 7.4, 6.4)	5.17 ddq(8.8, 7.4, 6.4)	4.33 m
17	2.48 s	1.52 d(6.4)	1.54 d(6.4)	1.33 d(6.4)
18	2.05 s	1.91 s	2.01 q	1.99 q
19	4.59 d(12.7), 4.70 d(12.8)	1.88 s	2.22 q	2.21 q
20	1.75 s	1.50 s	1.63 d	1.63 d
11-OH		4.88 s	5.11 br s	
14-OH		13.73 s	13.34 s	13.58 s

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10.5 Pimarane- and isopimarane-type diterpenoids

Table 10-5-1: Compounds, MFs, and test solvents of pimarane- and isopimarane-type diterpenoids **10-5-1**~**10-5-12**.

No.	Compounds	MFs	Test solvents	References
10-5-1	sandaracopimaradien-1α,9α-diol	$C_{20}H_{32}O_2$	$CDCl_3$	[267]
10-5-2	6β-acetoxysandaracopimaradien-1α,9α-diol	$C_{22}H_{34}O_4$	$CDCl_3$	[267]
10-5-3	sphaeropsidin C	$C_{20}H_{28}O_4$	$CDCl_3$	[268]
10-5-4	methyl ester of sphaeropsidin C	$C_{21}H_{30}O_4$	$CDCl_3$	[269]
10-5-5	sandaracopimara-8(14),15-dien-18-yl formate	$C_{21}H_{32}O_2$	$CDCl_3$	[270]
10-5-6	sandaracopimara-8(14),15-dien-18-yl hexadecanoate	$C_{36}H_{62}O_2$	$CDCl_3$	[270]
10-5-7	18-hydroxy-sandaracopimara-8(14),15-dien-7-one	$C_{20}H_{30}O_2$	$CDCl_3$	[270]
10-5-8	7β-hydroxyisopimara-8(14),15-dien-1-one	$C_{20}H_{30}O_2$	$CDCl_3$	[271]
10-5-9	7β-acetoxyisopimara-8(14),15-dien-1-one	$C_{22}H_{32}O_3$	$CDCl_3$	[271]
10-5-10	(1*R*,2*R*)-*ent*-1,2-dihydroxyisopimara-8(14),15-diene	$C_{20}H_{32}O_2$	$CDCl_3$	[272]
10-5-11	(2*R*)-*ent*-2-hydroxyisopimara-8(14),15-diene	$C_{20}H_{32}O$	$CDCl_3$	[272]
10-5-12	3α,12α-dihydroxy-*ent*-8(14),15-isopimaradien-18-al	$C_{20}H_{30}O_3$	$CDCl_3$	[273]

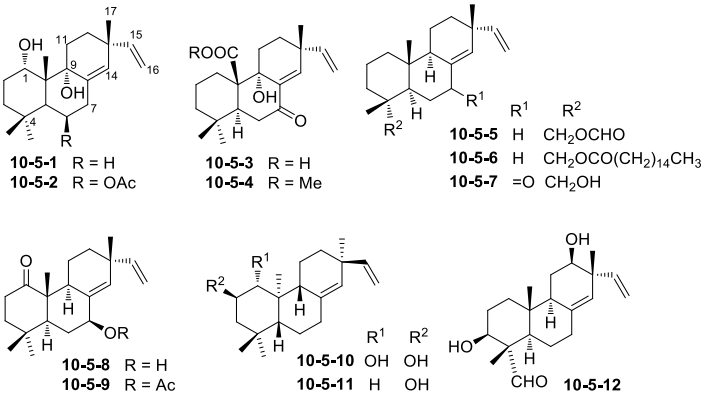

Table 10-5-2: ^{1}H NMR spectroscopic data of pimarane- and isopimarane-type diterpenoids **10-5-1**~**10-5-4**.

H	10-5-1	10-5-2	10-5-3	10-5-4
1	4.03 t(1.5, 1.5)	4.01 m	2.18 br d(13.1)	2.30 br d(12.8)
			1.57 m	1.60 m
2	1.40~1.90 m	1.3~2.2 m	1.84 m, 1.58 m	1.75 m, 1.60 m
3	α 1.40~1.90 m	1.3~2.2 m	1.86 m	1.88 dt(13.4, 3.5)
	β 1.15 dt(14, 3, 3)		1.63 dd(14.7, 11.6)	1.60 m

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Table 10-5-2 (continued)

H	10-5-1	10-5-2	10-5-3	10-5-4
5	2.24 dd(14, 3)	2.41 d(2)	2.33 dd(12.8, 6.6)	2.40 dd(12.7, 6.6)
6	*α* 1.40~1.90 m	5.40 m	2.69 dd(18.7, 12.8)	2.70 dd(18.6, 12.7)
	β 1.39 qd(14, 14, 14, 3.7)	2.0 s(OAc)	2.46 dd(18.7, 6.6)	2.53 dd(18.6, 6.6)
7	*α* 2.46 td(14, 14, 3)	*α* 2.76 ddd(15, 3.5, 2)		
	β 2.08 dt(14, 3, 3)	*β* 1.3~2.2 m		
11	*α* 1.40~1.90 m	1.3~2.2 m	1.29 td(13.4, 4.0)	1.30 m
	β 2.05 td(14, 14, 3.5)		1.42 m	1.60 m
12	1.40~1.90 m	1.3~2.2 m	1.50 m, 1.80 m	1.60 m, 1.75 m
14	5.29 br s	5.30 br s	6.58 br s	6.69 d(1.6)
15	5.82 dd(10, 18)	5.80 dd(10, 18)	5.78 dd(17.5, 10.7)	5.82 dd(18.2, 10.7)
16	4.94 dd(10, 1.5)	4.90 dd(10, 1.5)	5.00 d(17.5)	5.03 dd(18.2, 1.5)
	4.98 dd(18, 1.5)	4.94 dd(18, 1.5)	4.95 d(10.7)	5.00 dd(10.7, 1.5)
17	1.04 s	1.06 s	0.94 s	0.98 s
18	0.91 s	1.13 s	0.82 s	0.88 s
19	0.86 s	1.04 s	0.75 s	0.70 s
20	0.99 s	1.05 s		3.58 s(COOMe)
OH	3.5 s, 4.06 s	4.31 s		

Table 10-5-3: ^{1}H NMR spectroscopic data of pimarane- and isopimarane-type diterpenoids **10-5-5**~**10-5-8**.

H	10-5-5	10-5-6	10-5-7	10-5-8
1	0.97~1.05 m	1.00~1.06 m	1.05~1.15 m	
	1.70~1.75 m	1.71~1.76 m	1.77~1.81 m	
2	1.48~1.54 m	1.31~1.40 m	1.39~1.66 m	*α* 2.17 dt(12.5, 5.0)
		1.43~1.54 m		*β* 2.79 ddd(12.5, 12.0, 5.0)
3	1.33~1.48 m	1.31~1.40 m	1.34~1.39 m	*α* 1.75 m
				β 1.83 t(5.0)
5	1.29~1.32 m	1.28~1.32 m	1.86 dd(5.2, 13.6)	2.06 m
6	1.33~1.48 m	1.31~1.40 m	2.21 dd(13.6, 18.6)	*α* 1.77 t(2.5)
		1.43~1.54 m	2.49 dd(5.2, 18.6)	*β* 1.70 m
7	2.02~2.09 m	2.00~2.04 m		4.20 t(2.5)
	2.21~2.27 m	2.24 br d(12.6)		
9	1.74~1.78 m	1.71~1.76 m	2.10 m	2.70 td(7.0, 2.0)
11	1.54~1.59 m	1.54~1.65 m	1.39~1.66 m	*α* 1.48 m
			1.70~1.77 m	*β* 2.10 m
12	1.33~1.48 m	1.31~1.40 m	1.39~1.66 m	1.44 m
		1.43~1.54 m	1.64~1.67 m	
14	5.22 br s	5.22 br s	6.72 br s	5.59 d(2.0)
15	5.77 dd(10.6, 17.4)	5.77 dd(10.5, 17.4)	5.81 dd(10.6, 17.5)	5.77 dd(17.5, 10.0)
16	4.88 dd(1.5, 10.6)	4.88 dd(1.5, 10.5)	4.98 dd(0.9, 10.6)	4.92 dd(17.5, 1.5)
	4.91 dd(1.5, 17.4)	4.91 dd(1.5, 17.4)	5.01 dd(0.9, 17.5)	4.96 dd(10.0, 1.5)

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Table 10-5-3 (continued)

H	10-5-5	10-5-6	10-5-7	10-5-8
17	1.04 s	1.04 s	1.10 s	1.04 s
18	3.75 d(10.9)	3.62 d(10.9)	3.09 d(10.9)	0.96 s
	3.99 d(10.9)	3.88 d(10.9)	3.37 d(10.9)	
19	0.89 s	0.87 s	0.84 s	1.08 s
20	0.84 s	0.84 s	0.87 s	1.13 s
1′	8.11 s			
2′		2.32 t(7.4)		
3′		1.54~1.65 m		
4′ ~ 15′		1.25 m		
16′		0.80 t(6.7)		

Table 10-5-4: ^{1}H NMR spectroscopic data of pimarane- and isopimarane-type diterpenoids **10-5-9**~**10-5-12**.

H	10-5-9	10-5-10	10-5-11	10-5-12
1		3.23 d(9.3)	*α* 2.02~2.08 m	1.73~1.83 m
			β 0.99 t(11.8)	1.28 ddd
2	*α* 2.16 ddd(12.0, 4.5, 4.0)	3.63 ddd(12.4, 9.3, 4.4)	3.84 dddd(11.5, 11.5, 4.1, 4.1)	1.73~1.83 m
	β 2.83 ddd(12.0, 5.5, 1.0)			1.60~1.70 m
3	*α* 1.75 m	*α* 1.75 dd(12.6, 4.4)	*α* 1.75~1.79 m	3.81 dd(11.6, 4.1)
	β 1.84 m	*β* 1.31 t(12.4)	*β* 1.16 t(12.1)	
5	1.89 m	1.11 dd(12.4, 2.5)	1.02 dd(12.4, 2.5)	1.47~1.59 m
6	*α* 1.82 m	*α* 1.41 dddd(12.9, 12.9, 12.9, 4.7)	*α* 1.28 dddd(12.9, 12.9, 12.9, 4.7)	1.05~1.11 m(ov)
	β 1.75 m			
		β 1.59 d-quint (12.9, 2.2)	*β* 1.60 m	
7	5.31 t(3.0)	*α* 2.27 ddd(14.3, 4.4, 1.9)	*α* 2.28 ddd(14.3, 4.4, 2.2)	2.25 m
	2.00 s(OAc)	*β* 2.03 ddd(14.3, 14.3, 5.8)	*β* 2.02~2.08 m	2.00~2.05 m
9	2.60 ddd(7.0, 6.5, 2.0)	1.98 br t(8.5)	1.75~1.79 m	2.00~2.05 m
11	*α* 1.50 m	1.83~1.94 m	*α* 1.54 m	1.73~1.83 m
	β 2.05 m		*β* 1.63 m	1.47~1.59 m
12	1.40 m	*α* 1.50 dt-like(12.6, 3.3)	*α* 1.48 m	3.57 dd(12.2, 4.1)
		β 1.35 ddd(12.6, 12.6, 4.1)	*β* 1.37 ddd(12.4, 12.4, 3.6)	
14	5.73 d(2.0)	5.29 br s	5.25 s	5.09~5.17(ov)

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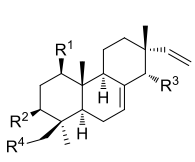
Table 10-5-4 (continued)

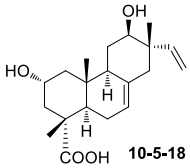
H	10-5-9	10-5-10	10-5-11	10-5-12
15	5.71 dd(17.5, 11.5)	5.78 dd(17.6, 10.7)	5.78 dd(17.3, 10.7)	5.76 dd(17.5, 10.7)
16	4.88 dd(17.5, 1.5)	4.88 dd(10.7, 1.4)	4.89 dd(10.7, 1.4)	5.09~5.17(ov)
	4.92 dd(11.5, 1.5)	4.92 dd(17.6, 1.4)	4.92 dd(17.3, 1.4)	
17	1.04 s	1.06 s	1.04 s	1.06 s
18	0.90 s	0.91 s	0.90 s	1.11 s
19	1.08 s	0.93 s	0.95 s	9.41 s
20	1.16 s	0.88 s	0.84 s	0.87 s

Table 10-5-5: Compounds, MFs, and test solvents of pimarane- and isopimarane-type diterpenoids **10-5-13**~**10-5-19**.

No.	Compounds	MFs	Test solvents	References
10-5-13	isopimara-7,15-dien-3β-ol	$C_{20}H_{32}O$	$CDCl_3$	[274]
10-5-14	3β-acetoxy-7,15-isopimaradien-19-ol	$C_{22}H_{34}O_3$	$CDCl_3$	[275]
10-5-15	19-acetoxy-7,15-isopimaradien-3β-ol	$C_{22}H_{34}O_3$	$CDCl_3$	[275]
10-5-16	14α-hydroxyisopimara-7,15-dien-1-one	$C_{20}H_{30}O_2$	$CDCl_3$	[271]
10-5-17	1β,14α-dihydroxyisopimara-7,15-diene	$C_{20}H_{32}O_2$	$CDCl_3$	[271]
10-5-18	wulingzhic acid B	$C_{20}H_{30}O_4$	CD_3OD	[276]
10-5-19	1-oxo-12β-hydroxy-13-*epi*-*ent*-pimara-9(11),15-dien-19-oic acid	$C_{20}H_{28}O_4$	$CDCl_3$	[277]



	R^1	R^2	R^3	R^4
10-5-13	H	OH	H	H
10-5-14	H	OAc	H	OH
10-5-15	H	OH	H	OAc
10-5-16	=O	H	OH	H
10-5-17	OH	H	OH	H



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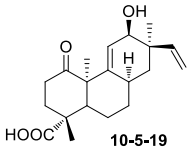

10-5-19

Table 10-5-6: ^{1}H NMR spectroscopic data of pimarane- and isopimarane-type diterpenoids **10-5-13**~**10-5-16**.

H	10-5-13	10-5-14	10-5-15	10-5-16
1	α 1.25 m	α 1.26 td(13.3, 4.2)	α 1.17 td(13.4, 4.1)	
	β 1.84 m	β 1.88 m(ov)	β 1.88 dt(13.4, 3.4)	
2	1.62 m	1.72 m(ov)	1.72 m(ov)	α 2.15 dt(12.5, 5.0)
			1.64 m(ov)	β 2.75 dd(12.5, 5.0)
3	3.26 dd(4.7, 10.9)	4.65 dd(10.1, 4.9)	3.30 dd(11.7, 4.2)	α 1.66 dt(13.0, 5.0)
				β 1.77 dd(13.0, 5.0)

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Table 10-5-6 (continued)

H	10-5-13	10-5-14	10-5-15	10-5-16
5	1.16 dd(4.9, 11.9)	1.36 m(ov)	1.31 m(ov)	1.61 m
6	1.97 m	1.97 m(ov)	2.07 m(ov)	α 2.01 m, β 2.15 m
7	5.37 br d(3.5)	5.34 t(2.3)	5.34 br t(2.3)	5.70 dd(4.0, 2.0)
9	1.63 m	1.63 m(ov)	1.62 m(ov)	2.77 m
11	α 1.57 m, β 1.39 m	1.55 m(ov), 1.33 m(ov)	1.55 m(ov), 1.32 m(ov)	α 2.03 m, β 1.30 m
12	α 1.36 m, β 1.53 m	1.46 m(ov), 1.33 m(ov)	1.46 m(ov), 1.32 m(ov)	α 2.06 m, β 1.30 m
14	1.95 m	1.92 m(ov)	1.90 m(ov)	3.64 s
15	5.80 dd(10.8, 17.6)	5.78 dd(17.6, 10.8)	5.78 dd(17.6, 10.8)	5.88 dd(18.0, 11.0)
16	4.87 dd(1.6, 10.8)	4.91 dd(17.6, 1.3)	4.91 dd(17.6, 1.3)	5.12 dd(18.0, 1.5)
	4.93 dd(1.6, 17.6)	4.86 dd(10.8, 1.3)	4.85 dd(10.8, 1.3)	5.16 dd(11.0, 15)
17	0.86 s	0.84 s	0.84 s	0.89 s
18	1.00 s	1.06 s	1.12 s	0.95 s
19	0.90 s	4.27 d(11.7)	4.42 d(11.6)	1.14 s
		3.51 d(11.7)	4.27 br d(11.6)	
20	0.87 s	0.81 s	0.82 s	1.15 s
OAc		2.08 s	2.05 s	
OH		2.14 d(7.0, OH)		

Table 10-5-7: ^{1}H NMR spectroscopic data of pimarane- and isopimarane-type diterpenoids **10-5-17**~**10-5-19**.

H	10-5-17	10-5-18	10-5-19
1	3.72 m	α 1.08 t(11.9), β 2.10 m	
2	α 1.68 m, β 1.19 m	3.82 dddd(11.7, 11.7, 4.3, 4.3)	α 2.66 td(13.5, 5.8)
			β 2.43 dt(13.5, 4.2)
3	α 1.59 m, β 1.86 m	α 1.68 t(11.5), β 1.89 m	α 1.78 ddd(13.5, 5.8, 4.2)
			β 2.54 td(13.5, 4.2)
5	1.53 dd(12.0, 5.0)	2.05 m	–
6	α 2.03 m, β 1.96 m	α 1.76 m, β 1.94 m	α –, β 1.96 m
7	5.69 dd(3.0, 2.0)	5.37 br d(5.1)	1.19 m
9	2.80 dd(6.0, 2.5)	2.04 m	
11	α 1.60 m, β 1.40 m	α 1.78 m, β 1.43 m	5.60 d(5.9)
12	α 2.00 m, β 1.33 m	3.52 dd(11.6, 5.6)	3.69 d(5.9)
14	3.64 s	1.93 m	
15	5.91 dd(17.5, 10.5)	5.89 dd(17.5, 10.8)	5.87 dd(17.7, 10.9)
16	5.09 dd(17.5, 1.5)	5.02 dd(17.5, 1.4)	5.09 dd(17.7, 1.0)
	5.13 dd(10.5, 1.5)	5.00 dd(10.8, 1.4)	5.16 dd(10.9, 1.0)
17	0.89 s	0.84 s	0.92 s
18	0.91 s	1.27 s	1.37 s
19	0.96 s		
20	0.87 s	0.98 s	1.27 s

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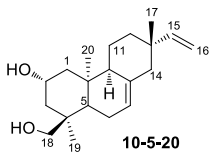
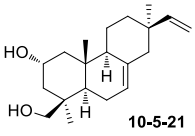
Table 10-5-8: Compounds, MFs, and test solvents of pimarane- and isopimarane-type diterpenoids **10-5-20**~**10-5-32**.

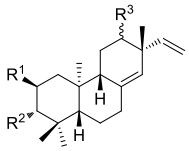
No.	Compounds	MFs	Test solvents	References
10-5-20	9-*epi*-*ent*-pimara-7,15-diene-2*α*,19-diol	$C_{20}H_{32}O_2$	$CDCl_3$	[278]
10-5-21	2*α*,19-dihydroxy-pimara-7,15-diene	$C_{20}H_{32}O_2$	$CDCl_3$	[279]
10-5-22	*ent*-pimara-8(14),15-diene-3,12-dione	$C_{20}H_{28}O_2$	$CDCl_3$	[280]
10-5-23	*ent*-3*β*-hydroxypimara-8(14),15-dien-12-one	$C_{20}H_{30}O_2$	$CDCl_3$	[280]
10-5-24	*ent*-12*β*-hydroxypimara-8(14),15-dien-3-one	$C_{20}H_{30}O_2$	$CDCl_3$	[280]
10-5-25	*ent*-3*β*,12*β*-dihydroxypimara-8(14),15-dien-2-one	$C_{20}H_{30}O_3$	$CDCl_3$	[280]
10-5-26	*ent*-3*β*,12*α*-dihydroxypimara-8(14),15-diene	$C_{20}H_{32}O_2$	$CDCl_3$	[280]
10-5-27	*ent*-pimara-15-ene-3*α*,8*α*-diol	$C_{20}H_{34}O_2$	$CDCl_3$	[281]
10-5-28	1*β*,3*α*,8*β*-trihydroxy-pimara-15-ene	$C_{20}H_{34}O_3$	$CDCl_3$	[279]
10-5-29	*ent*-3*β*,14*α*-hydroxypimara-7,9(11),15-trien-12-one	$C_{20}H_{28}O_3$	$CDCl_3$	[282]
10-5-30	*ent*-3*β*,14*α*-dihydroxypimara-7,9(11),15-triene-2,12-dione	$C_{20}H_{26}O_4$	$CDCl_3$	[280]
10-5-31	1-oxo-2*α*,9*α*-dihydroxy-13-*epi*-*ent*-pimara-11,15-dien-19-oic acid	$C_{20}H_{28}O_5$	$CDCl_3$	[277]
10-5-32	1-oxo-2*β*,9*α*-dihydroxy-13-*epi*-*ent*-pimara-11,15-dien-19-oic acid	$C_{20}H_{28}O_5$	$CDCl_3$	[277]



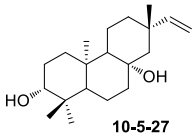
10-5-20



10-5-21



	R^1	R^2	R^3
10-5-22	H	=O	=O
10-5-23	H	OH	=O
10-5-24	H	=O	*α*-OH
10-5-25	=O	OH	*α*-OH
10-5-26	H	OH	*β*-OH



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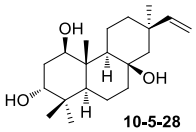

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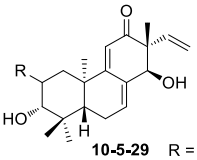
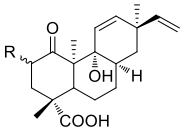


10-5-29 R = H
10-5-30 R = =O



10-5-31 R = *α*-OH
10-5-32 R = *β*-OH

Table 10-5-9: ^{1}H NMR spectroscopic data of pimarane- and isopimarane-type diterpenoids **10-5-20**~**10-5-23**.

H	10-5-20	10-5-21	10-5-22	10-5-23
1	–	*α* 2.30 m *β* 0.90 m	ax 1.47 ddd(13, 11, 5) eq 1.88 ddd(13, 5.5, 3)	ax 1.13 ddd(13.5, 3.5) eq 1.10 ddd(13.5, 4, 3.5)

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Table 10-5-9 (continued)

H	10-5-20	10-5-21	10-5-22	10-5-23
2	3.90 tt(3.8, 11.5)	3.90 tt(3.8, 11.5)	ax 2.63ddd(11, 5.5, 17)	ax 1.55 dddd(4, 12.5, 12)
			eq 2.33 ddd(5, 3, 17)	eq 1.67 dddd(3.5, 3.5, 12.5, 3.5)
3	–	*α* 2.10 m, *β* 1.20 m		3.26 ddd(12, 3.5)
5	–	1.40 d(9.2)	1.50 dd	1.05 dd
6	–	2.10 m	–	–
7	5.33 br d(5.5)	5.23 m	–	–
9	–	1.80 d(6.2)	2.28 ddd(7, 8, 1.5)	2.19 ddd(8.5, 7, 2)
11	–	*α* 1.60 m	ax 2.62 dd(7, 10)	ax 2.58 dd(8.5, 13.5)
		β 1.40 dd(7.3, 13.2)	eq 2.33 dd(8, 10)	eq 2.27 dd(7, 13.5)
12	–	*α* 1.50 m, *β* 1.20 m		
14	–	*α* 2.20 d(11.4)	5.28 dd(1.5)	5.20 dd(2)
		β 1.10 d(11.4)		
15	5.83 dd(10.7, 17.5)	5.80 dd(10.8, 17.7)	5.85 dd(10.5, 17.5)	5.82 dd(10, 17)
16	4.93 dd(1.07, 17.5)	4.90 dd(1.2, 17.7)	*cis* 5.17 dd(10.5, 1)	*cis* 5.15 dd(1, 10)
	4.89 dd(1.0, 10.7)	5.20 dd(1.2, 10.8)	*trans* 5.23 dd(17.5, 1)	*trans* 5.21 dd(1, 17)
17	0.91 s	0.89 s	1.18 s	1.16 s
18	3.74 d(10.8)	1.04 s	1.12 s	1.03 s
	3.53 d(10.8)			
19	1.00 s	*α* 3.80 d(10.8)	1.09 s	0.84 s
		β 3.40 d(10.8)		
20	1.07 s	0.86 s	1.05 s	0.84 s

Table 10-5-10: ^{1}H NMR spectroscopic data of pimarane- and isopimarane-type diterpenoids **10-5-24**~**10-5-26** and **10-5-30**.

H	10-5-24	10-5-25	10-5-26	10-5-30
1	ax 1.45 ddd(15)	ax 2.29 dd(13, 2)	ax 1.17 ddd	ax 2.66 dd(12, 1)
	eq 1.90 ddd(6)	eq 2.43 d(13)	eq 1.13 ddd	eq 2.71 d(12)
2	ax 2.65 ddd(15, 6, 6)		ax 1.51 dddd	
	eq 2.30 ddd(6)		eq 1.62 dddd	
3		ax 3.96 dd(5, 2)	ax 3.27 m	ax 3.99 dd(5, 1)
		eq 3.43 d(5, OH)	eq 1.40 d(7.5, OH)	eq 3.43 d(5, OH)
5	–	1.69 dd	1.09 dd	2.09 dd
9	2.25 ddd(2)	2.23 ddd(10, 12)	1.84 ddd(8.0, 8.0, 1.5)	
11	ax 1.44 ddd	ax 1.42 ddd(10, 12)	ax 1.41 ddd(8, 11)	5.64 s
	eq 1.65 ddd	eq 1.61 ddd(12, 3.5)	eq 1.68 ddd(8, 11)	
12	3.46 m	ax 3.46 ddd(12, 3.5, 8)	ax 1.31 s(OH)	
		eq 3.40 d(8, OH)	eq 3.64 m	
14	5.11 dd(2)	5.13 dd	5.07 dd(1.5)	4.35 m, 1.88 d(3, OH)
15	5.92 dd(11, 17.5)	5.88 dd(11, 17.5)	5.74 dd(11, 17)	5.93 dd(11, 17.5)

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Table 10-5-10 (continued)

H	10-5-24	10-5-25	10-5-26	10-5-30
16	*cis* 5.11 dd(2, 11) *trans* 5.22 dd(2, 17.5)	*cis* 5.21 dd(11, 11) *trans* 5.07 dd(11, 17.5)	*cis* 5.01 dd(11, 1.5) *trans* 5.02 dd(17, 1.5)	*cis* 5.47 dd(11, 1) *trans* 5.31 dd(17.5, 1)
17	1.17 s	1.17 s	1.09 s	1.16 s
18	1.10 s	1.21 s	1.02 s	1.23 s
19	1.08 s	0.71 s	0.83 s	0.84 s
20	1.00 s	0.79 s	0.76 s	1.07 s

Table 10-5-11: ^{1}H NMR spectroscopic data of pimarane- and isopimarane-type diterpenoids **10-5-27**~**10-5-29**.

H	10-5-27	10-5-28	10-5-29
1	α 1.71 dt(13.1, 3.5), β 0.98	3.42 dd(3.3, 9.6)	α 1.88 dt(13.7, 3.2), β 1.59 m
2	1.61 m	α 1.67 dd(4.5, 10.5) β 1.25 dd(9.5, 10.5)	α 1.79 m β 1.81 m
3	3.21 dd(11.1, 5.2)	3.40 br s	3.28 dd(11.5, 4.2)
5	0.82	1.38 m	1.44 dd(13.1, 5.6)
6	α 1.63 qd(13.4, 3.7), β 1.49	α 2.09 dt(14.1, 2.7), β 1.55 m	α 2.30 m, β 2.48 dt(20.5, 5.6)
7	α 1.78 dt(13.4, 3.2), β 1.22	1.40 m	6.45 br m($W_{1/2}$ = 12.4)
9	0.85	1.33 m	
11	α 1.47 qd(13.4, 3.1) β 1.47 m	α 2.40 ddd(1.2, 3.3, 13.5) β 1.78 ddd(3.6, 6.9, 13.5)	5.74 br s($W_{1/2}$ = 3.7)
12	α 2.01 dq(13.7, 3.1) β 1.21 dd(13.7, 4.4)	α 1.56 m β 1.42 m	
14	α 1.68 dd(14.0, 3.1), β 1.23	α 1.94 d(14.4), β 1.08 d(14.4)	4.33 br s($W_{1/2}$ = 7.9)
15	5.98 dd(17.9, 11.0)	5.76 dd(10.8, 17.4)	5.93 dd(17.8, 10.8)
16	5.09 dd(11.0, 1.2) 5.14 dd(17.9, 1.2)	4.84 d(10.8) 4.90 d(17.4)	5.44 dd(10.8, 0.9) 5.29 dd(17.8, 0.9)
17	0.91 s	0.85 s	1.12 s
18	0.99 s	0.83 s	1.04 s
19	0.81 s	1.22 s	0.96 s
20	0.93 s	1.08 s	1.07 d(0.7)

Table 10-5-12: ^{1}H NMR spectroscopic data of pimarane- and isopimarane-type diterpenoids **10-5-31** and **10-5-32**.

H	10-5-31	10-5-32	H	10-5-31	10-5-32
2	4.49 ddd(14.0, 6.0, 2.5)	4.96 dd(12.8, 6.8)	12	5.64 dd(10.3, 1.0)	5.56 dd(10.2, 1.6)
3	α 2.35 t(14.0) β 2.01 dd(14.0, 6.0)	α 2.81 dd(12.8, 6.8) β 1.29 t(12.8)	14	–	α 1.17 dd(13.0, 3.2) β 1.97 t(13.0)
5	2.70 dd(12.2, 3.0)	2.35 dd(13.0, 4.0)	15	5.76 dd(17.5, 10.5)	5.81 dd(17.4, 10.6)

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Table 10-5-12 (continued)

H	10-5-31	10-5-32	H	10-5-31	10-5-32
6	α –	α 2.04 qd(13.0, 4.0)	16	4.92 d(10.5)	4.93 dd(10.6, 1.0)
	β 1.95 dd(13.1, 3.0)	β 1.93 dq(13.0, 4.0)		4.95 d(17.5)	5.00 dd(17.4, 1.0)
7		α –	17	1.07 s	1.06 s
		β 1.51 qd(13.0, 4.0)			
8	1.83 m	1.78 tt(13.0, 3.2)	18	1.52 s	1.36 s
11	6.67 d(10.3)	5.98 d(10.2)	20	1.15 s	1.19 s
OH	3.65 d(2.5, OH)	2.94 br s, 3.65 br s			

Table 10-5-13: Compounds, MFs, and test solvents of pimarane- and isopimarane-type diterpenoids **10-5-33**~**10-5-42**.

No.	Compounds	MFs	Test solvents	References
10-5-33	7α,14α,18-triacetoxy-8,15-isopimaradien-1α-ol	$C_{26}H_{38}O_7$	$CDCl_3$	[283]
10-5-34	methyl 7α,14α-diacetoxy-1α-hydroxy-8,15-isopimaradien-18-oate	$C_{25}H_{36}O_7$	C_6D_6	[283]
10-5-35	methyl 7α,14α-diacetoxy-8,15-isopimaradien-18-oate	$C_{25}H_{36}O_6$	$CDCl_3$	[283]
10-5-36	methyl 7α,14α-diacetoxy-11α-hydroxy-8,15-isopimaradien-18-oate	$C_{25}H_{36}O_7$	$CDCl_3$	[283]
10-5-37	methyl 7α-acetoxy-11α,14α-dihydroxy-8,15-isopimaradien-18-oate	$C_{23}H_{34}O_6$	$CDCl_3$	[283]
10-5-38	7β-hydroxyisopimara-8,15-dien-14-one	$C_{20}H_{30}O_2$	$CDCl_3$	[271]
10-5-39	7-oxo-11α,19-diacetoxy-13-*epi*-*ent*-pimara-8(9),15-diene	$C_{20}H_{30}O_5$	$CDCl_3$	[277]
10-5-40	7-oxo-11β,19-diacetoxy-13-*epi*-*ent*-pimara-8(9),15-diene	$C_{20}H_{30}O_5$	$CDCl_3$	[277]
10-5-41	8(9),15-isopimaradien-3β-ol	$C_{20}H_{32}O$	$CDCl_3$	[284]
10-5-42	3β,19-dihydroxy-8(9),15-isopimaradien-7-one	$C_{20}H_{30}O_3$	$CDCl_3$	[284]

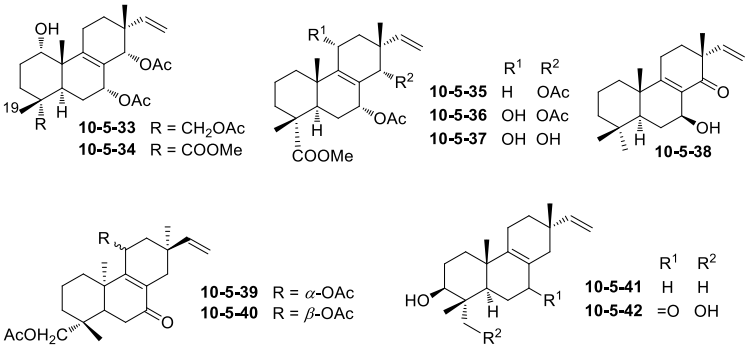

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Table 10-5-14: ^{1}H NMR spectroscopic data of pimarane- and isopimarane-type diterpenoids **10-5-33**~**10-5-35**.

H	10-5-33	10-5-34	10-5-35
1	1.35 d(3.1, OH), 3.94 m	0.92 br s(OH), 3.54 m	*α* 1.34 ddd(12.2, 8.3, 6.0) *β* 1.78(12.2)
2*α*	1.68 dddd(13.6, 3.2, 3.2, 3.2)	1.36	1.63 (6.0, 3.4)
2*β*	1.93 dddd(13.6, 12.5, 3.2, 3.2)	1.60 dddd(14.9, 13.5, 4.4, 2.2)	1.63 (8.3)
3*α*	1.84 ddd(12.5, 12.5, 3.2)	2.35 ddd(13.5, 13.5, 4.1)	1.74
3*β*	1.18 dt(12.5, 3.2, 3.2)	1.34 ddd(13.5, 4.4, 2.5)	1.58 ddd(3.4)
5	2.15 dd(2.2, 10.0)	3.06 dd(2.1, 13.1)	2.34 dd(2.0, 13.2)
6	1.76 m	*α* 1.78 ddd(14.5, 2.1, 2.0) *β* 1.64 ddd(14.5, 13.1, 4.2)	*α* 1.41 ddd(14.5, 2.2, 2.0) *β* 1.81 ddd(14.5, 13.2, 4.6)
7	5.15 br dd(2.8, 5.4)	5.42 ddd(4.2, 2.0, 2.0)	5.08 ddd(4.6, 2.2, 2.1)
11*α*	2.48 ddd(18.4, 6.6, 4.0)	2.40 ddd(17.4, 6.5, 4.5)	2.29 ddd(18.8, 6.8, 3.2)
11*β*	2.15 ddd(18.4, 12.0, 2.1)	1.87 dddd(17.4, 8.8, 2.1, 2.0)	2.06 dddd(18.8, 9.3, 2.0, 2.1)
12*α*	1.96 ddd(12.0, 11.8, 6.6)	2.05 ddd(13.0, 8.8, 6.5)	1.90 ddd(6.8, 9.3, 13.2)
12*β*	1.51 ddd(11.8, 4.0, 2.1)	1.43 dddd(13.0, 4.5, 2.1, 1.0)	1.47 dddd(13.2, 3.2, 2.0, 1.1)
14	5.09 br s	5.47 br s	5.06 br s
15	5.79 dd(11.0, 17.4)	6.11 dd(11.1, 17.4)	5.78 dd(10.7, 17.8)
16	5.00 dd(11.0, 1.2) 5.02 dd(17.4, 1.2)	5.18 dd(11.1, 1.5) 5.20 dd(17.4, 1.5)	4.98 dd(10.7, 1.2) 4.99 dd(17.8, 1.2)
17	0.90 s	0.91 s	0.87 s
18	3.68 d(11.1), 3.83 d(11.1)	3.44 s(COOMe)	3.59 s(COOMe)
19	0.89 s	1.23 s	1.17 s
20	1.05 s	0.69 s	1.01 s
OAc	2.04 s, 1.96 s, 1.94 s	2.00 s, 1.87 s	1.96 s, 1.95 s

Table 10-5-15: ^{1}H NMR spectroscopic data of pimarane- and isopimarane-type diterpenoids **10-5-36**~**10-5-38**.

H	10-5-36	10-5-37	10-5-38
1*α*	1.67 (12.6)	1.67 (12.4)	1.16 m
1*β*	1.88 ddd(12.6, 3.6, 2.4)	1.90 ddd(12.4, 3.7, 2.0)	1.78 m
2*α*	1.65(3.6)	1.65(3.7)	1.58 m
2*β*	1.65(2.4, 2.4)	1.65(2.0)	1.66 m
3*α*	1.74(12.9)	1.74	1.23 m
3*β*	1.58(2.4, 12.9)	1.57	1.44 m
5	2.39 dd(2.0, 13.2)	2.37 dd(1.8, 13.2)	1.50 m
6*α*	1.41 ddd(14.8, 2.0, 1.6)	1.45 ddd(14.8, 1.8, 1.7)	1.89 m
6*β*	1.80 ddd(14.8, 13.2, 4.5)	1.82 ddd(14.8, 13.2, 4.5)	1.61 m
7	5.11 dd(1.6, 4.5)	5.14 dd(1.7, 4.5)	4.60 dd(5.0, 1.5)
11	4.27 ddd(2.2, 6.3, 11.1) 2.54 d(11.1, OH)	4.26 ddd(6.3, 3.4, 1.5) 2.62 d(3.4, OH)	2.33 dt(10.0, 4.5)
12*α*	2.22 dd(2.2, 14.9)	2.26 dd(1.5, 15.2)	1.93 dd(10.0, 4.0)
12*β*	1.74 dd(6.3, 14.9)	1.56 dd(6.3, 15.2)	1.77 dd(10.0, 4.0)

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Table 10-5-15 (continued)

H	10-5-36	10-5-37	10-5-38
14	5.21 s	3.63 s	
15	5.88 dd(11.0, 17.7)	6.07 dd(10.8, 17.7)	5.78 dd(18.0, 10.5)
16	5.10 dd(11.0, 1.0)	5.16 dd(10.8, 1.0)	4.98 d(18.0)
	5.18 dd(17.7, 1.0)	5.18 dd(17.8, 1.0)	5.10 d(10.5)
17	0.93 s	0.88 s	1.19 s
18	3.61 s(COOMe)	3.61 s(COOMe)	0.96 s
19	1.17 s	1.17 s	0.88 s
20	0.96 s	0.93 s	1.05 s
OAc	2.00 s, 1.99 s	2.07 s	

Table 10-5-16: ^{1}H NMR spectroscopic data of pimarane- and isopimarane-type diterpenoids **10-5-39**~**10-5-42**.

H	10-5-39	10-5-40	10-5-41	10-5-42
1	*α* –	–	ax 1.15 td(13.2, 13.2, 3.8)	ax 1.34 td(13.2, 13.2, 3.6)
	β 1.35 td(12.9, 3.9)		eq 1.75 dt(13.2, 3.8, 3.8)	eq 1.87 dt(13.2, 3.6, 3.6)
2	–	–	ax 1.59 tdd(13.2, 11.6, 3.8)	ax 1.72 tdd
			eq 1.67 m	(13.2, 13.2, 11.6, 3.6)
				eq 1.76 m
3	*α* –	1.75 br d(13.5)	3.24 br d(11.6)	3.72 dd(11.6, 4.6)
	β 1.08 td(13.8, 4.0)			
5	1.78 dd(13.9, 4.0)		1.10 dd(12.6, 2.1)	1.82 dd(14.2, 3.8)
6	*α* 2.57 dd(18.0, 13.9)	*α* 2.49 dd(18.0, 14.8)	ax 1.49 m	ax 2.45 dd(17.7, 14.2)
	β 2.65 dd(18.0, 4.0)	*β* 2.70 dd(18.0, 3.7)	eq 1.68 m	eq 2.33 dd(17.7, 3.8)
7			1.94 m	
11	5.69 t(6.0)	5.53 br s	1.89 m	2.19 m
12	1.53 dd(13.6, 6.0)	–	ax 1.31 m	ax 1.33 m
	2.01 dd(13.6, 6.0)		eq 1.49 m	eq 1.60 dtd(13.1, 4.7, 2.2)
14	2.22 d(14.3)	2.65 dd(18.5, 2.0)	ax 1.73 d(17.2)	ax 2.03 dt(17.6, 2.2)
	2.27 d(14.3)		eq 1.81 d(17.2)	eq 2.33 dq(17.6, 2.2, 2.2, 2.2)
15	5.72 dd(17.5, 10.8)	5.87 dd(17.0, 11.4)	5.73 dd(17.5, 10.8)	5.67 dd(16.8, 10.9)
16	4.91 d(17.5)	4.83 dd(17.0, 1.0)	*Z* 4.84 dd(17.5, 1.6)	*Z* 4.84 dd(16.8, 1.2)
	4.95 d(10.8)	4.86 dd(11.4, 1.0)	*E* 4.89 dd(10.8, 1.6)	*E* 4.93 dd(10.9, 1.2)
17	1.03 s	1.05 s	0.97 s	1.01 s
18	0.98 s	1.00 s	1.00 s	3.42 d(10.4)
				3.68 d(10.4)

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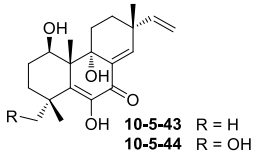
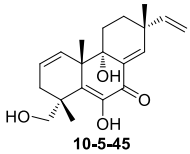
Table 10-5-16 (continued)

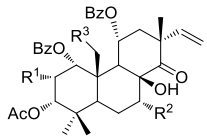
H	10-5-39	10-5-40	10-5-41	10-5-42
19	4.00 d(11.2), 4.28 d(11.2)	3.98 d(11.1), 4.26 d(11.1)	0.81 s	0.98 s
20	1.30 s	1.12 s	0.96 s	1.14 s
OAc	2.07 s, 2.08 s	2.00 s, 2.07 s		
OH			1.31 br s	2.06 br s, 2.63 br s

Table 10-5-17: Compounds, MFs, and test solvents of pimarane- and isopimarane-type diterpenoids **10-5-43**~**10-5-52**.

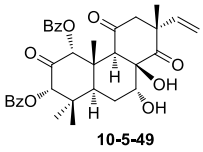
No.	Compounds	MFs	Test solvents	References
10-5-43	libertellenone A	$C_{20}H_{28}O_4$	$CDCl_3$	[285]
10-5-44	libertellenone C	$C_{20}H_{28}O_5$	$CDCl_3$	[285]
10-5-45	libertellenone B	$C_{20}H_{26}O_4$	$CDCl_3$	[285]
10-5-46	siphonol A	$C_{40}H_{46}O_{13}$	$CDCl_3$	[286]
10-5-47	siphonol C	$C_{38}H_{44}O_{12}$	$CDCl_3$	[286]
10-5-48	siphonol D	$C_{40}H_{46}O_{13}$	$CDCl_3$	[286]
10-5-49	orthosiphol S	$C_{34}H_{36}O_9$	$CDCl_3$	[287]
10-5-50	orthosiphol Y	$C_{24}H_{32}O_8$	$CDCl_3$	[288]
10-5-51	orthosiphol Z	$C_{22}H_{28}O_7$	$CDCl_3$	[288]
10-5-52	14-deoxo-14-*O*-acetylorthosiphol Y	$C_{26}H_{36}O_9$	$CDCl_3$	[289]

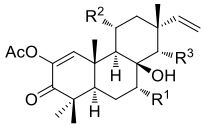






	R^1	R^2	R^3
10-5-46	OAc	OAc	OH
10-5-47	OH	OAc	OH
10-5-48	OAc	OH	OAc





	R^1	R^2	R^3
10-5-50	OAc	OH	=O
10-5-51	OH	=O	=O
10-5-52	OAc	OH	OAc

Table 10-5-18: ^{1}H NMR spectroscopic data of pimarane- and isopimarane-type diterpenoids **10-5-43**~**10-5-45**.

H	10-5-43	10-5-44	10-5-45
1	4.34 dd(9.5, 5.5)	4.27 dd(11.0, 5.0)	5.76 ddd(10.0, 2.0, 1.5)
2	1.74 m	1.74 m	6.09 ddd(10.5, 5.0, 3.0)
3	1.53 m(ov)	*α* 2.07 ddd(13.5, 13.5, 4.5) *β* 1.29 ddd(13.5, 3.5, 3.5)	*α* 2.47 ddd(16.5, 3.0, 2.0) *β* 1.82 m(ov)

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Table 10-5-18 (continued)

H	10-5-43	10-5-44	10-5-45
6	6.75 s(OH)	6.81 d(OH)	6.97 s(OH)
11	*α* 2.01 ddd(14.0, 14.0, 3.5) *β* 2.16 ddd(14.0, 14.0, 3.5)	*α* 1.95 ddd(14.0, 14.0, 3.5) *β* 2.14 ddd(14.0, 14.0, 3.5)	*α* 1.82 m(ov) *β* 2.09 ddd(13.5, 13.5, 3.0)
12	*α* 1.83 ddd(14.0, 14.0, 3.5) *β* 1.58 m(ov)	*α* 1.79 ddd(14.0, 14.0, 3.5) *β* 1.54 dddd(14.0, 14.0, 3.5, 2.0)	*α* 1.89 ddd(13.5, 13.5, 3.0) *β* 1.56 dddd(13.5, 13.5, 3.0, 2.0)
14	7.08 d(2.0)	7.06 d(2.0)	7.10 d(2.0)
15	5.84 dd(17.5, 10.5)	5.85 dd(17.5, 10.5)	5.85 dd(17.5, 10.5)
16	5.07 dd(17.5, 1.0) 5.03 dd(10.5, 1.0)	5.08 dd(17.5, 1.0) 5.03 dd(10.5, 1.0)	5.08 dd(17.5, 1.0) 5.05 dd(10.5, 1.0)
17	1.11 s	1.10 s	1.13 s
18	1.38 s	4.53 d(10.5), 3.08 d(10.5)	4.04 d(11.0), 3.43 d(11.0)
19	1.28 s	1.15 s	1.23 s
20	1.19 s	1.18 s	1.23 s

Table 10-5-19: ^{1}H NMR spectroscopic data of pimarane- and isopimarane-type diterpenoids **10-5-46**~**10-5-49**.

H	10-5-46	10-5-47	10-5-48	10-5-49
1	5.47 d(2.9)	5.49 d(3.2)	5.66 br s	6.13 s
2	5.49 t(2.9) 1.84 s(OAc)	4.49 t(3.2)	5.41 t(3.0) 1.75 s(OAc)	
3	5.03 d(2.9) 1.51 s(OAc)	5.03 d(3.2) 1.52 s(OAc)	4.94 d(3.0) 1.45 s(OAc)	5.73 s
5	2.60 dd(13.5, 2.2)	2.53 d(12.4)	2.76 dd	2.23 dd(11.0, 4.3)
6	2.01 m, 2.34 d(13.5)	2.01 d(12.4),OBz 2.22 m	1.80 m, 1.91 m	1.85 m
7	5.51 br s 2.22 s(OAc)	5.51 br s 2.22 s(OAc)	3.56 br s	4.35 s
9	3.35 d(5.6)	3.44 d(5.6)	3.10 d(3.9)	1.94 s
11	6.04 t(5.6)	6.13 t(5.6)	5.86 t(3.9)	
12	2.05 d(15.6) 2.72 dd(15.6, 5.6)	2.06 d(15.6) 2.73 dd(15.6, 5.6)	2.14 d(11.5) 2.73 dd(11.5, 3.9)	2.85 d(17.7) 2.63 d(17.7)
15	5.66 dd(17.5, 10.9)	5.70 dd(17.5, 10.6)	5.71 dd(17.6, 10.7)	5.48 dd(17.5, 10.5)
16	4.60 d(10.9), 4.83 d(17.5)	4.66 d(10.7), 4.90 d(17.5)	4.55 d(10.7), 4.80 d(17.6)	4.71 d(10.5), 4.81 d(17.5)
17	1.22 s	1.24 s	1.88 s	1.22 s
18	0.94 s	0.92 s	0.95 s	1.20 s
19	1.20 s	1.13 s	1.08 s	1.14 s
20	4.22 d(12.2), 4.45 d(12.2)	4.25 d(12.0), 4.48 d(12.0)	4.58 d(12.7), 5.01 d(12.7)	1.70 s
20-OAc			2.20 s	
1-OBz				
2′, 6′	7.71 d(7.1)	7.25 d(7.4)	7.59 d(7.8)	7.92 d(7.1)

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Table 10-5-19 (continued)

H	10-5-46	10-5-47	10-5-48	10-5-49
3′, 5′	7.28 t(7.1)	7.26 t(7.4)	7.13 t(7.8)	7.33 t(7.1)
4′	7.51 t(7.1)	7.52 t(7.4)	7.35 dt(7.8, 1.2)	7.48 t(7.1)
11-or 3-OBz				
2″, 6″	7.63 d(7.5)	7.53 d(7.6)	7.40 dd(7.6, 1.0)	7.99 d(8.3)
3″, 5″	7.12 t(7.5)	7.13 t(7.6)	6.95 t(7.6)	7.35 t(8.3)
4″	7.40 t(7.5)	7.43 t(7.6)	7.25 dt(7.6, 1.0)	7.50 t(8.3)

Table 10-5-20: ^{1}H NMR spectroscopic data of pimarane- and isopimarane-type diterpenoids **10-5-50**~**10-5-52**.

H	10-5-50	10-5-51	10-5-52
1	7.53 s	7.6 s	7.97 s
2	1.98 s(OAc)	2.21 s(OAc)	2.21 s(OAc)
5	2.24 dd(13.5, 2.0)	2.41 dd(13.9, 2.2)	2.17 dd(10.8, 2.4)
6	1.90 dt(14.6, 2.0), 2.19 m	1.76 td(13.9, 2.2), 2.03 d(13.9)	1.61 m, 2.22 m
7	5.32 t(2.8), 2.21 s(OAc)	4.31 br s	4.87 t(2.4), 1.98 s(OAc)
9	2.31 d(7.5)	3.11 s	2.07 d(4.4)
11	4.47 br t(7.5)		4.63 dd(10.8, 4.4)
12	2.05 dd(15.2), 2.50 dd(15.2, 7.5)	2.84 d(17.8), 2.95 d(17.8)	1.73 dd(10.8, 4.4), 2.08 d(10.8)
14			4.68 s, 2.01 s(OAc)
15	6.14 dd(17.7, 10.7)	5.76 dd(17.6, 10.5)	5.70 dd(17.3, 10.3)
16	5.19 d(10.7), 5.01 d(17.7)	5.25 d(10.5), 5.15 d(17.6)	4.94 d(17.3), 4.95 d(10.3)
17	1.24 s	1.30 s	1.33 s
18	1.14 s	1.17 s	1.10 s
19	1.16 s	1.21 s	1.17 s
20	1.44 s	1.44 s	1.49 s

Table 10-5-21: Compounds, MFs, and test solvents of pimarane- and isopimarane-type diterpenoids **10-5-53**~**10-5-70**.

No.	Compounds	MFs	Test solvents	References
10-5-53	3*β*,15,16-triacetoxy-*ent*-pimar-7-ene	$C_{26}H_{40}O_6$	$CDCl_3$	[290]
10-5-54	2*α*,15,16-trihydroxy-*ent*-pimar-7-ene	$C_{20}H_{34}O_3$	$CDCl_3$	[290]
10-5-55	3*α*,15,16,18-tetraacetoxy-*ent*-pimar-7-ene	$C_{28}H_{42}O_8$	$CDCl_3$	[290]
10-5-56	15,16-diacetoxy-*ent*-pimar-7-en-3-one	$C_{24}H_{36}O_5$	$CDCl_3$	[290]
10-5-57	15,16,18-triacetoxy-*ent*-pimar-7-en-3-one	$C_{26}H_{38}O_7$	$CDCl_3$	[290]
10-5-58	15,16-dihydroxypimar-8(14)-en-3-one	$C_{20}H_{32}O_3$	$CDCl_3$	[291]
10-5-59	*ent*-2*α*,15,16,19-tetrahydroxypimar-8(14)-ene	$C_{20}H_{34}O_4$	CD_3OD	[292]
10-5-60	*ent*-2-oxo-15,16,19-trihydroxypimar-8(14)-ene	$C_{20}H_{32}O_4$	CD_3OD	[292]

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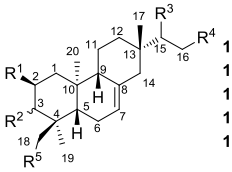
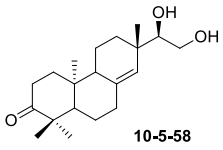
Table 10-5-21 (continued)

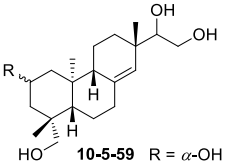
No.	Compounds	MFs	Test solvents	References
10-5-61	*ent*-3α,7β,15,16-tetrahydroxypimar-8(14)-ene	$C_{20}H_{34}O_4$	DMSO-d_6	[293]
10-5-62	*ent*-2β,15,16-trihydroxypimar-8(14)-en-19-oic acid	$C_{20}H_{32}O_5$	DMSO-d_6	[293]
10-5-63	wulingzhic acid A	$C_{20}H_{32}O_5$	CD_3OD	[276]
10-5-64	kirenol	$C_{20}H_{34}O_4$	CD_3OD	[294]
10-5-65	15,16-dihydroxy-7,11-dioxopimar-8(9)-ene	$C_{20}H_{30}O_4$	CD_3OD	[295]
10-5-66	15,16,17-trihydroxy-7-oxopimar-8(9)-ene	$C_{20}H_{32}O_4$	CD_3OD	[295]
10-5-67	15,16,17-trihydroxypimar-8(9)-ene	$C_{20}H_{34}O_3$	CD_3OD	[295]
10-5-68	hymatoxin C	$C_{20}H_{31}O_6S$	CD_3OD	[296]
10-5-69	hymatoxin A	$C_{20}H_{29}O_7S$	CD_3OD	[296]
10-5-70	hymatoxin B	$C_{20}H_{29}O_8S$	CD_3OD	[296]



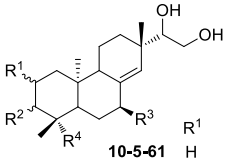
	R^1	R^2	R^3	R^4	R^5
10-5-53	H	α-OAc	OAc	OAc	H
10-5-54	OH	H	OH	OH	H
10-5-55	H	β-OAc	OAc	OAc	OAc
10-5-56	H	=O	OAc	OAc	H
10-5-57	H	=O	OAc	OAc	OAc



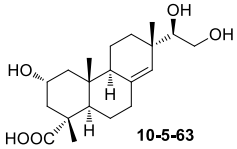
10-5-58



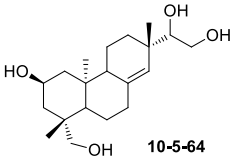
10-5-59 R = α-OH
10-5-60 R = =O



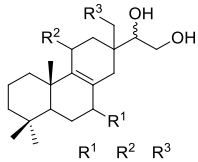
	R^1	R^2	R^3	R^4
10-5-61	H	α-OH	OH	Me
10-5-62	β-OH	H	H	COOH



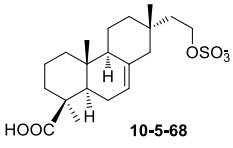
10-5-63



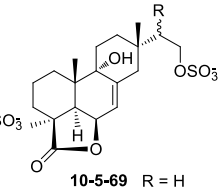
10-5-64



	R^1	R^2	R^3
10-5-65	=O	=O	H
10-5-66	=O	H	OH
10-5-67	H	H	OH



10-5-68



10-5-69 R = H
10-5-70 R = OH

Table 10-5-22: ^{1}H NMR spectroscopic data of pimarane- and isopimarane-type diterpenoids **10-5-53**~**10-5-56**.

H	10-5-53	10-5-54	10-5-55	10-5-56
1	–	α 2.12 dd(12, 3.5) β 1.15 dd(12, 12)	–	α 2.08 br d(3.5) β 1.46 m
2	1.63 m	3.68 tt(12, 3.5)	–	α 2.69 dt(14.5, 3.5) β 2.23 dt(14.5, 3.5)

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Table 10-5-22 (continued)

H	10-5-53	10-5-54	10-5-55	10-5-56
3	4.50 dd(3, 3)	1.77 tt, 0.98 dd(12, 12)	4.89 br t	
5	1.22 dd(10, 5)	1.22 dd(10, 5)	1.61 dd(10, 5)	1.53 dd(10, 5)
7	5.41 ddd(3, 1.5, 1.5)	5.37 ddd(3, 1.5, 1.5)	5.40 ddd(3, 1.5, 1.5)	5.45 ddd(3, 1.5, 1.5)
11	1.44 m	1.46 tt(13, 3, 3)	1.40 m	–
12	*α* 1.68 dd(3, 3)	*α* 2.01dd(3, 3)	*α* 1.73 dd(3, 3)	*α* 1.71(3, 3)
	β 1.05 m	*β* 1.04	*β* –	*β* 1.06
14	*α* 2.15 dd(14.5, 3)	*α* 2.06 dd(14.5, 3)	*α* 2.16 dd(14.5, 3)	*α* 2.18 dd(14.5, 3)
	β 1.88 d(14.5)	*β* 1.84 d(14.5)	*β* 1.91 dd(14.5)	*β* 1.89 d(14.5)
15	5.17 d(2.5)	3.68 d(2.5)	5.18 d(2.5)	5.21 d(2.5)
16	4.33 dd(11, 9)	3.73 dd(11, 9)	4.34 dd(11, 9)	4.35 d(11)
	4.03 dd(11, 2.5)	3.51 dd(11, 2.5)	4.02 dd(11, 2.5)	4.02 dd(11, 2.5)
17	0.87 s	0.88 s	0.93 s	0.94 s
18	0.92 s	0.96 s	3.80 d(11), 3.99 d(11)	1.12 s
19	0.93 s	0.93 s	1.10	1.11 s
20	0.96 s	0.81 s	0.97	1.05 s
OAc	2.05, 2.01		2.05, 2.01, 2.00, 1.99	2.06, 2.02

Table 10-5-23: ^{1}H NMR spectroscopic data of pimarane- and isopimarane-type diterpenoids **10-5-57**~**10-5-60**.

H	10-5-57	10-5-58	10-5-59	10-5-60
1	*α* 2.00 m	*α* 1.51 m	1.41 d(14.1)	2.18 dd(12.8, 2.1)
	β 1.48 m	*β* 2.01 ddd(3.2, 5.7, 13.3)	1.80 d(14.1)	2.31 d(12.8)
2	*α* 2.68 dt(14.5, 3.5)	*α* 2.30 ddd(3.2, 4.0, 14.8)	4.04 br s	
	β 2.31 dt(14.5, 3.5)	*β* 2.66 ddd(5.7, 14.6, 14.8)		
3			1.24 m	2.15 br d(13.3)
			1.91 d(14.2)	2.42 dd(13.3, 2.1)
5	1.50 dd(10, 5)	1.48 m	1.26 d(11.9)	1.77 dd(13.2, 2.3)
6	–	1.53 m	1.38 m, 1.67 m	1.36 dd(13.2, 4.5), 1.73 m
7	5.45 ddd(3, 1.5, 1.5)	*α* 2.11 m, *β* 2.36 m	1.98 d(14.1)	2.01 m, 2.24 dd(13.3, 2.5)
			2.23 d(14.1)	
9	–	1.79 br t(7.9)	1.69 m	1.99 m
11	–	*α* 1.67 m, *β* 1.51 m	1.55 m	1.43 br d(8.0)
12	*α* 1.72 dd(3, 3), *β*–	*α* 1.51 m, *β* 1.33 m	0.81 m, 1.93 m	0.84 dd(12.6, 4.7)
				1.89 ddd(12.6, 4.5, 3.3)
14	*α* 2.18 dd(14.5, 3)	5.31 br s	5.13 s	5.15 s
	β 1.93 d(14.5)			
15	5.20 d(2.5)	3.46 dd(2.1, 9.1)	3.52 m	3.43 dd(8.8, 2.0)
16	4.35 dd(11, 9)	*α* 3.75 dd(2.1, 10.6)	3.42 d(10.9)	3.35 m
	4.00 dd(11, 2.5)	*β* 3.52 dd(9.1, 10.6)	3.64 d(10.9)	3.57 dd(10.8, 2.0)
17	0.93 s	1.00 s	0.79 s	0.75 s
18	3.88 d(11), 4.17 d(11)	1.09 s	0.93 s	1.02 s
19	1.09 s	1.07 s	3.36 d(10.7),	3.22 m, 3.39 m
			3.93 d(10.7)	
20	1.07 s	0.99 s	0.98 s	0.71 s
OAc	2.05 s, 2.00 s, 1.99 s			

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Table 10-5-24: ^{1}H NMR spectroscopic data of pimarane- and isopimarane-type diterpenoids **10-5-61**~**10-5-64**.

H	10-5-61	10-5-62	10-5-63	10-5-64
1	–	–	α 1.09 t(11.9)	2.00 dm
			β 2.02 m	1.02 d(13)
2	–	3.84 m	3.80 dddd(11.6, 11.6, 4.3, 4.3)	3.76 m
3	3.04 m	–	α 1.67 t(11.6), β 1.89 m	3.24 m, 0.90 m
5	–	–	1.91 d(2.8)	1.20 dd(12, 1)
6	–	–	α 1.27 m, β 1.34 m	1.72 m, 1.25 m
7	3.95 d(2.4)	–	α 2.15 m	2.30 m, 2.00 m
			β 2.27 ddd(14.5, 5.6, 2.9)	
9	1.97 t(8.0)	–	1.85 m	1.81 m
11	–	–	α 1.64 m, β 1.52 m	1.58 m
12	1.88 m	–	α 1.30 m, β 1.47 m	2.00 m, 0.90 m
14	5.31 s	5.17 s	5.40 br s	5.18 m
15	3.28 m	3.30 m	3.24 dd(8.7, 2.6)	3.56 dd(9, 2)
16	3.43 dd(9.6, 3.6)	3.46 d(10.0)	3.61 dd(11.2, 2.6)	3.68 dd(11, 2)
	3.23 m	3.25 m	3.43 dd(11.2, 8.7)	3.45 dd(9, 11)
17	0.79 s	0.76 s	0.98 s	0.84 s
18	0.87 s	1.15 s		1.01 s
19	0.69 s	12.11 br s(COOH)	1.21 s	3.86 d(11)
				3.31 d(11)
20	0.66 s	0.61 s	0.87 s	0.82 s

Table 10-5-25: ^{1}H NMR spectroscopic data of pimarane- and isopimarane-type diterpenoids **10-5-65**~**10-5-67**.

H	10-5-65	10-5-66	10-5-67
1	1.20, 1.80	1.36, 1.93	1.20, 1.82
2	1.75 dd(12.0, 5.0), 1.56	1.75, 1.61	1.75, 1.56
3	1.48, 1.28	1.52, 1.28	1.46, 1.19
5	1.72	1.80	1.19
6	2.55 d(1.1), 2.50 d(8.2)	2.50 br s, 2.47 d(5.3)	1.46, 1.50
7			1.97, 2.01
11		2.33 d(17.0), 2.37 m	1.98, 2.06
12	2.11 dd(14.0, 1.7)	1.59, 1.65	1.46, 1.61
	2.83 d(14.0)		
14	2.41 dd(18.0, 1.2), 2.59 d(18.0)	2.07 d(17.0), 2.30 br d(13.0)	1.63, 2.08 d(17.0)
15	3.40 dd(8.0, 3.4)	3.55 dd(7.0, 2.6)	3.63
16	3.50 dd(11.4, 8.0)	3.66 dd(11.8, 7.0)	3.69 dd(10.0, 5.5)
	3.71 dd(11.4, 3.2)	3.72 dd(11.8, 3.1)	3.71 dd(10.0, 3.0)
17	0.90 s	3.36 d(11.4), 3.50 d(11.4)	3.47 d(11.0), 3.50 d(11.0)
18	0.93 s	0.94 s	0.92 s
19	0.96 s	0.99 s	0.98 s
20	1.36 s	1.16 s	1.05 s

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Table 10-5-26: ^{1}H NMR spectroscopic data of pimarane- and isopimarane-type diterpenoids **10-5-68**~**10-5-70**.

H	10-5-68	10-5-69	10-5-70
1ax	1.08 ddd(13.0, 12.6, 3.7)	1.70 m	1.70 m
1eq	1.89 br d(12.6)	1.30 m	1.30 m
2ax	1.96 ddddd(13.8, 13.7, 13.0, 3.3, 3.3)	1.69 m	1.69 m
2eq	1.44 ddddd(13.8, 3.7, 3.7, 3.3, 3.3)	1.56 m	1.55 m
3ax	1.05 br ddd(13.7, 13.2, 3.7)	1.45 ddd(14.4, 9.0, 5.6)	1.45 ddd(14.5, 8.5, 6.0)
3eq	2.14 br d(13.2)	2.08 ddd(14.4, 7.5, 5.6)	2.08 ddd(14.5, 7.3, 4.9)
5	1.34 dd(12.1, 4.3)	2.39 d(5.0)	2.39 d(5.0)
6	ax 2.47 br ddd(14.0, 12.1, 5.9) eq 2.14 br dd(14.0, 4.3)	eq 4.85 dd(5.0, 5.0, 3.0)	eq 4.86 dd(5.0, 4.9, 3.0)
7	5.36 br d(5.9)	5.74 dd(5.0, 2.5)	5.74 dd(4.9, 2.1)
9	1.68 br d(10)		
11ax	1.31 m	1.86 ddd(14.5, 14.0, 4.1)	1.86 m
11eq	1.56 m	1.54 ddd(14.5, 3.0, 3.0)	1.55 m
12ax	1.28 m	1.73 ddd(14.0, 13.0, 3.0)	1.84 m
12eq	1.55 m	1.41 dddd(13.0, 4.1, 3.0, 3.0)	1.36 m
14	1.92 br s	ax 2.37 ddd(14.7, 3.0, 2.5) eq 2.06 dd(14.7, 3.0)	ax 2.40 ddd(15.0, 3.0, 2.1) eq 2.21 dd(15.0, 2.8)
15	1.58 t(7.4)	1.65 t(7.3)	3.50 dd(8.5, 2.6)
16	4.09 t(7.4)	4.13 t(7.3)	4.24 dd(10.5, 2.6) 3.92 dd(10.5, 8.5)
17	0.82 s	0.90 s	0.86 s
18	1.23 s	1.29 s	1.29 s
19			
20	0.83 s	0.96 s	0.96 s

Table 10-5-27: Compounds, MFs, and test solvents of pimarane- and isopimarane-type diterpenoids **10-5-71**~**10-5-77**.

No.	Compounds	MFs	Test solvents	References
10-5-71	*ent*-16-hydroxy-13(*R*)-pimar-8(14)-ene-3,15-dione	$C_{20}H_{30}O_3$	–	[297]
10-5-72	*ent*-12α,16-dihydroxy-13(*R*)-pimar-8(14)-ene-3,15-dione	$C_{20}H_{30}O_4$	–	[297]
10-5-73	lonchophylloid B	$C_{20}H_{32}O_3$	$CDCl_3$	[298]
10-5-74	*ent*-15-oxo-2β,16,19-trihydroxypimar-8(14)-ene	$C_{20}H_{32}O_4$	CD_3OD	[292]
10-5-75	*ent*-16,18-dihydroxy-8(14)-pimaren-15-one	$C_{20}H_{32}O_3$	$CDCl_3$	[299]
10-5-76	*ent*-19-*nor*-4,16,18-trihydroxy-8(14)-pimaren-15-one	$C_{19}H_{30}O_4$	$CDCl_3$	[299]
10-5-77	lonchophylloid A	$C_{20}H_{28}O_4$	CD_3COCD_3	[298]

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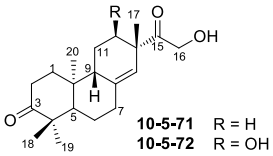
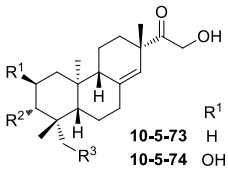
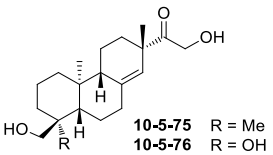


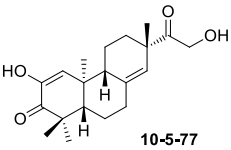
10-5-71 R = H
10-5-72 R = OH



	R^1	R^2	R^3
10-5-73	H	OH	H
10-5-74	OH	H	OH



10-5-75 R = Me
10-5-76 R = OH



10-5-77

Table 10-5-28: ^{1}H NMR spectroscopic data of pimarane- and isopimarane-type diterpenoids **10-5-71**~**10-5-73**.

H	10-5-71	10-5-72	10-5-73
1*α*	1.52 m	1.51 m	1.61 m
1*β*	2.03 ddd(3.3, 5.9, 13.4)	1.97 ddd(3.0, 5.6, 13.4)	1.14 m
2*α*	2.34 ddd(3.3, 4.7, 15.0)	2.31 ddd(3.2, 4.2, 15.0)	1.54 m
2*β*	2.65 ddd(5.9, 14.1, 15.0)	2.65 ddd(5.7, 14.7, 15.0)	1.18 m
3			3.25 dd(11.5, 4.1)
5	1.51 m	1.50 m	1.03 dd(12.6, 2.7)
6*α*	1.53 m	1.55 m	1.64 m
6*β*	1.63 m	1.78 m	1.37 ddd(14.1, 12.6, 5.7)
7*α*	2.11 m	2.05 m	2.03 td(13.8, 5.4)
7*β*	2.38 m	2.41 m	2.38 dt(13.8, 5.4)
9	1.81 br t(7.6)	1.60 m	1.68 t(8.4)
11*α*	1.64 m	1.55 m	1.19 m
11*β*	1.58 m	1.81 ddd(3.8, 7.0, 12.2)	1.48 ddd(14.1, 12.6, 3.3)
12*α*	1.75 m		2.33 dt(12.6, 5.3)
12*β*	1.55 m	3.99 dd(3.8, 12.2)	1.07 m
14	5.45 br s	5.39 br t(2)	5.53 d(1.6)
16	4.34 d(0.9)	4.45 br s	4.35 s
17	1.23 s	1.26 s	1.12 s
18	1.09 s	1.07 s	1.01 s
19	1.11 s	1.10 s	0.80 s
20	1.00 s	1.01 s	0.64 s

Table 10-5-29: ^{1}H NMR spectroscopic data of pimarane- and isopimarane-type diterpenoids **10-5-74**~**10-5-77**.

H	10-5-74	10-5-75	10-5-76	10-5-77
1	1.01 dd(12.1, 11.3), 1.90 br d(12.1)	–	–	6.12 s
2	3.73 dddd(11.5, 11.3, 3.9, 3.7)	–	–	7.01 s
3	0.88 t(12.1), 2.15 br d(12.1)	–	–	

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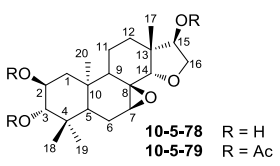
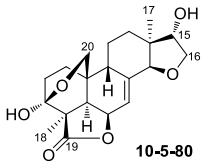
Table 10-5-29 (continued)

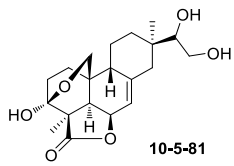
H	10-5-74	10-5-75	10-5-76	10-5-77
5	1.22 m	–	–	1.94 dd(12.5, 3.0)
6	1.33 dd(12.6, 4.5)	–	–	*α* 1.68 dt(12.5, 3.0)
	1.75 br d(12.6)			*β* 1.62 ddd(13.1, 12.5, 4.8)
7	2.07 m, 2.38 br d(14.2)			*α* 2.23 td(12.8, 5.6)
				β 2.49 ddd(12.8, 4.8, 1.9)
9	1.85 m	–	–	2.10 t(8.2)
11	1.64 m	–	–	*α* 1.86 ddd(13.2, 3.7, 3.6)
				β 1.36 ddt(13.2, 10.9, 2.9)
12	1.09 dd(12.7, 2.6)	–	–	*α* 2.34 dd(12.8, 2.9)
	2.29 br d(12.7)			*β* 1.18 ddd(12.8, 10.9, 2.9)
14	5.50 s	5.36 s	5.38 s	5.60 dd(5.6, 2.9)
16	4.33 d(18.8), 4.41 d(18.8)	4.29 d(1.7)	4.28 d(1.3)	4.45 d(19.2), 4.34 d(19.2)
17	1.09 s	1.16 s	1.14 s	1.13 s
18	1.01 s	3.36 d(10.9)	3.61 d(10.8)	1.19 s
		3.07 d(10.9)	3.40 d(10.8)	
19	3.32 d(11.0), 3.64 d(11.0)	0.79 s		1.07 s
20	0.69 s	0.76 s	0.64 s	0.93 s

Table 10-5-30: Compounds, MFs, and test solvents of pimarane- and isopimarane-type diterpenoids **10-5-78**~**10-5-84**.

No.	Compounds	MFs	Test solvents	References
10-5-78	2*β*,3*α*,15*β*-trihydroxy-7*β*,8*β*,14*α*,(16)-diepoxy-*ent*-pimarane	$C_{20}H_{32}O_5$	$CDCl_3$	[300]
10-5-79	2*β*,3*α*,15*β*-triacetoxy-7*β*,8*β*,14*α*,(16)-diepoxy-*ent*-pimarane	$C_{26}H_{38}O_8$	$CDCl_3$	[300]
10-5-80	humirianthol	$C_{20}H_{26}O_6$	DMSO-d_6	[301]
10-5-81	acrenol	$C_{20}H_{28}O_6$	DMSO-d_6	[301]
10-5-82	*ent*-12*α*,16-epoxy-2*β*,15*α*,19-trihydroxypimar-8-ene	$C_{20}H_{32}O_4$	CD_3OD	[292]
10-5-83	*ent*-14*β*,16-epoxy-8-pimarene-3*β*,15*α*-diol	$C_{20}H_{32}O_3$	$CDCl_3$	[302]
10-5-84	*ent*-12*β*-hydroxymethyl-3-oxo-16-norpimar-8(14)-ene-15,21-carbolactone	$C_{20}H_{28}O_3$	–	[297]







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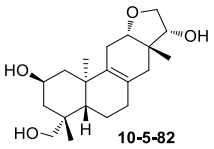
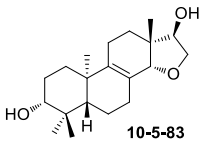


10-5-82



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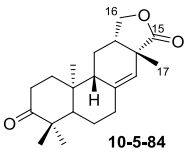

10-5-84

Table 10-5-31: ^{1}H NMR spectroscopic data of pimarane- and isopimarane-type diterpenoids **10-5-78**~**10-5-81**.

H	10-5-78	10-5-79	10-5-80	10-5-81
1	–	1.96 m(ov)	1.60 m, 1.65 m	1.55 m, 1.60 m
2	–	5.0 td(2.4, 10.0)	1.70 m, 1.98 m	2.0 m, 1.70 m
3	2.96 d(8.0)	4.68 d(10.0)	5.35 s(OH)	5.30 s(OH)
5	–	1.45 m(ov)	2.27 dd(2.5, 7.0)	2.23 dd(1.5, 7.0)
6	–	α 1.76 m(ov), β 1.85 m(ov)	4.92 dd(5.0, 7.0)	4.98 dd(5.0, 7.0)
7	3.15 br s	3.13 br s	5.84 d(5.0)	5.54 d(5.0)
9	–	–	1.80 dd(12.3, 2.8)	1.40 dd(2.9, 12.3)
11	–	–	1.15 m, 1.52 m	1.58 m, 1.60 m
12	–	–	1.28 m	1.35 m, 1.54 m
14	3.60 s	3.04 s	3.83 s	2.0 s
15	3.86 d(4.0)	4.91 dd(2.4, 4.6)	3.65 dd(4.0, 4.0) 4.99 d(4.0, OH)	3.12 m 4.52 d(4.0, OH)
16	α 3.63 dd(8.0) β 3.95 dd(4.0, 8.0)	α 3.63 dd(2.4, 10.0) β 4.00 dd(4.6, 10.0)	3.52 d(9.5)	3.25 m, 3.50 m 4.35 t(5.5, OH)
17	1.00 s	0.85 s	0.82 s	0.66 s
18	0.88 s	0.95 s	1.25 s	1.26 s
19	0.88 s	0.97 s		
20	1.18 s	1.08 s	3.41 dd(2.0, 9.0)	3.44 dd(1.5, 8.0)
OAc		1.96 s, 2.03 s, 2.05 s		

Table 10-5-32: ^{1}H NMR spectroscopic data of pimarane- and isopimarane-type diterpenoids **10-5-82**~**10-5-84**.

H	10-5-82	10-5-83	10-5-84
1	0.97 t(11.2), 2.11 br d(11.2)	1.17 ddd(13.3, 13.3, 3.7) 1.78 ddd(13.3, 3.7, 3.2)	α 1.52 m, β 2.02 m
2	3.85 dddd(11.6, 11.2, 4.0, 3.6)	1.61 m, 1.70 m	α 2.34 m β 2.65 ddd(5.8, 14.2, 14.2)
3	0.88 dd(12.6, 11.6), 2.16 br d(12.6)	3.23 dd(11.5, 4.6)	
5	1.27 m	1.09 dd(12.4, 1.4)	1.60 m
6	2.04 d(2.4)	1.51 m, 1.74 m	α 1.62 m, β 1.72 m
7	1.49 m, 1.86 m	1.92 m, 2.44 br dd(17.4, 5.5)	α 2.10 m, β 2.36 m
9			1.80 m
11	1.87 m, 2.38 m	1.97 m	α 1.70 m, β 1.50 m
12	3.56 br s	1.24~1.35 m	
14	1.25 d(12.6), 1.33 d(12.6)	3.57 s	5.64 br s

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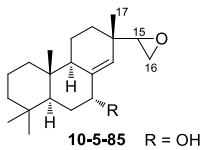
Table 10-5-32 (continued)

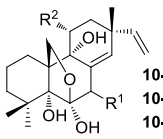
H	10-5-82	10-5-83	10-5-84
15	3.78 dd(4.6, 1.6)	3.85 dd(5.0, 2.3)	
16	3.57 dd(10.0, 1.6), 4.18 dd(10.0, 4.6)	3.63 dd(10.1, 2.3), 4.24 dd(10.1, 5.0)	3.71 dd, 4.25 dd
17	0.92 s	0.95 s	1.31 s
18	1.02 s	1.01 s	1.07 s
19	3.36 d(11.1), 3.66 d(11.1)	0.81 s	1.09 s
20	1.02 s	0.99 s	0.99 s

Table 10-5-33: Compounds, MFs, and test solvents of pimarane- and isopimarane-type diterpenoids **10-5-85**~**10-5-93**.

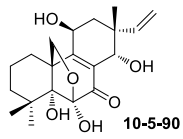
No.	Compounds	MFs	Test solvents	References
10-5-85	*rel*-15(*ζ*),16-epoxy-7*α*-hydroxypimar-8,14-ene	$C_{20}H_{32}O_2$	$CDCl_3$	[303]
10-5-86	*rel*-15(*ζ*),16-epoxy-7-oxopimar-8,14-ene	$C_{20}H_{30}O_2$	$CDCl_3$	[303]
10-5-87	diaporthein A	$C_{20}H_{30}O_6$	$CDCl_3$	[304]
10-5-88	diaporthein B	$C_{20}H_{28}O_6$	$CDCl_3$	[304]
10-5-89	scopararane A	$C_{20}H_{28}O_5$	$CDCl_3$	[305]
10-5-90	scopararane B	$C_{20}H_{28}O_6$	$CDCl_3$	[305]
10-5-91	ceriopsin D	$C_{20}H_{34}O_3$	$CDCl_3$	[306]
10-5-92	secoorthosiphol A	$C_{29}H_{36}O_{10}$	$CDCl_3$	[287]
10-5-93	secoorthosiphol B	$C_{30}H_{38}O_{10}$	$CDCl_3$	[287]



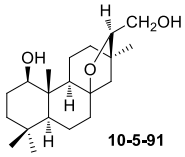
10-5-85 R = OH
10-5-86 R = =O



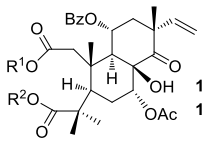
	R^1	R^2
10-5-87	OH	OH
10-5-88	=O	OH
10-5-89	=O	H



10-5-90



10-5-91



	R^1	R^2
10-5-92	H	H
10-5-93	H	Me

Table 10-5-34: ^{1}H NMR spectroscopic data of pimarane- and isopimarane-type diterpenoids **10-5-85**~**10-5-88**.

H	10-5-85	10-5-86	10-5-87	10-5-88
1	1.08 dt(3.5, 12.5), 1.71 m	1.11 dt(4.5, 13.0), 1.79 m	1.70 m, 1.82 m	1.96 m, 2.03 m
2	1.45 m	1.45 m, 1.58 m	1.61 m, 1.67 m	1.62 m, 1.68 m

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Table 10-5-34 (continued)

H	10-5-85	10-5-86	10-5-87	10-5-88
3	1.22 m, 1.44 m	1.51 m	1.22 m, 1.69 m	1.23 m, 1.55 m
5	1.57 m	1.47 m		
6	1.58 m, 1.79 m	2.28 dd(13.5, 18.5), 2.57 m		
7	4.20 t(2.5)		4.63 d(2.1)	
9	2.13 m	2.05 m		
11	1.47 m	1.45 m, 1.76 m	3.86 dd(12.0, 4.2)	4.03 dd(11.7, 4.1)
12	1.35 dt(3.5, 13.0), 1.43 m	1.42 m, 1.57 m	1.71 m, 1.89 m	1.73 m, 2.07 m
14	5.43 br s	6.61 br s	5.99 (1.6, 1.7)	6.81 d(1.8)
15	2.80 dd(2.5, 4.0)	2.85 dd(2.5, 3.5)	5.85 dd(17.5, 10.7)	5.82 dd(17.5, 10.7)
16	2.56 dd(2.5, 4.5), 2.66 t(4.5)	2.56 m, 2.66 t(4.0)	5.04 m	5.09 m
17	1.02 s	1.06 s	1.16 s	1.22 s
18	0.91 s	0.87 s	1.26 s	1.19 s
19	0.86 s	0.90 s	1.44 s	1.45 s
20	0.76 s	0.83 s	3.36 d(9.6), 3.97 d(9.6)	3.71 d(10.2), 4.14 d(10.2)

Table 10-5-35: ^{1}H NMR spectroscopic data of pimarane- and isopimarane-type diterpenoids **10-5-89**~**10-5-91**.

H	10-5-89	10-5-90	10-5-91
1	2.08 m	1.83 m, 1.70 m	3.25 dd(10.8, 4.8)
2	1.48 m	1.65 m	α 1.48 m, β 1.58 m
3	1.60 m, 1.24 m	1.60 m, 1.32 m	α 1.70 m, β 1.55 m
5	5.06 br s (OH)	5.06 br s(OH)	1.25 m
6			α 1.40 m, β 1.60 m
7			α 1.42 m, β 1.38 m
9			0.76 m
11	1.71 m	4.42 dd(6.3, 4.8)	α 1.72 m, β 2.18 m
12	1.55 m, 2.20 td(13.5, 4.8)	2.01 dd(14.4, 6.3), 2.24 dd(14.4, 4.8)	α 1.32 m, β 1.24 m
14	6.79 d(1.5)	4.43 s	α 1.58 m, β 1.22 m
15	5.87 dd(17.4, 10.5)	6.13 dd(17.7, 10.2)	3.74 dd(7.5, 2.5)
16	5.07 d(10.5), 5.12 d(17.7)	5.27 dd(17.7, 0.9), 5.34 dd(10.2, 0.9)	3.37 dd(10.8, 7.5), 3.48 dd(10.8, 2.5)
17	1.16 s	1.03 s	0.92 s
18	1.19 s	1.27 s	0.85 s
19	1.43 s	1.56 s	0.85 s
20	3.73 d(9.9), 4.04 d(9.9)	3.29 d(9.3), 4.45 d(9.3)	1.04 s

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Table 10-5-36: ^{1}H NMR spectroscopic data of pimarane- and isopimarane-type diterpenoids **10-5-92** and **10-5-93**.

H	10-5-92	10-5-93	H	10-5-92	10-5-93
1	2.63 d(20.3)	2.32 d(20.3)	16	5.15 d(10.8)	5.15 d(10.8)
	2.17 d(20.3)	2.22 d(20.3)		4.96 d(17.6)	4.98 d(17.6)
3		3.57 s(COOMe)	17	1.15 s	1.18 s
5	3.08 dd(12.7, 3.1)	3.05 dd(15.2, 2.7)	18	1.20 s	1.18 s
6	2.04 m, 2.08 m	2.07 m	19	1.11 s	1.20 s
		1.98 dt(15.2, 2.7)			
7	5.34 br s	5.30 t(2.7)	20	1.26 s	1.20 s
9	3.58 d(7.1)	3.78 d(7.3)	OAc	2.07 s	2.09 s
11	5.53 t(7.1)	5.60 dd(7.3)	2′, 6′	7.80 d(8.1)	8.03 dd(7.6, 1.5)
12	2.54 dd(15.4, 7.1)	2.53 dd(15.6, 7.3)	3′, 5′	7.34 t(8.1)	7.46 t(7.6)
	2.06 d(15.4)	2.09 m			
15	5.92 dd(17.6, 10.8)	5.95 dd(17.6, 10.8)	4′	7.50 t(8.1)	7.58 tt(7.6, 1.5)

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10.6 Rosane-type diterpenoids

Table 10-6-1: Compounds, MFs, and test solvents of rosane-type diterpenoids **10-6-1**~**10-6-18**.

No.	Compounds	MFs	Test solvents	References
10-6-1	18-hydroxy-2-oxorosa-1(10),15-diene	$C_{20}H_{30}O_2$	$CDCl_3$	[307]
10-6-2	hugorosenol	$C_{20}H_{32}O_2$	$CDCl_3$	[307]
10-6-3	18-hydroxyhugorosenone	$C_{20}H_{30}O_3$	$CDCl_3$	[308]
10-6-4	hugorosediol	$C_{20}H_{32}O_2$	$CDCl_3$	[308]
10-6-5	petalostigmone A	$C_{20}H_{30}O_2$	$CDCl_3$	[309]
10-6-6	petalostigmone B	$C_{20}H_{28}O_2$	$CDCl_3$	[309]
10-6-7	sagittine A	$C_{20}H_{30}O_2$	$CDCl_3$	[310]
10-6-8	sagittine G	$C_{20}H_{32}O_3$	$CDCl_3$	[310]
10-6-9	5β,11β-dihydroxy-ros-15-ene	$C_{20}H_{34}O_2$	$CDCl_3$	[311]
10-6-10	5β,12β-dihydroxy-ros-15-ene	$C_{20}H_{34}O_2$	$CDCl_3$	[311]
10-6-11	11β-hydroxy-7-oxo-rosa-5,15-diene	$C_{20}H_{30}O_2$	$CDCl_3$	[311]
10-6-12	1α,5β,11β-trihydroxy-7-oxo-ros-15-ene	$C_{20}H_{32}O_4$	$CDCl_3$	[311]
10-6-13	candidalactone	$C_{20}H_{28}O_4$	$CDCl_3$	[312]
10-6-14	5β,20-epoxy-20-hydroxy-ros-15-ene	$C_{20}H_{30}O_2$	$CDCl_3$	[311]
10-6-15	5β,20-epoxy-20-methoxy-ros-15-ene	$C_{21}H_{32}O_2$	$CDCl_3$	[311]
10-6-16	rosenonolactone	$C_{20}H_{28}O_3$	$CDCl_3$	[313]
10-6-17	6β-hydroxyrosenonolactone	$C_{20}H_{28}O_4$	$CDCl_3$	[313]
10-6-18	rosololactone	$C_{20}H_{30}O_3$	$CDCl_3$	[313]

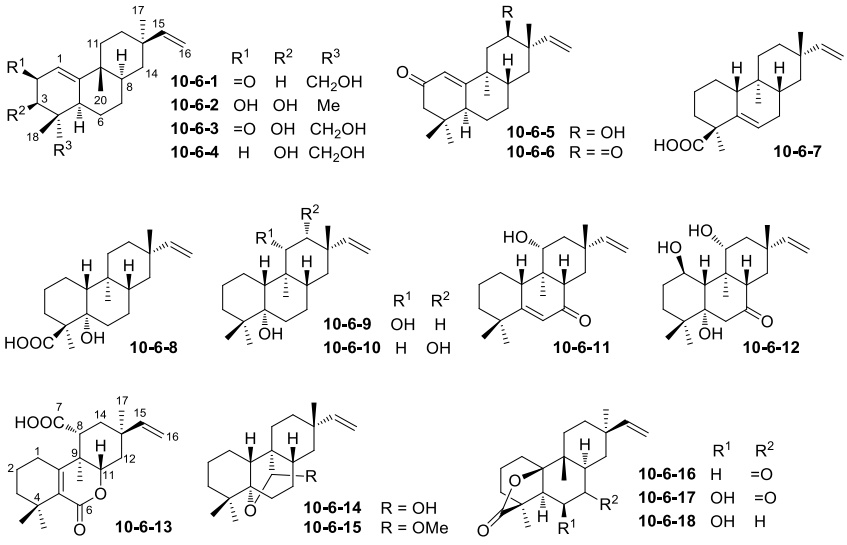

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Table 10-6-2: ^{1}H NMR spectroscopic data of rosane-type diterpenoids **10-6-1**~**10-6-4**.

H	10-6-1	10-6-2	10-6-3	10-6-4
1	6.09 d(2.74)	5.71 dd(4.7, 2.5)	6.09 d(3)	5.40 ddd(5.5, 2.5, 2.5)
2		4.17 m		2.28 (ov) 1.99 dddd(17.5, 10.5, 4.5, 2.5)
3	2.71 d(12), 2.76 d(12)	3.36 dd(8.4, 5.6), 2.72 d(8.4, OH)	4.34 s	3.91 dd(10.5, 6)
5	3.02 dd(11.7, 2.7, 2.6)	2.11 m	3.07 ddd(13, 5, 3)	2.30 (ov)
6	ax 1.45 m, eq 2.02 (ov)	ax 1.41 m, eq 1.75 m	1.85 (ov), 1.45 (ov)	1.60 (ov), 1.35 (ov)
7	ax 1.32 (ov), eq 1.78 (ov)	ax 1.28 (ov), eq 1.62 (ov)	1.30 (ov), 1.75 (ov)	1.25 (ov), 1.55 (ov)
8	2.03 (ov)	1.70 (ov)	1.85 (ov)	1.75 dddd(12.5, 11, 6.5, 4)
11	ax 1.51 (ov), eq 1.77 (ov)	ax 1.47 m, eq 1.75 m	1.50 (ov), 1.75 (ov)	1.45 m, 1.70 (ov)
12	ax 1.25 (ov)	ax 1.31 m, eq 1.52 m	1.25 (ov)	1.50 (ov), 1.25 (ov)
14	ax 1.36 (ov), eq 1.54 (ov)	ax 1.16 m, eq 1.21 m	1.35 (ov), 1.55 (ov)	1.20 dd(13.5, 12.5) 1.10 ddd(13.5, 4, 2.5)
15	5.82 dd(17.6, 10.8)	5.82 dd(17.6, 10.8)	5.81 dd(17.5, 11)	5.00 dd(17.5, 10.5)
16	ax 4.94 dd(17.6, 1.3) eq 4.86 dd(10.8, 1.3)	ax 4.86 dd(10.6, 1.3) eq 4.93 dd(17.6, 1.3)	4.94 dd(17.5, 1.5) 4.88 dd(11, 1.5)	4.91 dd(17.5, 1.5) 4.84 dd(10.5, 1.5)
17	0.98 s	0.97 s	0.99 s	0.98 s
18	0.77 s	0.76 s	0.62 s	0.75 s
19	3.27 d(11.0), 3.65 d(11.0)	1.04 s	3.58 d(11), 3.72 d(11)	3.57 d(11), 3.75 d(11)
20	1.04 s	0.97 s	1.04 s	0.92 s
OH			3.83 br s, 2.30 br s	2.40 br s, 2.40 br s

Table 10-6-3: ^{1}H NMR spectroscopic data of rosane-type diterpenoids **10-6-5**~**10-6-8**.

H	10-6-5	10-6-6	10-6-7	10-6-8
1	5.87 s	5.72 s	1.78 dd(3.2, 12.8) 1.07 d(9.6)	1.56 m, 1.62 m
2			1.68 d(10.4) 1.45 d(11.2)	1.62 m 1.35 d(10.4)
3	α 2.11 d(15.5) β 2.26 d(15.5)	α 2.28 d(16.1) β 2.12 d(15.6)	2.18 d(13.2) 1.18 d(13.2)	1.81 d(15.2) 1.66 d(10.4)
5	2.34 dd(12.1, 4.5)	2.23 dd(12.7, 3.8)		

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Table 10-6-3 (continued)

H	10-6-5	10-6-6	10-6-7	10-6-8
6	*α* 2.01~2.04 m	*α* 2.09~2.13 m	5.70 d(5.6)	2.09 dt(4.4, 13.2)
	β 1.35 qd(12.2, 4.5)	*β* 1.48 qd(12.8, 3.8)		1.72 d(14.0)
7	*α* 1.49~1.55 m	*α* 1.43 qd(12.8, 3.8)	1.71 d(12.0), 1.80 d(17.6)	1.46 d(20)
	β 1.40 qd(12.2, 3.2)	*β* 1.70~1.74 m		1.13 d(14.8)
8	1.47 m	1.99 tt(12.2, 3.5)	1.56 m	1.42 m
10			1.95 d(12.8)	1.77 d(14.0)
11	*α* 1.76 app dd(12.1, 4.0)	*α* 2.31 d(13.5)	1.62 d(10.8)	1.53 d(8.0)
	β 1.63 app t(11.8)	*β* 2.76 d(13.5)	1.29 d(9.6)	1.14 t(13.8)
12	3.80 app dd(11.6, 3.4)		1.47 t(12.8)	1.53 t(15.2)
			1.22 d(13.6)	1.16 d(12.8)
14	*α* 1.22 dd(13.3, 2.5)	*α* 1.80 t(13.5)	1.26 dd(6.4, 12.0)	1.38 m
	β 1.46 t(13.0)	*β* 1.59 dd(14.0, 3.6)	1.12 d(10.0)	0.98 d(11.6)
15	5.84 dd(17.6, 10.9)	6.20 dd(17.6, 0.9)	5.80 d(10.8, 17.6)	5.79 dd(10.8, 17.6)
16	5.10 dd(10.9, 1.0)	5.15 dd(10.9, 0.9)	4.90 d(17.6)	4.89 dd(0.8, 17.2)
	5.12 dd(17.6, 0.9)	5.06 dd(17.8, 0.8)	4.83 d(10.8)	4.82 dd(0.8, 10.8)
17	1.02 s	1.31 s	1.01 s	1.02 s
18	0.93 s	0.99 s		
19	1.02 s	1.00 s	1.36 s	1.20 s
20	1.11 s	1.01 s	0.67 s	0.88 s

Table 10-6-4: ^{1}H NMR spectroscopic data of rosane-type diterpenoids **10-6-9**, **10-6-14**, and **10-6-15**.

H	10-6-9	10-6-14	10-6-15
11	3.57 dd(11.1, 4.8)	5.20 br d(3.9)	
15	5.72 dd(10.7, 17.5)	5.78 dd(10.7, 17.5)	5.76 dd(10.7, 17.5)
16	4.87 dd(17.5, 1.1)	4.90 dd(17.5, 1.0)	4.87 dd(17.5, 1.3)
	4.83 dd(10.7, 1.1)	4.83 dd(10.7, 1.0)	4.82 dd(10.7, 1.3)
17	1.04 s	1.02 s	1.00 s
18	0.83 s	0.93 s	0.93 s
19	0.99 s	0.88 s	0.85 s
20	0.91 s		4.64 s
			3.35 s(OMe)

Table 10-6-5: ^{1}H NMR spectroscopic data of rosane-type diterpenoids **10-6-10**~**10-6-12**.

H	10-6-10	10-6-11	10-6-12
1	–	–	3.90 m
6	–	5.94 br d(1.4)	–
11	3.56 br s	3.91 t(8.0)	3.76 dd(5.3, 10.7)

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Table 10-6-5 (continued)

H	10-6-10	10-6-11	10-6-12
15	5.83 dd(10.8, 17.4)	5.79 dd(10.6, 17.4)	5.73 dd(10.7, 17.5)
16	5.15 d(10.8)	4.96 dd(17.4, 0.9)	4.87 dd(17.5, 0.8)
	5.12 d(17.4)	4.88 dd(10.6, 0.9)	4.79 dd(10.7, 0.8)
17	1.14 s	1.12 s	0.91 s
18	0.83 s	0.83 s	1.02 s
19	1.04 s	1.12 s	0.75 s
20	1.21 s	0.73 s	0.87 s

Table 10-6-6: ^{1}H NMR spectroscopic data of rosane-type diterpenoids **10-6-13** and **10-6-16**~**10-6-18**.

H	10-6-13	10-6-16	10-6-17	10-6-18
1	2.21~2.26 m	1.20~1.70 m	1.20~1.70 m	2.16 m
2	1.66~1.74 m	1.70 m, 1.92 m	1.80 m, 1.95 m	1.70 m, 1.85 m
3	*α* 1.37 dd(13.9, 2.9)	1.61 m, 1.70 m	1.60 m, 1.80 m	1.60 m, 1.75 m
	β 1.47~1.53 m			
5		2.25 m	2.30 d(4.8)	1.8 m
6		1.90 m, 2.20 m	3.95 d(4.8),	4.20 m
			2.70 s(OH)	
7				1.90 m, 2.0 m
8	2.51 dd(12.2, 3.2)	2.38 m	2.60 dd(3.9, 11.8)	1.30~1.80 m
10		2.10 m, 2.35 m		
11	3.94 dd(12.8, 3.7)	2.10 m, 2.35 m	2.10 m, 2.35 m	1.3~1.8 m
12	*α* 1.69 t(12.8)	1.20~1.70 m	1.20~1.70 m	1.3~1.8 m
	β 1.86~1.92 m			
14	*α* 1.77 t(13.6)	1.20~1.70 m	1.20~1.70 m	1.20 m, 1.40 m
	β 1.86~1.92 m			
15	5.71 dd(17.9, 10.9)	5.80 dd(17.6, 10.8)	5.80 dd(17.6, 10.8)	5.80 dd(17.6, 10.8)
16	5.11 d(17.9),	4.90 d(10.8),	4.90 d(10.8),	4.80 d(10.8),
	5.17 d(10.9)	4.95 d(17.6)	4.99 d(17.6)	4.90 d(17.6)
17	1.09 s	0.90 s	0.97 s	0.99 s
18	1.32 s			
19	1.24 s	1.80 s	1.4 s	1.30 s
20	1.17 s	0.93 s	1.1 s	1.23 s

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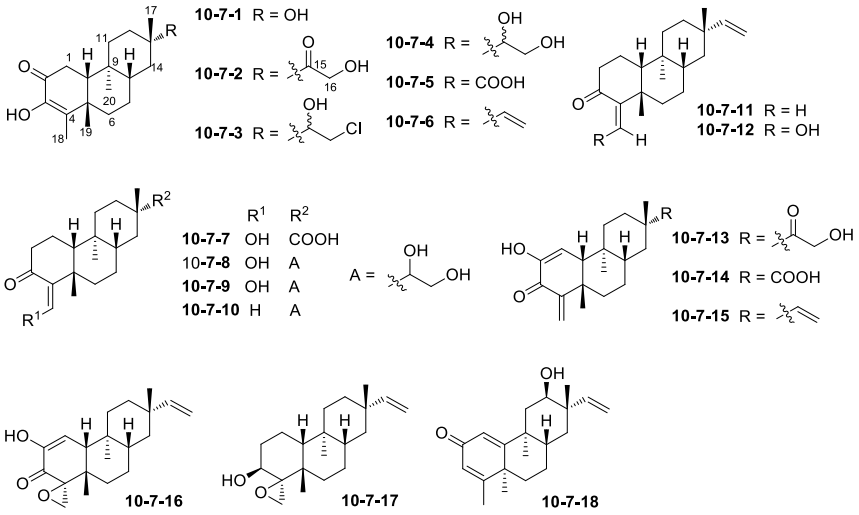
10.7 Dolabrane-type diterpenoids

Table 10-7-1: Compounds, MFs, and test solvents of dolabrane-type diterpenoids **10-7-1**~**10-7-20**.

No.	Compounds	MFs	Test solvents	References
10-7-1	tagalsin P	$C_{18}H_{28}O_3$	CD_3OD	[314]
10-7-2	*ent*-5*α*,2,15-dioxodolabr-3-ene-3,16-diol	$C_{20}H_{30}O_4$	$CDCl_3$	[315]
10-7-3	*ent*-5*α*,16-chloro-2-oxodolabr-3-ene-3,15*ξ*-diol	$C_{20}H_{31}ClO_3$	$CDCl_3$	[315]
10-7-4	*ent*-5*α*,2-oxodolabr-3-ene-3,15,16-triol	$C_{20}H_{32}O_4$	$CDCl_3$	[316]
10-7-5	*ent*-16-*nor*-5*α*,2-oxodolabr-3-ene-3-ol-15-oic acid	$C_{19}H_{28}O_4$	$CDCl_3$	[316]
10-7-6	tagalsin G	$C_{20}H_{30}O_2$	$CDCl_3$	[317]
10-7-7	tagalsin R	$C_{19}H_{28}O_4$	CD_3OD	[314]
10-7-8	tagalsin S	$C_{20}H_{30}O_4$	CD_3OD	[314]
10-7-9	tagalsin T	$C_{20}H_{32}O_4$	CD_3OD	[314]
10-7-10	tagalsin U	$C_{20}H_{32}O_3$	CD_3OD	[314]
10-7-11	tagalsin E	$C_{20}H_{30}O$	$CDCl_3$	[317]
10-7-12	tagalsin F	$C_{20}H_{30}O_2$	$CDCl_3$	[317]
10-7-13	*ent*-5*α*,3,15-dioxodolabr-1,4(18)-diene-2,16-diol	$C_{20}H_{28}O_4$	$CDCl_3$	[315]
10-7-14	*ent*-16-*nor*-3-oxodolabr-1,4(18)-diene-2-ol-15-oic acid	$C_{19}H_{26}O_4$	$CDCl_3$	[316]
10-7-15	tagalsin C	$C_{20}H_{28}O_2$	$CDCl_3$	[317]
10-7-16	tagalsin A	$C_{20}H_{28}O_3$	$CDCl_3$	[317]
10-7-17	tagalsin D	$C_{20}H_{32}O_2$	$CDCl_3$	[317]
10-7-18	petalostigmone C	$C_{20}H_{28}O_2$	$CDCl_3$	[318]
10-7-19	*ent*-2-*seco*-3-*nor*-5*α*,4,15-dioxo-16-hydroxydolabran-2-oic acid	$C_{19}H_{30}O_5$	$CDCl_3$	[315]
10-7-20	tagalsin H	$C_{19}H_{30}O_3$	$CDCl_3$	[317]



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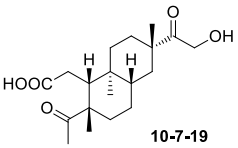
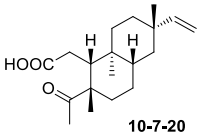


10-7-19



10-7-20

Table 10-7-2: ^{1}H NMR spectroscopic data of dolabrane-type diterpenoids **10-7-1**~**10-7-3**.

H	10-7-1	10-7-2	10-7-3
1*α*	2.67 d(18.5)	2.69 br dd(19.2)	2.70 br d
1*β*	2.92 dd(18.5, 6.5)	2.83 dd(19.0, 6.5)	2.81 dd
6*α*	2.22 dt(14.0, 3.0)	2.16 br ddd(14, 3, 3)	2.14 ddd
6*β*	1.33 m(ov)	1.26 ddd(14, 13, 2.5)	1.23 m
7	1.22 m(ov)	*α* 1.15 m, *β* –	*α* 1.10 m, *β* 1.25 m
8	1.31 m(ov)	1.39 m	–
10	1.69 d(6.5)	1.64 ddd(6.5, 2.1)	1.64 dd(6.5, 2)
11*α*	1.76 ddd(13.5, 4.5, 3.0)	1.71 ddd(13, 4.5, 2.5)	1.64 ddd
11*β*	1.05 dt(13.5, 4.0)	1.10 ddd(14, 14, 4)	1.02 ddd
12	*α* 1.67 m(ov), *β* 1.51 m(ov)	*α* 1.79 ddd(14, 14, 4.5), *β* 1.39 m	*α* 1.51 ddd, *β* 1.34 m
14	*α* 1.52 m(ov), *β* 1.31 m(ov)	*α* 1.58 dd(13, 13), *β* 1.19 m	*α* 1.41 dd, *β* –
15			3.35 dd(10.5, 2)
16		4.32 br s	3.72 dd(11, 2)
			3.44 dd(11, 10.5)
17	1.25 s	1.20 s	0.93 s
18	1.88 s	1.85 s	1.87 s
19	1.26 s	1.22 s	1.20 s
20	0.70 s	0.58 s	0.58 s
OH		6.12 br s	6.12 br s

Table 10-7-3: ^{1}H NMR spectroscopic data of dolabrane-type diterpenoids **10-7-4**~**10-7-6**.

H	10-7-4	10-7-5	10-7-6
1	*α* 2.69 dd(18.5, 2)	*α* 2.69 dd(19, 2)	2.77 d(18.7)
	β 2.81 dd(18.5, 6.5)	*β* 2.82 dd(19, 6.5)	2.87 dd(6.5, 18.7)
6	*α* 2.13 ddd(14, 3, 3)	*α* 2.14 ddd(14, 3, 3)	1.30 m
	β 1.24 ddd(14, 13, 3)	*β* 1.25 ddd(14, 13, 2.5)	2.19 ddd(2.5, 2.5, 13.5)
7	*α* 1.11 m	*α* 1.13 m	1.18 m, 1.53 m
8	1.35 m	1.38 dddd(13, 13, 3, 3)	1.41 m
10	1.61 dd(6.5, 2)	1.62 dd(6.5, 2)	1.68 d(6.5)
11	*α* 1.63 ddd(13.5, 4.5, 3.5)	*α* 1.67 m	1.12 ddd(4.0, 13.5, 13.5)
	β 1.02 ddd(13, 13, 14)	*β* 1.06 ddd(13, 13, 4)	1.66 ddd(3.5, 3.5, 13.5)
12	*α* 1.48 ddd(13, 5, 13, 4)	*α* 1.88 dddd(13.5, 13.5, 4)	1.21 ddd(3.5, 4.0, 13.5)
	β 1.3 m	*β* 1.45 ddd(13.5, 4, 3)	1.54 ddd(4.0, 13.5, 13.5)
14	*α* 1.35 m	*α* 1.69 dd(13, 13)	1.02 m
	β 0.85 m	*β* 1.27 dd(13, 3.5)	1.40 dd(13.0, 13.5)

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Table 10-7-3 (continued)

H	10-7-4	10-7-5	10-7-6
15	3.29 dd(10, 2), 6.09 br s(OH)		5.81 dd(17.5, 10.8)
16	3.70 br d(10, 2)		4.94 d(17.5)
	3.49 dd(10, 10)		4.87 d(10.8)
17	0.91 s	1.21 s	1.05 s
18	1.85 s	1.85	1.90 s
19	1.20 s	1.24 s	1.27 s
20	0.57 s	0.61 s	0.62 s
OH	6.09 br s	6.15 br s	

Table 10-7-4: ^{1}H NMR spectroscopic data of dolabrane-type diterpenoids **10-7-7**~**10-7-10**.

H	10-7-7	10-7-8	10-7-9	10-7-10
1	α 2.06 m, β 2.16 m	α 2.05 m, β 2.17 m	α 2.05 m, β 2.16 m	2.15 m(ov)
2	2.51 br s	2.50 m	2.50 m	2.55 m
6	α 2.25 m	α 2.25 br d(14.5)	α 2.23 br d(14.5)	α 2.17 m(ov)
	β 1.49 m(ov)	β 1.50 m(ov)	β 1.45 m(ov)	β 1.48 m(ov)
7	α 1.30 m(ov)	α 1.31 m(ov)	α 1.27 m(ov)	1.16 m(ov)
	β 1.18 m(ov)	β 1.18 m(ov)	β 1.13 br d(13.5)	
8	1.49 m(ov)	1.53 m(ov)	1.45 m(ov)	1.44 m(ov)
10	1.31 m(ov)	1.32 m(ov)	1.28 m(ov)	1.37 m(ov)
11	α 1.78 m(ov)	α 1.78 dt(13.5, 3.5)	α 1.71 dt(13.0, 3.5)	α 1.73 br d(13.0)
	β 1.18 m(ov)	β 1.20 m(ov)	β 1.08 m(ov)	β 1.12 m(ov)
12	α 1.97 dt(14.0, 3.5)	α 1.88 dt(14.0, 4.5)	α 1.58 dt(14.0, 4.5)	α 1.52 m(ov)
	β 1.47 m(ov)	β 1.42 m	β 1.32 m(ov)	β 1.32 m(ov)
14	α 1.72 m(ov)	α 1.62 t(13.5)	α 1.45 m(ov)	α 1.44 m(ov)
	β 1.27 m(ov)	β 1.21 m(ov)	β 0.91 br d(12.0)	β 0.92 m(ov)
15			3.21 dd(9.0, 2.5)	3.19 br d(8.8)
16		4.44 s	3.71 dd(11.5, 2.5)	3.70 br d(11.2)
			3.43 dd(11.0, 9.0)	3.41 br t(10.0)
17	1.26 s	1.24 s	0.94 s	0.93 s
18	7. 94 s	7.94 s	7.92 s	5.90 br s, 5.33 br s
19	1.20 s	1.20 s	1.19 s	1.11 s
20	0.77 s	0.75 s	0.73 s	0.80 s

Table 10-7-5: ^{1}H NMR spectroscopic data of dolabrane-type diterpenoids **10-7-11**~**10-7-13**.

H	10-7-11	10-7-12	10-7-13
1	2.00 m, 2.11 m	1.97 m, 2.04 ddd(7.0, 9.0, 16.5)	6.14 d(6.5)
2	2.53 dd(8.5, 13.5)	2.46 dd(3.0, 13.0)	
	2.54 dd(5.0, 13.5)	2.45 dd(9.0, 13.0)	
6	1.48 ddd(2.5, 14.0, 15.0)	1.42 ddd(4.0, 13.0, 14.0)	α 2.19 ddd
	2.15 m	2.13 ddd(4.0, 3.0, 14.0)	β 1.30~1.45 m

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Table 10-7-5 (continued)

H	10-7-11	10-7-12	10-7-13
7	1.12 m, 1.32 m	1.10 m, 1.23 m	1.30~1.45 m
8	1.40 ddd(2.0, 2.0, 11.5)	1.41 ddd(1.5, 13.0, 13.5)	
10	1.34 m	1.24 m	2.03 d(6.5)
11	1.12 m	1.10 ddd(3.5, 13.0, 14.0)	1.30~1.45 m
	1.69 ddd(3.5, 3.5, 13.0)	1.62 ddd(3.0, 4.0, 13.0)	
12	1.22 ddd(3.0, 3.5, 13.0)	1.20 ddd(3.0, 3.5, 14.0)	α 1.73 ddd
	1.52 ddd(3.5, 13.0, 13.0)	1.53 ddd(4.0, 14.0, 14.0)	β 1.40 m
14	0.98 m, 1.30 m	0.96 ddd(1.5, 1.5, 13.5)	α 1.58 dd
		1.32 dd(13.0, 13.5)	β 1.29 br d(13.0)
15	5.79 dd(17.5, 10.8)	5.78 dd(17.5, 10.7)	
16	4.84 d(10.8), 4.92 d(17.5)	4.84 d(10.7), 4.88 d(17.5)	4.36 s
17	1.02 s	1.01 s	1.24 s
18	5.92 br s, 5.24 br s	7.90 d(7.8)	6.23 s, 5.39 s
19	1.08 s	1.15 s	1.10 s
20	0.78 s	0.69 s	0.60 s

Table 10-7-6: ^{1}H NMR spectroscopic data of dolabrane-type diterpenoids **10-7-14**~**10-7-16**.

H	10-7-14	10-7-15	10-7-16
1	6.15 d(6.5)	6.22 d(6.7)	6.34 d(6.8)
6	–	1.48 m, 2.20 ddd(2.5, 2.5, 14.5)	1.19 m, 1.44 m
7	–	1.20 m, 1.32 m	1.06 m, 1.48 m
8	1.38 dddd(13, 13, 3, 3)	1.46 m	1.40 m
10	2.01 d(7)	2.08 d(6.7)	2.14 d(6.8)
11	α 1.55 ddd(13, 3, 3)	1.43 m, 1.53 m	1.40 dd(10.5, 12.5)
	β –		1.52 ddd(3.0, 4.0, 12.5)
12	α 1.83 ddd(14, 14, 4)	1.20 m, 1.48 m	1.20 dd(3.0, 14.0)
	β 1.43 m		1.48 dd(4.0, 10.5, 14.0)
14	α 1.68 dd(13, 13)	1.10 m, 1.30 m	1.03 m
	β 1.22 br d(13)		1.34 dd(11.5, 12.5)
15		5.80 dd(17.5, 10.8)	5.79 dd(10.7, 17.5)
16		4.87 d(10.8), 4.90 d(17.5)	4.85 br d(10.7), 4.92 br d(17.5)
17	1.23 s	1.05 s	1.05 s
18	6.22 s, 5.39 s	5.43 br s, 6.26 br s	2.96 d(6.1), 3.44 d(6.1)
19	1.10 s	1.14 s	1.18 s
20	0.61 s	0.64 s	0.77 s

Table 10-7-7: ^{1}H NMR spectroscopic data of dolabrane-type diterpenoids **10-7-17**~**10-7-20**.

H	10-7-17	10-7-18	10-7-19	10-7-20
1	1.82 m	6.20 s	α 3.09 dd(18.5, 2.5)	2.66 dd(7.0, 18.0)
	2.04 ddd(4.0, 4.5, 14.0)		β 2.60 dd(18.5, 2.5)	3.15 dd(2.0, 18.0)
2	1.80 m, 2.15 m			

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Table 10-7-7 (continued)

H	10-7-17	10-7-18	10-7-19	10-7-20
3	3.45 dd(1.5, 2.0)	6.05 s		
6	0.98 m	*α* 1.40 m	*α* 2.30 ddd	1.31 m
	1.59 ddd(2.5, 3.0, 14.5)	*β* 1.20 m	*β* 1.45~1.42 s	2.32 ddd(2.5, 2.5, 14.0)
7	0.99 m, 1.08 m	*α* 1.50 m, *β* 1.65 m	1.30 m	1.20 m, 1.46 m
8	1.33 m	1.49 m		1.52 m
10	1.39 m		1.85 dd(6.5, 2.5)	1.89 dd(2.0, 7.0)
11	1.18 ddd(4.0, 13.5, 13.5)	*α* 2.03 dd(12.5, 4.6)	1.22 m, 1.39 m	1.30 m, 1.51 m
	1.78 m	*β* 1.51 t(12.0)		
12	1.25 m	3.83 dd(11.6, 4.5)	*α* 1.78 ddd	1.22 m, 1.52 m
	1.47 ddd(4.0, 13.5, 13.5)		*β* 1.39 m	
14	0.98 m, 1.32 dd(12.0, 13.0)	*α* 1.49 m	*α* 1.53 dd	1.00 m, 1.38 m
		β 1.50 m	*β* 1.19 br d(13)	
15	5.80 dd(17.5, 10.8)	5.86 dd(17.3, 10.7)		5.78 dd(17.5, 10.5)
16	4.84 d(10.8)	5.11 dd(10.7, 1.0)	4.35 s	4.84 d(10.5), 4.88 d(17.5)
	4.90 d(17.5)	5.12 dd(17.3, 1.0)		
17	1.01 s	0.98 s	1.21 s	1.04 s
18	2.70 d(4.6), 3.08 d(4.6)	1.98 s	2.17 s	2.22 s
19	1.39 s	1.37 s	1.13 s	1.17 s
20	0.87 s	1.23 s	0.57 s	0.58 s

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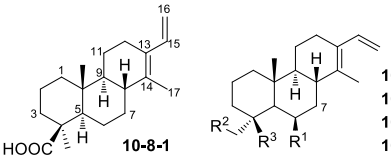
10.8 Cassane-type diterpenoids

Table 10-8-1: Compounds, MFs, and test solvents of cassane-type diterpenoids **10-8-1**~**10-8-7**.

No.	Compounds	MFs	Test solvents	References
10-8-1	cassa-13(14),15-dien-19-oic acid	$C_{20}H_{30}O_2$	$CDCl_3$	[319]
10-8-2	18-hydroxycassan-13,15-diene	$C_{20}H_{32}O$	$CDCl_3$	[320]
10-8-3	6*β*,18-dihydroxycassan-13,15-diene	$C_{20}H_{32}O_2$	$CDCl_3$	[320]
10-8-4	6*β*-hydroxy18-acetoxycassan-13,15-diene	$C_{22}H_{34}O_3$	$CDCl_3$	[320]
10-8-5	18-acetoxy-13,15-diene-19-cassanoic acid	$C_{22}H_{32}O_4$	$CDCl_3$	[320]
10-8-6	6*β*,13*β*-dihydroxy-18-acetoxycassan-14(17),15-diene	$C_{22}H_{34}O_4$	$CDCl_3$	[320]
10-8-7	chagresnol	$C_{22}H_{34}O_4$	$CDCl_3$	[321]



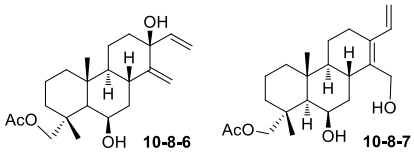


Table 10-8-2: ^{1}H NMR spectroscopic data of cassane-type diterpenoids **10-8-1**~**10-8-5**.

H	10-8-1	10-8-2	10-8-3	10-8-4	10-8-5
1	*α* 0.96 dt(4.4, 13.3) *β* 1.85 m	0.90 br, 1.74 br	0.89 br, 1.71 br	0.90 br, 1.75 br	0.91 br, 1.79 br
2	*α* 1.50 br d(14.3) *β* 1.90 m	1.52 br, 1.65 br	1.52 br, 1.69 br	1.51 br, 1.68 br	1.17 br, 1.50 br
3	*α* 1.04 dt(4.1, 12.9) *β* 2.17 br d(12.9)	1.28 br	1.17 br, 1.36 br	1.33 br, 1.41 br	1.01 br, 2.23 br
5	1.13 d(12.4, 3.6)	1.20 br	1.20 br	1.18 br	1.25 br
6	1.90 m	1.30 br, 1.55 br	4.38 d(2.3)	4.27 d(1.7)	1.78 br
7	*α* 0.85 dq(4.4, 12.6) *β* 2.23 dq(12.6, 3.6)	0.89 br, 2.13 br	1.19 br, 2.13 dt(3, 13)	1.19 br, 2.13 dt(3, 13)	2.16 br
8	2.00 m	2.02 br	2.40 br	2.42 br	1.93 br
9	0.88 m	0.96 br	0.92 br	0.92 br	0.84 br
11	*α* 1.85 m *β* 1.06 dt(4.0, 13.3)	0.96 br, 1.70 br	1.70 br, 2.02 br	1.18 br, 1.85 br	1.78 br

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Table 10-8-2 (continued)

H	10-8-1	10-8-2	10-8-3	10-8-4	10-8-5
12	*α* 2.00 m *β* 2.33 br d(17.0)	2.02 br, 2.31 br	1.99 br, 2.31 br	2.03 br, 2.34 br	2.25 br
15	6.81 dd(17.3, 11.0)	6.80 dd(11, 17)	6.78 dd(11 17)	6.77 dd(11, 17)	6.79 dd(11, 17)
16	*E* 4.96 d(11.0)	4.95 d(11)	4.93 d(11)	4.94 d(11)	4.95 d(11)
	Z 5.11 d(17.3)	5.03 d(17)	5.08 d(17)	5.10 d(17)	5.09 d(17)
17	1.75 s	1.73 s	1.72 s	1.73 s	1.66 s
18	1.23 s	3.12 d(11), 3.39 d(11)	3.19 d(11), 3.51 d(11)	3.69 d(11), 4.02 d(11)	3.92 d(10), 4.45 d(10)
OAc				2.02 s	1.97 s
19		0.80 s	1.16 s	1.25 s	
20	0.76 s	0.89 s	1.15 s	1.19 s	0.72 s

Table 10-8-3: ^{1}H NMR spectroscopic data of cassane-type diterpenoids **10-8-6** and **10-8-7**.

H	10-8-6	10-8-7	H	10-8-6	10-8-7
1	0.90 br, 1.75 br	0.90 m, 1.72 m	11	1.52 br, 1.69 br	1.81 m
2	1.62 br	1.52 m, 1.70 m	12	1.52 br, 2.22 dt(3, 13)	2.18 m, 2.43 m
3	1.41 br, 1.52 br	1.73 m	15	6.09 dd(11, 15)	6.85 dd(11, 17)
5	1.22 br	1.23 m	16	5.37 dd(1.3, 11) 5.38 dd(1.3, 15)	5.08 d(11), 5.24 d(17)
6	4.36 d(1.7)	4.31 m	17	4.92 d(1.7), 5.08 d(1.7)	4.26 m
7	1.51 br	1.29 m	18	3.73 d(11), 4.04 d(11)	3.72 d(11), 4.03 d(11)
	1.90 dt(3.0, 13.0)	2.24 dt(3.0, 13.0)	OAc	2.06 s	2.06 s
8	2.71 br	2.67 m	19	1.30 s	1.25 s
9	0.92 br	0.98 m	20	1.25 s	1.22 s

Table 10-8-4: Compounds, MFs, and test solvents of cassane-type diterpenoids **10-8-8**~**10-8-18**.

No.	Compounds	MFs	Test solvents	References
10-8-8	dipteryxic acid	$C_{20}H_{28}O_5$	DMSO-d_6	[322]
10-8-9	neocaesalpin E	$C_{21}H_{32}O_4$	$CDCl_3$	[323]
10-8-10	neocaesalpin F	$C_{28}H_{36}O_7$	$CDCl_3$	[323]
10-8-11	neocaesalpin G	$C_{30}H_{38}O_7$	$CDCl_3$	[323]
10-8-12	chagreslactone	$C_{25}H_{36}O_8$	$CDCl_3$	[321]
10-8-13	caesalpinolide A	$C_{22}H_{32}O_6$	C_5D_5N	[324]
10-8-14	caesalpinolide B	$C_{22}H_{32}O_6$	C_5D_5N	[324]
10-8-15	sucutinirane A	$C_{22}H_{32}O_5$	CD_3OD	[325]
10-8-16	sucutinirane B	$C_{22}H_{32}O_4$	$CDCl_3$	[325]
10-8-17	neocaesalpin O	$C_{26}H_{34}O_{10}$	$CDCl_3$	[326]
10-8-18	magnicaesalpin	$C_{26}H_{36}O_{11}$	$CDCl_3$	[326]

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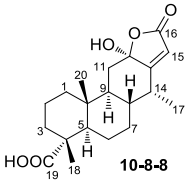
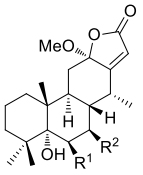
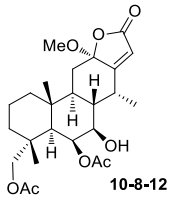


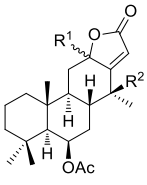
10-8-8



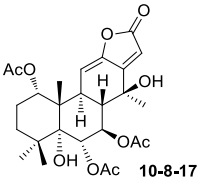
	R^1	R^2
10-8-9	H	H
10-8-10	OBz	OH
10-8-11	OCaff	OH



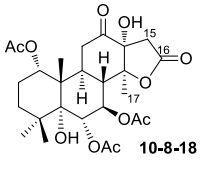
10-8-12



	R^1	R^2
10-8-13	α-OH	OH
10-8-14	β-OH	OH
10-8-15	α-OH	H
10-8-16	α-H	H



10-8-17



10-8-18

Table 10-8-5: ^{1}H NMR spectroscopic data of cassane-type diterpenoids **10-8-8**~**10-8-12**.

H	10-8-8	10-8-9	10-8-10	10-8-11	10-8-12
1	1.00 m, 1.69 m	1.41 m	1.55 m	1.53 m	0.99 m, 1.78 m
2	1.49 m	1.49 m, 1.64 m	1.54 m, 1.70 m	1.52 m, 1.60 m	1.57 m
3	1.48 m, 1.67 m	1.23 m, 1.63 m	1.20 m, 1.65 m	1.20 m, 1.65 m	1.37 m
5	1.63 m			3.49 s(OH)	1.38 m
6	1.18 m, 1.40 m	1.61 m 1.75 dt(13.5, 4.4)	5.77 d(4.1)	5.61 d(4.0)	5.58 d(2) 2.11 s(OAc)
7	1.30 m, 1.53 m	1.33 m 1.90 dq(13.0, 5.0)	4.47 dd(11.1, 4.1)	4.43 dd(11.1, 4.0)	3.65 dd(2, 11)
8	1.51 m	1.62 m	1.86 dt(11.1, 4.7)	1.84 dt(11.1, 5.0)	1.80 m
9	1.42 m	2.33 m	2.39 m	2.36 m	1.53 m
11	2.25 dd(12.7, 2.6) 1.17 m	1.27 m, 2.31 m	1.44 m, 2.40 m	1.42 m, 2.39 m	1.36 d(3), 2.47 dd(3, 13)
12	7.25 s(OH)	3.19 s(OMe)	3.21 s(OMe)	3.21 s(OMe)	3.20 s(OMe)
14	2.88 dq(7.0, 4.9)	2.89 dq(7.3, 4.8)	3.36 dq(7.3, 5.0)	3.38 dq(7.3, 4.9)	3.38 m
15	5.79 s	5.79 s	5.82 s	5.83 s	5.86 s
17	1.06 d(7.0)	1.17 d(7.3)	1.22 d(7.3)	1.22 d(7.3)	1.21 d(7.3)
18	1.07 s	0.97 s	1.43 s	1.34 s	3.74 d(11), 3.93 d(11)
OAc					2.06
19	12.13 s(COOH)	0.95 s	1.08 s	1.06 s	1.12 s
20	0.78 s	1.05 s	1.16 s	1.19 s	1.03 s
2′				6.43 d(16.0)	
3′			8.03 dd(8.4, 1.3)	7.72 d(16.0)	
4′			7.47 dd(8.4, 8.4)		
5′			7.59 tm(8.4)	7.39 m	
6′				7.54 m	
7′				7.41 m	

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Table 10-8-6: ^{1}H NMR spectroscopic data of cassane-type diterpenoids **10-8-13**~**10-8-16**.

H	10-8-13	10-8-14	10-8-15	10-8-16
1	1.03 s(ov), 1.66 m(ov)	0.95 m(ov), 1.63 br d(12.6)	1.10 m, 1.74 m	1.02 m, 1.71 m
2	1.53 m, 1.35 m	1.51 m(ov), 1.31 m	1.48 m, 1.59 m	1.47 m, 1.52 m
3	1.32 m, 1.14 m(ov)	1.28 m, 1.05 m	1.29 m, 1.38 m	1.24 m, 1.39 m
5	1.15 br s(ov)	1.03 br s	1.31 d(11.0)	1.22 m
6	5.77 br s	5.81 br s	5.12 ddd(11.0, 11.0, 4.1)	5.07 ddd(11.1, 11.1, 4.3)
OAc	1.91 s	2.14 s	2.04 s	2.06 s
7	2.65 td(14.4, 3.0) 1.66 m(ov)	2.25 td(14.4, 3.0) 2.09 dt(14.4, 3.0)	1.49 m, 1.84 m	1.41 m, 1.88 m
8	2.25 br t(11.4)	1.72 br dt(11.4, 3.0)	1.84 m	1.82 m
9	1.73 m(ov)	2.01 dt(12.6, 1.8)	1.54 m	1.25 m
11	2.80 dd(20.1, 11.5) 1.73 m(ov)	2.80 dd(13.2, 2.4) 1.58 t(12.8)	1.25 m 2.38 dd(12.9, 3.3)	0.99 m 2.50 ddd(11.8, 6.4, 3.0)
12				4.84 dd(11.4, 6.4)
14			2.96 m	2.95 m
15	6.48 s	6.09 s	5.74 s	5.68 s
17	1.78 s	1.50 s(ov)	1.17 d(7.3)	1.08 d(7.3)
18	1.00 s	0.95 s(ov)	1.10 s	1.06 s
19	1.02 s(ov)	1.02 s	0.91 s	0.89 s
20	1.12 s	1.12 s	0.91 s	0.88 s

Table 10-8-7: ^{1}H NMR spectroscopic data of cassane-type diterpenoids **10-8-17** and **10-8-18**.

H	10-8-17	10-8-18	H	10-8-17	10-8-18
1	5.03 s	4.78 s	8	2.27 br s	2.13~2.24 m
1-OAc	2.08 s	2.11 s	9	3.27 d(10.9)	2.30~2.50 m
2	*α* 1.72~1.80 m	*α* 1.69~1.77 m	11	5.52 s	2.30~2.50 m
	β 2.00~2.07 m	*β* 1.80~2.01 m	13-OH		4.28 s
3	*α* 1.08~1.12 m	*α* 1.13~1.18 m	14-OH	2.45 s	
	β 1.69~1.76 m	*β* 1.69~1.77 m	15	6.03 s	3.12 d(17), 2.57 d(17)
5-OH	2.94 s①	2.60 br s①	17	1.46 s	1.45 s
6	5.49 br s	5.42 br s	18	1.06 s	1.11 s
	1.97 s(OAc)	2.06 s(OAc)	19	1.08 s	1.12 s
7	5.66 br s	5.72 br s	20	1.18 s	1.30 s
7-OAc	2.04 s	2.06 s			

① Typographic errors exist in the literature, assigning this signal to 4-OH. Judged based on the structure, these signals should be assigned to 5-OH.

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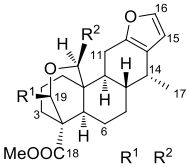
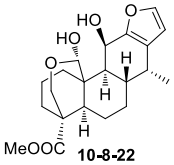
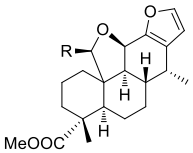
Table 10-8-8: Compounds, MFs, and test solvents of cassane-type diterpenoids **10-8-19**~**10-8-27**.

No.	Compounds	MFs	Test solvents	References
10-8-19	phanginin A	$C_{21}H_{28}O_5$	$CDCl_3$	[327]
10-8-20	phanginin B	$C_{21}H_{28}O_5$	$CDCl_3$	[327]
10-8-21	phanginin E	$C_{21}H_{26}O_5$	$CDCl_3$	[327]
10-8-22	phanginin F	$C_{21}H_{28}O_6$	$CDCl_3$	[327]
10-8-23	phanginin G	$C_{21}H_{28}O_5$	$CDCl_3$	[327]
10-8-24	phanginin H	$C_{21}H_{28}O_4$	$CDCl_3$	[327]
10-8-25	phanginin I	$C_{21}H_{28}O_4$	$CDCl_3$	[327]
10-8-26	phanginin J	$C_{21}H_{26}O_5$	$CDCl_3$	[327]
10-8-27	phanginin K	$C_{22}H_{28}O_6$	$CDCl_3$	[327]







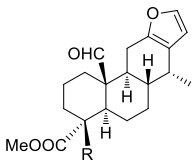


Table 10-8-9: ^{1}H NMR spectroscopic data of cassane-type diterpenoids **10-8-19**~**10-8-22**.

H	10-8-19	10-8-20	10-8-21	10-8-22
1	*α* 1.24 m, *β* 2.02 m	*α* 1.23 m, *β* 2.19 m	*α* 1.40 m, *β* 2.20 m	*α* 1.37 m, *β* 2.28 m
2	1.52 m, 1.62 m	1.64 m	1.92 m	1.68 m, 2.60 m
3	*α* 1.87 m, *β* 1.98 m	*α* 1.62 m, *β* 1.96 m	2.14 m	*α* 2.06 m, *β* 2.18 m
5	1.62 m	1.70 m	1.73 m	2.18 dd(11.4, 6.3)
6	*α* 1.19 m, *β* 2.23 m	1.84 m	*α* 1.43 m, *β* 1.62 m	*α* 1.60 m, *β* 1.70 m
7	1.36 m, 1.70 m	1.65 m	1.80 m	1.32 m, 1.72 m
8	2.38 m	1.62 m	1.90 m	2.07 m
9	1.45 m	1.52 m	1.70 m	1.85 dd(12.3, 4.5)
11	*α* 2.60 dd(15.9, 11.7)	*α* 2.27 m	*α* 2.07 m	5.19 d(4.5)
	β 2.72 dd(15.9, 5.7)	*β* 2.72 dd(16.2, 5.7)	*β* 2.78 dd(16.2, 5.7)	
14	2.58 m	2.62 br q(7.2)	2.71 br q(7.2)	2.71 qd(7.2, 4.2)
15	6.17 br s	6.17 d(1.5)	6.18 d(1.8)	6.22 d(1.8)
16	7.19 br s	7.22 d(1.5)	7.23 d(1.8)	7.35 d(1.8)
17	0.96 d(6.9)	0.97 d(7.2)	0.99 d(7.2)	0.96 d(7.2)
18	3.65 s(OMe)	3.64 s(OMe)	3.77 s(OMe)	3.68 s(OMe)
19	ax 4.37 d(11.7)	5.33 s		ax 4.22 dd(12.6, 3.0)
	eq 3.69 d(11.7)			eq 4.07 d(12.6)
20	5.01 s	ax 4.16 dd(11.4, 2.4)	ax 4.67 dd(11.7, 2.4)	5.47 s
		eq 3.56 d(11.4)	eq 4.24 dd(11.7, 0.9)	

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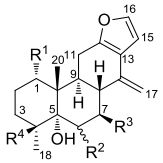
Table 10-8-10: ^{1}H NMR spectroscopic data of cassane-type diterpenoids **10-8-23**~**10-8-27**.

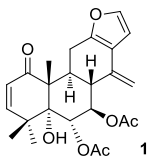
H	10-8-23	10-8-24	10-8-25	10-8-26	10-8-27
1	*α* 1.22 m	*α* 1.22 m	*α* 0.90 m	*α* 1.07 dd(13.2, 3.3)	*α* 0.98 m
	β 1.92 m	*β* 2.08 m	*β* 2.46 br d(12.0)	*β* 2.44 m	*β* 2.42 m
2	1.70 m	1.65 m	1.61 m, 1.80 m	1.69 m, 1.85 m	1.67 m
3	1.64 m	1.60 m, 1.86 m	1.59 m, 1.77 m	1.65 m, 2.32 m	1.66 m, 2.40 m
5	2.20 br d(12.0)	2.20 d(11.7, 3.0)	2.18 dd(12.9, 2.1)	2.18 br d(11.7)	2.16 dd(12.6, 2.4)
6	1.14 m, 2.10 m	1.29 m, 1.43 m	1.40 m, 2.17 m	1.60 m, 2.50 m	1.65 m, 2.61 m
7	1.39 m, 1.68 m	1.46 m, 1.71 m	1.69 m, 1.94 m	1.52 m, 1.87 m	1.60 m, 1.92 m
8	2.69 m	1.93 m	2.06 m	1.97 m	2.20 m
9	1.79 dd(12.0, 4.8)	1.80 dd(12.0, 3.9)	1.84 m	1.83 m	1.82 dt(1.4, 6.6)
11	4.85 d(4.8)	4.83 d(3.9)	*α* 2.69 dd(17.1, 6.6) *β* 2.18 m	*α* 2.77 dd(16.8, 6.6) *β* 2.31 dd(16.8, 10.5)	*α* 2.72 dd(16.8, 6.6) *β* 2.17 m
14	2.62 m	2.64 qd(7.2, 4.2)	2.65 br q(7.2)	2.67 br q(7.2)	2.69 m
15	6.23 d(1.5)	6.22 d(1.8)	6.15 d(1.8)	6.16 d(1.5)	6.17 d(1.8)
16	7.33 d(1.5)	7.31 d(1.8)	7.19 d(1.8)	7.19 d(1.5)	7.21 d(1.8)
17	0.94 d(6.6)	0.97 d(7.2)	1.00 d(7.2)	1.00 d(7.2)	1.01 d(7.2)
18	3.69 s(OMe)	3.69 s(OMe)	3.70 s(OMe)	3.77 s(OMe)	3.70 s(OMe)
19	1.25 s	0.99 s	1.04 s	9.68 s	3.74 s(OMe)
20	5.52 s	3.97 br dd(8.1, 3.0) 3.92 d(8.1)	10.21 d(1.2)	9.98 s	10.04 d(1.2)

Table 10-8-11: Compounds, MFs, and test solvents of cassane-type diterpenoids **10-8-28**~**10-8-37**.

No.	Compounds	MFs	Test solvents	References
10-8-28	caesaldekarin F	$C_{21}H_{28}O_4$	$CDCl_3$	[328]
10-8-29	caesalmin C	$C_{26}H_{34}O_8$	$CDCl_3$	[329]
10-8-30	isovouacapenol A	$C_{27}H_{32}O_4$	$CDCl_3$	[330]
10-8-31	caesalpinin MO	$C_{24}H_{28}O_7$	$CDCl_3$	[331]
10-8-32	benthaminin 2	$C_{21}H_{28}O_3$	$CDCl_3$	[332]
10-8-33	bonducellpin F	$C_{22}H_{28}O_6$	$CDCl_3$	[333]
10-8-34	isovouacapenol D	$C_{27}H_{30}O_4$	$CDCl_3$	[330]
10-8-35	caesalpinin MC	$C_{24}H_{32}O_6$	$CDCl_3$	[334]
10-8-36	caesalpinin MD	$C_{26}H_{32}O_8$	$CDCl_3$	[334]
10-8-37	benthaminin 1	$C_{21}H_{26}O_3$	$CDCl_3$	[332]



	R^1	R^2	R^3	R^4
10-8-28	H	H	H	COOMe
10-8-29	OAc	*α*-OAc	OAc	Me
10-8-30	H	*β*-OBz	H	Me



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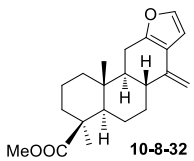

10-8-32

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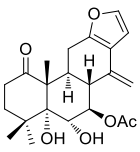

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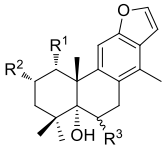
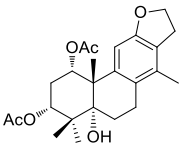


	R^1	R^2	R^3
10-8-34	H	H	β-OBz
10-8-36	OAc	OAc	α-OAc



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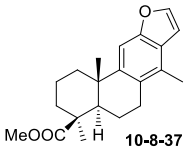

10-8-37

Table 10-8-12: ^{1}H NMR spectroscopic data of cassane-type diterpenoids **10-8-28**~**10-8-31**.

H	10-8-28	10-8-29	10-8-30	10-8-31
1	α 1.42 m, β 1.51 m	4.89 d(3), 2.08 s(OAc)	1.52, 1.60	
2	α 1.49 m, β 1.91 m	α 1.73 m, β 1.90 m	1.54, 1.79	5.80 d(10.2)
3	α 1.58 m, β 1.93 m	α 1.11 m, β 1.76 m	1.16, 1.75	5.80 d(10.2)
5			1.62 s(OH)	
6	α 1.87 m	5.59 br s	5.59 t(3.1)	5.56 m
	β 2.40 ddd(14.8, 14.8, 5.2)	1.97 s(OAc)		1.99 s(OAc)
7	α 1.69 m	5.59 br s	2.24	5.56 m
	β 2.16 m	2.10 s(OAc)		2.13 s(OAc)
8	2.26 m	2.82 br s	2.57	2.67 m
9	2.19 ddd(11.1, 11.1, 5.6)	2.72 dd(5.5, 11.0)	2.40	2.86 ddd(12.4, 11.2, 4.4)
11	α 2.63 dd(16.7, 5.6)	α 2.41 dd(4.5, 16.0)	2.65	3.47 dd(16.0, 4.4)
	β 2.45 dd(16.7, 11.1)	β 2.60 dd(11.0, 16.0)		2.62 dd(16.0, 11.2)
15	6.44 d(2.1)	6.41 d(2.0)	6.43 d(1.9)	6.40 d(2.0)
16	7.23 d(2.1)	7.23 d(2.0)	7.23 d(1.9)	7.23 d(2.0)
17	4.89 d(2.3), 5.09 d(2.3)	α 4.95 br s, β 5.09 br s	4.83 br d(1.8), 5.07 d(2.2)	4.76 d(1.9), 5.05 d(1.9)
18	1.21 s	1.16 s	1.60 s	1.28 s
19	3.69 s(COOMe)	1.16 s	1.24 s	1.30 s
20	0.87 s	1.31 s	1.04 s	1.40 s
2′, 6′			8.06	
3′, 5′			7.46	
4′			7.57	

Table 10-8-13: ^{1}H NMR spectroscopic data of cassane-type diterpenoids **10-8-32**~**10-8-35**.

H	10-8-32	10-8-33	10-8-34	10-8-35
1	α 1.50 m, β 1.75 m		2.08, 2.21	5.59 t(2.9), 1.94 s(OAc)
2	α 1.50 m, β 1.72 m	2.48 m, 2.58 m	1.72, 1.95	2.28 dt(16.6, 2.9), 2.43 dt(16.6, 2.9)
3	α 1.25 m, β 1.79 m	1.88 m, 1.75 m	1.17, 1.98	5.01 t(2.9), 2.00 s(OAc)
5	1.81 m		1.74 s(OH)	3.38 d(2.2, OH)
6	α 1.57 m, β 1.78 m	3.33 d(4.0, OH), 4.17 dd(8.0, 4.0)	5.89 dd(0.8, 7.3)	2.06 m

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Table 10-8-13 (continued)

H	10-8-32	10-8-33	10-8-34	10-8-35
7	*α* 2.22 m	5.36 t(9.6)	2.89 d(18.7)	2.77 m, 2.81 m
	β 2.26 m	2.14 s(OAc)	3.58 dd(18.7, 7.3)	
8	1.79 m	2.55 m		
9	1.56 m	2.79 ddd(16.4, 11.6, 4.4)		
11	*α* 2.69 dd(5.4, 16.7)	3.43 dd(16.4, 4.4)	7.43 s	6.28 s
	β 2.47 dd(11.2, 16.7)	2.58 m		
15	6.43 dd(1.9, 1.8)	6.40 d(2.0)	6.73 dd(0.9, 2.2)	3.10 t(9.0)
16	7.23 s	7.23 d(2.0)	7.55 d(2.2)	4.49 t(9.0)
17	5.07 s, 4.84 s	5.06 d(1.9), 4.57 d(1.9)	2.35 s	2.13 s
18	1.23 s	1.30 s	1.12 s	1.18 s
19	3.67 s(COOMe)	1.44 s	1.30 s	1.17 s
20	0.97 s	1.44 s	1.83 s	1.35 s
2′, 6′			8.03	
3′, 5′			7.44	
4′			7.55	

Table 10-8-14: ^{1}H NMR spectroscopic data of cassane-type diterpenoids **10-8-36** and **10-8-37**.

H	10-8-36	10-8-37	H	10-8-36	10-8-37
1	5.97 d(2.0), 1.97 s(OAc)	*α* 1.53 m, *β* 1.77 m	15	6.72 d(2.2)	6.71 dd(2.0, 0.7)
2	5.45 ddd(13.1, 4.5, 2.0)	*α* 1.55 m	16	7.54 d(2.2)	7.26 d(1.6)
	2.05 s(OAc)	*β* 1.67 m			
3	2.23 m, 1.44 m	*α* 1.25 m, *β* 1.74 m	17	2.36 s	
5	3.04 br s(OH)	1.80 m	18	1.39 s	1.30 s
6	5.07 t(8.1), 2.20 s(OAc)	*α* 1.58 m, *β* 1.88 m	19	1.26 s	3.68 s(OMe)
7	3.32 dd(16.6, 8.1)	*α* 2.77 m	20	1.52 s	1.26 s
	2.86 dd(16.6, 9.0)	*β* 2.88 dd(6.7, 16.9)			
11	7.10 s	6.72 s			

Table 10-8-15: Compounds, MFs, and test solvents of cassane-type diterpenoids **10-8-38**~**10-8-47**.

No.	Compounds	MFs	Test solvents	References
10-8-38	bonducellpin A	$C_{25}H_{34}O_9$	$CDCl_3$	[335]
10-8-39	bonducellpin B	$C_{23}H_{30}O_8$	$CDCl_3$	[335]
10-8-40	bonducellpin C	$C_{23}H_{32}O_7$	$CDCl_3$	[335]
10-8-41	caesalpinin MB	$C_{23}H_{32}O_6$	$CDCl_3$	[334]
10-8-42	17-*O*-demethylbonducellpin C	$C_{22}H_{30}O_7$	$CDCl_3$	[336]
10-8-43	bonducellpin E	$C_{23}H_{30}O_8$	$CDCl_3$	[333]
10-8-44	bonducellpin D	$C_{22}H_{28}O_7$	$CDCl_3$	[335]
10-8-45	caesalmin A	$C_{22}H_{28}O_8$	CD_3OD	[337]
10-8-46	caesalmin B	$C_{22}H_{28}O_6$	CD_3OD	[337]
10-8-47	macrocaesalmin	$C_{22}H_{26}O_7$	$CDCl_3$	[338]

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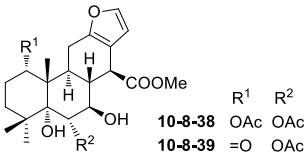
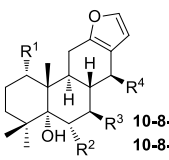
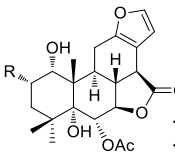


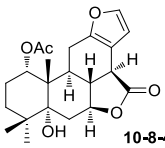
	R^1	R^2
10-8-38	OAc	OAc
10-8-39	=O	OAc
10-8-40	OAc	H



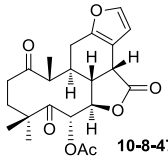
	R^1	R^2	R^3	R^4
10-8-41	OAc	H	H	COOMe
10-8-42	OAc	H	OH	COOH
10-8-43	=O	OH	OAc	COOMe



10-8-44 R = H
10-8-45 R = OH



10-8-46



10-8-47

Table 10-8-16: ^{1}H NMR spectroscopic data of cassane-type diterpenoids **10-8-38**~**10-8-41**.

H	10-8-38	10-8-39	10-8-40	10-8-41
1	4.87 t(3), 2.10 s(OAc)		4.90 br s, 2.10 s(OAc)	4.87 t(2.6), 2.10 s(OAc)
2	1.78 m, 1.95 m	2.44 m, 2.65 m	1.78 m, 1.99 m	1.98 m, 1.94 m
3	1.12 m, 1.75 m	1.78 m, 1.92 m	1.15 m, 1.74 m	1.81 m, 1.10 m
5				3.00 s(OH)
6	5.36 dd(9.8, 2.3) 2.16 s(OAc)	5.31 d(10) 2.16 s(OAc)	1.65 ddd(13.6, 11.3, 2.8) 2.02 m	1.67 m
7	3.92 dd(14.7, 9.8)	3.75 m	4.00 m	1.69 m
8	2.40 m	2.35 m	2.23 m	2.06 m
9	2.65 ddd(12, 12, 5)	2.67 ddd(11, 11, 5.3)	2.61 ddd(12.8, 12.8, 6.4)	2.59 td(11.4, 5.8)
11	α 2.30 dd(15.5, 6) β 2.48 dd(15.5, 12)	α 3.38 dd(16, 5.3) β 2.45 dd(16, 11)	α 2.50 ddd(16, 6.4, 3.2) β 2.26 dd(16, 12.8)	2.24 dd(16.0, 5.8) 2.45 m
14	3.49 br d(8.5)	3.51 br d(8)	3.47 d(8.8)	3.27 d(9.6)
15	6.17 d(2.5)	6.16 d(2)	6.17 d(2.5)	6.14 d(1.9)
16	7.25 d(2.5)	7.23 d(2)	7.24 d(2.5)	7.23 d(1.9)
17	3.73 s(OMe)	3.73 s(OMe)	3.74 s(OMe)	3.76 s(OMe)
18	1.14 s	1.18 s	1.05 s	1.09 s
19	1.15 s	1.27 s	1.09 s	1.02 s
20	1.26 s	1.50 s	1.19 s	1.14 s

Table 10-8-17: ^{1}H NMR spectroscopic data of cassane-type diterpenoids **10-8-42**~**10-8-45**.

H	10-8-42	10-8-43	10-8-44	10-8-45
1	4.95 t(2.9), 2.14 s(OAc)		3.70 m	3.61 d(2.6)
2	1.72 m, 2.05 m	2.54 m	1.66 m, 2.06 m	4.03 ddd(2.6, 4.5, 12.5)
3	1.20 m, 1.81 m	1.66 m, 2.02 m	1.11 m, 2.07 m	α 1.28 dd(4.5, 13.4) β 1.97 dd(12.5, 13.4)
6	1.75 m 2.39 dd(12.2, 5.0)	4.06 dd(9.2, 5.6) 2.90 d(5.6, OH)	5.58 d(9.8) 2.15 s(OAc)	5.50 d(9.3) 2.11 s(OAc)
7	4.70 dt(10.9, 5.0)	5.09 dd(10.4, 9.2) 2.07 s(OAc)	4.74 dd(13.1, 9.8)	4.81 dd(9.3, 11.3)

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Table 10-8-17 (continued)

H	10-8-42	10-8-43	10-8-44	10-8-45
8	1.93 ddd(10.9, 13.3, 13.3)	2.53 m	2.15 m	2.17 m
9	2.81 td(13.3, 8.6)	2.65 m	3.19 ddd(13.7, 8.9, 7)	3.18 ddd(8.0, 8.8, 13.5)
11	2.49 m, 2.58 m	3.50 dd(16.0, 4.0)	*α* 2.79 dd(16.3, 7)	*α* 2.62 dd(8.8, 16)
		2.46 m	*β* 2.57 dd(16.3, 8.9)	*β* 2.75 dd(8.0, 16)
14	3.24 d(13.3)	3.40 d(10.0)	3.31 ddd(12.8, 1.4, 1.4)	3.48 br d(13.2)
15	6.61 d(1.9)	6.11 d(2.0)	6.60 d(2.5)	6.54 d(2.0)
16	7.30 d(1.9)	7.21 d(2.0)	7.31 d(2.5)	7.38 d(2.0)
17		3.72 s(OMe)		
18	1.09 s	1.27 s	1.12 s	1.18 s
19	1.12 s	1.40 s	1.16 s	1.18 s
20	1.14 s	1.45 s	1.13 s	1.15 s

Table 10-8-18: ^{1}H NMR spectroscopic data of cassane-type diterpenoids **10-8-46** and **10-8-47**.

H	10-8-46	10-8-47	H	10-8-46	10-8-47
1	4.88 br s		11	*α* 2.41 dd(8.8, 17.6)	*α* 2.79 dd(4.6, 12.5)
	2.11 s(OAc)			*β* 2.58 dd(8.3, 17.6)	*β* 2.89 dd(6.0, 12.5)
2	*α* 1.65 m, *β* 1.92 m	*α* 1.68 m, *β* 2.10 m	14	3.36 br d(13.1)	3.40 br d(6.8)
3	*α* 1.28 m, *β* 1.96 m	*α* 1.37 m, *β* 1.87 m	15	6.52 d(1.8)	6.10 d(2.0)
6	1.84 dd(10.7, 11.1)	5.05 d(9.2), 2.00 s(OAc)	16	7.34 d(1.8)	7.22 d(2.0)
7	4.71 ddd(10.7, 11.1, 5.4)	5.00 dd(9.2, 11.2)	18	1.12 s	1.02 s
8	2.31 dd(5.4, 13.1)	2.23 ddd(4.8, 6.8, 11.2)	19	1.15 s	1.25 s
9	2.90 ddd(8.3, 8.8, 13.1)	3.27 m	20	1.06 s	1.29 d(8.1)
10		2.40 dq(4.2, 8.1)			

Table 10-8-19: Compounds, MFs, and test solvents of cassane-type diterpenoids **10-8-48**~**10-8-61**.

No.	Compounds	MFs	Test solvents	References
10-8-48	pulcherrimin A	$C_{34}H_{36}O_9$	$CDCl_3$	[339]
10-8-49	pulcherrimin C	$C_{34}H_{36}O_8$	$CDCl_3$	[339]
10-8-50	caesaldekarin A	$C_{22}H_{32}O_4$	$CDCl_3$	[340]
10-8-51	caesaldekarin H	$C_{22}H_{32}O_4$	$CDCl_3$	[340]
10-8-52	demethylcaesaldekarin C	$C_{20}H_{28}O_4$	$CDCl_3$	[340]
10-8-53	isovouacapenol C	$C_{27}H_{34}O_5$	$CDCl_3$	[330]
10-8-54	(+)-vouacapenic acid	$C_{20}H_{28}O_3$	$CDCl_3$	[319]
10-8-55	7-dehydroxycaesaldekarin I	$C_{20}H_{30}O_3$	$CDCl_3$	[336]
10-8-56	cordylane A	$C_{24}H_{34}O_6$	C_6D_6	[341]
10-8-57	cordylane C	$C_{20}H_{28}O_4$	CD_3OD	[341]
10-8-58	caesalmin D	$C_{26}H_{36}O_9$	$CDCl_3$	[329]
10-8-59	caesalmin E	$C_{26}H_{36}O_9$	$CDCl_3$	[329]
10-8-60	caesalpinin MA	$C_{24}H_{34}O_6$	$CDCl_3$	[334]
10-8-61	pulcherrimin B	$C_{34}H_{34}O_8$	$CDCl_3$	[339]

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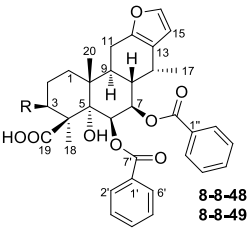
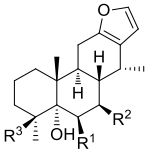
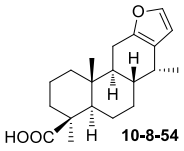


8-8-48 R = OH
8-8-49 R = H



	R^1	R^2	R^3
10-8-50	OAc	H	Me
10-8-51	H	H	CH_2OAc
10-8-52	H	H	COOH
10-8-53	OBz	OH	Me
10-8-55	H	H	CH_2OH



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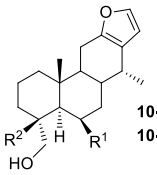
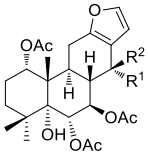
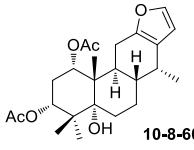


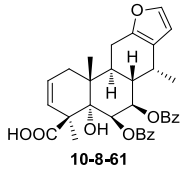
	R^1	R^2
10-8-56	OAc	CH_2OAc
10-8-57	H	COOH



	R^1	R^2
10-8-58	OH	Me
10-8-59	Me	OH



10-8-60



10-8-61

Table 10-8-20: ^{1}H NMR spectroscopic data of cassane-type diterpenoids **10-8-48**, **10-8-49**, **10-8-53**, and **10-8-61**.

H	10-8-48	10-8-49	10-8-53	10-8-61
1	1.80 ddd(3.3, 11.4, 12.6) 1.52 ddd(3.3, 3.3, 12.6)	1.53 m, 1.70 m	1.49, 1.54	2.27 dm(17.2) 2.07 dd(5.8, 17.2)
2	2.14 ddd(3.3, 11.4, 12.2) 1.58 m	1.44 m, 1.93 m	1.56, 1.70	5.78 dm(10.7)
3	3.42 dd(4.7, 12.2)	1.76 m, 1.55 m	1.18, 1.67	5.22 dm(10.7)
5			1.75 s(OH)	
6	6.12 d(3.8)	6.05 d(3.7)	5.81 d(4.1)	5.97 d(3.4)
7	5.72 dd(3.8, 11.4)	5.76 dd(3.7, 11.1)	4.41 dd(4.1, 11.0) 1.57 s(OH)	5.75 dd(3.4, 1.3)
8	2.42 ddd(5.0, 11.4, 11.8)	2.44 ddd(5.0, 11.1, 12.0)	2.02	2.41 ddd(5.0, 11.2, 11.3)
9	2.57 m	2.52 m	2.43	2.53 ddd(6.5, 11.2, 11.4)
11	2.63 m, 2.57 m	2.67 m, 2.63 m	2.57	2.67 m
14	2.86 dq(5.0, 7.0)	2.86 dq(5.0, 7.0)	3.04	2.88 dq(5.0, 7.0)
15	6.13 d(1.8)	6.14 d(1.8)	6.20 d(1.9)	6.12 d(1.8)
16	7.23 d(1.8)	7.24 d(1.8)	7.24 d(1.9)	7.22 d(1.8)
17	1.00 d(7.0)	1.00 d(7.0)	1.09 d(6.8)	0.98 d(7.0)
18	1.34 s	1.12 s	1.12 s	1.26 s
19			1.18 s	
20	1.44 s	1.35 s	1.54 s	1.56 s
2′, 6′	7.70 dd(1.3, 8.4)	7.76 dd(1.3, 8.4)	8.05	7.72 dd(1.3, 8.4)
3′, 5′	7.31 dd(8.4, 8.4)	7.36 dd(8.4, 8.4)	7.45	7.35 dd(8.4, 8.4)

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Table 10-8-20 (continued)

H	10-8-48	10-8-49	10-8-53	10-8-61
4′	7.49 tm(8.4)	7.50 tm(8.4)	7.57	7.55 tm(8.4)
2″, 6″	7.85 dd(1.3, 8.4)	7.78 dd(1.3, 8.4)		7.85 dd(1.3, 8.4)
3″, 5″	7.35 dd(8.4, 8.4)	7.28 dd(8.4, 8.4)		7.35 dd(8.4, 8.4)
4″	7.53 tm(8.4)	7.48 tm(8.4)		7.55 tm(8.4)

Table 10-8-21: ^{1}H NMR spectroscopic data of cassane-type diterpenoids **10-8-50** and **10-8-51**.

H	10-8-50	10-8-51	H	10-8-50	10-8-51
1	1.44 m, 1.53 m	1.40 m, 1.48 m	14	2.57 dq(6.8, 5.7)	2.60 m
2	1.51 m, 1.71 m	1.46 m, 1.82 m	15	6.19 d(1.7)	6.18 d(2.4)
3	1.14 m, 1.71 m	1.50 m, 1.54 m	16	7.22 d(1.7)	7.22 d(2.4)
6	5.23 t(3.3), 2.06 s(OAc)	1.66 m, 1.81 m	17	0.99 d(6.8)	1.01 d(6.8)
7	1.51 m	1.48 m	18	0.98 s	1.00 s
	2.19 ddd(13.4, 13.4, 3.3)	1.58 m			
8	1.26 m	1.78 m	19	1.25 s	4.05 d(10.7)
9	2.34 m	2.36 m			4.43 d(10.7)
11	2.47 dd(18.0, 10.0)	2.36 m			2.08 s(OAc)
	2.51 dd(18.0, 8.0)	2.48 dd(15.9, 9.1)	20	1.34 s	1.02 s

Table 10-8-22: ^{1}H NMR spectroscopic data of cassane-type diterpenoids **10-8-52** and **10-8-54**~**10-8-56**.

H	10-8-52	10-8-54	10-8-55	10-8-56
1	1.46 m, 1.51 m	*α* 1.06 dt(3.4, 13.7)	1.48 m, 1.51 m	1.34 m
		β 1.75 m		0.72 ddd(15.0, 15.0, 5.0)
2	1.50 m, 1.94 m	*α* 1.49 br d(13.7)	1.50 m, 1.58 m	1.33 m, 1.49 m
		β 1.86 tq(3.4, 13.7)		
3	1.59 m, 1.95 m	*α* 1.05 dt(3.4, 13.7)	1.40 m, 1.55 m	1.16 m, 1.67 m
		β 2.19 br d(13.7)		
5		1.16 dd(12.4, 3.9)		1.56 d(2.0)
6	1.83 m, 2.37 m	*α* 1.95 dq(14.0, 3.9)	1.64 m, 1.82 m	5.71 ddd(3.0, 3.0, 2.0)
		β 1.75 m		1.82 s(OAc)
7	1.53 m, 1.80 m	*α* 1.32 dq(3.9, 13.0)	1.44 m, 1.84 m	1.44 m, 1.88 m
		β 1.75 m		
8	1.81 m	1.75 m	1.76 m	1.84 m
9	2.21 m	1.46 dt(6.6, 10.3)	2.39 m	1.40 m
11	2.34 dd(16.7, 11.1)	*α* 2.59 dd(16.7, 6.6)	2.36 m, 2.47 m	2.49 dd(17.6, 8.0)
	2.50 dd(16.7, 6.1)	*β* 2.36 dd(16.7, 10.3)		2.38 dd(17.6, 10.0)
14	2.62 m	2.62 dq(6.6, 7.1)	2.59 dq(7.0, 4.8)	2.34 m
15	6.19 d(1.9)	6.16 d(1.8)	6.18 d(1.8)	6.04 d(2.0)
16	7.22 d(1.9)	7.21 d(1.8)	7.22 d(1.8)	7.16 d(2.0)
17	1.02 d(6.8)	0.97 d(7.1)	1.01 d(7.0)	0.83 d(6.8)

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Table 10-8-22 (continued)

H	10-8-52	10-8-54	10-8-55	10-8-56
18	1.26 s	1.27 s	1.03 s	4.27 d(11.4), 4.72 d(11.4) 1.64 s(OAc)
19			3.65 d(11.0), 3.92 d(11.0)	3.24 d(10.8), 3.47 d(10.8)
20	0.94 s	0.82 s	1.01 s	1.02 s

Table 10-8-23: ^{1}H NMR spectroscopic data of cassane-type diterpenoids **10-8-57**~**10-8-60**.

H	10-8-57	10-8-58	10-8-59	10-8-60
1	1.82 m, 1.11 m	4.88 s	4.84 br s	4.85 t(2.9)
1-OAc		2.03 s	2.06 s	2.05 s
2	1.97 m	α 1.68 m	α 1.73 m	2.27 dt(16.6, 2.9)
	1.56 m	β 1.87 m	β 1.86 m	2.15 dt(16.6, 2.9)
3	2.77 m, 1.22 m	α 1.08 m, β 1.74 m	α 1.08 m, β 1.76 m	4.94 t(2.9), 2.06 s(OAc)
5	1.36 dd(12.4, 2.4)			3.30 s(OH)
6	1.72 m, 1.88 m	5.40 br s	5.51 d(8.4)	1.96 m
6-OAc		1.99 s	1.95 s	
7	1.41 m, 1.71 m	5.86 br s 2.08 s(OAc)	5.64 dd(8.4, 8.8) 2.07 s(OAc)	1.73 m
8	1.75 m	2.28 dd(5.5, 15.6)	2.27 dd(5.4, 15.9)	1.84 m
9	1.52 m	3.00 ddd(4.6, 5.5, 15.6)	2.65 ddd(5.4, 6.3, 16.0)	2.91 td(11.1, 6.8)
11	2.57 dd(16.4, 6.4) 2.32 m	2.43 m	2.46 m	2.39 dd(16.4, 11.1) 2.24 dd(16.4, 6.8)
14	2.59 m			2.64 quint(6.8)
15	6.16 d(1.2)	6.42 d(2.0)	6.38 d(2.0)	6.19 d(1.9)
16	7.21 d(1.2)	7.28 d(2.0)	7.21 d(2.0)	7.22 d(1.9)
17	0.97 d(7.2)	1.38 s	1.48 s	1.07 d(6.8)
18		1.13 s	1.13 s	1.10 s
19	3.83 d(10.6) 3.46 d(10.6)	1.14 s	1.14 s	1.14 s
20	0.88 s	1.28 s	1.26 s	1.10 s

Table 10-8-24: Compounds, MFs, and test solvents of cassane-type diterpenoids **10-8-62**~**10-8-69**.

No.	Compounds	MFs	Test solvents	References
10-8-62	caesalpinin	$C_{24}H_{30}O_8$	$CDCl_3$	[342]
10-8-63	caesalpinin MM	$C_{26}H_{34}O_9$	$CDCl_3$	[331]
10-8-64	caesalpinin MN	$C_{26}H_{34}O_9$	$CDCl_3$	[331]
10-8-65	caesaldekarin G	$C_{21}H_{32}O_5$	$CDCl_3$	[328]
10-8-66	norcaesalpinin A	$C_{23}H_{30}O_7$	$CDCl_3$	[343]
10-8-67	norcaesalpinin B	$C_{23}H_{30}O_7$	$CDCl_3$	[343]
10-8-68	norcaesalpinin C	$C_{23}H_{30}O_7$	$CDCl_3$	[343]
10-8-69	norcaesalpin D	$C_{20}H_{26}O_5$	$CDCl_3$	[336]

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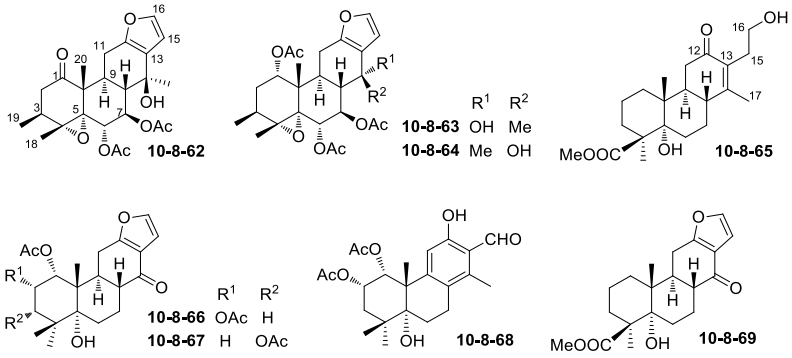

Table 10-8-25: ^{1}H NMR spectroscopic data of cassane-type diterpenoids **10-8-62**~**10-8-65**.

H	10-8-62	10-8-63	10-8-64	10-8-65
1		4.75 t(2.6), 2.02 s(OAc)	4.72 t(2.6), 2.02 s(OAc)	*α* 1.35 m, *β* 1.42 m
2	*α* 2.04 d(12.5)	1.83 ddd(15.4, 8.6, 2.6)	1.81 ddd(15.1, 8.3, 2.7)	*α* 1.49 m
	β 2.72 dd(12.5 8.5)	1.61 br dd(15.4, 2.6)	1.66 br dd(15.1, 2.7)	*β* 1.89 m
3	2.34 dq(8.0, 6.8)	2.00 m	2.00 m	*α* 1.57 m, *β* 1.95 m
6	5.72 d(9.6)	5.75 d(10.0) 2.03 s(OAc)	5.68 d(10.2) 2.02 s(OAc)	*α* 1.86 m *β* 2.49 ddd(14.5, 14.5, 5.3)
7	5.54 dd(10.4, 9.6)	5.59 t(10.0), 2.05 s(OAc)	5.54 t(10.2), 2.02 s(OAc)	*α* 1.47 m, *β* 2.09 m
8	2.28 dd(12.0, 10.4)	2.23 dd(10.5, 10.0)	2.38 m	2.35 m
9	2.47 ddd(12.0, 10.6, 4.0)	2.60 ddd(12.2, 10.5, 5.9)	2.49 m	2.27 ddd(10.5, 10.5, 4.0)
11	*α* 2.89 dd(14.6, 4.0) *β* 2.45 dd(14.6, 10.6)	2.38 m 2.18 m	2.46 m 2.34 m	*α* 2.38 dd(15.8, 4.0) *β* 2.06 dd(15.8, 10.5)
15	6.37 d(2.2)	6.41 d(1.9)	6.38 d(2.0)	2.65 dt(15.8, 6.6) 2.55 dt(15.8, 6.6)
16	7.23 d(2.2)	7.24 d(1.9)	7.24 d(2.0)	3.62 t(6.6)
17	1.53 s	1.50 s	1.50 s	1.95 s
18	1.50 s	1.45 s	1.47 s	1.18 s
19	1.10 d(6.8)	1.15 d(7.0)	1.14 d(7.1)	3.69 s(OMe)
20	1.53 s	1.29 s	1.30 s	0.82 s
OAc	2.02 s, 2.05 s			

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Table 10-8-26: ^{1}H NMR spectroscopic data of cassane-type diterpenoids **10-8-66**~**10-8-69**.

H	10-8-66	10-8-67	10-8-68	10-8-69
1	5.29 d(2.2)	4.92 t(3.2)	5.91 d(2.4)	1.40 m, 1.58 m
1-OAc	2.15 s	2.06 s	2.00 s	
2	5.35 ddd(13, 4.8, 2.2)	α 2.14 m, β 2.33 m	5.45 ddd(13, 4.6, 2.4)	1.53 m, 1.86 m
2-OAc	1.99 s		2.03 s	
3	α 2.03 m	4.95 t(2.8)	α 2.14 br t(13.3)	1.64 m, 1.94 m
	β 1.41 dd(13.0, 4.8)	2.05 s(OAc)	β1.47 dd(12.5, 4.6)	
5-OH	2.90 d(2.4)	2.28 d(2.9)	3.07 d(1.9)	
6	α 1.75 m	α 1.79 m	α 2.07 m	1.88 m, 2.40 m
	β 1.64 ddd(14.1, 4.4, 2.6)	β 1.71 m	β 2.79 dd(10.2, 7.5)	
7	α 2.15 m	α 2.15 m	α 2.66 dd(17.5, 7.5)	1.60 m, 2.33 m
	β 1.84 dd(13.4, 4.4)	β 1.82 m	β 1.98 m	
8	2.37 td(12, 4.8)	2.36 m		2.33 m
9	2.97 td(12, 5.3)	3.29 td(12, 5.3)		2.62 m
11	α 2.58 dd(17, 5.3)	α 2.44 dd(17, 5.3)	6.55 s	2.81 m
	β 2.70 dd(17, 12)	β 2.75 dd(17, 12)		
12			11.75 s(OH)	
15	6.63 d(2)	6.65 d(1.7)	10.38 s	6.64 d(2.0)
16	7.29 d(2)	7.31 d(1.7)		7.30 d(2.0)
17			2.46 s	
18	1.10 s	1.11 s	1.17 s	1.19 s
19	1.19 s	1.14 s	1.21 s	3.69 s(OMe)
20	1.30 s	1.20 s	1.43 s	0.89 s

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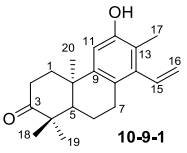
10.9 Cembranolide-type diterpenoids

Table 10-9-1: Compounds, MFs, and test solvents of cembranolide-type diterpenoids **10-9-1**~**10-9-3**.

No.	Compounds	MFs	Test solvents	References
10-9-1	sonderianol	$C_{20}H_{26}O_2$	$CDCl_3$	[344]
10-9-2	2,3-*seco*-sonderianol	$C_{20}H_{26}O_5$	DMSO-d_6	[345]
10-9-3	3,4-*seco*-sonderianol	$C_{21}H_{28}O_3$	$CDCl_3$	[344]



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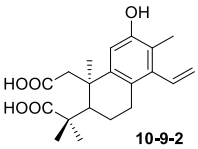

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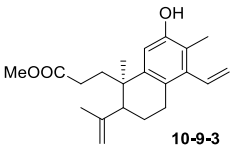

10-9-3

Table 10-9-2: ^{1}H NMR spectroscopic data of cembranolide-type diterpenoids **10-9-1**~**10-9-3**.

H	10-9-1	10-9-2	10-9-3
1	1.66~1.94 m	2.56 d(14.6), 2.33 d(14.6)	1.79~2.06 m
2	2.36~2.82 m		2.29~2.84 m
3			3.64 s(COOMe)
5	2.36~2.82 m	2.71 br s	2.06~2.27 m
6	1.66~1.94 m	2.01 m, 1.77 m	1.79~2.06 m
7	2.36~2.82 m	2.49 m	2.29~2.84 m
11	6.68 s	6.67 s	6.74 s
15	6.60 dd(10, 17)	6.57 dd(18.0, 11.4)	6.61 dd(11, 18)
16	5.55 dd(2, 10), 5.23 dd(2, 17)	5.48 d(11.4), 5.09 d(18.0)	5.52 dd(2, 11), 5.17 dd(2, 18)
17	2.20 s	2.01 s	2.20 s
18	1.15 s	1.11 s	4.94 m, 4.70 m
19	1.12 s	0.81 s	1.78 s
20	1.29 s	1.38 s	1.22 s
OH	5.14 s	8.87 s	6.50 s

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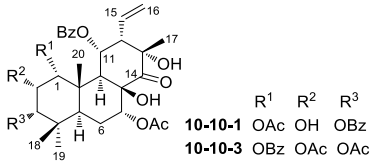
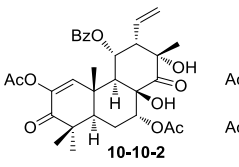
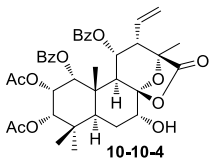
10.10 Staminane-type diterpenoids

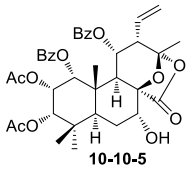
Table 10-10-1: Compounds, MFs, and test solvents of staminane-type diterpenoids **10-10-1**~**10-10-8**.

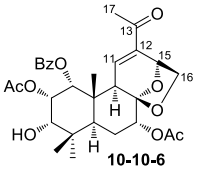
No.	Compounds	MFs	Test solvents	References
10-10-1	staminol C	$C_{38}H_{44}O_{12}$	$CDCl_3$	[346]
10-10-2	staminol D	$C_{31}H_{36}O_{10}$	$CDCl_3$	[346]
10-10-3	staminol A	$C_{40}H_{46}O_{13}$	$CDCl_3$	[347]
10-10-4	staminolactone A	$C_{38}H_{42}O_{12}$	$CDCl_3$	[348]
10-10-5	staminolactone B	$C_{38}H_{42}O_{12}$	$CDCl_3$	[348]
10-10-6	norstaminol C	$C_{30}H_{36}O_{10}$	$CDCl_3$	[349]
10-10-7	norstaminol B	$C_{37}H_{44}O_{13}$	$CDCl_3$	[349]
10-10-8	norstaminol A	$C_{37}H_{42}O_{12}$	$CDCl_3$	[348]

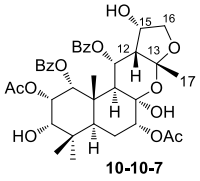












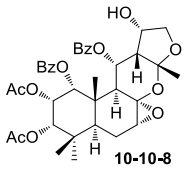


Table 10-10-2: ^{1}H NMR spectroscopic data of staminane-type diterpenoids **10-10-1** and **10-10-2**.

H	10-10-1	10-10-2	H	10-10-1	10-10-2
1	5.04 d(2.7)	7.34 s	17	1.33 s	1.70 s
1-OAc	2.22 s		18	0.89 s	1.15 s
2	4.40 t(2.7)	2.08 s(OAc)	19	1.09 s	1.16 s
3	5.19 d(2.7)		20	1.55 s	1.42 s
5	2.48 dd(13.2, 2.2)	2.34 dd(13.4, 2.4)	11-OBz		
6	1.99 t(2.2), 2.06 m	1.84 dt(13.4, 2.4), 2.18 m	2,6	7.76 d(7.8)	8.05 d(7.3)
7	5.41 t(2.2)	5.37 t(2.4)	3,5	7.34 t(7.8)	7.45 t(7.3)
7-OAc	1.48 s	2.10 s	4	7.57 t(7.8)	7.63 t(7.3)
9	3.29 d(9.5)	2.74 d(10.8)	3-OBz		
11	6.30 dd(9.5, 4.6)	6.22 dd(10.8, 4.4)	2,6	7.90 d(7.8)	
12	3.11 dd(9.5, 4.6)	3.19 dd(10.0, 4.4)	3,5	7.42 t(7.8)	
15	5.33 dt(16.6, 9.5)	5.61 dt(16.8, 10.0)	4	7.63 t(7.8)	
16	5.07 d(16.6)	5.14 d(16.8)			
	4.82 d(9.5)	5.34 d(10.0)			

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Table 10-10-3: ^{1}H NMR spectroscopic data of staminane-type diterpenoids **10-10-3**~**10-10-6**.

H	10-10-3	10-10-4	10-10-5	10-10-6
1	5.79 d(2)	5.13 br s	5.57 br s	5.55 d(2.8)
2	5.38 dd(3, 2)	2.34 br s	5.57 br s	5.46 t(2.8)
2-OAc	1.93 s	1.75 s	1.99 s	2.03 s
3	5.01 d(3)	4.99 d(3.1)	5.08 br s	3.65 br s
3-OAc	1.60 s	1.57 s	1.74 s	
5	2.63 dd(13.5, 2)	2.80 br d(13.8)	2.74 d(11.7)	2.48 dd(12.2, 4.3)
6	1.88 br d(13)	1.89 br t(13.8)	1.86 br t(13.9)	1.90 m
	2.08 br t(13)	2.02 br d(13.8)	1.93 br d(13.9)	
7	5.37 t(3)	4.00 br s	4.17 br s	5.10 t(2.6)
7-OAc	2.19 s			2.11 s
9	3.11 d(11)	3.10 d(11.0)	2.62 s	2.56 d(4.2)
11	6.29 dd(11, 3.5)	5.71 dd(11.0, 6.1)	5.53 d(5.2)	6.66 d(4.2)
12	2.96 dd(9.5, 3.5)	2.79 dd(10.5, 6.1)	2.78 dd(10.2, 5.2)	
15	5.15 dt(17, 9.5)	5.56 dt(17.3, 10.5)	5.47 dt(16.9, 10.2)	5.32 d(3.9)
16	4.51 dd(10, 1.5)	4.88 d(17.3)	5.19 d(10.2)	3.69 dd(6.8, 3.9)
	4.83 dd(17, 1.5)	5.03 d(10.5)	5.31 d(16.9)	3.57 d(6.8)
17	1.68 s	1.32 s	1.59 s	2.30 s
18	0.91 s	1.03 s	1.04 s	1.18 s
19	1.09 s	1.11 s	1.15 s	1.02 s
20	1.40 s	1.40 s	1.49 s	1.26 s
1-OBz				
2,6	8.13 dd(8, 1)	8.06 d(7.3)	7.86 d(7.6)	8.12 d(7.8)
3,5	7.42 t(8)	7.52 t(7.3)	7.10 t(7.6)	7.52 t(7.8)
4	7.58 tt(8, 1)	7.63 t(7.3)	7.21 t(7.6)	7.65 t(7.8)
11-OBz				
2,6	8.26 dd(8, 1)	7.72 d(7.6)	7.52 d(7.3)	
3,5	7.48 t(8)	7.33 t(7.6)	7.18 t(7.3)	
4	7.61 tt(8, 1)	7.53 t(7.6)	7.37 t(7.3)	

Table 10-10-4: ^{1}H NMR spectroscopic data of staminane-type diterpenoids **10-10-7** and **10-10-8**.

H	10-10-7	10-10-8	H	10-10-7	10-10-8
1	5.37 d(3)	5.29 br s	16	3.80 d(9.4)	3.69 br d(10.4)
2	5.45 t(3)	5.50 br s		3.70 dd(9.4, 1.9)	3.81 br d(10.4)
2-OAc	1.92 s	1.82 s	17	1.65 s	1.66 s
3	3.56 d(3)	5.05 d(2.9)	18	1.01 s	1.04 s
3-OAc		1.70 s	19	1.11 s	1.12 s
5	2.47 dd(10.5, 4.1)	2.62 br d(13.3)	20	1.34 s	1.33 s
6	1.90 m	1.82 br t(13.3)	1-OBz		
		1.91 br d(13.3)	2,6	7.59 d(7.5)	7.68 d(7.3)
7	5.04 t(2.6)	3.80 br s	3,5	7.11 t(7.5)	7.29 t(7.3)
	2.23 s(OAc)		4	7.43 t(7.5)	7.53 t(7.3)
9	2.66 d(3.8)	2.74 d(3.4)	11-OBz		
11	5.58 t(3.8)	5.58 t(3.4)	2,6	7.60 d(7.6)	7.58 d(7.6)
12	2.37 t(3.8)	2.41 t(3.4)	3,5	7.30 t(7.6)	7.07 t(7.6)
15	4.51 br s	4.59 br s	4	7.55 t(7.6)	7.41 t(7.6)

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10.11 Podocarpane-type diterpenoids

Table 10-11-1: Compounds, MFs, and test solvents of podocarpane-type diterpenoids **10-11-1**~**10-11-30**.

No.	Compounds	MFs	Test solvents	References
10-11-1	1,13,14-trihydroxypodocarpa-8,11,13-trien-7-one	$C_{17}H_{22}O_4$	$CDCl_3$	[350]
10-11-2	1*β*,13-dihydroxy-8,11,13-podocarpatriene	$C_{17}H_{24}O_2$	$CDCl_3$	[351]
10-11-3	18-*nor*-1*β*,4*α*,14-trihydroxy-13-methoxy-8,11,13-podocarpatriene	$C_{17}H_{24}O_4$	CD_3OD	[352]
10-11-4	18-*nor*-1*β*,4*α*,13,14-tetrahydroxy-8,11,13-podocarpatrien-7-one	$C_{16}H_{20}O_5$	CD_3OD	[352]
10-11-5	18-*nor*-1*β*,4*α*,14-trihydroxy-13-methoxy-8,11,13-podoc-arpatrien-7-one	$C_{17}H_{22}O_5$	$CDCl_3$	[352]
10-11-6	1*β*,14,19-trihydroxy-13-methoxy-8,11,13-podocarpatrien-7-one	$C_{18}H_{24}O_5$	$CDCl_3$	[352]
10-11-7	1*β*,13,14,18-tetrahydroxy-8,11,13-podocarpatrien-7-one	$C_{17}H_{22}O_5$	$CDCl_3$	[352]
10-11-8	18-acetoxy-1*β*,13,14-trihydroxy-8,11,13-podocarpatrien-7-one	$C_{19}H_{24}O_6$	$CDCl_3$	[352]
10-11-9	1*β*,14,18-trihydroxy-13-methoxy-8,11,13-podocarpatrien-7-one	$C_{18}H_{24}O_5$	$CDCl_3$	[352]
10-11-10	14-hydroxy-13-methoxy-8,11,13-podocarpatrien-7-one	$C_{18}H_{24}O_3$	$CDCl_3$	[353]
10-11-11	13,14-dihydroxy-8,11,13-podocarpatrien-7-one	$C_{17}H_{22}O_3$	$CDCl_3$	[353]
10-11-12	13-hydroxy-12-methoxy-8,11,13-podocarpatriene	$C_{18}H_{26}O_2$	$CDCl_3$	[353]
10-11-13	12-hydroxy-13-methoxy-8,11,13-podocarpatriene	$C_{18}H_{26}O_2$	$CDCl_3$	[353]
10-11-14	14-hydroxy-13-methoxy-8,11,13-podocarpatriene	$C_{18}H_{26}O_2$	$CDCl_3$	[353]
10-11-15	13-hydroxy-8,11,13-podocarpatriene	$C_{17}H_{24}O$	$CDCl_3$	[353]
10-11-16	(5*β*,10*α*)-12,13-dihydroxypodocarpa-8,11,13-trien-3-one	$C_{17}H_{22}O_3$	CD_3OD	[354]
10-11-17	(3*α*,5*β*,10*α*)-13-methoxypodocarpa-8,11,13-triene-3,12-diol	$C_{18}H_{26}O_3$	$CDCl_3$	[354]
10-11-18	gaultheric acid	$C_{19}H_{24}O_4$	$CDCl_3$	[355]
10-11-19	gaultheronoterpene	$C_{18}H_{22}O_3$	$CDCl_3$	[355]
10-11-20	1*β*,14-dihydroxy-13-methoxy-8,11,13-podocarpatriene-2,7-dione	$C_{18}H_{22}O_5$	$CDCl_3$	[351]
10-11-21	3*β*,12-dihydroxy-13-methyl-6,8,11,13-podocarpatetraen	$C_{18}H_{24}O_2$	$CDCl_3$	[356]
10-11-22	3*β*,12-dihydroxy-13-methyl-5,8,11,13-podocarpatetraen-7-one	$C_{18}H_{22}O_3$	CD_3COCD_3	[356]
10-11-23	4-*epi*-7*α*,15-dihydroxypodocarp-8(14)-en-13-one	$C_{17}H_{26}O_3$	CD_3OD	[357]
10-11-24	7*α*-hydroxypodocarp-8(14)-en-13-one-16-oic acid	$C_{17}H_{24}O_4$	CD_3OD	[357]
10-11-25	7*β*-hydroxypodocarpen-8(14)-en-13-on-18-oic acid	$C_{17}H_{24}O_4$	CD_3OD	[358]
10-11-26	cryptomelactone A	$C_{16}H_{22}O_4$	$CDCl_3$	[359]
10-11-27	cryptomelactone B	$C_{16}H_{22}O_4$	$CDCl_3$	[359]
10-11-28	1-(7-hydroxy-2,6-dimethyl-1-naphthy)-4-methyl-3-pentanone	$C_{18}H_{22}O_2$	CD_3COCD_3	[356]
10-11-29	moluccanic acid	$C_{17}H_{22}O_3$	CD_3OD	[360]
10-11-30	6,7-dehydromoluccacic acid	$C_{17}H_{20}O_3$	CD_3OD	[360]

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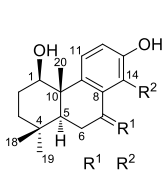
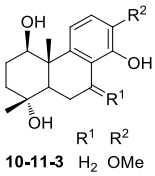
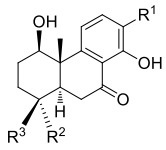


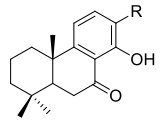
	R^1	R^2
10-11-1	O	OH
10-11-2	H_2	H



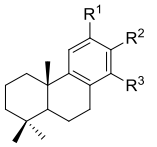
	R^1	R^2
10-11-3	H_2	OMe
10-11-4	O	OH
10-11-5	O	OMe



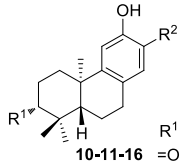
	R^1	R^2	R^3
10-11-6	OMe	Me	CH_2OH
10-11-7	OH	CH_2OH	Me
10-11-8	OH	CH_2OAc	Me
10-11-9	OMe	CH_2OH	Me



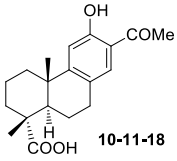
10-11-10 R = OMe
10-11-11 R = OH



	R^1	R^2	R^3
10-11-12	OMe	OH	H
10-11-13	OH	OMe	H
10-11-14	H	OMe	OH
10-11-15	H	OH	H



	R^1	R^2
10-11-16	=O	OH
10-11-17	OH	OMe



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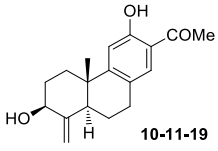

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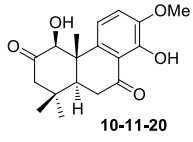

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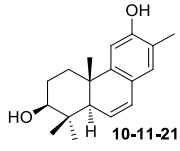

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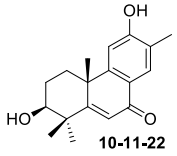
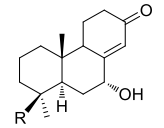
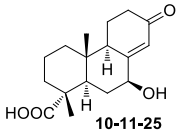


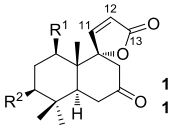
10-11-22



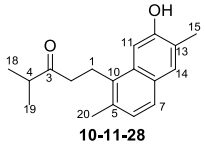
10-11-23 R = CH_2OH
10-11-24 R = COOH



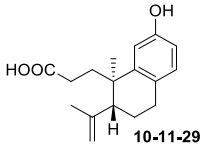
10-11-25



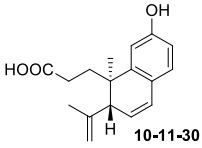
	R^1	R^2
10-11-26	OH	H
10-11-27	H	OH



10-11-28



10-11-29



10-11-30

Table 10-11-2: ^{1}H NMR spectroscopic data of podocarpane-type diterpenoids **10-11-1**~**10-11-4**.

H	10-11-1	10-11-2	10-11-3	10-11-4
1	3.98 br t(8.3)	3.82 dd(9.6, 6.2)	3.73 dd(11.0, 4.7)	3.91 dd(11.2, 4.5)
2	1.80 m	1.73 m	1.75 m	1.85 m, 1.72 m
3	1.28 m, 1.44 m	1.35 m	1.55 m, 1.76 m	1.59 m, 1.78 m

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Table 10-11-2 (continued)

H	10-11-1	10-11-2	10-11-3	10-11-4
5	1.79 dd(13.0, 4.7)	1.24 (ov)	1.49 dd(12.6, 2.1)	2.03 dd(12.8, 4.7)
6	2.78 dd(19.0, 13.0)	1.84 m	1.69 m	2.87 dd(18.6, 4.7)
	2.66 dd(19.0, 4.7)		2.12 m	2.81 dd(18.6, 12.8)
7		2.74 ddd(17.1, 8.7, 8.9)	2.59 ddd(17.8, 11.3, 8.3)	
		2.85 ddd(17.1, 7.5, 3.4)	2.86 dd(17.8, 5.9)	
11	7.64 d(8.7)	8.04 d(8.7)	7.75 d(8.9)	7.70 d(8.5)
12	7.03 d(8.7)	6.57 dd(8.7, 2.7)	6.66 d(8.9)	6.95 d(8.5)
13		6.47 s(OH)	3.80 s(OMe)	
14		6.48 d(2.7)		
18	0.86 s	0.89 s		
19	0.96 s	0.91 s	1.18 s	1.24 s
20	1.20 s	1.18 s	1.16 s	1.19 s

Table 10-11-3: ^{1}H NMR spectroscopic data of podocarpane-type diterpenoids **10-11-5**~**10-11-7**.

H	10-11-5	10-11-6	10-11-7
1	4.05 dd(11.1, 4.5)	4.03 dd(10.8, 4.5)	3.95 dd(9.2, 6.2)
2	1.92 m, 1.70 m	1.78 m	1.83 m
3	1.60 m, 1.86 dt(12.6, 3.4)	1.90 m	1.35 br d(13.2), 1.69 m
5	2.07 dd(13.8, 3.8)	1.92 dd(14.0, 3.6)	2.20 dd(13.6, 4.0)
6	2.98 dd(18.6, 3.8)	2.76 dd(18.6, 3.6)	2.63 dd(18.7, 4.0)
	2.75 dd(18.6, 13.8)	2.89 dd(18.6, 14.0)	2.75 dd(18.7, 13.6)
11	7.68 d(8.6)	7.67 d(8.6)	7.63 d(8.6)
12	6.98 d(8.6)	6.98 d(8.6)	7.02 d(8.6)
13	3.86 s(OMe)	3.85 s(OMe)	12.74 s(OH)
14	13.03 s(OH)	12.94 s(OH)	5.60 br s(OH)
18		1.01 s	3.15 d(10.9), 3.40 d(10.9)
19	1.28 s	3.62 d(10.8), 3.82 d(10.8)	0.92 s
20	1.19 s	1.22 s	1.23 s

Table 10-11-4: ^{1}H NMR spectroscopic data of podocarpane-type diterpenoids **10-11-8**~**10-11-11**.

H	10-11-8	10-11-9	10-11-10	10-11-11
1	3.99 dd(9.9, 5.8)	3.90 dd(9.7, 6.2)	1.47 m, 2.24 br d(12.3)	1.48 m, 2.24 br d(13.6)
2	1.84 m	1.80 m	1.52 m, 1.70 m	1.64 m, 1.74 m
3	1.44 dt(13.6, 3.4), 1.63 m	1.31 dt(13.3, 3.2), 1.67 m	1.22 m, 1.55 m	1.24 m, 1.52 m
5	2.12 dd(13.7, 4.0)	2.14 dd(13.5, 4.3)	1.82 dd(4.5, 13.0)	1.82 dd(6.4, 11.2)
6	2.63 dd(18.7, 4.0)	2.61 dd(18.7, 4.3)	2.59 dd(13.0, 18.9)	2.64 dd(11.2, 18.8)
	2.79 dd(18.7, 13.7)	2.73 dd(18.7, 13.5)	2.69 dd(4.5, 18.9)	2.70 dd(6.4, 18.8)
11	7.65 d(8.6)	7.62 d(8.7)	6.71 d(8.4)	6.67 d(7.8)

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Table 10-11-4 (continued)

H	10-11-8	10-11-9	10-11-10	10-11-11
12	7.05 d(8.6)	6.95 d(8.7)	6.98 d(8.4)	7.01 d(7.8)
13	12.72 s(OH)	12.88 s(OH)	3.86 s(OMe)	5.53 s(OH)
14	5.57 s(OH)	3.83 s(OMe)	12.98 s(OH)	12.80 s(OH)
18	3.70 d(11.4), 3.79 d(11.4)	3.10 d(11.0), 3.37 d(11.0)	0.92 s	0.92 s
19	0.99 s	0.87 s	0.97 s	0.97 s
20	1.24 s	1.20 s	1.18 s	1.18 s
OAc	2.00 s			

Table 10-11-5: ^{1}H NMR spectroscopic data of podocarpane-type diterpenoids **10-11-12**~**10-11-15**.

H	10-11-12	10-11-13	10-11-14	10-11-15
1	1.36 m, 2.18 br d(13.6)	1.32 m, 2.17 br d(13.2)	1.36 m, 2.40 br d(12.8)	1.30 m, 2.20 br d(13.1)
2	1.60 m, 1.80 m	1.58 m, 1.82 m	1.60 m, 1.82 m	1.62 m, 1.81 m
3	1.22 m, 1.44 m	1.18 m, 1.44 m	1.22 m, 1.46 m	1.17 m, 1.45 m
5	1.27 (ov)	1.28 (ov)	1.28 (ov)	1.22 (ov)
6	1.60 m, 1.80 m	1.68 m, 1.72 m	1.68 m, 1.90 m	1.64 m, 1.82 m
7	2.80 m	2.79 m	2.64 m, 2.92 m	2.80 m
11	6.72 s	6.81 s	6.76 d(8.7)	7.08 d(8.6)
12	3.83 s(OMe)	5.36 br s(OH)	6.69 d(8.7)	6.57 dd(2.8, 8.6)
13	5.40 br s(OH)	3.81 s(OMe)	3.81 s(OMe)	4.60 br s(OH)
14	6.56 s	6.48 s	5.64 br s(OH)	6.48 d(2.8)
18	0.92 s	0.92 s	0.95 s	0.92 s
19	0.90 s	0.89 s	0.92 s	0.90 s
20	1.16 s	1.14 s	1.17 s	1.14 s

Table 10-11-6: ^{1}H NMR spectroscopic data of podocarpane-type diterpenoids **10-11-16**~**10-11-19**.

H	10-11-16	10-11-17	10-11-18	10-11-19
1	1.83~1.85 m 2.35 ddd(13.8, 8.6, 3.2)	1.50 ddd(13.2, 8.8, 4.0) 2.22 ddd(12.8, 7.0, 3.2)	1.39 m, 2.21 m	2.19 m, 2.27 m
2	2.51~2.56 m, 2.60~2.63 m	1.74~1.76 m, 1.82~1.84 m	1.62 m, 2.01 m	1.67 m, 2.19 m
3		3.31 dd(3.7, 12.9)	1.06 m, 2.24 m	4.09 m
5	1.86 br s	1.30 dd(1.6, 10.0)	1.52 dd(12.2, 1.5)	2.17 m
6	1.66~1.70 m, 1.74~1.78 m	1.75 dd(6.6, 12.6) 1.84~1.86 m	2.01 m, 2.18 m	1.88 m, 2.88 m
7	2.66 ddd(16.4, 7.6, 4.8) 2.71 ddd(16.4, 5.2, 3.2)	2.60 ddd(17.0, 7.2, 5.2) 2.78 ddd(16.8, 6.8, 4.0)	2.76 m, 2.87 m	1.85 m, 2.90 m
11	6.64 s	6.80 s	6.80 s	6.91 s
13		3.83 s(OMe)	2.58 s(Ac)	2.60 s(Ac)

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Table 10-11-6 (continued)

H	10-11-16	10-11-17	10-11-18	10-11-19
14	6.41 s	6.51 s	7.40 s	7.45 s
18	1.11 s	1.07 s		4.80 s, 5.21 t
19	1.08 s	0.88 s	1.34 s	
20	1.18 s	1.17 s	1.12 s	1.01 s

Table 10-11-7: ^{1}H NMR spectroscopic data of podocarpane-type diterpenoids **10-11-20**~**10-11-23**.

H	10-11-20	10-11-21	10-11-22	10-11-23
1	4.54 s	*α* 1.68 m	*α* 1.58 dt(4.0, 13.5)	1.27 m
		β 2.07 m	*β* 2.37 td(3.5, 13.5)	1.87 m
2		*α* 1.88 m	*α* 1.88 dq(13.0, 4.0)	1.55 m
		β 1.77 dq(3.5, 11.8)	*β* 2.05 dq(4.0, 13.0)	1.59 m
3	2.44 (ov), 2.51 (ov)	3.37 dd(4.5, 11.5)	3.37 td(4.5, 12.0)	1.07 m
			4.02 d(4.5, OH)	1.96 m
5	2.47 (ov)	2.05 br d(2.5)		1.89 m
6	2.83 d(8.4)	5.83 d(9.5)	6.33 s	1.76 m, 2.01 m
7		6.49 dd(2.5, 9.5)		4.33 br t(2.7)
9				2.59 m
11	7.55 d(8.5)	6.60 s	7.02 s	1.81 m, 2.09 m
12	7.03 d(8.5)		8.95 s(OH)	2.35 m, 2.41 m
13	3.87 s(OMe)			
14	12.89 s(OH)	6.83 s	7.76 s	5.98 d(2.1)
15		2.20 s	2.83 s	
18	1.14 s	1.08 s	1.26 s	1.04 s
19	0.97 s	1.01 s	1.32 s	3.79 d(11.2)
				3.41 d(11.2)
20	1.08 s	1.00 s	1.49 s	0.86 s

Table 10-11-8: ^{1}H NMR spectroscopic data of podocarpane-type diterpenoids **10-11-24**~**10-11-27**.

H	10-11-24	10-11-25	10-11-26	10-11-27
1	1.30 m, 1.93 m	1.27 m, 1.85 m	3.50 t(7.7)	1.17 dt(13.5, 3.2)
				1.34 td(13.5, 4.3)
2	1.57 m, 1.54 m	1.54 m	1.64 m	1.63 m, 1.68 m
3	1.16 m, 2.24 m	1.63 m	1.32 m, 1.43 dt(13.2, 3.1)	3.28 dd(11.4, 4.6)
5	1.93 m	2.11 dd(10.9, 4.8)	2.10 dd(13.8, 4.0)	2.10 dd(14.0, 3.8)
6	2.22 m	1.63 m	2.38 dd(15.0, 13.8)	2.39 dd(15.6, 14.0)
			2.51 ddd(15.0, 4.0, 1.2)	2.55 ddd(15.6, 3.8, 1.4)
7	4.36 br t(2.8)	4.17 dd(9.7, 6.6)		
8			2.06 dd(16.2, 1.2)	2.17 dd(16.1, 1.4)
			2.86 d(16.2)	2.90 d(16.1)

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Table 10-11-8 (continued)

H	10-11-24	10-11-25	10-11-26	10-11-27
9	2.62 m	2.25 m		
11	2.08 m, 1.90 m	2.05 m, 1.66 m	7.67 d(5.6)	7.42 d(5.7)
12	2.41 m, 2.32 m	2.40 m, 2.31 m	5.93 d(5.6)	6.13 d(5.7)
14	5.99 d(2.1)	6.27 br s		
18	1.28 s		0.87 s	1.00 s
19		1.22 s	0.89 s	0.88 s
20	0.81 s	0.88 s	1.26 s	1.29 s

Table 10-11-9: ^{1}H NMR spectroscopic data of podocarpane-type diterpenoids **10-11-28**~**10-11-30**.

H	10-11-28	10-11-29	10-11-30
1	2.74 t-like(8.0)	2.19 m, 2.05 m	2.08 m, 1.55 (ov)
2	3.16 t-like(8.0)	2.20 m, 1.88 m	2.18 m, 1.81 (ov)
4	2.68 sept(7.0)		
5		2.43 dd(2.8, 11.7)	2.74 d(6.1)
6	7.07 d(8.0)	α 1.87 m, β 1.75 m	5.53 dd(6.1, 9.6)
7	7.48 d(8.0)	α 2.70 m, β 2.68 m	6.38 d(9.6)
11	7.28 s	6.71 d(2.4)	6.62 d(2.3)
12	8.61 s(OH)		
13		6.54 dd(2.4, 8.3)	6.53 dd(2.3, 8.1)
14	7.56 s	6.85 d(8.3)	6.84 d(8.1)
15	2.35 s		
18	1.08 d(7.0)	4.95 br s, 4.72 br s	4.74 d(2.2), 4.58 d(2.2)
19	1.08 d(7.0)	1.79 s	1.22 s
20	2.42 s	1.19 s	1.18 s

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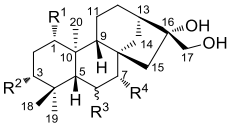
10.12 Kaurane-type diterpenoids

Table 10-12-1: Compounds, MFs, and test solvents of kaurane-type diterpenoids **10-12-1**~**10-12-6**.

No.	Compounds	MFs	Test solvents	References
10-12-1	suremulol A	$C_{20}H_{34}O_3$	$CDCl_3$-CD_3OD	[361]
10-12-2	broussonetone A	$C_{20}H_{32}O_4$	$CDCl_3$	[362]
10-12-3	1α,16α,17-trihydroxy-*ent*-kaurane	$C_{20}H_{34}O_3$	CD_3OD	[363]
10-12-4	6α-acetoxy-*ent*-kaurane-16β,17-diol	$C_{22}H_{36}O_4$	$CDCl_3$	[364]
10-12-5	abbeokutone	$C_{20}H_{32}O_3$	$CDCl_3$	[365]
10-12-6	*ent*-kaurane-3β,16β,17-triol	$C_{20}H_{34}O_3$	C_5D_5N	[366]



	R^1	R^2	R^3	R^4
10-12-1	H	H	α-OH	H
10-12-2	H	H	=O	OH
10-12-3	OH	H	H	H
10-12-4	H	H	β-OAc	H
10-12-5	H	=O	H	H
10-12-6	H	OH	H	H

Table 10-12-2: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-1**~**10-12-6**.

H	10-12-1	10-12-2	10-12-3	10-12-4	10-12-5	10-12-6
1	1.24 m, 1.35 m	1.87 br d(12.5)	3.16 dd, (10.8, 4.5)	–	1.34	0.77 dt(5.0, 13.0)
		0.97 dd(12.5, 4.2)			1.95	1.65 dt(13.0, 5.0)
2	1.45 m, 1.57 m	1.51 m	1.42 m, 1.70 m	–	2.44	1.61 m, 1.77 m
		1.36 dm(13)			–	
3	1.58 m, 1.70 m	1.36 dm(13)	1.21 m, 1.34 m	–	–	3.32 dt(11.0, 5.5)
		1.07 td(13, 3.8)				
5	0.88 m	2.16 s	0.68 br d(10.5)	–	1.38	0.66 dd(12.0, 2.0)
6	3.74 m		1.50 m	5.12 td(11, 4)	1.42, 1.49	1.42 m, 1.26 m
7	1.65 m, 1.86 m	4.07 s	1.48 m, 1.50 m	–	1.47, 1.63	1.42 m, 1.61 m
9	0.75 dt (12.5, 3.7)	1.52 m(ov)	1.17 d(6.6)	–	1.08	0.86 d(8.2)
11	1.25 m, 1.35 m	1.51 m(ov), 1.64 m	2.83 dd(9.9, 2.1)	–	1.57	1.47 m
			1.50 m		–	
12	1.62 m, 1.72 m	1.54 d(8.1), 1.62 m	1.49 m, 1.51 m	–	1.50, 1.60	1.49 m, 1.77 m
13	1.98 br s	2.10 br s	1.94 br s	–	2.04	2.36 m

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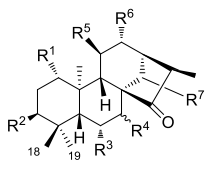
Table 10-12-2 (continued)

H	10-12-1	10-12-2	10-12-3	10-12-4	10-12-5	10-12-6
14	1.64 m, 1.88 m	1.26 dd(13, 1.6) 2.03 dd(13, 4)	1.87 d(11.7) 1.58 dd(11.7, 4.5)	–	1.61, 1.87	1.87 d(12.0) 1.93 dd(12.0, 4.0)
15	1.45 m, 1.55 m	1.77 d(13), 2.04 d(13)	1.33 m, 1.55 m	–	1.39, 1.52	1.59 m, 1.77 m
17	3.56 d(11.2) 3.59 d(11.2)	3.74, 3.68 d(11)	3.60 ABq(11.4)	3.62 d(11) 3.74 d(11)	3.67, 3.77	4.23 dd(10.5, 4.5) 3.95 dd(10.5, 4.5)
18	1.14 s	1.27 s	0.78 s	0.99 s	1.06	1.09 s
19	0.98 s	0.90 s	0.76 s	0.84 s	1.01	0.91 s
20	1.04 s	1.01 s	1.08 s	1.07 s	1.06	0.92 s
OAc				2.01 s		
OH						5.67 d(5,5, 3-OH) 6.03 t(4,5, 17-OH) 5.10 s(16-OH)

Table 10-12-3: Compounds, MFs, and test solvents of kaurane-type diterpenoids **10-12-7**~**10-12-19**.

No.	Compounds	MFs	Test solvents	References
10-12-7	dihydroinflexarabdonin G	$C_{24}H_{36}O_6$	$CDCl_3$	[367]
10-12-8	dihydrorabdoloxin B	$C_{20}H_{32}O_5$	C_5D_5N	[368]
10-12-9	melissoidesin W	$C_{20}H_{32}O_5$	C_5D_5N	[369]
10-12-10	glaucocalyxin E	$C_{20}H_{30}O_4$	C_5D_5N	[370]
10-12-11	dihydropseurata F①	$C_{22}H_{32}O_7$	CD_3COCD_3	[371]
10-12-12	dihydroinflexanin A	$C_{22}H_{34}O_5$	$CDCl_3$	[372]
10-12-13	dihydrohangshanin F	$C_{22}H_{32}O_6$	C_5D_5N	[373]
10-12-14	tetrahydroliangshanin B	$C_{22}H_{32}O_5$	$CDCl_3$	[373]
10-12-15	dihydroliangshanin E	$C_{22}H_{32}O_6$	C_5D_5N	[373]
10-12-16	dihydrorabdoloxin A	$C_{20}H_{30}O_6$	C_5D_5N	[368]
10-12-17	xindongnins K	$C_{21}H_{32}O_6$	C_5D_5N	[374]
10-12-18	glabcensin O	$C_{29}H_{42}O_{11}$	C_5D_5N	[375]
10-12-19	melissoidesin D	$C_{26}H_{40}O_9$	C_5D_5N	[376]

① Typographic error exists in the literature, drowing the C_{16}-C_{17} as double bond. But, judged by the NMR and MS data, as well as the identification process, it should be identified as a single bond.



	R^1	R^2	R^3	R^4	R^5	R^6	R^7
10-12-7	OH	OAc	H	H	OAc	H	H
10-12-8	H	H	H	α-OH	OH	OH	OH
10-12-9	H	OH	OH	β-OH	OH	H	H
10-12-10	H	=O	H	α-OH	H	H	OH
10-12-11	OH	OAc	H	α-OH	H	=O	OH
10-12-12	H	OAc	OH	H	OH	H	H

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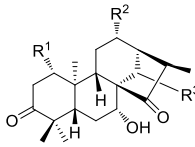
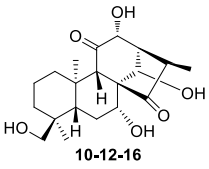
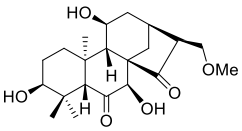


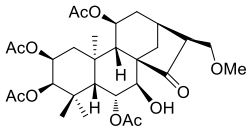
	R^1	R^2	R^3
10-12-13	H	OAc	OH
10-12-14	H	H	OAc
10-12-15	OAc	H	OH



10-12-16



10-12-17



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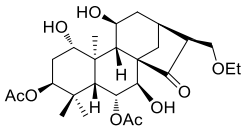

10-12-19

Table 10-12-4: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-7**~**10-12-10**.

H	10-12-7	10-12-8	10-12-9	10-12-10
1	3.74 m, 4.70 d(6.0, OH)	–	*α* 2.43 (ov), *β* 2.22 m	–
2	*α* –	–	*α* 2.23 (ov)	–
	β 1.73 ddd(15.0, 4.5, 3)		*β* 1.78 (ov)	
3	4.75 t(3)	–	3.64 br s	
5	–	–	2.58 br s	–
6	–	*α* 2.03 q(12.0)	4.59 br s	–
		β 2.22 dd(12.0, 4)		
7	–	–	4.22 d(3.2)	4.61 dd(9.6, 4.6)
9	–	1.97 s	2.54 br s	–
11	5.78 dd(5, 1.5)	4.39 or 4.79 or 5.97 br s	4.33 d(4.5)	–
12	–	4.39 or 4.79 or 5.97 br s	2.09 m	–
13	2.51 m	3.08 br d(7.5)	2.41 br s	3.21 dd(14.2, 7.1)
14	*α* 2.48 d(11.5)	4.39 or 4.79 or 5.97 br s	*α* 3.15 d(12.6)	5.06 s
	β –		*β* 1.78 (ov)	
16	2.35 m	3.51 m	2.42 (ov)	2.47 quint(8.0)
17	1.28 d(7.0)	1.67 d(7.5)	1.55 d(6.4)	1.18 d(8.0)
18	0.81 or 0.89 or 1.13	0.79 or 0.80 or 1.57	1.39 s	1.07 s
19	0.81 or 0.89 or 1.13	0.79 or 0.80 or 1.57	1.57 s	1.00 s
20	0.81 or 0.89 or 1.13	0.79 or 0.80 or 1.57	1.71 s	1.07 s
OAc	2.00 s, 2.09 s			

Table 10-12-5: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-11** and **10-12-15**.

H	10-12-11	10-12-15	H	10-12-11	10-12-15
1	3.57 dd(12.1, 5.5)	5.14 dd(8.8, 2.9)	16	–	3.17 q(7.0)
2	–	*α* 3.38 dd(16, 8.8)	17	1.05 d(4.6)	1.15 d(7.0)
		β 2.37 dd(8.8, 2.9)	18	0.92 or 0.95 or 1.05 s	1.15 s

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Table 10-12-5 (continued)

H	10-12-11	10-12-15	H	10-12-11	10-12-15
3	4.64 t(3.0)①		19	0.92 or 0.95 or 1.05 s	1.04 s
7	4.15 dd(11.8, 4.0)	4.55 dd(10, 6)	20	0.92 or 0.95 or 1.05 s	1.21 s
13	3.03 d(7.0)	2.59 m	OAc		2.02 s
14	5.02 br s	5.11 br s			

① Typographic error exists in the literature, assigning this signal to H-12. But, C-12 is a carbonyl, thus, judged by the identifying process, this signal was assigned to H-3.

Table 10-12-6: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-12**~**10-12-14** and **10-12-16**.

H	10-12-12	10-12-13	10-12-14	10-12-16
3	4.61 dd(3, 3)			–
6	4.44 dd(5, 3)	–	–	–
7	–	4.63 dd(11.6, 4.0)	4.06 dd(9, 5)	–
11	3.97 dd(4, 2.5)	–	–	
12	–	5.26 t(4.2)	–	–
13	2.46 m	2.84 m	2.58 m	–
14	α 2.74 d(12), β –	5.46 br s	6.02 br s	6.37 br s
16	2.25 m	3.30 q(7.0)	2.78 q(7.0)	–
17	1.28 d(7)	1.18 d(7.0)	1.15 d(7.0)	1.10 d(7.0)
18	0.95 or 1.27 or 1.39 s	1.09 s	1.11 s	3.54, 3.83 ABd(12.0)
19	0.95 or 1.27 or 1.39 s	1.09 s	1.08 s	0.86 or 1.74 s
20	0.95 or 1.27 or 1.39 s	1.19 s	1.19 s	0.86 or 1.74 s
OAc	2.06 s	2.12 s	2.05 s	

Table 10-12-7: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-17**~**10-12-19**.

H	10-12-17	10-12-18	10-12-19
1	α 1.74 (ov), β 2.24 (ov)	–	4.08 dd(11.3, 4.3)
2	α 2.03 m, β 1.72 (ov)	5.57 ddd(12.4, 4.0, 2.6)	α 2.34 ddd(15.0, 11.3, 2.6) β 2.17 ddd(15.0, 4.2, 2.6)
3	3.50 br s, 6.07 s(OH)	5.30 d(2.6)	4.83 t(2.6)
5	4.52 s		2.58 br s
6		5.56 d(3.5, 1.7)	5.56 dd(3.4, 1.8)
7	4.22 s, 6.64 s(OH)	4.01 d(3.5), 6.92 br s(OH)	4.02 d(3.4)
9	2.91 s		2.98 br s
11	4.24 d(4.0), 6.43 s(OH)	5.34 d(5.2)	5.95 d(4.2)
12	α 1.96 m		α 2.31 m
	β 2.26 br d(15.0)		β 2.19 m
13	2.72 m	2.70 m	2.75 br s
14	α 2.21 d(12.5)	α 2.69 d(12.5)	α 2.78 d(12.3)
	β 1.60 dd(4.0, 12.5)	β –	β 1.49 dd(12.3, 2.8)

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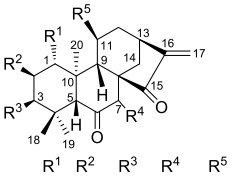
Table 10-12-7 (continued)

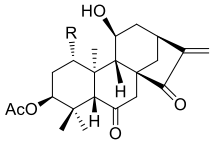
H	10-12-17	10-12-18	10-12-19
16	2.99 m	2.97 m	–
17	4.34 dd(8.0, 10.0)	3.99 dd(10.4, 4.3)	4.22 dd(10.2, 7.8)
	4.06 dd(4.0, 10.0)	3.85 dd(10.4, 8.2)	4.18 dd(10.2, 3.2)
18	1.35 s	1.08 s	1.02 s
19	1.46 s	1.12 s	1.14 s
20	1.12 s	1.49 s	1.85 s
OAc		2.15 s, 1.96 s, 1.94 s, 1.90 s	2.29 s, 2.01 s
OMe	3.25 s	3.36 s	
OEt			3.48 m(OCH_2)
			0.94 t($OCH_2\underline{CH_3}$)
OH			6.45 br s, 6.48 br s

Table 10-12-8: Compounds, MFs, and test solvents of kaurane-type diterpenoids **10-12-20**~**10-12-25**.

No.	Compounds	MFs	Test solvents	References
10-12-20	lungshengenin G	$C_{26}H_{34}O_9$	C_5D_5N	[377]
10-12-21	inflexarabdonin E	$C_{22}H_{30}O_6$	$CDCl_3$	[378]
			C_5D_5N	[378]
10-12-22	inflexarabdonin C	$C_{22}H_{30}O_5$	C_5D_5N	[378]
10-12-23	inflexarabdonin H	$C_{24}H_{32}O_7$	$CDCl_3$	[367]
10-12-24	xindongnin I	$C_{20}H_{28}O_5$	C_5D_5N	[374]
10-12-25	xindongnin J	$C_{20}H_{28}O_5$	C_5D_5N	[374]



	R^1	R^2	R^3	R^4	R^5
10-12-20	OH	OAc	OAc	H	OAc
10-12-24	H	H	OH	β-OH	OH
10-12-25	H	H	OH	α-OH	OH



10-12-21 R = OH
10-12-22 R = H
10-12-23 R = OAc

Table 10-12-9: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-20**~**10-12-22**.

H	10-12-20	10-12-21($CDCl_3$)	10-12-21(C_5D_5N)	10-12-22
1	4.70 d(9.2)	4.08 dd(10.5, 6)	4.43 dd(10.5, 6)	–
2	5.58 dd(9.2, 2.3)	–	–	–
3	5.28 d(2.3)	4.60 t(3)	4.81 t(3)	4.68 t(2.5)

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Table 10-12-9 (continued)

H	10-12-20	10-12-21($CDCl_3$)	10-12-21(C_5D_5N)	10-12-22
5	3.22 s	2.80 br s	3.11 s	2.96 s
7	α 2.42 d(12.5)	α 1.89 d(13.5)	α 2.12 d(13)	α 2.07 d(13.5)
	β 3.54 d(12.5)	β 3.21 br d(13.5)	β 3.62 d(13)	β 3.55 d(13.5)
9	2.72 s	–	–	2.50 br s
11	6.97 t(3.2)	5.24 br d(4.5)	6.09 t(3)	4.33 br d(4.5)
12	2.05 (ov)	–	–	α 2.04 m
				β 2.26 br d(14)
13	2.91 br s	3.09 m	3.02 m	3.00 m
14	α 2.42 d(12.1)	α 2.32 d(12.5)	α 2.49 d(12)	α 2.35 d(12)
	β 1.53 (ov)	β 1.50 br dd(12.5, 4.5)	β –	β 1.46 br dd(12, 4)
17	5.99 s, 5.24 s	5.37 br s, 5.96 br s	6.03 br s, 5.28 br s	5.31 br s, 6.05 br s
18	1.06 s	0.98 or 1.13 or 1.33 s	1.09 or 1.43 or 1.48 s	1.06 or 1.08 or 1.40 s
19	1.56 s	0.98 or 1.13 or 1.33 s	1.09 or 1.43 or 1.48 s	1.06 or 1.08 or 1.40 s
20	1.45 s	0.98 or 1.13 or 1.33 s	1.09 or 1.43 or 1.48 s	1.06 or 1.08 or 1.40 s
OAc	2.00 s, 1.82 s, 1.78 s	2.13 s	1.88 s	1.92 s
OH			6.21 m, 6.55 m	

Table 10-12-10: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-23**~**10-12-25**.

H	10-12-23	10-12-24	10-12-25
1	5.33 dd(11.5)	α 1.75 (ov), β 2.28 m	α 1.75 (ov), β 2.23 m
2	–	α 2.06 m, β 1.76 (ov)	α 2.05 m, β 1.73 (ov)
3	4.61 t(3)	3.52 br s, 6.09 s(OH)	3.48 br s
5	2.90 br s	4.56 s	3.37 s
7	α 1.86 d(12.5), β 3.25 d(12.5)	4.23 s, 6.79 s(OH)	5.34 s
9	2.29 br s	3.09 s	2.69 s
11	4.29 m①	4.35 d(3.5), 6.30 s(OH)	4.40 d(4.0)
12	–	α 2.14 m	α 2.12 m
		β 2.21 br d(14.8)	β 2.30 br d(14.8)
13	3.05 m	3.00 br s	3.06 br s
14	α 2.23 d(12)	α 2.20 d(12.0)	α 2.00 d(11.0)
	β –	β 1.57 dd(4.0, 12.0)	β 2.49 dd(4.0, 11.0)
17	5.36 br s, 5.95 br s	5.98 s, 5.30 s	6.04 s, 5.26 s
18	0.91 or 1.20 or 1.35 s	1.36 s	1.25 s
19	0.91 or 1.20 or 1.35 s	1.48 s	1.49 s
20	0.91 or 1.20 or 1.35 s	1.15 s	1.11 s
OAc	2.04 s, 2.16 s		

① 4.29 dd(5, 2.5) of H-11 was confirmed after the addition of D_2O.

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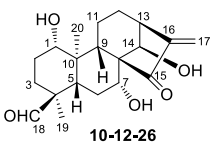
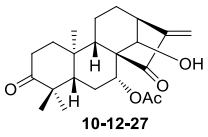
Table 10-12-11: Compounds, MFs, and test solvents of kaurane-type diterpenoids **10-12-26**~**10-12-42**.

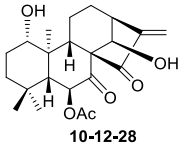
No.	Compounds	MFs	Test solvents	References
10-12-26	(1α,7α,14β)-1,7,14-trihydroxy-*ent*-kaur-16-en-15,18-dione	$C_{20}H_{28}O_5$	C_5D_5N	[379]
10-12-27	glaucocalyxin D	$C_{22}H_{30}O_5$	C_5D_5N	[370]
10-12-28	isodoglutinosin A	$C_{22}H_{30}O_6$	C_5D_5N	[380]
10-12-29	rabdoloxin A	$C_{20}H_{28}O_6$	C_5D_5N-D_2O	[368]
10-12-30	rabdokunmin B	$C_{20}H_{30}O_4$	C_5D_5N	[381]
10-12-31	rabdokunmin C	$C_{20}H_{30}O_5$	C_5D_5N	[381]
10-12-32	rabdokunmin D	$C_{20}H_{30}O_5$	C_5D_5N	[381]
10-12-33	rabdokunmin E	$C_{20}H_{30}O_6$	C_5D_5N	[381]
10-12-34	parvifoline A	$C_{20}H_{30}O_5$	C_5D_5N	[382]
10-12-35	rabdoloxin B	$C_{20}H_{30}O_5$	C_5D_5N-D_2O	[368]
10-12-36	pseurata F	$C_{22}H_{30}O_7$	CD_3COCD_3	[371]
10-12-37	pseurata A	$C_{20}H_{30}O_4$	CD_3COCD_3	[384]
10-12-38	pseurata B	$C_{20}H_{30}O_5$	C_5D_5N	[384]
10-12-39	pseurata C	$C_{22}H_{30}O_6$	CD_3COCD_3	[384]
10-12-40	liangshanin A	$C_{20}H_{26}O_4$	–	[373]
10-12-41	liangshanin E	$C_{22}H_{30}O_6$	–	[373]
10-12-42	liangshanin F	$C_{22}H_{30}O_6$	–	[373]



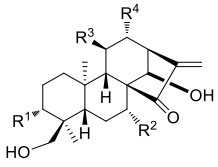
10-12-26



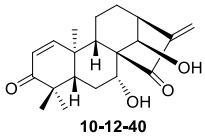
10-12-27



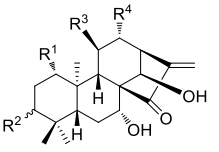
10-12-28



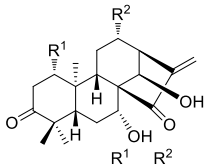
	R^1	R^2	R^3	R^4
10-12-29	H	OH	=O	OH
10-12-30	H	H	H	OH
10-12-31	H	OH	H	OH
10-12-32	H	OH	OH	H
10-12-33	H	OH	OH	OH
10-12-34	OH	OH	H	H



10-12-40



	R^1	R^2	R^3	R^4
10-12-35	H	H	OH	OH
10-12-36	OH	β-OAc	H	=O
10-12-37	H	α-OH	H	H
10-12-38	H	α-OH	H	OH
10-12-39	H	β-OAc	H	=O



	R^1	R^2
10-12-41	OAc	H
10-12-42	H	OAc

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Table 10-12-12: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-26**~**10-12-29**.

H	10-12-26	10-12-27	10-12-28	10-12-29
1	3.51 dd(10.0, 6.8)	–	3.58 dd(9.2, 4.4)	–
2	1.15~1.17 m	–	*α* 1.88 m	–
	1.50 ddd(13.6, 13.6, 4.0)		*β* 1.74 m	
3	1.68 t(4.0)	–	*α* 1.51 dt(9.8, 3.0)	–
			β 1.30 m	
5	1.60~1.62 m	–	1.80 d(12.4)	1.92 d(12.0)
6	1.92~1.94 m		*α* 6.10 d(12.4)	*α* 2.23 q(12.0)
	1.83 ddd(6.8, 6.4, 2.0)		*β* –	*β* 2.50 dd(12.0, 4.5)
7	4.83 dd(12.0, 3.6)	5.67 dd(11.3, 4.5)		5.05 dd(12.0, 4.5)
9	1.96 s	–	2.50 dd(5.5, 2.5)	2.36 d(0.5)
11	1.64~1.65 m	–	*α* 3.41 dd(15.5, 5.5)	
	3.59 dd(13.6, 4.4)		*β* 1.59 m	
12	2.21~1.24 m	–	*α* 2.16 m	4.34 dd(3.0, 0.5)
	2.13 ddd(7.2, 5.6, 2.0)		*β* 1.75 (ov)	
13	3.23 br s	3.24 br s	3.29 br s	3.82 dd(3.5, 1.5)
14	5.23 br s	4.96 s	5.17 s	6.26 br s
17	6.28 s, 5.30 s	6.23 s, 5.38 s	6.24 s, 5.32 s	5.26 br s, 6.41 br s
18	9.26 s	1.02 s	1.12 s	3.31 d(10.5), 3.67 d(10.5)
19	1.14 s	0.97 s	1.03 s	0.88 s
20	1.42 s	1.07 s	1.62 s	1.73 s
OAc		1.90 s	2.10 s	

Table 10-12-13: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-30**~**10-12-34**.

H	10-12-30	10-12-31	10-12-32	10-12-33	10-12-34
3	–	–	–	–	4.20 dd(10.0, 6.1)
6	–	–	–	–	*α* 2.11 q(12.2), *β*–
7	–	4.98 dd(3.7, 10.0)	5.02 dd(3.6, 11.7)	5.12 dd(3.3, 11.8)	4.98 dd(11.9, 4.1)
11	–	–	4.25 d(3.3)	4.45 br s	2.47 br d(14.0)
12	4.46 m	4.35 m	–	4.73 m	–
13	3.68 m	3.58 m	3.32 m	3.74 m	3.31 br d(9.0)
14	5.59 br s	5.82 br s	5.41 br s	5.97 br s	5.19 br s
17	5.38 br s, 6.28 br s	5.42 br s, 6.29 br s	5.26 br s, 6.27 br s	5.48 br s, 6.35 br s	5.39 s, 6.32 s
18	3.37 d(10.6)	3.32 d(10.6)	3.30 d(10.6)	3.34 d(10.5)	4.21 d(10.5)
	3.69 d(10.6)	3.65 d(10.6)	3.65 d(10.6)	3.66 d(10.5)	3.70 d(10.5)
19	0.84 s	0.87 s	0.88 s	0.91 s	1.06 or 1.15 s
20	1.63 s	1.67 s	1.12 s	1.68 s	1.06 or 1.15 s
OH	6.10, 6.82, 7.07	6.15, 6.93, 7.88	5.80, 6.05, 7.47, 8.12	6.04, 7.15, 7.45, 7.88	

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Table 10-12-14: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-35**~**10-12-38**.

H	10-12-35	10-12-36	10-12-37	10-12-38
1	–	3.57 dd(12.1, 5.5)	–	–
3	–	4.67 t(2.8)	3.17 dd(11.5, 4.5)	3.41 dd(11.7, 4.7)
5	1.04 d(12.0)	–	–	–
6	*α* (ov)	–	*α* 1.77 q(12.6)	*α* 2.18 q(12.4)
	β 2.24 dd(12.0, 4.5)		*β* –	*β* 2.32 dd(14.2, 4.0)
7	4.97 dd(12.0, 4.5)	4.38 dd(11.7, 4.4)	4.19 dd(13.2, 4.3)	4.94 dd(11.8, 4.7)
9	2.10 br s	–	–	–
11	4.44 br s	*α* 3.82 d(18.0)	–	–
		β –		
12	4.80 d(4.0)		–	4.40 t(2.9)
13	3.78 m	3.66 br s	2.99 br s	3.64 d(3.2)
14	5.49 br s	5.03 br s	4.83 br s	5.89 br s
17	5.49 br s, 6.39 br s	5.56 s, 6.08 s	5.99 s, 5.34 s	5.44 s, 6.36 s
18	0.81 s	0.88 or 0.94 or 0.98 s	1.10 or 1.02 or 0.88 s	1.22 or 1.09 s
19	0.82 s	0.88 or 0.94 or 0.98 s	1.10 or 1.02 or 0.88 s	1.22 or 1.09 s
20	1.59 s	0.88 or 0.94 or 0.98 s	1.10 or 1.02 or 0.88 s	1.68 s
OAc		2.03 s		

Table 10-12-15: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-39**~**10-12-42**.

H	10-12-39	10-12-40	10-12-41	10-12-42
1	–	7.01 d(10)	4.91 dd(8.8, 2.9)	–
2	–	5.88 d(10)	*α* 3.18 dd(16, 8.8)	–
			β 2.14 dd(16, 2.9)	
3	4.62 dd(4.9, 2.0)			
6	*α* 1.73 q(12.2)	–	–	–
	β –			
7	4.43 dd(12.5, 4.2)	4.40 dd(9, 5)	4.32 dd(9, 5)	4.85 dd(10, 6)
12		–	–	5.20 m
13	3.58 br s	3.12 m	3.12 m	3.58 m
14	5.04 br s	4.83 br s	4.79 br s	5.44 br s
17	6.12 s, 5.16 s	6.19 br s, 5.47 br s	6.14 br s, 5.42 br s	6.36 br s, 5.52 br s
18	0.96 or 0.93 or 0.92 s	1.17 s	1.14 s	1.12 s
19	0.96 or 0.93 or 0.92 s	1.17 s	1.14 s	1.12 s
20	0.96 or 0.93 or 0.92 s	1.28 s	1.14 s	1.21 s
OAc	2.03 s		2.04 s	2.16 s

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Table 10-12-16: Compounds, MFs, and test solvents of kaurane-type diterpenoids **10-12-43**~**10-12-58**.

No.	Compounds	MFs	Test solvents	References
10-12-43	glabcensin I	$C_{24}H_{34}O_8$	C_5D_5N	[375]
10-12-44	glabcensin J	$C_{22}H_{32}O_6$	C_5D_5N	[375]
10-12-45	melissoidesin N	$C_{22}H_{32}O_5$	C_5D_5N	[385]
10-12-46	melissoidesin S	$C_{24}H_{34}O_7$	C_5D_5N	[385]
10-12-47	gesneroidin A	$C_{22}H_{32}O_4$	C_5D_5N	[386]
10-12-48	melissoidesin A	$C_{24}H_{34}O_8$	C_5D_5N	[376]
10-12-49	inflexanin A	$C_{22}H_{32}O_5$	$CDCl_3$	[372]
10-12-50	inflexarabdonin I	$C_{20}H_{28}O_4$	C_5D_5N	[387]
10-12-51	inflexarabdonin K	$C_{22}H_{32}O_5$	$CDCl_3$	[387]
10-12-52	lungshengenin F	$C_{26}H_{36}O_8$	C_5D_5N	[377]
10-12-53	rosthornin A	$C_{22}H_{32}O_5$	C_5D_5N	[388]
10-12-54	rosthornin B	$C_{24}H_{34}O_7$	C_5D_5N	[388]
10-12-55	inflexanin B	$C_{22}H_{32}O_6$	C_5D_5N	[372]
10-12-56	gesneroidin B	$C_{22}H_{30}O_4$	C_5D_5N	[386]
10-12-57	gesneroidin C	$C_{28}H_{38}O_{10}$	C_5D_5N	[376]
10-12-58	excisanin K	$C_{20}H_{30}O_5$	C_5D_5N	[389]

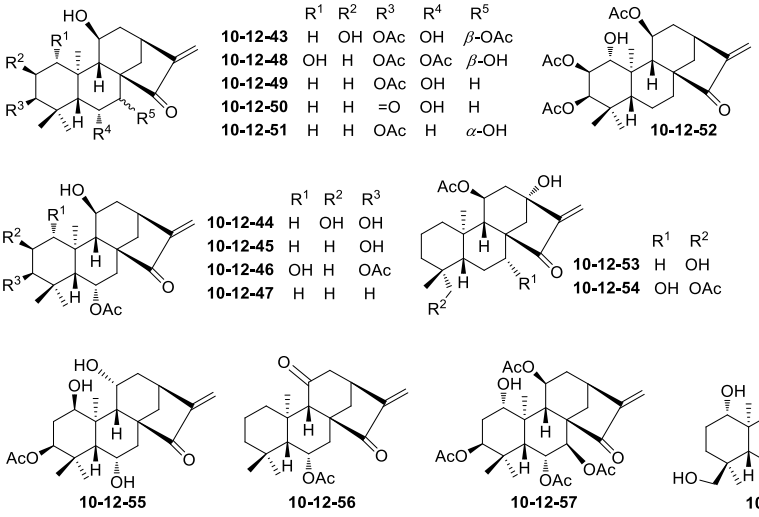

Table 10-12-17: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-43**~**10-12-46**.

H	10-12-43	10-12-44	10-12-45	10-12-46
1	–	–	*α* 1.73 (ov)	4.08 m
			β 2.10 (ov)	6.27 d(5.4, OH)
2	4.65 ddd(11.8, 3.7, 3.2)	4.33 ddd(11.5, 3.9, 2.3)	1.72 (ov)	*α* 2.09 m, *β* 2.31 m

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Table 10-12-17 (continued)

H	10-12-43	10-12-44	10-12-45	10-12-46
3	5.40 d(3.2)	4.64 d(2.3)	3.53 br s	4.84 br s
5	2.73 br s	–	2.09 s	1.72 s
6	4.54 d(3.3)	5.63 dd(3.8, 1.7)	5.78 t(3.0)	5.70 t(2.0)
7	5.41 d(3.3)	–	*α* 1.78 dd(15.0, 3.0)	*α* 1.79 dd(11.8, 2.0)
			β 2.50 dd(15.0, 3.0)	*β* 2.47 dd(11.8, 2.0)
9	2.36 br s	–	2.23 br s	2.41 br s
11	4.40 d(4.3)	4.40 d(3.8)	4.37 br s	6.06 m, 5.79 s(OH)
12	–	–	2.08 (ov)	2.27 m
13	2.74 br s	–	3.04 m	3.04 m
14	3.16 d(12.5)	3.06 d(12.1)	*α* 2.71 d(12.0)	*α* 2.78 d(12.0)
			β 1.34 dd(12.0, 3.2)	*β* 1.39 br d(12.0)
17	5.90 br s, 5.07 br s	6.02 br s, 5.26 br s	6.00 s, 5.25 s	6.00 s, 5.24 s
18	1.06 s	1.04 s	1.10 s	0.98 s
19	1.52 s	1.61 s	1.23 s	1.09 s
20	1.71 s	1.75 s	1.48 s	1.74 s
OAc	2.26 s, 2.20 s	2.00 s	2.11 s	2.14 s, 1.89 s
OH	6.95, 6.32, 6.10 br s			

Table 10-12-18: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-47**~**10-12-49**.

H	10-12-47	10-12-48	10-12-49
1	*α* 1.82 ddd(13.0, 3.0, 3.0)	4.20 dd(11.4, 4.2)	–
	β 0.89 ddd(13.0, 13.0, 4.0)		
2	*α* 1.26 ddddd(12.5, 13.0, 13.0, 4.0, 3.0)	*α* 2.34 ddd(15.0, 11.4, 4.2)	–
	β 1.67 ddddd(12.5, 4.0, 4.0, 3.0, 3.0)	*β* 2.13 ddd(15.0, 4.2, 2.8)	
3	*α* 1.22 ddd(14.0, 4.0, 3.0)	4.85 t(2.8)	4.62 t(3)
	β 0.98 ddd(14.0, 13.0, 4.0)		
5	1.01 d(3.0)	2.65 br s	–
6	5.66 ddd(3.5, 3.0, 2.0)	5.63 dd(3.5, 1.8)	4.49 m①
7	*α* 1.67 dd(15.5, 3.5)	4.05 d(3.5)	*α* –
	β 2.35 dd(15.5, 3.0)		*β* 2.31 dd(3, 14.5)
9	1.81 d(2.0)	3.00 br s	–
11	4.23 dd(4.3, 2.0)	6.03 br s(3.2)	4.10 br d(5)
12	*α* 2.12 ddd(13.5, 4.3, 3.0)	*α* 2.76 m	*α* 2.27 ddd(14.5, 5, 3)
	β 2.21 dddd(13.5, 4.0, 2.0, 2.0)	*β* 2.23 m	*β* –
13	2.96 ddd(4.0, 3.0, 3.0)	3.05 br s	3.09 m
14	*α* 2.59 br d(12.0)	*α* 2.80 d(12.1)	*α* 2.78 d(12.5)
	β 12.8 dddd(12.0, 3.0, 2.0, 2.0)	*β* 1.42 dd(12.1, 2.5)	*β* –
17	5.95 br s, 5.21 br s	5.99 br s, 5.30 br s	5.31 br s, 5.91 br s
18	0.85 s	1.08 s	0.96 or 1.28 or 1.42 s
19	0.93 s	1.14 s	0.96 or 1.28 or 1.42 s
20	1.31 s	1.72 s	0.96 or 1.28 or 1.42 s
OAc	2.03 s	2.18 s, 1.89 s	2.07 s
OH		6.62, 6.45, 6.35	

① The peaktype was changed into dd(5, 3) after the addition of D_2O.

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Table 10-12-19: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-50**~**10-12-52**.

H	10-12-50	10-12-51	10-12-52
1	*α* 2.11 ddd(13.0, 6.5, 3.5)	*α* 1.66 m	4.31 d(10.0)
	β 1.56 ddd(13.0, 12.5, 6.0)	*β* 1.36 ddd(13.6, 13.6, 4.2)	
2	*α* 2.80 ddd(15.5, 12.5, 6.5)	*α* 1.91 m	5.68 dd(10.0, 2.4)
	β 2.38 ddd(15.5, 6.0, 3.5)	*β* 1.66 m	
3		4.67 t(2.8)	5.37 d(2.4)
5	1.55 br s	1.52 dd(12.7, 1.0)	1.61 dd(11.7, 2.8)
6	4.66 m	*α* 1.43 ddd(12.7, 11.7, 11.3)	*α* 1.33 (ov)
		β 1.79 ddd(11.7, 4.5, 1.0)	*β* 1.49 br d(11.7)
7	*α* 2.51 dd(14.0, 2.5)	4.17 dd(11.3, 4.5)	*α* 1.39 (ov)
	β 1.81 dd(14.0, 3.5)		*β* 2.20 (ov)
9	1.98 br s	1.46 br s	2.11 br s
11	4.36 br d(3.0)	4.07 br d(4.7)	6.94 t(2.7)
12	*α* 2.24 ddd(14.0, 4.5, 3.0)	2.23 ddd(14.5, 4.7, 3.2)	2.07 (ov)
	β 2.28 dm(14.0)	2.01 m	
13	3.07 m	3.12 m	2.91 br d(3.0)
14	*α* 3.12 d(12.5)	*α* 2.04 d(11.9)	*α* 2.38 d(12.1)
	β –	*β* 2.12 dm(11.9)	*β* 1.34 (ov)
17	5.27 br s, 6.04 br s	5.31 br s, 5.91 br s	5.97 s, 5.18 s
18	1.30 s	0.90 or 0.91 s	0.84 s
19	1.67 s	0.90 or 0.91 s	0.95 s
20	1.73 s	1.05 s	1.36 s
OAc		2.08 s	2.04 s, 1.86 s, 1.73 s
OH	5.82 m, 5.90 d(4.0)		

Table 10-12-20: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-53**~**10-12-55**.

H	10-12-53	10-12-54	10-12-55
1	*α* 1.40 br d(13.3)	*α* 1.32 br d(13.9)	6.18 br d-like(3)
	β 0.96 t(13.3)	*β* 0.91 br t(13.9)	
2	*α* 1.59 br d(13.3)	*α* 1.66 br q(13.9)	2.12~2.42
	β 2.10 br d(13.3)	*β* 1.55 br d(13.9)	
3	*α* 1.92 br d(13.3)	*α* 1.91 br d(13.9)	4.95 dd(3, 3)
	β 0.95 t(13.3)	*β* 0.91 br t(13.9)	
5	1.05 br d(13.4)	1.07 d(12.4)	1.67 d(1)
6	*α* 1.34 br q(13.4)	*α* 1.66 q(12.4)	4.72 m
	β 1.48 dd(13.4, 4.1)	*β* 2.15 dd(12.4, 4.0)	
7	*α* 1.78 br d(13.4)	4.48 dd(12.4, 4.0)	*α* 1.73~1.91
	β 2.26 td(13.4, 4.1)		*β* 2.64 dd(3, 14)
9	1.55 br s	1.505 br s	2.52 br s
11	5.45 d(4.7)	5.40 d(4.5)	4.17 dd(16, 4)
12	*α* 2.43 d(14.3)	*α* 2.41 d(14.3)	2.12~2.42
	β 2.54 dd(4.7, 14.3)	*β* 2.57 dd(4.5, 14.3)	

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Table 10-12-20 (continued)

H	10-12-53	10-12-54	10-12-55
13			3.11 m
14	*α* 1.78 d(11.4) *β* 2.71 d(11.4)	*α* 2.38 d(11.3) *β* 2.85 d(11.3)	*α* 3.28 d(12) *β* 1.73~1.91
17	6.27 d(1.4), 5.75 d(1.4)	6.15 d(1.3), 5.67 d(1.3)	5.24 br s, 6.04 br s
18	1.17 s	1.03 s	1.09 or 1.58 s
19	3.91 d(10.7), 3.62 d(10.7)	4.29 d(11.0), 3.98 d(11.0)	1.09 or 1.58 s
20	1.02 s	0.94 s	2.03 s
OAc	1.96 s	2.02 s, 1.95 s	1.95 s
OH	7.31, 5.75	7.19 br s, 6.49 br s	5.90 d(3.0)

Table 10-12-21: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-56**~**10-12-58**.

H	10-12-56	10-12-57	10-12-58
1	*α* 1.78 ddd(13.5, 3.0, 3.0) *β* 1.12 ddd(13.5, 13.0, 4.0)	4.24 dd(11.4, 4.3)	3.55 ddd(9.8, 4.9, 4.9)
2	*α* 1.25 ddddd(12.5, 13.0, 13.0, 4.0, 3.0) *β* 1.44 ddddd(12.5, 4.0, 4.0, 3.0, 3.0)	*α* 2.30ddd(15, 11.4, 3.5) *β* 2.12 ddd(15, 4.3, 3.5)	2.01 m 1.91 m
3	*α* 1.19 ddd(15.0, 4.0, 3.0) *β* 1.07 ddd(15.0, 13.0, 4.0)	4.89 t(3.5)	1.40 m 1.99 m
5	1.02 d(2.0)	2.37 br s	1.80 dd(12.4, 1.2)
6	5.67 ddd(3.5, 3.5, 3.0)	5.38 dd(3.5, 1.8)	2.18 ddd(12.4, 12.4, 12.4) 2.45 ddd(12.4, 3.8, 1.2)
7	*α* 1.76 dd(15.5, 3.5) *β* 2.20 dd(15.5, 3.5)	5.48 d(3.5)	4.96 m
9	2.02 br s	2.65 br s	1.97 d(8.0)
11		6.43 br d(3.2)	3.68 m, 1.71 m
12	*α* 2.73 dd(15.5, 4.5) *β* 2.55 ddd(15.5, 4.5, 3.0)	*α* 2.19 m *β* 2.04 m	1.65 m, 2.21 m
13	3.12 dt(4.5, 4.5)	2.92 br s	3.30 br s
14	*α* 2.93 d(12.5) *β* 1.50 dddd(12.5, 3.0, 2.0, 2.0)	*α* 2.66 d(12.3) *β* 1.44 dd(12.3, 2.5)	5.33 s
17	6.01 br s, 5.23 br s	5.92 br s, 5.19 br s	6.28 s, 5.33 s
18	0.86 s	0.97 s	3.67 dd(10.5, 4.8) 3.34 dd(10.5, 4.8)
19	0.90 s	1.09 br s	0.92 s
20	1.34 s	1.67 s	1.51 s
OAc	2.07 s	2.23 s, 2.18 s, 2.02 s, 1.74 s	
OH		6.83 br s	

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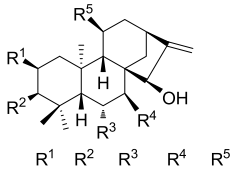
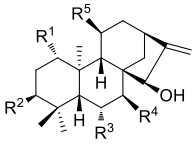
Table 10-12-22: Compounds, MFs, and test solvents of kaurane-type diterpenoids **10-12-59**~**10-12-80**.

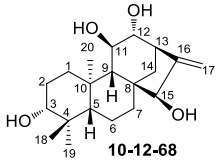
No.	Compounds	MFs	Test solvents	References
10-12-59	glabcensin K	$C_{24}H_{36}O_8$	C_5D_5N	[375]
10-12-60	glabcensin Y	$C_{24}H_{34}O_7$	C_5D_5N	[390]
10-12-61	melissoidesin M	$C_{22}H_{34}O_5$	C_5D_5N	[385]
10-12-62	melissoidesin P	$C_{22}H_{34}O_6$	C_5D_5N	[385]
10-12-63	melissoidesin C	$C_{24}H_{36}O_8$	C_5D_5N	[376]
10-12-64	adenanthin H	$C_{24}H_{36}O_7$	C_5D_5N	[391]
10-12-65	adenanthin J	$C_{26}H_{36}O_9$	C_5D_5N	[391]
10-12-66	inflexarabdonin J	$C_{20}H_{30}O_3$	$CDCl_3$	[387]
10-12-67	inflexarabdonin F	$C_{22}H_{34}O_6$	$CDCl_3$	[378]
			C_5D_5N	[378]
10-12-68	melissoidesin V	$C_{20}H_{32}O_4$	C_5D_5N	[369]
10-12-69	rabyunennane A	$C_{28}H_{38}O_9$	$CDCl_3$	[392]
10-12-70	rabyunennane B	$C_{26}H_{36}O_8$	$CDCl_3$	[392]
10-12-71	adenanthin K	$C_{26}H_{36}O_9$	C_5D_5N	[391]
10-12-72	lungshengenin B	$C_{28}H_{38}O_{10}$	C_5D_5N	[377]
10-12-73	lungshengenin E	$C_{28}H_{38}O_9$	C_5D_5N	[377]
10-12-74	forrestin F	$C_{28}H_{36}O_9$	$CDCl_3$	[393]
10-12-75	forrestin G	$C_{26}H_{34}O_7$	C_5D_5N	[393]
10-12-76	liangshanin D	$C_{20}H_{28}O_4$	–	[373]
10-12-77	*ent*-kaurene-3β, 15β-diol	$C_{20}H_{30}O_2$	$CDCl_3$	[394]
10-12-78	*ent*-16-kaurene-3β,15β,18-triol	$C_{20}H_{32}O_3$	$CDCl_3$	[395]
10-12-79	*ent*-3-oxo-16-kaurene-15β,18-diol	$C_{20}H_{30}O_3$	$CDCl_3$	[395]
10-12-80	3α,6β-dihydroxy-*ent*-kaur-16-ene	$C_{20}H_{32}O_2$	$CDCl_3$	[396]



	R^1	R^2	R^3	R^4	R^5
10-12-59	OH	OAc	OH	OAc	OH
10-12-60	H	OH	=O	OAc	OAc
10-12-61	H	OH	OAc	H	OH
10-12-62	H	OH	OAc	OH	OH



	R^1	R^2	R^3	R^4	R^5
10-12-63	OH	OAc	OAc	OH	OH
10-12-64	OAc	OH	H	OAc	OH
10-12-65	OAc	OH	=O	OAc	OAc
10-12-66	H	=O	H	H	OH
10-12-67	OH	OAc	OH	H	OH



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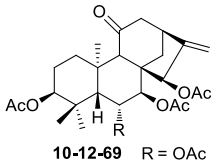
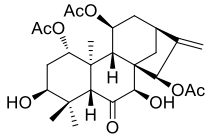


10-12-69 R = OAc
10-12-70 R = OH



10-12-71

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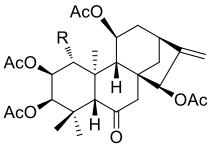
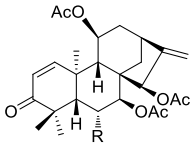
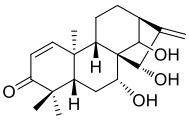


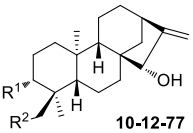
10-12-72 R = OH
10-12-73 R = H



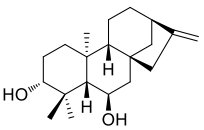
10-12-74 R = OAc
10-12-75 R = H



10-12-76



	R^1	R^2
10-12-77	OH	H
10-12-78	OH	OH
10-12-79	= O	OH



10-12-80

Table 10-12-23: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-59**~**10-12-62**.

H	10-12-59	10-12-60	10-12-61	10-12-62
1	–	–	*α* 1.81 (ov)	*α* 1.79 br d(10.3)
			β 2.17 dd(14.5, 3.0)	*β* 2.25 (ov)
2	4.67 ddd(11.8, 3.8, 3.0)	–	1.80 (ov)	*α* 2.17 br d(10.2)
				β 2.16 (ov)
3	5.33 d(3.0)	3.87 br s	3.57 br s	3.61 m
5	2.66 br s	3.49 br s	2.08 s	2.94 d(3.5)
6	4.45 dd(3.2, 1.8)		5.73 br s	5.74 t(3.5)
7	5.45 d(3.2)	5.01 br s	*α* 1.77 (ov), *β* 2.09 (ov)	3.83 d(3.5)
9	2.23 br s	2.82 br s	2.25 br s	2.62 br s
11	4.47 d(4.4)	5.33 br s	4.30 br s	4.24 m
12	–	–	2.11 (ov)	–
13	2.65 br s	2.54 br s	2.68 m	2.67 m
14	*α* 2.75 d(12.5)	–	*α* 2.32 d(12.1)	*α* 2.26 d(12.3)
	β –		*β* 1.08 (ov)	*β* 1.09 br d(12.3)
15	4.56 br s	4.56 br s	3.98 d(10.0)	4.56 d(6.4)
			5.53 d(10.0, OH)	6.12 d(6.4, OH)
17	5.33 br s, 5.14 br s	5.38 br s, 5.29 br s	5.36 s, 5.18 s	5.36 d(1.0), 5.20 d(1.0)
18	1.12 s	1.06 s	1.12 s	1.12 s
19	1.62 s	1.40 s	1.25 s	1.31 s
20	1.72 s	1.42 s	1.42 s	1.41 s
OAc	2.22 s, 2.03 s	2.25 s, 1.96 s	2.10 s	2.13 s
OH	6.85 br s, 6.80 br s			6.33 br s
	6.45 br s			5.97 s

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Table 10-12-24: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-63**~**10-12-65**.

H	10-12-63	10-12-64	10-12-65
1	4.40 dd(11.6, 4.0)	5.94 dd(4.4, 10.8)	5.96 dd(4.6, 11.0)
2	*α* 2.36 ddd(15.0, 11.6, 2.6)	*α* 2.13 (ov)	*α* 2.04 (ov)
	β 2.17 ddd(15.0, 4.0, 2.6)	*β* 2.23 (ov)	*β* 2.14 (ov)
3	4.91 t(2.6)	3.79 br s	3.55 br s
3-OH		6.42 br s	6.72 br s
5	2.62 br s	2.54 d(13.2)	4.05 s
6	5.56 br s	*α* 1.72 d(13.2), *β* 1.84 (ov)	
7	3.83 d(3.2)	5.15 br s	4.97 (ov)
9	2.90 br s	2.82 s	3.03 br s
11	6.09 br d(4.5)	4.91 br s	5.82 br s
11-OH		6.37 br s	
12	*α* 2.42 m, *β* 2.22 m	2.10~2.20 (ov)	1.95 (ov)
13	2.66 br s	2.63 d(2.8)	2.51 br s
14	*α* 2.39 d(12.0)	*α* 1.88 (ov)	*α* 1.68 dd(5.6, 12.2)
	β 1.10 dd(12.0, 2.8)	*β* 1.25 br d(12.3)	*β* 1.32 (ov)
15	4.56 d(5.4)①	4.45 d(9.3)	4.48 d(9.7)
15-OH		6.06 d(9.3)	3.92 d(9.7)
17	5.35 br s, 5.03 br s	5.30 s, 5.13 s	5.23 s, 4.98 (ov)
18	1.04 s	1.14 s	1.20 s
19	1.13 s	0.94 s	1.47 s
20	1.70 s	1.31 s	1.29 s
OAc	2.18 s, 1.92 s	2.10 s, 2.08 s	2.17 s, 2.11 s, 1.89 s
OH	6.42 br s, 6.33 br s, 6.18 br s		

① The peaktype was changed into br s after the addition of D_2O.

Table 10-12-25: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-66**, **10-12-68**, **10-12-71**, and **10-12-72**.

H	10-12-66	10-12-68	10-12-71	10-12-72
1	2.09 ddd(13.4,.9, 5.5)	*α* 2.17 m, *β* 1.53 m	6.08 dd(4.5, 11.2)	4.79 d(9.9)
2	*α* 2.45 ddd(15.7, 7.9, 7.9)	*α* 1.64 m	*α* 2.03 (ov)	5.59 dd(9.9, 2.8)
	β 2.58 ddd(15.7, 8.4, 5.5)	*β* 1.83 m	*β* 2.29 (ov)	
3		3.43 dd(11.6, 4.6)	3.59 br s	5.25 d(2.8)
5	–	1.01 dd(11.8, 1.8)	4.64 s	3.21 s
6	–	*α* 1.93 m, *β* 1.61 m		
7	–	*α* 1.42 m	3.89 s	*α* 2.21 d(12.6)
		β 2.04 dd(9.9, 6.3)	8.13 br s(OH)	*β* 3.17 d(12.6)
9	1.67 br s	2.10 br s	3.30 s	3.00 s
11	3.99 br d(4.5)	4.34 br s	5.92 br s	6.91 d(4.6)
12	*α* 2.03 ddd(14.8, 5.0, 4.5)	4.41 br d(3.3)	2.02 (ov)	2.00 (ov)
	β 1.78 m			
13	2.67 m	3.06 br s	2.56 br s	2.56 br s

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Table 10-12-25 (continued)

H	10-12-66	10-12-68	10-12-71	10-12-72
14	*α* 1.94 d(12.3) *β* 1.12 m	*α* 2.78 d(11.8) *β* 1.08 (ov)	*α* 1.76 d(12.2) *β* 1.37 (ov)	*α* 1.99 (ov) *β* 1.29 dd(12.2, 4.0)
15	3.81 t(2.5)	4.17 d(9.9)	6.04 s	5.49 br s
17	5.05 m, 5.13 m	5.49 s, 5.26 s	5.05 s, 4.98 s	5.00 s
18	1.04 s	1.06 s	1.28 s	1.00 s
19	1.11 s	1.20 s	1.54 s	1.56 s
20	0.99 s	1.59 s	1.37 s	1.37 s
OAc			1.99 s, 2.03 s, 2.25 s	2.01 s, 1.94 s, 1.90 s, 1.87 s

Table 10-12-26: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-67**, **10-12-69**, and **10-12-70**.

H	10-12-67 ($CDCl_3$)	10-12-67 (C_5D_5N)	10-12-69	10-12-70
1	3.84 dd(11.5, 4.5)	4.36 dd(11.5, 4.5)	–	–
3	4.67 t(3)	4.99 t(3)	4.64 t(1.6)	4.64 t(1.6)
6	4.39 m	4.70 m	5.30 dd(3.4, 2.0)	5.30 dd(3.4, 2.0)
7	–	–	4.93 d(3.4)	4.78 d(3.4)
11	5.26 br d(5)	6.21 br d(4)		
13	2.64 m	2.73 m	–	–
14	*α* 2.36 d(12.5), *β* –	*α* 2.91 d(12.5), *β* –	–	–
15	3.80 t(2.5)	4.16 m①	5.56 t(2.0)	5.56 t(2.0)
17	5.05 br d(3), 5.12 br s	5.43 br s, 5.21 br s	4.98 d(2.0), 5.12 d(2.0)	4.96 d(2.0), 5.10 d(2.0)
Me	0.92 s, 1.92 s, 1.41 s	1.11 s, 1.60 s, 1.99 s	0.89 s, 1.04 s, 1.43 s	0.87 s, 1.25 s, 1.44 s
OAc	2.08 s	1.94 s	1.97 s, 2.08 s, 2.12 s, 2.15 s	1.95 s, 2.06 s, 2.12 s
OH	4.08 m	5.74 d(3), 6.06 br d(10), 6.48 m		

① The peaktype was changed into t(2) after the addition of D_2O.

Table 10-12-27: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-73**~**10-12-76**.

H	10-12-73	10-12-74	10-12-75	10-12-76
1	*α* 2.35 (ov), *β* 1.85 (ov)	7.68 d(10.3)	7.93 d(10.3)	7.12 d(10)
2	5.50 ddd(12.4, 4.2, 2.8)	5.95 d(10.3)	6.0 d(10.3)	5.98 d(10)
3	5.22 d(2.8)			

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Table 10-12-27 (continued)

H	10-12-73	10-12-74	10-12-75	10-12-76
5	3.04 s	2.23 br s	2.23 dd(13.2, 1.8)	–
6		5.24 br s	*α* 1.65 ddd(13.6, 13.2, 2.2) *β* 1.90 ddd(13.6, 2.2, 1.8)	–
7	*α* 2.34 dd(13.4, 4.4) *β* 3.12 d(13.4)	4.86 d(2.8)	5.06 t(2.2)	4.35 dd(10, 5)
9	2.68 s	2.34 br s	2.45 br s	–
11	5.33 d(4.3)	5.28 d(4.7)	5.25 br d(4.4)	–
12	2.00 (ov)	1.97~2.23 m	1.92 m	–
13	2.57 br s	2.82 br s	2.64 br d(3.7)	3.06 m
14	*α* 1.99 (ov) *β* 1.29 dd(12.2, 4.4)	*α* 2.33 d(12.4) *β* 1.52 dd(12.4, 4.0)	*α* 1.80 d(12.5) *β* 1.32 dd(12.5, 5.1)	4.86 br s
15	5.22 br s	5.59 br s	5.82 dd(2.6, 2.2)	–
17	5.08 s	4.91 br s, 5.08 br s	5.04 d(2.2), 5.09 d(2.6)	5.71 br s, 5.34 br s
18	1.04 s	1.14 s	1.08 s	1.19 s
19	1.10 s	1.18 s	1.09 s	1.13 s
20	1.48 s	1.56 s	1.13 s	1.22 s
OAc	2.12 s, 2.02 s, 2.01 s, 1.94 s	2.15 s, 2.12 s, 2.02 s, 1.97 s	2.18 s, 2.08 s, 2.06 s	

Table 10-12-28: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-77**~**10-12-80**.

H	10-12-77	10-12-78	10-12-79	10-12-80
1	0.90, 1.86	1.85 m	2.12 dd(13.2, 2.7) 2.09 dd(13.2, 2.7)	0.84 m, 1.84 m
2	1.59, 1.65	1.60 m	2.61 ddd(16.8, 12.3, 7.2) 2.35 ddd(16.8, 6.6, 2.7)	1.69 m
3	3.21 dd(11.3, 4.9)	3.59 dd(10.8, 6.0)		3.18 dd(11.7, 5.4)
5	0.76	0.90 m	1.74 m	0.92 d(10.5)
6	1.36, 1.66	1.63 m, 1.42 m	1.67 m, 1.59 m	4.01 td(10.5, 3.9)
7	1.46, 1.73	1.39 m, 1.63 m	1.56 m, 1.78 br dd(9.6, 3.3)	1.61 m, 1.82 m
9	0.99	1.00 m	1.16 br d(6.6)	1.05 (ov)
11	1.41, 1.56	1.54 m	1.51 m, 1.48 m	1.55 m
12	1.38, 1.48	1.48 m	1.74 m	1.67, 1.47 m
13	2.75 t-like(5.4)	2.73 br s	2.79 br s	2.65 br s
14	1.36, 1.90	1.35 m, 1.85 m	1.46 m, 1.92 br d(12.0)	1.23 m, 1.93 br d(11.4)
15	3.80 br s	3.78 s	3.84 s	2.12 t(2.1)
17	5.08 s, 5.21 s	5.19 br s, 5.09 br s	5.24 br s, 5.11 br s	4.82 br s, 4.76 br s
18	1.00 s	3.33 d(10.8), 3.58 d(10.8)	3.43 d(11.1), 3.64 d(11.1)	1.30 s
19	0.79 s	0.80 s	1.03 s	0.99 s
20	1.03 s	1.02 s	1.20 s	1.05 s

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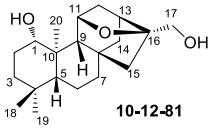
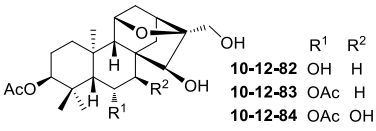
Table 10-12-29: Compounds, MFs, and test solvents of kaurane-type diterpenoids **10-12-81**~**10-12-85**.

No.	Compounds	MFs	Test solvents	References
10-12-81	isodoglutinosin B	$C_{20}H_{32}O_3$	C_5D_5N	[380]
10-12-82	melissoidesin I	$C_{22}H_{34}O_6$	C_5D_5N	[397]
10-12-83	melissoidesin J	$C_{24}H_{36}O_7$	C_5D_5N	[397]
10-12-84	melissoidesin K	$C_{24}H_{36}O_8$	C_5D_5N	[397]
10-12-85	lungshengenin D	$C_{22}H_{32}O_5$	C_5D_5N	[377]





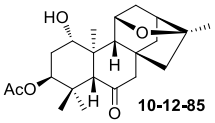


Table 10-12-30: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-81**~**10-12-85**.

H	10-12-81	10-12-82	10-12-83	10-12-84	10-12-85
1	3.59 dd(10.0, 4.0)	*α* 2.21 br d(11.0)	*α* 1.85 m	1.45~1.47 m	4.32 ddd(12.0, 5.8, 3.0)
		β 2.06 m	*β* 1.41 m		6.35 d(5.8, OH)
2	*α* 1.90 m, *β* 1.74 m	2.07 m	1.55 m	*α* 1.57 m, *β* 1.87 m	2.22 m
3	*α* 1.41 dt(14.1, 2.6) *β* 1.31 m	4.83 br s	4.74 t(3.1)	4.77 br s	4.83 t(3.0)
5	0.76 dd(10.6, 2.0)	1.53 br s	1.59 s	2.49 br s	2.96 s
6	1.35~1.40 (ov)	4.64 br s 5.64 br s(OH)	5.64 br s	5.56 d(2.2)	
7	*α* 1.51 dd(12.0, 3.0)	*α* 1.44 (ov)	*α* 2.20 br d(12.0)	3.87 d(2.2)	*α* 1.38 d(11.0)
	β 1.48	*β* 1.96 br d(12.0, 2.5)	*β* 1.63 dd(12.0, 2.8)		*β* 1.83 d(11.0)
9	1.94 br s	2.25 br s	2.29 br s	2.68 br s	2.55 br d(3.4)
11	5.91 br s	4.54 br s	4.50 br s	4.53 br s	5.71 t(3.4)
12	*α* 2.06 dd(11.0, 3.5)	*α* 2.31 dd(14.0, 3.0)	*α* 2.07 (ov)	*α* 2.12 (ov)	*α* 1.94 dt-like(11.8, 3.4)
			β 1.40 (ov)	*β* 1.43 (ov)	
	β 1.27 m	*β* 1.43 (ov)			*β* 1.27 m
13	2.72 t(6.0)	2.85 t(6.0)	2.83 t(6.0)	2.85 t(6.5)	2.13 (ov)
14	*α* 2.28 d(11.0)	*α* 2.68 d(12.4)	*α* 2.19 d(12.2)	*α* 2.16 d(11.7)	*α* 2.15 (ov)
	β 2.06 dd(11.0, 4.0)	*β* 1.41 (ov)	*β* 1.19 dd(12.2, 6.0)	*β* 1.26 dd(12.4, 6.5)	*β* 2.09 (ov)

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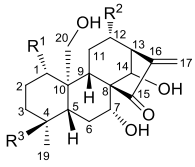
Table 10-12-30 (continued)

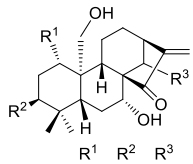
H	10-12-81	10-12-82	10-12-83	10-12-84	10-12-85
15	*α* 1.68 d(10.2) *β* 1.81 dd(10.2, 2.0)	3.60 d(6.0)	*α* 3.50 br s *β* –	4.11 d(8.3) 6.95 d(8.3, OH)	*α* 2.75 d(13.3) *β* 2.10 d(13.3)
17	4.10 d(11.2) 3.98 d(11.2)	4.18 d(13.4) 4.19 d(13.4) 6.44 br s(OH)	4.17 d(13.6) 4.15 d(13.6)	4.12 d(13.1) 4.14 d(13.1)	1.38 s
18	0.83 s	1.04 s	0.95 s	1.03 s	1.08 s
19	0.84 s	1.50 s	1.01 s	1.04 s	1.50 s
20	1.34 s	1.65 s	1.37 s	1.40 s	1.34 s
OAc		2.00 s	1.96 s, 2.08 s	1.92 s, 2.00 s	2.00 s
OH				6.53 br s, 6.74 br s	

Table 10-12-31: Compounds, MFs, and test solvents of kaurane-type diterpenoids **10-12-86**~**10-12-94**.

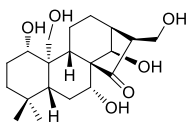
No.	Compounds	MFs	Test solvents	References
10-12-86	(1*α*,7*α*,14*β*)-1,7,14,18,20-pentahydroxy-*ent*-kaur-16-en-15-one	$C_{20}H_{30}O_6$	C_5D_5N	[379]
10-12-87	excisanin F	$C_{20}H_{28}O_6$	C_5D_5N	[398]
10-12-88	excisanin I	$C_{20}H_{30}O_5$	C_5D_5N	[389]
10-12-89	excisanin J	$C_{20}H_{30}O_5$	C_5D_5N	[389]
10-12-90	coetsoidm B	$C_{20}H_{30}O_5$	C_5D_5N	[399]
10-12-91	kamebakaurin 14-*O*-acetate	$C_{22}H_{32}O_6$	$CDCl_3$	[400]
10-12-92	excisanin G	$C_{20}H_{32}O_6$	C_5D_5N	[398]
10-12-93	phyllostachysin B	$C_{22}H_{30}O_7$	C_5D_5N	[401]
10-12-94	longirabdosin	$C_{26}H_{32}O_8$	$CDCl_3$	[402]



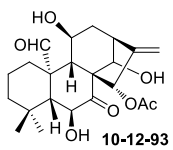
	R^1	R^2	R^3
10-12-86	OH	H	CH_2OH
10-12-87	OH	H	CHO
10-12-88	H	OH	Me
10-12-89	H	H	CH_2OH



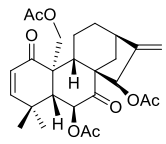
	R^1	R^2	R^3
10-12-90	H	OH	OH
10-12-91	OH	H	OAc



10-12-92



10-12-93



10-12-94

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Table 10-12-32: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-86**~**10-12-89**.

H	10-12-86	10-12-87	10-12-88	10-12-89
1	3.68 dd(11.2, 4.0)	3.80 dd(4.6, 10.3)	2.67 d(12.8) 0.48 ddd(12.8, 12.8, 3.1)	2.40 m 0.63 ddd(12.9, 12.9, 3.9)
2	2.08~2.11 m, 2.93~2.96 m	–	1.71 m, 1.41 m	2.06 m, 1.51 m
3	1.41~1.44 m, 2.67~2.70 m	–	1.41 m, 1.14 m	1.69 m, 2.94 m
5	1.88 dd(11.8, 1.6)	–	1.10 dd(12.4, 1.3)	1.96 dd(12.4, 2.0)
6	2.17 ddd(12.4, 12.4, 12.4) 2.36 ddd(12.0, 8.0, 1.4)	–	2.02 ddd(12.5, 12.5, 12.5) 2.14 ddd(12.5, 1.9, 1.6)	2.32 ddd(12.4, 12.4, 12.4) 2.41 m
7	5.06 dd(12.0, 4.0)	4.94 dd(4.4, 12.1)	4.97 ddd(12.6, 4.9, 4.9)	5.11 ddd(12.4, 4.7, 4.7)
9	2.06 d(8.8)	–	1.61 d(10.5)	1.72 m
11	1.73~1.74 m, 3.31~3.34 m	–	2.39 d(16.5), 1.80 m	1.85 m, 1.51 m
12	1.69~1.72 m, 1.96~1.99 m	–	4.37 ddd(8.8, 4.4, 4.4)	1.82 m, 1.42 m
13	3.30 br s	3.31 m	3.70 d(4.4)	3.34 br s
14	5.34 s	5.39 br s	6.06 s	5.72 s
17	6.27 s, 5.68 s	6.31 s, 5.96 s	6.35 s, 5.43 s	6.34 s, 5.39 s
18	3.61, 3.26 ABd(11.2)	9.30 s	0.84 s	3.68 dd(10.5, 5.2) 3.35 dd(10.5, 5.2)
19	0.93 s	–	0.88 s	0.99 s
20	4.77, 4.45 ABd(12.0)	4.65 d(12.1) 4.46 d(12.1)	4.31 dd(12.8, 4.4) 4.53 dd(12.8, 8.0)	4.42 dd(11.8, 4.4) 4.35 dd(11.8, 4.4)

Table 10-12-33: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-90**~**10-12-94**.

H	10-12-90	10-12-91	10-12-92	10-12-93	10-12-94
1	–	3.57 dd(10.5, 5)	3.64 dd(4.1, 10.1)	–	
2	–	–	–	–	5.86 d(10.5)
3	3.68 br s	–	–	–	6.39 d(10.5)
5	–	–	–	–	2.29 d(13.5)
6	–	–	–	6.75 d(12)	5.73 d(13.5)
7	5.07 dd(6.0, 10.0)	4.23~4.31	4.71 dd(4.7, 11.1)		
9	–	–	–	–	2.70 dd(8, 3.5)
11	–	–	–	4.52 d(4.8)	–
13	3.33 m	3.11 m	3.22 m	–	2.78 m
14	5.72 br s	6.00 d(1)	5.78 br s	5.31 s	–

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Table 10-12-33 (continued)

H	10-12-90	10-12-91	10-12-92	10-12-93	10-12-94
15				6.25 s	6.16 t(2.5)
16			2.90 m		
17	6.33 br s, 5.39 br s	5.39 br s, 6.13 br s	3.29 m, 3.23 m	5.55 s, 4.61 s	5.04 m
18	1.20 s	0.86 or 0.89 s	0.78 or 0.84 s	1.12 s①	1.29 or 1.25 s
19	1.05 s	0.86 or 0.89 s	0.78 or 0.84 s	0.92 s①	1.29 or 1.25 s
20	4.34 br s	4.23~4.31, 4.47 d(12)	4.68 d(11.9), 4.74 d(11.9)	10.75 s	4.67 d(12), 4.82 d(12)
OAc		1.97 s		2.17 s	2.19 s, 2.12 s, 2.09 s

① The NMR data of 18-Me and 19-Me were not assigned in the literature, and here, the deployments are only to display the data.

Table 10-12-34: Compounds, MFs, and test solvents of kaurane-type diterpenoids **10-12-95**~**10-12-119**.

No.	Compounds	MFs	Test solvents	References
10-12-95	xerophilusin G	$C_{22}H_{30}O_8$	C_5D_5N	[403]
10-12-96	xerophilusin J	$C_{22}H_{30}O_8$	C_5D_5N	[403]
10-12-97	xerophilusin K	$C_{22}H_{30}O_7$	C_5D_5N	[403]
10-12-98	rabdoternin F	$C_{21}H_{30}O_7$	C_5D_5N	[404]
10-12-99	rabdoternin G	$C_{21}H_{30}O_7$	C_5D_5N	[404]
10-12-100	enanderianin B	$C_{22}H_{30}O_8$	C_5D_5N	[405]
10-12-101	coetsoidin C	$C_{21}H_{30}O_5$	C_5D_5N	[399]
10-12-102	coetsoidin D	$C_{21}H_{30}O_6$	C_5D_5N	[399]
10-12-103	coetsoidin E	$C_{22}H_{32}O_5$	C_5D_5N	[399]
10-12-104	coetsoidin F	$C_{20}H_{28}O_6$	C_5D_5N	[399]
10-12-105	enanderianin K	$C_{22}H_{30}O_7$	C_5D_5N	[406]
10-12-106	enanderianin L	$C_{22}H_{30}O_6$	C_5D_5N	[406]
10-12-107	enanderianin M	$C_{22}H_{32}O_6$	C_5D_5N	[406]
10-12-108	enanderianin N	$C_{22}H_{32}O_6$	C_5D_5N	[406]
10-12-109	rabdoternin A	$C_{20}H_{28}O_6$	C_5D_5N	[407]
10-12-110	rabdoternin B	$C_{20}H_{28}O_7$	C_5D_5N	[407]
10-12-111	laxiflorin I	$C_{20}H_{26}O_6$	C_5D_5N	[408]
10-12-112	enanderinanin G	$C_{23}H_{34}O_8$	C_5D_5N	[409]
10-12-113	16α-ethoxymethyleneshikokianin	$C_{26}H_{38}O_9$	$CDCl_3$	[410]
10-12-114	adenolin D	$C_{23}H_{34}O_7$	C_5D_5N	[411]
10-12-115	wikestroemioidin A	$C_{20}H_{28}O_5$	C_5D_5N	[412]
10-12-116	maoyecrystal A	$C_{24}H_{36}O_9$	C_5D_5N	[413]
10-12-117	maoyecrystal B	$C_{24}H_{34}O_8$	C_5D_5N	[413]
10-12-118	lushanrubescensin G	$C_{20}H_{30}O_8$	C_5D_5N	[414]
10-12-119	rabdophyllin H	$C_{24}H_{36}O_9$	C_5D_5N	[415]

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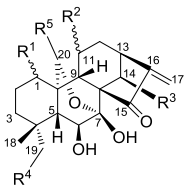
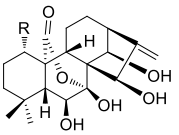
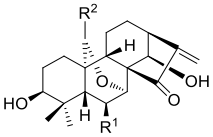


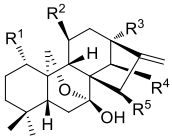
	R^1	R^2	R^3	R^4	R^5
10-12-95	β-OH	H	OH	OAc	H
10-12-96	α-OAc	H	OH	H	(*R*)OH
10-12-97	H	β-OAc	OH	H	H
10-12-98	α-OH	H	OH	H	(*S*)OMe
10-12-99	α-OH	β-OH	H	H	(*S*)OMe
10-12-100	β-OH	α-OH	H	OAc	H



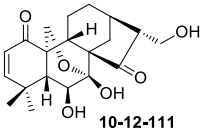
10-12-109 R = H
10-12-110 R = OH



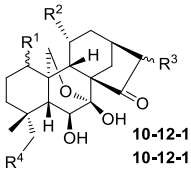
	R^1	R^2
10-12-101	H	OMe
10-12-102	OH	OMe
10-12-103	H	OEt
10-12-104	OH	OH



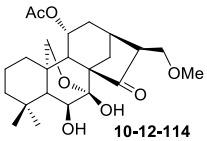
	R^1	R^2	R^3	R^4	R^5
10-12-105	OH	OAc	OH	H	=O
10-12-106	OAc	H	OH	H	=O
10-12-107	OAc	H	OH	H	OH
10-12-108	OAc	H	H	OH	OH



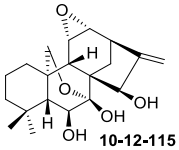
10-12-111



	R^1	R^2	R^3	R^4
10-12-112	β-OH	H	β-CH_2OMe	OAc
10-12-113	α-OAc	α-OAc	α-CH_2OEt	H



10-12-114



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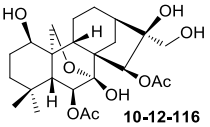

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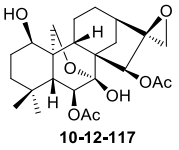

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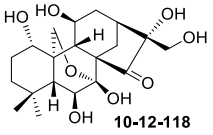

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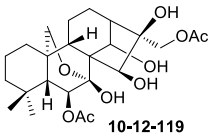

10-12-119

Table 10-12-35: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-95**~**10-12-98**.

H	10-12-95	10-12-96	10-12-97	10-12-98
1	3.63 br s	4.95 dd(4.9, 11.5)	α 1.29 (ov), β 1.24 (ov)	3.57 dd(11, 5)
2	1.77 (ov)	α 2.39 m, β 1.92 m	1.26 m	–
3	α 2.05 dd(5.4, 13.6) β 1.67 d(13.6)	1.42 (ov)	α 1.34 m β 1.11 m	–
5	2.34 d(5.9)	1.73 d(9.3)	1.50 d(5.8)	–
6	4.44 d(5.9)	4.68 m	4.19 d(5.8)	4.11 m①
9	2.66 dd(5.9, 12.5)	2.01 (ov)	2.15 d(9.3)	–
11	α 1.90 m, β 2.11 m	α 1.94 m, β 1.41 (ov)	5.41 m	–
12	α 2.37 (ov), β 1.53 m	α 2.27 m, β 1.43(ov)	α 3.15 m, β 1.52 m	–
13	3.17 d(9.4)	3.12 d(9.3)	3.18 d(9.0)	3.24 br d(10)
14	5.21 s	5.17 s	5.14 s	5.54 d(1.5)

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Table 10-12-35 (continued)

H	10-12-95	10-12-96	10-12-97	10-12-98
17	6.21 s, 5.44 s	6.28 s, 5.50 s	6.31 s, 5.56 s	6.23 br s, 5.48 br s
18	1.43 s	1.43 s	1.23 s	1.05 s or 1.24 s
19	4.47 d(11.2), 4.78 d(11.2)	1.53 s	1.05 s	1.05 s or 1.24 s
20	4.22 ABd(10.1)4.14 ABd(10.1)	6.09 s	4.17 ABd(10.3)	5.60 br s
			4.07 ABd(10.3)	
OAc	1.99 s	1.99 s	2.07 s	
OMe				3.47 s

① The peaktype was changed into d(6) after the addition of D_2O.

Table 10-12-36: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-99**, **10-12-100**, **10-12-105**, and **10-12-106**.

H	10-12-99	10-12-100	10-12-105	10-12-106
1	4.01 m①	3.75 t(2.8)	4.05 dd(5.2, 11.5)	4.86 dd(6.0, 11.2)
2	–	1.76 (ov)	1.90 m	*α* 1.53 m
				β 1.78 d(11.5)
3	–	*α* 2.20 (ov)	*α* 1.39 br d(12.1)	*α* 1.35 br d(11.7)
		β 1.71 (ov)	*β* 1.27 m	*β* 1.21 m
5	1.54 d(6)	2.39 d(6.8)	1.63 dd(5.6, 11.0)	1.59 dd(6.1, 11.5)
6	4.13 dd(10.5, 6.0)②	4.57 dd(6.8, 10.4)	*α* 2.16 br d(11.0)	*α* 2.02 (ov)
		7.13 d(10.4, OH)	*β* 3.64 t(11.0)	*β* 3.59 t(11.5)
9	1.97 d(9)	2.60 d(4.0)	2.15 (ov)	1.90 dd(5.5, 11.5)
11	5.15 m	5.31 br t(4.4)	6.30 dd(5.6, 13.0)	*α* 2.48 m, *β* 1.40 m
12	2.78 m	*α* 2.51 dd(9.6, 15.6)	*α* 3.68 m	*α* 2.51 m
		β 1.80 (ov)	*β* 2.08 m	*β* 2.00 (ov)
13	3.08 dd(10, 4)	3.15 m		
14	*α* 2.78 d(12)	*α* 3.20 d(11.6)	*α* 2.93 d(11.5)	*α* 2.82 d(11.5)
	β 2.50 dd(12, 4)	*β* 2.67 dd(4.4, 11.6)	*β* 2.78 d(11.5)	*β* 2.73 d(11.5)
17	5.28 br s, 5.91 br s	5.93 s, 5.26 s	6.21 br s, 5.85 br s	6.18 s, 5.75 s
18	1.02 s or 1.20 s	1.50 s	0.78 s	0.76 s
19	1.02 s or 1.20 s	4.85 d(10.8)	1.09 s	1.06 s
		4.54 d(10.8)		
20	5.56 br s	4.24 d(8.8), 4.60 d(8.8)	4.55 d(10.9), 4.75 d(10.9)	4.42 d(10.0), 4.56 d(10.0)
OAc		1.97 s	2.11 s	2.00 s
OMe	3.51 s			
OH	7.10 d(10.6)			

① The peaktype was changed into dd(9, 7) after the addition of D_2O.
② The peaktype was changed into d(6) after the addition of D_2O.

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Table 10-12-37: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-101**~**10-12-104**.

H	10-12-101	10-12-102	10-12-103	10-12-104
3	3.73 br s	3.70 d(2.0)	3.73 br s	3.82 d(2.5)
6	–	4.42 dd(3.0, 7.0)	–	4.55 dd(3.4, 6.9)
7	4.79 dd(2.0, 4.0)	4.77 d(3.0)	4.79 dd(2.0, 3.0)	4.91 d(3.4)
13	3.18 (10.0)	3.20 d(8.0)	3.20 d(10.0)	3.16 d(9.0)
14	5.15 br s	5.08 br s	5.23 br s	5.52 br s
17	6.20 br s, 5.41 br s	6.18 br s, 5.46 br s	6.20 br s, 5.51 br s	6.17 br s, 5.45 br s
18	1.15 s	1.57 s	1.16 s	1.63 s
19	1.06 s	1.13 s	1.07 s	1.12 s
20	5.38 s	5.28 s	5.37 s	6.10 s
OMe	3.45 s	3.40 s		
$O\underline{CH_2}CH_3$			3.95 dq(10.0, 7.0)	
			3.50 dq(10.0, 7.0)	
$OCH_2\underline{CH_3}$			1.19 t(7.0)	

Table 10-12-38: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-107**~**10-12-110**.

H	10-12-107	10-12-108	10-12-109	10-12-110
1	4.89 dd(5.2, 11.3)	4.80 dd(5.2, 11.5)	–	3.52 m
2	*α* 1.55 m	*α* 1.62 m	–	–
	β 1.78 m	*β* 1.77 m		
3	*α* 1.38 br d(11.8)	*α* 1.29 dt(2.5, 12.8)	–	–
	β 1.18 m	*β* 1.09 m		
5	1.90 dd(5.1, 10.9)	1.85 dd(5.5, 10.0)	1.74 d(4)	1.78 d(4)
6	*α* 2.03 (ov)	*α* 1.96 (ov)	4.26 dd(4, 4)①	4.24 dd(4, 4)①
	β 3.03 t(11.0)	*β* 3.00 t(10.0)		
9	2.52 br d(11.5)	2.71 dd(4.8, 10.2)	2.88 dd(6, 13)	3.12 dd(6, 12)
11	*α* 2.25 m, *β* 1.42 m	*α* 1.92 (ov), *β* 1.15 (ov)	–	–
12	*α* 2.51 (ov), *β* 2.11 m	*α* 2.31 m, *β* 1.60 (ov)	–	–
13		2.78 br d(8.5)	2.80 d(8)	2.82 d(8)
14	*α* 2.50 d(11.5)	5.04 br s	4.84 s	4.94 s
	β 2.40 d(11.5)			
15	5.28 br s	5.70 br s	5.65 s	5.66 br s
17	5.80 s, 5.59 s	5.63 br s, 5.32 br s	5.32 s, 5.65 s	5.33 br s, 5.66 br s
18	0.74 s	0.73 s	0.94 s or 1.12 s	0.98 s or 1.14 s
19	1.08 s	1.09 s	0.94 s or 1.12 s	0.98 s or 1.14 s
20	4.47 d(10.2), 4.60 d(10.2)	4.49 d(10.5), 4.60 d(10.5)		
OAc	2.00 s	1.98 s		
OH			6.42 s, 8.70 br s	4.70 d(10), 6.35 s
			9.14 d(4)	8.90 br s, 9.30 d(4)

① The peaktype was changed into d(4) after the addition of D_2O.

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Table 10-12-39: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-111**~**10-12-114**.

H	10-12-111	10-12-112	10-12-113	10-12-114
1		3.69 br s	4.70 m	–
2	6.01 d(10.1)	–	*α* 1.42 m, *β* 1.27 m	–
3	6.69 d(10.1)	–	*α* 1.73 br d(9.3), *β* –	–
5	2.18 (ov)	2.33 d(5.2)	1.33 (ov)	–
6	4.30 dd(8.3, 11.3)	4.40 dd(5.2, 10.5)	3.92 dd(12.0, 8.2)	4.19 dd(11.1, 6.4)
	6.32 d(11.4, OH)	6.79 d(10.5, OH)	5.45 d(12.0, OH)	6.19 d(11, OH)
9	1.96 dd(11.1, 6.2)	2.37 dd(5.3, 11.4)	1.51 br s	1.75 d(5)
11	*α* 2.22 (ov), *β* 1.60 m	–	4.86 t(4.0)	5.40 t(4.5)
12	*α* 2.20 (ov)	–	*α* 2.36 (ov)	*α* 1.93 (ov)
	β 1.29 m		*β* 1.63 br dd(15.9, 4.0)	*β* 2.11 (ov)
13	2.77 ddd(9.1, 4.4, 2.3)	2.68 m	2.52 br d(6.7)	2.77 m
14	*α* 2.48 dd(2.4, 12.6)	–	*α* 2.70 d(11.3)	*α* 3.03 d(12.6)
	β 2.88 dd(4.4, 12.6)		*β* 2.22 br d(11.2)	*β* 2.63 dd(12.6, 3)
16	2.63 dt(2.2, 4.4)	2.92 m	*β* 2.36 (ov)	2.95 m
17	4.08 m	3.67 dd(4.8, 10.0)	3.35 m, 3.44 (ov)	3.69 dd(8.4, 4.5)
		3.48 t(10.0)		3.59 dd(8.4, 4.5)
18	1.38 s	1.39 s	1.18 s	1.21 s
19	1.07 s	4.43 d(11.0),	1.15 (ov)	1.05 s
		4.76 d(11.0)		
20	4.54 d(9.8)	4.16 ABd(10.2)	4.40 d(8.9)	4.48 d(9)
	4.15 d(9.8)	4.01 ABd(10.2)	4.07 d(8.9)	4.18 d(9)
OAc		1.96 s	2.09 s, 1.90 s	2.07 s
OMe		3.17 s		3.21 s
$O\underline{CH_2}CH_3$			3.44 (ov)	
$OCH_2\underline{CH_3}$			1.15 (ov)	

Table 10-12-40: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-115**~**10-12-119**.

H	10-12-115	10-12-116	10-12-117	10-12-118	10-12-119
1	1.28 m	4.16 br s	3.73 br s	4.18 m	–
2	1.29 m	2.17 (ov)	1.76 (ov), 1.74 (ov)	*α* 2.82 m, *β* 1.86 m	–
3	1.29 m, 1.78 d(12.8)	1.63 (ov), 2.65 (ov)	1.20 (ov), 2.28 m	*α* 1.42 m, *β* 1.31 m	–
5	1.46 dd(4.3, 2.2)	2.73 br s	2.24 d(6.0)	1.53 d(5.6)	1.68 d(6.5)
6	4.11 d(4.3)	6.23 br s	5.83 d(6.0)	4.26 dd(5.6, 10.0)	5.76 d(6.5)
9	2.63 br d(4.0)	3.81 m	3.26 d(9.6, 4.4)	2.04 d(11.2)	–
11	3.17 t(4.3)	2.50 (ov), 2.10 (ov)	2.10 m, 1.67 (ov)	4.88 m	–
12	3.25 t(4.3)	3.00 (ov), 2.13 (ov)	1.97 m, 1.59 m	*α* 2.81 m, *β* 2.42 m	–

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Table 10-12-40 (continued)

H	10-12-115	10-12-116	10-12-117	10-12-118	10-12-119
13	3.22 t(4.3)	3.03 (ov)	1.78 (ov)	3.03 m	2.40 br d(9.0)
14	2.60 d(12.4)	2.50 (ov), 2.60 (ov)	2.51 dd(12.5, 9.0)	α 2.50 br d(12.4)	4.97 s
	2.12 dd(12.4, 4.5)		2.19 d(12.5)	β 3.51 dd(2.4, 12.4)	
15	5.17 br s	5.91 br s	5.97 s		5.27 s
17	5.22 br s	4.88 d(8.0)	2.94 d(5.0)	4.46 s	4.88 d(11.0)
	5.55 br s	4.57 d(8.0)	2.77 d(5.0)		4.67 d(11.0)
18	1.09 s	1.43 s	1.00 s	1.19 s	1.14 or 0.92 s
19	1.13 s	1.63 s	1.22 s	1.10 s	1.14 or 0.92 s
20	4.45 d(8.8)	4.59 br d(12.4)	4.13 br s	4.75 d(10.0)	4.16 d(9.2)
	4.12 dd(8.8, 2.2)	4.55 br d(12.4)		4.45 d(10.0)	3.96 d(9.2)
OAc		2.50 s(6-OAc)	2.03 s(6-OAc)		1.95 s, 2.18 s
		2.55 s(15-OAc)	2.16 s(15-OAc)		
OH				6.69 s(1-OH)	7.90 s, 8.31 s
				6.59 d(10.0, 6-OH)	

Table 10-12-41: Compounds, MFs, and test solvents of kaurane-type diterpenoids **10-12-120**~**10-12-138**.

No.	Compounds	MFs	Test solvents	References
10-12-120	laxiflorin J	$C_{20}H_{24}O_5$	C_5D_5N	[416]
10-12-121	laxiflorin K	$C_{20}H_{26}O_6$	C_5D_5N	[416]
10-12-122	laxiflorin L	$C_{20}H_{26}O_5$	C_5D_5N	[416]
10-12-123	laxiflorin M	$C_{22}H_{28}O_7$	C_5D_5N	[416]
10-12-124	coetsoidin A	$C_{22}H_{26}O_6$	C_5D_5N	[417]
10-12-125	maoecrystal P	$C_{20}H_{22}O_5$	C_5D_5N	[417]
10-12-126	eriocalyxin C	$C_{22}H_{28}O_7$	C_5D_5N	[418]
10-12-127	coetsoidin A	$C_{20}H_{28}O_5$	C_5D_5N	[399]
10-12-128	parvifoline B	$C_{20}H_{26}O_6$	C_5D_5N	[382]
10-12-129	pseudoirroratin A	$C_{20}H_{28}O_5$	C_5D_5N	[419]
10-12-130	rubescensin W	$C_{21}H_{30}O_6$	C_5D_5N	[420]
10-12-131	excisanin H	$C_{20}H_{28}O_5$	C_5D_5N	[389]
10-12-132	rabdoinflexin A	$C_{20}H_{28}O_6$	C_5D_5N	[383]
10-12-133	maoyecrystal I	$C_{20}H_{26}O_5$	C_5D_5N	[420]
10-12-134	xerophilusin A	$C_{22}H_{28}O_7$	CD_3COCD_3	[421]
10-12-135	xerophilusin B	$C_{20}H_{26}O_5$	C_5D_5N	[421]
10-12-136	baiyecrystal D	$C_{22}H_{30}O_7$	C_5D_5N	[422]
10-12-137	taibaijaponicain D	$C_{22}H_{28}O_{10}$	DMSO-d_6	[423]
10-12-138	xerophilusin E	$C_{22}H_{26}O_8$	–	[424]

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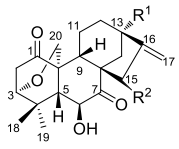
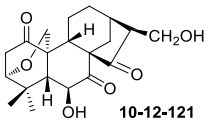
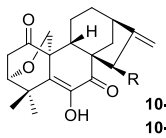


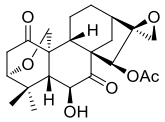
	R^1	R^2
10-12-120	H	=O
10-12-122	H	OH
10-12-123	OH	OAc



10-12-121



10-12-124 R = OAc
10-12-125 R = =O



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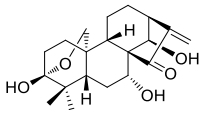

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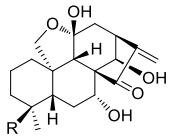
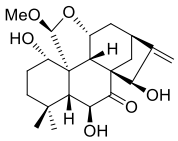


10-12-128 R = CHO
10-12-129 R = Me



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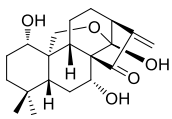

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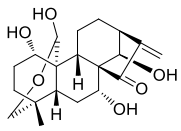

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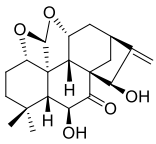

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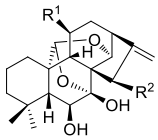
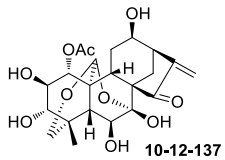


	R^1	R^2
10-12-134	OAc	=O
10-12-135	H	=O
10-12-136	OH	OAc



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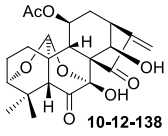

10-12-138

Table 10-12-42: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-120**~**10-12-123**.

H	10-12-120	10-12-121	10-12-122	10-12-123
2	2.79 d(9.2)	2.77 d(19.2)	2.76 d(19.0)	2.84 d(19.0)
	2.70 br d(9.2)	2.70 br d(19.2)	2.72 br d(19.0)	2.78 br d(19.0)
3	3.74 br s	3.75 br s	3.75 br s	3.78 br s
5	1.90 d(11.8)	1.90 (ov)	1.76 (ov)	1.93 (ov)
6	4.86 br d(11.8)	4.91 br d(12.1)	4.94 br d(11.7)	5.06 br d(11.8)
6-OH	6.70 br s		6.08 br s	
9	3.02 br d(8.1)	2.97 (ov)	3.57 d(8.1)	3.30 d(8.0)
11	*α* 1.54 m	*α* 1.58 m	*α* 1.50 (ov)	*α* 1.80 br d(14.4)
	β 1.75 m	*β* 1.76 m	*β* 2.42 m	*β* 2.26 m
12	1.42~1.47 m	*α* 1.42 m, *β* 1.90 (ov)	*α* 1.39 (ov), *β* 1.53 m	1.89 (ov)
13	2.88 br s	2.79 br s	2.68 br s	
14	*α* 2.10 d(11.9)	*α* 2.18 d(12.0)	*α* 1.79 (ov)	*α* 2.31 d(11.7)
	β 1.81 br d(11.9)	*β* 1.90 (ov)	*β* 1.46 (ov)	*β* 1.91 (ov)
15			5.41 br s	6.79 br s

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Table 10-12-42 (continued)

H	10-12-120	10-12-121	10-12-122	10-12-123
15-OH			7.36 br s	
16		2.95 m		
17	6.05 s	4.43 dd(4.6, 11.1)	5.52 s	5.60 s
	5.21 s	3.94 dd(9.1, 11.1)	5.11 s	5.45 s
18	1.14 s	1.14 s	1.11 s	1.67 s
19	1.68 s	1.70 s	1.70 s	1.71 s
20	4.13 d(9.6), 4.83 d(9.6)	4.11 d(9.4), 4.85 d(9.4)	4.20 d(9.7), 4.85 d(9.7)	4.27 d(9.6), 4.96 d(9.6)
OAc				2.04 s

Table 10-12-43: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-124**~**10-12-127**.

H	10-12-124	10-12-125	10-12-126	10-12-127
2	*α* 3.03 dd(3.2, 19.2)	*α* 2.93 dd(3.2, 19.6)	2.83 (ov)	–
	β 2.89 dd(3.2, 19.2)	*β* 2.85 dd(3.2, 19.6)		
3	3.86 br s	3.84 t(3.2)	3.77 dd(3.4, 1.8)	–
5			1.88 br d	–
6	11.00 s(OH)	11.25 s(OH)	5.02 d(11.8)	–
7				4.59 dd(4.0, 12.0)
9	3.72 d(7.6)	3.48 d(8.0)	3.30 d(7.8)	–
11	*α* 1.43~1.47 m(ov)	*α* 1.42~1.50 m(ov)	*α* 2.14 m	–
	β 2.19 m	*β* 1.71 m	*β* 1.67 dd(10.5, 5.3)	
12	*α* 1.28 m	1.42~1.50 m(ov)	*α* 1.54 m	–
	β 1.43~1.47 m(ov)		*β* 1.25 m	
13	2.66 br s	2.95 br s	1.87 m	3.18 m
14	*α* 1.80 d(12.0)	*α* 2.12 d(11.6)	*α* 1.95 m	4.71 br s
	β 1.54 dd(12.0, 4.8)	*β* 1.98 dd(11.6, 4.8)	*β* –	
15	6.83 t(2.0)		6.69 br s	
17	5.02 br s, 5.24 br s	6.09 br s, 5.23 br s	2.92 d(4.5), 2.83 (ov)	6.30 br s, 5.37 br s
18	1.80 s	1.78 s	1.23 s	1.33 s
19	1.96 s	1.29 s	1.71 s	1.21 s
20	4.36 d(8.8)	4.75 d(8.8)	4.86 d(9.4)	4.54 dd(9.0, 2.0)
	4.47 d(8.8)	4.33 d(8.8)	4.17 d(9.4)	3.94 dd(9.0, 2.0)
OAc	1.96 s		1.95 s	

Table 10-12-44: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-128**~**10-12-131**.

H	10-12-128	10-12-129	10-12-130	10-12-131
1	–	*α* 3.36 br d(13.5)	3.77 m	3.55 ddd(11.5, 4.4, 4.4)
		β 1.08 br d(14.8)	4.24 br s(OH)	
2	–	*α* 1.54 m	2.41 m	1.80 m
		β 1.38 br d(13.8)	1.69 m	1.72 m
3	–	*α* 1.12 dd(13.0, 4.3)	1.31 m	1.34 m
		β 1.25 br d(13.2)	1.14 m	1.27 m

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Table 10-12-44 (continued)

H	10-12-128	10-12-129	10-12-130	10-12-131
5	–	1.48 dd(12.4, 1.7)	1.57 d(13.2)	1.03 dd(12.6, 2.1)
6	2.18 q(12.4)	*α* 1.94 q(12.4) *β* 2.17 br d(15.7)	4.79 dd(13.2, 5.0) 5.72 d(5.0, OH)	2.57 ddd(12.6, 12.6, 12.6) 2.31 ddd(12.6, 5.6, 2.1)
7	4.97 dd(12.1, 3.3)	4.83 dd(12.1, 3.2)		4.74 ddd(12.6, 5.6, 5.6)
9	2.20 br s	2.29 s	3.50 d(4.0)	1.84 m
11			5.18 dd(4.0, 7.0)	3.16 dd(13.5, 11.9) 1.63 m
12	–	*α* 3.25 dd(13.7, 9.1) *β* 2.20 d(13.7)	1.79 m, 2.31 m	1.67 m, 2.80 m
13	3.46 br d(9.5)	3.30 br d(9.2)	2.63 m	3.35 br s
14	5.42 br s	5.44 br s	2.45 d(11.0) 1.39 dd(6.0, 11.0)	
15			5.56 s, 7.63 s(OH)	
17	6.25 br s, 5.42 br s	6.23 s, 5.41 s	5.53 s, 5.21 s	6.18 s, 5.23 s
18	9.39 s	0.83 or 0.64 s	1.26 s	0.84 s
19	0.94 s	0.83 or 0.64 s	1.21 s	0.95 s
20	4.13 dd(8.7, 1.9) 4.19 d(8.7)	4.17 ABd(8.6) 4.05 ABd(8.0)	5.53 s	4.70 d(11.8), 5.22 d(11.8)
OMe			3.40 s	

Table 10-12-45: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-132**~**10-12-134**.

H	10-12-132	10-12-133	10-12-134
1	3.72 m, 6.89 br s(OH)	4.36 t(4.4)	*α* 1.74 m, *β* 1.43 m
2	*α* 2.11 m, *β* 2.95 m	1.60 m, 1.40 m	1.57 m
3	*α* 1.69 m, *β* 1.42 dt(13.7, 13.7, 6.3)	1.24 m, 2.21 m	*α* 1.44 m, *β* 1.24 m
5	1.18 br d(12.2)	1.69 d(13.2)	1.34 d(1.6)
6	2.11 m	4.41 d(13.2), 5.70 br s(OH)	3.71 d(1.6)
7	4.63 dd(11.7, 4.9), 7.32 br s(OH)		
9	1.97 d(7.8)	3.17 d(4.8)	2.42 s
11	*α* 3.43 br d(15), *β* 1.69 m	4.94 dd(4.8, 7.2)	5.06 d(5.7)
12	1.69 m, 2.85 m	2.02 m, 2.50 m	*α* 2.46 ddd(13.5, 5.7, 3.8) *β* 1.73 m
13	3.27 s	2.71 m	3.21 m
14	5.16 s, 4.88 br s(OH)	2.19 d(11.2), 1.31 dd(6.2, 11.2)	4.53 d(6.0)
15		5.60 s, 7.70 s(OH)	
17	5.34 s, 6.25 s	5.54 s, 5.21 s	5.95 s, 5.47 s
18	0.63 s	1.18 s	0.94 s
19	3.77 AB(11.7, 2.4), 3.64 AB(11.7)	1.46 s	0.84 s
20	5.94 br d(4.9), 7.80 br d(7.8, OH)	6.25 s	5.13 s
OAc			1.79 s

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Table 10-12-46: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-135**~**10-12-138**.

H	10-12-135	10-12-136	10-12-137	10-12-138
1	*α* 1.68 d(13.3) *β* 1.02 m	*α* 1.69 br d(13.0) *β* 1.10 m	4.52 d(10.8)	*α* 1.92 (ov) *β* 1.68 m
2	1.38 m	1.44 m	4.43 dd(10.8, 9.9)	*α* 1.70 m, *β* 1.32 m
3	*α* 1.34 d(12.4) *β* 1.11 dd(3.8, 12.4)	*α* 1.39 m *β* 1.00 m	4.01 d(9.9)	3.50 t(2.2)
5	1.52 d(1.5)	1.43 s	2.01 d(2.4)	2.12 s
6	4.21 d(1.5)	4.62 d(1.8)	4.19 d(2.4)	
9	2.75 d(7.0)	2.83 br s	2.24 m	1.91 d(9.0)
11	*α* 1.61 dd(12.7, 6.4) *β* 1.51 (ov)	4.34 d(4.8)	*α* 1.90 m *β* 1.35 m	5.10 m
12	*α* 2.24 m *β* 1.37 m	*α* 2.59 dt(13.7, 4.8) *β* 2.03 br d(13.7)	3.59 ddd(3.2, 3.3, 9.2)	*α* 3.05 (ov) *β* 1.30 dd(9.0, 13.7)
13	3.10 m	2.90 m	2.96 d(9.2)	3.06 d(9.2)
14	4.95 d(6.2)	5.28 d(5.8)	*α* 1.89 (ov), *β* 1.32 (ov)	4.85 s
15		5.57 s		
17	6.17 s, 5.27 s	5.57 s, 5.30 s	5.98 br s, 5.58 br s	5.93 s, 5.49 s
18	1.05 s	0.84 s	1.07 s	1.09 s
19	0.91 s	0.93 s	3.96 d(9.8), 4.16 d(9.8)	1.08 s
20	5.48 s	5.41 s	5.66 s	5.78 br s
OAc		2.24 s	1.97 s	1.95 s
OH			4.61 br s, 6.81 br s	

Table 10-12-47: Compounds, MFs, and test solvents of kaurane-type diterpenoids **10-12-139**~**10-12-159**.

No.	Compounds	MFs	Test solvents	References
10-12-139	laxiflorin A	$C_{20}H_{26}O_5$	C_5D_5N	[425]
10-12-140	laxiflorin B	$C_{20}H_{24}O_5$	C_5D_5N	[425]
10-12-141	laxiflorin C	$C_{20}H_{26}O_5$	C_5D_5N	[425]
10-12-142	laxiflorin E	$C_{20}H_{26}O_5$	C_5D_5N	[408]
10-12-143	*epi*-eriocalyxin A	$C_{20}H_{24}O_5$	C_5D_5N	[426]
10-12-144	maoecrystal N	$C_{20}H_{24}O_6$	$CDCl_3$	[426]
10-12-145	acetylexidonin	$C_{26}H_{34}O_9$	C_5D_5N	[427]
10-12-146	longirabdolide E	$C_{20}H_{28}O_5$	C_5D_5N	[428]
10-12-147	longirabdolide F	$C_{22}H_{30}O_6$	C_5D_5N	[428]
10-12-148	maoecrystal O	$C_{22}H_{30}O_7$	C_5D_5N	[426]
10-12-149	rabdosichuanin A	$C_{22}H_{30}O_7$	C_5D_5N	[429]
10-12-150	rabdosichuanin B	$C_{20}H_{28}O_5$	C_5D_5N	[429]
10-12-151	loxothyrin A	$C_{24}H_{30}O_9$	C_5D_5N	[430]
10-12-152	isolongirabdiol	$C_{20}H_{28}O_5$	C_5D_5N	[431]
10-12-153	guidongnin B	$C_{20}H_{26}O_5$	C_5D_5N	[432]
10-12-154	guidongnin D	$C_{20}H_{26}O_7$	C_5D_5N	[432]
10-12-155	guidongnin E	$C_{20}H_{28}O_5$	C_5D_5N	[432]
10-12-156	guidongnin G	$C_{20}H_{28}O_6$	C_5D_5N	[432]
10-12-157	ludongnin F	$C_{21}H_{30}O_5$	C_5D_5N	[433]
10-12-158	ludongnin J	$C_{21}H_{28}O_5$	C_5D_5N	[433]
10-12-159	sculponeatin C	$C_{20}H_{24}O_6$	C_5D_5N	[434]

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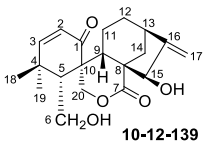
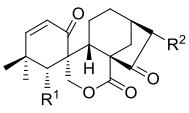
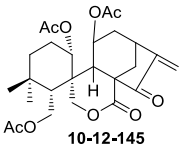


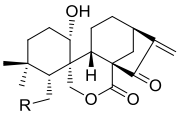
10-12-139



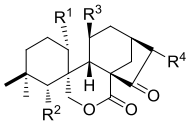
	R^1	R^2
10-12-140	CH_2OH	$=CH_2$
10-12-141	CH_2OH	Me
10-12-142	CH_2OH	α-Me
10-12-143	CHO	β-Me
10-12-144	COOH	α-Me



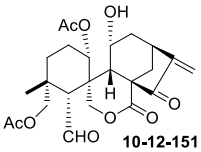
10-12-145



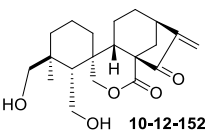
10-12-146 R = OH
10-12-147 R = OAc



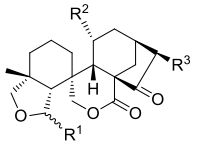
	R^1	R^2	R^3	R^4
10-12-148	α-OAc	COOH	H	α-Me
10-12-149	α-OAc	CHO	β-OH	β-Me
10-12-150	H	CHO	α-OH	β-Me



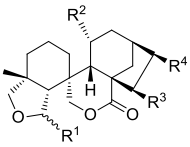
10-12-151



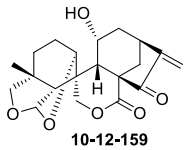
10-12-152



	R^1	R^2	R^3
10-12-153	=O	H	Me
10-12-154	=O	OH	CH_2OH
10-12-155	α-OH	H	Me



	R^1	R^2	R^3	R^4
10-12-156	β-OH	OH	OH	$=CH_2$
10-12-157	α-OMe	H	=O	Me
10-12-158	α-OMe	H	=O	$=CH_2$



10-12-159

Table 10-12-48: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-139**~**10-12-142**.

H	10-12-139	10-12-140	10-12-141	10-12-142
2	5.89 d(10.5)	5.88 d(10.0)	5.87 d(10.0)	5.90 d(10.2)
3	6.45 d(10.5)	6.44 d(10.0)	6.44 d(10.0)	6.48 d(10.2)
5	2.34 dd(3.5, 3.5)	2.18 dd(4.0, 4.0)	2.21 dd(4.5, 4.5)	2.25 br s
6	4.25 dd(11.5, 3.5) 4.04 dd(11.5, 3.5)	3.99 dd(12.5, 4.0) 3.94 dd(12.5, 4.0)	3.98 dd(12.0, 4.5) 3.96 dd(12.0, 4.5)	4.29 br s
9	3.35 dd(12.5, 4.5)	2.97 dd(13.0, 4.5)	2.79 dd(13.0, 5.0)	2.91 dd(4.4, 13.0)
11α	1.61 dddd(13.5, 12.5, 11.0, 7.6)	1.77 dddd(14.0, 13.0, 11.2, 7.0)	1.59 m	1.80 m
11β	1.56 ddd(13.5, 6.9, 4.5)	1.61 ddd(14.0, 6.6, 4.5)	1.43 m	1.64 m
12α	1.44 ddd(13.0, 7.6, 6.5)	1.33 ddd(13.5, 7.0, 4.5)	1.64 m	2.02 m
12β	1.98 ddd(13.0, 11.0, 6.9)	2.02 ddd(13.5, 11.2, 6.6)	1.56 m	1.29 m
13	2.66 dd(6.5, 6.5)	2.66 dd(12.0, 4.5)	2.36 m	1.99 br s
14	α 2.54 d(12.0) β 2.38 dd(12.0, 6.5)	α 2.92 d(13.0) β 2.66 dd(13.0, 4.5)	α 2.97 d(12.0) β 2.63 dd(12.0, 4.5)	2.81 m
15	4.96 s			
16			2.46 qd(7.0, 7.0)	2.08 br d(7.6)

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Table 10-12-48 (continued)

H	10-12-139	10-12-140	10-12-141	10-12-142
17	5.41 s, 5.16 s	5.86 s, 5.27 s	1.00 d(7.0)	1.06 d(7.6)
18	1.22 s	1.11 s	1.09 s	1.17 s
19	1.16 s	1.07 s	1.09 s	1.22 s
20	4.65 d(11.0), 5.38 d(11.0)	4.83 d(11.5), 5.28 d(11.5)	4.77 d(11.7), 5.25 d(11.5)	4.82 d(11.1), 5.27 d(11.1)

Table 10-12-49: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-143**~**10-12-146**.

H	10-12-143	10-12-144	10-12-145	10-12-146
1			4.63 dd(10.8, 3.8)	3.98 dd(12.2, 4.0)
2	5.94 d(10.0)	5.80 d(10.2)	–	–
3	6.5 d(10.0)	6.56 d(10.2)	*α* 1.58 dt(14.3, 3.3) *β* 1.42 br td(13.8, 4.3)	–
5	–	–	–	1.69 d(6.6)
6	10.06 d(3.6)		4.14 dd(12.8, 6.0) 4.43 dd(12.8, 3.5)	3.87 d(3.4)
9	–	–	3.03 d(11.6)	3.21 dd(12.8, 4.2)
11	–	–	4.97 ddd(11.6, 9.3, 7.5)	–
12	–	–	*α* 2.83 ddd(13.6, 9.2, 7.5) *β* 1.26 dd(13.6, 9.3)	–
13	–	–	3.14 dd(9.2, 4.5)	–
14	–	–	*α* 2.05 dd(13.0, 4.5) *β* 2.05 m	–
17	1.00 d(7.2)	1.09 d(7.6)	5.64 br s, 6.16 br s	5.33 br s, 5.99 br s
18	1.27 s	1.29 s	1.00 s	0.81 s
19	1.16 s	1.27 s	1.07 s	1.06 s
20	4.97 d(11.2) 5.32 d(11.2)	4.67 d(11.5) 5.11 d(11.5)	4.48 d(12.3), 4.89 d(12.3)	4.86 d(12.0), 5.15 d(12.0)
OAc			2.02 s, 2.04 s, 2.06 s	
OH				6.31 br s, 6.81 d(4.8)

Table 10-12-50: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-147**~**10-12-150**.

H	10-12-147	10-12-148	10-12-149	10-12-150
1	3.89 dd(12.2, 4.0)	5.13 d(3.3, 11.5)	5.45 dd(11.6, 4.0)	–
2	–	–	1.95 m, 1.36 br s	–
3	–	–	1.40 m	–
5	–	–	4.31 d(4.0)	2.93 d(4.0)
6	4.25 dd(12.7, 5.9) 4.32 dd(12.7, 2.5)		10.02 d(4.0)	10.08 d(4.0)
9	–	–	2.80 d(11.2)	–
11	–	–	4.35 ddd(11.2, 9.2, 8.4)	4.6 m

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Table 10-12-50 (continued)

H	10-12-147	10-12-148	10-12-149	10-12-150
12	–	–	1.45 m, 2.55 ddd(12.0, 9.6, 8.4)	–
13	–	–	2.00 dd(9.6, 1.2)	3.35 m
14	–	–	*α* 2.10 dd(12.0, 1.2) *β* 2.65 dd(12.0, 4.0)	–
16		–	2.40 qd(8.0, 2.4)	(ov)
17	5.31 br s, 5.98 br s	0.98 d(7.0)	1.09 d(8.0)	1.15 d(8.0)
18	0.77 s	1.24 s	1.02 s	1.01 s
19	0.89 s	1.08 s	0.99 s	0.97 s
20	4.64 d(12.2) 5.10 d(12.2)	5.39 d(12.7) 5.46 d(12.7)	5.16 d(12.0), 5.31 d(12.0)	5.1 m
OAc	1.99 or 2.01 s	2.18 s	2.16 s	

Table 10-12-51: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-151**~**10-12-155**.

H	10-12-151	10-12-152	10-12-153	10-12-154	10-12-155
1	5.78 dd(9.0, 9.0) 2.11 s(OAc)	1.29~1.38	1.20~1.50 (ov)	*α* 2.36 br d(11.0) *β* 1.14~1.19 m	*α* 1.88~1.92 m *β* 1.56 (ov)
2	2.00~2.10 m	1.29~1.38 m, 1.48 m	1.20~1.50 (ov)	1.36~1.42 (ov)	1.20~1.64 (ov)
3	*α* 1.60 m *β* 1.34 m	1.29~1.38 1.88 dt(13.5, 4)	1.20~1.50 (ov)	1.20~1.38 (ov)	*α* 1.84 (ov) *β* 1.36 (ov)
5	2.93 br s	2.41 t(4)	2.44 (ov)	2.80 (ov)	2.15 d(4.8)
6	10.90 s	4.01 m			6.07 d(4.8)
9	2.63 br s	3.16 dd(12.5, 5)	2.34 (ov)	2.26 br s	2.10
11	4.64 m	1.60 m 1.78 m	1.20~1.50 (ov)	4.50 br s 6.87 s(OH)	1.20~1.64 (ov)
12	*α* 2.37 dd(13.5, 9.5) *β* 1.66 m	1.29~1.38 m 2.04 m	*α* 1.65~1.72 m *β* 1.30~1.34 m	*α* 2.19 (ov) *β* 2.57 dd(4.0, 15.5)	1.20~1.64 (ov)
13	3.07 dd(9.0, 4.5)	2.91 br dd(9, 5)	2.38 (ov)	2.97~3.00 m	2.48 (ov)
14	*α* 3.37 d(11.5) *β* 2.54 dd(11.5, 4.5)	2.22 d(12.5) 2.57 dd(12.5, 4.5)	*α* 3.35~3.39 m *β* 2.16~2.20 m	*α* 3.78 br d(11.5) *β* 2.20 (ov)	*α* 2.44 (ov) *β* 2.00 (ov)
16			2.45 (ov)	3.00~3.04 m	2.46 (ov)
17	5.97 s 5.36 s	5.31 br s 5.95 br s	1.06 d(7.0)	4.25 dd(3.5, 11.0) 4.19 dd(7.5, 11.0)	1.08 d(6.8)
18	1.02 s	3.39 d(11), 3.48 d(11)	1.04 s	1.09 s	1.13 s
19	4.51 d(11.5) 4.16 d(11.5) 1.87 s(OAc)	0.97 s	3.87 ABd(8.8) 3.62 ABd(8.8)	3.54 ABd(8.5) 3.44 ABd(8.5)	3.82 ABd(8.0) 3.51 ABd(8.0)
20	5.45 d(11.5) 5.34 d(11.5)	4.87 d(11.5) 4.94 d(11.5)	4.87 ABd(10.8) 4.37 ABd(10.8)	5.45 ABd(10.0) 5.27 ABd(10.0)	4.37 ABd(10.8) 4.20 ABd(10.8)
OH		6.34 br			

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Table 10-12-52: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-156**~**10-12-159**.

H	10-12-156	10-12-157	10-12-158	10-12-159
1	*α* 0.94~0.96 (ov)	*α* 1.48 m	*α* 1.51 m	4.64 ddd(1, 3, 3)
	β 2.40 (ov)	*β* 1.21 m	*β* 1.22 m	
2	*α* 1.46~1.50 m	*α* 1.41 m	*α* 1.39 m	–
	β 0.94~0.96 (ov)	*β* 1.27 m	*β* 1.27 m	
3	*α* 1.58~1.62 m	*α* 1.83 m	*α* 1.82 m	–
	β 1.22~1.25 m	*β* 1.25 m	*β* 1.31 m	
5	2.64 d(6.0)	2.05 d(4.7)	2.06 d(4.8)	2.75 dd(1, 4)
6	5.77 d(6.0)	5.17 d(4.7)	5.19 d(4.8)	5.87 d(4)
6-OMe		3.24 s	3.24 s	
9	2.48 s	1.98 m	2.23 m	2.60 m
11	4.44 br s	*α* 1.46 m	*α* 1.59 m	4.44 dd(5, 5)①
	6.39 br s(OH)	*β* 1.19 m	*β* 1.43 m	7.14 br d(OH)
12	*α* 2.36 (ov)	*α* 1.70 m	*α* 2.18 m	*α* 1.81 dd(5, 15)
	β 1.80 dd(5.0, 14.0)	*β* 1.34 m	*β* 1.36 m	*β* 2.47 dd(9, 15)
13	2.80~2.82 (ov)	2.35 m	2.93 m	3.16 dd(4, 9)
14	*α* 3.24 br d(11.0)	*α* 2.45 d(12.0)	*α* 2.47 d(12.0)	*α* 2.10 dd(4, 11)
	β 1.76 dd(5.0, 11.0)	*β* 1.89 m	*β* 1.98 dd(4.0, 12.0)	*β* 3.61 d(11)
15	5.56 t(2.0)			
	6.22 d(5.0, OH)			
16		2.42 m		
17	5.50 s, 5.17 s	1.06 d(6.5)	6.07 s, 5.41 s	5.42 br s, 6.10 br s
18	1.37 s	1.05 s	1.04 s	1.11 s
19	3.54 ABd(7.5), 4.11	3.54 d(8.0),	3.56 d(10.0),	3.70 d(8), 3.89 d(8)
	ABd(7.5)	3.66 d(8.0)	3.68 d(10.0)	
20	5.22 ABd(10.5)	4.19 d(11.0)	4.25 d(8.5)	4.36 dd(2, 12)
	4.07 ABd(10.5)	4.17 d(11.0)	4.22 d(8.5)	5.33 d(12)

① The peaktype after the addition of D_2O.

Table 10-12-53: Compounds, MFs, and test solvents of kaurane-type diterpenoids **10-12-160**~**10-12-171**.

No.	Compounds	MFs	Test solvents	References
10-12-160	sculponeatin H	$C_{20}H_{24}O_6$	C_5D_5N	[435]
10-12-161	sculponeatin I	$C_{20}H_{24}O_6$	C_5D_5N	[435]
10-12-162	ludongnin D	$C_{20}H_{26}O_5$	C_5D_5N	[436]
10-12-163	ludongnin E	$C_{20}H_{26}O_6$	C_5D_5N	[436]
10-12-164	longirabdolide C	$C_{20}H_{26}O_7$	C_5D_5N	[437]
10-12-165	taibaijaponicain A	$C_{21}H_{30}O_7$	CD_3COCD_3	[438]
10-12-166	taibaijaponicain B	$C_{23}H_{32}O_9$	CD_3COCD_3	[438]
10-12-167	longirabdolide D	$C_{24}H_{32}O_8$	C_5D_5N	[439]
10-12-168	sculponeatin F	$C_{20}H_{28}O_6$	C_5D_5N	[435]
10-12-169	glaucocalactone	$C_{22}H_{26}O_7$	DMSO-d_6	[440]
10-12-170	enanderinanin F	$C_{22}H_{26}O_7$	C_5D_5N	[409]
10-12-171	irroratin A	$C_{21}H_{30}O_6$	C_5D_5N	[441]

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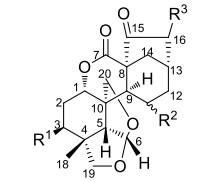
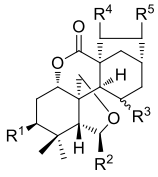
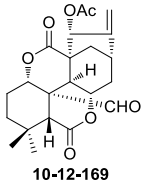


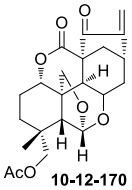
	R^1	R^2	R^3
10-12-160	H	α-OH	$=CH_2$
10-12-161	OH	H	$=CH_2$
10-12-162	H	H	β-Me
10-12-163	H	β-OH	α-Me



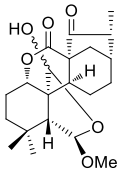
	R^1	R^2	R^3	R^4	R^5
10-12-164	OH	OH	β-OH	=O	$=CH_2$
10-12-165	H	OH	α-OH	=O	α-CH_2OMe
10-12-166	OAc	OH	α-OH	=O	α-CH_2OMe
10-12-167	H	OAc	β-OH	α-OAc	$=CH_2$
10-12-168	H	OH	α-OH	α-OH	$=CH_2$



10-12-169



10-12-170



10-12-171

Table 10-12-54: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-160**~**10-12-163**.

H	10-12-160	10-12-161	10-12-162	10-12-163
1	4.92 dd(5.2, 11.5)	5.41 dd(5.2, 11.8)	4.62 dd(5.3, 11.4)	5.51 dd(5.5, 12.0)
2	α 1.98 (ov), β 1.91 m	α 2.31 m, β 2.36 m	1.77~1.88 (ov)	1.74~1.96 (ov)
3	α 1.68 (ov), β 1.54 m	4.04 br s, 7.06 d(3.9, OH)	1.39 (ov), 1.60 (ov)	1.58~1.68 (ov)
5	4.08 (ov)	2.66 d(5.3)	2.39 d(5.0)	2.96 d(5.0)
6	6.22 d(5.3)	6.15 d(5.3)	6.02 d(5.0)	6.11 d(5.0)
9	2.41 d(10.2)	2.19 dd(5.4, 13.4)	2.11 (ov)	2.01 d(4.0)
11	4.40 m, 6.73 br s(OH)	α 1.66 m, β 1.73 m	1.68 (ov), 1.32 (ov)	4.43 t(4.0)
12	α 1.68 (ov)	α 1.28 m	α 2.10 (ov)	α 1.74 dd(4.0, 15.5)
	β 3.01 (ov)	β 2.08 m	β 2.00 (ov)	β 2.05 (ov)
13	3.04 m	2.86 m	2.16 (ov)	2.59 m
14	α 1.98 (ov)	α 1.96 dd(4.5, 11.9)	α 1.82 (ov)	α 2.09 (ov)
	β 2.70 d(11.9)	β 2.43 d(11.9)	β 2.52 d(11.8)	β 3.75 d(11.0)
16			2.50 (ov)	2.52 m
17	5.92 s, 5.30 s	6.01 s, 5.34 s	1.07 d(6.9)	1.03 d(7.0)
18	1.07 s	1.39 s	1.04 s	1.07 s
19	4.01 d(8.7)	4.01 d(8.7)	3.96 d(8.7)	4.01 d(8.5)
	3.45 d(8.7)	3.62 d(8.7)	3.42 d(8.7)	3.45 d(8.5)
20	4.33 d(9.5)	4.31 d(9.6)	4.21 d(9.0)	4.26 d(10.0)
	4.10 (ov)	4.18 d(9.6)	4.04 d(9.0)	4.11 d(10.0)

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Table 10-12-55: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-164**~**10-12-167**.

H	10-12-164	10-12-165	10-12-166	10-12-167
1	6.20 dd(6.6, 12.5)	4.77 dd(11.2, 3.9)	4.85 dd(10.8, 3.6)	5.96 dd(8.8, 8.8)
2	2.31 m	*α* 1.82 m, *β* 1.78 m	*α* 2.12 m, *β* 2.34 m	–
3	3.82 m, 6.77 d(5.6, OH)	*α* 1.48 m, *β* 1.38 m	4.79 dd(3.5, 3.6)	–
5	2.91 s	2.75 s	2.73 s	2.75 s
6	5.95 d(2.2)① 8.46 d(2.2, OH)	5.27 s	5.26 s	6.52 s
9	3.11 d(3.7)	2.14 br d(10.6)	2.13 br d(10.4)	3.01 d(4.0)
11	5.11 m② 6.16 d(3.4, OH)	4.30 ddd(10.6, 8.8, 3.4)	4.31 ddd(10.4, 8.3, 3.1)	4.66 dd(9.6, 4.2)
12	*α* 1.87 dd(15.0, 5.3) *β* 2.51 dd(15.0, 9.2)	*α* 2.40 m *β* 1.45 (ov)	*α* 2.41 m *β* 1.44 (ov)	*α* 1.95 dd(14.4, 6.0) *β* 2.53 m③
13	3.10 m	2.79 m	2.80 m	2.94 dd(8.4, 5.2)
14	*α* 2.18 dd(12.0, 5.3) *β* 3.65 d(12.0)	*α* 1.81 (ov) *β* 1.48 (ov)	*α* 1.82 m *β* 1.50 m	*α* 1.84 m *β* 3.22 d(11.6)③
15				6.81 t(2.8)
16		1.45 m	1.47 m	
17	5.31 br s 5.98 br s	3.64 ABdd(10.4, 4.5) 3.56 ABdd(10.4, 4.5)	3.65 ABdd(10.2, 4.3) 3.54 ABdd(10.2, 4.3)	5.20 br s
18	1.31 s	1.00 s	1.01 s	1.03 s
19	1.08 s	0.97 s	0.98 s	1.06 s
20	4.44 d(9.2), 4.66 d(9.2)	3.92 d(9.2), 3.73 d(9.2)	3.93 d(9.1), 3.71 d(9.1)	4.19 d(8.8), 4.23 d(8.8)
OAc			2.07 s	1.88 s, 2.06 s
OMe		3.30 s	3.32 s	
OH				6.70 d(3.2)

① The peaktype was changed into s after the addition of D_2O.
② The peaktype was changed into dd(5.3, 3.7) after the addition of D_2O.
③ The assignment in the literature was uncorrect, assigning both 2.53 m and 3.22 d(11.6) to 14*β*.

Table 10-12-56: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-168**~**10-12-171**.

H	10-12-168	10-12-169	10-12-170	10-12-171(20*S*)	10-12-171(20*R*)
1	5.51 dd(5.9, 11.7)	4.84 dd(11.9, 4.2)	5.35 dd(6.0, 10.6)	4.56 dd(5.5, 11.5)	4.58 t(8.5)
2	*α* 2.24 t(11.7) *β* 2.36 (ov)	2.34 dtd (13.0, 11.9, 5.2) 2.05 dd(13.0, 4.2)	*α* 2.33 m *β* 1.80 m	2.93 m 1.77 m	1.79 m
3	3.81 m 6.78 d(4.2, OH)	1.54 m 1.62 m	1.72 m	*α* 1.22 m *β* 1.46 dt(4.5, 12.5)	*α* 1.15 m *β* 1.30 dt(4.0, 12.5)
5	2.85 s	2.86 s	2.14 d(2.2)	1.99 br s	2.07 br s

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Table 10-12-56 (continued)

H	10-12-168	10-12-169	10-12-170	10-12-171(20*S*)	10-12-171(20*R*)
6	5.57 d(5.9) 8.1 br s(OH)		5.84 br s	4.68 br s	5.13 br s
9	3.71 dd(5.5, 12.9)	2.43 d(11.3)	3.25 s	2.09 dd(5.0, 12.5)	2.92 dd(6.0, 12.5)
11	2.32 (ov)	5.00 dt(11.3, 8.7)	4.88 d(3.5)	*α* 1.79 m	*α* 1.77 m
	β 1.84~1.89 m			*β* 1.38 m	*β* 1.36 m
12	*α* 1.62 (ov)	2.71 ddd(13.0, 8.7, 8.3)	*α* 1.64 m	*α* 1.68 m	*α* 1.74 m
	β 2.04 (ov)	1.48 dd(13.0, 8.7)	*β* 2.22 d (15.0, 8.4)	*β* 1.36 m	*β* 1.33 m
13	2.59~2.63 m	3.0 dd(8.3, 5.2)	3.03 m	2.38 m	2.27 m
14	*α* 1.66 dd(4.7, 11.5)	1.69 dd(12.5, 5.2)	*α* 2.70 dd(5.0, 11.8)	*α* 2.55 d(12.5)	*α* 2.51 d(11.5)
	β 1.97 d(11.5)	2.23 d(12.5)	*β* 3.22 d(11.8)	*β* 1.84 dd(3.0, 12.5)	*β* 1.93 dd(4.0, 11.5)
15	5.57 d(5.9) 7.9 d(5.9, OH)	5.92 t(2.5)			
16				2.29 m	2.35 m
17	5.09 s, 5.45 s	5.28 dd(2.5, 1.0) 5.01 br s	5.36 br s, 6.03 br s	0.98 d(6.5)	0.95 d(6.5)
18	1.34 s	0.93 s	1.06 s	1.00 s	0.92 s
19	1.05 s	1.10 s	4.87 ABd(12.0) 4.83 ABd(12.0)	1.42 s	0.90 s
20	4.79 ABd(8.3) 4.31 ABd(8.3)	10.00 s	5.13 ABd(12.5) 4.52 ABd(12.5)	6.12 s	6.07 d(4.5) 9.43 d(4.5, OH)
OAc		1.99 s	2.02 s		
OMe				3.21 s	3.18 s

Table 10-12-57: Compounds, MFs, and test solvents of kaurane-type diterpenoids **10-12-172**~**10-12-178**.

No.	Compounds	MFs	Test solvents	References
10-12-172	8,9-secokaurane	$C_{20}H_{28}O_3$	$CDCl_3$	[442]
10-12-173	*ent*-8,9-*seco*-7*α*-acetoxy-11*β*-hydroxykaura-8(14),16-dien-9,15-dione	$C_{22}H_{30}O_5$	$CDCl_3$	[442]
10-12-174	rabdohakusin	$C_{22}H_{32}O_4$	$CDCl_3$	[443]
10-12-175	16,17-dihydro-rabdoumbrosanin	$C_{20}H_{30}O_3$	$CDCl_3$	[444]
10-12-176	rubescensin S	$C_{20}H_{28}O_7$	C_5D_5N	[445]
10-12-177	rubescensin T	$C_{21}H_{30}O_7$	C_5D_5N	[445]
10-12-178	gesneroidin G	$C_{26}H_{36}O_{10}$	$CDCl_3$	[446]

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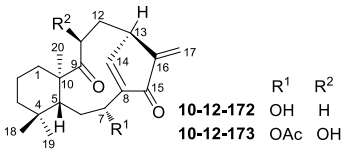
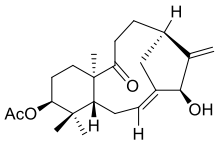
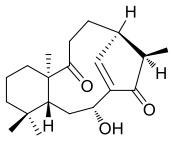


	R^1	R^2
10-12-172	OH	H
10-12-173	OAc	OH



10-12-174



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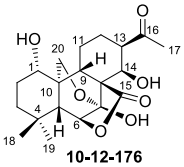
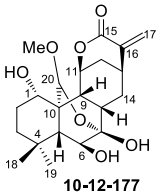
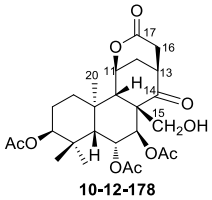


10-12-176



10-12-177



10-12-178

Table 10-12-58: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-172**~**10-12-174**.

H	10-12-172	10-12-173	10-12-174
1	ax 1.66 tm, eq 1.24 d	ax 2.55 td(12, 4), eq 1.2 d	*α* 1.07 ddd(13, 4, 2), *β* –
2	1.46 (ov)	1.3~1.5 (ov)	*α* –, *β* 1.69 ddd(14, 4, 2)
3	ax 1.2 t, eq 1.42 dm	1.2~1.4 (ov)	4.75
5	0.88 dd(6, 2)	1.9 (ov)	2.08 br t(4)
6	*R* 1.27 td(12, 2)	*R* 1.4 br t(12)	*α* 1.83 ddd(14, 13, 4)
	S 1.86 dt(14, 6)	*S* 1.9 ddd(12, 6, 4)	*β* –
7	4.68 dd(12, 5)	5.47 dd(12, 4)	5.43
11	*R* 1.75 d	*R* 4.40 ddd(5, 3, 1)	*α* 2.95 dd(18, 11)
	S 2.30 ddm(17, 12)		*β* 1.8-2.0 dd(18, 8)
12	*R* 2.58 td(12, 4)	*R* 2.99 ddd(15, 5, 1)	*α* 1.65 dd(14, 8)
	S 1.74 (ov)	*S* 2.07 ddd(15, 5, 3)	*β* 2.77 ddd(14, 11, 6)
13	3.59 br m	3.60 br m	2.84
14	7.24 br d(2)	7.13 br d(2)	*α* 2.16 d(15), *β* –
15			4.66
17	*E* 5.43 br s, *Z* 6.12 br s	*E* 5.35 br s, *Z* 5.95 br s	5.02 dd(2, 1.5), 5.30 t(2)
18	1.00 s	1.05 s	1.02 s
19	0.92 s	0.91 s	1.01 s
20	0.94 s	0.99 s	1.20 s
OAc		1.97 s	2.13 s
OH		1.39 d(3)	

Table 10-12-59: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-175**~**10-12-178**.

H	10-12-175①	10-12-176	10-12-177	10-12-178
1	–	3.70 dd(10.0, 5.5)	3.65 dd(9.0, 4.8)	*α* 1.60 (ov), *β* 1.50 (ov)
2	–	*α* 1.87 m, *β* 1.89 m	*α* 1.79 m, *β* 1.88 m	*α* 2.00 (ov), *β* 1.63 (ov)
3	–	*α* 1.36 dt(13.0, 3.0)	*α* 1.39 br d(13.0)	4.59 br d
		β 1.27 dt(13.0, 4.7)	*β* 1.26 dt(13.0, 2.5)	

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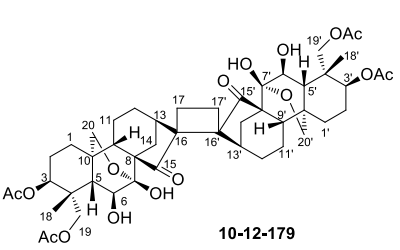
Table 10-12-59 (continued)

H	10-12-175[①]	10-12-176	10-12-177	10-12-178
5	–	1.59 s	1.57 s	1.73 d(2.2)
6	–	4.61 s	4.08 s	5.18 t(2.2)
7	4.58 dd(12, 5)			5.05 d(2.2)
8			3.27 m	
9		2.14 (ov)	2.80 d(10.5)	2.22 d(4.0)
11	2.02 br dd(18, 13)	*α* 2.17 (ov), *β* 2.31 m	5.82 s	4.87 d(4.0)
12	2.42 m	*α* 2.03 m	*α* 2.70 br d(13.5)	*α* 2.10 t(16.4)
		β 1.92 m	*β* 1.91 m	*β* –
13	3.20 br m	4.12 dt(10.5, 2.5)	2.94 m	2.92 m
14	7.34 br d(3)	5.26 d(10.5)	*α* 2.55 dt(13.5, 3.5)	
			β 2.19 m	
15				4.23 s
16	2.50 quint(7)			*α* 2.72 d(12.6)
				β 1.63 (ov)
17	1.14 d(7)	2.23 s	6.52 s, 5.45 s	
18	1.04 s	0.94 s	1.09 s	0.82 s
19	0.92 s	1.01 s	0.99 s	1.00 s
20	0.95 s	4.68 d(10.5), 4.68 d(10.5)	5.42 s	1.45 s
OMe			3.48 s	
OAc				2.05 s, 2.00 s, 1.98 s

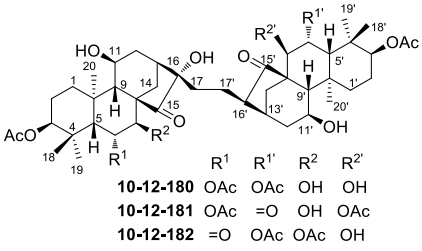
[①] The chemical shifts of 1.9~1.2 m in the literature were not assigned. These data might be the other data of this compound which were not listed in the literature.

Table 10-12-60: Compounds, MFs, and test solvents of kaurane-type diterpenoids **10-12-179**~**10-12-184**.

No.	Compounds	MFs	Test solvents	References
10-12-179	maoecrystal M	$C_{48}H_{64}O_{16}$	–	[447]
10-12-180	xindongnin M	$C_{48}H_{70}O_{15}$	C_5D_5N	[448]
10-12-181	xindongnin N	$C_{48}H_{68}O_{15}$	C_5D_5N	[448]
10-12-182	xindongnin O	$C_{48}H_{68}O_{15}$	C_5D_5N	[448]
10-12-183	lushanrubescensin J	$C_{40}H_{52}O_{12}$	C_5D_5N	[449]
10-12-184	taihangjaponicain A	$C_{40}H_{56}O_{13}$	C_5D_5N	[450]



10-12-179



	R^1	$R^{1'}$	R^2	$R^{2'}$
10-12-180	OAc	OAc	OH	OH
10-12-181	OAc	=O	OH	OAc
10-12-182	=O	OAc	OAc	OH

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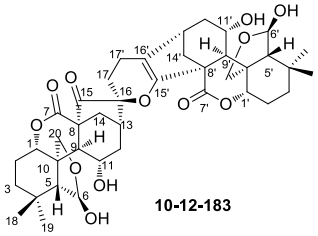
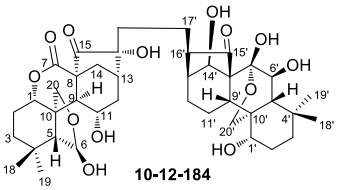


10-12-183



10-12-184

Table 10-12-61: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-179**~**10-12-181**.

H	10-12-179	10-12-180	10-12-181
1	1.75 (ov), 1.43 (ov)	1.44~1.67 (ov)	*α* 1.67 (ov), *β* 1.47 (ov)
2	1.77 (ov)	*α* 1.87~1.96 (ov)	1.54~1.64 (ov)
	1.05 br d(15.0)	*β* 1.44~1.67 (ov)	
3	5.36 br s	4.73 br s	4.73 br s
5	2.23 d(6.0)	2.60 s	2.60 s
6	4.36 dd(10.3, 6.0)	5.60 br s	5.59 br s
	6.94 d(10.3, OH)		
7		4.33 br s, 6.53 s(OH)	4.31 br s, 6.51 s(OH)
9	1.75 (ov)	2.62 s	2.60 s
11	1.39 (ov), 1.19 m	4.33 br s, 6.46 s(OH)	4.31 br s, 6.41 s(OH)
12	1.13 m, 1.60 m	2.54 (ov)	2.50~2.54 (ov)
13	2.83 dd(10.5, 4.0)	2.64 (ov)	2.60 m
14	2.11 d(15.0)	*α* 2.56 d(12.0)	*α* 2.44 (ov)
	3.02 dd(13.0, 4.0)	*β* 2.18 dd(4.0, 12.0)	*β* 2.16 (ov)
16		7.46 s(OH)	7.37 s(OH)
17	2.35 m, 1.92 m	3.17 m, 2.39 (ov)	3.05 m, 2.26 (ov)
18	1.43 s	1.02 s	1.00 s
19	4.62 d(11.6), 4.52 d(11.6)	1.01 s	1.00 s
20	4.00 d(10.8), 3.92 d(10.8)	1.39 s	1.37 s
1′	1.75 (ov), 1.43 (ov)	1.44~1.67 (ov)	*α* 1.92 m, *β* 2.26 (ov)
2′	1.77 (ov)	*α* 1.87~1.96 (ov)	1.54~1.64
	1.05 br d(15.0)	*β* 1.44~1.67 (ov)	
3′	5.36 br s	4.73 br s	4.65 br s
5′	2.23 d(6.0)	2.57 s	3.50 s
6′	4.36 dd(10.3, 6.0)	5.60 br s	
	6.94 d(10.3, OH)		
7′		3.93 br s, 6.47 s(OH)	5.31 br s
9′	1.75 (ov)	2.43 s	2.64 s
11′	1.39 (ov), 1.19 m	4.28 br s, 6.27 s(OH)	4.20 br s, 6.32 s(OH)
12′	1.13 m, 1.60 m	*α* 2.00 m, *β* 2.47 m	*α* 1.79 m, *β* 1.69 (ov)
13′	2.83 dd(10.5, 4.0)	2.54 m	2.44 (ov)
14′	2.13 d(13.0)	*α* 2.58 d(12.0)	*α* 2.12 m
	3.02 dd(13.0, 4.0)	*β* 1.24 dd(4.0, 12.0)	*β* 1.49 (ov)
16′		2.39 (ov)	2.30 m
17′	2.35 m, 1.92 m	2.97 m, 2.66 (ov)	2.89 m, 2.47 (ov)
18′	1.43 s	1.02 s	1.00 s
19′	4.62 d(11.6), 4.52 d(11.6)	1.01 s	1.30 s
20′	4.00 d(10.8), 3.92 d(10.8)	1.32 s	1.00 s
OAc	1.95 s, 2.15 s, 1.95 s, 2.15 s	2.10 s, 1.84 s, 2.10 s, 1.84 s	2.24 s, 2.03 s, 1.88 s, 1.83 s

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Table 10-12-62: ^{1}H NMR spectroscopic data of kaurane-type diterpenoids **10-12-182**~**10-12-184**.

H	10-12-182	10-12-183	10-12-184
1	*α* 1.61 m, *β* 1.44 m	4.55 dd(6.8, 10.4)	4.99 dd(10.4, 7.5)
2	1.52~1.58 (ov)	1.76 (ov)	1.90 m
3	4.66 br s	1.33 (ov), 1.24 (ov)	1.37 m
5	3.58 s	3.06 s	3.14 s
6		5.70 br s	5.74 s, 9.17 s(OH)
7	5.55 br s		
9	2.80 s	2.78 d(10.2)	2.89 d(10.4)
11	4.24 br s, 6.49 s(OH)	4.27~4.29 m	4.58 m, 7.44 s(OH)
12	*α* 2.38 (ov), *β* 1.99 (ov)	ax 2.88~2.91 m, eq 2.84 (ov)	*α* 1.77 m, *β* 2.93 m
13	2.56 m	2.25~2.28 m	2.76 m
14	*α* 2.37 (ov)	2.86 (ov)	*α* 2.73 m
	β 2.01 (ov)	1.62 (ov)	*β* 2.99 dd(12.0, 3.6)
16	7.48 s(OH)		8.16 s(OH)
17	2.94 m, 2.63 m	eq 2.26~2.29 m, ax 1.96 (ov)	1.72 m, 1.60 m
18	1.00 s	0.95 s	0.97 s
19	1.31 s	0.95 s	0.97 s
20	1.06 s	4.34 d(9.4), 4.23 d(9.4)	4.44 d(9.2), 4.33 d(9.2)
1′	1.67~1.81 (ov)	4.82 dd(6.5, 11.0)	3.60 m, 5.84 s(OH)
2′	1.52~1.58 (ov)	1.84 (ov)	1.84 m
3′	4.72 br s	1.33 (ov), 1.24 (ov)	1.37 m
5′	2.55 s	2.94 s	1.42 d(6.0)
6′	5.51 br s	5.65 d(6.4)	4.16 dd(10.8, 6.0)
			6.60 d(10.8, OH)
7′	3.92 br s, 6.46 s(OH)		8.54 s(OH)
9′	2.41 s	2.64 d(9.8)	1.77 m
11′	4.26 br s, 6.24 s(OH)	4.65~4.68 m	*α* 2.43 m, *β* 1.67 m
12′	*α* 2.07 m, *β* 1.23 m	1.90~1.94 m, 1.24 (ov)	*α* 2.30 m, *β* 1.88 m
13′	2.54 m	2.41~2.45 m	2.65 m
14′	*α* 2.59 d(12.0), *β* 2.35 (ov)	2.66~2.68 m, 1.63 (ov)	5.35 s, 7.77 s(OH)
16′	2.38 (ov)		3.34 m
17′	2.90 m, 2.50 m	1.96 (ov)	1.78 m, 1.70 m
18′	1.00 s	0.95 s	1.24 s
19′	1.01 s	0.95 s	1.11 s
20′	1.31 s	4.07 d(9.4), 4.07 d(9.4)	4.69 d(10.0), 4.37 d(10.0)
OAc	2.26 s, 2.10 s, 1.90 s, 1.85 s		

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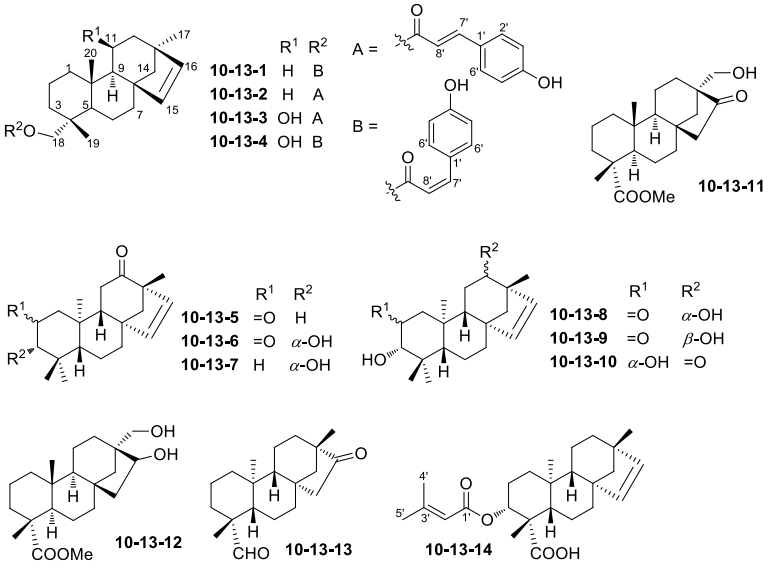
10.13 Beyerane-type diterpenoids

Table 10-13-1: Compounds, MFs, and test solvents of beyerane-type dterpenoids **10-13-1**~**10-13-21**.

No.	Compounds	MFs	Test solvents	References
10-13-1	obtsurin A	$C_{29}H_{38}O_3$	$CDCl_3$	[451]
10-13-2	obtsurin B	$C_{29}H_{38}O_3$	$CDCl_3$	[451]
10-13-3	obtsurin C	$C_{29}H_{38}O_4$	$CDCl_3$	[451]
10-13-4	obtsurin D	$C_{29}H_{38}O_4$	$CDCl_3$	[451]
10-13-5	*ent*-beyer-1,15-en-2,12-dione	$C_{20}H_{28}O_2$	$CDCl_3$	[452]
10-13-6	*ent*-3β-hydroxybeyer-15-ene-2,12-dione	$C_{20}H_{28}O_3$	$CDCl_3$	[452]
10-13-7	*ent*-3β-hydroxybeyer-15-ene-12-one	$C_{20}H_{30}O_2$	$CDCl_3$	[452]
10-13-8	*ent*-3β,12β-dihydroxybeyer-15-ene-2-one	$C_{20}H_{30}O_3$	$CDCl_3$	[452]
10-13-9	*ent*-3β,12α-dihydroxybeyer-15-ene-2-one	$C_{20}H_{30}O_3$	$CDCl_3$	[452]
10-13-10	*ent*-2α,3β-dihydroxybeyer-15-ene-12-one	$C_{20}H_{30}O_3$	$CDCl_3$	[452]
10-13-11	ceriopsin A	$C_{21}H_{32}O_4$	$CDCl_3$	[453]
10-13-12	ceriopsin B	$C_{21}H_{34}O_4$	C_5D_5N	[453]
10-13-13	ceriopsin G	$C_{20}H_{30}O_2$	$CDCl_3$	[454]
10-13-14	*ent*-3β-(3-methyl-2-butenoyl)oxy-15-beyeren-19-oic acid	$C_{25}H_{36}O_4$	$CDCl_3$	[455]
10-13-15	*ent*-2-hydroxybeyera-1,15-diene-3,12-dione	$C_{20}H_{26}O_3$	$CDCl_3$	[452]
10-13-16	2-acetoxy-1,15-beyeradiene-3,12-dione	$C_{22}H_{28}O_4$	$CDCl_3$	[456]
10-13-17	*ent*-3-oxa-beyer-15-en-2-one	$C_{19}H_{28}O_2$	$CDCl_3$	[457]
10-13-18	*ent*-2,17-dihydroxy-19-norbeyer-1,4,15-trien-3-one	$C_{19}H_{24}O_3$	$CDCl_3$	[457]
10-13-19	agallochin G	$C_{20}H_{30}O_2$	$CDCl_3$	[456]
10-13-20	agallochin H	$C_{20}H_{30}O_3$	$CDCl_3$	[456]
10-13-21	agallochin I	$C_{19}H_{28}O_3$	$CDCl_3$	[456]



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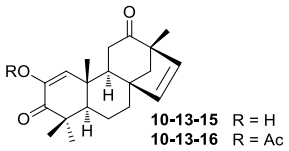

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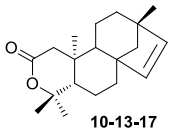
10-13-16 R = Ac



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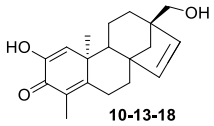

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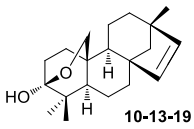

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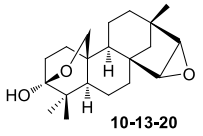
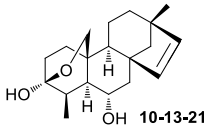


10-13-20



10-13-21

Table 10-13-2: ^{1}H NMR spectroscopic data of beyerane-type dterpenoids **10-13-1**~**10-13-4**.

H	10-13-1	10-13-2	10-13-3	10-13-4
1	0.81 dd(12.6, 3.6) 1.59 (ov)	0.86 dd(12.6, 3.6) 1.61 (ov)	1.06 (ov) 1.99 br d(12.5)	1.95 br d(12.5)
2	1.51 (ov), 1.40 (ov)	1.55 (ov), 1.46 (ov)	1.47 (ov), 1.66 (ov)	–
3	1.33 (ov), 1.29 (ov)	1.38 (ov), 1.42 (ov)	1.38 (ov), 1.48 (ov)	–
5	1.10 dd(1.8, 3.0)	1.18 dd(11.4, 2.4)	1.13 dd(11.5, 2.5)	1.00 dd(11.5, 2.5)
6	1.39 (ov)	1.41 (ov), 1.47 (ov)	1.50 (ov), 1.55 (ov)	–
7	1.27 (ov) 1.58 (ov)	1.34 dd(13.8, 4.8) 1.63 (ov)	1.38 (ov) 1.70 (ov)	–
9	0.99 (ov)	1.04 (ov)	1.29 d(5.0)	1.23 d(4.5)
11	1.25 (ov), 1.50 (ov)	1.25 (ov), 1.52 (ov)	4.23 dt(11.5, 5.0) 2.39 d(12.0, OH)	4.21 dt(11.5, 5.0) 2.35 d(12.0, OH)
12	1.24 (ov), 1.29 (ov)	1.27 (ov), 1.29 (ov)	1.70 (ov) 1.80 dd(14.0, 5.0)	1.70 dd(14.5, 2.0) 1.79 dd(14.5, 5.0)
14	1.01 d(9.6), 1.43 (ov)	1.06 d(10.2), 1.44 (ov)	1.22 d(10.0), 1.68 d(10.0)	–
15	5.67 d(5.4)	5.69 d(5.4)	6.23 d(6.0)	6.21 d(5.5)
16	5.45 d(5.4)	5.46 d(5.4)	5.79 d(6.0)	5.77 d(5.5)
17	0.99 s	0.99 s	1.06 s	1.06 s
18	3.72 d(11.4) 3.91 d(11.4)	3.79 d(10.8) 3.98 d(10.8)	3.77 d(10.5) 3.98 d(10.5)	3.71 d(11.0) 3.89 d(11.0)
19	0.84 s	0.89 s	0.96 s	0.90 s
20	0.77 s	0.80 s	1.23 s	1.20 s
2′, 6′	7.62 d(8.4)	7.45 d(9.0)	7.45 d(8.5)	7.61 d(8.5)
3′, 5′	6.79 d(8.4)	6.86 d(9.0)	6.85 d(8.5)	6.79 d(8.5)
7′	6.86 d(12.6)	7.62 d(16.2)	7.62 d(15.5)	6.85 d(13.0)
8′	5.87 d(12.6)	6.32 d(16.2)	6.32 d(15.5)	5.85 d(13.0)

Table 10-13-3: ^{1}H NMR spectroscopic data of beyerane-type dterpenoids **10-13-5**~**10-13-7**.

H	10-13-5	10-13-6	10-13-7
1	ax 2.00 dd(12.5, 2) eq 2.14 d(12.5)	ax 2.09 dd(11.5, 2) eq 2.31 d(11.5)	ax 0.99 ddd eq 1.48 ddd
2			ax 1.49 dddd, eq 1.61 dddd
3	ax 2.32 dd(13, 2), eq 2.16 d(13)	ax 3.90 dd(6, 2), 3.40 d(6, OH)	3.21 dd(11.5, 5)

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Table 10-13-3 (continued)

H	10-13-5	10-13-6	10-13-7
5	1.94 dd	1.57 dd	0.86 dd
9	1.87 dd(10.5, 6.5)	1.91 dd(11.5, 7)	1.56 dd(11, 7)
11	ax 2.41 dd(16.5, 10.5) eq 2.21 dd(16.5, 6.5)	ax 2.42 dd(17, 11.5) eq 2.21 dd(17, 7)	ax 2.40 dd(17, 11) eq 2.27 dd(17, 7)
14	ax 1.65 d(11), eq 1.94 d(11)	ax 1.66 d(11.5), eq 1.97 d(11.5)	ax 1.60 d(11), eq 1.89 d(11)
15	6.02 d(6)	6.02 d(6)	6.03 d(6)
16	5.63 d(6)	5.66 d(6)	5.72 d(6)
17	1.11 s	1.12 s	1.10 s
18	1.09 s	1.21 s	1.01 s
19	0.90 s	0.73 s	0.80 s
20	0.78 s	0.76 s	0.77 s

Table 10-13-4: ^{1}H NMR spectroscopic data of beyerane-type dterpenoids **10-13-8**~**10-13-10**.

H	10-13-8	10-13-9	10-13-10
1 ax	2.13 dd(12, 1)	2.15 dd(12, 1)	0.93 dd(12, 12)
1 eq	2.45 d(12)	2.39 d(12)	1.82 dd(12, 4.5)
2			3.65 dddd(12, 4.5, 3.5, 9.5) 2.05 d(3.5, OH)
3	3.90 ddd	ax 3.91 dd(4, 1), eq 3.40 d(OH)	3.00 dd(9.5, 4), 2.19 d(4, OH)
5			0.97 dd
9	1.39 dd(12, 5)	2.35 dd	1.63 dd(10.5, 6.5)
11	ax 1.81 ddd(12, 9, 11) eq 1.14 ddd(11, 6, 5)	ax 1.66 ddd(1.5) eq 1.46 ddd(1.5)	ax 2.43 dd(17, 10.5) eq 2.30 dd(17, 6.5)
12	3.51 dd(9, 6)	ax 3.41 d(3.0, OH) eq 3.71 ddd(1.5, 1.5, 3.0)	
14	ax 1.06 d(9), eq 1.58 d(9)	ax 1.29 d(11), eq 1.78 d(11)	ax 1.62 d(11), eq 1.91 d(11)
15	5.78 d(5.5)	5.70 d(6)	6.02 d(5.5)
16	5.62 d(5.5)	5.61 d(6)	5.62 d(5.5)
17	1.13 s	1.08 s	1.10 s
18	1.19 s	1.20 s	1.11 s
19	0.70 s	0.70 s	0.86 s
20	0.75 s	0.67 s	0.85 s

Table 10-13-5: ^{1}H NMR spectroscopic data of beyerane-type dterpenoids **10-13-11**, **10-13-12**, and **10-13-19**~**10-13-21**.

H	10-13-11	10-13-12	10-13-19	10-13-20	10-13-21
1	α 0.95 m	α 0.85 m	α 1.18 m	α 1.22 m	2.00 m
	β 1.75 m	β 1.76 m	β 2.12 m	β 2.20 m	
2	α 1.86 m	α 2.00 m	α 1.72 m	α 1.80 m	α 1.70 m
	β 1.46 m	β 1.42 m	β 2.12 m	β 2.22 m	β 1.98 m

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Table 10-13-5 (continued)

H	10-13-11	10-13-12	10-13-19	10-13-20	10-13-21
3	*α* 1.02 m	*α* 1.05 m			
	β 2.10 m	*β* 2.30 m			
4					2.05 m
5	1.12 m	1.10 m	1.24 d(5.0)	1.30 m	0.98 m
6	*α* 1.90 m	*α* 1.85 m	*α* 1.64 m	*α* 1.60 m	*β* 3.80 m
	β 1.72 m	*β* 1.75 m	*β* 1.08 m	*β* 1.32 m	
7	*α* 1.50 m	*α* 1.40 m	*α* 1.28 m	*α* 1.38 m	*α* 1.40 m
	β 1.70 m	*β* 1.60 m	*β* 1.62 m	*β* 1.68 m	*β* 1.86 m
9	1.30 m	1.18 m	1.08 m	1.28 m	1.10 m
11	*α* 1.90 m	*α* 2.15 m	*α* 1.63 m	1.72 m	1.70 m
	β 1.45 m	*β* 1.72 m	*β* 1.49 m		
12	*α* 1.30 m	*α* 1.60 m	*α* 1.24 m	*α* 1.20 m	1.21 m
	β 1.82 m	*β* 2.35 m	*β* 1.68 m	*β* 1.90 m	
14	*α* 1.28 m	*α* 1.25 m	*α* 1.02 m	*α* 0.53 m	*α* 1.05 m
	β 1.82 m	*β* 1.75 m	*β* 1.47 m	*β* 1.24 m	*β* 1.52 m
15	*α* 2.65	*α* 2.25 m	5.59 d(6.0)	3.15 d(4.0)	5.49 d(5.4)
	β 1.85	*β* 1.90 m			
16		4.88 dd(7.2, 1.5)	5.46 d(6.0)	3.00 d(4.0)	5.57 d(5.4)
17	3.75 d(11)	3.89 d(10.2)	1.00 s	1.02 s	1.00 s
	3.50 d(11)	3.81 d(10.2)			
18	3.64 s(COOMe)	3.58 s(COOMe)	1.02 s	1.04 s	
19	1.20 s	1.19 s	0.96 s	1.00 s	1.13 d(6.3)
20	0.70 s	0.91 s	3.82 Abq	3.89 d(8.0)	3.80 m
			(8.0, 7.0)	4.05 d(8.0)	

Table 10-13-6: ^{1}H NMR spectroscopic data of beyerane-type dterpenoids **10-13-14**~**10-13-16**.

H	10-13-14	10-13-15	10-13-16
1	1.78 dm(13.1), 1.15 m	6.11 s	6.46 s
2	*α* 2.31 m, *β* 1.71 m	5.98 s(OH)	2.18 s(OAc)
3	4.60 dd(12.3, 4.4)		
5	1.18 dd(11.8, 2.1)	–	1.85 dd(11.0, 12.0)
6	*α* 1.66 m, *β* 1.86 m	–	*α* 1.70 m, *β* 1.62 m
7	1.69 m, 1.32 m	–	*α* 1.56 m, *β* 2.00 m
9	0.97 m	1.91 dd(11, 6.5)	1.99 dd(11.0, 6.0)
11	1.28 m, 1.54 m	ax 2.60 dd(16.5, 11)	*α* 2.60 dd(16.0, 11.0)
		eq 2.50 dd(16.5, 6.5)	*β* 2.45 dd(16.0, 6.0)
12	1.28 m		
14	1.48 dd(9.7, 1.9), 1.03 d(9.8)	ax 1.67 d(11), eq 1.95 d(11)	*α* 1.68 d(11.0), *β* 1.96 d(11.0)
15	5.67 d(5.7)	6.07 d(5.5)	6.08 d(5.5)
16	5.47 d(5.7)	5.70 d(5.5)	5.72 d(5.5)
17	1.01 s	1.26 s	1.12 s
18	1.29 s	1.13 s	1.22 s

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Table 10-13-6 (continued)

H	10-13-14	10-13-15	10-13-16
19	10.46 br s(COOH)	1.09 s	1.14 s
20	0.77 s	1.15 s	1.11 s
2′	5.70 m		
4′	1.89 d(1.3)		
5′	2.16 d(1.3)		

Table 10-13-7: ^{1}H NMR spectroscopic data of beyerane-type dterpenoids **10-13-13**, **10-13-17**, and **10-13-18**.

H	10-13-13	10-13-17	10-13-18
1	–	1.89 dd(16.5, 0.5), 2.61 d(16.5)	6.28 s
14	–	1.06 d(9.5)	0.97 d(10.0) 1.76 dd(10.0, 3.0) 6.42 s(OH)
15	2.78 d(6.0), 2.58 d(6.0)	5.67 d(6.0)	6.03 d(6.0)
16		5.53 d(6.0)	5.78 d(6.0)
17	1.02 s	1.02 s	3.59 d(10.5), 3.50 d(10.5)
18	1.04 s	1.42 or 1.35 s	1.99 s
19	9.78 s	1.42 or 1.35 s	
20	0.78 s	0.88 d(1)	1.12 s

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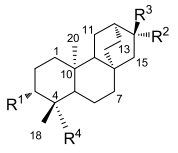
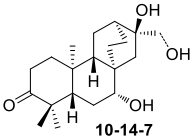
10.14 Atisane-type diterpenoids

Table 10-14-1: Compounds, MFs, and test solvents of atisane-type diterpenoids **10-14-1**~**10-14-25**.

No.	Compounds	MFs	Test solvents	References
10-14-1	(16*α*)-17-hydroxy-*ent*-atisan-19-oic acid methyl ester	$C_{21}H_{34}O_3$	CD_3OD	[458]
10-14-2	(16*α*)-16,17-dihydroxy-*ent*-atisan-19-oic acid methyl ester	$C_{21}H_{34}O_4$	$CDCl_3$	[458]
10-14-3	(16*α*)-*ent*-atisan-16,17,19-triol	$C_{20}H_{34}O_3$	C_5D_5N	[458]
10-14-4	16*α*,17-dihydroxy-*ent*-atisan-19-al	$C_{20}H_{32}O_3$	$CDCl_3$	[459]
10-14-5	17-hydroxy-*ent*-atisan-19-oic acid	$C_{20}H_{32}O_3$	$CDCl_3$	[459]
10-14-6	*ent*-16*α*,l7-dihydroxyatisan-3-one	$C_{20}H_{32}O_3$	$CDCl_3$	[460]
10-14-7	*ent*-7*β*,16*α*,l7-trihydroxyatisan-3-one	$C_{20}H_{32}O_4$	$CDCl_3$	[460]
10-14-8	*ent*-(13*S*)-hydroxyatis-16-ene-3,14-dione	$C_{20}H_{28}O_3$	$CDCl_3$	[460]
10-14-9	*ent*-atis-16-ene-3,14-dione	$C_{20}H_{28}O_2$	$CDCl_3$	[460]
10-14-10	*ent*-(13*S*),15*β*-dihydroxyatis-16-ene-3,14-dione	$C_{20}H_{28}O_4$	$CDCl_3$	[460]
10-14-11	*ent*-(13*S*),18-dihydroxyatis-16-ene-3,14-dione	$C_{20}H_{28}O_4$	$CDCl_3$	[460]
10-14-12	*ent*-18-hydroxyatis-16-ene-3,14-dione	$C_{20}H_{28}O_3$	$CDCl_3$	[460]
10-14-13	alboatisin A	$C_{20}H_{30}O_5$	C_5D_5N	[461]
10-14-14	alboatisin B	$C_{20}H_{28}O_5$	C_5D_5N	[461]
10-14-15	alboatisin C	$C_{20}H_{30}O_4$	C_5D_5N	[461]
10-14-16	*ent*-(13*S*,14*S*)-dihydroxy-3,14-dioxo-atis-15-en-17-al	$C_{20}H_{28}O_4$	$CDCl_3$	[460]
10-14-17	spiramilactone E	$C_{20}H_{28}O_4$	C_5D_5N	[462]
10-14-18	agallochaol G	$C_{20}H_{32}O_3$	$CDCl_3$	[463]
10-14-19	agallochaol H	$C_{20}H_{32}O_4$	CD_3OD-$CDCl_3$ (4:1)	[463]
10-14-20	agallochaol I	$C_{20}H_{32}O_3$	$CDCl_3$	[463]
10-14-21	agallochaol J	$C_{20}H_{30}O_3$	$CDCl_3$	[463]
10-14-22	*ent*-(13*S*)-hydroxy-14-oxo-3,4-*seco*-atis-16-en-3,4-olide	$C_{20}H_{28}O_4$	$CDCl_3$	[460]
10-14-23	*ent*-(13*S*)-hydroxy-4,5-oxy-4,5-*seco*-atis-16-ene-3,4-dione	$C_{20}H_{28}O_4$	$CDCl_3$	[460]
10-14-24	crotobarin	$C_{22}H_{28}O_5$	CD_3COCD_3	[464]
10-14-25	crotogoudin	$C_{20}H_{26}O_3$	$CDCl_3$	[464]



	R^1	R^2	R^3	R^4
10-14-1	H	CH_2OH	H	COOMe
10-14-2	H	OH	CH_2OH	COOMe
10-14-3	H	OH	CH_2OH	CH_2OH
10-14-4	H	OH	CH_2OH	CHO
10-14-5	H	H	CH_2OH	COOH
10-14-6	=O	CH_2OH	OH	Me



10-14-7

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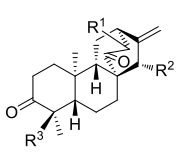
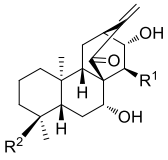
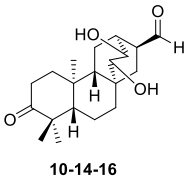


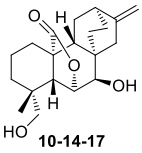
	R^1	R^2	R^3
10-14-8	OH	H	Me
10-14-9	H	H	Me
10-14-10	OH	OH	Me
10-14-11	OH	H	CH_2OH
10-14-12	H	H	CH_2OH



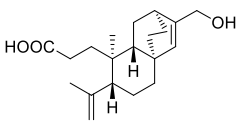
	R^1	R^2
10-14-13	OH	CH_2OH
10-14-14	OH	CHO
10-14-15	H	CH_2OH



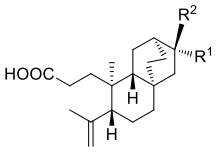
10-14-16



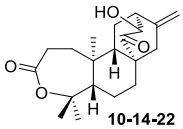
10-14-17



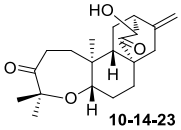
10-14-21



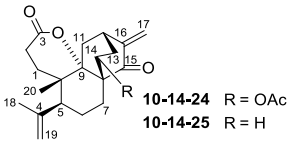
	R^1	R^2
10-14-18	OH	Me
10-14-19	OH	CH_2OH
10-14-20	H	CH_2OH



10-14-22



10-14-23



10-14-24 R = OAc
10-14-25 R = H

Table 10-14-2: ^{1}H NMR spectroscopic data of atisane-type diterpenoids **10-14-1**~**10-14-4**.

H	10-14-1	10-14-2	10-14-3	10-14-4
1	1.85~1.89 m	*α* 1.76~1.80 m	*α* 1.65~1.70 m	*α* 1.80 m
		β 0.72~0.76 m	*β* 0.65~0.71 m	*β* 0.80 m
2	*α* 1.40~1.42 m	*α* 1.39~1.42 m	1.26~1.33 m	1.56 m
	β 1.83~1.85 m	*β* 1.80~1.83 m		
3	0.99~1.05 m	*α* 2.12~2.15 m	*α* 2.14~2.17 m	*α* 2.15 m
		β 0.94~0.97 m	*β* 0.93~0.95 m	*β* 0.94 m
5	1.05~1.08 m	1.00~1.02 m	0.85~0.88 m	1.14 m
6*α*	1.75~1.76 m	1.69~1.72 m	1.55~1.61 m	1.56 m
6*β*	1.83~1.86 m	1.80~1.86 m	1.27~1.30 m	1.01 m
7	1.44~1.46 m	1.39~1.44 m	1.39~1.40 m	1.52 m, 1.71 m
	0.83~0.85 m	1.62~1.66 m	1.55~1.58 m	
9	1.00~1.02 m	0.92~0.96 m	0.93~0.95 m	1.01 m
11	1.61~1.63 m	1.48~1.54 m	1.47~1.53 m	1.56 m, 1.92 m
		1.58~1.61 m	1.81~1.83 m	
12	2.12~2.14 m	2.00 br s	2.39~2.41 m	2.02 m
13	1.07~1.08 m	1.59~1.60 m	1.83~1.86 m	1.66 m, 1.90 m
	1.83~1.84 m	1.89~1.92 m	1.92~1.95 m	
14	1.42~1.44 m	1.51~1.58 m	1.53~1.55 m	1.54 m
	1.52~1.54 m		1.80~1.83 m	
15	0.99 dd(13.6, 5.6)	1.39~1.42 m	1.68~1.70 m	1.48 m, 1.59 m
	1.56~1.58 m	1.56~1.58 m	1.80~1.83 m	

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Table 10-14-2 (continued)

H	10-14-1	10-14-2	10-14-3	10-14-4
16	2.09~2.11 m	3.65 d(11.0) 3.76 d(10.9)		
17	3.76 d(7.6)		4.03 d(10.9), 4.11 d(10.8)	3.66 m, 3.78 m
18	1.15 s	1.14 s	1.15 s	0.97 s
19			4.24 d(9.4), 4.70 d(9.5)	9.72 s
20	0.86 s	0.80 s	0.99 s	0.86 s
OMe	3.65 s	3.62 s		

Table 10-14-3: ^{1}H NMR spectroscopic data of atisane-type diterpenoids **10-14-5**~**10-14-7**.

H	10-14-5	10-14-6	10-14-7
1α	1.86 m	1.38 m	1.36 m
1β	0.80 m	1.85 m	1.84 s
2α	1.41 m	2.33 ddd(16.0, 6.0, 3.2)	2.35 ddd(16.2, 6.3, 3.2)
2β	1.89 m	2.58 ddd(16.0, 12.3, 6.9)	2.56 ddd(16.2, 11.9, 7.1)
3	α 2.16 m, β 0.99 m		
5	1.05 m	1.30 m	–
6	α 1.75 m, β 1.82 m	1.45 m	α 1.62 m, β 1.54 m
7	1.44 m	α 1.18 m, β 1.42 m	3.34 dd(11.0, 4.9)
9	1.03 m	1.32 m	1.30 m
11	1.50 m, 1.60 m	1.24 m, 2.03 m	1.25 m, 2.04 m
12	2.06 m	1.82 q(3.0)	1.81 q(3.0)
13	0.97 m, 1.84 m	1.50 m, 1.63 m	1.02 m, 1.63 m
14	1.42 m, 1.58 m	0.82 m, 1.87 m	0.84 m, 1.48 m
15	0.88 m, 1.55 m	1.10 m, 1.24 m	1.30 m
16	1.95 m		
17	3.44 m	3.43, 3.57 ABq(10.9)	3.46, 3.56 ABq(11.1)
18	1.23 s	1.07 s	1.08 s
19		1.04 s	1.04 s
20	0.93 s	1.11 s	1.11 s

Table 10-14-4: ^{1}H NMR spectroscopic data of atisane-type diterpenoids **10-14-8**~**10-14-11**.

H	10-14-8	10-14-9	10-14-10	10-14-11
1α	1.39 ddd(13.4, 13.2, 5.5)	1.37 ddd(13.4, 13.2, 4.7)	1.39 m	1.49 ddd(13.4, 13.1, 3.8)
1β	1.87 ddd(13.4, 6.4, 3.2)	1.84 ddd(13.4, 6.3, 3.1)	1.83 m	1.88 ddd(13.4, 6.6, 4.2)
2	α 2.34 ddd(15.8, 5.5, 3.2) β 2.56 ddd(15.8, 13.2, 6.4)	α 2.34 m β 2.57 ddd(15.8, 13.2, 6.3)	α 2.34 m β 2.56 ddd(15.7, 13.2, 6.2)	2.46 m

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Table 10-14-4 (continued)

H	10-14-8	10-14-9	10-14-10	10-14-11
5	1.32 dd(12.0, 2.9)	1.29 dd(12.4, 2.5)	1.25 m	1.57 m
6	*α* 1.50 m, *β* 1.51 m	*α* 1.52 m, *β* 1.65 m	1.50 m	1.57 m
7*α*	0.95 m	0.92 m	1.00 m	0.90 m
7*β*	2.41 ddd(13.5, 3.2, 3.2)	2.35 m	2.73 ddd(13.5, 3.6, 3.1)	2.40 ddd(13.5, 3.3, 2.9)
9	1.66 dd(11.5, 6.2)	1.65 m	1.55 m	1.69 dd(11.2, 6.2)
11*α*	2.02 ddd(14.1, 11.5, 3.7)	1.95 br dt(11, 3)	1.90 m	2.04 ddd(13.7, 11.2, 3.7)
11*β*	1.76 ddd(14.1, 6.2, 2.5)	1.66 m	1.70 m	1.75 ddd(13.7, 6.2, 2.5)
12	2.83 ddd(3.7, 3.0, 2.5)	2.73 dddd(3.7, 3.0, 3, 2.5)	2.90 br q(3)	2.82 br q(3.7, 3.4, 2.5)
13	3.88 d(3.0)	2.32 m	3.88 d(3.1)	3.86 d(3.4)
15	2.32 br dd(2.5, 2.1)	2.30 m, 2.34 m	3.99 br s	2.32 br t(2.3)
17	4.86 dt(11, 2.1) 5.02 dt(11, 2.5)	4.69 dt(11, 2.1) 4.90 dt(11, 2.4)	5.28 br d(1.0) 5.35 br d(1.8)	4.87 dt(1.1, 2.1) 5.03 dt(1.1, 2.4)
18	1.09 s	1.09 s	1.09 s	3.47, 3.82 AM (11.1, 7.5, 3.2)
19	1.01 s	1.02 s	1.02 s	1.22 s
20	0.85 s	0.88 s	0.87 s	0.78 s

Table 10-14-5: ^{1}H NMR spectroscopic data of atisane-type diterpenoids **10-14-12**~**10-14-15**.

H	10-14-12	10-14-13	10-14-14	10-14-15
1*α*	1.38 m	1.54 m	1.55 m	1.66 m
1*β*	1.84 m	0.72 m	0.73 m	0.76 m
2	2.47 m	*α* 1.53 m, *β* 1.62 m	*α* 1.42 m, *β* 1.57 m	*α* 1.53 m, *β* 1.63 m
3		*α* 1.75 m, *β* 1.38 m	*α* 1.30 m, *β* 1.15 m	*α* 1.84 m, *β* 1.42 m
5	1.30 m	1.62 m	1.41 m	1.64 m
6	1.60 m	*α* 2.01 m *β* 2.36 dd(12.8, 4.1)	*α* 1.65 m *β* 2.05 dd(12.5, 4.0)	*α* 1.85 m *β* 2.26 dd(12.5, 4.8)
7	*α* 0.90 m, *β* 2.33 m			4.77 dd(11.5, 4.8)
9	1.60 m	1.46 m	1.39 m	1.40 m
11*α*	1.90 m	*α* 1.61 m	1.64 m	1.53 m
11*β*	1.70 m	2.41 dd(12.4, 7.7)	2.38 dd(12.4, 7.7)	2.51 dd(12.6, 7.7)
12	2.73 br q(3)	3.17 br s	3.17 br s	2.99 br s
13	2.30 m	4.48 br s	4.45 br s	4.38 dd(10.3, 3.0)
14		5.11 br s	5.00 br s	2.39 dd(15.5, 3.0) 2.73 dd(15.5, 10.3)
15	2.30 m			
17	4.68 dt(2.1, 1.1) 4.89 dt(2.4, 1.1)	5.30 br s 6.26 br s	5.20 br s 6.28 br s	5.25 br s 6.20 br s
18	3.47, 3.89 ABq(11.3)	3.32 d(10.8), 3.65 d(10.8)	9.27 s	3.33 d(10.5) 3.67 d(10.5)
19	1.22 s	0.86 s	1.03 s	0.86 s
20	0.82 s	1.40 s	1.32 s	1.50 s

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Table 10-14-6: ^{1}H NMR spectroscopic data of atisane-type diterpenoids **10-14-16** and **10-14-17**.

H	10-14-16	10-14-17	H	10-14-16	10-14-17
1	*α* 1.45 m	1.11 dd(10.8, 4.0)	12	2.79 m	2.27~2.29 m
	β 1.86 ddd(9.4, 6.4, 3.0)	2.23~2.27 m			
2	*α* 2.35 ddd(15.9, 5.5, 3.2)	1.51~1.55 m	13	3.66 m	1.55~1.57 m
	β 2.59 ddd(15.9, 13.2, 6.4)	1.61~1.64 m			1.59~1.61 m
3		1.06 dd(10.8, 2.0)	14	3.86 br s	1.24 dd(11.6, 7.2)
		2.19 d(10.8)			2.39 ddd(11.6, 8.8, 6.4)
5	1.40 m	2.51 s	15	6.67 d(2.1)	2.23~2.27 m, 2.93 d(16.2)
6	*α* 1.50 m, *β* 1.60 m	5.04 d(4.3)	17	9.55 br s	4.86 d(1.4), 4.95 d(1.4)
7	*α* 1.00 m	3.98 br s	18	1.09 s	1.32 s
	β 2.76 ddd(13.2, 3.3, 2.9)		19	1.03 s	3.72 d(11.0), 3.97 d(11.0)
9	1.64 dd(11.5, 6.4)	1.89 br dd(8.0)	20	0.91 s	
11	*α* 1.78 m	1.59~1.61 m			
	β 1.73 m	1.70~1.72 m			

Table 10-14-7: ^{1}H NMR spectroscopic data of atisane-type diterpenoids **10-14-18**~**10-14-21**.

H	10-14-18	10-14-19	10-14-20	10-14-21
1	1.53~1.55 m	1.44~1.46 m	1.55~1.57 m	1.54~1.57 m
2	2.15~2.18 m,	2.07~2.09 m,	2.21~2.24 m,	2.14~2.17 m,
	2.36~2.39 m	2.26~2.29 m	2.39~2.41 m	2.38~2.41 m
5	1.89~1.92 m	1.88~1.90 m	1.92~1.94 m	2.02~2.04 m
6*α*	1.32~1.35 m	1.28~1.30 m	1.32~1.34 m	1.33~1.35 m
6*β*	1.77~1.80 m	1.88~1.90 m	1.73~1.75 m	1.54~1.56 m
7*α*	1.34~1.38 m	1.34~1.36 m	1.30~1.32 m	1.77~1.80 m
7*β*	1.06~1.10 m	1.05~1.08 m	1.10~1.12 m	1.59~1.61 m
9	1.08~1.10 m	1.00~1.03 m	1.30~1.32 m	1.15~1.17 m
11*α*	1.33~1.35 m	1.28~1.30 m	1.32~1.34 m	1.34~1.36 m
11*β*	2.02~2.05 m	1.95~1.97 m	1.66~1.68 m	1.80~1.83 m
12	1.53~1.55 m	1.74~1.76 m	1.70~1.72 m	2.49~2.51 m
13*α*	1.53~1.55 m	1.46~1.47 m	1.46~1.48 m	1.48~1.51 m
13*β*	1.38~1.68 m	1.28~1.30 m	1.26~1.28 m	1.33~1.35 m
14*α*	1.83~1.85 m	1.85~1.87 m	1.86~1.88 m	2.00~2.02 m
14*β*	1.06~1.08 m	1.06~1.08 m	0.86~0.87 m	0.82~0.85 m
15	*α* 1.20~1.23 m	*α* 0.96~0.98 m	*α* 0.77~0.79 m	5.85 br s
	β 1.37~1.40 m	*β* 1.18~1.20 m	*β* 1.30~1.32 m	
16			1.86~1.88 m	
17	1.29 s	3.32 d(11.4),	3.52 d(7.1),	4.15 br s
		3.47 d(11.4)	3.53 d(7.1)	
18	1.74 s	1.70 s	1.74 s	1.75 s
19	4.67 br s, 4.86 br s	4.64 br s, 4.78 br s	4.67 br s, 4.85 br s	4.69 br s, 4.86 br s
20	0.97 s	0.94 s	0.97 s	1.00 s

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Table 10-14-8: ^{1}H NMR spectroscopic data of atisane-type diterpenoids **10-14-22**~**10-14-25**.

H	10-14-22	10-14-23	10-14-24	10-14-25
1	1.43 m	1.40 m	1.70 m, 1.89 m	1.69 m, 1.74 m
2	2.64 m	2.65 m	2.49 m	2.41 ddd(19.4, 8.4, 1.4) 2.56 ddd(19.4, 10.8, 9.2)
5	1.60 m	3.88 m	2.44 m	2.38 dd(12.7, 3.1)
6	1.55 m		1.57 m, 1.95 m	1.59 m, 1.83 m
7	α 1.00 m, β 2.38 m	α 1.00 m, β 2.40 m	1.50 m, 1.89 m	1.43 m, 2.20 m
9	1.74 m			
11	α 2.02 m, β 1.80 m		1.86 m, 2.53 m	1.81 m, 2.33 dd(14.3, 4.3)
12	2.81 br q(3)	2.81 br q(3)	3.06 t(2.2)	2.90 m
13	3.84 d(2.8)	3.85 d(3.0)	1.64 m 2.37 dd(14.8, 2.3)	1.65 m, 1.79 m
14			5.62 dd(10.1, 0.9)	1.33 ddd(15.1, 11.7, 6.6) 2.21 ddd(15.1, 11.3, 3.4)
15	2.31 br t(2)	2.30 m		
17	4.85 br s, 5.01 br s	4.85 br s, 5.01 br s	5.30 d(1.7), 5.91 d(1.7)	5.22 d(1.1), 6.02 d(1.1)
18	1.45 s	1.29 s	1.82 s	1.77 m
19	1.40 s	1.21 s	4.86 br s, 5.00 br s	4.88 m, 4.95 m
20	0.91 s	0.82 s	1.23 s	1.82 s
OAc			1.94 s	

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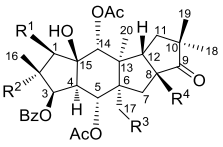
10.15 Paraliane-, pepluane-, and euphoractine-type diterpenoids

Table 10-15-1: Compounds, MFs, and test solvents of paraliane-type diterpenoids **10-15-1**~**10-15-5**.

No.	Compounds	MFs	Test solvents	References
10-15-1	(1*R**,2*R**,3*S**,4*R**,5*R**,6*R**,8*S**,12*S**,13*S**, 14*R**,15*R**)-1,5,8,14-tetraacetoxy-3-benzoyloxy-15-hydroxy-9-oxo-paraliane	$C_{35}H_{44}O_{12}$	$CDCl_3$	[465]
10-15-2	(1*R**,2*R**,3*S**,4*R**,5*R**,6*R**,8*R**,12*R**,13*S**, 14*R**,15*R**)-1,5,14-triacetoxy-3-benzoyloxy-15-hydroxy-9-oxo-par-aliane	$C_{33}H_{42}O_{10}$	$CDCl_3$	[465]
10-15-3	(2*R**,3*R**,4*S**,5*R**,6*R**,8*R**,12*R**,13*S**,14*R**, 15*R**)-2,5,14-triacetoxy-3-benzoyloxy-15-hydroxy-9-oxo-paraliane	$C_{33}H_{42}O_{10}$	$CDCl_3$	[465]
10-15-4	(1*R**,2*R**,3*S**,4*R**,5*R**,6*R**,8*R**,12*R**,13*S**, 14*R**,15*R**)-1,5,14,17-tetraacetoxy-3-benzoyloxy-15-hydroxy-9-oxo-paraliane	$C_{35}H_{44}O_{12}$	$CDCl_3$	[465]
10-15-5	(2*S**,3*S**,4*R**,5*R**,6*R**,8*S**,12*S**,13*S**,14*R**, 15*R**)-5,8,14-triacetoxy-3-benzoyloxy-15-hydroxy-9-oxo-paraliane	$C_{33}H_{42}O_{10}$	$CDCl_3$	[466]



	R^1	R^2	R^3	R^4
10-15-1	OAc	H	H	OAc
10-15-2	OAc	H	H	H
10-15-3	H	OAc	H	H
10-15-4	OAc	H	OAc	H
10-15-5	H	H	H	OAc

Table 10-15-2: ^{1}H NMR spectroscopic data of paraliane-type diterpenoids **10-15-1**~**10-15-4**.

H	10-15-1	10-15-2	10-15-3	10-15-4
1	5.05 d(10)	5.04 d(10)	*α* 2.37 d(15) *β* 2.14 d(15)	5.05 d(10)
2	2.87 ddq(10, 7, 7)	2.87 ddq(10, 7, 7)		2.87 ddq(10, 7, 7)
3	5.76 dd(7, 5)	5.79 dd(7, 6)	5.85 ddd(6)	5.79 dd(7, 6)
4	2.37 dd(5, 12)	2.39 dd(6, 12)	2.87 dd(6, 12)	2.59 dd(6, 17)
5	5.98 d(12)	5.68 d(12)	5.56 d(12)	5.77 d
7*α*	1.91 d(14.5)	1.81 dd(14, 10)	1.79 dd(14, 11)	1.77 m
7*β*	2.14 d(14.5)	1.46 dd(14, 7)	1.46 dd(14, 7)	1.77 m
8		3.21 ddd(13, 7, 10)	3.15 ddd(12, 11, 7)	3.24 ddd(7, 17, 9)
11*α*	1.78 dd(14, 3)	1.78 dd(14, 4)	1.76 dd(14, 4)	1.78 m
11*β*	2.16 dd(12, 14)	1.95 dd(14, 11)	1.90 dd(14, 10)	1.97 dd(14, 10)
12	4.39 dd(12, 3)	4.21 ddd(13, 11, 4)	4.19 ddd(12, 4, 10)	4.27 ddd(17, 4, 10)
14	4.82 s	4.83 s	4.87 s	4.84 s
15	2.86 s(OH)	2.79 s(OH)	2.55 s(OH)	2.82 s(OH)

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Table 10-15-2 (continued)

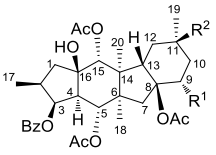
H	10-15-1	10-15-2	10-15-3	10-15-4
16	0.84 d(7)	0.84 d(7)	1.57 s	0.84 d(7)
17	1.06 s	1.07 s	1.12 s	4.41 d(12), 4.23 d(12)
18	1.11 s	1.05 s	1.04 s	1.06 s
19	1.27 s	1.14 s	1.11 s	1.16 s
20	0.70 s	0.59 s	0.60 s	0.62 s
OAc	1.89 s, 1.90 s, 2.11 s, 2.13 s	1.94 s, 2.09 s, 2.13 s	1.98 s, 2.05 s, 2.08 s	1.94 s, 2.06 s, 2.10 s, 2.13 s
OBz	8.03 AA′ 7.42 BB′ 7.56 C	8.02 AA′ 7.46 BB′ 7.57 C	7.97 AA′ 7.48 BB′ 7.60 C	8.01 AA′ 7.46 BB′ 7.57 C

Table 10-15-3: ^{1}H NMR spectroscopic data of paraliane-type diterpenoid **10-15-5**.

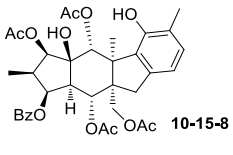
H	10-15-5	H	10-15-5	H	10-15-5
1α	2.16 dd(14,11)	7α	1.86 d(16)	15	3.25 s(OH)
1β	1.48 dd(14, 5.5)	7β	2.09 d(16)	16	1.04 d(7)
2	2.49 dddq(11, 5.5, 6, 7)	11	α 1.79 dd(14, 3) β 2.14 dd(14, 11)	17	1.09 s
3	5.78 dd(6, 4)	12	4.42 br dd(11, 3)	18	1.12 s
4	2.37 dd(4, 12)	13		19	1.25 s
5	5.95 d(12)	14	4.94 s	20	0.74 s
OBz	7.93 AA′ 7.45 BB′ 7.57 C	OAc	1.97 s(5-OAc) 1.83 s(8-OAc) 2.12 s(14-OAc)		

Table 10-15-4: Compounds, MFs, and test solvents of pepluane-type diterpenoids **10-15-6**~**10-15-8**.

No.	Compounds	MFs	Test solvents	References
10-15-6	–	$C_{35}H_{46}O_{12}$	$CDCl_3$	[467]
10-15-7	pepluanone	$C_{35}H_{44}O_{12}$	$CDCl_3$	[468]
10-15-8	(1*R**,2*R**,3*S**,4*R**,5*R**,6*R**,13*S**,14*R**,15*R**)-8,10,(18)11-hexadehydro-1,5,14,17-tetraacetoxy-3-benzoyloxy-11,15-dihydroxy-pepluane	$C_{35}H_{40}O_{12}$	$CDCl_3$	[465]



	R^1	R^2
10-15-6	OAc	OH
10-15-7	=O	OAc



10-15-8

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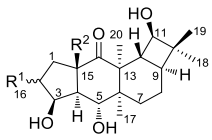
Table 10-15-5: ^{1}H NMR spectroscopic data of pepluane-type diterpenoids **10-15-6**~**10-15-8**.

H	10-15-6	10-15-7	10-15-8
1	*α* 2.17 dd(14.2,11.6)	*α* 2.07 dd(ov)	5.02 d(10)
	β 1.51 dd(14.2, 5.1)	*β* 1.48 dd(14.2, 5.1)	
2	2.54 m	2.56 m(ov)	2.83 ddq(10, 7, 7)
3	5.80 m	5.77 m	5.74 dd(7, 6)
4	2.40 dd(12.0, 4.3)	2.38 dd(12.0, 4.3)	2.73 dd(6, 12)
5	5.83 d(12.0)	5.85 d(12.0)	5.52 d(12)
7*α*	2.48 d(16.0)	1.74 d(16.0)	2.84 d(16)
7*β*	1.58 d(16.0)	2.55 d(16.0)	2.57 d(16)
9	5.78 d(4.9)		6.81 d(8)
10	*α* 1.85 d(16.9)	*α* 2.31 d(16.5)	7.02 d(8)
	β 1.97 dd(16.9, 5.7)	*β* 3.27 d(16.5)	
11	2.82 s(OH)		
12	*α* 1.69 t(12.9)	*α* 1.16 dd(13.0, 6.0)	
	β 1.75 m	*β* 2.47 dd(13.0, 6.0)	
13	4.30 dd(12.8, 6.6)	4.56 dd(13.0, 6.0)	
15	5.07 s	4.93 s	5.59 s
16	3.17 s(OH)	3.06 s(OH)	
17	1.05 d(7.3)	1.07 d(7.3)	0.76 d(7)
18	1.08 s	1.09 s	4.50 d(12), 4.41 d(12)
19	1.29 s	1.59 s	2.19 s
20	0.92 s	0.65 s	1.04 s
OBz		7.97 d(7.4, AA′), 7.37 t(BB′)	7.82 (AA′), 7.31 (BB′)
		7.54 d(7.4, C)	7.46 (C)
OAc		1.85 s(5-OAc), 2.14 s(8-OAc)	2.17 s, 2.15 s
		1.94 s(11-OAc), 2.08 s(15-OAc)	2.12 s, 1.94 s

Table 10-15-6: Compounds, MFs, and test solvents of euphoractine-type diterpenoids **10-15-9**~**10-15-12**.

No.	Compounds	MFs	Test solvents	References
10-15-9	euphoractine A	$C_{29}H_{38}O_6$	$CDCl_3$	[469]
10-15-10	euphoractine C	$C_{27}H_{36}O_6$	$CDCl_3$	[470]
10-15-11	euphoractine D	$C_{27}H_{36}O_6$	$CDCl_3$	[470]
10-15-12	euphoractine E	$C_{29}H_{36}O_5$	$CDCl_3$	[470]



	R^1	R^2
10-15-9	*β*-Me	OCinn
10-15-10	*β*-Me	OBz
10-15-11	*α*-Me	OBz

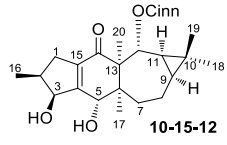


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Table 10-15-7: ^{1}H NMR spectroscopic data of euphoractine-type diterpenoids **10-15-9**~**10-15-12**.

H	10-15-9	10-15-10	10-15-11	10-15-12
1	2.01 m, 2.61 m	*α* 2.63 dd(15.2, 11.3) *β* 2.10 dd(15.2, 4.5)	*α* 2.75 dd(14.5, 7.5) *β* 1.65 dd(14.5, 10.7)	*α* 2.64 m *β* 2.32 m
2	2.51 m	2.48 m	2.40 m	2.35 m
3	4.46 t(5.8)	4.57 dd(5.5, 5.5)	4.20 dd(6.6, 2.4)	4.80 d(6.4)
4	2.07 m	2.05 dd(11.5, 5.5)	2.15 dd(11.5, 6.6)	
5	4.97 d(11.5)	5.06 d(11.5)	5.02 d(11.5)	5.20 br s
7	2.22 m, 1.20 m	2.20 m, 1.18 m	2.20 m, 1.18 m	1.93 m, 1.70 m
8	1.50 m	1.43 m	1.43 m	1.56 m, 1.51 m
9	1.13 m	1.15 m	1.15 m	0.83 m
11	3.42 d(8.7)	3.36 d(8.7)	3.36 d(8.7)	0.76 m
12	2.55 m	2.50 dd(12.0, 8.7)	2.50 dd(11.9, 8.7)	5.29 d(9.1)
16	1.08 d(7.4)	1.01 d(7.5)	1.03 d(6.7)	1.08 d(7.1)
17	0.76 s	0.78 s	0.78 s	0.83 s
18	0.81 s	0.91 s	0.93 s	1.14 s
19	0.99 s	0.37 s	0.36 s	1.04 s
20	1.16 s	1.16 s	1.16 s	1.40 s
OBz		8.10 dd(7.2, 1.1, *o*) 7.46 ddd(7.2, 7.2, 0.4, *m*) 7.58 m(*p*)	8.12 dd(7.2, 1.0, *o*) 7.45 ddd(7.2, 7.2, 0.4, *m*) 7.58 m(*p*)	
OCinn	7.76 d(15.8) 6.60 d(15.8) 7.36 m(*o*) 7.53 m(*m*) 7.30 m(*p*)			7.59 d(16.0) 6.32 d(16.0) 7.50 m(*o*) 7.35 m(*m*) 7.35 m(*p*)

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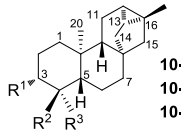
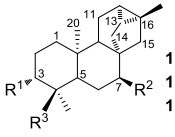
10.16 Trachylobane-type diterpenoids

Table 10-16-1: Compounds, MFs, and test solvents of trachylobane-type diterpenoids **10-16-1**~**10-16-21**.

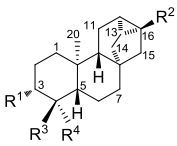
No.	Compounds	MFs	Test solvents	References
10-16-1	*ent*-trachyloban-18-oic acid	$C_{20}H_{30}O_2$	$CDCl_3$	[471]
10-16-2	*ent*-18-hydroxytrachyloban-19-oic acid	$C_{20}H_{30}O_3$	$CDCl_3$	[471]
10-16-3	*ent*-trachyloban-3-one	$C_{20}H_{30}O$	$CDCl_3$	[472]
10-16-4	*ent*-18-hydroxy-trachyloban-3-one	$C_{20}H_{30}O_2$	$CDCl_3$	[473]
10-16-5	*ent*-7*α*-acetoxytrachyloban-18-oic acid	$C_{22}H_{32}O_4$	$CDCl_3$	[474]
10-16-6	*ent*-7*α*-hydroxytrachyloban-18-oic acid	$C_{20}H_{30}O_3$	$CDCl_3$	[474]
10-16-7	3-oxo-*ent*-trachyloban-17-oic acid	$C_{20}H_{28}O_3$	$CDCl_3$	[475]
10-16-8	*ent*-trachyloban-4*β*-ol	$C_{19}H_{30}O$	$CDCl_3$	[476]
10-16-9	*ent*-17-hydroxytrachyloban-18-oic acid	$C_{20}H_{30}O_3$	CD_3OD	[476]
10-16-10	*ent*-3*β*-acetoxytrachyloban-18-al	$C_{22}H_{32}O_3$	$CDCl_3$	[477]
10-16-11	*ent*-3*β*-acetoxytrachyloban-19-al	$C_{22}H_{32}O_3$	$CDCl_3$	[477]
10-16-12	*ent*-trachyloban-17-al	$C_{20}H_{30}O$	$CDCl_3$	[477]
10-16-13	mitrephorone A	$C_{21}H_{26}O_5$	$CDCl_3$	[478]
10-16-14	mitrephorone B	$C_{21}H_{28}O_4$	$CDCl_3$	[478]
10-16-15	mitrephorone C	$C_{21}H_{26}O_5$	$CDCl_3$	[478]
10-16-16	6*α*,18,19-*ent*-trachylobantriol	$C_{20}H_{32}O_3$	C_5D_5N	[479]
10-16-17	2*α*,17,18-*ent*-trachylobantriol	$C_{20}H_{32}O_3$	C_5D_5N	[479]
10-16-18	2*β*,6*α*,18,19-*ent*-trachylobantetraol	$C_{20}H_{32}O_4$	C_5D_5N	[479]
10-16-19	*ent*-1*α*-hydroxytrachyloban-18-oic acid	$C_{20}H_{30}O_3$	CD_3OD	[476]
10-16-20	wallichanol A	$C_{20}H_{32}O_2$	$CDCl_3$	[475]
10-16-21	wallichanol B	$C_{20}H_{30}O_3$	$CDCl_3$	[475]



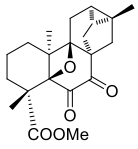
	R^1	R^2	R^3
10-16-1	H	COOH	Me
10-16-2	H	CH_2OH	COOH
10-16-4	=O	CH_2OH	Me



	R^1	R^2	R^3
10-16-3	=O	H	Me
10-16-5	H	OAc	COOH
10-16-6	H	OH	COOH



	R^1	R^2	R^3	R^4
10-16-7	=O	COOH	Me	Me
10-16-8	H	Me	OH	Me
10-16-9	H	CH_2OH	COOH	Me
10-16-10	OAc	Me	CHO	Me
10-16-11	OAc	Me	Me	CHO
10-16-12	H	CHO	Me	Me



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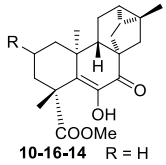
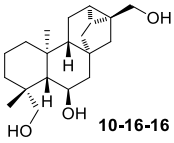
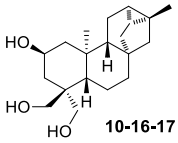


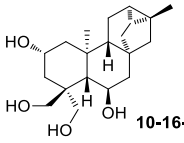
10-16-14 R = H
10-16-15 R = =O



10-16-16



10-16-17



10-16-18

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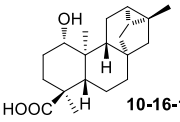

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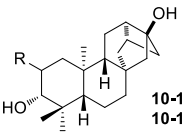

10-16-20 R = H
10-16-21 R = =O

Table 10-16-2: ^{1}H NMR spectroscopic data of trachylobane-type diterpenoids **10-16-1**~**10-16-4**.

H	10-16-1	10-16-2	10-16-3	10-16-4
1	1.35 m, 1.45 m	1.31 m, 1.41 m	1.77 ddd(13.5, 7.1, 3.5) 1.28 m	1.46 m
2	1.45 m, 1.57 m	1.44 m, 1.47 m	2.28 ddd(15.8, 5.9, 3.2) 2.56 ddd(15.8, 12.3, 6.8)	*α* 2.22 m *β* 2.62 m
3	ax 1.73 dt(13.8, 4.2) eq 1.58 m	ax 1.05 dt(13.3, 4.4) eq 2.32 br d(13.3)		
5	1.21 m	1.14 br d(10.4)	1.22 m	1.21 m
6	1.45 m	1.63 m, 1.66 m	1.18 m, 1.44 m	1.43 m
7	0.83 m	ax 0.77 dt(13.2, 4.0) eq 1.58 br d(13.2)	1.19 m, 1.48 m	*α* 1.25 m *β* 1.83 m
9	1.61 m	1.09 m	1.12 m	1.59 m
11	1.66 ddd(12.8, 7.2, 2.3) 1.88 m	1.64 m, 1.89 m	1.69 ddd(14.4, 7.4, 3.4) 1.90 ddd(14.4, 11.2, 3.0)	*α* 1.94 m *β* 1.72 m
12	0.57 br d(7.7)	0.58 br d(7.5)	0.59 br d(11.8)	0.62 d(7.8)
13	0.81 dd(7.7, 3.1)	0.82 dd(7.5, 3.1)	0.81 m	0.87 dd(7.8, 3.1)
14	1.14 m, 2.04 br d(11.8)	R 1.18 br d(11.0) S 2.03 br d(11.0)	1.21 m, 2.06 d(11.8)	*α* 1.24 m *β* 2.09 d(11.9)
15	1.26 d(11.3), 1.38 d(11.3)	1.22 d(11.3), 1.38 d(11.3)	1.23 d(12.0), 1.43 d(12.0)	*α* 1.44 d, *β* 1.27 d
17	1.12 s	1.12 s	1.13 s	1.14 s
18		3.40 d(10.5) 4.02 d(10.5)	1.01 s	3.37 d(11.4) 3.63 d(11.4)
19	1.14 s		1.04 s	0.99 s
20	0.97 s	0.91 s	1.10 s	1.18 s

Table 10-16-3: ^{1}H NMR spectroscopic data of trachylobane-type diterpenoids **10-16-5**~**10-16-8**.

H	10-16-5	10-16-6	10-16-7	10-16-8
1	0.90 m, 1.55 m	0.93 m, 1.55 m	*α* 1.77 ddd(13.0, 7.0, 3.2) *β* 1.29 m	ax 0.73 m eq 1.44 m
2	1.45 m, 1.55 m	1.52 m, 1.62 m	*α* 2.56 ddd(15.8, 13.0, 6.9) *β* 2.32 ddd(15.8, 6.1, 3.2)	ax 1.44 m eq 1.39 m
3	1.65 m, 1.70 m	1.65 m, 1.75 m		ax 1.27 m, eq 1.72 m
5	2.18 d(4.5)	2.23 d(4.6)	1.26 br d(10.5)	1.01 m

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Table 10-16-3 (continued)

H	10-16-5	10-16-6	10-16-7	10-16-8
6	1.40 m, 1.60 m	1.36 m, 1.76 m	1.50 m	ax 1.24 m, eq 1.66 m
7	4.65 br t(4.0)	3.60 br t(4.1)	α 1.52 m, β 1.42 m	1.40 m
9	1.60 m	1.52 m	1.20 br dd(12.0, 6.5)	1.15 m
11	1.70 m, 1.90 m	1.64 m, 1.69 m	α 1.79 ddd(15.0, 6.5, 2.7) β 2.04 ddd(15.0, 12.0, 3.6)	1.64 m 1.87 ddd(14.3, 11.6, 2.8)
12	0.64 m	0.64 m	1.80 br d(8.7)	0.55 m
13	0.90 m	1.11 m	1.98 dd(8.4, 3.4)	0.79 dd(7.7, 2.7)
14	1.45 d(4.8), 1.95 m	1.39 d(4.9), 1.99 m	1.31 dd(12, 3.6) 2.17 d(12.4)	en 2.02 d(11.9) ex 1.14 m
15	1.35 m, 1.55 m	1.32 m, 1.49 m	α 1.87 d(12.0), β 1.51 d(12.0)	1.23 d(11.4), 1.37 d(11.4)
17	1.18 s	1.20 s		1.11 s
18			1.06 s	
19	1.15 s	1.23 s	1.02 s	1.08 s
20	1.01 s	1.02 s	1.10 s	0.88 s
ACO	2.06 s			

Table 10-16-4: ^{1}H NMR spectroscopic data of trachylobane-type diterpenoids **10-16-9**~**10-16-12**.

H	10-16-9	10-16-10	10-16-11	10-16-12
1ax	0.87 m	1.02 m	1.01 m	0.71 dt(13.1, 3.7)
1eq	1.59 m	1.61 td(13.6, 3.5)	1.65 m	1.46 m
2	ax 1.64 m eq 1.45 m	1.70 m	ax 1.88 br d eq 1.96 m	ax 1.34 m eq 1.53 m
3	ax 1.75 m eq 1.53 m	4.91 dd(11.3, 5.1)	4.62 dd(12.0, 5.3)	ax 1.11 dd(9.2, 3.7) eq 1.34 m
5	1.65 m	1.31 m	1.06 m	0.75 dd(n.d., 2.0)
6ax	1.45 m	1.65 m	1.26 m	1.24 ddd(12.3, 6.0, 2.5)
6eq	1.12 m	1.70 m	1.68 m	1.51 m
7	ax 1.41 m eq 1.46 m	1.36 m	ax 1.45 td(13.4, 3.0) eq 1.32 dt(13.4, 4.0)	1.44 m
9	1.28 dd(10.7, 7.3)	1.04 s	1.04 s	1.17 ddd(n.d., 6.4, 1.7)
11	1.95 ddd(14.3, 11.7, 2.8) 1.74 m	1.61 td(13.8, 3.6) 1.89 ddd(14.5, 11.3, 3.1)	1.62 ddd(14.5, 7.2, 2.3) 1.89 m	1.81 ddd(15.1, 6.4, 2.6) 1.94 ddd(15.2, 11.3, 3.2)
12	0.81 m	0.58 td(7.8, 2.5)	0.57 td(7.8, 2.5)	2.01 dt(8.3, 3.5)
13	1.06 m(7.9, 3.0)	0.82 dd(8.0, 3.2)	0.80 dd(7.8, 3.1)	1.77 dt(8.5, 2.8)
14	en 2.14 d(11.9) ex 1.17 m	1.14 m, 2.01 d(11.7)	1.14 m, 1.94 d(11.7)	1.19 m, 2.22 d(12.1)

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Table 10-16-4 (continued)

H	10-16-9	10-16-10	10-16-11	10-16-12
15	1.42 d, 1.55 d	1.26 d(11.4), 1.37 m	1.21 d(11.2), 1.40 d(11.3)	1.44 m, 1.81 d(11.6)
17	3.52 s	1.12 s	1.11 s	8.92 s
18		9.22 s	1.04 s	0.83 s
19	1.13 s	1.03 s	10.00 s	0.78 s
20	1.01 s	0.99 s	0.83 s	0.94 s
OAc		1.94 s	2.03 s	

Table 10-16-5: ^{1}H NMR spectroscopic data of trachylobane-type diterpenoids **10-16-13**~**10-16-15**.

H	10-16-13	10-16-14	10-16-15
1	1.63 m, 2.20 m	1.19 m, 1.69 br d(9)	2.08 d(18), 2.53 d(18)
2	1.58 m	1.74 br d(11)	
3	1.64 br d(10), 1.78 br d(10)	1.54 br d(11), 2.18 m	2.44 d(18), 2.96 d(18)
9		1.78 br d(11)	1.95 br d(11)
11	2.11 dd(17, 2) 2.29 dd(17, 2)	1.86 br dd(14, 9) 2.02 ddd(14, 11, 4)	1.85 br dd(12, 9) 2.05 br dd(12, 4)
12	0.74 br dd(7, 2)	0.71 br d(6)	0.76 br dd(7, 3)
13	1.07 dd(7, 3)	1.02 dd(6, 3)	1.07 dd(8, 3)
14	1.74 d(13), 2.49 dd(13, 3)	1.91 br d(12), 2.18 m	1.99 m, 2.19 br d(12)
15	1.63 d(12), 2.31 d(12)	1.47 d(12), 2.21 d(12)	1.50 d(12), 2.25 d(12)
17	1.21 s	1.22 s	1.24 s
18	1.12 s	1.45 s	1.46 s
20	1.09 s	1.33 s	1.44 s
OMe	3.64 s	3.65 s	3.70 s
OH		6.24 s	6.32 s

Table 10-16-6: ^{1}H NMR spectroscopic data of trachylobane-type diterpenoids **10-16-16**~**10-16-18**.

H	10-16-16	10-16-17	10-16-18
1	0.81 dd(12.7, 3.9) 1.42 dt(12.8, sm)	1.21 m, 2.28 dt(11.3, sm)	1.75 m, 1.98 m
2	1.30 m, 1.50 m	4.42 br t	4.48 m
3	1.25 m, 1.70 m	1.90 t(12.5) 2.92 ddd(12.7, 4.3, 2.0)	1.98 m, 2.56 dd(13.4, 3.8)
5	1.18 d(10.9)	1.63 d(11.7)	1.33 m
6	4.38 m	1.55 m, 1.90 m	4.33 td(10.5, 3.5)
7	1.86 t(12.1) 2.01 dd(12.1, 3.3)	1.44 m, 1.50 m	1.75 m, 1.86 m
9	1.30 m	1.38 m	1.33 m
11	1.70 m, 1.93 d(11.1)	1.80 ddd(11.5, 6.3, 2.0) 1.90 m	1.82 m, 1.98 m

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Table 10-16-6 (continued)

H	10-16-16	10-16-17	10-16-18
12	1.00 d(7.7)	0.62 d(7.8)	0.62 d(7.7)
13	1.21 dd(7.7, 3.1)	0.87 d(7.8, 3.0)	0.87 dd(7.7, 2.9)
14	1.32 m, 2.14 d(11.8)	1.27 m, 2.11 d(11.8)	1.26 br d(11.8), 2.08 d(11.8)
15	1.93 d(11.1), 1.68 d(11.1)	1.27 d(11.2), 1.37 d(11.2)	1.33 m, 1.47 d(11.1)
17	3.90 d(11.1), 3.95 d(11.1)	1.14 s	1.15 s
18	1.63 s	4.02 d(10.8), 4.25 d(10.8)	4.09 d(10.8), 4.65 d(10.6)
19	3.71 dd(10.3, 2.6), 4.38 m	4.01 d(10.8), 4.22 d(10.8)	4.25 d(10.6), 4.57 d(10.6)
20	1.13 s	1.14 s	1.43 s

Table 10-16-7: ^{1}H NMR spectroscopic data of trachylobane-type diterpenoids **10-16-19**~**10-16-21**.

H	10-16-19	10-16-20	10-16-21
1	3.26 dd(11.4, 4.2)	α 1.56 m, β 0.93 m	α 2.40 d(12.0), β 2.06 d(12.0)
2	ax 1.69 dddd(13.9, 13.9, 11.4, 3.9)	α 1.57 m	
	eq 1.52 m	β 1.60 m	
3	ax 1.86 ddd(13.8, 13.8, 4.3)	3.22 dd(11.0, 4.2)	3.90 br d(4.2)
	eq 1.50 m		
5	1.59 dd(11.5, 1.7)	0.81 br d(11.7)	1.52 br d(11.5)
6	ax 1.48 m, eq 1.07 m	α 1.50 m, β 1.35 m	α 1.65 br d(12.9), β 1.42 m
7	ax 1.42 m	α 1.52 m	α 1.60 ddd(13.0, 3.0, 3.0)
	eq 1.34 m	β 1.23 m	β 1.35 m
9	1.44 m	1.19 br dd(12.0, 6.0)	1.55 m
11	2.10 ddd(15.4, 11.5, 3.5)	α 1.27 ddd(15.0, 5.5, 2.4)	α 1.34 m
	2.24 ddd(15.4, 7.3, 2.4)	β 1.76 ddd(15.0, 12.0, 3.0)	β 1.79 ddd(15.0, 11.5, 3.0)
12	0.57 ddd(7.9, 3.5, 2.4)	1.93 m	1.95 m
13	0.81 dd(7.9, 3.2)	2.04 q(6.7)	2.07 m
14	en 2.06 d(11.8)	0.86 br d(13.4)	0.91 br d(13.2)
	ex 1.15 ddd(11.8, 3.2, 1.7)	2.17 br dd(13.2, 6.6)	2.10 m
15	1.32 d(11.3)	α 1.70 d(12.0)	α 1.74 d(12.2)
	1.39 dd(11.3, 0.9)	β 1.26 m	β 1.33 m
17	1.12 s	1.45 d(8.2), 1.95 m	1.48 d(8.4), 1.97 m
18		0.98 s	1.19 s
19	1.12 s	0.77 s	0.70 s
20	1.06 s	0.91 s	0.89 s

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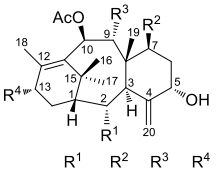
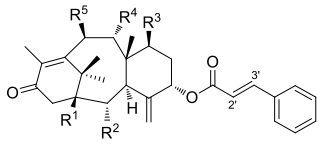
10.17 Taxane-type diterpenoids

Table 10-17-1: Compounds, MFs, and test solvents of taxane-type diterpenoids **10-17-1**~**10-17-18**.

No.	Compounds	MFs	Test solvents	References
10-17-1	7,9-dideacetyl-5-decinnamoyl taxinine J	$C_{26}H_{38}O_9$	$CDCl_3$	[480]
10-17-2	5*α*,9*α*-dihydroxy-2*α*,10*β*,13*α*-triacetoxytaxa-4(20),11-diene	$C_{26}H_{38}O_8$	$CDCl_3$	[481]
10-17-3	2*α*,9*α*,10*β*-triacetoxy-taxa-4(20),11-diene-5*α*,13*α*-diol	$C_{26}H_{38}O_8$	$CDCl_3$	[482]
10-17-4	10*β*-acetoxy-2*α*,5*α*,7*β*,9*α*-tetrahydroxytaxa-4(20),11-dien-13-one	$C_{22}H_{32}O_7$	CD_3OD	[483]
10-17-5	1*β*,2*α*,9*α*,10*β*-tetrahydroxy-5*α*-cinnamoyoxytaxa-4(20),11-dien-13-one	$C_{29}H_{36}O_7$	$CDCl_3$	[484]
10-17-6	2*α*,9*α*,10*β*-trihydroxy-5*α*-cinnamoyoxytaxa-4(20),11-dien-13-one	$C_{29}H_{36}O_6$	$CDCl_3$	[484]
10-17-7	1*β*,7*β*-dihydroxytaxinine	$C_{35}H_{42}O_{11}$	$CDCl_3$	[485]
10-17-8	2*α*,9*α*-dihydroxy-10*β*,13*α*-diacetoxy-5*α*-(3′-*N*-methyl-amino)-3′-phenyl)propanoyloxytaxa-4(20),11-diene	$C_{34}H_{47}NO_8$	$CDCl_3$	[486]
10-17-9	2*α*-hydroxy-7*β*,9*α*,10*β*,13*α*-tetraacetoxy-5*α*-(2′-hydroxy-3′-*N*,*N*-dimethylamino-3′-phenyl)-propanoyloxy-taxa-4(20),11-diene	$C_{39}H_{53}NO_{12}$	CD_3COCD_3	[486]
10-17-10	2-*O*-deacetyl taxine II	$C_{35}H_{47}NO_8$	$CDCl_3$	[487]
10-17-11	2*α*,7*β*,9*α*,10*β*-tetra-acetoxy-5*α*-[(2*R*,3*S*)-*N*,*N*-dimethyl-3-phenylisoseryloxy]-taxa-4(20),11-dien-13-one	$C_{39}H_{51}NO_{12}$	$CDCl_3$	[488]
10-17-12	1*β*,10*β*-dihydroxy-9*α*,13*α*-diacetoxy-5*α*-(3′-dimethylamino-3′-phenyl)-propionyloxy-taxa-4(20),11-diene	$C_{35}H_{49}NO_8$	$CDCl_3$	[489]
10-17-13	hongdoushan A	$C_{29}H_{44}O_7$	$CDCl_3$	[490]
10-17-14	hongdoushan B	$C_{27}H_{40}O_7$	$CDCl_3$	[490]
10-17-15	2*α*,9*α*,10*β*-triacetoxy-5*α*,14*β*-dihydroxy-4(20),11(12)-taxa-diene	$C_{26}H_{38}O_8$	$CDCl_3$	[491]
10-17-16	tasumatrol K	$C_{29}H_{44}O_8$	$CDCl_3$	[492]
10-17-17	9*α*,10*β*-diacetoxy-2*α*,5*α*,14*β*-trihydroxy-4,20-epoxy,11(12)-taxene	$C_{24}H_{36}O_8$	$CDCl_3$	[491]
10-17-18	9*α*,10*β*-diacetoxy-2*α*,5*α*,14*β*-trihydroxy-4,20:11,12-diepo-xytaxane	$C_{24}H_{36}O_9$	$CDCl_3$	[491]



	R^1	R^2	R^3	R^4
10-17-1	OAc	OH	OH	OAc
10-17-2	OAc	H	OH	OAc
10-17-3	OAc	H	OAc	OH
10-17-4	OH	OH	OH	=O



	R^1	R^2	R^3	R^4	R^5
10-17-5	**OH**	OH	H	OH	OH
10-17-6	H	OH	H	OH	OH
10-17-7	OH	OAc	OH	OAc	OAc

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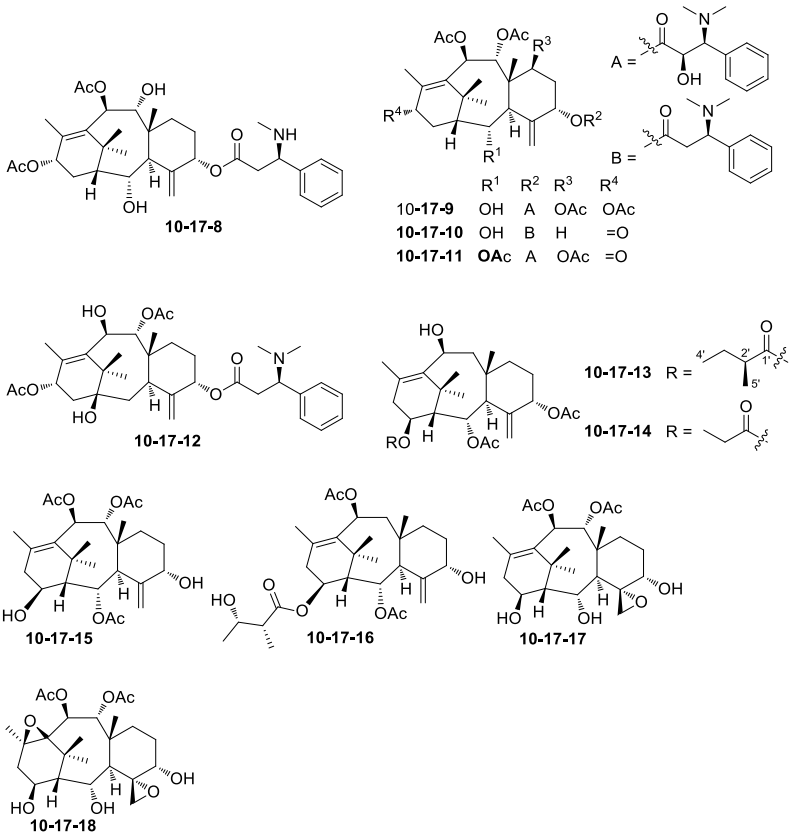

Table 10-17-2: ^{1}H NMR spectroscopic data of taxane-type diterpenoids **10-17-1**~**10-17-4**.

H	10-17-1	10-17-2	10-17-3	10-17-4
1	1.77 dd(8.6, 1.6)	1.75 m	1.75 br d(6.9)	2.23 br d(6.5)
2	5.41 dd(5.5, 1.6)	5.38 dd(5.8, 1.7)	5.41 dd(5.8, 1.9)	4.20 dd(5.4, 1.0)
3	3.40 d(5.5)	3.51 d(5.8)	3.46 d(5.8)	3.18 d(5.4)
5	4.24 t(2.9)	4.23 s	4.30 br s	4.04 t(3.2)
6	2.10 m, 1.59 m	1.79 m, 1.61 m	1.70 m	1.88 m, 1.57 m
7	4.44 dd(11.1, 5.1)	1.51 m	1.95 m	4.28 dd(11.7, 5.1)
9	4.37 d(10.3)	4.21 d(9.9)	5.76 d(10.5)	4.23 d(10.0)
10	6.08 d(10.2)	5.86 d(9.9)	6.05 d(10.5)	6.11 d(10.0)
13	5.77 br ddq(10.5, 5.1, 1.2)	5.73 m	4.35 m	
14	2.63 ddd(15.6, 10.5, 8.8)	2.63 ddd(15.8, 10.5, 9.1)	2.70 m	2.70 dd(19.8, 6.5)
	1.46 dd(15.6, 5.3)	1.51 dd(15.8, 5.1)	1.56 m	2.37 d(19.8)
16	1.03 s	1.00 s	1.66 s	1.11 s
17	1.60 s	1.57 s	0.93 s	1.60 s
18	2.13 d(1.4)	2.14 s	2.25 br s	2.14 s

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Table 10-17-2 (continued)

H	10-17-1	10-17-2	10-17-3	10-17-4
19	1.12 s	1.04 s	0.85 s	1.15 s
20	4.96 t(1.5), 5.25 br s	4.88 s, 5.21 br s	4.84 br s, 5.21 br s	5.46 d(1.2), 5.13 d(1.2)
OAc	2.06 s, 2.09 s, 2.13 s	2.04 s(2-OAc) 2.09 s(10-OAc) 2.10 s(13-OAc)	2.01 s(2-OAc) 2.04 s(9-OAc) 2.05 s(10-OAc)	2.11 s

Table 10-17-3: ^{1}H NMR spectroscopic data of taxane-type diterpenoids **10-17-5**~**10-17-8**.

H	10-17-5	10-17-6	10-17-7	10-17-8
1		2.36 dd(6.9, 2.1)		2.05 m(ov)
2	4.04 d(6.6)	4.21 dd(6.4, 2.1)	5.56 d(6.0), 2.14 s(OAc)	4.06 dd(6.8, 2.1)
3	3.36 d(6.6)	3.23 d(6.4)	3.18 d(6.0)	2.97 d(6.8)
5	5.31 br t(2.5)	5.32 br s	5.35 t(3.0)	5.26 t(2.6)
6	1.73 m, 1.98 m	1.77 m, 1.99 m	*α* 2.19 ddd(14.5, 5.0, 3.0) *β* 1.74 m	1.65 m
7	1.43 m, 1.81 m	1.47 m, 1.78 m	4.19 dd(11.5, 5.0) 2.58 br s(OH)	1.30 m, 1.80 m
9	4.17 d(9.6)	4.09 d(9.2)	5.89 d(10.9), 2.07 s(OAc)	4.19 d(10.0)
10	4.91 d(9.6))	4.87 d(9.2)	6.08 d(10.9), 2.09 s(OAc)	5.76 d(10.0)
13				5.84 br t(8.9)
14	2.64 d(19.2) 2.71 d(19.2)	2.84 dd(19.8, 7.0) 2.24 d(19.8)	*α* 2.63 d(20.0) *β* 2.94 d(20.0)	1.27 m(ov) 2.48 m(ov)
16	1.35 s	1.25 s	1.72 s	1.11 s
17	1.60 s	1.64 s	1.24 s	1.51 s
18	2.10 s	2.11 s	2.29 s	1.98 br s
19	1.16 s	1.14 s	0.99 s	1.06 s
20	5.45 br s, 5.37 br s	5.42 br s, 5.37 br s	5.37 s, 4.93 s	5.40 s, 5.39 s
2′	6.38 d(15.7)	6.40 d(16.0)	6.43 d(16.0)	2.83 m
3′	7.63 d(15.7)	7.64 d(16.0)	7.67 d(16.0)	4.01 br dd(7.8, 5.8)
5′/9′	7.75 br d(7.5)	7.75 br d(7.5)	7.78 m	7.34 m①
6′/8′	7.44 m	7.44 m	7.44 m	7.33 m①
7′	7.41 m	7.39 m	7.44 m	7.28 m①
OAc				2.08 s, 1.66 s
NCH_3				2.32 s

① The data of 3′-Ph in the literature were not assigned, and here, the deployments are only to display the data.

Table 10-17-4: ^{1}H NMR spectroscopic data of taxane-type diterpenoids **10-17-9**~**10-17-12**.

H	10-17-9	10-17-10	10-17-11	10-17-12
1	2.06 m	2.37 br d(7.1)	2.20 br d(6.9)	
2	4.26 td(6.5, 1.9) 3.52 d(6.5)	4.26 br d(7.1)	5.53 dd(6.3, 1.9)	*α* 2.05 m *β* 1.41 d(12.9)

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Table 10-17-4 (continued)

H	10-17-9	10-17-10	10-17-11	10-17-12
3	2.78 d(ov)	3.04 br d(7.1)	2.93 d(6.3)	2.61 d(8.2)
5	5.15 t (2.7)	5.07 br s	4.94 br s	5.21 br s
6	0.85 br, 1.55 m	1.57 m	1.40 ddd(21.2, 11.6, 4.4) 1.03 dd(21.2, 5.8)	1.53 m
7	5.29 dd(10.8, 4.3)		5.21 dd(11.6, 5.8)	1.30 m
9	5.80 d(10.8)	5.78 d(10. 1)	5.84 d(10.7)	5.53 d(9.3)
10	6.16 d(10.8)	6.01 d(10.1)	6.19 d(10.7)	4.43 br d(8.2)
13	5.91 br t(*ca*. 9)			5.51 t(6.6)
14	2.44 dt(15.2, 9.7) 1.43 m(ov)	*α* 2.18 br d(19.8) *β* 2.83 dd(19.8, 6.9)	*α* 2.31 d(20.3) *β* 2.81 dd(20.3, 6.9)	*α* 1.20 m *β* 2.38 dd(6.9, 13.7)
16	1.12 s	1.68 s	1.72 s	1.37 s
17	1.66 s	1.16 s	1.13 s	1.15 s
18	2.24 s	2.23 s	2.44 s	1.93 br s
19	0.95 s	0.90 s	0.91 s	0.68 s
20	5.82 s, 5.35 s	5.40 s, 5.38 s	5.34 br s, 4.83 br s	5.08 br s, 4.69 br s
OAc	2.07 s, 2.03 s	2.05 s, 2.06 s	2.03 s(2-OAc), 2.04 s(7-OAc)	2.12 s(9-OAc)
	2.02 s, 1.94 s		2.04 s(9-OAc), 2.04 s(10-OAc)	1.95 s(13-OAc)
2′	3.93 br	2.93 dd(7.1, 15.7) 2.54 dd(7.4, 15.7)	4.43 d(10.1)	2.90 dd(6.9, 13.7) 2.66 dd(9.1, 13.7)
3′	4.77 br	3.83 t(7.2)	3.68 d(10.1)	3.78 t(8.3)
5′/9′	7.45 br (7.2)	7.32 m	7.20 m	7.34 m
6′/8′	7.38 t	7.32 m	7.33 m	7.27 m
7′	7.31 t	7.32 m	7.33 m	7.27 m
$N(CH_3)_2$	2.30 br	2.22 s	2.30 s	2.16 s

Table 10-17-5: ^{1}H NMR spectroscopic data of taxane-type diterpenoids **10-17-13**~**10-17-16**.

H	10-17-13	10-17-14	10-17-15	10-17-16
1	1.86 d(2.2)	1.87 d(2.2)	1.79 br s	1.87 d(1.5)
2	5.36 dd(6.3, 2.2)	5.36 dd(6.3, 2.2)	5.47 br s	5.36 dd(6.1, 1.5)
3	2.94 d(6.3)	2.93 d(6.3)	3.22 d(6.6)	2.69 d(6.1)
5	5.28 t(3.0)	5.28 t(3.0)	3.42 br s	4.19 m
6	1.80 m, 1.76 m	1.80 m, 1.76 m	1.73 m	2.18 m, 1.74 m
7	1.92 m, 1.21 m	1.92 m, 1.21 m	1.65 m	1.20 m, 1.15 m
9	1.64 dd(15.1, 5.9), 2.35 m	2.35 dd(15.1, 11.9) 1.67 dd(15.1, 5.9)	5.77 d(10.4)	1.61 m, 2.28 m
10	5.10 dd(11.7, 5.6)	5.11 dd(11.7, 5.6)	6.07 d(10.4)	6.11 dd(5.3, 1.5)
13	2.83 dd(19.1, 9.2) 2.35 m	2.81 dd(19.1, 9.2) 2.40 dd(19.1, 4.7)	2.68 dd(14.4, 8.0) 2.44 dd(14.4, 4.5)	2.41 m, 2.81 m
14	4.99 dd(9.2, 4.7)	5.00 dd(9.2, 4.7)	4.08 dd(9.0, 5.2)	5.08 m

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Table 10-17-5 (continued)

H	10-17-13	10-17-14	10-17-15	10-17-16
16	1.73 s	1.72 s	1.17 s	1.66 s
17	1.19 s	1.18 s	1.71 s	1.12 s
18	1.98 s	1.98 s	2.15 s	2.09 s
19	0.85 s	0.84 s	0.82 s	0.81 s
20	5.25 br s, 4.81 br s	5.25 br s, 4.88 br s	4.79 s, 5.17 s	5.12 s, 4.75 s
2′	2.35 m	2.28 q(7.5)		2.36 m
3′	1.63 m, 1.46 m	1.10 t (7.5)		3.85 m
4′	0.88 t(7.3)			1.22 d(6.3)
5′	1.12 d(6.9)			1.15 d(7.2)
OAc	2.17 s(2-OAc)	2.17 s(2-OAc)	2.08 s(2-OAc)	2.03 s(2-OAc)
	2.01 s(5-OAc)	2.04 s(5-OAc)	2.03 s(9-OAc)	2.06 s(10-OAc)
			2.01 s(10-OAc)	

Table 10-17-6: ^{1}H NMR spectroscopic data of taxane-type diterpenoids **10-17-17** and **10-17-18**.

H	10-17-17	10-17-18	H	10-17-17	10-17-18
1	1.90 br s	1.64 br s	13	2.50 dd(13.5, 3.0)	2.44 m
				2.75 m	
2	4.08 br s	4.18 br s	14	4.21 dd(8.4, 5.1)	4.33 dd(8.7, 6.9)
3	2.88 d(4.5)	2.60 br s	16	1.17 s	1.00 s
5	3.11 br s	3.22 br s	17	1.59 s	1.65 s
6	1.74 m	1.95 m	18	2.15 s	1.93 s
7	1.68 m	1.71 m	19	0.96 s	1.03 s
9	5.65 d(10.5)	5.78 d(10.7)	20	2.66 d(4.2), 3.67 d(4.2)	2.70 d(3.6), 3.80 d(3.6)
10	6.05 d(10.5)	5.33 d(10.7)	OAc	1.99 s(9-OAc)	2.03 s(9-OAc)
				2.05 s(10-OAc)	2.03 s(10-OAc)

Table 10-17-7: Compounds, MFs, and test solvents of taxane-type diterpenoids **10-17-19**~**10-17-26**.

No.	Compounds	MFs	Test solvents	References
10-17-19	5*α*-*O*-(3′-dimethylamino-3′-phenylpropionyl)taxinine M	$C_{46}H_{55}NO_{15}$	$CDCl_3$	[493]
10-17-20	tasumatrol L	$C_{36}H_{44}O_{15}$	$CDCl_3$	[492]
10-17-21	taxezopidine N	$C_{39}H_{51}NO_{13}$	CD_3OD	[494]
10-17-22	taxezopidine M	$C_{37}H_{49}NO_{10}$	CD_3OD	[494]
10-17-23	5-decinnamoyltaxuspine D	$C_{30}H_{42}O_{12}$	$CDCl_3$	[480]
10-17-24	taxinine A 11,12-epoxide	$C_{26}H_{36}O_9$	$CDCl_3$	[495]
10-17-25	dantaxusin C	$C_{37}H_{44}O_{12}$	$CDCl_3$	[496]
10-17-26	2*α*,9*α*-diacetoxy-5*α*-cinnamoyloxy-11,12-epoxy-10*β*-hydroxytax-4(20)-en-13-one	$C_{33}H_{40}O_9$	$CDCl_3$	[497]

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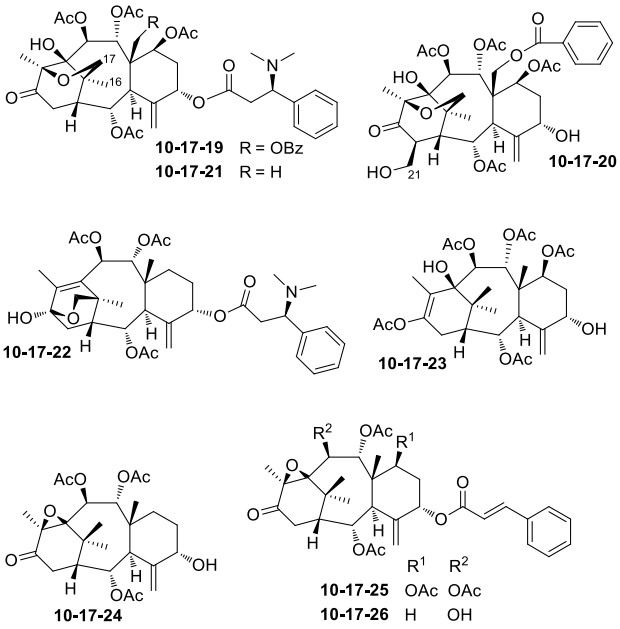

Table 10-17-8: ^{1}H NMR spectroscopic data of taxane-type diterpenoids **10-17-19**~**10-17-22**.

H	10-17-19	10-17-20	10-17-21	10-17-22
1	2.48 m	2.43 s	2.54 m	2.14 m
2	6.11 br d(10.2)	6.21 d(9.9)	5.59 m	5.53 d(4.9)
3	3.42 d(10.2)	3.77 br s	3.29 m	2.96 d(4.9)
5	5.23 br s	4.47 br s	5.17 m	5.21 br s
6	2.00 m, 1.55 m	*α* 2.18 m, *β* 1.72 m	1.93 m, 1.55 m	1.76 m
7	5.34 br d(6.2)	5.49 m	5.29 m	1.76 m
9	5.31 d(3.0)	5.42 br s	5.27 d(2.6)	5.75 d(10.7)
10	5.29 d(3.0)	5.32 s	5.35 d(2.6)	6.07 d(10.7)
11	4.15 br s(OH)①			
14	3.10 dd(11.5, 19.2) 2.65 d(19.2)	3.01 br s	3.23 m, 2.51 m	1.48 d(15.4), 2.14 m
16	1.26 s	1.28 s	1.53 s	1.49 s
17	3.65 d(8.0), 4.10 d(7.9)	3.63 d(8.1), 4.00 d(8.1)	3.82 d(8.1), 4.12 d(8.1)	3.08 d(8.1), 3.52 d(8.1)
18	1.15 s	1.16 s	1.12 s	2.27 s
19	5.19 d(12.2) 4.37 d(12.2)	5.10 d(12.3) 4.38 d(12.3)	1.05 s	0.89 s
20	5.49 s, 4.75 s	5.41 s, 4.69 s	4.63 s, 5.37 s	5.32 s, 5.12 s

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Table 10-17-8 (continued)

H	10-17-19	10-17-20	10-17-21	10-17-22
OAc	1.97 s, 1.97 s, 2.06 s, 2.11 s	2.05 s(2-OAc)	1.99 s(2-OAc)	2.04 s(2-OAc)
		2.16 s(7-OAc)	2.17 s(7-OAc)	2.07 s(9-OAc)
		2.03 s(9-OAc)	2.12 s(9-OAc)	2.00 s(10-OAc)
		2.11 s(10-OAc)	2.02 s(10-OAc)	
NMe	2.76 s, 2.88 s		3.02 m, 2.88 m	2.82 m, 2.82 m
2′	3.78 m		3.72 m, 3.64 m	3.28 m, 3.64 m
3′	4.95 m		5.00 m	4.83 m
3′-Ph	7.48 m		7.61 m	7.53 m
19-OBz	8.12 d(7.9, *o*)	8.16 d(7.2, *o*)		
	7.48 m(*m*)	7.52 t(7.2, *m*)		
	7.58 m(*p*)	7.61 t(7.2, *p*)		
21		3.79 br d(8.0)		

① This signal was not assigned as hydroxyl in the literature. But the C-11 was a quaternary carbon, this signal was infered to due to 11-OH.

Table 10-17-9: ^{1}H NMR spectroscopic data of taxane-type diterpenoids **10-17-23**~**10-17-26**.

H	10-17-23	10-17-24	10-17-25	10-17-26
1	1.88 d(7.8)	1.91 m	2.00 m	1.93 m
2	5.72 d(7.2)	5.74 dd(5.4, 1.8)	5.78 dd(5.6, 1.2)	5.73 dd(5.3, 1.6)
3	3.61 d(7.2)	3.28 d(5.5)	3.08 d(5.6)	3.09 d(5.3)
5	4.22 br t(8.3)	4.30 br s	5.52 t(4.0)	5.47 m
6	2.20 m, 1.78 m	*α* 1.78 m, *β* 1.72 m	*α* 2.16 m, *β* 1.86 m	1.98 m, 1.87 m
7	4.72 dd(10.0, 8.1)	*α* 1.93 m, *β* 1.72 m	5.64 dd(11.2, 2.6)	1.77 m
9	4.70 d(4.9)	5.96 d(10.8)	6.04 d(11.2)	5.91 d(10.5)
10	5.57 d(4.9)	5.38 d(10.8)	5.47 d(11.2)	3.83 d(10.5)
14	2.57 ddd(18.5, 7.8, 1.2)	*α* 2.48 d(19.8)	*α* 2.35 d(20.0)	*α* 2.42 d(20.1)
	2.38 d(18.5)	*β* 2.65 dd(19.8, 8.8)	*β* 2.70 dd(20.0, 8.4)	*β* 2.68 dd(8.8, 20.1)
16	1.17 s	1.83 s	0.82 s	0.84 s
17	1.46 s(ov)	0.80 s	1.84 s	1.84 s
18	1.55 s	1.94 s	2.12 s	1.91 s
19	1.46 s(ov)	0.94 s	1.05 s	1.00 s
20	5.27 br s, 5.04 br s	5.29 s, 5.14 s	5.12 s, 5.58 s	5.49 s, 5.19 s
OAc	1.94 s, 1.97 s(× 2), 2.17 s, 2.20 s	2.05 s, 2.06 s, 2.07 s	2.02 s(2-OAc)	2.06 s, 2.13 s
			2.04 s(7-OAc)	
			2.08 s(9-OAc)	
			2.05 s(10-OAc)	
2′			6.23 d(16)	6.24 d(16.0)
3′			7.70 d(16)	7.65 d(16.0)
3′-Ph			7.60 m(H-5′, 9′)	7.60 m(H-5′, 9′)
			7.50 m(H-6′, 7′, 8′)	7.43 m(H-6′, 7′, 8′)
OH	2.14 s(11-OH)			

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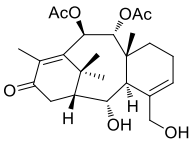
Table 10-17-10: Compounds, MFs, and test solvents of taxane-type diterpenoids **10-17-27**~**10-17-31**.

No.	Compounds	MFs	Test solvents	References
10-17-27	2*α*,20-dihydroxy-9*α*,10*β*-diacetoxy-taxa-4,11-diene-13-one	$C_{24}H_{34}O_7$	$CDCl_3$	[498]
10-17-28	2*α*,9*α*,10*β*-triacetoxy-20-hydroxy-11,12-epoxytaxa-4-en-13-one	$C_{26}H_{36}O_9$	$CDCl_3$	[499]
10-17-29	7,9-deacetyltaxuspine L	$C_{28}H_{42}O_{11}$	$CDCl_3$	[480]
10-17-30	taxumairol N	$C_{28}H_{42}O_{12}$	$CDCl_3$	[500]
10-17-31	taxumairol O	$C_{28}H_{42}O_{13}$	$CDCl_3$	[500]
			CD_3COCD_3	[500]



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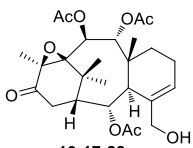

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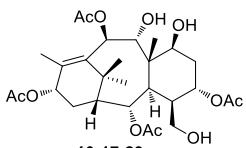

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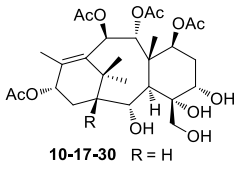

10-17-30 R = H
10-17-31 R = OH

Table 10-17-11: ^{1}H NMR spectroscopic data of taxane-type diterpenoids **10-17-27**~**10-17-30**.

H	10-17-27	10-17-28	10-17-29	10-17-30
1	2.50 dd(7.4, 4.4)	1.94 m(ov)	1.91 br d(8.1)	1.90 m
2	4.33 dd(4.4, 8.5)	5.83 br m(2.4)	5.32 dd(5.9, 2.9)	3.65 br s
3	2.79 br d(8.5)	3.23 br m(5.7)	2.62 d(ov)	2.94 d(4.5)
4			2.00 m(ov)	
5	5.35 br s	5.93 m	5.11 m	4.27 br s
6	1.34 m, 2.19 m	2.10 m	1.77 ddd(14.7, 11.2, 2.7) 1.98 m(ov)	1.70 m, 1.95 m
7	1.35 m, 1.98 m	1.96 m(ov) 1.39 td(12.2, 12.2, 6.1)	4.14 dd(11.2, 4.6)	5.59 dd(11.4, 4.8)
9	5.95 d(10.4)	6.12 d(11.1)	4.43 d(10.3)	5.67 d(11)
10	6.00 d(10.4)	5.20 d(11.2)	5.97 d(10.2)	6.10 d(11)
13			5.89 br t(8.6)	5.65 (ov)
14	*α* 2.45 d(20.3) *β* 2.78 dd(20.3, 7.4)	3.04 d(20.1) 2.63 dd(20.1, 8.4)	2.60 m(ov) 1.47 dd(15.4, 8.1)	2.00 m, 2.60 m
16	1.67 s	0.84 s	1.13 s	1.60 s
17	1.20 s	1.90 s	1.60 s	1.00 s
18	2.07 s	1.59 s	2.14 br s	2.19 s
19	0.90 s	1.00 s	1.06 s	1.00 s

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Table 10-17-11 (continued)

H	10-17-27	10-17-28	10-17-29	10-17-30
20	4.41 dt(13.2, 1.6) 4.24 dt(13.2, 2.2)	4.12 d(11.7), 4.62 br d(11.9)	3.41 m, 3.47 m	3.67 d(10.8), 4.22 d(10.8)
OAc	2.07 s(9-OAc)	(ov)	2.20 s, 2.10 s, 2.11 s(ov), 2.14 s(ov)	2.09 s(7-OAc)
	2.10 s(10-OAc)			2.03 s(9-OAc) 2.00 s(10-OAc) 1.94 s(13-OAc)
OH	–	–	–	2.80 br s, 3.13 br s, 4.89 br s

Table 10-17-12: ^{1}H NMR spectroscopic data of taxane-type diterpenoid **10-17-31**.

H	10-17-31($CDCl_3$)	10-17-31(CD_3COCD_3)	H	10-17-31($CDCl_3$)	10-17-31(CD_3COCD_3)
2	4.00 br s	4.22 d(4.2)	13	5.84 d(9.0)	5.84 m
3	2.58 d(3.0)	2.68 d(4.2)	14	2.40 m	β 2.47 dd(15.6, 6.9)
5	4.21 br s	4.17 m	16	1.58 s	1.55 s
6	2.00 m, 1.73 m	–	17	1.37 s	1.38 s
7	5.57 dd(10.8, 3.9)	5.67 dd(4.2, 12)	18	2.12 s	2.11 s
9	5.78 d(11)	5.86 d(11.1)	19	1.11 s	1.11 s
10	6.13 d(11)	6.12 d(11)	20	4.30 d(10.4) 3.94 d(10.4)	4.20 3.95
OAc	2.08 s(7-OAc) 2.07 s(9-OAc) 2.05 s(10-OAc) 1.98 s(13-OAc)	1.95 s, 2.03 s, 2.05 s, 2.09 s	OH		5.17 d(4.2)

Table 10-17-13: Compounds, MFs, and test solvents of taxane-type diterpenoids **10-17-32**~**10-17-36**.

No.	Compounds	MFs	Test solvents	References
10-17-32	1β-hydroxy-10-deacetyl-10-glycolylbaccatin I	$C_{32}H_{44}O_{15}$	$CDCl_3$	[501]
10-17-33	9α,10β-diacetoxy-5α,13α-dihydroxy-4,20-epoxy-11(12)-taxene	$C_{24}H_{36}O_7$	$CDCl_3$	[491]
10-17-34	9α,10β-diacetoxy-2α,5α,14β-trihydroxy-4,20-epoxy-11(12)-taxene	$C_{24}H_{36}O_8$	$CDCl_3$	[491]
10-17-35	9α,10β-diacetoxy-5α,13α-dihydroxy-4,20:11,12-diepoxy-taxane	$C_{24}H_{36}O_8$	$CDCl_3$	[491]
10-17-36	9α,10β-diacetoxy-2α,5α,14β-trihydroxy-4,20:11,12-diepoxytaxane	$C_{24}H_{36}O_9$	$CDCl_3$	[491]

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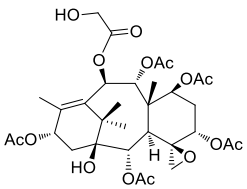

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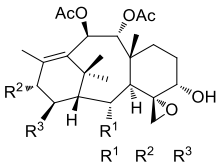
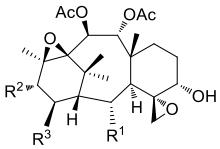


	R^1	R^2	R^3
10-17-33	H	OH	H
10-17-34	OH	H	OH



	R^1	R^2	R^3
10-17-35	H	OH	H
10-17-36	OH	H	OH

Table 10-17-14: ^{1}H NMR spectroscopic data of taxane-type diterpenoids **10-17-32**~**10-17-36**.

H	10-17-32	10-17-33	10-17-34	10-17-35	10-17-36
1		1.44 br s	1.90 br s	1.62 br s	1.64 br s
2	5.47 d(ov)	0.98 br s, 1.36 br s	4.08 br s	0.93 br s, 1.47 br s	4.18 br s
3	3.14 d(3.0)	3.09 d(4.7)	2.88 d(4.5)	2.68 br s	2.60 br s
5	4.21 t(2.8)	3.41 br s	3.11 br s	3.48 br s	3.22 br s
6	2.16 m(ov) 1.74 ddd(13.6, 3.6, 1.9)	1.76 m, 1.87 m	1.74 m	1.84 m, 1.93 m	1.95 m
7	5.48 dd(10.0, 4.3, ov)	1.59 m	1.68 m	1.66 m	1.71 m
9	6.08 d(11.1)	5.69 d(10.3)	5.65 d(10.5)	5.84 d(10.8)	5.78 d(10.7)
10	6.38 d(11.1)	6.06 d(10.3)	6.05 d(10.5)	5.44 d(10.8)	5.33 d(10.7)
13	6.10 t(8.2)	4.38 br d(7.5)	2.50 dd(13.5, 3.0) 2.75 m	4.14 br t(9.2)	2.44 m
14	2.53 dd(14.4, 9.2) 1.88 dd(14.4, 6.4)	2.79 m 1.65 m	4.21 dd(8.4, 5.1)	1.32 m 2.49 m	4.33 dd (8.7, 6.9)
16	1.23 s	0.90 s	1.17 s	1.59 s	1.00 s
17	1.61 s	1.48 s	1.59 s	0.85 s	1.65 s
18	2.25 s	2.22 s	2.15 s	1.93 s	1.93 s
19	1.24 s	0.79 s	0.96 s	0.87 s	1.03 s
20	3.53 d(5.5) 2.31 d(5.5)	2.60 br s	2.66 d(4.2) 3.67 d(4.2)	2.66 br s	2.70 d(3.6) 3.80 d(3.6)
OAc	2.04 s×2, 2.08 s 2.11 s, 2.22 s	2.00 s(9-OAc) 2.05 s(10-OAc)	1.99 s(9-OAc) 2.05 s(10-OAc)	2.04 s(9-OAc) 2.04 s(10-OAc)	2.03 s(9-OAc) 2.03 s(10-OAc)
1′	4.07 dd(17.5, 5.4) 4.02 dd(17.5, 4.3)				
OH	2.34 t(5.2)				

Table 10-17-15: Compounds, MFs, and test solvents of taxane-type diterpenoids **10-17-37**~**10-17-40**.

No.	Compounds	MFs	Test solvents	References
10-17-37	1-dehydroxylbaccatin III	$C_{31}H_{38}O_{10}$	$CDCl_3$	[502]
10-17-38	13-*epi*-10-deacetylbaccatin III	$C_{29}H_{36}O_{10}$	DMSO-d_6	[503]
10-17-39	19-hydroxybaccatin III	$C_{31}H_{38}O_{12}$	–	[504]
10-17-40	19-hydroxy-7-*epi*-baccatin III	$C_{31}H_{38}O_{12}$	$CDCl_3$	[505]

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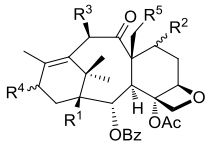

	R^1	R^2	R^3	R^4	R^5
10-17-37	H	β-OH	OAc	α-OH	H
10-17-38	OH	β-OH	OH	β-OH	H
10-17-39	OH	β-OH	OAc	α-OH	OH
10-17-40	OH	α-OH	OAc	α-OH	OH

Table 10-17-16: ^{1}H NMR spectroscopic data of taxane-type diterpenoids **10-17-37**~**10-17-40**.

H	10-17-37	10-17-38	10-17-39	10-17-40
1	1.96			
2	5.62 d(8)	5.36 d(6.9)	6.34 d(7)	6.26 d(7.7)
3	4.00 d(8)	3.52 d(6.9)	3.88 d(7)	4.00 d(7.3)
5	5.00 dd(9, 1)	4.92 br d(8.5)	5.00 m	4.98 dd(9.4, 2.8)
6	1.86 m, 2.15 m	α 2.30 m, β 1.62 rn	2.6 m	2.20 m
7	4.47 dd(11, 7)	4.02 m	4.4 m	3.86 ddd(11.7, 5.1, 1.8) 4.94 d(11.4, OH)
10	6.32 s	5.11 d(2.4)	6.41 s	6.86 s
13	4.88 br t(8)	3.71 m	5.0 m	4.83 m, 2.07 d(4.0, OH)
14	2.56 m	α 2.56 dd(14.0, 9.8) β 1.73 br d(14.0)	2.6 m	2.20 m
16	1.26 s	0.95 s	1.25 s	1.26 s
17	1.10 s	1.12 s	1.11 s	1.65 s
18	2.00 s	1.85 br s	2.07 d(1.5)	1.99 d(1.5)
19	1.68 s	1.51 s	–	α 4.48 dd(12.5, 5.9) β 4.24 dd(12.3, 7.9) 2.95 dd(5.9, 8.1, OH)
20	4.18 d(8) 4.30 d(8)	4.02 s	4.72 ABq(12) 4.30 ABq(8)	4.45 d(8.6) 4.37 d(8.6)
OAc	2.22 s, 2.37 s	2.25 s	2.26 s, 2.29 s	2.22 s, 2.37 s
OBz	7.46 m 8.05 dd(8, 2)	8.00 d(7.6, *o*) 7.54 t(7.6, *m*) 7.64 t (7.6, *p*)	8.13 dd(2, 8) 7.54 m	8.12 dd(7.0, 1.5, *o*) 7.62 m(*m*) 7.49 m(*p*)

Table 10-17-17: Compounds, MFs, and test solvents of taxane-type diterpenoids **10-17-41**~**10-17-45**.

No.	Compounds	MFs	Test solvents	References
10-17-41	2′-acetyl-7-*epi*-taxol	$C_{49}H_{53}NO_{15}$	$CDCl_3$	[506]
10-17-42	10-deacetyl-10-oxo-7-*epi*-cephalomannine	$C_{43}H_{49}NO_{13}$	$CDCl_3$	[507]
10-17-43	*N*-acetyl-*N*-debenzoyltaxol	$C_{42}H_{49}NO_{14}$	$CDCl_3$	[501]
10-17-44	taxuyunnanine Z	$C_{26}H_{38}O_{11}$	CD_3OD, C_5D_5N	[508]
10-17-45	9α-hydroxy-2α,10β,13α-triacetoxytaxa-4(20),5(6),11(12)-triene	$C_{26}H_{36}O_7$	$CDCl_3$	[509]

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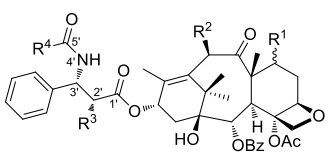
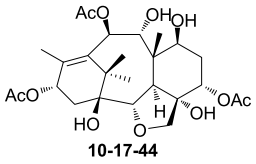


	R^1	R^2	R^3	R^4
10-17-41	α-OH	OAc	OAc	Ph
10-17-42	α-OH	=O	OH	
10-17-43	β-OH	OAc	OH	Me



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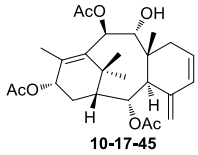

10-17-45

Table 10-17-18: ^{1}H NMR spectroscopic data of taxane-type diterpenoids **10-17-41**~**10-17-43**.

H	10-17-41	10-17-42	10-17-43
1		1.91 s(OH)	
2	5.74 d(7.1)	5.87 d(7.6)	5.68 d(7.1)
3	3.93 d(7.1)	4.01 d(7.6)	3.79 d(7.1)
5	4.93 dd(8.6, 3.4)	4.88 dd(8.1, 4.3)	4.93 d(8.1)
6	2.28 m, 2.33 m	2.26 m	2.54 ddd(15.4, 10.5, 6.8) 1.86 m(ov)
7	3.70 br ddd(11.4, 4.7, 1.7) 4.67 d(11.4, OH)	3.85 br ddd(11.0, 4.5, 2.0) 4.42 d(11.0, OH, ov)	4.40 dd(10.5, 6.8)
10	6.82 s		6.28 s
13	6.22 t(9.0)	6.20 t(8.1)	6.23 m(ov)
14	2.13 m, 2.36 m	2.45 m, 2.31 m	2.29 m(ov)
16	1.17 s	1.23 s	1.27 s
17	1.13 s	1.13 s	1.15 s
18	1.90 s	1.76 s	1.82 s
19	1.66 s	1.73 s	1.68 s
20	4.38 br s	4.41 d(8.6), 4.33 d(8.6)	4.30 d(8.5), 4.19 d(8.5)
OAc	2.18 s, 2.13 s, 2.53 s	2.48 s	2.25 s, 2.33 s
2′	5.55 d(3.3)	4.73 br t(3.1), 3.54 d(4.1, OH)	4.67 d(2.3)
3′	5.97 dd(9.1, 3.3)	5.61 dd(9.0, 2.6)	5.55 dd(8.8, 2.3)
4′	6.87 d(9.1)	6.44 d(8.9, NH)	6.23 m(ov, NH)
6′		1.78 s(6′-Me)	2.01 s
7′		1.71 d(6.9, 7′-Me), 6.42 q(6.9)	
3′ or 5′-Ph	7.72 d(7.7, *o*) 7.30~7.49 m(3′, 5′, *m*, *p*)	7.30~7.40 m	7.32~7.43 m
OBz	8.16 d(7.8, *o*) 7.52 t(7.2, *m*) 7.60 t(7.4, *p*)	8.16 d(7.7, *o*) 7.53 t (7.9, *m*) 7.63 t (7.2, *p*)	8.11 d(8.0, *o*) 7.51 t(7.8, *m*) 7.62 t(8.0, *p*)

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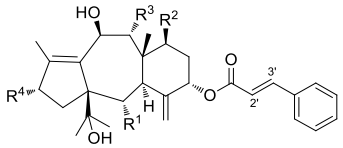
Table 10-17-19: ^{1}H NMR spectroscopic data of taxane-type diterpenoids **10-17-44** and **10-17-45**.

H	10-17-44(CD_3OD)	10-17-44(C_5D_5N)	10-17-45
1		6.57 s(OH)	1.66 d(8.9)
2	4.23 d(9.3)	4.89 d(9.8)	5.48 d(2.8)
3	2.39 d(9.8)	2.87 d(9.8)	2.99 br s(<1.8)
5	4.83 (ov)	5.43 t(2.8)	5.99 dd(9.7, 1.5)
4		7.27 s(OH)	
6	2.19 m, 1.82 m	2.88 m, 2.49 br dd(4.4, 14.5)	5.59 br t (6~7)
7	4.14 dd(4.6, 11.4)	4.75 dd(4.6, 11.3), 7.07 s(OH)	2.27 dd(18.3, 6.1), 2.11 m
9	4.48 d(10.4)	5.02 (ov), 8.46 d(6.1, OH)	4.35 d(9.7)
10	6.04 d(10.4)	6.67 d(10.3)	5.77 d(9.7)
13	5.73 dt(3.2, 8.9)	6.14 dd(3.5, 9.4)	5.53 br dd(10, 3)
14	1.99 m, 2.38 m	2.93 dd(10.5, 15.9)	2.74 ddd(8.9, 10, 15.7)
		2.53 dd(4.7, 15.6)	1.69 dd(15.7, 4.2)
16	1.07 s	1.32 s	0.99 s
17	1.40 s	1.71 s	1.58 s
18	2.02 s	2.28 s	1.91 s
19	1.44 s	2.06 s	1.02 s
20	3.43 s	3.91 d(8.5), 3.85 d(8.5)	5.55 br s, 4.97 br s
OAc	2.11 s, 2.06 s, 2.05 s	2.23 s, 2.07 s, 2.04 s	1.99 s, 2.02 s, 2.11 s

Table 10-17-20: Compounds, MFs, and test solvents of taxane-type diterpenoids **10-17-46**~**10-17-50**.

No.	Compounds	MFs	Test solvents	References
10-17-46	chinentaxunine	$C_{33}H_{42}O_8$	$CDCl_3$	[510]
10-17-47	2*α*,7*β*-diacetoxy-9*α*-benzoyloxy-5*α*-cinnamoyloxy-11(15→1)-abeotaxa-4(20),11-diene-10*β*,13*α*,15-triol	$C_{40}H_{46}O_{11}$	$CDCl_3$	[511]
10-17-48	2*α*-acetoxy-9*α*-benzoyloxy-5*α*,7*β*,10*β*,15-tetrahydroxy-11(15→1)-abeotaxa-4(20),11-dien-13-one	$C_{29}H_{36}O_9$	CD_3OD $CDCl_3$	[483]
10-17-49	15-benzoyl-10-deacetyl-2-debenzoyl-10-dehydro-*abeo*-baccatin III	$C_{29}H_{34}O_{10}$	$CDCl_3$	[501]
10-17-50	taxuyunnanine M	$C_{24}H_{36}O_{10}$	C_5D_5N	[512]



	R^1	R^2	R^3	R^4
10-17-46	H	H	OAc	OAc
10-17-47	OAc	OAc	OBz	OH

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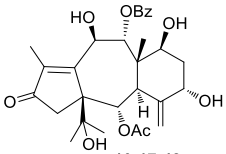

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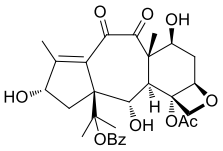

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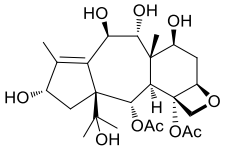

10-17-50

Table 10-17-21: ^{1}H NMR spectroscopic data of taxane-type diterpenoids **10-17-46** and **10-17-47**.

H	10-17-46	10-17-47	H	10-17-46	10-17-47
2	1.38 m, 2.10 m	5.92 d(8.8) 1.98 s(OAc)	16	1.38 s	1.10 s
3	2.79 br d(7.8)	3.30 d(8.8)	17	1.16 s	1.29 s
5	5.49 br s	5.67 br t(8.1)	18	1.92 s	1.49 s
6	2.04 m, 1.70 m	*α* 2.04 m, *β* 2.24 m	19	0.80 s	1.73 s
7	1.28 m	4.89 dd(10.0, 8.3)	20	4.80 br s, 5.24 br s	5.00 s, 5.33 s
7-OAc		2.04 s			
9	5.61 d(9.9), 2.13 s(OAc)	5.25 d(3.9)	2′	6.41 d(16.0)	6.44 d(16.1)
10	4.52 d(9.9)	4.93 d(3.9)	3′	7.66 d(16.0)	7.70 d(16.1)
13	5.43 dd(6.6,13.8)	4.60 m	3′-Ph	7.49 m(H-5′, 9′)	7.54 m(*o*-)
13-OAc	1.51 s			7.38 m(H-6′, 8′)	7.59 m(*m*-)
				7.38 m(H-7′)	7.38~7.46 m(*p*-)
14	1.14 m, 2.39 m	*α* 2.04 m	OBz		7.92 d(7.1, *o*)
		β 2.36 dd(7.6, 7.1)			7.38~7.46 m(*m*-, *p*-)

Table 10-17-22: ^{1}H NMR spectroscopic data of taxane-type diterpenoids **10-17-48**~**10-17-50**.

H	10-17-48(CD_3OD)	10-17-48($CDCl_3$)	10-17-49	10-17-50
2	6.04 d(9.3)	6.07 d(9.0)	4.52 dd(6.8, 4.9)	6.46 d(7.4)
2-OH			2.46 d(4.9)	
3	2.81 d(9.3)	2.82 d(9.0)	3.34 d(6.8)	3.47 d(7.3)
5	4.50 dd(9.5, 7.6)	4.66 t(7.1)	5.04 d(8.8)	5.34 d(8.7)
6	1.95 m, 1.99 m	1.73 m, 2.14 m	2.67 dt(15.0, 7.6)	2.96 dt(15.8, 8.4)
			1.87 dd(15.0, 9.5, 1.2)	2.34 (ov)
7	3.61 dd(10.0, 8.1)	3.64 t(8.8)	4.15 dd(9.5, 7.6)	4.85 t(8.7)
9	5.26 br s	5.40 d(3.2)		4.99 br d(7.9)
10	5.26 br s	5.34 d(3.2)		5.12 br d(7.9)
13			4.83 br t(7.1)	4.96 br t(6.6)
14	2.42 d(19.0), 2.77 d(19.0)	2.49 d(18.6), 2.85 d(18.6)	2.76 dd(14.7, 7.1)	2.34 dd(14.5, 7.0)
			1.91 dd(14.7, 7.8)	2.20 dd(14.5, 7.4)
15				5.72 br s(OH)
16	1.15 s	1.25 s	1.58 s(ov)	1.39 s
17	0.82 s	0.95 s	1.52 s	1.31 s
18	1.34 s	1.53 s	2.25 d(1.2)	2.10 s

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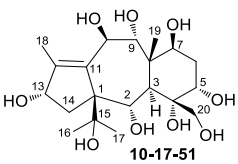
Table 10-17-22 (continued)

H	10-17-48(CD_3OD)	10-17-48($CDCl_3$)	10-17-49	10-17-50
19	1.52 s	1.65 s	1.76 s	2.30 s
20	4.73 br s, 5.33 s	4.74 br s, 5.44 s	4.58 d(8.4), 4.65 d(8.4)	4.67 ABd(7.4), 4.80 ABd(7.3)
OAc	1.91 br s	1.98 br s	2.21 s	2.06 s(2-OAc) 2.38 s(4-OAc)
OBz	7.80 br d(7.3, *o*-) 7.37 dd(7.8, 7.3, *m*-) 7.51 tt(7.8, 1.2, *p*-)	7.81 d(7.8, *o*-) 7.43 dd(7.8, 7.3, *m*-) 7.57 t(7.3, *p*-)	7.79 dd(8.3, 1.2, *o*-) 7.47 t(7.8, *m*-) 7.58 t(7.3, *p*-)	

Table 10-17-23: Compounds, MFs, and test solvents of taxane-type diterpenoids **10-17-51**~**10-17-56**.

No.	Compounds	MFs	Test solvents	References
10-17-51	taxuyunnanine S	$C_{20}H_{34}O_9$	CD_3OD	[513]
10-17-52	taxuyunnanine V	$C_{28}H_{42}O_{12}$	C_5D_5N	[513]
10-17-53	taxuyunnanine W	$C_{33}H_{42}O_{12}$	C_5D_5N	[508]
			CD_3OD	[508]
10-17-54	2*α*,7*β*-diacetoxy-5*α*,10*β*,13*α*,15-tetrahydroxy-4*β*(20)-epoxy-9*α*-benzoyloxy-11(15→1)abeotax-11-ene	$C_{31}H_{40}O_{11}$	$CDCl_3$	[514]
10-17-55	taxuyunnanine Y	$C_{29}H_{38}O_{10}$	C_5D_5N	[508]
10-17-56	taxumairol J	$C_{26}H_{36}O_{10}$	$CDCl_3$	[515]



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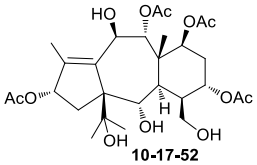

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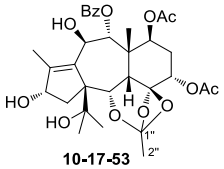

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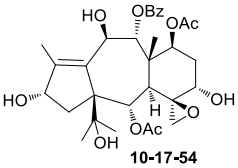

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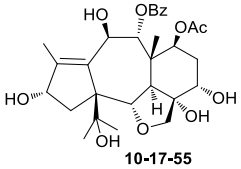

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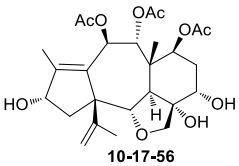

10-17-56

Table 10-17-24: ^{1}H NMR spectroscopic data of taxane-type diterpenoids **10-17-51**~**10-17-53**.

H	10-17-51	10-17-52	10-17-53(C_5D_5N)	10-17-53(CD_3OD)
2	4.42 d(7.4)	5.18 d(9.0)	5.75 d(10.6)	5.16 d(10.6)
3	2.53 d(7.6)	2.99 dd(7.9, 4.3)	3.29 d(10.6)	2.72 d(10.6)
4		2.92 m		

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Table 10-17-24 (continued)

H	10-17-51	10-17-52	10-17-53(C_5D_5N)	10-17-53(CD_3OD)
5	3.74 br t(3.0)	5.43 br d(1.5)	5.39 br s	4.97 br d(2.4)
6	1.74 m, 1.86 m	2.16 m	1.77 m, 2.31 m	1.98 dt(4.0, 13.1)
		2.07 dt(14.2, 3.8)		1.67 dt(1.4, 13.8)
7	4.10 dd(11.4, 4.8)	5.79 dd(11.0, 5.1)	5.70 (ov)	5.26 dd(4.3, 12.4)
9	3.96 d(9.6)	6.34 d(10.5)	5.69 (ov)	5.15 d(5.0)
10	4.43 d(9.8)	5.14 d(10.3)	5.56 d(4.9)	4.90 d(5.2)
13	4.47 t(7.0)	5.91 t(7.5)	4.80 t(7.0)	4.37 t(7.2)
14	2.20 dd(7.1, 14.0)	2.60 dd(14.6, 7.1)	2.66 m	2.22 dd(6.9, 14.7)
	1.78 dd(7.7, 14.1)	2.21 dd(14.3, 7.4)	2.56 m	2.05 dd(7.8, 14.7)
16	1.33 s	1.80 s	1.76 s	1.40 s
17	1.06 s	1.37 s	1.33 s	1.02 s
18	1.85 br d(0.9)	2.03 s	1.75 s	1.40 s
19	1.22 s	1.43 s	1.81 s	1.49 s
20	4.00 ABd(11.5)	4.30 dd(10.3, 7.4)	4.83 d(8.3)	4.62 d(7.9)
	3.65 ABd(11.5)	3.48 dd(10.3, 8.2)	3.75 d(7.8)	3.54 d(7.4)
OAc		2.15 s, 2.14 s	1.66 s(5-OAc)	1.89 s(5-OAc)
		2.04 s, 2.03 s	1.93 s(7-OAc)	1.97 s(7-OAc)
2″			1.73 s	1.50 s
OBz			8.44 d(7.9, H-3′/7′)	8.06 dd(1.4, 8.0, H-3′/7′)
			7.40 t(7.4, H-4′/6′)	7.49 dt(1.5, 8.0, H-4′/6′)
			7.48 t(7.5, H-5′)	7.61 dt(1.3, 8.7, H-5′)

Table 10-17-25: ^{1}H NMR spectroscopic data of taxane-type diterpenoids **10-17-54**~**10-17-56**.

H	10-17-54	10-17-55	10-17-56
2	5.95 d(6.5)	5.99 d(11.3)	4.75 (ov)
3	3.17 d(6.5)	3.37 d(11.3)	2.30 d(7.1)
5	3.12 br s	4.58 br s	4.30 br t
6	α 1.89 br d(13.0), β 2.04 m	2.88 t(11.9), 2.33 m	1.95 m, 1.83 m
7	5.45 dd(11.5, 5.0)	6.29 dd(4.5, 11.9)	4.92 d(9.6)
9	6.05 d(5.5)	5.91 d(5.1)	4.85 d(4.2)
10	4.72 d(5.5)	5.63 d(5.1)	5.80 d(4.2)
13	4.62 br s	4.96 t(6.9)	4.70 (ov)
14	α 1.63 dd(14.3, 6.0)	2.76 dd(6.6, 14.0)	1.95 m, 2.18 m
	β 2.27 dd(14.3, 7.5)	2.55 dd(7.6, 14.0)	
16	1.25 s	1.40 s	4.81 s, 4.75 s
17	1.50 s	1.84 s	1.67 s
18	1.71 s	1.76 s	1.76 s
19	1.07 s	2.31 s	1.40 s
20	2.21 d(5.2), 3.41 d(5.2)	4.60 d(7.9), 4.08 d(7.9)	3.90 d(10.2), 3.80 d(10.2)

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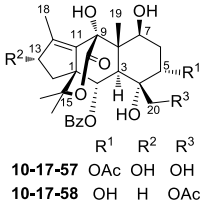
Table 10-17-25 (continued)

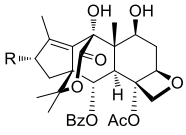
H	10-17-54	10-17-55	10-17-56
OAc	2.04 s(2-OAc) 2.05 s(7-OAc)	1.99 s	1.99 s(7-OAc) 2.06 s(9-OAc) 1.94 s(10-OAc)
OBz	8.00 d(7.5, *o*-) 7.45 t(7.5, *m*-) 7.56 t(9.1, *p*-)	8.57 d(8.2, *o*-) 7.23 t(7.7, *m*-) 7.34 t(8.8, *p*-)	

Table 10-17-26: Compounds, MFs, and test solvents of taxane-type diterpenoids **10-17-57**~**10-17-61**.

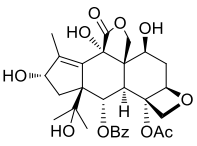
No.	Compounds	MFs	Test solvents	References
10-17-57	tasumatrol H	$C_{29}H_{36}O_{11}$	$CDCl_3$	[492]
10-17-58	tasumatrol I	$C_{29}H_{36}O_{10}$	$CDCl_3$	[492]
10-17-59	13-*O*-acetylwallifoliol	$C_{33}H_{36}O_{11}$	$CDCl_3$	[516]
10-17-60	tasumatrol J	$C_{29}H_{34}O_9$	$CDCl_3$	[492]
10-17-61	tasumatrol A	$C_{29}H_{34}O_{11}$	$CDCl_3$	[517]



	R^1	R^2	R^3
10-17-57	OAc	OH	OH
10-17-58	OH	H	OAc



10-17-59 R = OAc
10-17-60 R = H



10-17-61

Table 10-17-27: ^{1}H NMR spectroscopic data of taxane-type diterpenoids **10-17-57**~**10-17-61**.

H	10-17-57	10-17-58	10-17-59	10-17-60	10-17-61
2	5.74 d(12.0)	5.90 d(12.0)	5.85 d(12.0)	5.82 d(12.0)	6.19 d(11.5)
3	2.85 d(12.0)	2.74 d(12.0)	2.73 d(12.0)	2.69 d(12.0)	2.63 d(11.5)
5	5.10 br s	3.76 br s	4.86 d(7.9)	4.85 d(9.0)	4.76 d(7.5)
6	1.97 m, 1.95 m	2.36 m, 1.80 m	1.85 m, 2.80 m	2.71 m, 2.67 m	2.75 m, 1.86 m
7	4.25 m	4.35 m	4.35 t(8.0)	4.31 br s	4.47 m
13	4.54 m	2.57 m, 2.54 m	5.55 t(6.4)	2.43 m, 2.39 m	4.60 m
14	2.46 dd(14.8, 6.6) 2.22 dd(14.8, 7.5)	1.51 m, 1.65 m	2.11 m, 2.29 m	2.36 m, 2.40 m	2.16 m
16	1.27 s	1.84 s	1.34 s	1.32 s	1.05 s
17	1.24 s	1.33 s	1.25 s	1.26 s	1.23 s

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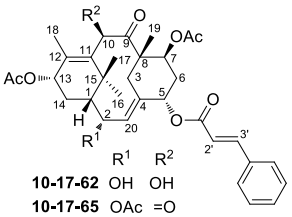
Table 10-17-27 (continued)

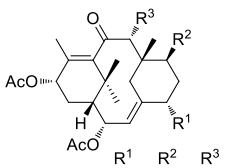
H	10-17-57	10-17-58	10-17-59	10-17-60	10-17-61
18	1.24 s	2.04 s	2.10 s	2.04 s	2.31 s
19	2.08 s	1.20 s	1.69 s	1.60 s	5.03 d(10.0)
					4.95 d(10.0)
20	3.73 br s	4.50 d(12.4)	4.22 d(8.6)	4.68 d(9.0)	4.37 d(8.8)
	3.81 br s	4.24 d(12.4)	4.63 d(8.6)	4.24 d(9.0)	4.85 d(8.8)
OAc	2.02 s(5-OAc)	2.02 s(20-OAc)	1.74 s, 2.01 s	1.76 s(4-OAc)	2.18 s(4-OAc)
3′, 7′	8.01 d(6.9)	8.03 d(6.8)	7.92 d(7.3)	7.97 d(7.1)	7.98 d(7.5)
4′, 6′	7.46 t(6.9)	7.48 t(6.8)	7.48 t(7.3)	7.47 t(7.1)	7.54 t(7.5)
5′	7.57 t(6.9)	7.60 t(6.8)	7.62 t(7.3)	7.61 t(7.1)	7.45 t(7.5)
OH					3.55 br s, 4.50 br s

Table 10-17-28: Compounds, MFs, and test solvents of taxane-type diterpenoids **10-17-62**~**10-17-67**.

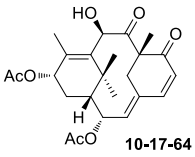
No.	Compounds	MFs	Test solvents	References
10-17-62	2-deacetyl taxuspine B	$C_{33}H_{40}O_9$	$CDCl_3$	[518]
10-17-63	2*α*,5*α*,13*α*-triacetoxy-7*β*-hydroxy-9,10-diketon-2(3→20)abeotaxane	$C_{26}H_{34}O_9$	$CDCl_3$	[518]
10-17-64	2*α*,13*α*-diacetoxy-10*β*-hydroxy-2(3→20)-*abeo*-taxa-4(20),5,11-triene-7,9-diones	$C_{24}H_{30}O_7$	$CDCl_3$	[519]
10-17-65	dantaxusin A	$C_{35}H_{40}O_{10}$	$CDCl_3$	[520]
10-17-66	2*α*,7*β*,13*α*-triacetoxy-5*α*,9*α*-dihydroxy-2(3→20)-abeotaxa-4(20),11-dien-10-one	$C_{26}H_{36}O_9$	$CDCl_3$	[521]
10-17-67	taxumairone A	$C_{26}H_{32}O_8$	$CDCl_3$	[522]



	R^1	R^2
10-17-62	OH	OH
10-17-65	OAc	=O



	R^1	R^2	R^3
10-17-63	OAc	OH	=O
10-17-66	OH	OAc	OH



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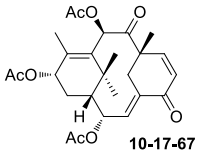

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Table 10-17-29: ^{1}H NMR spectroscopic data of taxane-type diterpenoids **10-17-62**~**10-17-65**.

H	10-17-62	10-17-63	10-17-64	10-17-65
1	1.81 dd(8.1, 2.2)	1.99 d(2.4)	1.75 dd(7.7, 2.5)	1.80 m
2	4.62 dd(9.8, 2.2)	5.85 br d(9.1)	5.73 dd(10.4, 2.5)	5.85 d(8.8)
3	2.72 d(15.6)	2.74 br d(15.7)	3.15 dd(15.9, 1.9)	2.54 d(16)
	2.00 d(15.6)	2.46 br d(15.7)	2.55 dd(15.9, 2.5)	2.81 d(16)
5	5.75 d(6.5)	5.69 br s	6.54 dd(10.2, 1.9)	5.55 dd(5.2)
6	*α* 2.07 m	2.37 ddd(14.3, 5.8, 3.4)	6.29 dd(10.2)	*α* 1.65 m
	β 2.27 m	1.44 br d(14.3)		*β* 2.33 m
7	5.21 dd(12.3, 3.0)	4.27 m		5.75 br s
10	5.40 d(2.7)		5.06 d(2.8)	
	4.21 d(2.7, OH)		4.14 d(2.8, OH)	
13	5.41 dd(10.7, 2.7)	5.34 br d(9.6)	5.28 br d(10.4)	5.40 d(9.6)
14	*α* 1.90 m	1.79 dd(14.3, 2.5)	*α* 1.99 br d(17.6)	1.90 ddd(2.4, 5.2, 9.6)
	β 2.65 m	2.70 m	*β* 2.70 ddd(17.6, 10.4, 7.7)	2.72 ddd(2.4, 5.2, 9.6)
16	1.20 s	1.21 s	1.17 s	1.12 s
17	1.17 s	1.18 s	1.18 s	1.55 s
18	1.90 s	1.70 br s	1.57 br s	1.75 s
19	1.34 s	1.53 s	1.25	1.25 s
20	5.50 br d(3.8)	5.56 dt(9.1, 2.2)	6.41 dd(10.4, 2.2)	5.28 d(8.8)
OAc	2.03 s	2.05 s(2-OAc)	2.05 s(2-OAc)	2.15 s(2-OAc)
		2.10 s(5-OAc)	2.18 s(13-OAc)	2.14 s(7-OAc)
		2.15 s(13-OAc)		2.02 s(13-OAc)
OCinn	6.55 d(15.9)			6.45 d(16.0)
	7.85 d(15.9)			7.75 d(16.0)
	7.52 m, 7.41 m			7.50 m, 7.40 m, 7.40 m

Table 10-17-30: ^{1}H NMR spectroscopic data of taxane-type diterpenoids **10-17-66** and **10-17-67**.

H	10-17-66	10-17-67	H	10-17-66	10-17-67
1	1.87 m	1.80 m	13	5.34 br d(9.9)	5.26 d(10.0)
2	5.79 br d(9.3)	5.76 d(10.5)	14	*α* 1.95 m	*α* 2.02 m
				β 2.69 ddd(7.5, 9.9, 17.4)	*β* 2.67 m
3	2.37 br d(15.4)	3.08 dd(14, 2)	16	1.42 s	1.26 s
	2.25 br d(15.4)	2.60 d(14)			
5	4.32 dd(9.6, 14.7)		17	1.15 s	1.11 s
6	2.33 dd(5.8, 9.6)	6.29 d(10.2)	18	1.72 br s	1.51 s
	1.92 m				
7	5.28 br s	6.76 dd(10.2, 1.8)	19	0.90 s	1.45 s
9	4.60 br s		20	5.46 br d(9.3)	6.35 dd(10.5, 2)
10		6.08 s	OAc	2.16 s(2-OAc)	2.19 s
				2.07 s(7-OAc)	2.17 s
				2.03 s(13-OAc)	2.04 s

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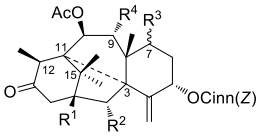
Table 10-17-31: Compounds, MFs, and test solvents of taxane-type diterpenoids **10-17-68**~**10-17-71**.

No.	Compounds	MFs	Test solvents	References
10-17-68	7-acetoxytaxuspine C	$C_{37}H_{44}O_{11}$	$CDCl_3$	[523]
10-17-69	9α-hydroxy-2α,7α,10β-triacetoxy-5α-cinnamoyloxy-3,11-cyclotaxa-4(20)-en-13-one	$C_{35}H_{42}O_{10}$	$CDCl_3$	[481]
10-17-70	9α,10β-diacetoxy-5α-cinnamoyloxy-3,11-cyclotaxa-4(20)-en-13-one	$C_{33}H_{40}O_7$	$CDCl_3$	[481]
10-17-71	1β,2α,9α-trihydroxy-10β-acetoxy-5α-cinnamoyloxy-3,11-cyclotaxa-4(20)-en-13-one	$C_{31}H_{38}O_8$	$CDCl_3$	[499]



	R^1	R^2	R^3	R^4
10-17-68	H	OAc	β-OAc	OAc
10-17-69	H	OAc	α-OAc	OH
10-17-70	H	H	H	OAc
10-17-71	OH	OH	H	OH

Table 10-17-32: ^{1}H NMR spectroscopic data of taxane-type diterpenoids **10-17-68**~**10-17-71**.

H	10-17-68	10-17-69	10-17-70	10-17-71
1	2.17 br t	2.15 m	1.95 t(6.3)	
2	6.09 d(5.1)	6.05 d(5.5)	2.57 dd(15.7, 5.5)	4.78 br s
			2.09 d(15.7)	
5	5.73 t(10.4, ov)	5.71 t(9.1)	5.70 t(9.7)	5.59 t(8.8)
6	2.70 ddd(14.6, 10.4, 4.4)	2.67 ddd(15.3, 10.1, 4.3)	1.82 m	1.70 m(ov)
	2.05 m(ov)	2.01 dd(15.3, 8.9)	2.28 m	2.20 m
7	5.01 d(4.4)	5.32 dd(4.2, 1.1)	1.74 m	1.93 m(ov)
			0.97 td(14.7, 2.8)	1.34 m(ov)
9	5.80 d(9.5)	4.52 d(9.2)	5.60 d(9.5)	4.40 d(9.8)
10	5.63 d(9.5)	5.35 d(9.2)	5.78 d(9.5)	5.40 d(9.8)
12	3.58 q(7.0)	3.62 q(7.2)	3.38 q(7.3)	3.50 q(7.3)
14	2.62 d(20.3)	2.62 d(20.1)	2.66 dd(20.4, 7.1)	3.05 d(19.8)
	2.52 dd(20.3, 6.8)	2.52 dd(20.1, 7.2)	2.32 d(20.4)	2.36 d(19.8)
16	1.23 s	1.24 s	1.19 s	1.12 s
17	1.69 s	1.55 s	1.55 s	1.40 s(ov)
18	1.29 d(7.0)	1.33 d(7.2)	1.27 s	1.31 d(7.3)
19	1.42 s	1.43 s	1.20 s	1.40 s(ov)
20	5.84 s, 5.72 s	5.84 s, 5.70 s	5.63 s, 5.53 s	5.80 s, 5.60 s(ov)
OAc	2.07 s, 2.06 s	2.16 s, 2.07 s, 1.95 s	2.05 s(9-OAc)	2.16 s
	2.04 s, 1.95 s		2.04 s(10-OAc)	
OCinn	6.35 d(16.1)	6.34 d(16.0)	6.36 d(16.0)	6.39 d(16.1)
	7.67 d(16.1)	7.66 d(16.0)	7.66 d(16.0)	7.66 d(16.1)
	7.53 m(*o*-)	7.54 m(*o*-)	7.55 m(*o*-)	7.55 m(*o*-)
	7.37 m(*m*-, *p*-)	7.38 m(*m*-, *p*-)	7.37 m(*m*-, *p*-)	7.38 m(*m*-, *p*-)

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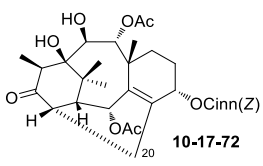
Table 10-17-33: Compounds, MFs, and test solvents of taxane-type diterpenoids **10-17-72**~**10-17-76**.

No.	Compounds	MFs	Test solvents	References
10-17-72	2α,9α-diacetoxy-5α-cinnamoyloxy-10β,11β-dihydroxy-14,20-cyclotaxa-3-en-13-one	$C_{33}H_{40}O_9$	$CDCl_3$	[524]
10-17-73	canataxapropellane	$C_{26}H_{36}O_8$	$CDCl_3$	[525]
10-17-74	dipropellane A	$C_{24}H_{34}O_8$	$CDCl_3$	[526]
			CD_3COCD_3	[526]
10-17-75	dipropellane B	$C_{24}H_{34}O_8$	CD_3COCD_3	[526]
10-17-76	dipropellane C	$C_{26}H_{36}O_9$	CD_3COCD_3	[526]



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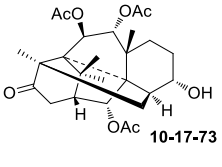

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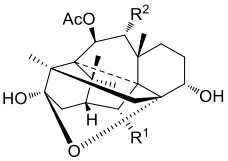

	R^1	R^2
10-17-74	OAc	OH
10-17-75	OH	OAc
10-17-76	OAc	OAc

Table 10-17-34: ^{1}H NMR spectroscopic data of taxane-type diterpenoids **10-17-72**~**10-17-74**.

H	10-17-72	10-17-73	10-17-74($CDCl_3$)	10-17-74(CD_3COCD_3)
1	2.41 d(8.9)	2.21 br t(*ca*. 6.1)	2.03 m	1.93 m(ov)
2	6.00 s	5.71 d(5.2)	5.59 d(5.3)	5.60 d(5.3)
4		2.55 m(ov)		
5	5.30 br m	4.12 m	4.28 dd(9.5, 1.4)	4.23 ddd(9.0, 2.5, 2.4) 3.48 br d(2.5)
6	2.04 m(ov)	2.00 m(ov)	2.01 m	ax 2.01 m(ov)
	1.93 m	1.46 m	1.62 br d(15.0)	eq 1.55 m
7	1.72 m	2.00 m(ov)	1.84 td(14.2, 5.0)	ax 1.94 m(ov)
		1.54 m(ov)	1.32 m	eq 1.27 m(ov)
9	5.76 d(9.5)	5.57 d(9.8)	4.16 d(9.2)	4.13 m(ov) 4.11 d(ov, OH)
10	3.59 dd(9.5, 7.0) 2.72 br d(7.0, OH)	5.46 d(9.8)	5.30 d(9.2)	5.47 d(9.0)
12	2.77 q(6.8)			
13				4.75 s(OH)
14	3.02 m	2.61 d(20.2)	2.12 m	2.09 m(ov)
		2.53 dd(20.2, 7.2)	1.95 dd(14.2, 2.8)	1.90 dd(13.4, 3.4)
16	0.95 s	1.12 s	1.25 s	1.23 s
17	1.43 s	1.58 s	1.33 s	1.34 s
18	1.09 d(6.8)	1.22 s	1.22 s	1.20 s
19	1.14 s	1.09 s	1.17 s	1.14 s
20	2.89 dd(15.8, 6.6)	1.97 m(ov)	2.11 m	2.11 d(11.4)
	2.12 dd(15.5, 1.3)	1.74 m(ov)	2.05 m	2.00 d(11.4)
OAc	2.17 s	2.08 s, 2.02 s	2.14 s(2-OAc)	2.07 s(2-OAc)
	2.04 s	2.01 s	2.09 s(10-OAc)	2.01 s(10-OAc)

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Table 10-17-34 (continued)

H	10-17-72	10-17-73	10-17-74($CDCl_3$)	10-17-74(CD_3COCD_3)
OCinn	6.37 d(16.1) 7.68 d(16.1) 7.59 m(*o*-) 7.40 m(*m*-, *p*-)			

Table 10-17-35: ^{1}H NMR spectroscopic data of taxane-type diterpenoids **10-17-75** and **10-17-76**.

H	10-17-75($CDCl_3$)	10-17-75(CD_3COCD_3)	10-17-76
1	1.76 m	1.66 m	1.96 m
2	4.67 dd(11.9, 5.1) 3.95 d(11.9, OH)	4.60 dd(11.9, 5.1) 3.89 d(11.9, OH)	5.63 d(5.0)
5	4.31 dd(9.5, 2.5)	4.14 br m, 3.67 d(3.9, OH)	4.23 m, 3.50 br(OH)
6	2.11 m, 1.59 m	2.03 m, 1.55 m	1.95 m, 1.54 m
7	1.93 m, 1.23 m	1.90 m, 1.20 m	1.95 m, 1.18 m
9	5.43 d(9.2)	5.44 d(9.3)	5.43 d(9.2)
10	5.55 d(9.2)	5.58 d(9.3)	5.63 d(9.2)
13		5.14 s(OH)	4.77 (OH)
14	2.22 dd(14.3, 2.4), 2.05 m(ov)	2.18 m, 1.98 m	2.07 m, 1.87 m(ov)
16	1.23 s	1.25 s	1.26 s
17	1.34 s	1.32 s	1.43 s
18	1.19 s	1.18 s	1.19 s
19	1.29 s	1.28 s	1.15 s
20	2.11 m(ov), 2.04 m(ov)	2.16 m(ov), 1.98 m(ov)	2.15 d(11.7), 1.99 d(11.7)
OAc	2.00 s(9-OAc) 2.04 s(10-OAc)	2.02 s(9-OAc) 1.95 s(10-OAc)	2.04 s(2-OAc), 2.01 s(9-OAc) 2.03 s(10-OAc)

Table 10-17-36: Compounds, MFs, and test solvents of taxane-type diterpenoids **10-17-77**~**10-17-84**.

No.	Compounds	MFs	Test solvents	References
10-17-77	13-oxo-taxachitriene A	$C_{30}H_{40}O_{12}$	$CDCl_3$	[527]
10-17-78	2,20-dideacetyl-13-oxo-taxachitriene A	$C_{26}H_{36}O_{10}$	$CDCl_3$	[527]
10-17-79	(3*E*,8*E*)-2*α*,7*β*,9,10*β*,13*α*,20-hexaacetoxy-5-(2′-acetoxy-cinnamoyloxy)-3,8-secotaxa-3,8,11-triene	$C_{43}H_{52}O_{16}$	$CDCl_3$	[528]
10-17-80	taxumairol M	$C_{32}H_{44}O_{14}$	$CDCl_3$	[529]
10-17-81	(3*E*,7*E*)-2*α*,10*β*,13*α*,20-tetraacetoxy-5*α*-hydroxy-3,8-secotaxa-3,7,11-trien-9-one	$C_{28}H_{38}O_{10}$	$CDCl_3$	[530]
10-17-82	(3*E*,7*E*)-10*β*,13*α*-diacetoxy-2*α*,5*α*,20-trihydroxy-3,8-secotaxa-3,7,11-trien-9-one	$C_{24}H_{34}O_8$	$CDCl_3$	[530]
10-17-83	(11*α*H)-3,8-*seco*-taxa-3*E*,7*E*,12(18)-triene-2*α*,6*α*,9*β*-triol	$C_{20}H_{32}O_3$	$CDCl_3$	[531]
10-17-84	cespitularin C	$C_{20}H_{32}O$	$CDCl_3$	[532]

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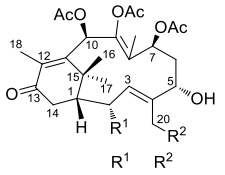
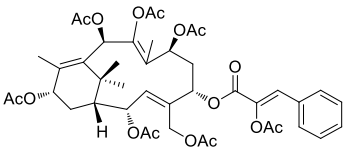


	R1	R2
10-17-77	OAc	OAc
10-17-78	OH	OH



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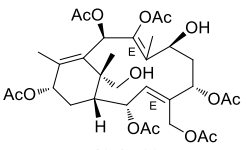

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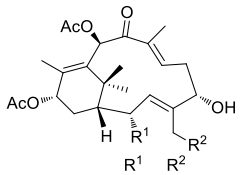
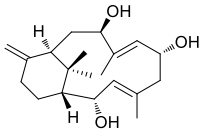


	R1	R2
10-17-81	OAc	OAc
10-17-82	OH	OH



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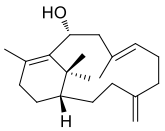

10-17-84

Table 10-17-37: ^{1}H NMR spectroscopic data of taxane-type diterpenoids **10-17-77**~**10-17-80**.

H	10-17-77	10-17-78	10-17-79	10-17-80
1	2.20 m	2.16 m	1.80 m	2.15 m
2	5.82 dd(11.6, 4.2)	4.80 dd(11.8, 4.1)	5.79 dd(10.5, 4.6)	5.73 dd(11.5, 4.5)
3	5,65 br d(11.6)	5.56 br d(11.8)	5.83 br d(10.5)	6.50 d(11.5)
5	4.44 br s	4.50 br s	5.75 br s	4.47 br s
6	*α* 2.54 ddd(13.2, 5.0, 8.2)	*α* 2.61 m	*α* 2. 10 m	1.90 m, 2.60 m
	β 2.03 m	*β* 2.04 m	*β* 2.62 ddd(16.1, 10.8, 2.9)	
7	5.02 br d(8.2)	5.02 br d(8.0)	5.58 br d(10.8)	5.10 d(8.0)
10	7.10 br d(1.4)	7.10 br d(1.3)	7.27 br s	6.93 s
13			5.20 br s(8.8)	5.29 d(9.0)
14	*α* 3.02 br d(19.5)	*α* 3.04 br d(18.1)	*α* 2.04 m	2.10 m, 2.52 m
	β 2.82 dd(19.5, 7.4)	*β* 2.78 dd(18.1, 8.3)	*β* 2.49 ddd(16.1, 8.8, 7.6)	
16	1.26 s	1.29 s	1.10 s	3.24 d(11), 3.45 d(11)
17	1.33 s	1.33 s	1.30 s	1.26 s
18	1.98 s	1.99 s	2.21 br s	1.98 s
19	1.66 s	1.62 s	1.66 br s	1.65 s
20	4.36 d(12.8), 4.87 d(12.8)	3.80 d(12.1)	4.43 d(12.9)	4.38 d(12.7)
		4.35 d(12.1)	4.91 d(12.9)	4.84 d(12.7)
OAc	2.01 s, 2.03 s, 2.09 s 2.13 s, 2.24 s	2.09 s, 2.11 s 2.23 s	2.22 s(2-OAc), 2.08 s(7-OAc) 2.05 s(9-OAc), 2.01 s(10-OAc) 1.96 s(13-OAc), 1.79 s(20-OAc) 2.34 s(2′-OAc)	2.18 s, 2.11 s 2.03 s, 2.01 s 2.22 s, 1.96 s
3′			7.75 s	
3′-Ph			7.55 m(H-5′, 9′) 7.42 m(H-6′, 7′, 8′)	

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Table 10-17-38: ^{1}H NMR spectroscopic data of taxane-type diterpenoids **10-17-81**~**10-17-84**.

H	10-17-81	10-17-82	10-17-83	10-17-84
1	1.83 br t(5.1)	1.77 m	1.66 m	1.53 m
2	5.72 dd(11.0, 5.1)	4.60 dd(10.5, 4.6)	4.70 dd(11.1, 4.5)	1.50 m, 2.16 m
3	6.45 br d(11.0)	6.29 br d(10.5)	5.63 br d(11.1)	2.00 m, 2.30 m
5	4.70 br s	4.74 br s	*α* 2.14 m *β* 2.62 dd(11.9, 4.2)	1.94 m, 2.15 m
6	*α* 2.54 br d(14.7) *β* 2.84 ddd(14.7, 12.1, 3.6)	*α* 2.50 m *β* 2.76 m	4.74 td(10.5, 4.6)	2.14 m
7	6.42 br d(12.1)	6.38 br d(12.1)	4.94 br d(9.4)	5.19 dd(10.5, 3.9)
9			4.00 dd(11.6, 3.3)	*α* 2.95 t(12.0) *β* 2.30 m
10	6.70 s	6.70 br s	*α* 1.60 m(ov) *β* 1.43 t(12.7)	4.59 dd(12.3, 4.2)
11			2.50 br d(11.4)	
13	5.37 br d(8.8)	5.40 d(9.0)	2.30 m(ov)	2.72 dd(14.7, 9.3) 1.97 m
14	*α* 2.19 br d(16.5) *β* 2.52 m	*α* 2.28 br d(18.0) *β* 2.52 m	*α* 2.06 m(ov) *β* 1.75 m(ov)	1.58 m
16	0.90 s	0.84 s	0.80 s	0.91 s
17	1.26 s	1.26 s	0.88 s	1.12 s
18	1.93 s	1.82 s	4.87 br d(1.0) 4.68 br d(1.0)	1.95 s
19	1.78 br s	1.72 d(1.0)	1.66 d(1.1)	1.64 s
20	*α* 4.80 d(12.9) *β* 4.34 d(12.9)	*α* 4.30 d(12.2) *β* 3.37 d(12.2)	1.70 br s	4.60 s, 4.68 s
OAc	2.02 s(2-OAc), 2.19 s(10-OAc) 2.16 s(13-OAc), 2.05 s(20-OAc)	2.15 s(10-OAc) 2.19 s(13-OAc)		

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10.18 Jatrophane-type diterpenoids

Table 10-18-1: Compounds, MFs, and test solvents of jatrophane-type diterpenoids **10-18-1**~**10-18-56**.

No.	Compounds	MFs	Test solvents	References
10-18-1	(2*S*,3*S*,4*R*,5*R*,7*S*,8*S*,9*S*,11*E*,13*S*,14*S*,15*R*)-3,5,7,8,9,14,15-heptahydroxyjatropha-6(17),11-diene 5,7-bis(2-methyl-propionate) 8-(2-methylbutyrate) 14-acetate	$C_{35}H_{56}O_{11}$	$CDCl_3$	[533]
10-18-2	(2*S*,3*S*,4*R*,5*R*,7*S*,8*S*,9*S*,11*E*,13*S*,14*S*,15*R*)-3,5,7,8,9,14,15-heptahydroxyjatropha-6(17),11-diene 7-(2-methylpropi-onate) 5,8-bis(2-methylbutyrate) 14-acetate	$C_{36}H_{58}O_{11}$	$CDCl_3$	[533]
10-18-3	(2*R**,3*R**,4*S**,5*R**,7*S**,8*S**,9*S**,13*S**,14*S**,15*R**)-2,5,14-triacetoxy-3-benzoyloxy-8,15-dihydroxy-7-isobutyroyloxy-9-nicotinoyloxyjatropha-6(17),11*E*-diene	$C_{43}H_{53}NO_{14}$	$CDCl_3$	[534]
10-18-4	(2*R**,3*R**,4*S**,5*R**,7*S**,8*S**,9*S**,13*S**,14*S**,15*R**)-2,5,7,14-tetraacetoxy-3-benzoyloxy-8,15-dihydroxy-9-nicoti-noyloxyjatropha-6(17),11*E*-diene	$C_{41}H_{49}NO_{14}$	$CDCl_3$	[534]
10-18-5	(2*R**,3*R**,4*S**,5*R**,7*S**,8*S**,9*S**,13*S**,14*S**,15*R**)-2,5,7,9,14-pentaacetoxy-3-benzoyloxy-8,15-dihydroxyjatropha-6(17),11*E*-diene	$C_{37}H_{48}O_{14}$	$CDCl_3$	[534]
10-18-6	(2*S**,3*S**,4*R**,5*R**,7*S**,8*R**,13*R**,14*R**,15*R**)-5,7,8,14-tetraacetoxy-3-benzoyloxy-15-hydroxy-9-oxojatropha-6(17),11*E*-diene	$C_{35}H_{44}O_{12}$	$CDCl_3$	[535]
10-18-7	(2*S**,3*S**,4*R**,5*R**,7*S**,8*R**,13*R**,14*R**,15*R**)-5,7,14-tri-acetoxy-3-benzoyloxy-8-isobutyroyloxy-15-hydroxy-9-oxojatropha-6(17),11*E*-diene	$C_{37}H_{48}O_{12}$	$CDCl_3$	[535]
10-18-8	(2*S**,3*S**,4*R**,5*R**,7*S**,8*R**,13*R**,14*R**,15*R**)-5,7-diacet-oxy-3-benzoyloxy-8,14,15-trihydroxy-9-oxojatropha-6(17),11*E*-diene	$C_{31}H_{40}O_{10}$	$CDCl_3$	[535]
10-18-9	(2*S**,3*S**,4*R**,5*R**,7*R**,13*R**,14*R**,15*R**)-5,7,14-triacet-oxy-3-benzoyloxy-15-hydroxy-9-oxojatropha-6(17),11*E*-diene	$C_{33}H_{42}O_{10}$	$CDCl_3$	[535]
10-18-10	(2*S**,3*S**,4*R**,5*R**,9*S**,13*S**,15*R**)-5-acetoxy-3,9-dicin-namoyloxy-15-hydroxy-14-oxo-jatropha-6(17),11*E*-diene	$C_{40}H_{46}O_8$	$CDCl_3$	[536]
10-18-11	(2*S*,3*S*,4*S*,5*R*,7*S*,8*S*,9*S*,11*E*,13*S*,15*R*)-3,5,7,8,9,15-hexa-hydroxyjatropha-6(17),11-dien-14-one 5,7,8-tris(2-meth-ylbutyrate)	$C_{35}H_{56}O_{10}$	$CDCl_3$	[533]
10-18-12	(2*S*,3*S*,4*R*,5*R*,7*S*,8*S*,9*S*,11*E*,13*S*,15*R*)-3,5,7,8,9,15-hexa-hydroxyjatropha-6(17),11-dien-14-one 5,7,8-tris(2-methylpropionate)	$C_{32}H_{50}O_{10}$	$CDCl_3$	[533]

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Table 10-18-1 (continued)

No.	Compounds	MFs	Test solvents	References
10-18-13	(2*S*,3*S*,4*R*,5*R*,7*S*,8*S*,9*S*,11*E*,13*S*,15*R*)-3,5,7,8,9,15-hexa-hydroxyjatropha-6(17),11-dien-14-one 3-acetate 7-(2-methylpropionate) 8-(2-methylbutyrate)	$C_{31}H_{48}O_{10}$	$CDCl_3$	[533]
10-18-14	esulatin D	$C_{32}H_{44}O_{13}$	$CDCl_3$	[537]
10-18-15	3,5,7,15-tetraacetoxy-9-nicotinoyloxy-14-oxojatropha-6(17),11-diene	$C_{34}H_{43}NO_{11}$	$CDCl_3$	[538]
10-18-16	amygdaloidin A	$C_{40}H_{51}NO_{13}$	$CDCl_3$	[539]
10-18-17	amygdaloidin B	$C_{38}H_{49}NO_{12}$	$CDCl_3$	[539]
10-18-18	amygdaloidin C	$C_{38}H_{49}NO_{14}$	$CDCl_3$	[539]
10-18-19	(2*R**,3*R**,4*S**,5*R**,7*S**,8*R**,13*R**,15*R**)-3,5,7,8,15-penta-acetoxy-2-benzoyloxy-9,14-dioxojatropha-6(17),11*E*-diene	$C_{37}H_{44}O_{14}$	$CDCl_3$	[535]
10-18-20	(2*R**,3*R**,4*S**,5*R**,7*S**,8*R**,13*R**,15*R**)-2,3,5,7,15-penta-acetoxy-8-hydroxy-9,14-dioxojatropha-6(17),11*E*-diene	$C_{30}H_{40}O_{13}$	$CDCl_3$	[535]
10-18-21	(2*R**,3*S**,4*R**,5*R**,8*R**,13*S**,15*R**)-5,8,15-triacetoxy-3-benzoyloxy-9,14-dioxojatropha-6(17),11*E*-diene	$C_{33}H_{40}O_{10}$	$CDCl_3$	[540]
10-18-22	3β,5α,8α,15β-tetraacetoxy-7β-benzoyloxyjatropha-6(17),11*E*-dien-9,14-dione	$C_{35}H_{42}O_{12}$	$CDCl_3$	[541]
10-18-23	euphopubescenol	$C_{33}H_{40}O_{11}$	$CDCl_3$	[542]
10-18-24	esulatin E	$C_{28}H_{36}O_{10}$	$CDCl_3$	[537]
10-18-25	esulatin A	$C_{36}H_{50}O_{16}$	$CDCl_3$	[543]
10-18-26	kansuinin C	$C_{30}H_{42}O_{14}$	$CDCl_3$	[544]
10-18-27	kansuinin B	$C_{30}H_{42}O_{14}$	$CDCl_3$	[544]
10-18-28	kansuinin E	$C_{41}H_{47}NO_{14}$	$CDCl_3$	[545]
10-18-29	(2*R**,3*S**,4*S**,7*S**,8*S**,9*S**,13*S**,14*S**,15*R**)-8,9,14,15-tetra-acetoxy-3-benzoyloxy-7-hydroxyjatropha-5*E*,11*E*-diene	$C_{35}H_{46}O_{11}$	$CDCl_3$	[546]
10-18-30	14β-acetoxy-3β-benzoyloxy-7β,9α,15β-trihydroxyjatro-pha-5*E*,11*E*-diene	$C_{29}H_{40}O_7$	$CDCl_3$	[547]
10-18-31	7β,9α,14β-triacetoxy-3β-benzoyloxy-15β,17-dihydroxy-jatropha-5*E*,11*E*-diene	$C_{33}H_{44}O_{10}$	$CDCl_3$	[547]
10-18-32	14α,15β-diacetoxy-3β,7β-dibenzoyloxy-17-hydroxy-9-oxo-2β*H*,13β*H*-jatropha-5*E*,11*E*-diene	$C_{38}H_{44}O_{10}$	$CDCl_3$	[547]
10-18-33	euphopubescene	$C_{32}H_{46}O_{12}$	$CDCl_3$	[542]
10-18-34	pubescene D	$C_{31}H_{40}O_8$	$CDCl_3$	[548]
10-18-35	pubescene B	$C_{30}H_{44}O_9$	$CDCl_3$	[549]
10-18-36	euphoheliosnoid D	$C_{29}H_{36}O_8$	$CDCl_3$	[550]
10-18-37	(2*S*,3*S*,6*S*,7*R*,8*R*,9*S*,13*S*,14*S*,15*R*)-7,8,9,14,15-pentaace-toxy-3-benzoyloxy-6-hydroxyjatropha-4*E*,11*E*-diene	$C_{37}H_{48}O_{13}$	$CDCl_3$	[546]
10-18-38	*rel*-(2*S*,3*S*,4*E*,6*S*,7*R*,8*R*,9*S*,11*E*,13*S*,14*S*,15*R*)-7,8,9,14,15-pentaacetoxy-3-(benzoyloxy)-6-hydroxyjatropha-4,11-diene	$C_{37}H_{48}O_{13}$	$CDCl_3$	[551]

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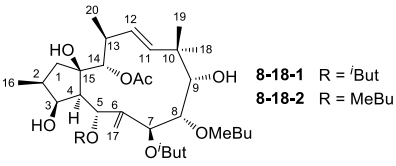
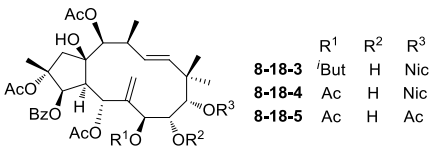
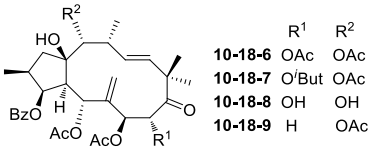
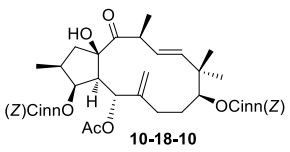
Table 10-18-1 (continued)

No.	Compounds	MFs	Test solvents	References
10-18-39	(2*R**,3*R**,6*S**,7*R**,8*R**,9*S**,13*S**,15*R**)-6,7,8,9,15-pentaace-toxy-3-benzoyloxy-2-hydroxy-14-oxojatropha-4*E*,11*E*-diene	$C_{37}H_{46}O_{14}$	$CDCl_3$	[546]
10-18-40	serrulatin B	$C_{37}H_{46}O_{13}$	$CDCl_3$	[552]
			C_6D_6	[552]
10-18-41	kansuinin A	$C_{37}H_{46}O_{15}$	$CDCl_3$	[544]
10-18-42	kansuinin D	$C_{41}H_{47}NO_{15}$	$CDCl_3$	[545]
10-18-43	esulatin C	$C_{36}H_{50}O_{17}$	$CDCl_3$	[543]
10-18-44	serrulatin A	$C_{38}H_{48}O_{12}$	$CDCl_3$	[552]
10-18-45	*rel*-(2*R*,3*S*,6*R*,7*S*,8*S*,9*S*,13*R*,14*S*,15*S*)-(4*E*,11*E*)-8,14,15-triacetoxy-3-(benzoyloxy)-6,9-epoxy-9-hydroxy-7-(tig-loyloxy)jatropha-4,11-diene	$C_{38}H_{48}O_{12}$	$CDCl_3$	[553]
10-18-46	*rel*-(2*R*,3*S*,4*E*,6*S*,7*R*,8*S*,9*R*,11*E*,13*R*,14*S*,15*R*)-8,14,15-triacetoxy-3,7-bis(benzoyloxy)-6,9-epoxy-9-hydroxyjat-ropha-4,11-diene	$C_{40}H_{46}O_{12}$	$CDCl_3$	[551]
10-18-47	7*β*,9*α*,14*β*-triacetoxy-3*β*-benzoyloxy-12*β*,15*β*-epoxy-11*β*-hydroxyjatropha-5*E*-ene	$C_{33}H_{44}O_{10}$	$CDCl_3$	[547]
10-18-48	terracinolide H	$C_{38}H_{54}O_{16}$	$CDCl_3$	[536]
10-18-49	terracinolide I	$C_{38}H_{52}O_{18}$	$CDCl_3$	[536]
10-18-50	13*α*-hydroxyterracinolide B	$C_{38}H_{52}O_{18}$	$CDCl_3$	[536]
10-18-51	isoterracinolide A	$C_{41}H_{54}O_{16}$	$CDCl_3$	[554]
10-18-52	isoterracinolide B	$C_{40}H_{52}O_{16}$	$CDCl_3$	[554]
10-18-53	salicinolide	$C_{36}H_{50}O_{17}$	$CDCl_3$	[555]
10-18-54	(2*S*,3*S*,4*R*,5*R*,7*S*,8*S*,9*S*,11*E*,13*S*,14*S*)-3,5,7,8,9,14-hexa-hydroxy-1(15→14)abeo-jatropha-6(17),11-dien-15-one 5,8-bis(2-methylbutyrate) 7-(2-methylpropionate)	$C_{34}H_{54}O_{10}$	$CDCl_3$	[533]
10-18-55	abeodendroidin F	$C_{37}H_{48}O_{13}$	$CDCl_3$	[556]
10-18-56	salicifoline	$C_{36}H_{50}O_{17}$	C_6D_6	[555]









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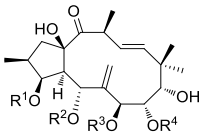
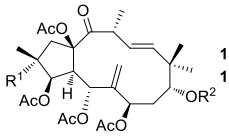
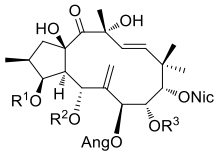


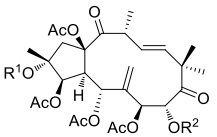
	R^1	R^2	R^3	R^4
10-18-11	H	MeBu	MeBu	MeBu
10-18-12	H	^{i}But	^{i}But	^{i}But
10-18-13	Ac	H	^{i}But	MeBu



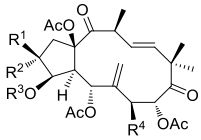
	R^1	R^2
10-18-14	OAc	Ac
10-18-15	H	Nic



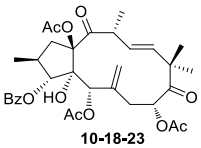
	R^1	R^2	R^3
10-18-16	Ac	Ac	Ang
10-18-17	Ang	H	Ac
10-18-18	Hydrp	H	Ac



	R^1	R^2
10-18-19	Bz	Ac
10-18-20	Ac	H



	R^1	R^2	R^3	R^4
10-18-21	H	Me	Bz	H
10-18-22	Me	H	Ac	OBz



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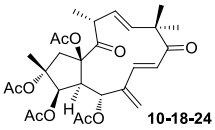
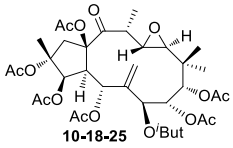
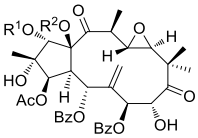


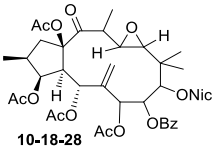
10-18-24



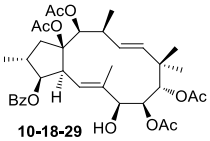
10-18-25



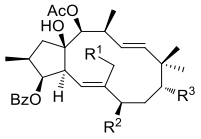
	R^1	R^2
10-18-26	Ac	H
10-18-27	H	Ac



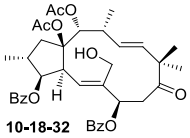
10-18-28



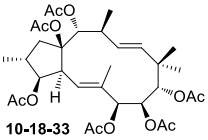
10-18-29



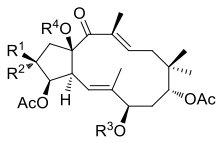
	R^1	R^2	R^3
10-18-30	H	OH	OH
10-18-31	OH	OAc	OAc



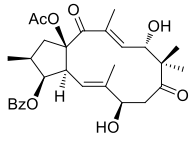
10-18-32



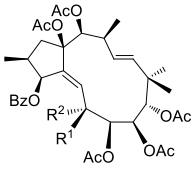
10-18-33



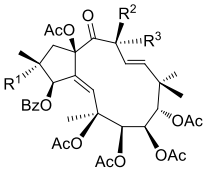
	R^1	R^2	R^3	R^4
10-18-34	H	Me	Bz	H
10-18-35	Me	H	But	Ac



10-18-36



	R^1	R^2
10-18-37	OH	Me
10-18-38	Me	OH



	R^1	R^2	R^3
10-18-39	OH	Me	H
10-18-40	H	H	Me

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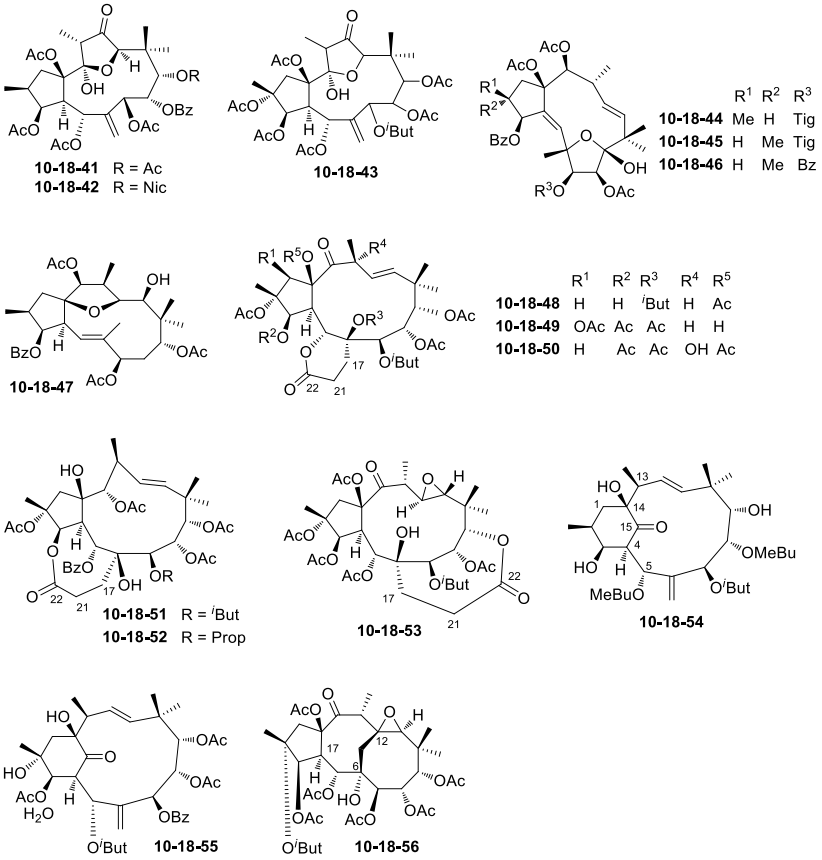

Table 10-18-2: ^{1}H NMR spectroscopic data of jatrophane-type diterpenoids **10-18-1**~**10-18-4**.

H	10-18-1	10-18-2	10-18-3	10-18-4
1α	2.10 m(ov)	2.15 m(ov)	2.86 br d(15)	2.84 br d(15)
1β	1.55 m(ov)	1.69 m(ov)	2.08 d(15)	2.07 d(15)
2	2.10 m(ov)	2.15 m(ov)		
3	4.16 ddd(7.5, 4, 3)	4.16 ddd(7.5, 4, 3)	5.92 d(6)	5.97 d(6)
4	2.35 m(ov)	2.35 m(ov)	3.75 dd(6, 4)	3.76 dd(6, 4)
5	5.80 br s	5.79 br s	5.80 br d(4)	5.80 br d(4)
7	5.40 s	5.42 s	5.39 br s	5.29 br s
8	5.18 s	5.18 s	4.14 d(11.5)	4.15 d(11.5)
			2.95 d(11.5, OH)	2.85 d(11.5, OH)
9	3.62 br s	3.61 br s	5.08 s	5.11 s
11	5.77 d(16)	5.76 d(16)	6.17 d(16)	6.13 d(16)
12	5.55 dd(16, 9)	5.55 dd(16, 9)	5.67 dd(16, 9)	5.65 dd(16, 9)
13	2.45 dq(9, 7)	2.45 dq(9, 7)	2.88 dq(9, 7)	2.82 dq(9, 7)
14	4.98 s	4.98 s	5.15 s	5.14 s

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Table 10-18-2 (continued)

H	10-18-1	10-18-2	10-18-3	10-18-4
15			3.67 br s(OH)	3.67 br s(OH)
16	1.10 d(6.5)	1.10 d(6.5)	1.48 s	1.47 s
17	5.08 s, 5.02 s	5.07 s, 5.01 s	4.83 br s, 4.44 d	4.77 br s, 4.47 d
18	1.05 s	1.05 s	1.07 s	1.08 s
19	1.24 s	1.25 s	1.37 s	1.36 s
20	1.20 d(7)	1.20 d(7)	1.17 d(7)	1.17 d(7)
OAc	2.11 s	2.11 s	2.21 s, 2.11 s	2.22 s, 2.11 s
			2.04 s	2.05 s, 1.47 s
OCOR	2.60 sept(7)	2.61 sept(7)		
	2.57 sept(7)	2.50, 2.35 m(ov)		
	2.30~2.40 m(ov)	1.65 m(ov), 1.45 m(ov)		
	1.55 m(ov), 1.45 m(ov)	1.10~1.20(ov), 1.20 d(7)		
	1.10~1.20(ov)	0.87 t(7.5)		
	0.87 t(7.5)	0.83 t(7.5)		
OBz			8.05 (*o*)	8.06 (*o*)
			7.42 (*m*)	7.42 (*m*)
			7.56 (*p*)	7.57 (*p*)
O^{i}But			2.00 qq(7, 7)	
			0.93 d(7)	
			0.47 d(7)	
ONic			9.30 br d, 8.36 ddd	9.32 br d, 8.37 ddd
			7.43 br d, 8.22 dd	7.41 dd, 8.83 dd

Table 10-18-3: ^{1}H NMR spectroscopic data of jatrophane-type diterpenoids **10-18-5**~**10-18-8**.

H	10-18-5	10-18-6	10-18-7	10-18-8
1α	2.69 br d(15)	2.20 m	2.20 m	2.39 br dd(13.5, 6.5)
1β	2.15 d(15)	1.92 m	1.89 m	1.92 dd(13.5, 13.0)
2		1.92 m	1.95 m	2.15 m
3	5.89 d(6)	5.69 br dd(3.5, 3.5)	5.69 br dd(3.5, 3.5)	5.70 br dd(3.5, 3.5)
4	3.38 dd(6, 4)	2.88 dd(3.5, 2.0)	2.87 dd(3.5, 2.0)	2.81 dd(3.5, 2.0)
5	5.75 br d(4)	5.52 br s	5.51 br s	5.56 br s
7	5.18 br s	5.62 br s	5.59 br s	5.42 br s
8	4.04 d(11.5)	5.74 s	5.74 s	4.49 d
	2.94 d(11.5, OH)			3.21 d(OH)
9	4.72 s			
11	5.90 d(16)	6.13 d(16.0)	6.13 d(16.0)	5.92 d(16.0)
12	5.57 dd(16, 9)	5.89 dd(16.0, 9.0)	5.90 dd(16.0, 9.0)	6.18 dd(16.0, 9.0)
13	2.68 dq(9, 7)	3.20 dq(9.0, 7.0)	3.20 dq(9.0, 7.0)	3.04 dq(9.0, 7.0)
14	5.10 s	5.13 s	5.14 s	3.70 s
15	3.64 br s(OH)	2.59 br s(OH)	2.60 br s(OH)	2.51 br s(OH)
16	1.51 s	0.91 d(6.5)	0.91d(6.5)	0.91 d(6.5)
17	4.86 br s	5.14 br s	5.11 br s	5.10 br s
	4.51 d	4.96 br s	4.94 br s	4.91 br s

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Table 10-18-3 (continued)

H	10-18-5	10-18-6	10-18-7	10-18-8
18	1.01 s	1.21 s	1.19 s	1.20 s
19	1.29 s	1.23 s	1.22 s	1.23 s
20	1.14 d(7)	1.14 d(7.0)	1.14 d(7.0)	1.18 d(7.0)
OAc	2.15 s, 2.10 s	1.63 s(5-OAc), 2.12 s(7-OAc)	1.64 s(5-OAc)	1.69 s(5-OAc)
	2.08 s, 2.07 s	2.07 s(8-OAc)	2.07 s(7-OAc)	2.07 s(7-OAc)
	2.01 s	2.21 s(14-OAc)	2.23 s(14-OAc)	
OBz	8.09 AA′	8.09 AA′	8.09 AA′	8.11 AA′
	7.44 BB′, 7.57 C	7.48 BB′, 7.60 C	7.48 BB′, 7.60 C	7.48 BB′, 7.60 C
O^{i}But			2.63 m, 1.18 d(7.0)	
			1.16 d(7.0)	

Table 10-18-4: ^{1}H NMR spectroscopic data of jatrophane-type diterpenoids **10-18-9**~**10-18-12**.

H	10-18-9	10-18-10	10-18-11	10-18-12
1α	2.21 m	2.39 dd(14, 8.5)	2.45 dd(14, 11)	2.44 dd(14, 11)
1β	1.88 m	1.86 dd(14, 11)	1.45 m(ov)	1.50 dd(14, 7.5)
2	1.93 m	2.30 dddq(6.5, 8.5, 11, 3.5)	2.30 m(ov)	2.30 m(ov)
3	5.71 m	5.75 dd(3.5, 3.5)	4.18 ddd(8, 4, 3.5)	4.19 ddd(8, 4, 3.5)
4	2.87 dd(3.5, 2.0)	2.79 dd(3.5, 10)	2.76 br s	2.75 br s
5	5.71 m	5.73 d(10)	5.23 s	5.23 s
7	5.25 br d(9.0)	α 1.66 m, β 2.23 m	5.38 s	5.37 s
8	α 2.32 dd(9.0, 14.0)	α 1.43 m	4.98 s	4.93 s
	β 3.40 br d(14.0)	β 1.56 m		
9		4.51 br d(8)	3.54 s	3.57 s
11	5.98 d(16.0)	5.52 d(16)	5.97 d(16)	5.96 d(16)
12	5.72 dd(16.0, 9.0)	5.45 d(16)	5.40 dd(16, 9.5)	5.40 dd(16, 9.5)
13	3.16 dq(7.0, 9.0)	3.43 dq(6.5, 9)	3.70 dq(9.5, 6.5)	3.69 dq(9.5, 6.5)
14	5.10 s			
15	2.60 br s(OH)	4.31 s(OH)		
16	0.91 d(6.5)	1.07 d(6.5)	1.16 d(7)	1.14 d(7)
17	5.04 br s, 4.86 br s	5.16 br s, 4.71 br s	5.21 br s, 5.05 br s	5.23 br s, 5.05 br s
18	1.21 s	1.10 s	1.07 s	1.07 s
19	1.17 s	1.14 s	1.20 s	1.19 s
20	1.13 d(7.0)	1.35 d(6.5)	1.24 d(6.5)	1.24 d(6.5)
OAc	1.62 s(5-OAc)	1.95 s(5-OAc)		
	2.11 s(7-OAc)			
	2.19 s(14-OAc)			
3-Cinn		6.49 d, 7.74 d		
		7.55 m, 7.37 m		
8-Cinn		6.43 d, 7.67 d		
		7.53 m, 7.38 m		
OCOR	8.09 AA′		2.30~2.40 m	2.60 sept(7)
	7.48 BB′		1.40~1.70 m	2.50~2.60 m(ov)
	7.60 C		1.14 d, 1.00 d	1.21 d, 1.20 d
			0.92 d(7)	1.13 d(7)
			0.93 t, 0.85 t	1.12 d(7)
			0.81 t(7.5)	

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Table 10-18-5: ^{1}H NMR spectroscopic data of jatrophane-type diterpenoids **10-18-13**, **10-18-14**, and **10-18-19**.

H	10-18-13	10-18-14	10-18-19
1	α 2.40 m(ov), β 1.65 m(ov)	3.80 br d(16.1), 1.93 d(16.1)	α 4.08 dd(16.0, 1.0), β 2.05 d(16.0)
2	2.40 m		
3	5.59 dd(4, 4)	5.42 d(3.1)	5.74 dd(1.0, 4.0)
4	2.85 br s	2.85 d(3.1)	2.96 dd(1.0, 4.0)
5	4.05 d(1.5)	5.94 s	5.70 br s
7	5.38 s	4.96 t(5.6)	5.41 br s
8	4.79 s	2.00 m	5.69 s
9	3.48 s	4.74 dd(7.2, 4.4)	
11	5.96 d(16)	5.85 d(16.0)	6.22 d(16.0)
12	5.26 dd(16, 9.5)	5.54 dd(16.0, 9.3)	5.46 dd(16.0, 9.0)
13	3.66 dq(9.5, 6.5)	3.48 dq(9.3, 6.6)	3.62 dq(9.0, 7.0)
16	1.00 d(6.5)	1.49 s	1.65 s
17	5.26 br s, 5.10 d(1)	5.21 s, 5.15 s	5.28 br s, 5.27 br s
18	1.06 s	1.06 s	1.12 s
19	1.08 s	1.02 s	1.22 s
20	1.28 d(6.5)	1.14 d(6.6)	1.08 d(7.0)
OAc	2.04 s	2.11 s(2-OAc), 2.14 s(3-OAc)	2.21 s, 2.14 s
		2.00 s(5-OAc), 2.12 s(7-OAc)	2.13 s, 2.11 s
		2.14 s(9-OAc), 2.00 s(15-OAc)	2.07 s
OCOR	2.65 sept(7), 2.40 m		8.01 AA′
	1.65 m, 1.45 m		7.40 BB′
	1.24 d, 1.22 d		7.52 C
	1.12 d(7), 0.86 t(7.5)		

Table 10-18-6: ^{1}H NMR spectroscopic data of jatrophane-type diterpenoids **10-18-15**~**10-18-18**.

H	10-18-15	10-18-16	10-18-17	10-18-18
1α	3.01 dd(14.0, 7.7)	2.49 dd(15.0, 8.0)	2.56 dd(15.0, 8.0)	2.56 dd(15.0, 8.0)
1β	1.65 dd(14.0, 12.7)	1.80 dd(15.0, 11.0)	1.82 dd(15.0, 11.0)	1.84 dd(15.0, 11.0)
2	2.22 m	2.10 m	2.18 m	2.18 m
3	5.42 t(3.0)	5.43 d(7.0, 3.5)	5.66 d(7.0, 3.5)	5.72 d(7.0, 3.5)
4	2.71 d(3.0)	3.79 dd(3.5, 10.0)	3.41dd(3.5, 10.0)	3.45 dd(3.5, 10.0)
5	5.81 s	5.53 d(10.0, ov)	4.43 d(10.0)	4.49 d(10.0)
5-OH			2.18 d	2.30 d
7	4.84 dd(7.1, 2.3)	5.14 d(12)	5.27 d(12, ov)	5.33 d(12, ov)
8	2.18 m	5.53 d(12, ov)	5.50 d(12)	5.55 d(12, ov)
9	5.09 dd(2.7, 7.9)	5.22 s	5.27 s	5.32 s
11	5.94 d(16.0)	5.81 d(16.0)	5.82 d(16.0)	5.80 d(16.0)
12	5.65 dd(16.0, 9.0)	5.52 d(16.0, ov)	5.41 d(16.0)	5.45 d(16.0)
13	3.53 dq(9.0, 6.7)	4.95 s(OH)	4.85 s(OH)	5.40 s(OH)
15		4.02 s(OH)	3.32 s(OH)	4.55 s(OH)

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Table 10-18-6 (continued)

H	10-18-15	10-18-16	10-18-17	10-18-18
16	0.90 d(6.6)	0.90 d	1.01 d(ov)	1.05 d
17	5.07 s	5.65 s, 5.78 s	5.43 s, 5.62 s	5.55 s, 5.73 s
18	1.13 s	1.00 s	1.01 s	1.00 s
19	1.11 s	1.12 s	1.10 s	1.06 s
20	1.20 d(6.7)	1.49 s	1.45 s	1.46 s
OAc	2.13 s(3-OAc) 2.15 s(5-OAc) 1.52 s(7-OAc) 2.11 s(15-OAc)	1.97 s(3-OAc) 1.72 s(5-OAc)	1.99 s(8-OAc)	2.02 s(8-OAc)
2-ONic	9.23 d(1.5)	9.27 s	9.30 s	9.30 s
4-ONic	8.21 dt(7.9, 1.5)	8.33 d(8.0)	8.38 d(8.0)	8.37 d(8.0)
5-ONic	7.43 dd(7.9, 4.8)	7.44 br dd(8.0, 5.0)	7.45 br dd(8.0, 5.0)	7.45 br dd(8.0, 5.0)
6-ONic	8.80 dd(4.8, 1.5)	8.80 br d(5.0)	8.80 br d(5.0)	8.82 br d(5.0)
3(8)-Ang-3′		6.89 br q(7.0)	6.98 br q(7.0)	
3(8)-Ang-4′		1.86 d(7.0)	1.90 d(7.0)	
3(8)-Ang-5′		1.92 s	1.96 s	
7-Ang-3′		6.74 br q(7.0)	6.63 br q(7.0)	6.66 br q(7.0)
7-Ang-4′		1.67 d(7.0)	1.70 d(7.0)	1.70 d(7.0)
7-Ang-5′		1.66 s	1.66 s	1.65 s
Hydrp-3′				4.95 br q(7.0) 10.30 s(OH)
Hydrp-4′				1.51 d(7.0)
Hydrp-5′				5.85 s, 6.45 s

Table 10-18-7: ^{1}H NMR spectroscopic data of jatrophane-type diterpenoids **10-18-20**~**10-18-23**.

H	10-18-20	10-18-21	10-18-22	10-18-23
1	*α* 3.88 dd(16.0, 1.0) *β* 1.92 d(16.0)	2.16 m 3.10 dd(15.9, 9.0)	*α* 2.93 dd(16.0, 8.0) *β* 2.11 dd(16.0, 12.5)	2.43 m (ov)
2		2.48 m	2.37 m	2.94 m
3	5.53 dd(1.0, 4.0)	5.45 dd(5.1, 1.2)	5.59 t(3.6)	5.63 d(10.4)
4	2.91 dd(1.0, 4.0)	2.89 dd(9.9, 5.4)	2.93 dd(10.0, 3.6)	3.47 br s(OH)
5	5.81 br s	5.90 d(9.9)	5.74 d(10.0)	4.88 s
7	5.20 br s	2.16 m	6.11 br s	1.73 dd(9.2, 14.8) 2.03 br d(14.8)
8	4.77 s, 3.35 d(OH)	5.32 br d(7.2)	5.44 br s	5.69 d(9.2)
11	6.09 d(16.0)	5.53 d(15.9)	6.08 d(16.0)	5.89 d(16.0)
12	5.59 dd(16.0, 9.0)	5.94 dd(15.9, 9.9)	5.95 dd(16.0, 9.0)	5.93 dd(9.6, 16.0)
13	3.63 dq(9.0, 7.0)	3.54 m	3.47 dq(9.0, 6.5)	3.87 m
16	1.51 s	1.35 d(7.2)	1.01 d(6.5)	1.26 d(7.2)
17	5.27 br s, 5.23 br s	5.28 br s, 4.96 br s	5.62 br s, 5.55 br s	4.86 br s, 5.14 br s
18	1.19 s	1.24 s	1.26 s	1.23 s
19	1.22 s	1.43 s	1.34 s	1.47 s
20	1.16 d(7.0)	1.35 d(6.5)	1.44 d(6.5)	1.40 d(6.4)

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Table 10-18-7 (continued)

H	10-18-20	10-18-21	10-18-22	10-18-23
OAc	2.18 s, 2.13 s, 2.12 s, 2.09 s	1.83 s(5-OAc)	2.01 s(3-OAc)	2.08 s(5-OAc)
	2.01 s	2.25 s(8-OAc)	1.34 s(5-OAc)2.18 s(8,15-OAc)	1.91 s(8-OAc)
		2.06 s(15-OAc)		2.18 s(15-OAc)
OBz		8.04 br d(7.2, AA′)	7.43 br t(8.0, AA′)	8.00 d(7.6, AA′)
		7.46 t(7.5, BB′)	7.56 br t(8.0, BB′)	7.47 t(7.6, BB′)7.59 t(7.6, C)
		7.60 t(7.5, C)	8.00 br d(8.0, C)	

Table 10-18-8: ^{1}H NMR spectroscopic data of jatrophane-type diterpenoids **10-18-24**~**10-18-27**.

H	10-18-24	10-18-25	10-18-26	10-18-27
1	3.46 d(15.9)	3.73 d(16.2)	4.93 s	4.32 d(3.9)
	2.13 d(15.9)	2.04 d(16.2)		3.92 d(3.9, OH)
2			2.32 s(OH)	2.52 s(OH)
3	5.33 d(6.9)	5.58 br d(3.3)	5.38 d(4.9)	5.54 d(4.9)
4	2.21 dd(6.9, 3.5)	2.98 dd(3.3, 1.7)	3.48 m	3.61 dd(11.3, 4.8)
5	6.03 d(3.5)	6.06 br s	5.95 s	5.91 m
7	6.71 d(16.4)	5.38 br s	5.87 s	5.89 m
8	6.58 d(16.4)	5.51 d(4.1)	4.70 d(9.4)	4.65 d(9.2)
			3.53 d(9.4, OH)	3.54 d(9.4, OH)
9		4.95 d(4.1)		
11	5.70 d(15.9)	3.00 d(2.1)	3.65 d(2.1)	3.69 d(2.2)
12	5.42 dd(15.9, 9.0)	3.32 dd(4.7, 2.1)	3.43 m	3.33 dd(2.4, 9.4)
13	3.60 dq(9.0, 6.7)	3.67 dq(4.7, 6.9)	3.26 m	3.93 m
15			4.11 s(OH)	
16	1.64 s	1.52 s	1.32 s	1.31 s
17	5.37 s	5.09 s, 5.05 s	6.31 s, 5.91 s	6.52 br s, 5.94 br s
18	1.27 s	0.99 s	1.33 s	1.34 s
19	1.23 s	0.71 s	0.85 s	0.85 s
20	1.16 d(6.7)	1.18 d(6.9)	1.66 d(6.4)	1.52 d(6.4)
OAc	2.17 s(2-OAc)	2.11 s(2,3-OAc)	2.13 s(1-OAc)	1.89 s(3-OAc)
	2.02 s(3-OAc)	2.16 s(5-OAc)	1.95 s(3-OAc)	2.31 s(15-OAc)
	2.03 s(5-OAc)	2.03 s(8-OAc)		
	2.15 s(15-OAc)	2.04 s(9-OAc)		
		2.12 s(15-OAc)		
O^{i}But(ONic)		2.60 sept(7.0)		
		1.21 d(7.0)		
		1.18 d(7.0)		
5(8)-OBz			7.48 m(AA′)	7.55 m(AA′)
			6.88 m(BB′)	7.02 m(BB′)
			7.09 m(C)	7.22 m(C)
7-OBz			7.53 m(AA′)	7.50 m(AA′)
			7.02 m(BB′)	6.92 m(BB′)
			7.24 m(C)	7.11 m(C)

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Table 10-18-9: ^{1}H NMR spectroscopic data of jatrophane-type diterpenoids **10-18-28**~**10-18-31**.

H	10-18-28	10-18-29	10-18-30	10-18-31
1	α 2.91 dd(7.9, 14.0)	3.59 dd(14.5, 5.7)	α 2.07 m	α 2.12 m
	β 1.89 m	1.44 dd(14.5, 12.3)	β 1.77 m	β 1.79 m
2	2.29 m	2.36 m	2.17 m	2.18 m
3	5.48 s	4.90 t(9.1)	5.39 t(4.0)	5.47 s
4	3.18 s	3.41 dd(9.1, 10.7)	2.90 dd(5.2, 11.2)	3.11 dd(9.6, 6.0)
5	5.57 s	5.76 d(10.7)	5.62 d(11.2)	5.89 d(9.6)
7	4.88 s	3.75 br d(4.2)	4.20 d(6.0)	5.26 br s
		2.83 br d(4.2, OH)		
8	5.98 s	5.05 br d(3.1)	α 1.76 m, β 1.92 m	1.98 m
9	5.38 s	4.69 br d(3.1)	3.33 t(3.2)	4.83 br s
11	3.37 d(1.8)	5.07 d(15.8)	5.08 d(15.6)	4.99 d(16.0)
12	3.27 br d(6.8)	5.63 dd(15.8, 8.4)	5.56 dd(8.8, 15.6)	5.56 dd(9.6, 16.0)
13	2.75 m	2.60 m	2.53 m	2.54 m
15		4.99 d(2.7)	4.91 d(2.8)	4.94 br s
16	0.90 d(6.8)	1.08 d(6.6)	0.98 d(7.2)	1.00 d(6.4)
17	5.11 s, 4.94 s	1.69 s	1.66 d(1.2)	4.41 d(12.0),
				3.92 d(12.0)
18	0.72 br s	1.01 s	0.86 s	0.87 s
19	1.32 br s	0.91 s	1.08 s	0.95 s
20	1.36 d(6.7)	0.94 d(7.0)	0.96 d(7.2)	0.95 d(6.8)
OAc	1.69 s, 2.09 s,	2.04 s(8-OAc)	2.22 s(14-OAc)	1.14 s(7-OAc)
	2.11 s			
		2.10 s(9-OAc)		1.96 s(9-OAc)
		2.12 s(14-OAc)		2.22 s(14-OAc)
		2.18 s(15-OAc)		
OBz	7.44 m, 7.58 m,	7.96 d(7.1, AA′)	7.44 d(8.0),	7.44 t(8.0),
	8.04 m		7.55 t(8.0),	7.54 t(8.0),
		7.39 t(7.6, BB′)	8.04 t(8.0)	8.04 d(8.0)
		7.50 t(7.4, C)		
O^{i}Bu(ONic)	9.33 br s, 8.86 br s			
	8.34 d(6.3), 7.53 m			

Table 10-18-10: ^{1}H NMR spectroscopic data of jatrophane-type diterpenoids **10-18-32**~**10-18-35**.

H	10-18-32	10-18-33	10-18-34	10-18-35
1α	2.98 dd(4.4, 15.6)	1.38 br t(14.0)	2.55 dd(8.4, 13.2)	3.42 dd(8.0, 13.6)
1β	1.48 dd(8.0, 15.6)	2.81 dd(6.0, 14.0)	2.09 dd(7.2, 13.2)	1.56 t(13.6)
2	2.11 m	2.30 m	2.50 m	2.20 m
3	5.22 dd(2.4, 6.4)	4.67 br t(9.2)	4.93 dd(3.6, 6.8)	5.22 t(3.6)
4	3.52 dd(6.8, 9.6)	3.79 br t(9.2,	2.92 dd(6.8, 10.4)	2.66 dd(3.6, 10.8)
		10.0)		
5	5.97 d(9.6)	5.84 br d(10.0)	6.08 d(10.4)	5.90 d(10.8)
7	5.67 dd(7.2, 11.2)	5.44 br s	5.41 d(5.2)	5.18 d(5.6)

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Table 10-18-10 (continued)

H	10-18-32	10-18-33	10-18-34	10-18-35
8	*α* 3.34 dd(8.4, 16.0)	5.36 br s	1.68 m	1.77 m
	β 2.91 dd(4.4, 16.0)		2.22 m	2.02 m
9		5.34 br s	5.78 d(7.2)	5.61 d(5.6)
11	5.35 d(16.0)	5.12 d(15.6)	2.13 m	1.93 m
12	5.13 dd(8.8, 16.0)	5.48 dd(9.2, 15.6)	7.97 br t(4.8)	7.11 br s
13	2.44 m	2.38 m		
15	5.93 br s	6.50 d(10.0)	3.25 br s(OH)	
16	1.07 d(6.8)	0.86 d(6.4)	1.14 d(6.8)	0.97 d(6.4)
17	4.33 s, 4.35 s	1.89 br s	1.40 br s	1.36 br s
18	1.13 s	0.98 s (ov)	0.94 s	0.93 s
19	1.33 s	0.98 s (ov)	0.90 s	0.83 s
20	0.93 d(6.8)	1.03 d(6.8)	1.73 brs	1.71 br s
OAc	2.20 s(14-OAc)	1.75 s, 1.76 s, 1.83 s, 1.85 s, 1.95 s, 2.28 s,	2.01 s(3-OAc)	2.07 s(3-OAc)
	2.19 s(15-OAc)		1.53 s(9-OAc)	2.12 s(9-OAc)
				2.22 s(15-OAc)
3-OBz	7.64 d(8.0)		8.04 d(7.2, AA′)	
	7.12 t(8.0)		7.45 t(7.2, BB′)	
	7.36 t(8.0)		7.57 t(7.2)	
OBu				2.20 m
				1.63 m
				0.96 t(7.6)

Table 10-18-11: ^{1}H NMR spectroscopic data of jatrophane-type diterpenoids **10-18-36**~**10-18-39**.

H	10-18-36	10-18-37	10-18-38	10-18-39
1	*α* 1.70 dd(13.7, 8.2)	2.45 m	2.53 m	3.18 d(15.6)
	β 3.27 dd(13.7, 7.3)			2.16 dd(15.6, 2.0)
2	2.38 m	2.20 m	2.22 m	3.96 d(2.0, OH)
3	5.22 dd(4.1, 3.3)	6.25 d(3.0)	6.36 d(2.5)	5.93 s
4	2.96 dd(10.6, 4.1)			
5	5.86 d(10.6)	6.63 br s	6.52 s	6.06 s
6		3.34 s(OH)	6.07 s(OH)	
7	4.17 m	5.85 br s	4.96 d(6.7)	5.59 d(3.5)
8	*α* 2.49 dd(16.0, 5.6)	5.44 br s	5.60 d(6.7)	5.34 d(3.5)
	β 3.67 d(16.0)			
9		5.69 s	5.52 s	5.15 s
11	4.19 d(9.4)	5.39 d(16.7)	5.37 d(16.7)	5.41 d(15.9)
12	6.38 d(9.4)	5.68 dd(16.7, 9.3)	5.47 dd(16.7, 8.6)	5.58 dd(15.9, 8.7)
13		2.50 m	2.62 m	4.28 dq(8.7, 6.9)
14		5.98 br s	5.97 br s	
16	1.00 d(6.7)	1.07 d(6.7)	1.22 d(6.6)	1.39 s

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Table 10-18-11 (continued)

H	10-18-36	10-18-37	10-18-38	10-18-39
17	1.51 s	1.11 s	1.28 s	1.53 s
18	1.28 s	0.98 s	0.92 s	0.92 s
19	0.87 s	0.90 s	0.88 s	0.83 s
20	1.83 s	1.06 d(6.4)	1.04 d(7.0)	1.22 d(6.9)
OAc	2.20 s(15-OAc)	2.11 s(7-OAc)	2.12 s(7-OAc)	2.11 s(6-OAc)
		2.06 s(8-OAc)	2.06 s(8-OAc)	2.19 s(7-OAc)
		2.21 s(9-OAc)	2.09 s(9-OAc)	2.10 s(8-OAc)
		2.24 s(14-OAc)	2.20 s(14-OAc)	2.10 s(9-OAc)
		1.99 s(15-OAc)	1.60 s(15-OAc)	2.08 s(15-OAc)
OBz	8.07 d(7.4, AA′)	7.98 d(7.6, AA′)	7.93 d(7.2, AA′)	8.01 d(7.6, AA′)
	7.48 t(7.4, BB′)	7.39 t(7.6, BB′)	7.41 t(7.8, BB′)	7.44 t(7.5, BB′)
	7.60 t(7.5, C)	7.53 t(7.4, C)	7.56 t(7.5, C)	7.58 t(7.4, C)

Table 10-18-12: ^{1}H NMR spectroscopic data of jatrophane-type diterpenoids **10-18-40**~**10-18-42**.

H	10-18-40($CDCl_3$)	10-18-40(C_6D_6)	10-18-41	10-18-42
1	*α* 2.70 dd(13.4, 6.7)	*α* 2.75 dd(13.2, 6.5)	2.65 dd(6.4, 13.9)	*α* 2.68 dd(4.5, 12.0)
	β 2.02 t(13.4)	*β* 2.13 t(13.2)	2.20 m	*β* 2.19 m
2	2.33 m	2.45 ddq(13.2, 6.8, 6.5)	2.12 m	2.20 m
3	5.75 dd(4.5, 1.5)	6.33 br d(4.4)	5.58 m	5.58 br s
4			2.97 br s	3.05 d(2.7)
5	5.90 d(1.5)	6.53 d(1.6)	6.13 s	6.19 s
7	5.25 d(3.0)	5.67 d(2.9)	6.39 s	6.43 s
8	5.37 d(3.0)	5.71 d(2.9)	6.05 s	6.17 s
9	5.41 s	5.76 s	5.07 s	5.36 s
11	5.42 d(16.3)	5.61 d(16.3)	4.13 s	4.30 s
12	5.75 dd(16.3, 9.0)	5.67 dd(16.3, 7.8)		
13	3.72 dq(9.0, 6.7)	3.68 dq(7.8, 6.7)	2.28 q(6.5)	2.33 q(6.6)
16	1.45 d(6.9)	1.69 d(6.8)	0.92 d(6.3)	0.92 d(6.0)
17	1.48 s	1.81 s	5.24 s, 5.14 s	5.17 s, 4.99 s
18	0.90 s	0.95 s	1.29 s	1.21 s
19	0.85 s	0.90 s	1.14 s	1.40 s
20	1.26 d(6.7)	1.47 d(6.7)	1.30 d(6.5)	1.32 d(6.5)
OAc	2.15 s(6-OAc)	1.99 s(6-OAc)	1.98 s(3,15-OAc)	2.09 s(3-OAc)
	2.04 s(7-OAc)	1.64 s(7-OAc)	1.91 s(5-OAc)	1.95 s(5-OAc)
	2.07 s(8-OAc)	1.82 s(8-OAc)	2.18 s(7-OAc)	1.51 s(7-OAc)
	2.12 s(9-OAc)	1.76 s(9-OAc)	2.07 s(9-OAc)	2.00 s(15-OAc)
	2.11 s(15-OAc)	1.63 s(15-OAc)		
OBz	8.07 d(7.1, AA′)	8.28 dd(6.8, 1.5, AA′)	8.03 m(AA′)	
	7.54 t(7.4, BB′)	7.06 m(BB′)	7.42 m(BB′)	
	7.42 t(7.7, C)	7.06 m(C)	7.42 m(C)	
ONic				8.03 m, 7.41 m
				7.55 m, 9.18 s
				8.77 d(4.2)
				8.31 d(7.8), 7.39 m

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Table 10-18-13: ^{1}H NMR spectroscopic data of jatrophane-type diterpenoids **10-18-43**~**10-18-46**.

H	10-18-43	10-18-44	10-18-45	10-18-46
1	3.10 d(16.5)	*α* 2.56 dd(13.8, 12.2)	*α* 1.54 dd(14.4, 5.3)	2.74 dd(14.4, 9.7)
	2.80 d(16.5)	*β* 1.76 dd(12.2, 5.5)	*β* 2.71 dd(14.4, 9.7)	1.55 m
2		2.45 m	2.53 m	2.56 m
3	6.02 d(3.5)	6.23 br d(5.5)	5.74 dd(3.9, 2.4)	5.80 br s
4	3.28 d(3.5)			
5	6.20 s	5.41 d(1.7)	5.55 d(2.4)	5.60 d(2.0)
7	6.49 s	5.79 d(3.7)	5.70 d(4.0)	5.89 d(4.0)
8	5.65 s	5.59 d(3.7)	5.61 d(4.0)	5.69 d(4.0)
9	4.94 s	3.34 s(OH)	3.20 s(OH)	3.26 s(OH)
11	4.13 s	5.41 d(16.1)	5.43 d(16.2)	5.48 d(16.2)
12		5.27 dd(16.1, 9.3)	5.36 dd(16.2, 9.0)	5.39 dd(16.2, 8.9)
13	2.17 dq(7.0, 1.9)	3.15 m	3.18 m	3.20 m
14	3.99 d(1.9, OH)	4.96 d(9.7)	4.19 d(9.3)	4.94 d(9.2)
16	1.56 s	0.93 d(6.5)	1.24 d(7.4)	1.25 d(7.0)
17	5.04 s, 4.95 s	1.13 s	1.28 s	1.37 s
18	1.24 s	1.18 s	1.18 s	1.21 s
19	1.12 s	0.91 s	0.90 s	0.91 s
20	1.24 d(7.0)	0.96 d(6.9)	0.98 d(7.0)	1.00 d(6.9)
OAc	2.06 s(8-OAc)	2.08 s(8-OAc)	2.02 s(8-OAc)	2.20 s
	1.99 s(9-OAc)	2.16 s(14-OAc)	2.15 s(14-OAc)	2.16 s
	2.02 s, 2.16 s	2.21 s(15-OAc)	2.19 s(15-OAc)	2.00 s
	2.11 s, 2.00 s			
O^{i}But	2.61 sept(7.0)			
	1.16 d(7.0)			
	1.23 d(7.0)			
OBz		8.09 d(7.1, AA′)	8.09 d(7.1, AA′)	7.78 d(7.4, AA′)
		7.49 t(7.4, BB′)	7.49 t(7.4, BB′)	7.34 t(7.5, BB′)
		7.39 t(7.6, C)	7.39 t(7.6, C)	7.51 t(7.4, C)
OTig		6.70 dq(7.2, 1.6)	6.59 dq(7.0, 1.4)	
		1.71 m	1.66 dd(7.0, 1.0)	
		1.71 m	1.59 d(1.0)	

Table 10-18-14: ^{1}H NMR spectroscopic data of jatrophane-type diterpenoids **10-18-47**~**10-18-50**.

H	10-18-47	10-18-48	10-18-49	10-18-50
1	2.05 m	*α* 2.93 d(17)	5.14 s	*α* 4.01 d(18)
		β 2.70 d(17)		*β* 2.83 d(18)
2	2.09 m			
3	5.39 t(6.8)	4.70 d(3)	5.82 d(4.5)	5.47 d(4.5)
4	3.10 dd(6.8, 11.2)	3.58 dd(3, 8.5)	3.80 dd(4.5, 9.5)	3.85 dd(4.5, 9.5)
5	5.68 d(11.2)	5.80 d(8.5)	5.37 d(9.5)	5.49 d(9.5)
7	4.96 d(4.8)	6.12 s	6.11 s	5.86 s
8	*α* 1.85 dt(5.2, 16.0)	5.59 s	5.53 s	5.52 s
	β 1.68 d(16.0)			

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Table 10-18-14 (continued)

H	10-18-47	10-18-48	10-18-49	10-18-50
9	6.20 d(5.2)	4.86 s	4.85 s	4.91 s
11	2.91 dd(6.4, 11.2)	5.90 d(16)	6.00 d(16)	6.08 d(17)
12	3.60 t(8.8)	5.47 dd(16, 10)	5.42 dd(16, 10)	5.86 d(17)
13	2.26 m	4.00 dq(10, 7)	3.95 dq(10, 7)	3.64 s(OH)
14	5.15 d(4.8)			
15			3.99 s(OH)	
16	1.05 d(6.8)	1.70 s	1.53 s	1.49 s
17	1.63 d(1.2)	*α* 2.45 m, *β* 1.74 m	*α* 2.36 m, *β* 1.83 m	*α* 2.45 m, *β* 1.85 m
18	0.85 s	0.91 s	0.91 s	0.96 s
19	0.91 s	1.27 s	1.24 s	1.28 s
20	1.12 d(6.8)	1.32 d(7)	1.40 d(7)	1.54 s
21		*α* 2.45 m, *β* 3.34 m	*α* 2.41 m, *β* 3.21 m	*α* 2.45 m, *β* 3.31 m
OAc	1.32 s(7-OAc)	2.26 s, 2.07 s, 2.04 s, 2.01 s	2.28 s, 2.07 s,	2.19 s, 2.16 s, 2.06 s, 2.05 s
	1.99 s(9-OAc)		2.07 s, 2.01 s	2.02 s, 1.98 s
	2.17 s(14-OAc)		2.01 s, 1.99 s	
7-O^{i}But		1.20 d(7), 1.26 d(7), 2.56 qq(7, 7)	1.16 d(7), 1.21 d(7), 2.54 qq(7, 7)	1.23 d(7), 1.27 d(7), 2.69 qq(7, 7)
6-O^{i}But		1.16 d(7), 1.20 d(7), 2.51 qq		
OBz	7.41 t(8.0), 7.50 t(8.0), 8.05 d(8.0)			

Table 10-18-15: ^{1}H NMR spectroscopic data of jatrophane-type diterpenoids **10-18-51**~**10-18-53**.

H	10-18-51	10-18-52	10-18-53
1	*α* 2.82 d(16.5), *β* 2.22 d(16.5)	*α* 2.82 d(16.5), *β* 2.22 d(16.5)	*α* 3.37 d(16.8), *β* 2.29 d(16.8)
3	5.46 d(4)	5.48 d(3.5)	5.76 d(3.0)
4	2.97 dd(4, 3.5)	2.97 t(3.5)	3.08 d(3.0)
5	6.56 d(3.5)	6.57 d(3.5)	5.50 s
6			3.36 s(OH)
7	5.32 s	5.30 s	4.97 d(10.1)
8	5.69 d(6)	5.69 d(6)	5.66 dd(10.1, 9.2)
9	4.95 d(6)	4.95 d(6)	4.78 d(9.2)
11	5.49 d(16)	5.49 d(16)	3.84 d(1.8)
12	5.76 dd(16, 10)	5.77 dd(16, 10)	2.85 dd(8.4, 1.8)
13	2.66 m	2.67 dq(10, 7)	2.68 dq(8.4, 1.8)
15	5.02 s	5.03 s	
16	1.73 s	1.73 s	1.49 s
17	*α* 1.68 ddd(14, 7, 2)	*α* 1.69 ddd(14, 7, 2.5)	2.40 m
	β 1.82 ddd(14, 14, 3)	*β* 1.83 ddd(14, 14, 2.5)	2.32 m
18	0.96 s	0.96 s	0.99 s

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Table 10-18-15 (continued)

H	10-18-51	10-18-52	10-18-53
19	1.03 s	1.03 s	0.73 s
20	1.08 d(7)	1.09 d(7)	1.27 d(6.6)
21	*α* 3.17 ddd(14, 14, 2)	*α* 3.20 ddd(14, 14, 2.5)	2.47 m
	β 2.30 ddd(14, 7, 3)	*β* 2.32 ddd(14, 7, 2.5)	2.30 m
OAc	2.35 s, 2.18 s	2.35 s, 2.19 s	2.05 s(2-OAc), 2.12 s(3-OAc)
	2.15 s, 2.12 s	2.15 s, 2.13 s	2.22 s(5-OAc), 2.10 s(15-OAc)
O^{i}But	2.66 sept(7)		2.48 sept(7.0)
	1.19 d(7), 1.18 d(7)		1.16 d(7.0), 1.13 d(7.0)

Table 10-18-16: ^{1}H NMR spectroscopic data of jatrophane-type diterpenoids **10-18-54**~**10-18-56**.

H	10-18-54	10-18 55	10-18-56
1	*α* 2.15 m(ov), *β* 1.70 m(ov)	*α* 2.23 d(17),	*α* 4.03 d(16.8), *β* 2.19 d(16.8)
		β 1.58 d(17)	
2	2.20 m(ov)	2.07 s(OH)	
3	3.74 m	5.51 d(2)	5.55 d(3.2)
4	3.69 dd(10.5, 2.5)	4.22 dd(12, 2)	3.03 dd(10.4, 3.2)
5	5.78 d(10.5)	5.12 d(12)	5.89 d(10.4)
7	5.95 s	6.32 s	5.52 br d(7.6)
8	5.08 s	5.21 s	6.00 br d(7.6)
9	3.40 d(5)	4.93 s	5.45 br s
11	6.00 d(16)	6.13 d(16)	3.10 s
12	5.24 dd(16, 9.5)	5.30 dd(16, 10)	
13	2.90 dq(9.5, 6.5)	3.06 dq(10, 7)	3.26 q(6.9)
14		3.81 s(OH)	
16	1.05 d(7)	1.15 s	1.42 s
17	5.58 s, 5.36 s	5.73 s, 5.42 s	2.72 d(16.7), 2.62 d(16.7)
18	1.02 s	0.79 s	1.35 s
19	1.23 s	1.14 s	1.10 s
20	1.10 d(6.5)	0.95 d(7)	1.10 d(6.9)
OAc		1.43 s, 1.96 s,	1.75 s(9-OAc)
		2.16 s	
			1.69 s(15-OAc)
			2.20 s, 1.80 s, 1.80 s, 1.75 s
O^{i}But		0.61 d(7),	1.23 d(7.1), 1.13 d(7.1), 2.49 sept(7.1)
		0.82 d(7),	
		1.81 sept(7)	
OBz		8.06 d(7.5, *o*-),	
		7.44 t(7.5, *m*)	
		7.57 d(7.5, *p*-)	
OCOR	2.45 sext(7), 2.25 sext(7),		
	2.54 sept(7), 1.80~1.40 m,		
	1.00~1.10 m, 1.21 d, 1.19 d(7),		
	0.93 t, 0.87 t(7.5)		

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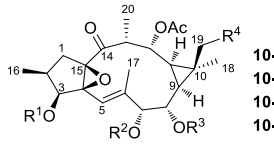
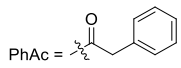
10.19 Lathyrane-type diterpenoids

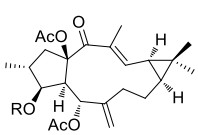
Table 10-19-1: Compounds, MFs, and test solvents of lathyrane-type diterpenoids **10-19-1**~**10-19-14**.

No.	Compounds	MFs	Test solvents	References
10-19-1	19-hydroxyingol 3,12-diacetate 7,8-ditiglate	$C_{34}H_{46}O_{11}$	$CDCl_3$	[557]
10-19-2	19-hydroxyingol 3,12,19-triacetate 8-tiglate	$C_{31}H_{42}O_{11}$	$CDCl_3$	[557]
10-19-3	19-hydroxyingol 12,19-diacetate 8-tiglate	$C_{29}H_{40}O_{10}$	$CDCl_3$	[557]
10-19-4	ingol 7,8,12-triacetate 3-phenylacetate	$C_{34}H_{42}O_{10}$	$CDCl_3$	[558]
10-19-5	(2*R**,3*S**,4*R**,5*R**,9*S**,11*S**,15*R**)-5,15-diacetoxy-3-benzoyloxy-14-oxolathyra-6(17),12*E*-diene	$C_{31}H_{38}O_7$	$CDCl_3$	[559]
10-19-6	(2*R**,3*S**,4*R**,5*R**,9*S**,11*S**,15*R**)-3,5,15-triacetoxy-14-oxolathyra-6(17),12*E*-diene	$C_{26}H_{36}O_7$	$CDCl_3$	[559]
10-19-7	5-*O*-acetyl-3-*O*-butanoyl-12-hydroxylathyrol	$C_{26}H_{38}O_7$	C_5D_5N	[560]
10-19-8	15,17-di-*O*-acetyl-3-*O*-cinnamoyl-l7-hydroxyjolkinol	$C_{33}H_{40}O_7$	$CDCl_3$-D_2O	[561]
10-19-9	(2*R**,3*S**,4*R**,5*R**,6*R**,11*S**,15*R**)-3-acetoxy-15-benzoyloxy-5,6-epoxylathyr-12*E*-en-14-one	$C_{29}H_{36}O_6$	$CDCl_3$ C_6D_6	[562] [562]
10-19-10	(2*R**,3*S**,4*R**,5*R**,6*R**,11*S**,15*R**)-5,15-diacetoxy-3-phenylacetoxy-14-oxolathyra-6(17),12*E*-diene-6(17)-epoxide	$C_{32}H_{40}O_8$	$CDCl_3$	[563]
10-19-11	5,15,17-tri-*O*-acetyl-3-*O*-benzoyl-17-hydroxyisolath-yrol	$C_{35}H_{44}O_9$	$CDCl_3$-D_2O	[561]
10-19-12	17-hydroxyisolathyrol	$C_{22}H_{34}O_5$	$CDCl_3$-D_2O	[561]
10-19-13	lathyranoic acid A	$C_{29}H_{34}O_7$	$CDCl_3$	[564]
10-19-14	lathyranone A	$C_{36}H_{40}O_8$	$CDCl_3$	[565]



	R^1	R^2	R^3	R^4
10-19-1	Ac	Tig	Tig	OH
10-19-2	**Ac**	H	Tig	OAc
10-19-3	H	H	Tig	OAc
10-19-4	PhAc	Ac	Ac	H





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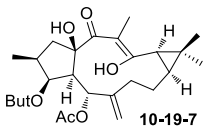
10-19-6 R = Ac



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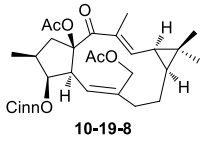

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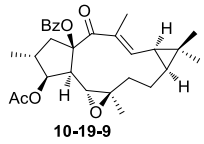

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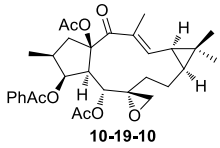

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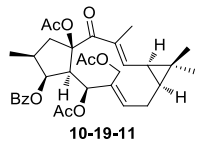

10-19-11

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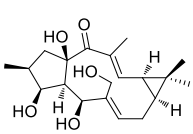

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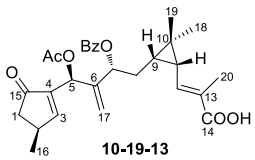

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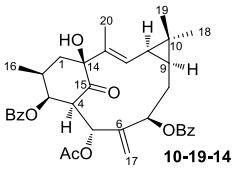

10-19-14

Table 10-19-2: ^{1}H NMR spectroscopic data of lathyrane-type diterpenoids **10-19-1**~**10-19-4**.

H	10-19-1	10-19-2	10-19-3	10-19-4
1α	1.69 d(15)	1.65 d(15)	1.65 d(15)	2.76 dd(15.0, 9.0)
1β	2.79 dd(15, 9)	2.81 dd(15, 9)	2.76 dd(15, 9)	1.67 d(15.0)
2	2.51 m	2.56 m	2.50 m	2.5 m
3	5.21 d(8.5)	5.20 d(8.3)	4.36 d(8.5)	5.14 d(8.6)
5	5.56 br s	5.78 br s	5.85 br s	5.38 br s
7	5.24 br s	4.29 br s	4.29 br s	5.14 d(1.9)
8	4.70 dd(10.5, 2.5)	4.52 dd(10.5, 1.5)	4.54 dd(10.7, 1.5)	4.52 dd(10.7, 1.9)
9	1.43 dd(10.5, 9)	1.65 dd(10.5, 9)	1.65 dd(10.7, 9)	1.09 dd(10.9, 9.0)
11	1.31 dd(11, 9)	1.33 dd(11, 9)	1.31 dd(11, 9)	1.02 dd(10.9, 9.0)
12	5.00 dd(11, 4)	4.92 dd(11, 4)	4.92 dd(11, 4)	4.81 dd(10.9, 3.4)
13	2.94 dq(4, 7)	2.88 dq(4, 7)	2.89 dq(4, 7)	2.86 dq(3.8, 7.1)
16	0.92 d(7.5)	0.89 d(7.5)	1.03 d(7.5)	0.91 d(7.5)
17	2.12 br s(ov)	2.05 d(1)	2.05 s(1)	2.06 d(1.2)
18	1.19 s	1.11 s	1.11 s	1.04 s
19	3.52 dd(12, 5.5)	4.20 d(12)	4.20 d(12)	0.81 s
	3.35 dd(12, 6)	3.54 d(12)	3.54 d(12)	
20	1.10 d(7)	1.07 d(7)	1.05 d(7)	1.04 d(7.1)
OAc	2.11 s, 2.07 s	1.93 s, 2.09 s, 2.10 s	1.93 s, 2.09 s	1.95 s, 2.05 s, 2.08 s
OCOR	6.85 qq(7, 1.5)	6.91 qq(7, 1.5)	6.90 qq(7, 1.5)	3.70 br s
	6.80 qq(7, 1.5)	1.84 d(1.5)	1.84 d(1.5)	7.25 m
	1.84 d(1.5), 1.83 d(1.5)	1.81 dq(7, 1.5)	1.80 dq(7, 1.5)	7.28 m
	1.81 dq(7, 1.5)			
	1.79 dq(7, 1.5)			

Table 10-19-3: ^{1}H NMR spectroscopic data of lathyrane-type diterpenoids **10-19-5**~**10-19-8**.

H	10-19-5	10-19-6	10-19-7	10-19-8
1	2.3 (ov)	2.39 m	α 3.47 m	3.60 dd(14, 8)
	2.94 d(9.3)	2.78 dd(15.0, 7.7)	β 2.04 t(12.3)	
2	2.33 (ov)	2.20 m	2.4 m	–
3	5.26 dd(5.2, 2.2)	4.94 m	5.83 t(3.6)	5.44 t(3.5)
4	3.03 dd(8.9, 5.3)	2.89 dd(8.4, 6.0)	3.01 dd(10.5, 3.6)	2.80 dd(11, 3.5)
5	6.26 d(8.9)	6.10 br d(8.5)	6.56 d(10.5)	5.69 d(11)
7	2.0 (ov), 2.3 (ov)	2.0 (ov), 2.3 (ov)	2.13 m, 2.54 dd(15.0, 5.4)	–
8	2.0 (ov), 1.6 (ov)	2.0 (ov), 1.8 (ov)	1.94 m	–

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Table 10-19-3 (continued)

H	10-19-5	10-19-6	10-19-7	10-19-8
9	1.2 (ov)	1.2 (ov)	1.10 dd(15.3, 8.3)	–
11	1.45 dd(11.5, 8.4)	1.45 dd(11.5, 8.4)	1.50 dd(11.8, 8.3)	–
12	6.52 dd(11.5, 1.0)	6.42 br d(11.5)	8.25 br s(OH)	6.60 br d(11)
15			7.40 br s(OH)	
16	1.24 d(5.2)	1.15 d(7.1)	1.03 d(6.8)	0.98 d(7)
17	4.71 s, 4.90 s	4.72 s, 4.92 s	5.10 s, 5.07 s	4.28 AB(13)
18	1.19 s	1.20 s	1.06 s	1.16 s
19	1.24 s	1.25 s	1.05 s	1.06 s
20	1.76 d(0.7)	1.73 s	1.91 s	1.87 br s
OAc	1.84 s(5-OAc)	2.10 s(3-OAc)	2.08 s	2.02 s, 2.09 s
	2.12 s(15-OAc)	2.02 s(5-OAc)		
		2.05 s(15-OAc)		
OCOR	8.04 br d(8.0, *o*-)		2.36 m(H-2′)	7.76 d(16)
	7.46 t(7.5, *m*-)		1.66 m(H-3′)	6.50 d(16)
	7.58 t(7.4, *p*-)		0.81 t(7.4, H-4′)	7.3-7.6 (5H)

Table 10-19-4: ^{1}H NMR spectroscopic data of lathyrane-type diterpenoids **10-19-9**~**10-19-11**.

H	10-19-9($CDCl_3$)	10-19-9(C_6D_6)	10-19-10	10-19-11
1	*α* 3.09 dd(14.4, 4.4)	*α* 2.44 dd(14.7, 7.8)	1.35 dd(14, 12.5)	3.48 dd(14, 8)
	β 2.31 dd(14.4, 7.9)	*β* 3.34 dd(14.7, 5.5)	3.31 dd(14, 8)	
2	2.37 m	2.33 m	2.07 m	–
3	5.16 dd(5.6, 2.4)	5.45 dd(5.9, 3.0)	5.48 dd(3.5, 3.5)	5.90 t(3.5)
4	1.94 m	2.13 dd(9.3, 6.0)	1.86 dd(9.5, 3.5)	2.81 dd(8, 3.5)
5	3.53 d(9.2)	3.78 d(9.3)	6.23 d(9.5)	6.40 d(9)
7	*α* 1.99 m	*α* 1.75 br t(12.3)	0.92 m, 2.10 m	5.69 dd(12, 4.5)
	β 1.61 m	*β* 1.58 m		
8	*α* 1.99 m, *β* 1.34 m	*α* 1.58 m, *β* 1.34 m	1.72 m, 2.10 m	–
9	1.08 m	0.59 m	1.08 dd(12, 8)	–
11	1.45 dd(11.2, 8.0)	1.16 dd(11.1, 8.0)	1.47 dd(11.5, 8)	–
12	6.93 dd(11.2, 0.6)	7.03 m	6.59 dq(11.5, 1.5)	6.70 br d(11)
16	1.06 d(7.0)	0.99 d(7.1)	0.65 d(6.5)	0.96 d(6.5)
17	1.15 s	1.05 s	2.30 dd(3.5, 2)	4.50 s
			2.48 d(3.5)	
18	1.03 s	0.79 s	1.20 s	1.37 s
19	0.29 s	0.29 s	1.21 s	1.20 s
20	1.90 s	1.96 s	1.84 d(1.5)	1.80 d(1)
OAc	2.16 s	1.84 s	2.03 s(5-OAc)	1.70 s, 2.07 s, 2.26 s
			2.13 s(15-OAc)	
OCOR	8.04 d(7.1, *o*-)	8.12 d(7.2, *o*-)	3.59 d(15)	8.02 m(2H)
	7.47 t(7.7, *m*-)	7.11 t(7.4, *m*-)	3.55 d(15)	7.5 m(3H)
	7.60 t(7.5, *p*-)	7.03 m(*p*-)	7.22-7.32 m	

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Table 10-19-5: ^{1}H NMR spectroscopic data of lathyrane-type diterpenoids **10-19-12**~**10-19-14**.

H	10-19-12	10-19-13	10-19-14
1	3.25 dd(14, 9)	*α* 2.69 dd(19.0, 6.3) *β* 2.02 br dd(19.0, 1.7)	*α* 2.55 dd(14.0, 3.0) *β* 1.87 t(14.0)
2	–	2.96 m	2.37 m
3	4.51 t(3.5)	7.47 br s	5.76 br s
4	2.34 dd(9, 3.5)		4.02 dd(11.0, 1.1)
5	5.18 d(9)	6.05 s, 1.91 s(OAc)	5.55 d(11.0), 1.62 s(OAc)
7	5.47 m	5.42 dd(5.5, 4.9)	5.52 d(5.6)
8	–	1.97 m	*α* 2.35 m, *β* 1.58 m
9	–	1.23 dd(9.6, 9.6)	1.48 m
11	1.50 m	1.45 dd(10.3, 9.6)	1.55 m
12	7.56 dd(10, 1)	6.68 d(10.3)	4.65 d(10.0)
16	1.16 d(7)	1.17 d(7.2)	0.99 d(7.0)
17	4.12 AB(12)	5.34 s, 5.41 s	5.79 s, 5.70 s
18	1.30 s	1.09 s	1.09 s
19	1.20 s	1.10 s	0.97 s
20	1.73 d(1)	1.89 s	2.10 s
7-OBz		7.45 br t(7.6, *o*-), 7.57 t(7.4, *m*-), 8.05 d(7.3, *p*-)	7.99 d(7.5, *o*-), 7.40 d(7.5, *m*-), 7.55 m(*p*-)
3-OBz			7.92 d(7.5, *o*-), 7.40 d(7.5, *m*-), 7.55 m(*p*-)

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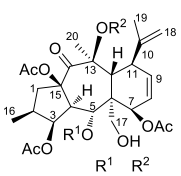
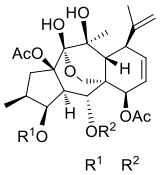
10.20 Myrsinane-type diterpenoids

Table 10-20-1: Compounds, MFs, and test solvents of myrsinane-type diterpenoids **10-20-1**~**10-20-14**.

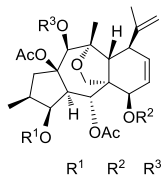
No.	Compounds	MFs	Test solvents	References
10-20-1	13-deacetylisodecipidone	$C_{30}H_{42}O_{11}$	$CDCl_3$	[566]
10-20-2	13-deacetylisodecipinone	$C_{33}H_{40}O_{11}$	$CDCl_3$	[566]
10-20-3	isodecipidone	$C_{32}H_{42}O_{12}$	$CDCl_3$	[566]
10-20-4	–	$C_{35}H_{44}O_{11}$	$CDCl_3$	[567]
10-20-5	–	$C_{32}H_{39}NO_{11}$	$CDCl_3$	[567]
10-20-6	decipinol ester A	$C_{34}H_{43}NO_{11}$	$CDCl_3$	[566]
10-20-7	14-desoxo-3-*O*-propionyl-5,15-di-*O*-acetyl-7-*O*-nic-otinoyl-myrsinol-14β-nicotinoate	$C_{39}H_{44}N_2O_{11}$	$CDCl_3$	[568]
10-20-8	14-desoxo-3,5,15-tri-*O*-acetyl-7-*O*-benzoyl-myrsinol-14β-nicotinoate	$C_{39}H_{43}NO_{11}$	$CDCl_3$	[568]
10-20-9	14-desoxo-3-*O*-propionyl-5,15-di-*O*-acetyl-7-O-nic-otinoyl-myrsinol-14β-acetate	$C_{35}H_{43}NO_{11}$	$CDCl_3$	[568]
10-20-10	15-*O*-acetyl-3-*O*-butanoyl-5-*O*-propionyl-7-*O*-nicot-inoylmyrsinol	$C_{35}H_{43}NO_{10}$	$CDCl_3$	[569]
10-20-11	15-*O*-acetyl-3,5-*O*-dibutanoyl-7-*O*-nicotinoylmyrsinol	$C_{36}H_{45}NO_{10}$	$CDCl_3$	[569]
10-20-12	cheiradone	$C_{33}H_{40}O_{11}$	$CDCl_3$	[570]
10-20-13	cheiradone A	$C_{31}H_{38}O_{10}$	$CDCl_3$	[570]
10-20-14	cheiradone B	$C_{31}H_{38}O_{10}$	$CDCl_3$	[570]



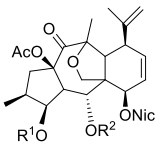
	R^1	R^2
10-20-1	But	H
10-20-2	Bz	H
10-20-3	But	Ac



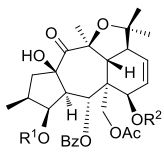
	R^1	R^2
10-20-4	But	Bz
10-20-5	Ac	Nic
10-20-6	But	Nic



	R^1	R^2	R^3
10-20-7	Prop	Nic	Nic
10-20-8	Ac	Bz	Nic
10-20-9	Prop	Nic	Ac



	R^1	R^2
10-20-10	But	Prop
10-20-11	But	But



	R^1	R^2
10-20-12	Ac	Ac
10-20-13	Ac	H
10-20-14	H	Ac

Table 10-20-2: ^{1}H NMR spectroscopic data of myrsinane-type diterpenoids **10-20-1**~**10-20-4**.

H	10-20-1	10-20-2	10-20-3	10-20-4
1	α 3.30 dd(10.4, 14.8) β 1.56 dd(6.8, 14.8)	α 3.30 dd(10.4, 14.6) β 1.58 dd(9.6, 15.0)	α 3.34 dd(8.8, 14.9) β 1.70 dd(6.9, 14.9)	α 2.39 dd(10.8, 14.4) β 2.47 d(13.8)
2	2.10 m	2.10 m	2.10 m	2.71 m

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Table 10-20-2 (continued)

H	10-20-1	10-20-2	10-20-3	10-20-4
3	5.23 t(3.4)	5.23 t(3.4)	5.25 t(3.6)	5.55 t(3.4)
4	2.40 dd(3.2, 11.7)	2.45 dd(3.1, 11.6)	2.53 dd(3.2, 11.6)	2.72 dd(5.2, 10.6)
5	5.91 d(11.7)	6.18 d(11.6)	6.14 d(11.6)	5.68 d(10.7)
7	4.77 d(6.4)	4.80 d(6.4)	4.59 d(6.4)	4.52 d(6.0)
8	6.03 ddd(1.6, 6.4, 9.6)	5.99 ddd(1.7, 6.4, 9.5)	5.99 m	6.28 br t(7.9)
9	5.85 dd(4.2, 9.4)	5.83 dd(4.8, 9.5)	5.76 br d(9.6)	6.35 br t(8.9)
11	3.46 m	3.50 br t(5.5)	3.47 m	3.18 d(6.4)
12	3.46 m	3.55 d(7.0)	3.63 d(9.7)	2.89 br s
16	0.77 d(6.9)	0.94 d(6.9)	0.90 d(6.8)	0.88 d(7.4)
17	3.80 d(12.1)	4.03 d(12.1)	3.91 d(12.0)	3.77 dd(1.0, 11.2)
	4.16 d(12.1)	4.13 d(12.1)	4.07 d(12.0)	4.09 d(11.2)
18	4.93 br s, 4.90 m	4.90 br s, 4.94 br s	4.96 br s, 4.86 br s	4.80 s, 4.55 s
19	1.80 s	1.80 s	1.78 s	1.91 s
20	1.40 s	1.40 s	1.56 s	1.34 s
OAc	2.14 s, 2.00 s, 1.98 s	2.19 s, 2.03 s, 2.02 s	2.16 s, 2.08 s	2.18 s, 2.07 s
			2.04 s, 1.98 s	
OBut	2.20 m, 1.50 m		2.22 m, 1.56 m	2.11 m, 1.51 m
	0.91 t(7.4)		0.93 d(7.2)	0.90 t(7.0)
OBz		7.89 dd(1.3, 8.4, AA′)		7.86 br d(7.2, AA′)
		7.40 br t(8.2, BB′)		7.38 br t(7.8, BB′)
		7.50 dt(1.4, 7.6, C)		7.52 br t(3.3, C)

Table 10-20-3: ^{1}H NMR spectroscopic data of myrsinane-type diterpenoids **10-20-5**~**10-20-8**.

H	10-20-5	10-20-6	10-20-7	10-20-8
1	α 2.41 dd(10.7, 14.6)	α 2.44 dd(10.8, 14.8)	2.79 (16, 10.5)	2.80 (16, 10.5)
	β 2.51 br d(14.4)	β 2.53 br d(14.4)	2.69 (16, 9)	2.68 (16, 9)
2	2.73 m	2.73 m	2.17(10.5, 9, 4, 6.5)	2.20 (10.5, 9, 4, 6.5)
3	5.51 t(6.2)	5.54 t(6.5)	5.30 (4, 4)	5.26 (4, 4)
4	2.71 dd(5.0, 10.4)	2.73 dd(5.1, 10.5)	3.21 (11, 4)	3.19 (11, 4)
5	5.53 d(8.5)	5.53 d(10.5)	6.07 (11, 1.5)	6.13 (11, 1.5)
7	4.46 d(6.1)	4.48 d(6.2)	5.15	5.09
8	6.24 br t(6.4)	6.26 br t(6.5)	6.26(1.5, 10)	6.27 (1.5, 10)
9	6.38 br t(8.3)	6.40 br t(7.2)	5.90(10, 6)	5.86 (10, 6)
11	3.17 br d(6.8)	3.20 d(7.0)	3.29(1.5, 6, 3.5)	3.30 (1.5, 6, 3.5)
12	2.91 br s	2.93 br s	3.46(3.5)	3.44(3.5)
14			5.31	5.31
16	0.88 d(7.0)	0.90 d(7.5)	0.81(6.5)	0.84(6.5)
17	3.68 dd(1.2, 11.2)	3.95 d(11.4)	4.14	4.14
	3.92 d(11.3)	3.70 dd(1.0, 11.4)	3.62	3.62
18	4.82 br s, 4.54 br s	4.81 br s, 4.57 br s	4.91, 4.78	4.90, 4.80
19	1.95 s	1.95 s	1.89	1.88
20	1.31 s	1.33 s	1.33	1.34

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Table 10-20-3 (continued)

H	10-20-5	10-20-6	10-20-7	10-20-8
OAc	1.63 s, 2.02 s, 2.08 s	1.67 s, 2.10 s	1.96 s(5-OAc) 2.19 s(15-OAc)	1.84 s(3-OAc) 1.97 s(5-OAc) 2.20 s(15-OAc)
OBut		2.10 m(2′) 1.52 m(3′) 0.88 t(7.4, 4′)		
OBz				8.02, 7.54, 7.39
5-ONic	9.28 br s(2″)	9.30 br s(2″)	8.26, 9.18	
or	8.36 br d(6.5, 4″)	8.40 dt(1.6, 8.0, 4″)		
7-ONic	7.42 dd(4.8, 7.7, 5″) 8.76 br d(3.8, 6″)	7.45 dd(4.9, 8.0, 5″) 8.79 br d(3.9, 6″)	7.37, 8.75	
14-ONic			9.08, 8.26, 7.42, 8.79	9.09, 8.27, 7.42, 8.79
OProp			2.14(7.5), 0.94(7.5)	

Table 10-20-4: ^{1}H NMR spectroscopic data of myrsinane-type diterpenoids **10-20-9**~**10-20-11**.

H	10-20-9	10-20-10	10-20-11
1	2.79(16, 10.5), 2.54(16, 9)	3.54 dd(9, 14), 1.43 dd(11, 14)	3.52 dd(9, 14), 1.42 dd(11, 14)
2	2.18(10.5, 9, 4, 6.5)	2.18 t(9, 11, 4)	2.16 t(9, 11, 4)
3	5.27(4, 4)	5.23 t(4, 4)	5.21 t(4, 4)
4	3.12(11, 4)	2.30 dd(4, 11)	2.30 dd(4, 11)
5	5.97(11, 1.5)	6.08 d(11)	6.09 d(11)
7	5.07	5.15 d(6)	5.12 d(6)
8	6.29(1.5, 10)	6.22 ddd(6, 10, 2)	6.22 ddd(6, 10, 2)
9	5.94(10, 6)	5.93 dd(6.5)	5.93 dd(6.5)
11	3.14(1.5, 6, 3.5)	3.38 dd(2, 6.5)	3.38 dd(2, 6.5)
12	3.32(3.5)	3.25 d(3.5)	3.26 d(3.5)
14	5.03		
16	0.81(6.5)	0.89 d	0.89 d
17	4.05, 3.59	3.99 d(9), 3.62 d(9)	3.99 d(9), 3.61 d(9)
18	4.75, 4.62	4.81 br s, 4.84 br s	4.79 br s, 4.81 br s
19	1.87	1.76 s	1.76 s
20	1.28	1.58 s	1.58 s
OAc	1.94 s(5-OAc) 2.06 s(14-OAc) 2.20 s(15-OAc)	2.21 s	2.22 s
Obut or OBz		2.28 t(7), 1.44 tq(7, 7) 0.87 t(7)	2.18 t(7), 1.45 tq(7, 7) 0.86 t(7)
ONic	7.36, 8.24, 8.74, 9.13	9.16 d(2, 2‴) 8.23 ddd(2, 8, 2.1, 4‴) 7.39 dd(8, 4.8, 5‴) 8.76 dd(2.1, 4.8, 6‴)	9.15 d(2, 2‴) 8.24 ddd(2, 8, 2.1, 4‴) 7.39 dd(8, 4.8, 5‴) 8.76 dd(2.1, 4.8, 6‴)
OProp	2.12(7.5), 0.95(7.5)	2.18 q(7), 0.96 t(7)	

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Table 10-20-5: ^{1}H NMR spectroscopic data of myrsinane-type diterpenoids **10-20-12**~**10-20-14**.

H	10-20-12	10-20-13	10-20-14
1	2.83 dd(9.7, 14.8)	2.83 dd(9.7, 14.8)	2.85 dd(9.8, 14.7)
	1.70 dd(9.6, 14.8)	1.71 dd(9.6, 14.8)	1.70 dd(9.5, 14.7)
2	2.1 m	2.1 m	2.3 m
3	5.50 t(4.1)	5.49 t(4.1)	4.09 t(4.0)
4	2.99 dd(4.1, 11.0)	2.99 dd(4.1, 11.0)	2.95 dd(4.0, 11.1)
5	6.48 d(11.0)	6.12 d(11.0)	5.93 d(11.1)
7	5.06 d(5.3)	4.19 d(5.1)	5.57 d(5.2)
8	6.00 ddd(2.8, 5.3, 9.7)	6.08 ddd(2.3, 5.1, 9.9)	6.02 ddd(2.5, 5.2, 9.8)
9	5.82 dd(2.0, 9.7)	5.92 dd(1.8, 9.9)	5.83 dd(1.9, 9.8)
11	2.84 br d(12.7)	2.86 br d(12.7)	2.83 br d(12.7)
12	3.15 d(12.7)	2.92 d(12.7)	3.01 d(12.7)
16	0.90 d(6.8)	0.94 d(6.8)	1.10 d(6.7)
17	4.22 br d(12.1), 4.58 d(12.1)	4.27 d(12.4), 5.34 d(12.4)	4.25 d(12.4), 4.85 d(12.4)
18	1.42 s	1.41 s	1.43 s
19	1.03 s	1.06 s	1.04 s
20	1.52 s	1.59 s	1.49 s
OAc	2.14 s, 1.89 s, 1.67 s	2.35 s, 1.61 s	2.35 s, 1.79 s
OBz	7.87 br d(7.8, AA′)	8.03 dd(1.3, 7.7, AA′)	7.91 dd(1.4, 7.7, AA′)
	7.38 br t(7.8, BB′)	7.45 br t(7.7, BB′)	7.38 br t(7.7, BB′)
	7.50 br t(7.4, C)	7.50 tt(1.3, 7.5, C)	7.50 tt(1.4, 7.4, C)

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10.21 Cyclo- and pre-myrsinane-type diterpenoids

Table 10-21-1: Compounds, MFs, and test solvents of cyclo-myrsinane-type diterpenoids **10-21-1**~**10-21-3**.

No.	Compounds	MFs	Test solvents	References
10-21-1	3,5,10,14,15-*O*-pentaacetyl-8-*O*-2′-(methylbutanoyl)-cyclomyrsinol	$C_{35}H_{48}O_{14}$	$CDCl_3$	[571]
10-21-2	5,10,14,15-*O*-tetraacetyl-3-*O*-nicotinoyl-8-*O*-2′-(methylbutanoyl)-cyclomyrsinol	$C_{39}H_{49}NO_{14}$	$CDCl_3$	[571]
10-21-3	3-*O*-propionyl-5,10,15-tri-*O*-acetyl-8,14-di-*O*-nic-otinoyl-cyclomyrsinol	$C_{41}H_{46}N_2O_{14}$	$CDCl_3$	[572]

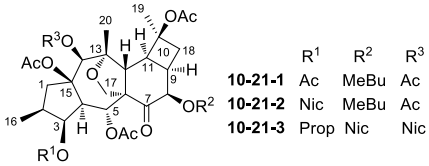

Table 10-21-2: ^{1}H NMR spectroscopic data of cyclo-myrsinane-type diterpenoids **10-21-1**~**10-21-3**.

H	10-21-1	10-21-2	10-21-3
1	*α* 2.85 dd(9.8, 16.0)	*α* 2.94 dd(11.2, 16.1)	2.86 dd(16, 11)
	β 2.49 dd(9.7, 16.0)	*β* 2.4 m	2.50 m
2	2.3 m	2.2 m	2.26 m
3	5.40 t(4.3)	5.72 t(3.8)	5.52 dd(4, 4)
4	2.90 dd(3.9, 11.0)	3.10 dd(3.6, 11.1)	3.03 dd(11)
5	5.86 dd(1.6, 11.0)	5.86 dd(1.1, 11.1)	6.11 dd(11, 1.5)
8	5.25 d(6.9)	5.19 d(7)	5.31 d(7)
9	2.73 dddd(6.9, 9.2, 9.2, 9.4)	2.70 m	2.94 dddd(9, 9, 9)
11	2.40 m	2.40 m	2.33 m
12	4.03 d(12.4)	4.09 d(12.3)	4.21 d(12)
14	5.02 s	5.11 s	5.39 s
16	0.85 d(6.8)	0.62 d(6.8)	0.87 d(7)
17	3.58 dd(1.6, 9.7), 4.21 d(9.7)	3.60 dd(1.5, 9.8), 4.25 d(9.8)	3.71 dd(10), 4.36 d(10)
18	2.50 m	2.50 m	2.66 ddd(9, 3.5, 13) 2.45 m
19	1.62 s	1.63 s	1.62 s
20	1.18 s	1.21 s	1.25 s

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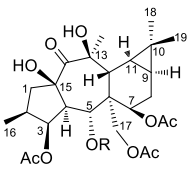
Table 10-21-2 (continued)

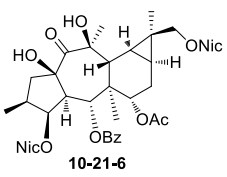
H	10-21-1	10-21-2	10-21-3
OAc	1.90 s, 1.95 s, 2.07 s, 2.08 s, 2.18 s	1.93 s, 2.10 s, 2.12 s, 2.31 s	1.86 s(5-OAc)
			1.86 s(5-OAc)
			1.96 s(15-OAc)
OMeBu	2.6 q(6.9, H-2′), 1.70 m(H-3′)	2.70 m(H-2′), 1.60 m(H-3′)	
	0.88 t(7.5, H-4′)	0.78 t(7.4, H-4′)	
	1.29 d(6.9, H-5′)	0.93 d(6.7, H-5′)	
3-Onic or 8-ONic		9.09 br s(H-2″)	9.53 br d(2)
		8.26 br d(8.0, H-4″)	8.42 ddd(2, 8, 6)
		7.45 br s(H-5″)	7.44 br dd(8, 5)
		8.79 br s(H-6″)	8.82 dd(2, 5)
14-ONic			9.16 br d(2)
			8.31 ddd(2, 8, 6)
			7.83 br dd(8, 5)
			8.76 dd(2, 5)
3-OProp			2.40 q(7.5), 1.05 t(7.5)

Table 10-21-3: Compounds, MFs, and test solvents of premyrsinane-type diterpenoids **10-21-4**~**10-21-11**.

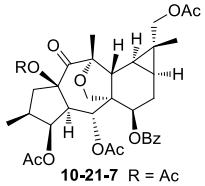
No.	Compounds	MFs	Test solvents	References
10-21-4	kandovanol ester A	$C_{33}H_{44}O_{11}$	$CDCl_3$	[573]
10-21-5	kandovanol ester B	$C_{30}H_{44}O_{11}$	$CDCl_3$	[573]
10-21-6	7-*O*-acetyl-5-*O*-benzoyl-13,15-dihydroxy-3,18-*O*-dinicotinoyl-14-oxo-lathyrane	$C_{41}H_{44}N_2O_{11}$	$CDCl_3$	[574]
10-21-7	karajinone A	$C_{35}H_{42}O_{12}$	$CDCl_3$	[575]
10-21-8	karajinone B	$C_{33}H_{40}O_{11}$	$CDCl_3$	[575]
10-21-9	aleppicatine A	$C_{35}H_{48}O_{13}$	$CDCl_3$	[576]
			C_6D_6	[576]
10-21-10	euphoreppine A	$C_{35}H_{48}O_{13}$	$CDCl_3$	[577]
10-21-11	3,5,14,15,17-penta-*O*-acetyl-7-*O*-nicotinoyleuphoppin	$C_{36}H_{45}NO_{13}$	$CDCl_3$	[573]



10-21-4 R = Bz
10-21-5 R = But



10-21-6



10-21-7 R = Ac
10-21-8 R = H

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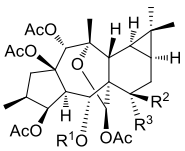
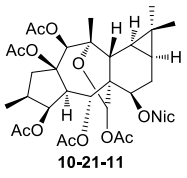


	R^1	R^2	R^3
10-21-9	Tig	H	OAc
10-21-10	Ac	OTig	H



10-21-11

Table 10-21-4: ^{1}H NMR spectroscopic data of pre-myrsinane-type diterpenoids **10-21-4**~**10-21-6**.

H	10-21-4	10-21-5	10-21-6
1*α*	2.70 dd(10.9, 14.8)	2.60 dd(10.9, 14.9)	2.61 dd(9, 16)
1*β*	1.76 dd(6.9, 14.9)	1.81 dd(7.3, 14.1)	1.78 m
2	2.40 m	2.35 m	2.64 m
3	5.52 t(4.7)	5.48 t(4.4)	5.87 t(3.6)
4	2.93 dd(4.3, 10.5)	2.93 dd(4.0, 10.5)	3.28 dd(3.6, 10.1)
5	5.99 d(10.5)	5.72 d(10.5)	6.14 d(10.1)
7	4.83 dd(3.3, 6.3)	4.77 dd(1.6, 7.1)	4.96 dd(1.5, 6.2)
8	1.62 ddd(3.2, 3.2, 6.3)	1.63 ddd(1.8, 1.8, 6.9)	2.32 ddd(7.1, 2.4, 16)
	2.10 m	2.24 ddd(7.2, 9.5, 14.0)	1.75 m
9	0.82 ddd(3.1, 9.2, 9.2)	0.75 ddd(2.0, 9.5, 9.5)	0.82 m
11	0.90 dd(7.7, 9.3)	0.90 m	0.97 m
12	2.24 d(7.6)	2.20 m	2.18 d(7.4)
16	0.90 d(7.5)	0.97 d(7.0)	0.96 m
17	4.89 d(12.1), 4.33 d(12.1)	4.85 d(12.3), 4.37 d(12.3)	0.99 s
18	1.07 s	1.06 s	5.50 d(12.3), 4.71 d(12.3)
19	0.97 s	0.92 s	1.10 s
20	1.54 s	1.54 s	1.71 s
OAc	1.89 s, 1.87 s, 1.86 s	1.95 s, 2.02 s, 2.08 s	1.98 s
OBut		2.15 m(H-2′), 1.56 m(H-3′) 0.91 t(7.4, H-4′)	
OBz	7.87 dd(1.1, 8.1, *o*)		7.35 dd(7.1, 7.1)
	7.38 br t(8.0, *m*)		6.89 ddd(7.1, 7.1, 0.5)
	7.51 dt(1.3, 7.4, *p*)		7.16 m
ONic			9.18, 8.71, 7.93, 7.30
ONic			9.10, 8.65, 7.88, 7.14
OH			4.03 br s, 3.92 br s

Table 10-21-5: ^{1}H NMR spectroscopic data of pre-myrsinane-type diterpenoids **10-21-7** and **10-21-8**.

H	10-21-7	10-21-8	H	10-21-7	10-21-8
1*α*	3.41 dd(9.5, 14.9)	*α* 2.71 dd(11.2, 15.6)	9	1.13 m	1.2 m
1*β*	1.47 dd(10.0, 14.9)	1.72 dd(7.7, 15.6)	11	1.18 t(7.0)	0.98 dd(6.7, 9.9)
2	2.1 m	2.1 m	12	2.82 br d(4.5)	3.08 d(6.7)
3	5.16 t(3.9)	5.24 dd(3.7, 4.8)	16	0.87 d(6.8)	0.92 d(7.1)

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Table 10-21-5 (continued)

H	10-21-7	10-21-8	H	10-21-7	10-21-8
4	2.48 dd(3.6, 10.9)	2.99 dd(3.7, 10.9)	17	3.97 dd(1.0, 9.7) 4.17 d(9.7)	4.04 dd(1.5, 9.9) 4.46 d(9.9)
5	5.93 dd(0.8, 10.9)	5.74 dd(1.5, 10.9)	18	3.78 d(11.2) 3.83 d(11.2)	3.73 d(11.2) 3.91 d(11.2)
7	4.94 dd(4.4, 7.2)	4.88 dd(3.2, 10.7)	19	1.17 s	1.13 s
8	1.85 m, 2.2 m	1.7 dd(8.0, 14.3), 2.1 m	20	1.55 s	1.39 s
OBz	7.95 br dd(1.0, 8.0, *o*) 7.41 br t(8.0, *m*) 7.54 br tt(1.0, 7.5, *p*)	7.95 br dd(1.3, 8.2, *o*) 7.43 br t(8.0, *m*) 7.55 brtt(1.3, 7.5, *p*)	OAc	1.54 s, 1.96 s 2.03 s, 2.18 s	1.34 s, 2.05 s 2.07 s

Table 10-21-6: ^{1}H NMR spectroscopic data of pre-myrsinane-type diterpenoids **10-21-9**~**10-21-11**.

H	10-21-9($CDCl_3$)	10-21-9(C_6D_6)	10-21-10	10-21-11
1	1.78 dd, 2.39 dd	2.48 dd(15, 8) 1.81 dd(15, 11)	*α* 2.25 dd(8.4, 15.1) *β* 1.60 dd(3.5, 15.1)	*α* 2.72 dd(9.8, 16.1) *β* 2.40 dd(9.6, 16.1)
2	1.97 m	1.62 dddq (18, 11, 4, 7)	1.91 m	2.10 m
3	5.12 t	5.22 t(4, 4)	4.96 t(3.5)	5.00 t(3.9)
4	3.14 dd	3.21 dd(4, 11)	3.0 dd(3.5, 10.5)	2.99 dd(3.6, 10.7)
5	5.85 d	6.11 d(11)	5.71 d(10.5)	5.80 d(10.7)
7	5.03 dd	5.36 dd(10, 3)	4.90 dd(3.0, 10.0)	5.32 dd(3.7, 6.3)
8	1.38 m, 1.87 m	1.95 ddd(10, 14, 9) 1.32 ddd(3, 14, 3)	*α* 1.80 ddd(3.0, 3.0, 15.0) *β* 1.20 ddd(7.5, 10.0, 15.0)	1.62 ddd (2.2, 6.4, 14.3)
9	0.98 ddd	0.85 m	0.87 m	0.93 dd(1.8, 9.6)
11	0.87 dd	0.85 m	0.75 m	0.79 dd(6.9, 9.7)
12	2.55 br d	2.69 br d(9)	2.43 d(7.5)	2.73 d(6.8)
14	5.69 s	6.02 s	5.52 s	4.99 s
16	0.83 d	0.78 d(7)	0.69 d(7.0)	0.74 d(7.8)
17	6.58 s	7.11 s	6.45 s	6.39 s
18	1.06 s	0.84 s	0.96 s	1.10 s
19	1.03 s	0.82 s	0.91 s	1.11 s
20	1.32 s	1.48 s	1.17 s	1.28 s
OAc	2.19 s, 2.11 s 2.05 s, 2.05 s 1.79 s	2.04 s, 1.79 s 1.78 s, 1.72 s 1.58 s	2.01 s, 1.99 s 1.96 s, 1.95 s 1.64 s	1.36 s, 1.94 s 2.03 s, 2.10 s 2.16 s
OTig	6.85 br q 1.84 br s 1.78 br d	7.04 br q 1.89 br s 1.42 br d		
OMeBu			6.73 q(7.0) 1.67 m	
ONic				9.1 br s(H-2″) 8.21 br d(7.0, H-4″) 7.37 dd(4.8, 7.4, H-5″) 8.74 br s(H-6″)

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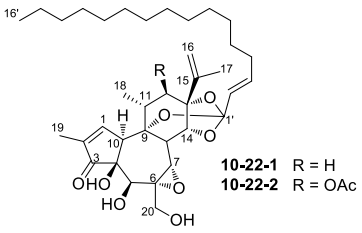
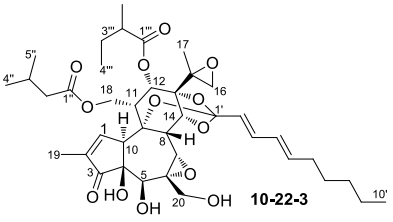
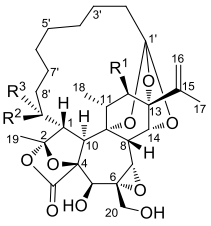
10.22 Daphnane-type diterpenoids

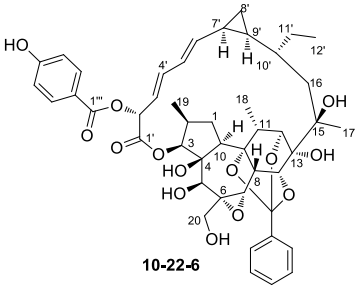
Table 10-22-1: Compounds, MFs, and test solvents of daphnane-type diterpenoids **10-22-1**~**10-22-10**.

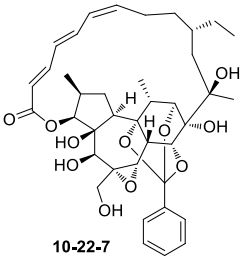
No.	Compounds	MFs	Test solvents	References
10-22-1	5β-hydroxyresiniferonol-6α,7α-epoxy-9,13,14-ortho-2*E*-hexadecenoate	$C_{36}H_{54}O_8$	$CDCl_3$	[578]
10-22-2	kirkinine	$C_{38}H_{56}O_{10}$	$CDCl_3$	[578]
10-22-3	–	$C_{40}H_{56}O_{13}$	$CDCl_3$	[579]
10-22-4	pimelotide A	$C_{30}H_{42}O_9$	$CDCl_3$	[580]
10-22-5	pimelotide B	$C_{32}H_{44}O_{11}$	$CDCl_3$	[580]
10-22-6	trigochilide A	$C_{46}H_{54}O_{14}$	$CDCl_3$	[581]
10-22-7	trigochilide B	$C_{39}H_{50}O_{11}$	$CDCl_3$	[581]
10-22-8	trigonothyrin A	$C_{38}H_{42}O_{11}$	$CDCl_3$	[582]
10-22-9	trigonothyrin B	$C_{36}H_{40}O_{10}$	$CDCl_3$	[582]
10-22-10	trigochinin H	$C_{34}H_{34}O_{10}$	$CDCl_3$	[583]

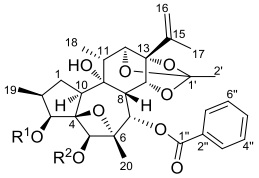












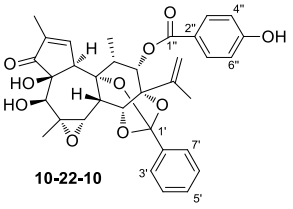


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Table 10-22-2: ^{1}H NMR spectroscopic data of daphnane-type diterpenoids **10-22-1**, **10-22-2**, **10-22-4**, and **10-22-5**.

H	10-22-1	10-22-2	10-22-4	10-22-5
1	7.66 dd(1.3, 2.3)	7.58 q(1.8, 2.4)	2.50 dd(4.3, 10.2)	2.35 dd(3.5, 8.0)
5	4.28 d(2.0)	4.26 s	4.86 br s	4.87 br d(3.0)
7	3.47 s	3.55 s	3.46 br s	3.52 br s
8	2.96 d(2.6)	3.51 d(2.6)	3.20 dd(1.4, 2.8)	3.75 br d(2.6)
10	3.82 d(2.3)	3.82 t(2.9)	2.81 d(4.3)	3.03 d(8.0)
11	2.50 p(7.8)	2.37 q(7.3)	1.98 m	1.87 m
12	1.70 d(14.2)	4.97 s	1.70 d(14.0)	5.00 s
	2.26 m	1.99 s(OAc)	2.08 dd(7.3, 14.0)	
14	4.43 d(2.6)	4.74 d(2.6)	4.27 d(2.8)	4.58 br d(2.6)
16	5.04, 4.93 st(1.3)	5.01 s, 4.95 s	4.87 br s, 4.95 br s	4.91 br s, 4.97 br s
17	1.83 d(1.3)	1.83 s	1.74 br s	1.77 br s
18	1.20 d(7.2)	1.29 d(7.3)	1.32 d(6.7)	1.35 d(7.1)
19	1.82 d(1.3)	1.79 q(1.4, 1.1)	1.79 br s	1.75 br s
20	3.85 AB(12.2)	3.87 dd(12.6)	3.69 dd(4.7, 12.7)	3.66 br d(12.4)
			4.07 dd(6.7, 12.7)	4.10 br d(12.4)
2′	5.69 tt(15.6, 1.5)	5.61 d(15.6)	1.92 ddd(3.8, 7.3, 14.6)	1.88 m
			2.08 m	
3′	6.33 tt(15.5, 6.6)	6.27 dt(15.6, 6.9, 6.6)	1.56 m, 1.74 m	1.53 m, 1.58 m
4′	2.12 m	2.07 d(6.6)	1.27 m, 1.62 m	1.24 m
5′	1.44 m	1.40 q(14.2, 7.3)	1.17 m, 1.47 m	1.30 m, 1.49 m
6′	1.27 m	1.25 m	1.09 m, 1.52 m	1.31 m
7′	1.27 m	1.25 m	1.22 m, 1.47 m	1.31 m
8′	1.27 m	1.25 m	0.77 m, 2.26 m	1.19 m, 1.48 m
9′	1.27 m	1.25 m	1.13 m	2.09 m, 1.98 s(Me)
10′	1.27 m	1.25 m	1.02 d(6.6)	1.04 d(7.1)
11′~15′	1.27 m	1.25 m		
16′	0.90 t(6.8)	0.88 t(7.0, 6.6)		

Table 10-22-3: ^{1}H NMR spectroscopic data of daphnane-type diterpenoids **10-22-3** and **10-22-10**.

H	10-22-3	10-22-10	H	10-22-3	10-22-10
1	7.64 br s	7.65 br s	5′	5.88 dt(15.0, 8.0)	7.39 m
4	3.64 s(OH)	3.79 s(OH)	6′	2.10 q	7.41 m
5	4.27 s	4.04 br s	7′	1.40 m	7.81 m
5-OH	4.00 s	3.91 d(2.7)			
7	3.47 br s	3.32 s	8′	1.28 m	
8	3.24 d(2.5)	3.38 d(2.3)	9′	1.24 m	
10	3.80 d(2.5)	4.04 br s	10′	0.89 m	
11	2.90 t(8.0)	3.15 m	2″	2.37 dd(15.0, 6.5)	
				2.23 m	
12	5.44 d(8.0)	5.47 d(8.2)	3″	2.18 m	7.93 m
14	4.60 d(2.5)	4.68 d(2.3)	4″	0.98 d	6.82 m
16	2.49 d(5.0), 2.75 d(5.0)	5.29 br s, 5.04 br s	5″	0.98 d	6.28 br s(OH)
17	1.36 s	1.79 s	6″		6.82 m
18	4.39 dd(13.0, 7.0)	1.12 d(7.1)	7″		7.93 m
	4.76 d(13.0)				
19	1.76 br s	1.76 s	2‴	2.15 m	

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Table 10-22-3 (continued)

H	10-22-3	10-22-10	H	10-22-3	10-22-10
20	3.78 d(12.5), 3.91 d(12.5)	1.47 s	3‴	2.00 m	
2′	5.59 d(15.5)		4‴	0.89 m	
3′	6.64 dd(15.5, 10.5)	7.81 m	5‴	0.89 m	
4′	6.02 dd(15.5, 10.5)	7.41 m			

Table 10-22-4: ^{1}H NMR spectroscopic data of daphnane-type diterpenoids **10-22-6** and **10-22-7**.

H	10-22-6	10-22-7	H	10-22-6	10-22-7
1	1.89 m, 1.72 m	2.19 m, 1.88 m	5′	6.23 dd(15.0, 10.9)	6.87 dd(14.6, 11.2)
2	1.55 m	1.68 m	6′	5.55 dd(15.0, 9.9)	6.15 t(11.2)
3	4.58 br s	4.93 br d(3.0)	7′	1.51 m	5.78 m
5	3.82 br s	3.87 br s	8′	α 1.20 m, β 0.52 br d(5.2)	2.45 m, 1.95 m
7	3.30 br s	3.36 br s	9′	1.00 m	α 1.52 m, β 1.40 m
8	4.31 br s	4.25 br s	10′	1.05 m	1.38 m
10	2.94 dd(12.9, 6.0)	2.93 dd(13.3, 6.4)	11′	1.46 m, 1.75 m	1.38 m, 1.28 m
11	2.55 q(6.3)	3.36 m	12′	1.00 t(6.9)	0.88 t(6.9)
12	3.97 br s	4.18 br s	3″, 7″	7.67 m	7.71 m
14	4.25 br s	4.22 br s	4″, 6″	7.35 m	7.38 m
16	2.15 dd(14.3, 8.6) 1.54 m	1.64 m, 1.91 m	5″	7.35 m	7.36 m
17	1.21 s	1.28 s	3‴, 7‴	7.96 d(8.2)	
18	1.46 d(6.3)	1.60 d(6.9)	4‴, 6‴	6.83 d(8.2)	
19	1.00 d(6.7)	1.01 d(6.4)	4-OH	2.80 s	
20	3.72 br d(7.2) 3.64 br d(7.2)	3.62 m, 3.74 m	5-OH	4.00 br s	
2′	5.91 d(6.7)	5.78 d(15.4)	13-OH	3.71 s	3.01 br s
3′	5.97 dd(15.1, 6.7)	7.47 dd(15.4, 11.6)	15-OH	1.62 br s	3.82 br s
4′	6.53 dd(15.1, 10.9)	6.31 dd(14.6, 11.6)	20-OH	2.51 s	

Table 10-22-5: ^{1}H NMR spectroscopic data of daphnane-type diterpenoids **10-22-8** and **10-22-9**.

H	10-22-8	10-22-9	H	10-22-8	10-22-9
1	α 1.32 m, β 2.03 m	α 1.12 m, β 1.91 m	17	1.91 br s	1.92 br s
2	2.55 m	2.23 m	18	1.30 d(7.1)	1.28 d(7.0)
3	5.45 d(10.4)	4.20 d(10.0)	19	0.94 d(7.1)	0.94 d(7.2)
5	6.47 s, 1.76 s(OAc)	6.67 s	20	1.35 s	1.45 s
7	5.86 d(3.8)	5.89 d(3.9)	2′	1.27 s	1.27 s
8	2.86 br d(3.8)	2.80 dd(3.9, 1.2)	3″, 7″	8.09 d(7.7)	8.14 m
9	3.77 s(OH)	3.78 br s(OH)	4″, 6″	7.42 t(7.7)	7.45 m
10	2.27 dd(13.7, 6.0)	2.24 m	5″	7.53 t(7.7)	7.55 m
11	1.70 br q(7.1)	1.71 br q(7.0)	3‴, 7‴	8.19 d(7.7)	8.12 m
12	4.03 br s	4.03 br s	4‴, 6‴	7.48 t(7.7)	7.43 m
14	4.46 br s	4.47 br s	5‴	7.60 t(7.7)	7.55 m
16	5.07 br s, 5.27 br s	5.07 br s, 5.27 br s			

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10.23 Ingenane-type diterpenoids

Table 10-23-1: Compounds, MFs, and test solvents of ingenane-type diterpenoids **10-23-1**~**10-23-13**.

No.	Compounds	MFs	Test solvents	References
10-23-1	20-*O*-(2′E,4′*E*-decadienoyl)ingenol	$C_{30}H_{42}O_6$	$CDCl_3$	[584]
10-23-2	20-*O*-(2′E,4′Z-decadienoyl)ingenol	$C_{30}H_{42}O_6$	$CDCl_3$	[584]
10-23-3	3-*O*-(2′E,4′E-decadienoyl)ingenol	$C_{30}H_{42}O_6$	$CDCl_3$	[584]
10-23-4	3-*O*-(2,3-dimethylbutanoyl)-13-*O*-dodecanoyl-20-*O*-acetylingenol	$C_{40}H_{62}O_9$	$CDCl_3$	[585]
10-23-5	3-*O*-benzoyl-13-octanoyloxyingenol	$C_{35}H_{46}O_8$	$CDCl_3$	[586]
10-23-6	3-*O*-(2,3-dimethylbutanoyl)-13-octanoyloxyingenol	$C_{34}H_{52}O_8$	$CDCl_3$	[586]
10-23-7	3-*O*-angeloyl-17-[(2*Z*,4*E*,6*Z*)-deca-2,4,6-trienoyl-oxy]ingenol	$C_{35}H_{46}O_8$	–	[587]
10-23-8	3-*O*-acetyl-20-*O*-angeloyl-17-hydroxyingenol	$C_{27}H_{36}O_8$	–	[587]
10-23-9	17-(acetyloxy)-3-*O*-angeloylingenol	$C_{27}H_{36}O_8$	–	[587]
10-23-10	17-benzoyloxy-3-*O*-(2,3-dimethylbutanoyl)-13-(2,3-dimethylbutanoyloxy)-20-deoxyingenol	$C_{39}H_{52}O_9$	$CDCl_3$	[586]
10-23-11	17-benzoyloxy-20-*O*-(2,3-dimethylbutanoyl)-13-(2,3-dimethylbutanoyloxy)ingenol	$C_{39}H_{52}O_{10}$	$CDCl_3$	[586]
10-23-12	3-*O*-benzoyl-17-benzoyloxy-13-octanoyloxyingenol	$C_{42}H_{50}O_{10}$	$CDCl_3$	[586]
10-23-13	3-*O*-benzoyl-13,17-dibenzoyloxyingenol	$C_{41}H_{40}O_{10}$	$CDCl_3$	[586]

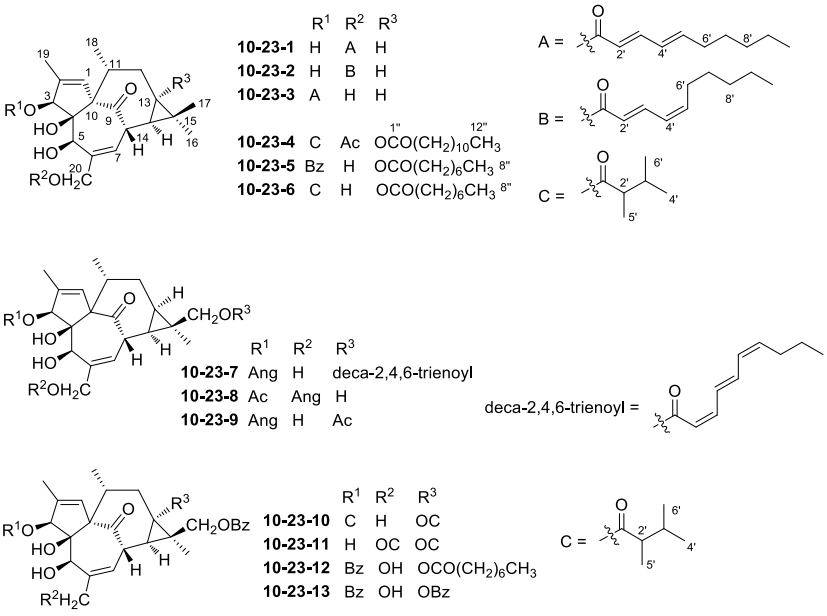

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Table 10-23-2: ^{1}H NMR spectroscopic data of ingenane-type diterpenoids **10-23-1**~**10-23-3**.

H	10-23-1	10-23-2	10-23-3	H	10-23-1	10-23-2	10-23-3
1	5.93 d(1.5)	5.94 d(1.5)	6.03 d(1.5)	19	1.84 d(1.5)	1.85 d(1.5)	1.79 d(1.5)
3	4.42 s	4.44 s	5.54 s	20	4.78, 4.57 ABq(12.8)	4.81, 4.61 ABq(12.8)	4.10~4.17 m(ov)
5	3.69 s	3.69 s	4.04 s	2′	5.78 d(15.2)	5.85 d(15.2, ov)	5.86 d(15.2)
7	6.11 d(3.6)	6.11 m(ov)	6.05 (3.7)	3′	7.25 m	7.60 dd(15.2, 11.0)	7.30 m
8	4.11 dd(3.6, 13.7)	4.10 dd(3.6, 13.7)	4.10~4.17 m(ov)	4′	6.14 m(ov)	6.12 m(ov)	6.20 m(ov)
11	2.34 m	2.34 m(ov)	2.52 m	5′	6.14 m(ov)	5.84 m(ov)	6.20 m(ov)
12	2.28 ddd(3.0, 8.8, 15.6)	2.28 m(ov)	2.25 ddd(3.0, 8.8, 15.8)	6′	2.15 m	2.29 m	2.19 m
	1.76 m	1.76 m	1.75 m				
13	0.69 m	0.69 m	0.69 m	7′	1.42 m	1.42 m	1.44 m
14	0.95 m	0.95 m	0.93 m	8′	1.29 m(ov)	1.29 m(ov)	1.26 m(ov)
16	1.05 s	1.05 s	1.04 s	9′	1.29 m(ov)	1.29 m(ov)	1.26 m(ov)
17	1.12 s	1.11 s	1.08 s	10′	0.89 t(7.0)	0.89 t(7.0)	0.89 t(7.0)
18	0.97 d(7.0)	0.97 d(7.0)	0.98 (7.0)				

Table 10-23-3: ^{1}H NMR spectroscopic data of ingenane-type diterpenoids **10-23-5** and **10-23-6**.

H	10-23-5	10-23-6	H	10-23-5	10-23-6
1	6.10 d(1.2)	6.10 s	19	1.85 d(1.2)	1.77 s
3	5.74 s	5.44 s	20	4.19 br s	4.14 br s
5	4.14 s	4.05 s	2′	8.02 dd(7.6, 1.2)	2.31 m
7	6.04 d(3.6)	6.02 s	3′	7.48 t(7.6)	1.91 m
8	4.10 dd(3.6, 12.0)	4.09 dd(3.6, 12.0)	4′	7.61 t(1.2, 7.6)	0.95 d(6.8)
11	2.71 m	2.60 m	5′	7.48 t(7.6)	1.14 d(6.8)
12	2.74 dd(3.2, 16.8)	2.71 dd(3.2, 16.8)	6′	8.02 dd(7.6)	0.92 d(6.8)
	2.23 dd(5.2, 16.8)	2.21 dd(5.2, 16.8)			
14	1.23 d(12.0)	1.22 d(12.0)	2″	2.19 t(7.2)	2.20 t(7.2)
16	1.04 s	1.05 s	3″	1.56 m	1.55 m
17	1.15 s	1.18 s	4″ ~7″	1.26 m	1.25 m
18	1.05 d(7.2)	0.96 d(7.2)	8″	0.87 t(6.8)	0.86 t(6.8)

Table 10-23-4: ^{1}H NMR spectroscopic data of ingenane-type diterpenoids **10-23-4** and **10-23-7**~**10-23-9**.

H	10-23-4	10-23-7	10-23-8	10-23-9
1	6.01 q(1.5)	6.02 d(1.5)	6.08 d(1.5)	6.02 d(1.5)
3	5.44 s, 3.48 s(OH)	5.45 s	5.95 s	5.45 s
5	3.88 d(6.9) 3.51 s(6.9, OH)	3.77 br s	3.80 br s	3.98 br s

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Table 10-23-4 (continued)

H	10-23-4	10-23-7	10-23-8	10-23-9
7	6.07 d(3.9)	6.05 d(3.7)	6.12 d(3.7)	6.09 d(3.7)
8	4.06 dd(12.6, 3.9)	4.20 dd(3.7, 15)	4.23 dd(3.7, 15)	4.06 dd(3.7, 15)
11	2.56 m	2.60 ddq(3.5, 7.0)	2.66 ddq(3.5, 7.0)	2.59 ddq(3.5, 7.0)
12	2.72 dd(16.8, 3.3)	2.22 dd(16, 5.5)	2.23 dd(16, 5.5)	2.23 dd(16, 5.5)
	2.19 m(ov)	2.71 dd(16, 3.5)	2.71 dd(16, 3.5)	2.71 dd(16, 3.5)
13		1.08 ddd(9, 6, 8)	1.02 ddd(9, 6, 8)	1.09 ddd(9, 6, 8)
14	1.23 m(ov)	1.26 dd(11.6, 8.5)	1.21 dd(11.6, 8.5)	1.26 dd(11.6, 8.5)
16	1.07 s	1.18 s	1.09 s	1.28 s
17	1.19 s	4.23 d(12.5),	4.30 br s	4.23 d(12.5),
		4.26 d(12.5)		4.26 d(12.5)
18	0.97 d(7.5)	0.98 d(7.4)	0.94 d(7.4)	0.98 d(7.4)
19	1.78 d(1.5)	1.78 d(1.5)	1.77 d(1.5)	1.78 d(1.5)
20	4.73, 4.47 ABq(12.6)	4.09 br s	4.42 d(12.5)	4.09 br s
	2.05 s(OAc)		4.74 d(12.5)	
3*R*	2.31 m, 1.92 m,	–	–	–
	0.92 d(6.9), 0.96 d(6.6)			
	1.14 d(7.2)			
13*R*	2.19 t(7.5, ov)			
	1.55 m, 1.25 s(ov)			
	0.88 t(6.9)			

Table 10-23-5: ^{1}H NMR spectroscopic data of ingenane-type diterpenoids **10-23-10**~**10-23-13**.

H	10-23-10	10-23-11	10-23-12	10-23-13
1	6.02 d(1.2)	5.88 d(1.2)	6.10 d(1.2)	6.12 d(1.2)
3	5.40 s	4.39 s	5.79 s	5.84 s
5	3.65 s	3.67 s	4.09 s	4.14 s
7	5.64 d(3.6)	6.05 d(3.6)	5.94 d(3.6)	6.00 d(3.6)
8	4.13 dd(3.6, 12.0)	4.21 dd(3.6, 12.0)	4.29 dd(3.6, 12.0)	4.42 dd(3.6, 12.0)
11	2.55 m	2.48 m	2.76 m	2.79 m
12	2.80 dd(3.2, 16.8)	2.82 dd(3.2, 16.8)	2.84 dd(3.2, 16.8)	2.95 dd(3.2, 16.8)
	2.34 dd(5.2, 16.8)	2.32 dd(5.2, 16.8)	2.42 dd(5.2, 16.8)	2.61 dd(5.2, 16.8)
14	1.42 d(12.0)	1.49 d(12.0)	1.45 d(12.0)	1.62 d(12.0)
16	1.20 s	1.25 s	1.24 s	1.28 s
17	4.46 d(12.0)	4.55 d(12.0)	4.62 d(12.0)	4.65 d(12.0)
	4.42 d(12.0)	4.48 d(12.0)	4.33 d(12.0)	4.39 d(12.0)
18	0.99 d(7.2)	1.00 d(7.2)	1.08 d(7.2)	1.08 d(7.2)
19	1.74 d(1.2)	1.84 d(1.2)	1.85 s	1.83 s
20	1.64 s	4.63 d, 4.41 d	4.02 br s	4.07 br s
3*R* or 20*R*-2′	2.28 m	2.19 m	8.02 dd	8.01 dd
3′	1.87 m	1.83 m	7.46 m	7.44 m(ov)
4′	0.90 d(6.8)	0.85 d(6.8)	7.56 m	7.56 m(ov)
5′	1.08 d(6.8)	1.03 d(6.8)	7.46 m	7.44 m(ov)

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Table 10-23-5 (continued)

H	10-23-10	10-23-11	10-23-12	10-23-13
6′	0.87 d(6.8)	0.84 d(6.8)	8.02 dd	8.01 dd
13*R*-2′	2.17 m	2.19 m	2.26 t(7.2)	8.02 dd
3′	1.95 m	1.97 m	1.59 m	7.44 m(ov)
4′	0.92 d(6.8)	0.93 d(6.8)	1.29 m	7.56 m(ov)
5′	1.04 d(6.8)	1.06 d(6.8)	1.29 m	7.44 m(ov)
6′	0.85 d(6.8)	0.88 d(6.8)	1.29 m	8.02 dd
7′			1.29 m	
8′			0.88 t(6.8)	
17-OBz	8.07 dd(7.6, 1.2, *o*)	8.10 dd(7.6, 1.2, *o*)	8.08 dd(7.6, 1.2, *o*)	8.11 dd(7.6, 1.2, *o*)
	7.42 t(7.6, 7.6, *m*)	7.46 t(7.6, 7.6, *m*)	7.46 t(7.6, 7.6, *m*)	7.44 t(7.6, 7.6, *m*)
	7.53 t(1.2, 7.6, *p*)	7.57 t(1.2, 7.6, *p*)	7.56 t(1.2, 7.6, *p*)	7.57 t(1.2, 7.6, *p*)

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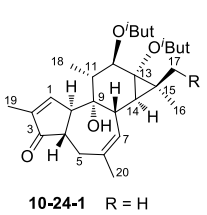
10.24 Tigliane-type diterpenoids

Table 10-24-1: Compounds, MFs, and test solvents of tigliane-type diterpenoids **10-24-1**~**10-24-14**.

No.	Compounds	MFs	Test solvents	References
10-24-1	4,20-dideoxyphorbol 12,13-bis(isobutyrate)	$C_{28}H_{40}O_6$	$CDCl_3$	[588]
10-24-2	17-acetoxy-4,20-dideoxyphorbol 12,13-bis(isobutyr-ate)	$C_{30}H_{42}O_8$	$CDCl_3$	[588]
10-24-3	4,12,20-trideoxyphorbol-13-(2,3-dimethyl)butyrate	$C_{26}H_{38}O_4$	$CDCl_3$	[589]
10-24-4	12-*O*-tigloyl-13-*O*-isobutyroyl-4-deoxyphorbol	$C_{29}H_{40}O_7$	$CDCl_3$	[590]
10-24-5	12-deoxyphorbol-13-hexadecanoate	$C_{36}H_{58}O_6$	$CDCl_3$	[591]
10-24-6	4-deoxyphorbol 12,13-bis(isobutyrate)	$C_{28}H_{40}O_7$	$CDCl_3$	[588]
10-24-7	17-acetoxy-4-deoxyphorbol 12,13-bis(isobutyrate)	$C_{30}H_{42}O_9$	$CDCl_3$	[588]
10-24-8	4-deoxyphorbol 12,13-bis(isobutyrate) 20-acetate	$C_{30}H_{42}O_8$	$CDCl_3$	[588]
10-24-9	4-*epi*-4-deoxyphorbol 12,13-bis(isobutyrate)	$C_{28}H_{40}O_7$	$CDCl_3$	[588]
10-24-10	4,12-dideoxy(4α)phorbol-13-hexadecanoate	$C_{36}H_{58}O_5$	$CDCl_3$	[592]
10-24-11	12-deoxyphorbaldehyde-13-acetate	$C_{22}H_{28}O_6$	$CDCl_3$	[593]
10-24-12	12-deoxyphorbaldehyde-13-hexadecacetate	$C_{36}H_{56}O_6$	$CDCl_3$	[593]
10-24-13	6α,7α-epoxy-5β-hydroxy-12-deoxyphorbol-13-decanoate	$C_{30}H_{46}O_8$	$CDCl_3$	[594]
10-24-14	subtoxin B	$C_{34}H_{50}O_8$	$CDCl_3$	[594]



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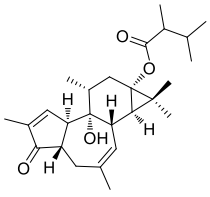
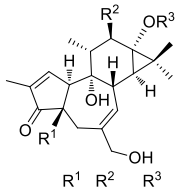
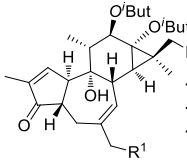
10-24-2 R = OAc



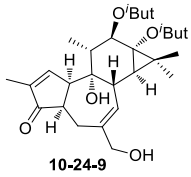
10-24-3



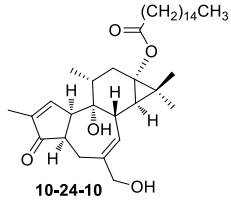
	R^1	R^2	R^3
10-24-4	H	OTig	^{i}But
10-24-5	OH	H	$CO(CH_2)_{14}CH_3$



	R^1	R^2
10-24-6	OH	H
10-24-7	OH	OAc
10-24-8	OAc	H



10-24-9



10-24-10

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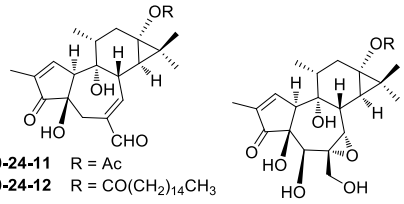

Table 10-24-2: ^{1}H NMR spectroscopic data of tigliane-type diterpenoids **10-24-1**, **10-24-2**, **10-24-6**, and **10-24-7**.

H	10-24-1	10-24-2	10-24-6	10-24-7
1	7.56 br s	7.51 br s	7.55 br s	7.50 br s
4	2.43 ddd(10.5, 9, 4.5)	2.44 m	2.46 ddd(10, 9.5, 4.5)	2.47 ddd(10, 9.5, 4.5)
5*α*	2.00 dd(18.2, 10.5)	2.00 dd(18, 10)	2.14 dd(18, 10)	2.10 dd(18, 10)
5*β*	2.82 br dd(18.2, 9)	2.74 br dd(18, 9)	2.82 br dd(18, 9.5)	2.73 br dd(18, 9.5)
7	5.21 br dq(5.5, 2)	5.20 br dq(5.5, 2)	5.54 br dq(5.5, 2)	5.52 br dq(5.5, 2)
8	2.32 br t(5.5)	2.25 br t(5.5)	2.36 br t(5.5)	2.33 br t(5.5)
9	5.70 br s(OH)	5.50 br s(OH)	5.80 br s(OH)	5.60 br s(OH)
10	3.28 dddq(4.5, 2.5, 2.5, 1.5)	3.24 dddq(4.5, 2.5, 2.5, 1.5)	3.24 dddq(4.5, 2.5, 2.5, 1.5)	3.20 dddq(4.5, 2.5, 2.5, 1.5)
11	1.55 dq(9.5, 6.5)	1.60 dq(9.5, 6.5)	1.56 dq(10, 6.5)	1.67 dq(10, 6.5)
12	5.37 d(9.5)	5.38 d(9.5)	5.38 d(10)	5.40 d(10)
14	0.96 d(5.5)	1.15 m(ov)	1.03 d(5.5)	1.20 d(5.5)
16	1.20 s	1.29 s	1.20 s	1.29 s
17	1.20 s	4.48 d(12.5) 4.07 d(12.5) 2.05 s(OAc)	1.20 s	4.50 d(12.5) 4.08 d(12.5) 2.05 s(OAc)
18	0.89 d(6.5)	0.92 d(6.5)	0.90 d(6.5)	0.93 d(6.5)
19	1.72 br s	1.72 t(1.5)	1.72 dd(2.5, 1.5)	1.72 dd(2.5, 1.5)
20	1.72 br s	1.73 dd(2, 1.5)	4.01 br d(15) 3.99 br d(15)	4.00 br s
O^{i}But	2.55 qq(7, 7) 2.54 qq(7, 7) 1.17 d(7), 1.16 d(7) 1.15 d(7), 1.14 d(7)	2.55 qq(7, 7) 2.53 qq(7, 7) 1.18 d(7), 1.16 d(7) 1.14 d(7), 1.12 d(7)	2.56 qq(7, 7) 2.55 qq(7, 7) 1.17 d(7), 1.16 d(7) 1.15 d(7), 1.14 d(7)	2.58 qq(7, 7) 2.54 qq(7, 7) 1.18 d(7), 1.17 d(7) 1.16 d(7), 1.15 d(7)

Table 10-24-3: ^{1}H NMR spectroscopic data of tigliane-type diterpenoids **10-24-3**~**10-24-5** and **10-24-11**.

H	10-24-3	10-24-4	10-24-5	10-24-11
1	7.56 br s	7.55 dq(2.5, 1.5)	7.55 br s	7.54 s
4	2.40 ddd(10, 9, 4)	2.48 ddd(10.0, 10.0, 5.0)		
5	1.98 dd(18, 10) 2.81 dd(18, 9)	*α* 2.15 br dd(18.0, 10.0) *β* 2.84 br dd(18.0, 10.0)	*α* 2.43 d(19.0) *β* 2.53 d(19.0)	2.60 ABq(19.5)

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Table 10-24-3 (continued)

H	10-24-3	10-24-4	10-24-5	10-24-11
7	5.22 br s	5.54 br d(6.0)	5.65 d(4.1)	6.71 q(2.1)
8	2.07 dd(6.5, 4)	2.39 br dd(6.0, 5.5)	2.99 m	3.38 t(5.5)
9	5.54 s(OH)			
10	3.29 br s	3.25 ddq(5.0, 2.5, 3.0)	3.23 br s	3.06 s
11	–	1.60 dq(10.0, 6.5)	1.96 m	2.05 m
12	2.10 dd(15, 6)	5.45 d(10.0)	*α* 1.51 dd(11.0, 14.2)	2.17 m
	1.53 dd(15, 4)		*β* 2.03 dd(6.9, 14.2)	1.61 m
13				2.09 s(OAc)
14	0.75 d(5)	1.04 d(5.5)	0.80 d(5.2)	1.01 d(5.4)
16	1.02 s	1.21 s	1.16 s	1.08 s
17	1.19 s	1.23 s	1.04 s	1.25 s
18	0.91 d(6.5)	0.91 d(6.5)	0.86 d(6.2)	0.89 d(6.4)
19	–	1.73 dd(3.0, 1.5)	1.65 d(1.7)	1.76 s
20	1.71 br s	3.99 d(13.0), 4.05 d(13.0)	3.94 d(12.6), 4.01 d(12.6)	9.41 s
O^{i}But		1.16 d(7.0), 1.19 d(7.0), 2.58 m		
2′	2.19 m		2.26 t(7.5)	
3′	1.93 m	6.83 qq(7.0, 1.5, Tig)	1.58 m	
4′	1.09 d(6.5)	1.80 dq(7.0, 1.5, Tig)	1.23 br s	
5′	0.93 d(6.5)	1.83 br d(1.5,Tig)	1.23 br s	
6′	0.90 d(6.5)		1.23 br s	
7′~15′			1.23 br s	
16′			0.85 m	

Table 10-24-4: ^{1}H NMR spectroscopic data of tigliane-type diterpenoids **10-24-8** and **10-24-9**.

H	10-24-8	10-24-9	H	10-24-8	10-24-9
1	7.55 br s	7.05 br s	11	1.60 dq(9.5, 6.5)	1.68 dq(10.5, 6.5)
4	2.44 m	2.78 ddd(5.2, 2.5, 2.5)	12	5.38 d(9.5)	5.41 d(10.5)
5	*α* 2.13 dd(18, 10)	*α* 2.47 dd(15.5, 5.2)	14	1.00 d(6)	0.75 d(5)
	β 2.84 br dd(18, 9)	*β* 3.45 dddd(15.5, 2.5, 2.5, 2.5)			
7	5.55 m(ov)	5.10 br s	16	1.20 s	1.16 s
8	2.37 br t(6)	1.95 m	17	1.20 s	1.20 s
9	5.80 br s(OH)	5.30 br s(OH)	18	0.90 d(6.5)	1.06 d(6.5)
10	3.24 dddq (4.5, 2.5, 2.5, 1.5)	3.50 dddq (2.5, 2.5, 2.5, 1.5)	19	1.72 t(1.5)	1.78 t(1.5)
O^{i}But	2.55 qq(7, 7)	2.60 qq(7, 7)	20	4.46 br d(12.5)	4.00 br d(12)
	2.53 qq(7, 7)	2.52 qq(7, 7)		4.42 br d(12.5)	3.88 br d(12)
	1.18 d(7), 1.16 d(7)	1.21 d(7), 1.19 d(7)		2.05 s(OAc)	
	1.14 d(7), 1.12 d(7)	1.15 d(7), 1.12 d(7)			

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Table 10-24-5: ^{1}H NMR spectroscopic data of tigliane-type diterpenoids **10-24-10** and **10-24-12**~**10-24-14**.

H	10-24-10	10-24-12	10-24-13	10-24-14
1	7.11 br s	7.54 s	7.68 br q(1.4)	7.69 br q(1.7)
4	2.85 ddd(6.7, 5.0, 3.0)			
5	α 2.54 dd(15.4, 5.0) β 3.54 dm(15.4)	2.66 ABq(19.6)	4.23 s	4.24 br s
7	5.15 br s	6.71 q(2.1)	3.25 br s	3.25 br s
8	1.82 m	3.38 t(5.4)	2.82 d(7.5)	2.82 d(7.5)
9	5.32 br s(OH)			
10	3.57 br s	3.06 s	3.93 br s	3.93 br s
11	1.58 m	2.04 m	1.80 m	1.83 m
12	1.75 dd(14.5, 12.0) 2.16 dd(14.5, 6.4)	1.62 m, 2.14 m	1.54 m	1.59 dd(9.4, 15.3)
13			2.02 dd(7.3, 15.0)	2.05 dd(7.4, 15.3)
14	0.58 d(5.0)	0.98 d(5.3)	1.11 d(7.4)	1.15 d(7.5)
16	1.19 s	1.07 s	1.17 s	1.19 s
17	1.09 s	1.23 s	1.05 s	1.06 s
18	1.12 d(6.4)	0.89 d(6.8)	0.90 d(6.6)	0.89 d(6.7)
19	1.83 br s	1.76 t(1.1)	1.75 dd(1.4, 2.9)	1.75 dd(1.4, 2.7)
20	4.06 d(12.1), 3.93 d(12.1)	9.41 s	3.88 br s	3.80 br s
2′	2.32 t(7.6)	2.31 t(7.4)	2.28 t(7.4)	5.74 d(15.0)
3′	1.62 m	1.62 m	1.63 m	7.26 ddd(4.9, 10.2, 15.0)
4′	1.30~1.35 m	1.24 br s	1.28 m	6.16 m
5′	1.30~1.35 m	1.24 br s	1.25 m	6.16 m
6′	1.30~1.35 m	1.24 br s	1.25 m	2.15 m
7′	1.30~1.35 m	1.24 br s	1.24 m	1.41 m
8′	1.30~1.35 m	1.24 br s	1.26 m	1.26 m
9′	1.30~1.35 m	1.24 br s	1.27 m	1.26 m
10′	1.30~1.35 m	1.24 br s	0.86 t(7.0)	1.26 m
11′,12′	1.30~1.35 m	1.24 br s		1.26 m
13′	1.30~1.35 m	1.24 br s		1.28 m
14′	1.30~1.35 m	1.62 m		0.86 t(6.8)
15′	1.30~1.35 m	1.24 m		
16′	0.92 t(6.9)	0.89 (ov)		

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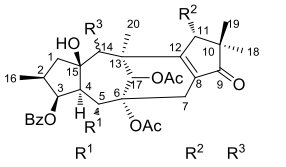
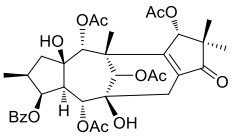
10.25 Segetane-type diterpenoids

Table 10-25-1: Compounds, MFs, and test solvents of segetane-type diterpenoids **10-25-1**~**10-25-11**.

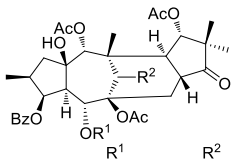
No.	Compounds	MFs	Test solvents	References
10-25-1	segetene A	$C_{37}H_{44}O_{14}$	$CDCl_3$	[595]
10-25-2	segetene B	$C_{37}H_{44}O_{14}$	$CDCl_3$	[595]
10-25-3	euphoportlandol A	$C_{35}H_{42}O_{13}$	$CDCl_3$	[596]
10-25-4	(2*S**,3*S**,4*R**,5*R**,6*R**,8*R**,11*S**,12*S**,13*R**,14*R**,15*R**)-5,6,11,14,17-pentaacetoxy-3-benzoyloxy-15-hydroxy-9-oxo-segetane	$C_{37}H_{46}O_{14}$	$CDCl_3$	[597]
10-25-5	(2*S**,3*S**,4*R**,5*R**,6*S**,8*R**,11*S**,12*S**,13*R**,14*R**,15*R**)-6,11,14-triacetoxy-5-(2-acetoxyacetoxy)-3-benzoyloxy-15-hydroxy-9-oxo-segetane	$C_{37}H_{46}O_{14}$	$CDCl_3$	[597]
10-25-6	paralinone A	$C_{37}H_{46}O_{14}$	$CDCl_3$ C_6D_6	[598] [598]
10-25-7	paralinone B	$C_{39}H_{48}O_{16}$	C_6D_6-D_2O	[598]
10-25-8	segetanin A	$C_{35}H_{44}O_{12}$	$CDCl_3$	[599]
10-25-9	segetanin B	$C_{39}H_{48}O_{17}$	$CDCl_3$	[599]
10-25-10	(2*S**,3*S**,4*R**,5*R**,6*R**,7*S**,8*R**,12*R**,13*S**,14*R**,15*R**)-5-angeloyloxy-3-benzoyloxy-6,14:8,14-diepoxy-7,13,15,17-tetrahydroxy-9-oxo-15-*epi*-presegetane	$C_{32}H_{40}O_{11}$	$CDCl_3$	[600]
10-25-11	presegetanin	$C_{34}H_{44}O_{13}$	$CDCl_3$	[599]



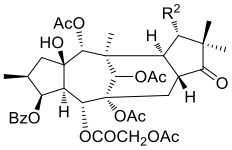
	R^1	R^2	R^3
10-25-1	OAc	OAc	*β*-OAc
10-25-2	$OCOCH_2OAc$	H	*α*-OAc



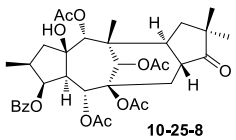
10-25-3



	R^1	R^2
10-25-4	Ac	OAc
10-25-5	$COCH_2OAc$	H



10-25-6 R = H
10-25-7 R = OAc



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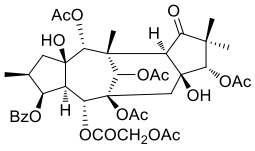
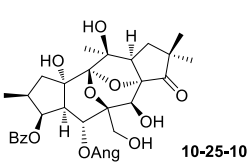
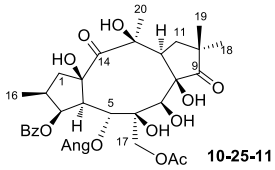


10-25-9



10-25-10



10-25-11

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Table 10-25-2: ^{1}H NMR spectroscopic data of segetane-type diterpenoids **10-25-1**~**10-25-4**.

H	10-25-1	10-25-2	10-25-3	10-25-4
1*α*	2.34 dd(15.1, 10.0)	2.32 dd(15.4, 10.0)	2.33 dd(10.4, 15.2)	2.38 dd(16, 9)
1*β*	1.52 dd(15.1, 10.2)	1.47 dd(15.4, 10.3)	1.53 dd(10.4, 15.2)	1.60 dd(16, 11.5)
2	2.15 m	2.14 m	2.15 m	2.10 m
3	5.74 t(3.5)	5.73 t(3.4)	5.70 m	5.80 dd(3.5, 3.5)
4	3.59 dd(11.0, 3.0)	3.61 dd(11.0, 3.2)	2.83 dd(3.4, 11.4)	3.39 dd(11.5, 3.5)
5	5.39 d(11.0)	5.43 d(10.7)	5.26 d(11.4)	5.52 d(11.5)
6			2.60 br s(OH)	
7*α*	2.47 dd(17.0, 2.0)	2.38 dd(16.8, 2.9)	2.39 dd(1.8, 16.9)	1.81 dd(12.5, 12.5)
7*β*	2.90 br d(17.0)	2.83 br d(16.8)	2.60 br s(16.9)	2.31 br d(12.5, 4)
8				3.77 ddd(12.5, 4)
11	6.13 t(2)	*α* 2.32 br d(16.7) *β* 2.73 br dt(16.7, 2.9)	6.07 br s	5.59 dd(11)
12				2.08 m
14	5.38 s	5.31 s	5.35 s	5.28 s
16	0.91 d(7.0)	0.90 d(6.8)	0.92 d(6.8)	0.93 d(7)
15	2.60 s(OH)	2.46 s(OH)	2.60 br s(OH)	2.64 s(OH)
17	6.53 s	6.53 s	5.75 s	6.38 br s
18	1.02 s	1.13 s	1.00 s	0.96 s
19	1.24 s	1.10 s	1.21 s	1.23 s
20	1.10 s	1.03 s	1.07 s	1.06 s
OAc	1.87 s(5-OAc)	2.02 s(6-OAc)	1.95 s	1.95 s(5-OAc)
	2.00 s(6-OAc)	2.23 s(14-OAc)	2.10 s	2.07 s(6-OAc)
	2.11 s(11-OAc)	2.02 s(17-OAc)	2.10 s	2.13 s(11-OAc)
	2.22 s(14-OAc)	2.04 s	2.20 s	2.17 s(14-OAc)
	2.09 s(17-OAc)			1.94 s(17-OAc)
OCH_2OR		4.44 d(15.9) 4.48 d(15.9)		
OBz	7.72 dd(8, 1, *o*-) 7.40 dd(7, 1, *m*-) 7.55 tt(8, 1, *p*-)	7.72 dt(8.3, 1.3, *o*-) 7.39 t(8.1, *m*-) 7.54 tt(7.4, 1.2, *p*-)	7.74 dt(7.2, *o*-) 7.41 t(7.8, *m*-) 7.56 t(7.5, *p*-)	7.83 (*o*-) 7.46 (*m*-) 7.59 (*p*-)

Table 10-25-3: ^{1}H NMR spectroscopic data of segetane-type diterpenoids **10-25-5**~**10-25-7**.

H	10-25-5	10-25-6($CDCl_3$)	10-25-6(C_6D_6)	10-25-7
1*α*	2.37 dd(15, 9.5)	2.35 dd(15, 8)	2.38 dd(15, 8)	2.16 m
1*β*	1.60 dd(15, 11.5)	1.53 dd(15, 11)	1.35 dd(15, 11)	1.17 dd(11, 15)
2	2.09 m	2.10 dq(11, 4, 6.8)	1.71 m	1.70 m
3	5.79 dd(3.5)	5.76 t(4)	6.06 t(4)	6.05 t(4)
4	3.28 dd(11.5, 3.5)	3.39 dd(4, 11)	3.73 dd(4, 11)	3.68 dd(4, 11)
5	5.27 d(11.5)	5.51 d(11)	6.00 d(11)	5.91 d(11)
7*α*	1.35 dd(12.5, 12.5)	1.72 dd(13, 13)	2.12 dd(13, 13)	2.19 t(13)
7*β*	2.61 ddd(12.5, 4.5, 2.5)	2.31 dd(13, 4)	3.03 dd(13, 4)	3.06 dd(3.5, 13)

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Table 10-25-3 (continued)

H	10-25-5	10-25-6($CDCl_3$)	10-25-6(C_6D_6)	10-25-7
8	3.71 ddd(12.5, 4.5, 16)	3.65 ddd(4, 14, 13)	3.93 ddd(4, 14, 13)	4.11 ddd(3.5, 13, 14)
11	5.55 d(11)	α 1.83 m, β 1.83 m	α 1.63 m, β1.38 m	5.98 d(10)
12	1.77 dd(16, 11)	1.94 ddd(8, 12)	1.94 ddd(8, 12)	2.26 dd(10, 14)
14	5.18 s	5.20 s	5.39 s	5.56 s
15	2.58 s(OH)	2.60 br s(OH)	2.43 br s(OH)	
16	0.94 d(7)	0.91 d(6.8)	0.75 d(6.8)	0.76 d(7)
17	3.51 dd(15, 2.5), 1.08 d(15)	6.41 s	6.83 s	6.78
18	0.93 s	1.05 s	1.14 s	0.99 s
19	1.20 s	1.12 s	1.05 s	0.99 s
20	1.08 s	1.00 s	0.99 s	1.20 s
$COCH_2OR$	4.60 d, 4.49 d	4.55 d, 4.43 d	4.70 br s	4.56 br s
OAc	2.08 s(6-OAc)	2.00 s, 2.04 s,	1.98 s, 1.76 s, 1.64 s, 1.60 s	1.97 s, 1.78 s, 1.63 s,
	2.14 s(11, 14-OAc) 2.09 s	2.05 s, 2.15 s		1.61 s, 1.57 s
OBz	7.84 (*o*-)	7.82 dd(7.3, 1.1, *o*-)	7.94 dd(7.3, 1.1, *o*-)	8.02 dd(7, 1, *o*-)
	7.46 (*m*-)	7.45 t(7.3, 1, *m*-)	6.99 t(7.3, 1, *m*-)	7.00 br t(7, *m*-)
	7.59 (*p*-)	7.55 tt(7.3, 1.1, *p*-)	7.02 td(7.3, 1.1, *p*-)	7.03 td(1.7, *p*-)

Table 10-25-4: ^{1}H NMR spectroscopic data of segetane-type diterpenoids **10-25-8**~**10-25-11**.

H	10-25-8	10-25-9	10-25-10	10-25-11
1α	2.39 dd(15.0, 9.0)	2.35 dd(13.0, 9.5)	2.32 dd(13, 8)	2.54 dd(13.0, 8.0)
1β	1.55 dd(15.0, 11.5)	1.60 dd(13.0, 11.5)	1.70 dd(13)	1.79 dd(13.0, 13.0)
2	2.09 m	2.17 m	2.43 m	2.47 m
3	5.80 dd(3.5, 3.5)	5.74 dd(3.5, 3.5)	5.65 dd(4, 6)	5.58 dd(3.5, 3.5)
4	3.38 dd(11.5, 3.5)	3.63 dd(3.5, 10.5)	3.55 dd(4, 6)	2.99 dd(3.5, 10.5)
5	5.53 d(11.5)	5.37 d(10.5)	5.18 d(4)	5.46 d(10.5)
6				2.04 s(OH)
7	α 1.72 dd(12.5, 12.5)	α 2.49 d(17.0)	4.24 d(4)	3.25 d(3.5)
	β 2.22 br d(12.5, 4.0)	β 2.94 d(17.0)	2.99 d(4, OH)	3.49 d(3.5, OH)
8	3.68 ddd(12.5, 4.0, 16.0)	5.02 s(OH)		5.14 s(OH)
9		6.10 s		
11	α 1.82 m(ov)		α 2.08 dd(9, 2)	α 2.01 dd(9.0, 2.0)
	β 2.01 dd(12.0, 12.0)		β 1.90 dd(9, 11)	β 2.32 dd(9.0, 11.0)
12	1.85 m(ov)	3.49 s	3.52 dd(2, 11)	3.08 dd(2.0, 11.0)
13			1.93 s(OH)	4.48 s(OH)
14	5.22 s	5.38 s		
15	2.50 s(OH)	2.53 s(OH)	4.35 s(OH)	3.04 s(OH)
16	0.94 d(7.0)	0.92 d(7.0)	0.96 d(7)	1.01 d(7.0)

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Table 10-25-4 (continued)

H	10-25-8	10-25-9	10-25-10	10-25-11
17	6.45 br s	6.51 s	3.85 dd(10, 12) 3.65 dd(10, 1) 3.93 dd(12, 1, OH)	3.24 d(11.5) 5.24 d(11.5)
18	1.08 s	1.01 s	1.10 s	1.10 s
19	1.16 s	1.21 s	1.23 s	1.28 s
20	1.03 s	1.10 s	1.52 s	1.61 s
OAc	1.95 s(5-OAc) 2.06 s(6-OAc) 2.19 s(14-OAc) 1.94 s(17-OAc)	2.09 s(6-OAc) 2.11 s(9-OAc) 2.23 s(14-OAc) 2.04 s(17-OAc) 2.04 s		1.80 s(17-OAc)
OBz	7.82 d(7.4, *o*-) 7.47 t(7.4, *m*-) 7.59 t(7.4, *p*-)	7.73 d(7.4, *o*-) 7.41 t(7.4, *m*-) 7.56 d(7.4, *p*-)	8.08 (*o*-) 7.50 (*m*-) 7.62 (*p*-)	8.03 d(7.4, *o*-) 7.50 t(7.4, *m*-) 7.61 t(7.4, *p*-)
OCH_2OR		4.50 d, 4.43 d		
OAng			6.31 qq 2.05 m, 2.05 m	5.99 br q(7.0) 1.87 d(7.0), 1.84 s

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11 Triterpenoids

11.1 Squalene- and botryococcane-type triterpenoids

Table 11-1-1: Compounds, MFs, and test solvents of squalene- and botryococcane-type triterpenoids **11-1-1**~**11-1-39**.

No.	Compounds	MFs	Test solvents	References
11-1-1	*Z*,*E*,*E*-cupaniopsin A	$C_{30}H_{42}O_5$	$CDCl_3$	[1]
11-1-2	*Z*,*E*,*Z*-cupaniopsin A	$C_{30}H_{42}O_5$	$CDCl_3$	[1]
11-1-3	*Z*,*E*,*E*-cupaniopsin A methyl ester	$C_{31}H_{44}O_5$	$CDCl_3$	[1]
11-1-4	*Z*,*E*,*E*,*E*-cupaniopsin B	$C_{30}H_{50}O_3$	$CDCl_3$	[1]
11-1-5	*Z*,*E*,*Z*-cupaniopsin C	$C_{30}H_{44}O_3$	$CDCl_3$	[1]
11-1-6	22-hydroxy-*Z*,*E*,*Z*-cupaniopsin C	$C_{30}H_{44}O_4$	$CDCl_3$	[1]
11-1-7	23-hydroxy-*Z*,*E*,*Z*-cupaniopsin C	$C_{30}H_{44}O_4$	$CDCl_3$	[1]
11-1-8	*Z*,*Z*,*E*,*E*-cupaniopsin D	$C_{30}H_{48}O_4$	$CDCl_3$	[1]
11-1-9	*Z*,*E*,*Z*-cupaniopsin A methyl ester	$C_{31}H_{44}O_5$	$CDCl_3$	[1]
11-1-10	*Z*,*E*,*Z*-cupaniopsin E	$C_{31}H_{44}O_6$	$CDCl_3$	[1]
11-1-11	(2*E*,6*E*,12*E*,16*E*)-3,7,13,17,21-pentamethyl-10-(1-methyl-ethenyl)-2,6,12,16,20-docosapentaen-1-ol	$C_{30}H_{50}O$	$CDCl_3$	[2]
11-1-12	tetrahydroxysqualene	$C_{30}H_{50}O_4$	$CDCl_3$	[3]
11-1-13	concentricol B	$C_{30}H_{52}O_7$	CD_3OD	[4]
11-1-14	concentricol C	$C_{32}H_{56}O_7$	CD_3OD	[4]
11-1-15	concentricol D	$C_{32}H_{54}O_6$	CD_3OD	[4]
11-1-16	3,7,18,22-tetramethylsqualene	$C_{34}H_{58}$	$CDCl_3$	[5]
11-1-17	3,7,22-trimethylsqualene	$C_{33}H_{56}$	$CDCl_3$	[5]
11-1-18	3,22-dimethylsqualene	$C_{32}H_{54}$	$CDCl_3$	[5]
11-1-19	3-methylsqualene	$C_{31}H_{52}$	$CDCl_3$	[5]
11-1-20	ekebergin D_1	$C_{32}H_{56}O_5$	$CDCl_3$	[6]
11-1-21	ekebergin D_2	$C_{30}H_{54}O_5$	$CDCl_3$	[6]
11-1-22	ekebergin D_3	$C_{30}H_{54}O_5$	$CDCl_3$	[6]
11-1-23	ekebergin D_4	$C_{30}H_{54}O_6$	$CDCl_3$	[6]
11-1-24	ekebergin D_5	$C_{32}H_{56}O_6$	$CDCl_3$	[6]
11-1-25	armatol A	$C_{30}H_{51}BrO_6$	$CDCl_3$	[7]
11-1-26	armatol B	$C_{30}H_{52}Br_2O_6$	$CDCl_3$	[7]
11-1-27	armatol C	$C_{30}H_{52}Br_2O_6$	$CDCl_3$	[7]
11-1-28	armatol D	$C_{30}H_{52}Br_2O_6$	$CDCl_3$	[7]
11-1-29	armatol E	$C_{30}H_{52}Br_2O_6$	$CDCl_3$	[7]
11-1-30	armatol F	$C_{30}H_{52}Br_2O_6$	$CDCl_3$	[7]
11-1-31	martiriol	$C_{30}H_{50}O_7$	$CDCl_3$	[8]
11-1-32	pseudodehydrothyrsiferol	$C_{30}H_{52}O_7$	$CDCl_3$	[8]
11-1-33	dioxepandehydrothyrsiferol	$C_{30}H_{51}BrO_6$	$CDCl_3$	[8]
11-1-34	16-epihydroxydehydrothyrsiferol	$C_{30}H_{51}BrO_6$	$CDCl_3$	[8]
11-1-35	clavidol	$C_{30}H_{55}BrO_6$	$CDCl_3$	[9]
11-1-36	3-*epi*-dehydrothyrsiferol	$C_{30}H_{51}BrO_6$	$CDCl_3$	[9]
11-1-37	lactodehydrothyrsiferol	$C_{27}H_{44}O_7$	$CDCl_3$	[9]
11-1-38	botryolin A	$C_{34}H_{60}O_3$	$CDCl_3$	[10]
11-1-39	botryolin B	$C_{34}H_{60}O_3$	$CDCl_3$	[10]

https://doi.org/10.1515/9783110634723-011

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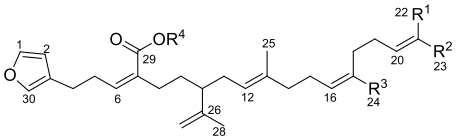
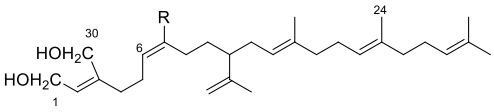
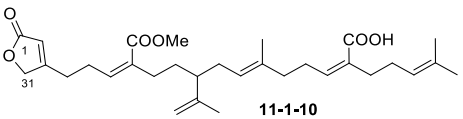


	Δ^{16}	R^1	R^2	R^3	R^4
11-1-1	E	Me	Me	COOH	H
11-1-2	Z	Me	Me	COOH	H
11-1-3	E	Me	Me	COOH	Me
11-1-5	Z	Me	Me	Me	H
11-1-6	Z	CH_2OH	Me	Me	H
11-1-7	Z	Me	CH_2OH	Me	H
11-1-9	Z	Me	Me	COOH	Me



	Δ^6	R
11-1-4	*E*	CH_2OH
11-1-8	*Z*	COOH



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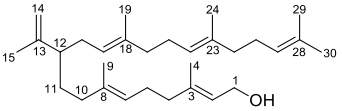

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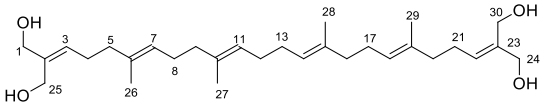

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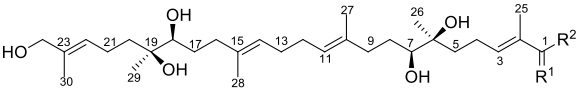
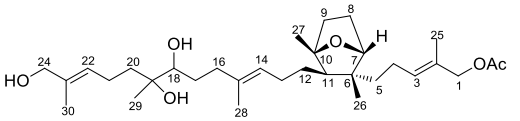


	R^1	R^2
11-1-13	O	OH
11-1-14	H_2	OAc



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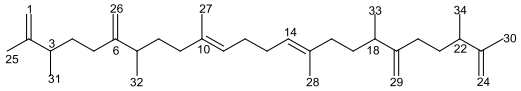

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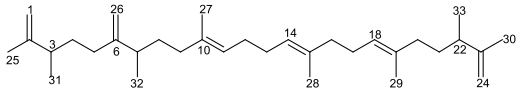

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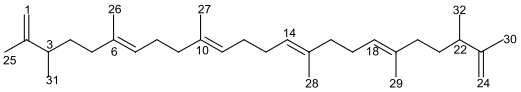

11-1-18

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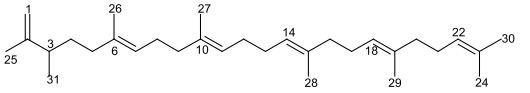

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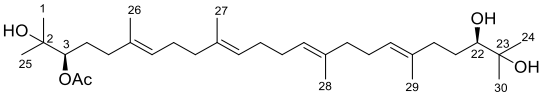

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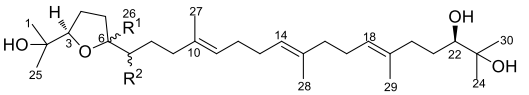
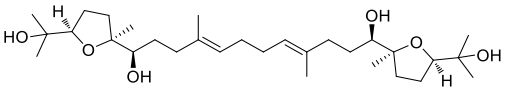


	R^1	R^2
11-1-21	β-Me	α-OH
11-1-22	α-Me	β-OH



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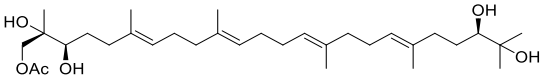

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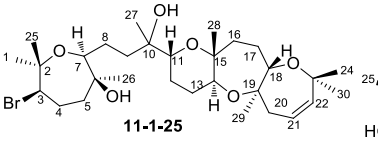

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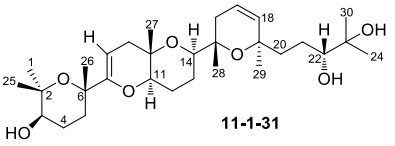

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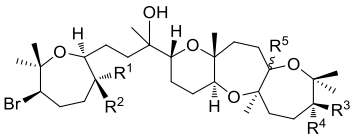
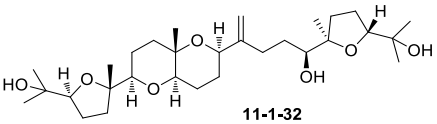


	R^1	R^2	R^3	R^4	R^5
11-1-26	Me	OH	H	Br	β-H
11-1-27	OH	Me	H	Br	β-H
11-1-28	Me	OH	Br	H	β-H
11-1-29	OH	Me	Br	H	β-H
11-1-30	Me	OH	H	Br	α-H



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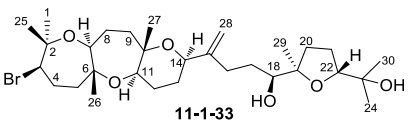
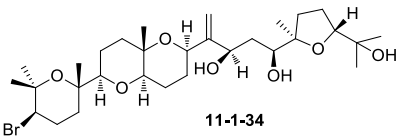
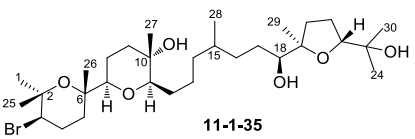


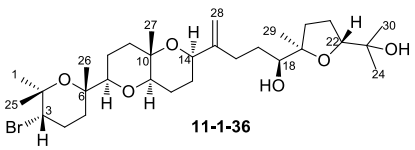
11-1-33



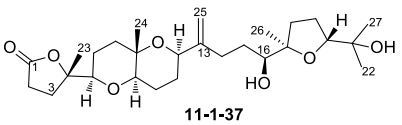
11-1-34



11-1-35



11-1-36



11-1-37

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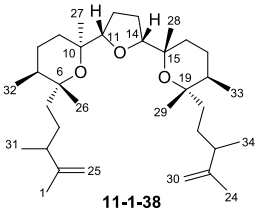
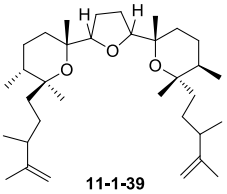


11-1-38



11-1-39

Table 11-1-2: ^{1}H NMR spectroscopic data of squalene- and botryococcane-type triterpenoids **11-1-1**~**11-1-5**.

H	11-1-1	11-1-2	11-1-3	11-1-4	11-1-5
1	7.32 t(1.6)	7.33 s	7.33 t (1.6)	4.20 d(6.8)	7.34 s
2	6.26 s	6.26 s	6.26 s	5.61 t(6.8)	6.27 s
4	2.53 t(7.4)	2.52 m	2.53 t(7.4)	2.18 m	2.54 t(7.3)
5	2.72 dt (7.2, 7.4)	2.73 m	2.66 dt(7.0, 7.4)	2.20 m	2.75 dt(7.1, 7.3)
6	5.97 t(7.2)	5.98 t(7.3)	5.85 t(7.0)	5.37 m	6.01 t(7.1)
8	2.08 m, 2.20 m	2.09 m, 2.20 m	2.05 m, 2.20 m	1.93 m, 2.01 m	1.96 m, 2.20 m
9	1.40 m, 1.50 m	1.38 m, 1.55 m	1.40 m, 2.01 m	1.37 m, 1.43 m	1.46 m, 1.51 m
10	2.01 m	2.01 m	2.01 m	2.02 m	2.02 m
11	2.01 m	2.02 m	2.01 m	2.02 m	2.02 m
12	5.09 m	5.08 m	5.07 m	5.06 m	5.08 m
14	2.08 m	2.05 m	2.08 m	1.97 m	1.98 m
15	2.30 m	2.53 m	2.28 m	2.05 m	1.98 m
16	6.85 t(7.3)	5.97 t(7.3)	6.84 t(7.3)	5.08 m	5.10 m
18	2.08 m	2.25 m	2.28 m	1.96 m	1.94 m
19	2.30 m	2.10 m	2.08 m	2.05 m	2.06 m
20	5.11 m	5.09 m	5.14 m	5.07 m	5.09 m
22	1.59 s	1.58 s	1.58 s	1.59 s	1.59 m
23	1.66 s	1.67 s	1.66 s	1.67 s	1.66 s
24				1.58 s	1.58 s
25	1.58 s	1.58 s	1.58 s	1.58 s	1.57 s
27	4.63 br s, 4.73 br s	4.63 br s, 4.73 br s	4.64 br s, 4.74 br s	4.68 br s, 4.76 br s	4.64 br s, 4.74 br s
28	1.60 s	1.60 s	1.58 s	1.62 s	1.60 s
29				4.01 s	
30	7.21 s	7.21 s	3.72 s	4.15 s	7.22 s
31			7.21 s		

Table 11-1-3: ^{1}H NMR spectroscopic data of squalene- and botryococcane-type triterpenoids **11-1-6**~**11-1-10**.

H	11-1-6	11-1-7	11-1-8	11-1-9	11-1-10
1	7.33 s	7.33 s	4.18 m	7.33 s	
2	6.26 s	6.26 s	5.59 t(6.7)	6.26 s	5.90 m
4	2.54 t(7.4)	2.54 t(7.4)	2.20 t(7.8)	2.57 m	2.54 m

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Table 11-1-3 (continued)

H	11-1-6	11-1-7	11-1-8	11-1-9	11-1-10
5	2.75 dt(7.0, 7.4)	2.75 dt(7.0, 7.4)	2.58 dt(7.6, 7.8)	2.66 dt(7.1, 7.2)	2.72 m
6	5.99 t(7.0)	5.99 t(7.0)	5.95 t(7.6)	5.85 t(7.1)	5.79 t(7.3)
8	1.96 m, 2.20 m	1.96 m, 2.20 m	2.04 m, 2.21 m	2.03 m, 2.18 m	2.08 m, 2.20 m
9	1.38 m, 1.46 m	1.38 m, 1.46 m	1.46 m, 1.51 m	1.44 m, 1.49 m	1.38 m, 1.44 m
10	2.01 m	2.01 m	2.02 m	2.02 m	2.03 m
11	2.02 m	2.02 m	1.99 m	2.04 m	2.04 m
12	5.02 m	5.02 m	5.06 m	5.06 m	5.07 m
14	2.02 m	2.02 m	1.95 m	2.08 m	2.07 m
15	2.03 m	2.03 m	1.98 m	2.53 m	2.57 m
16	5.08 m	5.08 m	5.10 m	5.99 t(7.1)	5.97 t(7.1)
18	2.02 m	2.02 m	1.95 m	2.24 m	2.24 m
19	2.03 m	2.03 m	1.98 m	2.11 m	2.08 m
20	5.27 m	5.35 m	5.08 m	5.08 m	5.08 m
22	4.08 m	1.65 s	1.59 s	1.57 s	1.57 s
23	1.78 s	3.99 m	1.67 s	1.66 s	1.66 s
24	1.57 s	1.57 s	1.58 s		
25	1.56 s	1.56 s	1.58 s	1.58 s	1.57 s
27	4.64 br s, 4.74 br s	4.64 br s, 4.74 br s	4.64 br s, 4.74 br s	4.65 br s, 4.75 br s	4.67 br s, 4.77 br s
28	1.60 s	1.60 s	1.60 s	1.60 s	1.59 s
30	7.22 s	7.22 s	4.16 m	3.72 s	3.73 s
31				7.21 s	4.75 s

Table 11-1-4: ^{1}H NMR spectroscopic data of squalene- and botryococcane-type triterpenoids **11-1-11**~**11-1-15**.

H	11-1-11	11-1-12	11-1-13	11-1-14	11-1-15
1	4.15 d(6.9)	4.18 br s		4.44 s 2.03 s(OAc)	4.45 s 2.04 s(OAc)
2	5.41 t(6.9)				
3		5.51 t(7.2)	6.80 t(7.1)	5.49 t(7.1)	5.47 t(7.1)
4	1.68 s	2.16 q(7.2)	2.07 m 2.33 dd(5.5, 13.7)	2.12 dd(5.2, 12.6) 2.17 dd(5.5, 12.6)	1.96 m 2.11 m
5	1.94~2.12 m	2.01 m	1.49 ddd(1.9, 5.2, 13.7) 1.57 ddd(1.9, 5.0, 13.7)	1.48 ddd(1.3, 5.2, 12.8) 1.60 ddd(1.1, 5.2, 12.8)	1.44 m 1.52 dd(4.9, 11.5)
6	1.94~2.12 m				
7	5.07~5.12 m	5.10 m	3.25 dd(4.4, 6.5)	3.28 dd(1.9, 8.0)	3.85 d(5.5)
8		2.06 m①	1.38 dd(4.4, 10.2) 1.75 m	1.38 ddd(4.9, 9.1, 13.7) 1.75 dd(7.7, 13.7)	1.51 m 1.67 m

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Table 11-1-4 (continued)

H	11-1-11	11-1-12	11-1-13	11-1-14	11-1-15
9	1.58 s	1.97 m	2.00 m	2.00 m	1.71 dd(5.2, 12.4)
			2.26 m	2.25 ddd(4.4, 9.6, 13.5)	1.97 m
10	1.9 m				
11	1.38 m, 1.46 m	5.12 m	5.22 br d(1.1)	5.21 br s	1.28 t(6.9)
12	1.94~2.12 m	1.99 m	2.04 m	2.04 m	1.35 m
13		1.99 m	2.04 m	2.04 m	1.99 m
14	4.65 s, 4.74 s	5.12 m	5.22 br d(1.1)	5.21 br s	5.19 t(7.2)
15	1.61 s				
16	1.94~2.12 m	1.97 m	2.00 m	2.00 m	2.01 m
			2.26 m	2.25 ddd(4.4, 9.6, 13.5)	2.25 ddd(4.7, 9.6, 14.3)
17	5.07~5.12 m	2.06 m	1.38 dd(4.4, 10.2)	1.38 ddd(4.9, 9.1, 13.7)	1.38 m
			1.75 m	1.75 dd(7.7, 13.7)	1.75 m
18		5.10 m	3.25 dd(4.4, 6.5)	3.28 dd(1.9, 8.0)	3.28 dd(1.4, 10.2)
19	1.59 s				
20	1.94~2.12 m	2.01 m	1.49 ddd(1.9, 5.2, 13.7)	1.48 ddd(1.3, 5.2, 12.8)	1.48 m
			1.57 ddd(1.9, 5.0, 13.7)	1.60 ddd(1.1, 5.2, 12.8)	1.57 dd(4.7, 11.8)
21	1.94~2.12 m	2.16 q(7.2)	2.11 dd(6.3, 12.2)	2.12 dd(5.2, 12.6)	2.10 m
			2.17 dd(6.3, 12.2)	2.17 dd(5.5, 12.6)	2.15 m
22	5.07~5.12 m	5.51 t(7.2)	5.41 dd(6.5, 7.8)	5.41 t(7.1)	5.41 t(7.2)
24	1.59 s	4.18 br s	3.91 s	3.91 s	3.91 s
25	1.94~2.12 m	4.28 br s	1.83 s	1.67 s	1.66 s
26	1.94~2.12 m	1.58 br s	1.01 s	1.10 s	1.03 s
27	5.07~5.12 m	1.58 br s	1.63 s	1.62 s	1.34 s
28		1.58 br s	1.63 s	1.62 s	1.63 s
29	1.605 s	1.58 br s	1.01 s	1.10 s	1.11 s
30	1.68 s	4.28 br s	1.66 s	1.66 s	1.66 s

① Typographic error exists in the literature, typing the NMR data of 8-position as that of 7-position.

Table 11-1-5: ^{1}H NMR spectroscopic data of squalene- and botryococcane-type triterpenoids **11-1-16**~**11-1-20**.

H	11-1-16	11-1-17	11-1-18	11-1-19	11-1-20
1	4.69 m	4.69 m	4.67 m	4.67 m	1.18 s
3	2.16 m	2.15 m	2.09 m	2.09 m	4.78 dd(10, 2.5)
					2.01 s (OAc)
4	1.52 m, 1.43 m	1.35~1.50 m	1.46 m, 1.36 m	1.46 m, 1.35 m	1.70 m
5	1.89 m	1.89 m	1.89 m	1.89 m	
7	2.06 m	2.07 m	5.10 m	5.11 m	5.19 m

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Table 11-1-5 (continued)

H	11-1-16	11-1-17	11-1-18	11-1-19	11-1-20
8	1.52 m, 1.34 m	1.52 m, 1.34 m	2.06 m	2.06 m	
9	1.91 m	1.91 m	1.98 m	1.98 m	
11	5.12 m	5.13 m	5.14 m	5.14 m	5.14 m
12	2.00 m	2.01 m	2.02 m	2.02 m	
13	2.00 m	2.01 m	2.02 m	2.02 m	
14	5.12 m	5.13 m	5.14 m	5.14 m	5.14 m
16	1.91 m	2.00 m	1.98 m	1.98 m	
17	1.52 m, 1.34 m	2.07 m	2.06 m	2.06 m	
18	2.06 m	5.10 m	5.10 m	5.10 m	5.12 m
20	1.89 m	1.91 m	1.89 m	2.06 m	
21	1.52 m, 1.43 m	1.35~1.50 m	1.46 m, 1.36 m	2.06 m	1.42 m
22	2.16 m	2.11 m	2.09 m	5.10 m	3.35 dd(10, 1.5)
24	4.69 m	4.67 m	4.67 m	1.60 s	1.15 s
25	1.66 br s	1.66 br s	1.65 br s	1.65 br s	1.19 s
26	4.71 m	4.71 m	1.58 br s	1.58 br s	1.62 br s
27	1.58 s	1.58 br s	1.60 br s	1.60 s	1.60 br s
28	1.58 s	1.60 br s	1.60 br s	1.60 s	1.60 br s
29	4.71 m	1.58 br s	1.58 br s	1.60 s	1.60 br s
30	1.66 br s	1.65 br s	1.65 br s	1.68 br s	1.19 s
31	1.02 d(7.0)	1.02 d(7.0)	1.00 d(6.9)	1.00 d(6.9)	
32	1.00 d(6.8)	1.00 d(6.8)	1.00 d(6.9)		
33	1.00 d(6.8)	1.00 d(6.8)			
34	1.02 d(7.0)				

Table 11-1-6: ^{1}H NMR spectroscopic data of squalene- and botryococcane-type triterpenoids **11-1-21**~**11-1-25**.

H	11-1-21	11-1-22	11-1-23	11-1-24	11-1-25
1	1.13 s	1.21 s	1.13 s	1.15 s	1.36 s
3	3.76 dd(10, 6)	3.77 dd(7, 7)	3.81 dd(7.5, 7.5)	3.48 dd(10, 2.5)	3.89 d(11.0)
4	1.85 m	1.87 m	1.90 dd(7.5, 7.5) 1.92 m	1.55 m, 1.60 m	ax 2.33, eq 2.00
5	1.56 m, 2.09 m	1.46 m, 2.05 m	1.50 m, 2.11 m	2.23 m, 2.23 m	ax 1.49, eq 1.74
7	3.50 dd(10, 1.5)	3.51 dd(10.5, 2)	3.55 dd(10.5, 2)	5.19 m	3.28 dd(10.4, 3.0)
8	1.40 m, 1.60 m	1.34 m, 1.55 m	1.38 m, 1.59 m	2.10 m	1.65~1.34 m
9	2.03 m, 2.26 m	1.99 m, 2.21 m	2.11 m, 2.14 m	2.00 m	1.50~1.33 m
11	5.20 m	5.14 m	5.20 m	5.14 m	3.25 dd(10.8, 3.1)
12	2.03 m	1.19 m	2.05 m		1.64 m
13	2.03 m	1.19 m	2.05 m		1.66 m
14	5.14 m	5.09 m	5.20 m	5.14 m	3.38 dd(11.3, 4.3)
16	2.03 m, 2.09 m	1.19 m, 2.05 m	2.11 m, 2.24 m		1.74 m
17	2.09 m	1.34 m	1.38 m, 1.59 m	2.10 m	1.85~1.65 m
18	5.20 m	5.16 m	3.55 dd(10.5, 2)	5.19 m	3.72 dd(11.2, 3.9)
20	2.05 m, 2.25 m	1.19 m, 2.21 m	1.50 m, 2.11 m	2.23 m, 2.23 m	2.48~2.11 m

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Table 11-1-6 (continued)

H	11-1-21	11-1-22	11-1-23	11-1-24	11-1-25
21	1.40 m, 1.56 m	1.39 s, 1.45 m	1.90 dd(7.5, 7.5) 1.92 dd(7.5, 7.5)	1.45 m, 1.55 m	5.42 m
22	3.34 dd(10.5, 2)	3.30 dd(10.5, 2)	3.81 dd(7.5, 7.5)	3.35 dd(10.5, 2)	5.35 d(12.1)
24	1.15 s	1.11 s	1.13 s	1.15 s	1.19 s
25	1.22 s	1.09 s	1.25 s	4.00 d(11.5) 4.14 d(11.5)	1.40 s
26	1.14 s	1.12 s	1.15 s	1.62 br s	1.11 s
27	1.60 br s	1.57 br s	1.61 s	1.60 br s	1.08 s
28	1.60 br s	1.55 br s	1.61 s	1.60 br s	1.19 s
29	1.62 br s	1.57 br s	1.15 s	1.62 br s	1.26 s
30	1.20 s	1.15 s	1.25 s	1.20 s	1.24 s
OAc				2.10 s	

Table 11-1-7: ^{1}H NMR spectroscopic data of squalene- and botryococcane-type triterpenoids **11-1-26**~**11-1-30**.

H	11-1-26	11-1-27	11-1-28	11-1-29	11-1-30
1	1.36 s	1.35 s	1.36 s	1.36 s	1.36 s
3	3.90 d(11.0)	3.99 d(10.4)	3.89 d(11.0)	4.10 d(10.4)	3.89 d(11.4)
4ax	2.35 m	2.33 m	2.33 m	2.30 m	2.35 m
4eq	2.04 m	2.05 m	2.01 m	2.00 m	2.05 m
5ax	1.48 m	1.44 m	1.48 m	1.54 m	1.49 m
5eq	1.77 m	1.83 m	1.75 m	1.85 m	1.75 m
7	3.31 dd(10.3, 2.9)	3.28 dd(9.2, 2.4)	3.30 dd(9.9, 2.6)	3.28 dd(9.8, 3.0)	3.31 dd(10.2, 3.0)
8	1.48 ~1.63 m	1.44~1.65 m	1.47~1.63 m	1.43~1.62 m	1.64 m
9	1.35~1.52 m	1.34~1.52 m	1.35~1.50 m	1.33~1.53 m	1.34~1.54 m
11	3.27 dd(12.4, 2.6)	3.25 dd(10.1, 1.8)	3.27 dd(11.7, 1.8)	3.25 dd(11.8, 2.4)	3.44 dd(5.0, 2.4)
12	1.65 m	1.65 m	1.64 m	1.65 m	1.58~1.73 m
13	1.63 m	1.63 m	1.66 m	1.63 m	1.72 m
14	3.50 dd(11.0, 4.0)	3.48 dd(10.7, 3.0)	3.44 dd(10.6, 4.8)	3.45 dd(10.4, 3.9)	3.74 dd(11.0, 4.2)
16	1.73~1.88 m	1.70~1.87 m	1.77 m	1.72~1.88 m	1.58~2.02 m
17	1.45~2.05 m	1.48~2.00 m	1.50~1.90 m	1.56~2.00 m	ax 2.28 m, eq 1.88 m
18	3.14 dd(11.4, 2.6)	3.13 dd(10.9, 2.4)	3.72 dd(11.4, 3.3)	3.73 dd(10.9, 3.1)	3.34 dd(7.4, 1.7)
20	ax 1.52 m eq 1.75 m	ax 1.54 m eq 1.77 m	ax 1.64 m eq 2.13 m	ax 1.67 m eq 2.10 m	1.18~2.12 m
21	ax 2.21 m eq 2.05 m	ax 2.22 m eq 2.04 m	2.04 m	2.06 m	2.09~2.43 m
22	4.10 d(10.6)	4.10 d(10.9)	4.31 dd(7.4, 2.6)	4.33 dd(7.3, 2.5)	4.22 bt(3.7)
24	1.32 s	1.32 s	1.27 s	1.27 s	1.31 s

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Table 11-1-7 (continued)

H	11-1-26	11-1-27	11-1-28	11-1-29	11-1-30
25	1.41 s	1.41 s	1.42 s	1.40 s	1.42 s
26	1.12 s	1.18 s	1.11 s	1.19 s	1.12 s
27	1.09 s	1.09 s	1.09 s	1.10 s	1.10 s
28	1.19 s	1.18 s	1.22 s	1.22 s	1.22 s
29	1.22 s	1.23 s	1.24 s	1.24 s	1.32 s
30	1.31 s	1.33 s	1.40 s	1.34 s	1.40 s

Table 11-1-8: ^{1}H NMR spectroscopic data of squalene- and botryococcane-type triterpenoids **11-1-31**~**11-1-35**.

H	11-1-31	11-1-32	11-1-33	11-1-34	11-1-35
1	1.21 s	1.11 s	1.32 s	1.26 s	1.23 s
3	3.99 dd(6.0, 10.0)	3.76 dd(5.8, 9.1)	4.16 dd(2.0, 10.2)	3.89 dd(4.1, 12.3)	3.83 dd(4.0, 12.3)
4	1.52, 1.93	1.84	2.10, 2.20	2.11, 2.24	2.08, 2.22
5	1.78, 2.06	1.66, 2.04	1.60, 1.76	1.54, 1.83	1.47, 1.75
7		3.32 dd(2.6, 11.4)	3.53 dd(1.0, 10.3)	3.08 dd(1.6, 10.6)	3.04 dd(2.5, 11.5)
8	5.34 dd(2.0, 6.0)	1.51, 1.66	1.43, 1.83	1.47, 1.74	1.45, 1.75
9	1.90 dd(2.0, 12.0) 2.05 dd(6.0, 12.0)	1.57, 1.81	1.50, 1.69	1.51, 1.75	1.57, 1.77
11	3.96 dd(6, 10)	3.46 dd(5.6, 11.7)	3.49 dd(5.1, 11.5)	3.38 dd(5.6, 11.5)	3.95 dd(8.0, 9.8)
12	1.78, 2.03	1.65, 1.84	1.51, 1.73	1.65, 1.76	1.36, 1.88
13	1.55, 1.98	1.85, 2.08	1.84, 2.04	1.93, 2.18	1.55, 2.14
14	4.06 dd(5.7, 10.3)	4.29 dd(4.2, 7.1)	4.10 dd(5.5, 5.7)	4.35 dd(5.5, 5.7)	1.25 (2H)
15					1.35
16	2.23 2.07	2.20 2.46	2.23 2.44	4.70 ddd (1.6, 6.3, 10.0)	1.39 1.53
17	5.66 ddd (5.3, 2.7, 11.0)	1.48 1.64	1.40 1.63	1.73 1.86	1.20 1.54
18	5.64 d(11.0)	3.53 dd(1.5, 10.8)	3.50 dd(1.7, 9.9)	3.77 dd(1.6, 10.0)	3.76 dd(2.2, 13.0)
20	1.56, 2.07	1.58, 2.10	1.81, 2.10	1.58, 2.13	1.50, 2.11
21	1.92, 2.06	1.83(2H)	1.57, 1.86	1.84, 2.07	1.79 (2H)
22	3.85 dd(4.5, 7.5)	3.76 dd(6.5, 9.8)	3.73 dd(5.8, 10.2)	3.74 dd(6.0, 9.9)	3.73 dd(6.0, 10.0)
24	1.12 s	1.13 s	1.11 s	1.12 s	1.10 s
25	1.16 s	1.19 s	1.34 s	1.39 s	1.37 s
26	1.20 s	1.14 s	1.10 s	1.19 s	1.17 s
27	1.12 s	1.25 s	1.15 s	1.24 s	1.24 s

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Table 11-1-8 (continued)

H	11-1-31	11-1-32	11-1-33	11-1-34	11-1-35
28	1.19 s	4.89 bs, 5.05 bs	4.86 bs, 4.98 bs	5.17 bs, 5.30 bs	0.82 d(6.4)
29	1.30 s	1.14 s	1.12 s	1.12 s	1.10 s
30	1.18 s	1.21 s	1.20 s	1.20 s	1.24 s
OH		2.38 s(18-OH)	2.35 s(18-OH)	3.30 d(6.3, 16-OH) 2.66 s (18-OH)	

Table 11-1-9: ^{1}H NMR spectroscopic data of squalene- and botryococcane-type triterpenoids **11-1-36**~**11-1-39**.

H	11-1-36	11-1-37	11-1-38	11-1-39
1	1.31 s		1.63 s	1.64 s
2		2.50, 2.68		
3	4.09 dd(3.3, 7.6)	1.75, 2.46	2.05 m	2.03 m
4	2.12, 2.20		1.40 m, 1.30 m	1.35 m
5	1.52, 2.12	3.53 dd(1.7, 11.8)	1.35 m, 1.20 m	1.40 m, 1.15 m
6		1.49, 1.67		
7	3.43 dd(1.8, 10.8)	1.63, 1.87	1.54 m	1.52 m
8	1.56, 1.79		1.51 m, 1.41 m	1.78 m, 1.44 m
9	1.55, 1.80	3.46 dd(5.6, 11.7)	ax 1.27 m, eq 1.98 m	ax 1.26 m, eq 1.86 m
10		1.60, 1.88		
11	3.46 dd(5.9, 10.0)	1.85, 2.06	4.00 dd(6.7, 7.0)	3.70 dd(6.6, 7.0)
12	1.62, 1.83	4.28	1.75 m	1 73 m
13	1.84, 2.08		1.71 m	1 73 m
14	4.27 dd(4.2, 7.6)	2.18, 2.47	3.48 dd(6.7, 7.4)	3.52 dd(6.6, 7.0)
15		1.50, 1.65		
16	2.19, 2.45	3.53 dd(1.5, 11.7)	1.51 m, 1.41 m	1.52 m, 1.42 m
17	1.46, 1.63		ax 1.50 m, eq 1.42 m	1.52 m, 1.42 m
18	3.51 dd(1.5, 10.6)	1.60, 2.13	1.51 m	1.52 m
19		1.87 (2H)		
20	1.56, 2.12	3.76 dd(6.6, 10.6)	1.35 m, 1.20 m	1.36 m, 1.15 m
21	1.85 (2H)		1.45 m, 1.35 m	1.44 m, 1.38 m
22	3.74 dd(5.7, 10.2)	1.13 s	2.05 m	2.03 m
23		1.34 s		
24	1.11 s	1.26 s	1.64 s	1.63 s
25	1.33 s	4.89 bs, 5.05 bs	4.67 br s	4.66 br s
26	1.12 s	1.14 s	1.00 s	1.17 s
27	1.22 s	1.22 s	1.03 s	1.13 s
28	4.86 bs, 5.03 bs		1.12 s	1.15 s
29	1.12 s		1.05 s	1.05 s
30	1.20 s		4.66 br s	4.66 br s
31			1.00 d(5.7)	1.01 d(7.0)
32			0.79 d(6.6)	0.90 d(6.8)
33			0.77 d(6.9)	0.78 d(6.2)
34			0.99 d(6.8)	0.99 d(7.0)

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11.2 Lanostane-type triterpenoids

Table 11-2-1: Compounds, MFs, and test solvents of lanostane-type triterpenoids **11-2-1**~**11-2-62**.

No.	Compounds	MFs	Test solvents	References
11-2-1	25,26,27-trisnor-3α-hydroxy-lanost-9(11)-en-24-oic acid	$C_{27}H_{44}O_3$	$CDCl_3$	[11]
11-2-2	25,26,27-trisnor-3α-methoxy-lanost-9(11)-en-24-oic acid	$C_{28}H_{46}O_3$	$CDCl_3$	[11]
11-2-3	25,26,27-trisnor-3β-methoxy-lanost-9(11)-en-24-oic acid	$C_{28}H_{46}O_3$	$CDCl_3$	[11]
11-2-4	25,26,27-trisnor-3-oxo-lanost-9(11)-en-24-oic acid	$C_{27}H_{42}O_3$	$CDCl_3$	[11]
11-2-5	20-hydroxylucidenic acid N	$C_{27}H_{40}O_7$	$CDCl_3$	[12]
11-2-6	20-hydroxylucidenic acid P	$C_{29}H_{42}O_9$	$CDCl_3$	[12]
11-2-7	20(21)-dehydrolucidenic acid A	$C_{27}H_{36}O_6$	$CDCl_3$	[12]
11-2-8	methyl-20(21)-dehydrolucidenate A	$C_{28}H_{38}O_6$	$CDCl_3$	[12]
11-2-9	20-hydroxylucidenic acid E_2	$C_{29}H_{40}O_9$	$CDCl_3$	[12]
11-2-10	20-hydroxylucidenic acid F	$C_{27}H_{36}O_7$	$CDCl_3$	[12]
11-2-11	20-hydroxylucidenic acid D_2	$C_{29}H_{38}O_9$	$CDCl_3$	[12]
11-2-12	(23*S*)-17α,23-epoxy-3β,24ξ-dihydroxy-27,28,29-trisnor-l-anost-8-ene	$C_{27}H_{44}O_3$	$CDCl_3$	[13]
11-2-13	(22*R*,23*S*)-17α,23-epoxy-22,29-dihydroxy-27-nor-lanost-8-en-3,24-dione	$C_{29}H_{44}O_5$	C_5D_5N-DMSO-d_6	[13]
11-2-14	(22*R*,23*S*)-17α,23-epoxy-3β,22,24ξ-trihydroxy-27,28-bisnor-lanost-8-ene	$C_{28}H_{46}O_4$	C_5D_5N	[13]
11-2-15	adiantulanosterol	$C_{30}H_{52}O$	$CDCl_3$	[14]
11-2-16	tyromycic acid C	$C_{32}H_{48}O_5$	$CDCl_3$	[15]
11-2-17	tyromycic acid D	$C_{30}H_{44}O_4$	$CDCl_3$	[15]
11-2-18	tyromycic acid B	$C_{34}H_{50}O_7$	$CDCl_3$	[15]
11-2-19	3β-methoxy-24-methylenelanost-9(11)-en-25-ol	$C_{32}H_{54}O_2$	$CDCl_3$	[16]
11-2-20	3β-methoxy-24-methyllanost-9(11),25-dien-24-ol	$C_{32}H_{54}O_2$	$CDCl_3$	[16]
11-2-21	24-methylenelanosta-7,9(11)-diene-3-one	$C_{31}H_{48}O$	$CDCl_3$	[17]
11-2-22	marianine	$C_{31}H_{50}O_3$	$CDCl_3$	[18]
11-2-23	fomefficinic acid C	$C_{31}H_{50}O_4$	C_5D_5N	[19]
11-2-24	5α,8α-peroxydehydrotumulosic acid	$C_{31}H_{46}O_6$	C_5D_5N	[20]
11-2-25	fomefficinic acid B	$C_{31}H_{48}O_4$	C_5D_5N	[19]
11-2-26	15α-hydroxydehydrotumulosic acid	$C_{31}H_{48}O_5$	C_5D_5N	[20]
11-2-27	fomefficinic acid A	$C_{31}H_{48}O_3$	$CDCl_3$	[19]
11-2-28	fomefficinic acid D	$C_{31}H_{48}O_4$	C_5D_5N	[19]
11-2-29	fomefficinic acid E	$C_{33}H_{48}O_5$	C_5D_5N	[19]
11-2-30	16α,25-dihydroxydehydroeburicoic acid	$C_{31}H_{46}O_5$	C_5D_5N	[20]
11-2-31	24-ethyl-3β-methoxylanost-9(11)-en-25-ol	$C_{33}H_{58}O_2$	$CDCl_3$	[16]
11-2-32	3β-methoxy-25-methyl-24-methylenelanost-9(11)-en-21-ol	$C_{33}H_{56}O_2$	$CDCl_3$	[16]
11-2-33	7,14,24-mariesatrien-26,23-olide-3α,23-diol	$C_{30}H_{44}O_4$	$CDCl_3$	[21]

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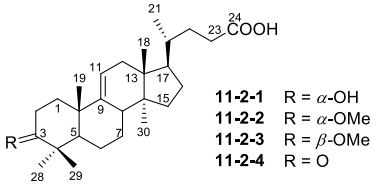
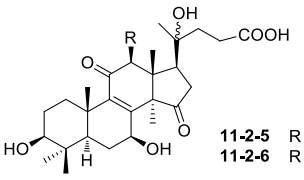
Table 11-2-1 (continued)

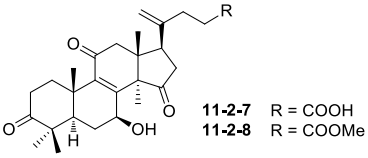
No.	Compounds	MFs	Test solvents	References
11-2-34	7,14,22*Z*,24-mariesatetraen-26,23-olide-3α-ol	$C_{30}H_{42}O_3$	$CDCl_3$	[21]
11-2-35	astrapteridiol	$C_{30}H_{50}O_3$	C_5D_5N	[22]
11-2-36	3-*epi*-astrapteridiol	$C_{30}H_{50}O_3$	C_5D_5N	[22]
11-2-37	astrapteridone	$C_{30}H_{48}O_3$	C_6D_6	[22]
11-2-38	colossolactone I	$C_{30}H_{46}O_3$	$CDCl_3$	[23]
11-2-39	colossolactone II	$C_{30}H_{46}O_4$	C_5D_5N	[23]
11-2-40	colossolactone III	$C_{31}H_{46}O_4$	$CDCl_3$	[23]
11-2-41	lanopropic acid	$C_{30}H_{46}O_6$	C_5D_5N	[24]
11-2-42	kadsuracoccinic acid B	$C_{30}H_{48}O_2$	$CDCl_3$	[25]
11-2-43	*seco*-coccinic acid D	$C_{30}H_{48}O_3$	C_5D_5N	[26]
11-2-44	*seco*-coccinic acid E	$C_{30}H_{48}O_3$	C_5D_5N	[26]
11-2-45	*seco*-coccinic acid A	$C_{30}H_{48}O_3$	C_5D_5N	[26]
11-2-46	*seco*-coccinic acid C	$C_{30}H_{48}O_4$	C_5D_5N	[26]
11-2-47	*seco*-coccinic acid B	$C_{30}H_{46}O_3$	C_5D_5N	[26]
11-2-48	*seco*-coccinic acid F	$C_{30}H_{46}O_4$	C_5D_5N	[26]
11-2-49	kadsuracoccinic acid C	$C_{30}H_{46}O_4$	CD_3OD	[25]
11-2-50	16-deoxyporicoic acid B	$C_{30}H_{44}O_4$	C_5D_5N	[20]
11-2-51	25-hydroxyporicoic acid H	$C_{30}H_{48}O_6$	C_5D_5N	[20]
11-2-52	poricoic acid CM	$C_{32}H_{48}O_4$	$CDCl_3$	[20]
11-2-53	kadsuracoccinic acid A	$C_{30}H_{44}O_4$	$CDCl_3$	[25]
11-2-54	coccinilactone A	$C_{30}H_{48}O_3$	C_5D_5N	[26]
11-2-55	abiesanolide F	$C_{30}H_{44}O_5$	$CDCl_3$	[21]
11-2-56	abiesanolide I	$C_{30}H_{42}O_5$	$CDCl_3$	[27]
11-2-57	abiesanolide E	$C_{30}H_{42}O_5$	$CDCl_3$-CD_3OD	[21]
11-2-58	abiesanolide J	$C_{32}H_{46}O_5$	$CDCl_3$	[27]
11-2-59	colossolactone IV	$C_{30}H_{44}O_5$	$CDCl_3$	[23]
11-2-60	tyromycic acid E	$C_{30}H_{44}O_3$	$CDCl_3$	[15]
11-2-61	sablacaurin A	$C_{33}H_{54}O_2$	$CDCl_3$	[28]
11-2-62	sablacaurin B	$C_{32}H_{52}O_2$	$CDCl_3$	[28]



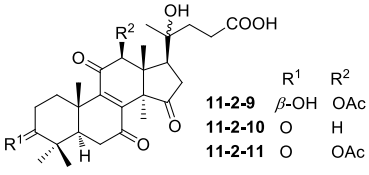
11-2-1 R = α-OH
11-2-2 R = α-OMe
11-2-3 R = β-OMe
11-2-4 R = O



11-2-5 R = H
11-2-6 R = OAc



11-2-7 R = COOH
11-2-8 R = COOMe



	R^1	R^2
11-2-9	β-OH	OAc
11-2-10	O	H
11-2-11	O	OAc

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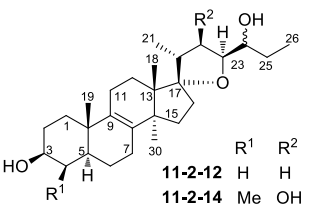
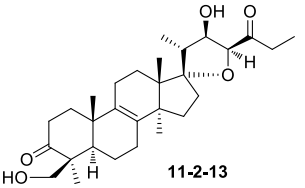
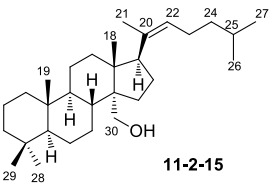


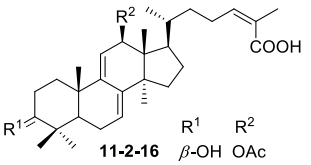
	R^1	R^2
11-2-12	H	H
11-2-14	Me	OH



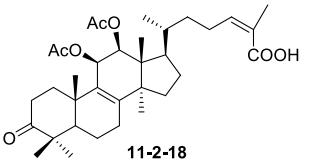
11-2-13



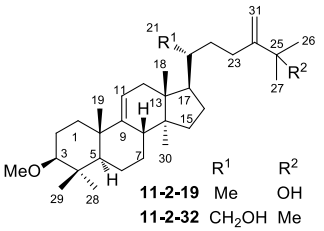
11-2-15



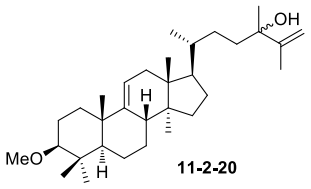
	R^1	R^2
11-2-16	β-OH	OAc
11-2-17	O	OH



11-2-18



	R^1	R^2
11-2-19	Me	OH
11-2-32	CH_2OH	Me



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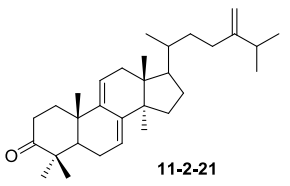

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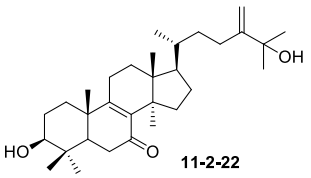
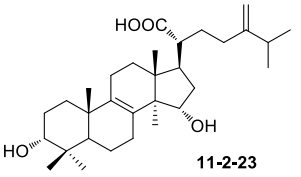
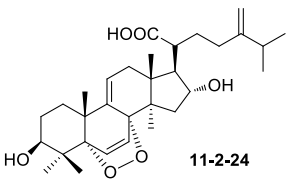


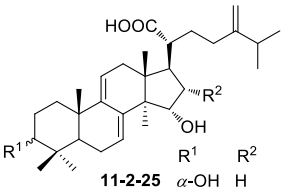
11-2-22



11-2-23



11-2-24



	R^1	R^2
11-2-25	α-OH	H
11-3-26	β-OH	OH

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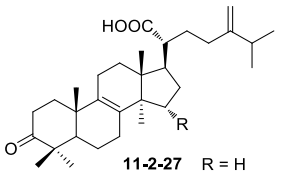
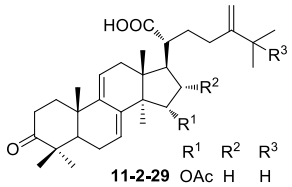
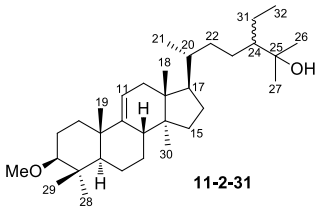


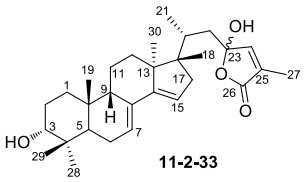
11-2-27 R = H
11-2-28 R = OH



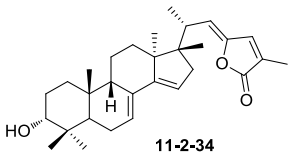
	R^1	R^2	R^3
11-2-29	OAc	H	H
11-2-30	H	OH	OH



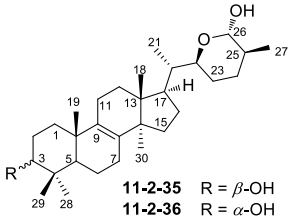
11-2-31



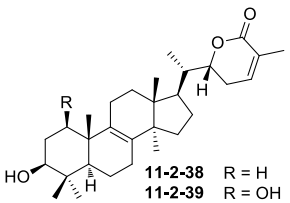
11-2-33



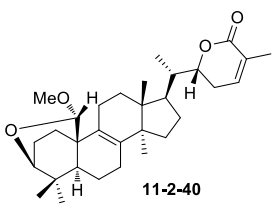
11-2-34



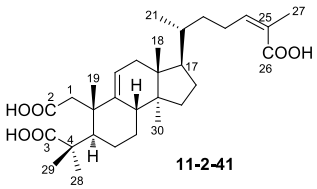
11-2-35 R = β-OH
11-2-36 R = α-OH
11-2-37 R = = O



11-2-38 R = H
11-2-39 R = OH



11-2-40



11-2-41

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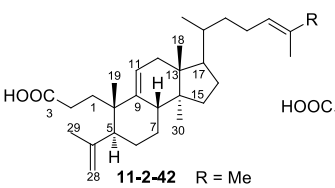
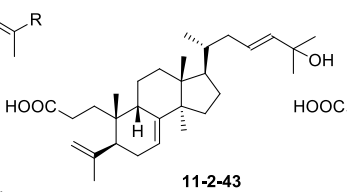
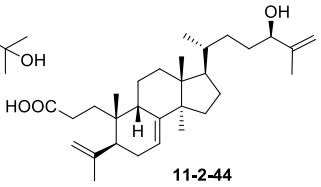


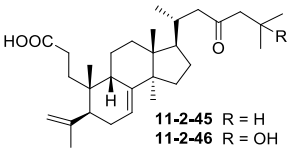
11-2-42 R = Me
11-2-49 R = COOH



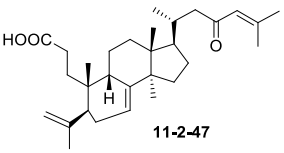
11-2-43



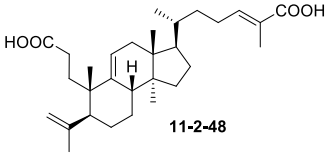
11-2-44



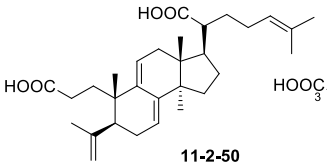
11-2-45 R = H
11-2-46 R = OH



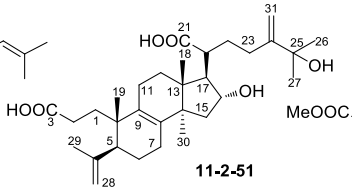
11-2-47



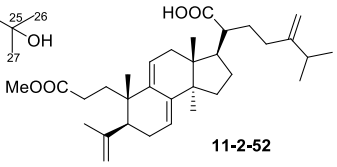
11-2-48



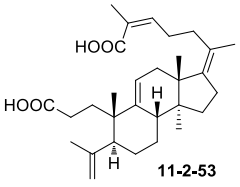
11-2-50



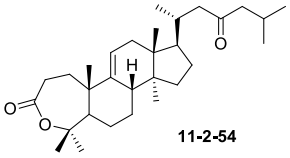
11-2-51



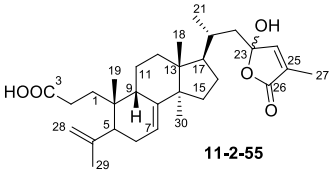
11-2-52



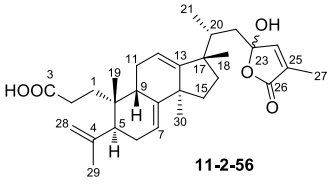
11-2-53



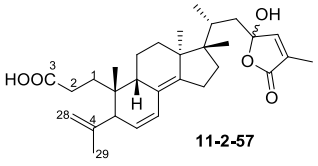
11-2-54



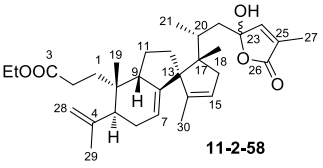
11-2-55



11-2-56



11-2-57



11-2-58

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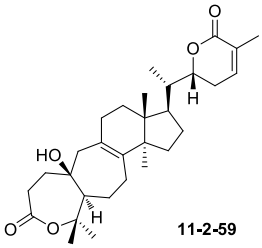
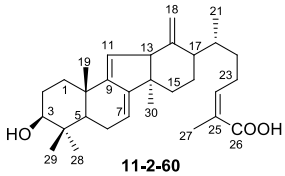
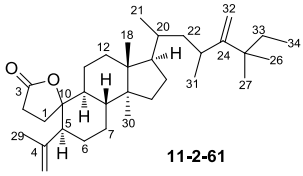


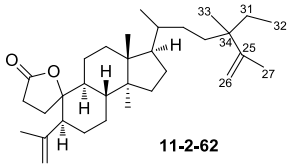
11-2-59



11-2-60



11-2-61



11-2-62

Table 11-2-2: ^{1}H NMR spectroscopic data of lanostane-type triterpenoids **11-2-1**~**11-2-5**.

H	11-2-1	11-2-2	11-2-3	11-2-4	11-2-5
1*α*	1.79 m	1.71 m	1.38 m	1.80 m	0.99 m
1*β*	1.50 m	1.42 m	1.82 m	2.10 m	2.85 ddd(3.4, 3.6, 13.7)
2	*α* 1.68 m	*α* 1.85 m	*α* 1.71 m	*α* 2.41 ddd(15.5, 5.0, 3.0)	1.66 m(2H)
	β 2.00 dddd(14.5, 14.5, 4.0, 3.0)	*β* 1.75 m	*β* 1.48 m	*β* 2.72 ddd(15.5, 13.5, 6.5)	
3	*β* 3.43 t(3.0)	*β* 2.81 t(3.0)	*α* 2.65 dd(11.5, 4.0)		3.21 dd(5.6, 10.7)
5	*α* 1.31 m	*α* 1.30 m	*α* 0.86 m	*α* 1.37 m	0.88 br d(13.7)
6*α*	1.92 m	1.90 m	1.92 m(2H)	1.64 m(2H)	2.19 br dd(8.5, 12.2)
6*β*	1.36 m	1.35 m			1.62 m
7	*α* 1.65 m	*α* 1.60 m	*α* 1.66 m	1.70 m(2H)	4.80 dd(8.5, 8.8)
	β 1.37 m	*β* 1.40 m	*β* 1.33 m		
8	*β* 2.18 br d(11.0)	2.16 br d(10.5)	2.17 br d(11.5)	2.23 br d(11.5)	
11	5.26 dt(6.0, 2.0)	5.22 dt(6.5, 2.0)	5.22 dt(6.0, 1.5)	5.29 dt(6.0, 2.0)	
12	*α* 2.08 br d(17.5)	*α* 2.06 br d(18.0)	*α* 2.07 br d(19.5)	*α* 2.09 m	2.81 s(2H)
	β 1.89 m	*β* 1.88 m	*β* 1.89 m	*β* 1.92 m	
15	1.36 m(2H)	*α* 2.35 t(7.5)	1.36 m(2H)	1.38 m(2H)	
		β 1.34 m			
16*α*	1.58 m	1.58 m	1.67 m	1.95 m	2.61 m
16*β*	1.46 m	1.40 m	1.46 m	1.36 m	2.49 m
17	1.61 m	1.60 m	1.60 m	1.62 m	2.52 m
18	0.65 s	0.65 s	0.65 s	0.68 s	1.13 s
19	1.06 s	1.06 s	1.04 s	1.23 s	1.22 s
20	1.45 m	1.44 m	1.44 m	1.46 m	

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Table 11-2-2 (continued)

H	11-2-1	11-2-2	11-2-3	11-2-4	11-2-5
21	0.90 d(6.0)	0.90 d(6.5)	0.90 d(6.5)	0.91 d(6.5)	1.51 s
22*α*	1.34 m	1.34 m	1.34 m	1.35 m	2.06 m
22*β*	1.85 m	1.84 m	1.84 m	1.86 m	2.06 m
23	2.28 ddd(16.0, 9.5, 6.5)	2.27 dddd(15.8, 9.6, 6.5)	2.28 ddd(15.8, 10.0, 6.5)	2.29 ddd(15.8, 10.0, 6.5)	2.54 m
				2.43 ddd(15.8, 10.0, 5.0)	2.64 m
	2.42 ddd(16.0, 10.0, 5.0)	2.42 ddd(15.6, 10.0, 5.5)	2.42 ddd(15.8, 10.0, 5.5)		
28	0.96 s	0.93 s	0.97 s	1.08 s	1.04 s
29	0.88 s	0.87 s	0.80 s	1.07 s	0.85 s
30	0.75 s	0.74 s	0.74 s	0.75 s	1.38 s
OMe		3.31 s	3.37 s		

Table 11-2-3: ^{1}H NMR spectroscopic data of lanostane-type triterpenoids **11-2-6**~**11-2-10**.

H	11-2-6	11-2-7	11-2-8	11-2-9	11-2-10
1*α*	0.96 ddd(4.3, 13.2, 14.3)	1.48 ddd(8.2, 8.6, 13.8)	1.63 ddd(8.2, 8.2, 13.7)	1.18 m	1.74 ddd(5.6, 9.8, 13.9)
				2.73 m	
1*β*	2.63 ddd(3.7, 3.7, 13.2)	2.95 ddd(5.2, 7.6, 13.8)	3.18 ddd(6.5, 6.5, 13.7)		2.63 m
2	1.65 m(2H)	*α* 2.45 ddd(5.2, 8.2, 16.5)	2.57 dd-like(8.3, 8.3)(2H)	1.71 m(2H)	*α* 2.52 ddd(5.6, 7.3, 15.1)
					β 2.62 m
		β 2.53 ddd(7.6, 8.6, 16.5)			
3	3.20 dd(5.1, 11.2)			3.26 dd(4.9, 11.2)	
5	0.89 br d(14.9)	1.58 dd(1.7, 13.7)	1.76 dd(1.7, 13.7)	1.56 dd(2.7, 14.4)	2.32 dd(2.7, 12.2)
6*α*	2.24 br dd(9.2, 13.5)	2.12 ddd(1.7, 7.6, 13.1)	2.22 ddd(1.7, 8.0, 13.1)	2.59 dd(2.7, 13.6)	2.48 dd(2.7, 13.7)
6*β*	1.65 m	1.68 ddd(9.6, 13.1, 13.7)	1.87 ddd(9.3, 13.1, 13.7)	2.68 dd(13.6, 14.4)	2.73 dd(13.7, 14.9)
7	4.83 dd(6.0, 13.5)	4.87 dd(7.6, 9.6)	5.19 dd(8.0, 9.3)		
12	5.64 s	*α* 2.83 d(16.8)	*α* 3.06 d(16.8)	5.65 s	*α* 2.93 d(16.1)
		β 2.65 d(16.8)	*β* 2.80 d(16.8)		*β* 2.86 d(16.4)
16	*α* 2.81 dd(8.6, 15.5)	2.61 d-like(9.0)	*α* 2.62 dd(7.6, 18.9)	*α* 2.81 dd(9.8, 18.1)	*α* 2.64 m
	β 2.52 dd(9.7, 16.9)		*β* 2.85 dd(11.0, 18.9)	*β* 2.28 dd(8.5, 18.1)	*β* 2.28 dd(5.9, 14.9)

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Table 11-2-3 (continued)

H	11-2-6	11-2-7	11-2-8	11-2-9	11-2-10
17	2.84 dd(8.9, 8.9)	3.01 dd(9.0, 9.0)	3.12 dd(7.6, 11.0)	2.93 dd(8.5, 9.8)	2.65 m
18	1.08 s	0.90 s	1.10 s	0.93 s	1.02 s
19	1.26 s	1.26 s	1.35 s	1.33 s	1.28 s
21	1.49 s	4.91 s, 5.08 s	4.93 s, 5.05 s	1.48 s	1.50 s
22	2.08 m(2H)	2.31 ddd(7.9, 7.9, 16.2) 2.48 ddd(5.2, 7.9, 13.4)	2.36 ddd(7.2, 15.5, 16.2) 2.48 ddd(7.6, 15.8, 16.2)	2.05 m(2H)	2.02 m, 2.07 m
23	2.54 m, 2.70 m	2.59 dd-like(7.6, 7.6)	2.61 d-like(7.2)	2.52 m, 2.68 m	2.61 m, 2.67 m
28	1.04 s	1.13 s	1.15 s	1.03 s	1.14 s
29	0.86 s	1.11 s	1.12 s	0.89 s	1.12 s
30	1.54 s	1.39 s	1.43 s	1.78 s	1.68 s
OAc	2.26 s			2.26 s	
COOMe			3.64 s		

Table 11-2-4: ^{1}H NMR spectroscopic data of lanostane-type triterpenoids **11-2-11**~**11-2-15**.

H	11-2-11	11-2-12	11-2-13	11-2-14	11-2-15
1*α*	1.73 ddd(6.9, 9.7, 14.3)	1.92 m	1.93 m	1.05 m	1.590 dddd(12.4, 12.4, 5,5, 6.6)
1*β*	2.76 ddd(6.3, 8.3, 14.3)	1.92 m	1.93 m	1.65 m	1.631 dddd(12.4, 12.4, 5.5, 5.0)
2*α*	2.48 ddd(6.9, 8.3, 15.4)	1.30 m	1.32 m	1.72 m	1.179 m
2*β*	2.60 ddd(6.3, 9.7, 15.4)	1.62 m	1.32 m	1.93 m	1.979 m
3		3.60 m		3.16 m	*α* 1.194 dddd(9.5, 13.5, 5.5, 11.8) *β* 1.386 dddd(13.9, 5.5, 13.5, 9.5)
4		1.15 m, 1.72 m		1.41 m	
5	2.31 dd(2.3, 14.9)	1.32 m	1.50	0.89	1.354 dd(11.7, 5.5)
6*α*	2.50 dd(2.3, 13.8)	1.96 m	1.63 m	1.93 m	1.315 m
6*β*	2.74 dd(13.8, 14.9)	1.75 m	1.53 m	2.06 m	1.435 m①
7		*α* 2.06 m	1.98 m(2H)	*α* 1.16 m *β* 1.67 m	*α* 1.224 m *β* 1.827 m
9					1.513 m
11*α*		1.82 m	2.78 m	2.06 m	1.513 m
11*β*		1.40 m	2.21 m	1.92 m	1.534 m
12	5.70 s	*α* 2.08 m *β* 2.20 m	*α* 1.36 m *β* 2.30 m	1.42 m(2H)	*α* 1.224 dddd(9.5, 5.0, 13.2, 8.5) *β* 1.805 dddd(5.0, 8.5, 5.5, 13.9)

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Table 11-2-4 (continued)

H	11-2-11	11-2-12	11-2-13	11-2-14	11-2-15
15*α*		1.32 d(1.3)	1.34 m	1.30 m	1.435 m
15*β*		1.54 d(1.7)	1.59 m	1.55 m	1.827 m
16*α*	2.84 dd(10.0, 18.3)	1.15 m	2.21 m	2.68 m	1.805 m
16*β*	2.27 dd(8.3, 18.3)	1.72 m	2.23 m	2.28 m	2.010 m
17	2.95 dd(8.3, 10.0)				1.524 dd
18	0.96 s	0.91 s	0.84 s	0.88 s	0.752 s
19	1.34 s	0.92 s	1.13 s	0.90 s	0.897 s
20		2.18 m	2.35 m	2.39 m	
21	1.49 s	1.04 d(6.8)	0.94 d(7.3)	0.99 d(7.1)	1.564 s
22	*α* 2.04 ddd(3.4, 10.3, 13.0) *β* 2.10 ddd(2.7, 10.0, 13.0)	1.51 dd(6.0, 6.2) 1.66	4.42 bs	4.13	*α* 1.165 d(5.3)
23	2.56 m, 2.69 m	3.82 m	4.74 d(5.1)	4.01	1.827 m, 1.524 m
24		3.35 m		4.07 m	1.250 m, 1.315 m
25		1.40 m	2.51 q(7.3) 2.61 q(7.5)	1.75 m	1.412 m
26		0.99 t(7.3)	0.96	1.05 t(7.3)	0.885 d(5.8)
27					0.806 d(6.5)
28	1.14 s		1.27 s		1.041 s
29	1.12 s		3.63 d(11.0) 4.24 d(11.0)	1.13 d(6.2)	0.921 s
30	1.85 s	1.11 s	1.40 s	1.33 s	3.88 d(11.7) 3.80 d(11.7)
OAc	2.26 s				

① Typographic error of NMR data exists in the literature.

Table 11-2-5: ^{1}H NMR spectroscopic data of lanostane-type triterpenoids **11-2-16**~**11-2-20**.

H	11-2-16	11-2-17	11-2-18	11-2-19	11-2-20
1	1.78 m 1.41 ddd(1.9, 9.3, 12.4)	2.30 ddd(3.3, 5.8, 13.2) 1.79 dt(4.4, 13.2)	1.64 m, 1.86 m	1.41 m, 1.83 m	1.38 m, 1.82 m
2	1.65 m, 2.00 m	2.78 dt(5.8, 14.8) 2.37 ddd(3.3, 4.4, 14.8)	2.61 ddd(6.3, 12.9, 15.9) 2.35 ddd(3.0, 5.5, 15.9)	1.44 m, 1.93 m	1.46 m, 1.91 m
3	3.38 br s			2.63 dd(4.0, 11.2)	2.62 dd(4.0, 11.2)
5	1.59 m	1.55 dd(3.6, 12.1)	1.44 dd(2.8, 12.6)	0.89 m	0.87 m
6	2.07 dd(7.4, 12.4)	2.22 dd(12.1, 17.3) 2.08 ddd(3.6, 6.9, 17.3)	1.67 m, 1.73 m	1.46 m, 1.67 m	1.44 m, 1.66 m

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Table 11-2-5 (continued)

H	11-2-16	11-2-17	11-2-18	11-2-19	11-2-20
7	5.62 t(4.1)	5.57 d(6.9)	2.19 m	1.32 m, 1.66 m	1.28 m, 1.66 m
8				2.18 m	2.16 m
11	5.02 s	5.23 s	5.66 d(6.0)	5.20 br d(6.0)	5.19 br d(6.0)
12	5.46 s	4.26 s	5.45 d(6.0)	1.92 m, 2.08 m	1.89 m, 2.05 m
15	1.62 m, 1.82 m	1.74 m 1.36 ddd(2.2, 9.3, 12.1)	1.30 m, 1.73 m	1.36 m	1.34 m
16	1.53 m, 2.04 m	2.01 dd(7.7, 13.5) 1.48 m	1.53 m, 1.97 m	1.30 m, 1.60 m	1.32 m, 1.88 m
17	1.91 t(7.7)	1.88 dd(8.2, 17.9)	1.86 m	1.65 m	1.60 m
18	0.69 s	0.56 s	0.97 s	0.63 s	0.62 s
19	1.04 s	1.23 s	1.26 s	1.02 s	1.02 s
20	1.47 s	1.51 s	1.48 m	1.41 m	1.37 m
21	0.92 d(6.6)	1.09 d(5.2)	0.90 d(6.9)	0.90 d(6.4)	0.85 d(6.0)
22	1.14 m, 1.60 m	1.62 m 1.18 ddd(4.9, 9.1, 18.4)	1.07 m, 1.60 m	1.28 m, 1.64 m	0.92 m, 1.33 m
23	2.45 m	2.57 m, 2.49 m	2.54 m, 2.47 m	1.95 m, 2.19 m	1.46 m, 1.62 m
24	5.93 t(7.1)	6.10 dt(1.4, 7.7)	6.08 dt(1.4, 7.6)		
26				1.33 s	4.80 br s, 4.94 br s
27	1.87 d(1.1)	1.92 s	1.92 s	1.33 s	1.72 s
28	0.94 s	1.13 s	1.09 s	0.95 s	0.94 s
29	0.95 s	1.09 s	1.08 s	0.78 s	0.77 s
30	1.03 s	0.93 s	1.07 s	0.72 s	0.71 s
31				4.75 br d(0.8) 5.07 br s	1.29 s
OAc	2.06 s		2.08 s, 1.06 s		
OMe				3.35 s	3.35 s

Table 11-2-6: ^{1}H NMR spectroscopic data of lanostane-type triterpenoids **11-2-21**~**11-2-25**.

H	11-2-21	11-2-22	11-2-23	11-2-24	11-2-25
1	2.00 m(2H)	α 1.86 dt(13.1, 3.3) β 2.06 m	1.80 m, 1.94 m	α 2.33, β 1.67	1.72 m, 2.25 m
2	2.00 m 2.78 td(14.8, 5.9)	1.75 m	2.03 m, 2.08 m	2.00(2H)	2.12 m, 2.14 m
3		α 3.29 dd(4.6, 11.6)	3.61 br s	4.22 dd(7.2, 9.1)	3.62 br s
5	1.50 m	α 1.67 m	2.04 m		2.04 m
6	2.00 m	α 2.49 dd(3.9, 15.8) β 2.38 dd(12.4, 15.8)	1.62 m, 1.77 m	6.64 d(8.9)	1.92 m, 2.02 m
7	5.50 d(6.4)		1.78 m, 2.04 m	6.97 d(8.9)	6.50 br s

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Table 11-2-6 (continued)

H	11-2-21	11-2-22	11-2-23	11-2-24	11-2-25
11	5.39 d(6.0)	α 2.37 m β 2.24 ddd(4.2, 4.2, 2.0)	1.03 m, 2.02 m	5.39 br s	5.47 d(5.5)
12	2.00 m(2H)	1.80 m	1.94 m, 2.01 m	α 2.64, β 2.32	1.84 m, 2.06 m
15	1.30 m, 2.00 m	α 1.56 m β 2.13 m	4.65 dd(6, 9.5)	α 1.88 d(13.5) β 2.81 dd(8.8, 13.5)	4.77 dd(6, 9.5)
16	1.40 m, 1.60 m	α 1.33 m, β 1.93 m	2.23 m, 2.27 m	4.56 br dd(6.9, 8.8)	2.20 m, 2.29 m
17	1.60 m	1.43 m	2.69 m	3.00	2.64 m
18	0.59 s	0.72 s	1.21 s	1.24 s	1.15 s
19	1.20 s	1.05 s	1.07 s	1.20 s	1.13 s
20	–	1.43 m	2.64 m	2.96	2.74 m
21	0.92 d(6.4)	0.88 d(6.0)			
22	2.00 m, 2.30 m	1.11 m	1.97 m, 2.14 m	2.40, 2.65	2.38 m, 2.70 m
23	1.70 m, 2.30 m	1.85 m, 2.10 m	2.29 m, 2.43 m	2.36, 2.55	2.31 m, 2.42 m
25	2.00 m		2.24 m	2.30	2.24 m
26	1.03 d(2.4)	1.00 s	1.00 d(7)	1.03 d(6.6)	1.00 d(7)
27	1.02 d(2.0)	0.99 s	0.97 d(7)	1.01 d(6.6)	0.98 d(7)
28	1.09 s	0.97 s	1.20 s	1.44 s	1.16 s
29	1.13 s	0.85 s	0.92 s	1.38 s	0.95 s
30	0.89 s	0.95 s	1.28 s	1.64 s	1.36 s
31	4.66 s, 4.72 s	4.62 s	4.85 s, 4.88 s	4.86 br s, 4.96 br s	4.84 s, 4.88 s

Table 11-2-7: ^{1}H NMR spectroscopic data of lanostane-type triterpenoids **11-2-26**~**11-2-30**.

H	11-2-26	11-2-27	11-2-28	11-2-29	11-2-30
1α	1.52	1.60 m	2.45 m	1.65 m	1.66
1β	2.00 br d(14.1)	2.10 m	2.60 m	2.17 m	2.13
2	1.92(2H)	2.39 m, 2.55 m	1.52 m, 1.88 m	2.35 m, 2.74 m	α 2.34, β 2.75
3	3.46 dd(6.5, 8.3)				
5	1.34	2.09 m	1.70 m	1.59 dd(5, 11)	1.61 dd(3.4, 11.9)
6	α 2.26 br dd(6.5, 13.4) β 2.19 br dd(12.4, 16.5)	1.63 m, 1.66 m	1.67 m, 1.69 m	1.91 m, 2.05 m	α 2.02 β 2.16
7	6.52 d(5.8)	2.03 m, 2.05 m	2.64 m, 2.66 m	5.81 d(6)	5.58 br d(13.3)
11	5.38 br s	1.06 m, 2.03 m	2.00 br s	5.50 d(5.5)	5.36 br s
12	α 2.76 br d(17.9) β 2.47	1.26 t, 1.66 m	2.02 m, 2..24 m	2.37 m, 2.58 m	α 2.66 β 2.40
15	4.58 d(7.9)	1.41 m 1.72 m	4.63 dd(6, 9.5)	5.40 dd(5.5, 9.5)	α 1.90 br d(12.8) β 2.43
16	4.31 dd(6.2, 7.9)	1.38 m, 1.96 m	2.28 m, 2.38 m	2.22 m, 2.25 m	4.53 br dd(6.8, 7.2)
17	2.77 br dd(6.2, 11.3)	1.59 m	2.78 m	2.53 m	2.88
18	1.13 s	0.79 s	1.18 s	1.11 s	1.03 s
19	1.10 s	1.11 s	1.03 s	1.03 s	1.14 s

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Table 11-2-7 (continued)

H	11-2-26	11-2-27	11-2-28	11-2-29	11-2-30
20	2.93 br dd(8.9, 11.3)	2.32 m	2.71 m	2.70 m	2.99
22	2.47, 2.56	1.69 m, 1.72 m	2.05 m, 2.22 m	2.36 m, 2.72 m	2 57, 2.80
23	2.35, 2.55	1.95 m, 2.05 m	2.38 m, 2.51 m	2.31 m, 2.46 m	2.67, 2.82
25	2.28 dd(6.8, 13.7)	2.22 m	2.32 m	2.25 m	
26	0.99 d(6.8)	1.02 d(7.0)	1.00 d(6.5)	1.10 d(6.5)	1.54 s
27	0.99 d(6.8)	1.01 d(7.0)	0.98 d(6.5)	1.08 d(6.5)	1.55 s
28	1.19 s	1.06 s	1.10 s	1.00 s	1.13 s
29	1.12 s	1.09 s	1.01 s	1.13 s	1.07 s
30	1.44 s	0.91 s	1.35 s	1.20 s	1.44 s
31	4.85, 4.97	4.69 s, 4.76 s	4.85 s, 4.89 s	4.86 s, 4.88 s	5.15 br s, 5.46 br s
OAc				2.17 s	

Table 11-2-8: ^{1}H NMR spectroscopic data of lanostane-type triterpenoids **11-2-31**~**11-2-35**.

H	11-2-31	11-2-32	11-2-33	11-2-34	11-2-35
1	1.39 m, 1.82 m	1.39 m, 1.82 m	0.94 (ov) 2.00 dd(13.8, 2.4)	0.93 m 2.01 dd(13.8, 2.4)	1.24 m, 1.72 m
2	1.44 m, 1.88 m	1.47 m, 1.92 m	1.61 m, 1.96 (ov)	1.60 m, 1.95 (ov)	1.47 m, 1.88 m
3	2.62 dd(4.0, 11.2)	2.62 dd(4.0, 11.2)	3.47 br s	3.45 br s	3.46 br s
5	0.87 m	0.86 m	1.54 dd(11.7, 4.8)	1.52 dd(11.4, 4.2)	1.20 m
6	1.43 m, 1.62 m	1.49 m, 1.68 m	1.89 (ov), 1.95 (ov)	1.91 br d(12.6) 1.95 m	1.72 m
7	1.30 m, 1.65 m	1.27 m, 1.66 m	5.56 d(5.1)	5.59 br d(6.0)	1.88 m
8	2.18 m	2.18 m			
9			1.40 (ov)	1.37 br d(13.2)	
11	5.19 br d(6.0)	5.20 br d(6.0)	1.44 (ov), 1.81 (ov)	1.33 m, 1.75 m	2.03 m
12	1.92 m, 2.04 m	1.90 m, 2.08 m	1.48 dd(12.9, 4.8) 1.83 (ov)	1.22 dt(11.3, 4.2) 1.69 m	2.02 m
15	1.36 m	1.40 m	5.17 br s	5.20 br s	1.72 m
16	1.30 m, 1.88 m	1.36 m, 1.92 m	2.17 d(15.6) 1.90 dd(15.6, 3.7)	1.98 (ov) 2.24 d(15.6)	1.72 m
17	1.62 m	1.94 m			2.17 m
18	0.62 s	0.66 s	0.87 s	1.00 s	0.80 s
19	1.02 s	1.02 s	0.94 s	0.96 s	1.07 s
20	1.36 m	1.52 m	2.02 m	3.23 m	1.47 m
21	0.88 d(6.4)	3.62 br d(10.4) 3.74 br d(10.4)	0.94 d(6.6)	1.01 d(7.2)	1.16 d(6.6)
22	1.04 m, 1.54 m	1.60 m	1.67 m, 2.08 m	5.21 br d(10.8)	4.44 d(12.0)
23	1.02 m, 1.58 m	1.88 m, 2.06 m			1.12 m, 1.47 m
24	1.04 m		6.85 br s	6.98 d(1.8)	1.12 m, 1.47 m
25					1.98 m
26	1.16 s	1.04 s			5.28 s
27	1.16 s	1.04 s	1.94 s	2.00 s	1.13 d(7.2)
28	0.95 s	0.95 s	0.96 s	0.98 s	1.24 s

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Table 11-2-8 (continued)

H	11-2-31	11-2-32	11-2-33	11-2-34	11-2-35
29	0.78 s	0.78 s	0.93 s	0.93 s	1.08 s
30	0.72 s	0.74 s	0.88 s	0.80 s	0.80 s
31	1.22 m	4.68 br d(0.8) 4.84 br s			
32	0.94 t(7.2)	1.04 s			
OMe	3.35 s	3.35 s			

Table 11-2-9: ^{1}H NMR spectroscopic data of lanostane-type triterpenoids **11-2-36**~**11-2-40**.

H	11-2-36	11-2-37	11-2-38	11-2-39	11-2-40
1	1.50 m, 2.03 m	1.60 m	1.70, 1.24 m	3.70 dd(4.5, 11.1)	0.95, 2.18 m
2	1.82 m, 2.03 m	2.32 m, 2.37 m	1.56 1.65 m	2.35, 2.39 m	1.80, 1.98 m
3	3.63 br s		3.20 dd(4.0, 11.5)	3.46 dd(5.7, 12.3)	3.29 dd(2.7, 5.4)
5	1.94 m	1.48 m	1.21 dd(4.4, 12.0)	1.19 m	1.30 m
6	1.72 m	1.39 m	1.70 m	1.78 m	1.54 m
7	1.44 m	1.48 m	2.08 m	2.05 m	2.08 m
11	2.03 m	1.85 m	2.12 m	2.11 m	2.02 m
12	2.03 m	2.00 m	1.80, 1.66 m	1.90 m(2H)	1.28 m(2H)
15	1.72 m	1.70 m	1.26, 1.62 m	1.68 m(2H)	1.25, 1.58 m
16	1.72 m	1.70 m	1.28, 2.03 m	1.80 m(2H)	1.28, 2.03 m
17	2.14 m	2.20 m	2.06 m	2.50 m	2.10 m
18	0.80 s	0.79 s	0.68 s	0.68 s	0.69 s
19	1.07 s	0.94 s	0.97 s	1.22 s	4.60 s
20	1.47 m	1.41 m	1.52 m	1.47 m	1.52 m
21	1.14 d(6.6)	1.14 d(6.6)	1.02 d(6.3)	0.94 d(6.3)	1.03 d(6.5)
22	4.42 d(11.4)	4.14 d(11.4)	4.50 dd(4.0, 13.5)	4.42 dd(4.0, 13.5)	4.50 dd(4.0, 13.5)
23	1.12 m, 1.47 m	1.30 m	1.98, 2.56 m	2.41 m(2H)	2.00, 2.58 m
24	1.12 m, 1.47 m	1.30 m	6.59 m	6.60 m	6.53 m
25	1.98 m	1.80 m			
26	5.27 s	4.81 s			
27	1.12 d(6.6)	0.99 d(6.6)	1.90 s	1.87 s	1.91 s
28	1.22 s	1.13 s	0.99 s	1.13 s	0.97 s
29	0.92 s	1.00 s	0.80 s	1.00 s	1.02 s
30	0.80 s	1.03 s	0.90 s	0.81 s	0.94 s
OMe					3.40 s

Table 11-2-10: ^{1}H NMR spectroscopic data of lanostane-type triterpenoids **11-2-41**~**11-2-45**.

H	11-2-41	11-2-42	11-2-43	11-2-44	11-2-45
1	α 3.18 d(18.0) β 3.47 d(18.0)	1.58 m, 1.71 m	1.92 m, 2.03 m	1.96 m, 2.03 m	1.99 m, 2.03 m
2		2.30 m	2.57 m(2H)	2.57 m(2H)	2.57 m(2H)

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Table 11-2-10 (continued)

H	11-2-41	11-2-42	11-2-43	11-2-44	11-2-45
5	*α* 3.33 dd(11.0, 5.0)	2.06 d(7.2)	2.26 d(4.9)	2.26 d(7.1)	2.26 d(7.1)
6	*α* 1.68~1.74 (ov) *β* 1.92~2.00 (ov)	1.63 m	2.07 m, 2.40 m	2.08 m, 2.40 m	2.07 m, 2.38 m
7	*α* 1.57~1.67 (ov) *β* 1.57~1.67 (ov)	1.26 m, 1.64 m	5.32 d(3.5)	5.31 d(2.8)	5.32 d(2.5)
8	*β* 2.20 m	2.57 m			
9			2.65 m	2.64 m	2.64 m
11	5.63 d(6.0)	5.31 dd(3.4)	1.53 m(2H)	1.67 m, 1.55 m	1.69 m, 1.54 m
12	*α* 2.03 d(17.5) *β* 1.86 dd(17.0, 5.5)	1.50 m	1.62 m, 1.77 m	1.64 m, 1.84 m	1.64 m, 1.81 m
15	*α* 1.30~1.37 (ov) *β* 1.39~1.43 (ov)	2.00 m	1.46 m, 1.54 m	1.44 m, 1.55 m	1.44 m, 1.56 m
16	*α* 1.91~1.97 (ov) *β* 1.30~1.37 (ov)	1.55 m, 1.65 m	1.28 m, 1.96 m	1.30 m, 1.97 m	1.24 m, 1.90 m
17	*α* 1.58~1.66 (ov)	1.48 m	1.53 m	1.52 m	1.53 m
18	0.72 s	0.75 s	0.81 s	0.82 s	0.82 s
19	1.41 s	1.02 s	0.94 s	0.94 s	0.93 s
20	1.47 m	1.46 m	1.52 m	1.50 m	2.17 m
21	0.94 d(6.6)	0.88 d(6.5)	0.95 d(5.8)	0.96 d(5.8)	0.97 d(5.8)
22	1.60~1.70 (ov), 1.22 m	1.04 m, 1.09 m	2.25 m, 2.28 m	0.97 m, 1.40 m	2.18 m, 2.47 m
23	2.86 m, 2.74 m	1.85 m, 2.02 m	5.92 m	1.93 m, 1.69 m	
24	6.03 t-like(7.5)	5.10 m	5.93 m	4.37 m	2.31 m, 2.29 m
25					2.24 m
26		1.68 s	1.55 s	5.29 s, 4.98 s	0.92 d(6.7)
27	2.12 s	1.61 s	1.55 s	1.92 s	0.91 d(6.4)
28	1.52 s	4.82 br s, 4.87 br s	5.00 s(2H)	5.00 s(2H)	4.99 s(2H)
29	1.54 s	1.80 s	1.86 s	1.86 s	1.85 s
30	0.86 s	0.85 s	1.04 s	1.05 s	1.07 s

Table 11-2-11: ^{1}H NMR spectroscopic data of lanostane-type triterpenoids **11-2-46**~**11-2-50**.

H	11-2-46	11-2-47	11-2-48	11-2-49	11-2-50
1	2.02 m, 1.97 m	2.03 m, 1.98 m	2.76 m(2H)	1.90 m, 1.72 m	1.87, 2.11
2	2.56 m(2H)	2.57 m(2H)	2.37 m, 2.11 m	2.24 m, 1.99 m	2.47, 2.52
5	2.25 d(7.1)	2.26 d(7.1)	2.19 m	2.15 d(7.2)	2.33 br d(7.2)
6	2.06 m, 2.38 m	2.09 m, 2.39 m	1.73 m, 1.92 m	1.57 m, 1.70 m	*α* 2.57, *β* 2.06
7	5.3 d(3.0)	5.31 d(2.8)	1.50 m	1.06 m, 1.32 m	5.29
8			2.12 m	2.62 m	
9	2.63 m	2.64 m			
11	1.68 m, 1.52 m	1.68 m, 1.55 m	5.58 d(5.5)	5.35 dd(3.5)	5.31
12	1.80 m, 1.64 m	1.81 m, 1.64 m	2.08 m, 1.87 m	1.58 m	2.43, 2.48
15	1.54 m, 1.45 m	1.54 m, 1.46 m	1.36 m	1.97 m	*α* 1.39, *β* 1.74
16	1.90 m, 1.26 m	1.93 m, 1.29 m	1.52 m	1.55 m, 1.69 m	*α* 1.43, *β* 2.08

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Table 11-2-11 (continued)

H	11-2-46	11-2-47	11-2-48	11-2-49	11-2-50
17	1.53 m	1.55 m	1.63 m	1.58 s	2.46
18	0.81 s	0.82 s	0.70 s	0.80 s	1.00 s
19	0.93 s	0.93 s	1.11 s	1.07 s	1.02 s
20	2.19 m	2.18 m	1.47 m	1.42 m	2.63
21	1.01 d(6.4)	1.01 d(5.7)	0.97 d(6.4)	0.95 d(6.5)	
22	2.70 m, 2.40 m	2.56 m, 2.18 m	1.60 m, 1.20 m	1.60 m, 1.18 m	1.72, 1.91
23			2.34 m, 2.17 m	2.15 m, 2.25 m	2.23, 2.35
24	2.8 d(7.1)	6.18 s	7.21 m	6.72 t(7.2)	5.31
26	1.51 s	1.77 s			1.67 s
27	1.51 s	2.22 s	2.13 s	1.81 s	1.61 s
28	4.97 s	4.99 s	4.97 s	4.84 br s, 4.90 br s	4.75 d(2.4), 4.82 s
29	1.84 s	1.84 s	1.83 s	1.81 s	1.72 s
30	1.04 s	1.06 s	0.80 s	0.87 s	1.02 s

Table 11-2-12: ^{1}H NMR spectroscopic data of lanostane-type triterpenoids **11-2-51**~**11-2-55**.

H	11-2-51	11-2-52	11-2-53	11-2-54	11-2-55
1	2.01	1.57 ddd(6.0, 13.2, 13.2)	2.50 m	1.90 m(2H)	1.60 m
	2.07	1.82 ddd(4.6, 13.2, 16.0)	2.40 m		
2	2.33, 2.70	2.15, 2.26	2.09 m, 1.78 m	2.78 m(2H)	1.74 (ov), 2.26 (ov)
5	2.31 br dd(2.0, 12.7)	2.22	2.09 m	1.66 m	2.12 d(7.1)
6	*α* 1.52	*α* 2.56 br dd(5.2, 18.9)	1.55 m	1.54 m(2H)	1.99 (ov)
	β 1.72	*β* 2.06	1.79 m		2.32 (ov)
7	*α* 2.13, *β* 2.00	5.30 br s	1.26 m, 1.64 m	1.87 m(2H)	5.34 br d(2.9)
8			2.10 m	2.14 m	
9					2.58 m
11	2.14(2H)	5.30 br s	5.36 dd(5.2)	5.26 d(5.8)	2.58 m, 1.66 (ov)
12	*α* 2.03	*α* 1.98	2.15 m, 2.40 m	2.09 m, 1.89 m	1.68 (ov)
	β 2.28	*β* 2.21			1.86 dt(11.2,3.4)
15	*α* 1.70 br d(12.7)	*α* 1.37	1.42 m	1.36 m(2H)	1.49 m
	β 2.38 br dd(8.6, 12.7)	*β* 1.67			1.56 (ov)
16	4.55 br t(6.9)	*α* 1.30, *β* 1.38	2.21 m	1.55 m(2H)	1.29 m, 1.99 (ov)
17	2.85 dd-like(5.5, 11.0)	2.16		1.66 m	1.55 (ov)
18	1.17 s	0.71 s	0.81 s	0.72 s	0.79 s
19	0.97 s	0.95 s	1.06 s	1.16 s	0.87 s
20	3.00 br t(10.3)	2.33		2.20 m	1.58 m

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Table 11-2-12 (continued)

H	11-2-51	11-2-52	11-2-53	11-2-54	11-2-55
21			1.58 s	1.01 d(5.8)	1.01 s
22	2.58, 2.80	1.33, 1.69	1.89 m, 2.42 m	2.18 m, 2.48 m	1.63 m, 2.07 m
23	2.68, 2.82	1.98, 2.07	2.23 m, 2.69 m		
24			6.08 t(7.2)	2.31 m(2H)	6.89 br s
25		2.23		2.24 m	
26	1.55 s	1.02 d(6.8)		0.94 d(6.4)	
27	1.56 s	1.01 d(6.8)	1.92 s	0.92 d(6.7)	1.92 br s
28	4.89 s, 4.99 s	4.64 br s, 4.66 br s	4.70 br s, 4.87 br s	1.39 s	4.83 br s, 4.78 br s
29	1.80 s	1.65 s	1.76 s	1.42 s	1.80 s
30	1.51 s	0.87 s	0.70 s	0.78 s	1.05 s
31	5.18 s, 5.50 s	4.69 br s, 4.76 br s			
OMe		3.62 s			

Table 11-2-13: ^{1}H NMR spectroscopic data of lanostane-type triterpenoids **11-2-56**~**11-2-60**.

H	11-2-56	11-2-57	11-2-58	11-2-59	11-2-60
1	1.58 m, 1.78 (ov)	2.01 t-like	1.56 (ov), 1.60 m	1.99 m(2H)	1.90 m, 1.53 m
2	2.31 t(8.3)	1.60 m	2.26 t(8.2)	2.56 m(2H)	1.66 m, 1.73 m
3					3.27 dd(4.4, 11.3)
5	2.08 (ov)	2.62 d(5.4)	2.08 (ov)	1.80 m	1.45 dd(4.4, 11.5)
6	1.75 (ov), 1.89 (ov)	5.37 dd(10.2, 5.4)	2.02 (ov), 2.32 m	2.40 m(2H)	2.19 td(4.7, 17.3) 2.12 dd(12.2, 17.3)
7	5.50 br s	6.21 d(10.2)	5.32 t-like	2.08 m(2H)	5.29 d(5.8)
9	2.08 (ov)	2.58 m	2.16 (ov)		
11	2.00 (ov) 1.89 ddd(14.4, 11.7, 2.7)	1.58 (ov) 1.62 (ov)	1.44 m 1.68 (ov)	2.41 m(2H)	5.22 s
12	5.57 dd(6.9, 2.7)	1.64 (ov), 1.67 (ov)	1.63 m, 1.69 (ov)	1.79, 2.46 m	2.99 s
15	1.63 m, 1.77 (ov)	2.25 (ov)	5.20 br s	1.25, 1.64 m	1.40 ddd(2.5, 6.6, 12.1) 1.19 dd(2.5, 12.1)
16	1.23 m, 1.75 (ov)	1.48 t(10.8), 1.68 (ov)	1.95 (ov)	2, 2.5 m	1.56 m, 1.10 m
17				2.11 m	1.88 m
18	0.94 s	0.67 s	0.95 s	0.74 s	4.83 d(2.8), 4.65 d(2.8)

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Table 11-2-13 (continued)

H	11-2-56	11-2-57	11-2-58	11-2-59	11-2-60
19	0.92 s	0.86 s	0.91 s	1.60 m, 3.18 d(14.4)	0.99 s
20		1.95 m		1.58 m	1.33 m
21	0.97 d(6.3)	0.96 d(6.6)	0.87 d(6.8)	1.01 d(6.5)	0.84 d(6.6)
22		1.54 (ov), 2.32 (ov)		4.52 dd(2.5, 13)	1.56 m, 1.02 m
23				1.96, 2.55 m	2.52 m, 2.43 m
24	6.82 br s	6.84 br s	6.58 br s	6.61 m	6.00 dt(1.4, 7.7)
27	1.94 br s	1.96 s	1.95 br s	1.92 s	1.88 d(1.4)
28	4.74 br s, 4.79 br s	4.83 br s	4.79 br s, 4.82 br s	1.28 s	1.01 s
29	1.74 s	1.78 s	1.78 s	1.32 s	0.90 s
30	1.04 s	1.04 s	1.58 s	0.94 s	1.06 s
OCH_2			4.11 q(7.1)		
OCH_2CH_3			1.24 t(7.1)		

Table 11-2-14: ^{1}H NMR spectroscopic data of lanostane-type triterpenoids **11-2-61** and **11-2-62**.

H	11-2-61	11-2-62	H	11-2-61	11-2-62
1	2.33 ddd(13.0, 12.7, 8.0)	2.33 ddd(13.0, 12.7, 8.0)	16	1.93 m, 1.23 m	1.92 m, 1.24 m
	1.74 m	1.74 m	17	1.53 m	1.53 m
2	2.47 m(2H)	2.47 m(2H)	18	0.82 s	0.80 s
5	2.57 br d(9.3)	2.56 br d(9.3)	20	1.42 m	1.32 m
6	1.75 m, 1.49 m	1.75 m, 1.47 m	21	0.90 d(6.4)	0.85 d(6.6)
7	1.50 m, 1.27 m	1.48 m, 1.28 m	22	1.65 m, 1.44 m	1.64 m, 1.45 m
8	1.43 m	1.45 m	23	1.58 m	1.47 m, 1.03 m
9	1.92 m	1.90 m	26	1.01 s	4.81 br s, 4.63 br s
11	1.82 m, 1.68 m	1.80 m, 1.68 m	27	1.01 s	1.63 s
12	1.63 m, 1.52 m	1.63 m, 1.49 m	28	4.93 br s, 4.82 br s	4.93 br s, 4.82 br s
15	1.25 m(2H)	1.23 m(2H)	29	1.77 s	1.77 br s
30	0.86 s	0.84 s	33	1.37 q(7.5)	0.94 s
31	0.85 d(6.7)	1.46 m, 1.24 m	34	0.70 t(7.5)	
32	4.79 br s, 4.76 br s	0.71 t(7.4)			

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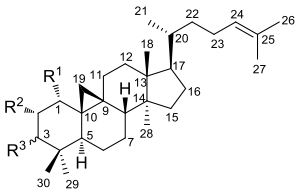
11.3 Cycloartane-type triterpenoids

Table 11-3-1: Compounds, MFs, and test solvents of cycloartane-type triterpenoids **11-3-1**~**11-3-27**.

No.	Compounds	MFs	Test solvents	References
11-3-1	cycloartan-24-ene-1α,2α,3α-triol	$C_{30}H_{50}O_3$	$CDCl_3$	[29]
11-3-2	3β-acetoxycycloartan-24-ene-1α,2α-diol	$C_{32}H_{52}O_4$	$CDCl_3$	[29]
11-3-3	1α-acetoxycycloartan-24-ene-2α,3β-diol	$C_{32}H_{52}O_4$	CD_3COCD_3	[29]
11-3-4	3β-isovaleroyloxycycloartan-24-ene-1α,2α-diol	$C_{35}H_{58}O_4$	$CDCl_3$	[29]
11-3-5	cycloartan-24-ene-1α,3β-diol	$C_{30}H_{50}O_2$	$CDCl_3$	[29]
11-3-6	cycloarta-23,25-dien-3-one	$C_{30}H_{48}O$	$CDCl_3$	[30]
11-3-7	tillandsinone	$C_{33}H_{54}O$	$CDCl_3$	[31]
11-3-8	cyclolaudenyl formate	$C_{32}H_{52}O_2$	$CDCl_3$	[31]
11-3-9	(6*S*)-hydroxy-25-methoxy-29-*nor*-3,4-*seco*-cycloart-4(30),23-dien-3-oic acid methyl ester	$C_{31}H_{50}O_4$	$CDCl_3$	[32]
11-3-10	(6*S*,25)-dihydroxy-29-*nor*-3,4-*seco*-cycloart-4(30),23-dien-3-oic acid methyl ester	$C_{30}H_{48}O_4$	$CDCl_3$	[32]
11-3-11	berenjenol	$C_{31}H_{52}O_2$	$CDCl_3$	[33]
11-3-12	cycloartan-23*E*-ene-1α,2α,3β,25-tetrol	$C_{30}H_{50}O_4$	C_5D_5N	[29]
11-3-13	24*R*,25-epoxycycloartane-1α,2α,3β-triol	$C_{30}H_{50}O_4$	$CDCl_3$	[29]
11-3-14	24*S*,25-epoxycycloartane-1α,2α,3β-triol	$C_{30}H_{50}O_4$	$CDCl_3$	[29]
11-3-15	cycloartan-24-ene-1α,2α,3β-triol	$C_{30}H_{52}O_3$	$CDCl_3$	[29]
11-3-16	tubiferolide methyl ester	$C_{31}H_{46}O_4$	$CDCl_3$	[34]
11-3-17	tubiferaoctanolide	$C_{30}H_{46}O_2$	$CDCl_3$	[34]
11-3-18	capisterone A	$C_{32}H_{49}NaO_8S$	DMSO-d_6	[35]
11-3-19	capisterone B	$C_{30}H_{47}NaO_7S$	DMSO-d_6	[35]
11-3-20	methyl 3β,23(*R*)-dihydroxycycloart-24-en-28-oate-3-sulfate	$C_{31}H_{49}O_7S$	CD_3OD	[36]
11-3-21	methyl 3β-hydroxy-23-oxocycloart-24-en-28-oate-3-sulfate	$C_{31}H_{47}O_7S$	CD_3OD	[36]
11-3-22	cycloart-24-en-3β,23(*R*),28-triol-3-sulfate	$C_{30}H_{49}O_6S$	CD_3OD	[36]
11-3-23	3β,28-dihydroxycycloart-24-en-23-one-3-sulfate	$C_{30}H_{47}O_6S$	CD_3OD	[36]
11-3-24	cycloart-24-en-3β,23(*R*)-diol-3-sulfate	$C_{30}H_{49}O_5S$	DMSO-d_6	[36]
11-3-25	3β-hydroxycycloart-24-en-23-one-3-sulfate	$C_{30}H_{47}O_5S$	DMSO-d_6	[36]
11-3-26	methyl 3β,23(*R*)-dihydroxy-29-*nor*-cycloart-24-en-2-oate-3-sulfate	$C_{30}H_{47}O_7S$	CD_3OD	[36]
11-3-27	methyl 3β-hydroxy-23-oxo-29-*nor*-cycloart-24-en-2-oate-3-sulfate	$C_{30}H_{45}O_7S$	CD_3OD	[36]



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11-3-2	OH	OH	β-OAc
11-3-3	OAc	OH	β-OH
11-3-5	OH	H	β-OH
11-3-15	OH	OH	β-OH

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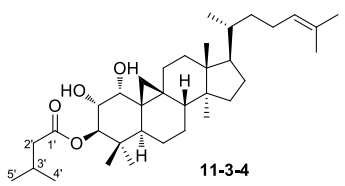

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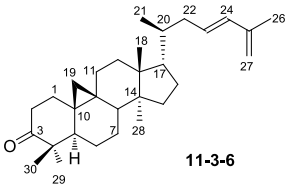

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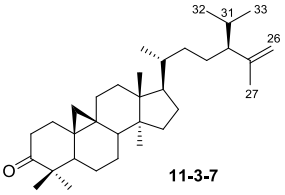

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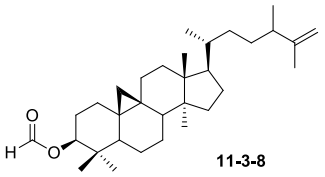

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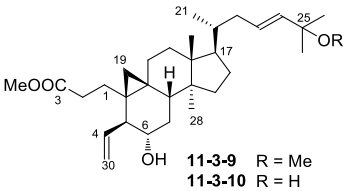

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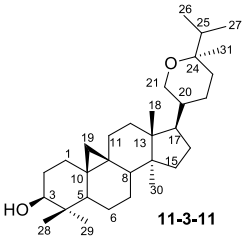
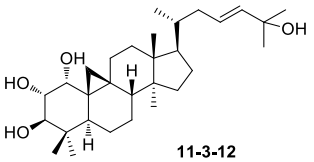
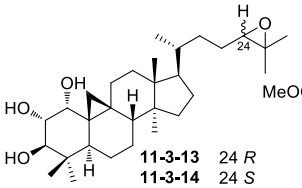
11-3-10 R = H



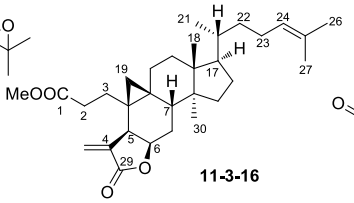
11-3-11



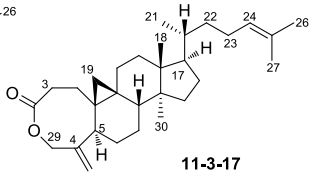
11-3-12



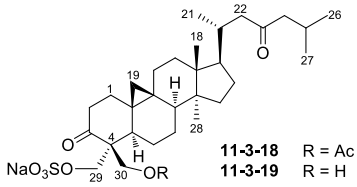
11-3-13 24 *R*
11-3-14 24 *S*



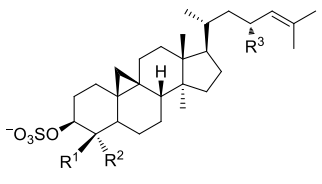
11-3-16



11-3-17



11-3-18 R = Ac
11-3-19 R = H



	R^1	R^2	R^3
11-3-20	Me	COOMe	OH
11-3-21	Me	COOMe	=O
11-3-22	Me	CH_2OH	OH
11-3-23	Me	CH_2OH	=O
11-3-24	Me	Me	OH
11-3-25	Me	Me	=O
11-3-26	H	COOMe	OH
11-3-27	H	COOMe	=O

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Table 11-3-2: ^{1}H NMR spectroscopic data of cycloartane-type triterpenoids **11-3-1**~**11-3-5**.

H	11-3-1	11-3-2	11-3-3	11-3-4	11-3-5
1	3.54 br s	3.53 br s	4.90 d(3.4)	3.54 br s	3.60 t(3.0)
2	3.85 br s	3.73 d(10.1)	3.72 m	3.75 d(9.9)	1.76 m 1.92 dd(3.2, 4.5)
3	3.52 br s	4.92 d(10.1)	3.20 dd(3.7, 10.0)	4.94 d(10.1)	3.76 dd(4.5, 12.0)
5	2.11 dd(4.4, 12.6)	2.04 dd(4.4, 12.2)	1.93 m	2.05 dd(4.0, 12.4)	1.90 m
6α	0.86 m	0.87 m	0.92 m	0.84 m	0.84 m
6β	1.63 m	1.64 m	1.64 m	1.67 m	1.65 m
7α	1.1 8 m	1.17 m	1.18 m	1.18 m	1.12 m
7β	1.39 m	1.35 m	1.38 m	1.32 m	1.37 m
8	1.57 dd(4.9, 12.3)	1.53 dd(3.9, 12.1)	1.62 m	1.52 dd(3.8, 12.4)	1.50 dd(4.5, 12.5)
11α	2.27 m	2.29 m	1.91 m	2.30 m	2.18 m
11β	1.29 m	1.28 m	1.30 m	1.32 m	1.33 m
12	1.67 m	1.64 m	1.62 m	1.67 m	1.65 m
15	1.29 m	1.35 m	1.30 m	1.32 m	1.33 m
16α	1.92 m	1.90 m	1.91 m	1.90 m	1.90 m
16β	1.29 m	1.35 m	1.30 m	1.32 m	1.33 m
17	1.63 m	1.64 m	1.62 m	1.61 m	1.62 m
18	0.96 s	0.95 s	0.95 s	0.93 s	0.94 s
19	0.51 d(4.5) 0.71 d(4.5)	0.52 d(4.2) 0.72 d(4.2)	0.60 d(4.7) 0.83 d(4.7)	0.53 d(3.8) 0.74 d(3.9)	0.48 d(4.6) 0.72 d(4.6)
20	1.39 m	1.35 m	1.30 m	1.32 m	1.40 m
21	0.90 d(6.5)	0.89 br s	0.92 d(6.5)	0.89 br s	0.89 d(5.0)
22	1.06 m, 1.43 m	1.05 m, 1.42 m	1.08 m, 1.45 m	1.06 m, 1.44 m	1.05 m, 1.43 m
23	1.89 m, 2.05 m	1.90 m, 2.04 m	1.91 m, 2.05 m	1.90 m, 2.05 m	1.90 m, 2.06 m
24	5.11 br t(7.1)	5.10 t(6.2)	5.12 t(7.2)	5.12 t(6.0)	5.11 br t(7.1)
26	1.63 s	1.61 s	1.60 s	1.62 s	1.62 s
27	1.70 s	1.67 s	1.66 s	1.70 s	1.69 s
28	0.98 s	0.96 s	0.98 s	0.93 s	0.97 s
29	1.04 s	0.89 s	1.02 s	0.89 s	1.01 s
30	0.89 s	0.87 s	0.85 s	0.89 s	0.80 s
OAc		2.14 s	2.00 s		
2′				2.30 br d(7.1)	
3′				2.17 m	
4′, 5′				1.03 d(6.6, 6H)	

Table 11-3-3: ^{1}H NMR spectroscopic data of cycloartane-type triterpenoids **11-3-6**~**11-3-10**.

H	11-3-6	11-3-7	11-3-8	11-3-9	11-3-10
1	1.49, 1.82	α 1.85 tdd(13.5, 4.5, 1.0) β 1.54 m	α 1.60 m β 1.25 m	1.98 (ov), 1.20 (ov)	1.35 (ov), 2.02 (ov)

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Table 11-3-3 (continued)

H	11-3-6	11-3-7	11-3-8	11-3-9	11-3-10
2	2.71 td(13.9, 6.5) 2.30 ddd(14.1, 4.3, 2.6)	*α* 2.30 ddd(14, 4.5, 3.0) *β* 2.71 td(14.0, 5.0, 7.0)	*α* 1.75 m *β* 1.60 m	2.07 (ov), 2.33 (ov)	2.29 (ov), 2.46 (ov)
3			4.57 dd(11.5, 4.5)		
4				5.68 m	5.66 m
5	1.70	1.71 dd(12.5, 4.5)	1.40 m	2.10 (ov)	2.09 (ov)
6	0.94	*α* 1.55 m, *β* 0.94 m	*α* 1.60 m, *β* 0.80 m	3.08 br t	3.09 br t
7	1.90, 1.32	*α* 1.28 m, *β* 1.90 m	*α* 1.27 m, *β* 1.86 m	1.19 (ov), 1.52 (ov)	1.17 (ov), 1.55 (ov)
8	1.59	1.58 m	1.50 m	1.56 (ov)	1.67 (ov)
11	1.37, 1.15	*α* 2.03 m, *β* 1.17 m	*α* 1.98 m, *β* 1.11 m	1.09 (ov), 2.03 (ov)	1.18 (ov), 2.13 (ov)
12	1.34	1.65 m(2H)	1.60 m(2H)	1.55 (ov)	1.66 (ov)
15	1.65	1.28 m(2H)	1.27 m(2H)	1.22 (ov)	1.29 (ov)
16	2.07	1.38 m, 1.14 m	1.32 m, 1.12 m	1.20 (ov), 1.84 (ov)	1.30 (ov), 1.93 (ov)
17	1.59	1.60 m	1.57 m	1.56 (ov)	1.60 (ov)
18	1.01	0.98 s	0.96 s	0.98 s	0.97 s
19	0.79 d(4.0) 0.57 d(4.3)	*α* 0.57 d(4.5) *β* 0.79 d(4.0)	*α* 0.35 d(4.4) *β* 0.59 d(4.4)	0.40 br s 0.42 br s	0.40 br s 0.42 br s
20	1.49	1.32 m	1.35 m	1.39 (ov)	1.34 (ov)
21	0.89 d(6.5)	0.88 d(7.0)	0.86 d(6.5)	0.88 d(6.4)	0.88 d(6.3)
22	1.82, 2.27	0.80 m, 1.37 m	0.93 m, 1.32 m	1.68 (ov), 2.07 (ov)	1.73 (ov), 2.17 (ov)
23	5.65 ddd(15.3, 8.4, 6.5)	1.03 m, 1.62 m	1.14 m, 1.45 m	5.50 m	5.60 br s
24	6.12 d(15.6)	1.53 m	2.09 m	5.39 d(15.7)	5.60 br s
26	1.85	4.61 d(2.5) 4.75 dq(2.5, 1.5)	4.66 m 4.67 m	1.26 s	1.31 s
27	4.86	1.58 br s	1.69 br s	1.26 s	1.31 s
28	0.91	1.05 s	0.89 s	0.96 s	0.97 s
29	1.05	1.10 s	0.91 s		
30	1.10	0.90 s	0.89 s	5.22 m, 5.26 m	5.26 m
31		1.52	1.00 d(6.9)		
32		0.92 d(6.0)			
33		0.81 d(6.0)			
OMe				3.02 s	
COOMe				3.64 s	3.65 s
COOH			8.12 s		

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Table 11-3-4: ^{1}H NMR spectroscopic data of cycloartane-type triterpenoids **11-3-11**~**11-3-15**.

H	11-3-11	11-3-12	11-3-13;11-3-14	11-3-15
1	*α* 1.20, *β* 1.51	3.91 d(2.7)	3.47 br s	3.56 br s
2	*α* 1.72, *β* 1.52	4.14 dd(2.8, 9.8)	3.59 br d(10.2)	3.65 br d(7.9)
3	3.24 dd(10.9, 4.2)	4.11 d(9.8)	3.44 d(9.9)	3.50 d(9.8)
5	1.25	2.40 dd(4.5, 12.6)	1.89 dd(4.6, 12.5)	1.94 dd(4.3, 12.8)
6	1.55	*α* 0.88 m, *β* 1.65 m	*α* 0.83 m, *β* 1.62 m	*α* 0.85 m, *β* 1.65 m
7	*α* 1.28, *β* 1.04	*α* 1.33 m, *β* 1.33 m	*α* 1.11 m, *β* 1.30 m	*α* 1.16 m, *β* 1.36 m
8	1.47	1.53 m	1.47 dd(4.2, 12.8)	1.53 dd(4.5, 10.2)
11	*α* 1.08, *β* 1.93	*α* 2.67 m, *β* 1.36 m	*α* 2.30 m, *β* 1.15 m	*α* 2.29 m, *β* 1.27 m
12	1.46	1.65 m	1.62 m	1.68 m
15	1.28	1.33 m	1.30 m	1.32 m
16	*α* 1.28, *β* 1.82	*α* 1.92 m, *β* 1.33 m	*α* 1.89 m, *β* 1.30 m	*α* 1.91 m, *β* 1.32 m
17	1.51	1.60 m	1.62 m	1.60 m
18	0.96 s	1.00 s	0.94 s	0.97 s
19	*α* 0.51 d(4.3) *β* 0.31 d(4.3)	0.47 d(3.9) 0.70 d(3.9)	0.45 d(3.9) 0.66 d(3.9)	0.51 d(4.3) 0.73 d(4.3)
20	1.42	1.49 m	1.40 m	1.32 m
21	*α* 3.79 dd(11.2, 1.8) *β* 3.20 dd(11.2, 1.8)	0.88 d(6.4)	0.87 d(6.5)	0.90 d(6.4)
22	*α* 1.65, *β* 1.22	1.80 m, 2.27 br d(9.1)	1.03 m, 1.62 m	1.05 m, 1.42 m
23	*α* 1.47, *β* 1.34	5.84 m	1.40 m, 1.62 m	1.88 m, 2.06 m
24		5.97 d(15.9)	2.68 t(5.5)	5.11 t(7.0)
25	1.43			
26	0.86 d(6.8)	1.57 s	1.25 s	1.62 s
27	0.83 d(6.8)	1.58 s	1.29 s	1.69 s
28	0.93 s	1.01 s	0.93 s	0.97 s
29	0.77 s	1.27 s	0.96 s	1.01 s
30	0.85 s	1.17 s	0.77 s	0.83 s
31	1.00 s			

Table 11-3-5: ^{1}H NMR spectroscopic data of cycloartane-type triterpenoids **11-3-16**~**11-3-19**.

H	11-3-16	11-3-17	11-3-18	11-3-19
1	2.23 m, 1.59 (ov)	2.10 (ov), 1.30 (ov)	1.52 m, 1.80 m	1.52 m, 1.80 m
2	2.44 m, 2.53 m	2.15 (ov), 2.16 m	2.19 m 2.66 ddd(14.1, 6.3)	2.19 m 2.66 ddd(14.1, 6.3)
5	3.24 br d(8.3)	2.35 m	2.20 m	2.20 m
6	4.75 td(8.3, 6.5)	1.75 (ov), 0.67 (ov)	1.20 m, 1.78 m	1.20 m, 1.78 m
7	1.78 (ov), 1.53 (ov)	1.25 (ov), 0.94 (ov)		
8	2.14 br t(5.7)	1.52 obsc	1.54 m	1.54 m
11	1.75 (ov), 1.64 (ov)	2.13 (ov), 1.21 (ov)	1.23 m(2H)	1.23 m(2H)
12	1.70 (ov), 1.60 (ov)	1.65 (ov), 0.88 (ov)	1.60 m, 1.80 m	1.60 m, 1.80 m
15	1.30 (ov)	1.23 (ov), 0.89 (ov)	1.27 m(2H)	1.27 m(2H)

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Table 11-3-5 (continued)

H	11-3-16	11-3-17	11-3-18	11-3-19
16	1.93 (ov), 1.32 (ov)	1.84 (ov), 1.24 (ov)	1.26 m	1.26 m
17	1.62 (ov)	1.55 (ov)	1.61 m	1.55 m
18	0.93 s	0.91 s	0.99 s	0.99 s
19	0.43 d(5.3), 0.17 d(5.3)	0.76 d(4.0), 0.46 d(4.0)	0.67 br s(2H)	0.67 br s(2H)
20	1.47 (ov)	1.35 (ov)	1.82 m	1.82 m
21	0.89 d(6.4)	0.83 d(6.3)	0.80 d	0.80 d
22	1.06 (ov), 1.42 (ov)	1.37 (ov)	2.14 m, 2.41 br d(16.0)	2.14 m, 2.41 br d(16.0)
23	2.08 (ov), 1.86 (ov)	1.98 (ov), 1.77 (ov)		
24	5.10 br t(7.0)	5.04 br t(6.9)	2.26 d(7.2)(2H)	2.26 d(7.2)(2H)
25			2.01 m	2.01 m
26	1.69 br s	1.62 br s	0.88 d(6.2)	0.88 d(6.2)
27	1.61 br s	1.54 br s	0.84 d(6.2)	0.84 d(6.2)
28	6.34 d(2.5) 5.74 d(2.1)	5.22 br s 5.11 br s	0.90 s	0.90 s
29		4.30 d(11.3), 4.56 d(11.3)	3.71 d(9.9), 4.09 d(9.9)	3.81 d(10), 4.11 d(10)
30	0.91 s	0.86 s	4.03 d(11.7), 4.70 d(11.7)	3.55 dd(5.6, 11.6, 16.8) 4.05 dd(6.4, 10.8, 17.6)
32			1.92 s	
OH				4.50 t(6.4, 11.6)
OMe	3.70 s			

Table 11-3-6: ^{1}H NMR spectroscopic data of cycloartane-type triterpenoids **11-3-20**~**11-3-22**.

H	11-3-20	11-3-21	11-3-22
1	*α* 1.67 m, *β* 1.34 m	*α* 1.64 m, *β* 1.36 m	*α* 1.58 m, *β* 1.32 m
2	*α* 2.25 m, *β* 1.71 m	*α* 2.26 m, *β* 1.72 qd(12.0, 3.3)	*α* 2.13 m, *β* 1.79 qd(12.6, 4.6)
3	4.74 dd(4.5, 11.6)	4.77 dd(4.1, 11.4)	4.39 dd(4.7, 11.7)
5	2.09 dd(4.2, 12.3)	2.09 m	1.80 dd(4.0, 12.2)
6	*α* 1.06 m, *β* 0.96 m	*α* 1.07 m, *β* 0.97 m	*α* 1.64 m, *β* 0.83 m
7	*α* 1.14 m, *β* 1.31 m	*α* 1.15 m, *β* 1.30 m	*α* 1.18 m, *β* 1.35 m
8	1.61 m	1.62 m	1.57 m
11	*α* 2.04 m, *β* 1.20 m	*α* 2.04 m, *β* 1.21 m	*α* 2.04 m, *β* 1.20 m
12	1.68 m	1.67 m	1.68 m
15	1.32 m	1.32 m	1.32 m
16	*α* 1.92 m, *β* 1.36 m	*α* 1.92 m, *β* 1.31 m	*α* 1.93 m, *β* 1.35 m
17	1.60 m	1.68 m	1.59 m
18	1.02 s	1.03 s	1.03 s
19	*α* 0.44 d(4.2), *β* 0.63 d(4.2)	*α* 0.45 d(4.2), *β* 0.64 d(4.2)	*α* 0.44 d(4.1), *β* 0.59 d(4.1)
20	1.68 m	1.96 m	1.68 m

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Table 11-3-6 (continued)

H	11-3-20	11-3-21	11-3-22
21	0.95 d(6.5)	0.87 d(6.4)	0.95 d(7.0)
22	0.98 dd(3.2, 9.7), 1.65 m	2.09 m, 2.52 dd(3.0, 15.0)	0.99 dd(3.7, 10.1), 1.65 m
23	4.41 td(9.1, 3.3)		4.41 td(9.6, 3.4)
24	5.16 dt(8.5, 1.4)	6.16 t(1.3)	5.16 dt(8.6, 1.2)
26	1.70 d(1.0)	1.90 d(1.2)	1.70 d(0.7)
27	1.67 d(1.3)	2.11 d(1.2)	1.67 d(1.0)
28			3.33 d(12.1), 3.57 d(12.1)
29	1.17 s	1.17 s	0.74 s
30	0.94 s	0.94 s	0.94 s
OMe	3.67 s	3.68 s	

Table 11-3-7: ^{1}H NMR spectroscopic data of cycloartane-type triterpenoids **11-3-23**~**11-3-27**.

H	11-3-23	11-3-24	11-3-25	11-3-26	11-3-27
1	*α* 1.60 m, *β* 1.32 m	*α* 1.42 m, *β*1.18 m	*α* 1.40 m, *β* 1.18 m	*α* 1.61 m, *β* 1.37 m	*α* 1.61 m, *β* 1.37 m
2*α*	2.13 m	2.06 m	2.03 m	2.45 m	2.45 dq(11.9, 3.9)
2*β*	1.80 qd(12.5, 4.3)	1.43 m	1.43 m	1.52 qd(11.8, 3.2)	1.52 qd(12.9, 3.4)
3	4.42 dd(4.6, 11.8)	3.67 dd(4.1, 10.6)	3.67 dd(4.2, 10.6)	4.55 td(10.8, 4.7)	4.55 td(10.8, 4.7)
4				2.26 t(10.8)	2.26 t(10.7)
5	1.80 dd(4.3, 12.5)	1.26 m	1.27 m	1.84 td(11.6, 4.3)	1.84 td(11.6, 4.3)
6	*α* 1.62 m, *β* 0.84 m	*α* 1.50 m, *β* 0.76 m	*α* 1.50 m, *β* 0.74 m	*α* 1.27 m, *β* 0.79 m	*α* 1.30 m, *β* 0.79 m
7	*α* 1.18 m, *β* 1.36 m	*α* 1.03 m, *β* 1.27 m	*α* 1.04 m, *β* 1.27 m	*α* 1.12 m, *β* 1.31 m	*α* 1.14 m, *β* 1.33 m
8	1.57 m	1.48 m	1.49 m	1.71 m	1.71 m
11	*α* 2.04 m, *β* 1.20 m	*α* 1.91 m, *β* 1.13 m	*α* 1.94 m, *β* 1.10 m	*α* 2.01 m, *β* 1.28 m	*α* 2.00 m, *β* 1.29 m
12	1.66 m	1.58 m	1.54 m	1.67 m	1.66 m
15	1.34 m	1.24 m	1.25 m	1.30 m	1.32 m
16	*α* 1.91 m, *β* 1.32 m	*α* 1.82 m, *β* 1.25 m	*α* 1.82 m, *β* 1.27 m	*α* 1.92 m, *β* 1.34 m	*α* 1.92 m, *β* 1.32 m
17	1.66 m	1.51 m	1.57 m	1.61 m	1.66 m
18	1.05 s	0.93 s	0.95 s	1.02 s	1.04 s
19*α*	0.41 d(4.0)	0.30 d(3.9)	0.30 d(3.7)	0.22 d(4.1)	0.23 d(4.0)
19*β*	0.61 d(4.0)	0.48 d(3.6)	0.49 d(3.7)	0.50 d(4.1)	0.51 d(4.3)
20	1.97 m	1.58 m	1.86 m	1.67 m	1.98 m
21	0.86 d(6.3)	0.86 d(5.9)	0.79 d(6.3)	0.95 d(6.4)	0.86 d(6.4)

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Table 11-3-7 (continued)

H	11-3-23	11-3-24	11-3-25	11-3-26	11-3-27
22	2.10 dd(10.1, 14.8)	0.85 m	2.06 m	0.98 dd(3.7, 10.0)	2.10 dd(3.2, 14.8)
	2.53 dd(3.0, 14.8)	1.49 m	2.44 dd(2.2, 15.0)	1.65 m	2.53 dd(10.1, 14.7)
23		4.21 m		4.41 td(9.1, 3.2)	
24	6.17 t(1.2)	5.09 dt(8.2, 1.3)	6.13 br s	5.16 dt(8.5, 1.3)	6.17 t(1.2)
26	1.90 br s	1.61 d(1.0)	1.84	1.69 d(1.0)	1.90 d(1.0)
27	2.11 br s	1.57 d(1.0)	2.04 br s	1.66 d(1.3)	2.11 d(1.0)
28	3.37 d(12.3)	0.87 s	0.87 s		
	3.57 d(12.3)				
29	0.74 s	0.71 s	0.71 s		
30	0.94 s	0.84 s	0.86 s	0.93 s	0.94 s
OH		4.29 d(4.9, 3-OH)			
OMe				3.67 s	3.67 s

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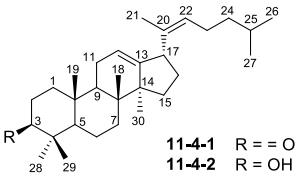
11.4 Dammarane-type triterpenoids

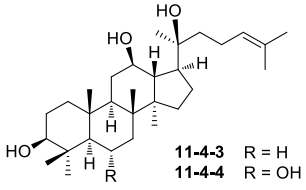
Table 11-4-1: Compounds, MFs, and test solvents of dammarane-type triterpenoids **11-4-1**~**11-4-17**.

No.	Compounds	MFs	Test solvents	References
11-4-1	dammara-12,20(22)*Z*-dien-3-one	$C_{30}H_{48}O$	$CDCl_3$	[37]
11-4-2	dammara-12,20(22)*Z*-dien-3-ol	$C_{30}H_{50}O$	$CDCl_3$	[37]
11-4-3	20(*S*)-protopanaxadiol	$C_{30}H_{52}O_3$	$CDCl_3$	[38]
			C_5D_5N	[38]
11-4-4	20(*S*)-protopanaxatriol	$C_{30}H_{52}O_4$	$CDCl_3$	[38]
			C_5D_5N	[38]
11-4-5	aglaiabbreviatin E	$C_{30}H_{48}O_2$	$CDCl_3$	[39]
11-4-6	(11*R*,20*R*)-11,20-dihydroxy-24-dammaren-3-one	$C_{30}H_{50}O_3$	$CDCl_3$	[40]
11-4-7	aglaiabbreviatin F①	$C_{32}H_{54}O_5$	$CDCl_3$	[39]
11-4-8	cordianol H	$C_{30}H_{48}O_4$	$CDCl_3$	[41]
11-4-9	cordianol E	$C_{30}H_{46}O_5$	$CDCl_3$	[41]
11-4-10	cordianol G	$C_{30}H_{48}O_4$	$CDCl_3$	[41]
11-4-11	cordianol D	$C_{30}H_{48}O_5$	CD_3OD	[41]
11-4-12	cordianol F	$C_{32}H_{50}O_6$	$CDCl_3$	[41]
11-4-13	cordianol I	$C_{31}H_{52}O_6$	$CDCl_3$	[41]
11-4-14	cordianol A	$C_{30}H_{50}O_6$	CD_3OD	[41]
11-4-15	cordianol C	$C_{31}H_{52}O_6$	CD_3OD	[41]
11-4-16	cordianol B	$C_{30}H_{48}O_5$	CD_3OD	[41]
11-4-17	cordialin A	$C_{30}H_{46}O_5$	$CDCl_3$	[41]

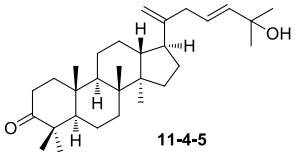
① Typographic error with structure exists in the literature. Judgong on the NMR and MS data, it can be inferred that this is a C-23-alkene product.



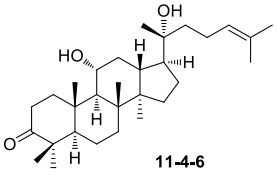
11-4-1 R = = O
11-4-2 R = OH



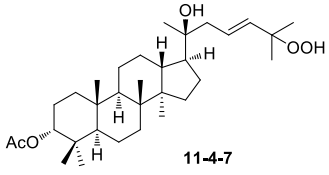
11-4-3 R = H
11-4-4 R = OH



11-4-5



11-4-6



11-4-7

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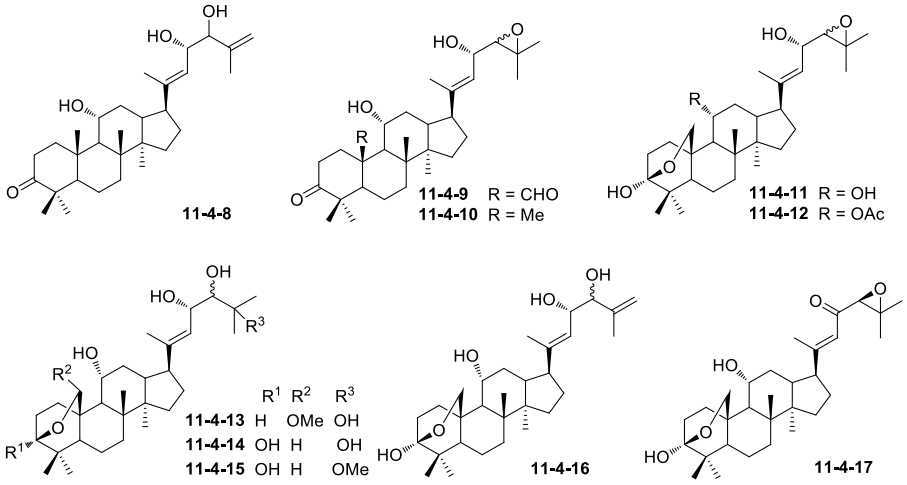

Table 11-4-2: ^{1}H NMR spectroscopic data of dammarane-type triterpenoids **11-4-1**, **11-4-2**, and **11-4-17**.

H	11-4-1	11-4-2	11-4-17	H	11-4-1	11-4-2	11-4-17
2	2.48 m, 2.32 m		–	22	5.40 qt(6.9, 1.2)	5.39 qt(7.0, 1.2)	6.28 s
3		3.21 dd(10.5, 4.9)	–	23	2.27 m		
11			3.66 br t(10.0)	26	0.83 d(6.9)②	0.83 d(7.2)	1.27 s
12	5.17 t(3.8)	5.10 t(3.6)	–	27	0.85 d(6.5)②	0.93 d(7.2)	1.42 s
18	0.82 s①	0.78 s	0.96 s	28	0.86 s①	0.98 s	1.01 s
19	0.84 s①	0.82 s	4.18 dd(8.5, 2.5)	29	0.87 s①	0.88 s	1.04 s
			4.35 dd(8.5, 2.5)	30	0.88 s①	0.85 s	0.90 s
21	1.62 d(1.2)	1.67 t(1.2)	2.13 s				

①② Assignments bearing the same superscript may be exchanged in each column.

Table 11-4-3: ^{1}H NMR spectroscopic data of dammarane-type triterpenoids **11-4-3** and **11-4-4**.

H	11-4-3($CDCl_3$)	11-4-3(C_5D_5N)	11-4-4($CDCl_3$)	11-4-4(C_5D_5N)
1	1.72 (ov), 1.01 (ov)	1.65 (ov), 0.96 (ov)	1.72 m, 1.04 m	1.69 m, 1.05 m
2	1.63 (ov), 1.60 (ov)	1.83 (ov)	1.65 (ov), 1.60 (ov)	1.93 (ov), 1.88 (ov)
3	3.20 dd(10.4, 7.4)	3.45 dd(11.0, 5.0)	3.19 dd(11.9, 5.0)	3.55 ddd(11.4, 5.0, 4.6)
5	0.73 d(11.4)	0.85 dd(11.7, 1.8)	0.98 d(10.5)	1.22 d(9.5)
6	1.55 (ov), 1.46 (ov)	1.59 (ov), 1.48 (ov)	4.12 td(10.3, 3.9)	4.40 dddd(105, 9.5, 6.6, 3.9)
7	1.49 (ov), 1.30 (ov)	1.55 (ov), 1.28 (ov)	1.60 (ov), 1.56 (ov)	1.98 (ov), 1.91 (ov)

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Table 11-4-3 (continued)

H	11-4-3($CDCl_3$)	11-4-3(C_5D_5N)	11-4-4($CDCl_3$)	11-4-4(C_5D_5N)
9	1.42 (ov)	1.50 (ov)	1.44 dd(13.0, 2.0)	1.60 (ov)
11	1.84 (ov), 1.26 (ov)	2.12 (ov), 1.57 (ov)	1.88 (ov), 1.23 (ov)	2.17 br dd(9.6, 5.0), 1.59 (ov)
12	3.60 td(10.3, 5.0)	3.94 br td(10.8, 7.1)	3.59 td(10.3, 5.3)	3.95 m
13	1.74 (ov)	2.08 (ov)	1.72 (ov)	2.06 (ov)
15	1.51 (ov), 1.04 (ov)	1.62 (ov), 1.08 (ov)	1.52 (ov), 1.05 (ov)	1.62 (ov), 1.06 (ov)
16	1.85 (ov), 1.26 (ov)	1.91 (ov), 1.41 (ov)	1.87 (ov), 1.27 (ov)	1.89 (ov), 1.40 (ov)
17	2.03 td(10.8, 7.3)	2.37 td(10.8, 7.1)	2.04 td(10.7, 7.4)	2.36 td(10.8, 7.3)
18	0.99	1.02	1.07 d(0.6)	1.13
19	0.88	0.90	0.94 s	1.02
21	1.20	1.45	1.20 s	1.43 s
22	1.42 (ov), 1.66 (ov)	2.07 (ov) 1.73 td(13.0, 5.5)	1.68 (ov) 1.41 ddd(13.8, 10.3, 5.5)	1.71 m, 2.05 (ov)
23	2.17, 2.03 (ov)	2.63 m, 2.30 m	2.17 m, 2.05 m	2.63 m, 2.30 m
24	5.17 br t(7.1)	5.34 br t(7.1)	5.16 br t(6.7)	5.32 br t(7.1)
26	1.70 s	1.67 s	1.69 s	1.67 s
27	1.64 s	1.64 s	1.64 s	1.64 s
28	0.98 s	1.25 s	1.32 s	2.01 s
29	0.78 s	1.05 s	0.99 s	1.47 s
30	0.89 s	0.95 s	0.91 s	0.98 s
OH		5.78 br s(3-OH) 7.26 br s(12-OH) 7.00 br s(20-OH)		5.74 br d(4.6, 3-OH) 5.26 d(6.6, 6-OH) 7.27 br d(1.6, 12-OH) 6.99 br s(20-OH)

Table 11-4-4: ^{1}H NMR spectroscopic data of dammarane-type triterpenoids **11-4-5**~**11-4-7** and **11-4-9**.

H	11-4-5	11-4-6	11-4-7	11-4-9
1	1.43 m, 1.92 m	ax 1.69 m eq 2.67 ddd(13.9, 8.3, 5.6)	1.17 m, 1.45 m	2.22 dt(15.0, 4.2) 2.42 dt(6.0, 15.0)
2	2.45 dt(14.2, 3.6) 2.73 dt(14.2, 5.6)	ax 2.41 ddd(15.3, 8.3, 8.9) eq 2.49 ddd(15.3, 8.9, 5.6)	1.57 m, 1.87 m	
3			4.63 t(2.5)	
5	1.38 m	1.52 m	1.23 m	1.30 (ov)
6	1.46 m, 1.55 m	ax 1.47 m, eq 1.52 m	1.45 m, 1.56 m	1.73 (ov), 2.04 (ov)
7	1.68 m, 1.88 m	ax 1.27 m, eq 1.55 m	1.26 m, 1.57 m	1.30 (ov), 1.50 (ov)
9	1.43 m	1.55 m	1.45 m	1.85 d(10.8)
11	1.42 m, 1.52 m	3.99 ddd(10.7, 10.7, 4.9)	1.19 m, 1.53 m	3.80 dt(4.8, 10.8)
12	1.07 m, 1.59 m	ax 1.42 m eq 2.23 ddd(3.9, 4.9, 12.2)	1.25 m, 1.80 m	1.20 (ov), 1.79 dt(11.8, 4.6)
13	2.23 m	1.88 m	1.65 m	

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Table 11-4-4 (continued)

H	11-4-5	11-4-6	11-4-7	11-4-9
15	1.59 m, 1.61 m	α 1.10 m, β 1.40 m	1.08 m, 1.48 m	1.47 (ov), 1.17 (ov)
16	1.41 m, 1.91 m	α 1.35 m, β 1.79 m	1.75 m, 1.92 m	1.85 (ov), 1.47 (ov)
17	1.70 dd(10.4, 3.0)	1.79 m	1.87 m	2.26 dt(6.2, 10.8)
18	1.01 s	0.93 d(1)	0.97 s	0.96 s
19	1.08 s	1.08 br s	0.87 s	10.43 s
21	4.88 s, 4.95 s	1.14 s	1.14 s	1.64 d(1.2)
22	2.66 d(4.0), 2.70 d(4.0)	1.48 m	2.23 m, 2.24 m	5.28 d(9.0)
23	5.64 m	2.07 m	5.76 m	4.21 t(8.4)
24	5.64 m	5.13 tsp(7.2, 1.4, 1.4)	5.63 m	2.81 d(7.8)
26	1.33 s	1.69 br s	1.35 s	1.21 s
27	1.33 s	1.63 br s	1.33 s	1.31 s
28	0.94 s	1.10 s	0.84 s	1.17 s
29	1.04 s	1.07 s	0.89 s	1.08 s
30	0.87 s	1.02 s	0.92 s	0.94 s
OAc			2.08 s	

Table 11-4-5: ^{1}H NMR spectroscopic data of dammarane-type triterpenoids **11-4-8** and **11-4-10**~**11-4-12**.

H	11-4-8	11-4-10	11-4-11	11-4-12
1	1.70 (ov)	1.70 (ov)	1.18 (ov)	1.28 (ov)
	2.67 ddd(13.7, 4.9, 5.5)	2.18 ddd(14.0, 8.5, 5.5)	3.15 dt(6.0, 13.2)	2.66 dt(6.0, 12.6)
2	2.40 dt(15.0, 7.0)	2.40 dt(14.5, 7.5)	1.65 (ov)	1.65 (ov)
	2.50 ddd(15.0, 8.0, 5.6)	2.50 ddd(15.0, 9.0, 5.5)	2.08 dt(5.8, 12.6)	2.14 dt(6.0, 12.0)
9	1.54 d(10.8)	1.55 d(10.8)	1.60 d(11.0)	
11	3.93 dt(4.5, 10.8)	3.95 ddd(15.5, 11.1, 5.0)	3.57 dt(5.0, 11.0)	4.81 dt(4.8, 12.0)
12			1.22 (ov)	
			1.78 dt(12.4, 5.0)	
17		2.28 dt(5.5, 10.5)	2.28 dt(6.3, 11.1)	
18	1.02 s	1.03 s	0.96 s	0.98 s
19	1.07 s	1.07 s	4.15 dd(8.5, 1.0)	3.68 d(9.6)
			4.33 dd(8.5, 2.5)	4.28 d(9.6)
21	1.65 d(1.5)	1.65 d(1.0)	1.66 d(1.0)	1.63 s
22	5.22 d(9.0)	5.30 d(9.0)	5.27 d(9.5)	5.29 d(18.4)
23	4.34 dd(9.0, 6.0)	4.22 dd(9.0, 7.5)	4.12 dd(9.5, 8.0)	4.20 t(8.4)
24	3.91 d(6.0)	2.82 d(7.5)	2.77 d(8.0)	2.80 d(8.4)
26	5.02 s, 5.21 s	1.33 s	1.25 s	1.30 s
27	1.74 s	1.33 s	1.27 s	1.33 s
28	1.11 s	1.11 s	1.01 s	1.04 s
29	1.07 s	1.08 s	1.00 s	0.99 s
30	0.92 s	0.93 s	0.92 s	0.91 s
OAc				2.04 s

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Table 11-4-6: ^{1}H NMR spectroscopic data of dammarane-type triterpenoids **11-4-13**~**11-4-16**.

H	11-4-13	11-4-14	11-4-15	11-4-16
1	2.77 t(11.4)	3.15 dt(6.0, 12.5)	–	1 18 (ov), 3.14 dt(3.5, 12.5)
2	–	1.18 (ov)	1.64 (ov)	
			2.07 dt(5.8, 11.9)	
3	3.31 t(2.4)			
5	–	3.57 dt(6.0, 12.5)	–	
6	–	1.65 dq(3.2, 12.8)	–	1.44 (ov)
		1.45 (ov)		1.65 dq(3.2, 12.6)
7	–	1.50 (ov), 1.30 (ov)	–	1.33 (ov), 1.52 (ov)
9	1.52 d(11.0)	1.60 d(12.5)	1.60 d(11.3)	1.59 d(11.3)
11	3.85 tt(11.0, 4.2)	3.57 dt(6.0, 12.5)	3.57 dt(4.5, 11.0)	3.55 dt(4.5, 11.0)
12	1.73 dt(12.3, 4.2)	1.20 (ov)	1.20 (ov)	1.20 (ov)
	1.74 dt(12.0, 6.3)	1.79 dt(11.8, 4.6)	1.79 dt(12.0, 4.6)	1.77 dt(11.9, 4.3)
15	–	1.15 (ov), 1.47 (ov)	–	1.17 (ov), 1.47 (ov)
16	–	1.85 (ov), 1.47 (ov)	–	1.45 (ov), 1.85 (ov)
17	2.29 dt(6.6, 11.4)	2.26 dt(6.2, 10.8)	2.25 dt(5.2, 10.1)	2.21 dt(5.8, 10.7)
18	1.02 s	0.97 s	0.96 s	0.95 s
19	5.18 s	4.15 dd(8.5, 1.5)	4.15 dd(8.5, 1.5)	4.14 dd(8.5, 1.5)
		4.33 dd(8.5, 3.0)	4.33 dd(8.5, 2.5)	4.33 dd(8.5, 2.5)
21	1.68 d(1.2)	1.66 d(1.0)	1.65 d(1.5)	1.64 d(1.0)
22	5.51 d(8.4)	5.44 d(9.0)	5.40 d(9.0)	5.15 d(9.0)
23	4.66 dd(8.4, 2.4)	4.66 dd(9.0, 3.0)	4.58 dd(9.0, 3.0)	4.27 dd(9.0, 8.0)
24	3.19 br s	3.13 d(3.0)	3.22 d(3.0)	3.83 d(8.0)
26	1.26 s	1.24 s	1.20 s	4.83 m, 4.93 m
27	1.31 s	1.21 s	1.22 s	1.69 s
28	1.01 s	1.01 s	1.01 s	1.01 s
29	0.99 s	1.00 s	1.00 s	1.00 s
30	0.90 s	0.91 s	0.91 s	0.90 s
OMe	3.50 s		3.23 s	
OH	4.21 d(3.6, 11-OH)			

Table 11-4-7: Compounds, MFs, and test solvents of dammarane-type triterpenoids **11-4-18**~**11-4-30**.

No.	Compounds	MFs	Test solvents	References
11-4-18	–	$C_{31}H_{46}O_7$	–	[42]
11-4-19	–	$C_{29}H_{46}O_4$	$CDCl_3$	[43]
11-4-20	11α,15α-diacetoxybrachycarpon-22(23)-ene	$C_{33}H_{46}O_{10}$	$CDCl_3$	[44]
11-4-21	(20*S*,24*R*)-epoxydammarane-3β,25-diol	$C_{30}H_{52}O_3$	$CDCl_3$	[45]
11-4-22	(20*S*,24*S*)-epoxydammarane-3β,25-diol	$C_{30}H_{52}O_3$	$CDCl_3$	[45]
11-4-23	3-acetyl-24-*epi*-polacandrin	$C_{32}H_{54}O_6$	$CDCl_3$	[46]
11-4-24	1,3-diacetyl-24-*epi*-polacandrin	$C_{34}H_{56}O_7$	$CDCl_3$	[46]
11-4-25	polacandrin	$C_{30}H_{52}O_5$	–	[42]
11-4-26	–	$C_{34}H_{56}O_7$	–	[42]
11-4-27	aglaiabbreviatin D	$C_{30}H_{48}O_2$	$CDCl_3$	[39]
11-4-28	3β-acetyl-20,25-epoxydammarane-24α-ol	$C_{32}H_{54}O_4$	$CDCl_3$	[47]
11-4-29	3β-acetyl-20,25-epoxydammarane-24β-ol	$C_{32}H_{54}O_4$	$CDCl_3$	[47]
11-4-30	gentirigenic acid	$C_{30}H_{50}O_7$	C_5D_5N	[48]

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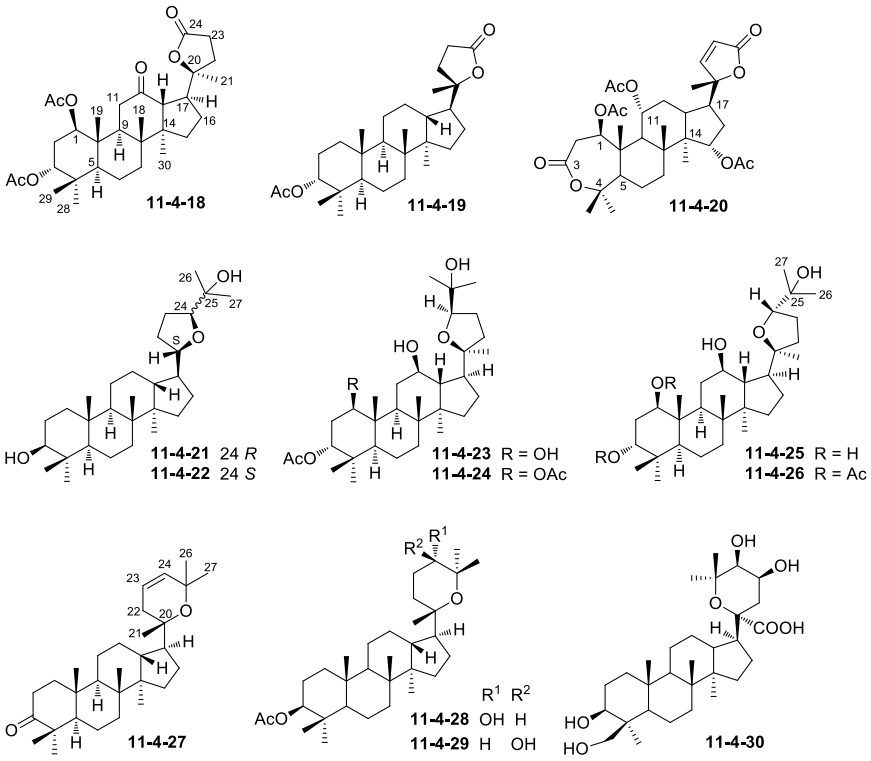

Table 11-4-8: ^{1}H NMR spectroscopic data of dammarane-type triterpenoids **11-4-18**~**11-4-20**.

H	11-4-18	11-4-19	11-4-20
1	4.80 dd(5.0, 11.0)	*α* 1.04, *β* 1.66	5.16 br d(4.7)
2	*α* 1.90 m, *β* 1.82 m	*α* 1.68, *β* 1.56	3.19 dd(15.6, 5.6), 2.91 br d(15.3)
3	4.75 t(3.0)	4.47 dd(5.7, 10.8)	
5	1.33 dd(2.5, 10.0)	0.82	1.97 m
6	1.58 m	*α* 1.54, *β* 1.44	1.74 m, 1.45 m
7	*α* 1.58 m, *β* 1.40 dt(3.0, 12.5)	*α* 1.55, *β* 1.26	1.30 m, 1.60 m
9	2.01 dd(5.0, 13.5)	1.33	1.92 m
11	*α* 2.34 t(13.5), *β* 2.15 dd(5.0, 13.5)	*α* 1.50, *β* 1.20	5.09 ddd(11, 11, 4.7)
12		*α* 1.23, *β* 1.75	1.53 m, 1.90 m
13	2.86 d(10.0)	1.57	1.80 m
15	*α* 1.74 m, *β* 1.22 m	*α* 1.12, *β* 1.51	4.91 dd(9.2, 7.2)
16	*α* 1.87 m, *β* 1.58 m	1.82	1.65 m, 2.05 m
17	2.60 m	1.98 ddd(5.7, 10.3, 16.5)	2.17 m
18	1.22 s	0.95 s	1.40 s
19	1.12 s	0.86 s	1.47 s
21	1.25 s	1.35 s	1.42 s

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Table 11-4-8 (continued)

H	11-4-18	11-4-19	11-4-20
22	2.18 m, 1.94 m	*α* 1.92 ddd(4.6, 10.3, 12.8) *β* 2.11 ddd(9.2, 10.3, 12.8)	7.39 d(5.7)
23	2.61 m	*α* 2.54 ddd(4.6, 10.3, 18.3) *β* 2.64 ddd(9.2, 10.3, 18.3)	6.11 d(5.7)
28	0.95 s	0.85 s	1.20 s
29	0.86 s	0.84 s	1.17 s
30	0.79 s	0.88 s	1.09 s
Oac	2.01 s, 2.11 s	2.04 s	2.01 s, 1.95 s, 2.01 s

Table 11-4-9: ^{1}H NMR spectroscopic data of dammarane-type triterpenoids **11-4-21**~**11-4-24**.

H	11-4-21	11-4-22	11-4-23	11-4-24
1	1.66 m, 0.94 m	1.68 m, 0.95 m	3.62 ddd(10.6, 5.4, 5.4)	4.75 dd(10.7, 4.9)
2	1.63 m, 1.56 m	1.64 m, 1.56 m	*α* 1.85 m, *β* 1.75 m	*α* 1.76 m, *β* 1.71 m
3	3.20 dd(11.2, 4.9)	3.20 dd(11.2, 4.9)	4.68 t(3.0)	4.66 t(3.0)
5	0.73 dd(11.0, 2.0)	0.73 dd(11.7, 2.0)	1.20 m	1.22 m
6	1.53 m, 1.44 m	1.51 m	1.52 m	1.42 m
7	1.50 m, 1.26 m	1.53 m, 1.25 m	*α* 1.50 m, *β* 1.27 m	*α* 1.49 m, *β* 1.23 m
9	1.30 dd(14.0, 3.0)	1.31 m	1.74 m	1.68 m
11	1.46 m, 1.50 m	1.48 m, 1.87 m	*α* 2.67 ddd(11.3, 4.2, 4.2) *β* 1.28 m	*α* 1.71 m *β* 1.15 m
12	1.77 m, 1.47 m	1.74 m, 1.34 m	3.55 ddd(11.3, 11.3, 4.2)	3.41 ddd(10.0, 10.0, 4.5)
13	1.55 m	1.62 m	1.63 t(11.3)	1.54 t(10.0)
15	1.44 m, 1.61 m	1.06 m, 1.45 m	*α* 1.54 m *β* 1.08 dd(11.5, 8.0)	*α* 1.49 m *β* 1.05 m
16	1.84 m, 1.07 m	1.78 m, 1.65 m	*α* 1.95 m, *β* 1.23 m	*α* 1.89 m, *β* 1.23 m
17	1.78 m	1.84 m	2.16 ddd(10.9, 10.9, 3.0)	2.09 br t(10.1)
18	0.95 s	0.97 s	0.97 s	0.92 s
19	0.83 s	0.85 s	0.91 s	0.97 s
21	1.13 s	1.15 s	1.24 s	1.19 s
22	1.62 m, 1.55 m	1.86 m, 1.64 m	1.85 m, 1.62 m	1.56 m, 1.11 m
23	1.84 m, 1.78 m	1.80 m	1.97 m, 1.81 m	1.95 m, 1.79 m
24	3.73 dd(7.5, 7.5)	3.64 dd(10.0, 5.1)	3.81 dd(8.6, 6.7)	3.75 dd(8.8, 6.8)
26	1.21 s	1.19 s	1.24 s	1.19 s
27	1.11 s	1.11 s	1.06 s	1.02 s
28	0.97 s	0.97 s	0.78 s	0.76 s
29	0.77 s	0.77 s	0.86 s	0.84 s
30	0.87 s	0.87 s	0.91 s	0.84 s
OAc			2.05 s	2.03 s, 1.92 s
OH			5.40 br s, 3.88 br s	5.23 br s

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Table 11-4-10: ^{1}H NMR spectroscopic data of dammarane-type triterpenoids **11-4-25**~**11-4-28**.

H	11-4-25	11-4-26	11-4-27	11-4-28
1	3.82 dd(5.0, 10.5)	4.86 dd(5.5, 10.5)	1.46 m, 1.92 m	1.00 m, 1.65 m
2	1.82 m	1.83 m	2.47 dt(14.4, 4.6) 2.72 dt(14.2, 5.6)	1.60 m, 1.62 m
3	3.46 t(3.0)	4.75 t(3.0)		4.44 dd(10.5, 5.5)
5	1.30 m	1.25 m	1.38 m	0.79 m
6	1.48 m	1.50 m	1.46 m, 1.56 m	1.38 m, 1.47 m
7	α 1.50 m, β 1.27 m	α 1.50 m, β 1.27 m	1.32 m, 1.56 m	1.23 m, 1.48 m
9	1.77 m	1.77 m	1.74 m	1.32 m
11	α 2.70 dt(4.0, 13.0) β 1.28 m	α 1.77 m β 1.28 m	1.26 m, 1.51 m	1.15 m, 1.46 m
12	3.58 td(5.0, 10.0)	3.50 td(5.0, 10.0)	1.28 m, 1.88 m	1.18 m, 1.73 m
13	1.66 t(10.0)	1.65 t(10.0)	1.68 m	1.52 m
15	α 1.50 m β 1.08 dd(8.0, 11.5)	α 1.50 m β 1.08 m	1.09 m, 1.47 m	1.03 m, 1.42 m
16	α 1.95 m, β 1.28 m	α 1.95 m, β 1.27 m	1.53 m, 1.73 m	1.43 m, 1.75 m
17	2.23 td(4.0, 10.0)	2.23 td(5.0, 10.0)	1.43 m	1.76 m
18	1.01 s	1.07 s	1.00 s	0.92 s
19	0.95 s	1.02 s	0.94 s	0.81 s
21	1.25 s	1.26 s	1.13 s	1.09 s
22	1.95 m, 1.76 m	2.01 m, 1.75 m	2.19 m, 2.67 m	1.58 m, 1.68 m
23	1.89 m	1.82 m	5.70 m	1.74 m, 1.83 m
24	3.89 dd(5.0, 5.5)	3.88 dd(5.5, 6.0)	5.70 m	3.69 t(7.0)
26	1.19 s	1.23 s	1.32 s	1.08 s
27	1.13 s	1.09 s	1.34 s	1.17 s
28	0.90 s	0.92 s	1.08 s	0.83 s
29	0.82 s	0.84 s	1.04 s	0.81 s
30	0.93 s	0.93 s	0.88 s	0.83 s
OAc		2.03 s, 2.12 s		2.01 s
OH	6.04 s	5.46 s		

Table 11-4-11: ^{1}H NMR spectroscopic data of dammarane-type triterpenoids **11-4-29** and **11-4-30**.

H	11-4-29	11-4-30	H	11-4-29	11-4-30
1	1.03 m, 1.67 m	0.90 m, 1.61 m	18	0.93 s	0.89 s
2	1.60 m, 1.62 m	1.16 m, 1.54 m	19	0.81 s	0.82 s
3	4.46 dd(10.5, 5.5)	3.30 dd(5.7, 11.8)	21	1.09 s	
5	0.80 m	0.89 m	22	1.63 m, 1.81 m	2.75 dd(16.0, 5.3) 3.13 dd(16.0, 8.7)
6	1.42 m, 1.47 m	1.44 m, 1.63 m			
7	1.24 m, 1.50 m	1.15 m, 1.46 m	23	1.73 m, 1.82 m	5.65 ddd(1.7, 5.3, 8.7)
9	1.31 m	1.29 m	24	3.62 dd(10.5, 5.3)	4.33 d(1.7)
11	1.18 m, 1.48 m	1.25 m, 1.32 m	26	1.12 s	1.55 s
12	1.18 m, 1.75 m	1.61 m, 2.56 m	27	1.17 s	1.50 s

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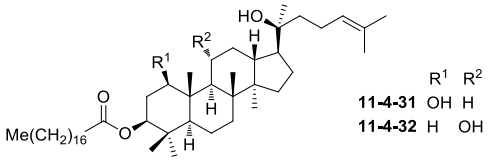
Table 11-4-11 (continued)

H	11-4-29	11-4-30	H	11-4-29	11-4-30
13	1.60 m	2.00 dd(8.7, 10.0)	28	0.84 s	1.61 s
15	1.03 m, 1.42 m	0.98 m, 1.51 m	29	0.82 s	3.69 dd(1.1, 16.1) 4.86 dd(7.2, 16.1)
16	1.28 m, 1.70 m	1.51 m, 1.95 m	30	0.85 s	0.85 s
17	1.83 m	2.73 ddd(5.8, 9.1, 10.0)	OAc	2.02 s	

Table 11-4-12: Compounds, MFs, and test solvents of dammarane-type triterpenoids **11-4-31**~**11-4-36**.

No.	Compounds	MFs	Test solvents	References
11-4-31	bruguierin A	$C_{48}H_{86}O_4$	–	[49]
11-4-32	bruguierin B	$C_{48}H_{86}O_4$	–	[49]
11-4-33	bruguierin C	$C_{48}H_{86}O_6$	–	[49]
11-4-34	mansumbinone	$C_{22}H_{34}O$	$CDCl_3$	[50]
11-4-35	15α-hydroxymansumbinone	$C_{22}H_{34}O_2$	$CDCl_3$	[50]
11-4-36	28-acetoxy-l5α-hydroxymansumbinone	$C_{24}H_{36}O_4$	$CDCl_3$	[50]



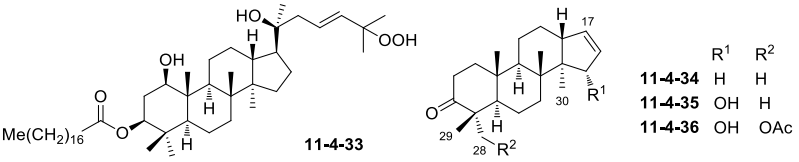


Table 11-4-13: ^{1}H NMR spectroscopic data of dammarane-type triterpenoids **11-4-31**~**11-4-33**.

H	11-4-31	11-4-32	11-4-33	H	11-4-31	11-4-32	11-4-33
1	3.53 dd(10.9, 4.4)	–	3.54 dd(11.3, 4.5)	19	0.93 s	1.07 s	0.94 s
2	1.72 m	1.63 m	1.70 m	21	1.14 s	1.16 s	1.14 s
3	4.50 dd(13.0, 4.4)	4.51 dd(10.0, 6.3)	4.51 dd(13.5, 4.5)	22	1.47 t(8.0)	1.44 m	2.25 m
5	0.74 m		0.75 m	23	2.06 m	2.05 m	5.78 m
6	1.55 m	1.51 m	1.60 m	24	5.12 t(6.5)	5.12 t(6.3)	5.62 d(15.8)

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Table 11-4-13 (continued)

H	11-4-31	11-4-32	11-4-33	H	11-4-31	11-4-32	11-4-33
7	1.28 m	1.22 m	1.58 m	26	1.69 s	1.77 s	1.36 s
9	1.53 m	1.53 m	1.55 m	27	1.62 s	1.69 s	1.35 s
11	1.60 m	3.98 m	1.30 m	28	0.84 s	0.86 s	0.85 s
12	1.57 m	1.42 m	1.85 m	29	0.84 s	0.88 s	0.85 s
13	1.61 m	1.80 m	1.65 m	30	0.88 s	0.92 s	0.88 s
15	1.10 m	1.38 m	1.05 m	2′	2.29 t(8.0)	2.29 t(7.1)	2.32 t(7.3)
16	–	1.55 m	1.68 m	3′ ~ 17′	1.25 br s	1.26 br s	1.26 br s
17	1.73 m		1.75 m	18′	0.88 t(6.0)	0.88 t(6.5)	0.88 t(5.8)
18	0.97 s	0.98 s	0.98 s				

Table 11-4-14: ^{1}H NMR spectroscopic data of dammarane-type triterpenoids **11-4-34**~**11-4-36**.

H	11-4-34	11-4-35	11-4-36
1	1.45 m	1.43 m	1.42 m
	1.90 ddd(12.8, 7.7, 4.8)	1.90 ddd(13.1, 8.1, 4.4)	1.96 ddd(13.1, 8.1, 3.7)
2	2.44 ddd(15.4, 7.9, 4.8)	2.42 ddd(14.6, 7.7, 4.4)	2.44 ddd(13.7, 7.3, 3.7)
	2.47 ddd(15.4, 9.8, 7.7)	2.48 ddd(14.6, 8.1, 5.7)	2.49 ddd(15.2, 8.1, 6.3)
5	1.40 m	1.41 m	1.68 m
6	1.48 m	1.50 m	1.34 m, 1.53 m
7	1.33 m, 1.60 m	1.54 m	1.52 m
9	1.54 m	1.51 m	1.54 m
11	1.60 m	1.59 m	1.34 m, 1.57 m
12	1.72 m	1.71 m	1.46 m, 1.72 m
13	2.73 m	2.64 m	2.64 m
15	1.70 m, 2.35 m	4.91 m	4.91 m
16	5.65 m	5.51 m	5.52 m
17	5.57 m	5.65 m	5.67 m
18	1.04 s	1.12 s	1.14 s
19	0.94 s	0.94 s	0.97 s
28	1.07 s	1.06 s	4.02 AB(11.0), 4.05 AB(11.0)
29	1.03 s	1.03 s	1.01 s
30	0.99 d(1.1)	1.01 s	1.03 s
OAc			2.02 s

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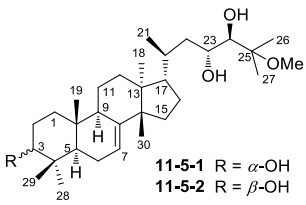
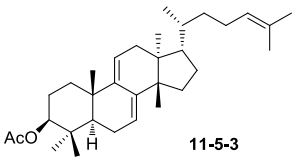
11.5 Tirucallane-type triterpenoids

Table 11-5-1: Compounds, MFs, and test solvents of tirucallane-type triterpenoids **11-5-1**~**11-5-26**.

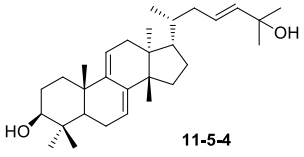
No.	Compounds	MFs	Test solvents	References
11-5-1	hispidol A 25-methyl ether	$C_{31}H_{54}O_4$	C_5D_5N	[51]
11-5-2	hispidol B 25-methyl ether	$C_{31}H_{54}O_4$	C_5D_5N	[51]
11-5-3	antiquol C acetate	$C_{32}H_{50}O_2$	$CDCl_3$	[52]
11-5-4	Kansenol	$C_{30}H_{48}O_2$	$CDCl_3$	[53]
11-5-5	meliastatin 1	$C_{30}H_{48}O_3$	$CDCl_3$	[54]
11-5-6	meliastatin 5	$C_{30}H_{48}O_3$	$CDCl_3$	[54]
11-5-7	Kansenone	$C_{30}H_{48}O_2$	$CDCl_3$	[53]
11-5-8	*epi*-kansenone	$C_{30}H_{48}O_2$	$CDCl_3$	[53]
11-5-9	Kansenonol	$C_{30}H_{42}O_3$	$CDCl_3$	[53]
11-5-10	Schinol	$C_{30}H_{48}O_3$	C_5D_5N	[55]
11-5-11	11-oxo-kansenonol	$C_{30}H_{46}O_4$	$CDCl_3$	[53]
11-5-12	3α-hydroxy-6-oxo-7, 24*Z*-tirucalladien-26-oic acid	$C_{30}H_{46}O_4$	C_5D_5N	[55]
11-5-13	3α-hydroxy-7-oxo-8,24*Z*-tirucalladien-26-oic acid	$C_{30}H_{46}O_4$	C_5D_5N	[55]
11-5-14	meliastatin 2	$C_{31}H_{48}O_5$	$CDCl_3$	[54]
11-5-15	meliastatin 3	$C_{31}H_{48}O_6$	$CDCl_3$	[54]
11-5-16	meliastatin 4	$C_{31}H_{48}O_5$	$CDCl_3$	[54]
11-5-17	3,7-dioxo-8,24*Z*-tirucalladien-26-oic acid	$C_{30}H_{44}O_4$	C_5D_5N	[55]
11-5-18	7,11-dioxo-3α-hydroxy-8,24*Z*-tirucalladien-26-oic acid	$C_{30}H_{44}O_5$	$CDCl_3$	[55]
11-5-19	3,8-dioxo-7β-hydroxy-7,9-cycro-7,8-seco-24*Z*-tirucalladien-26-oic acid	$C_{30}H_{46}O_5$	$CDCl_3$	[55]
11-5-20	(24*S*)-24,25-dihydroxysunpollenol	$C_{30}H_{54}O_4$	$CDCl_3$	[56]
11-5-21	(24*R*)-24,25-dihydroxysunpollenol	$C_{30}H_{54}O_4$	$CDCl_3$	[56]
11-5-22	(24*R*)-24,25-epoxysunpollenol	$C_{30}H_{52}O_3$	$CDCl_3$	[56]
11-5-23	(24*S*)-24,25-epoxysunpollenol	$C_{30}H_{52}O_3$	$CDCl_3$	[56]
11-5-24	sunpollenol	$C_{30}H_{52}O_2$	$CDCl_3$	[56]
11-5-25	(23*E*)-23-dehydro-25-hydroxysunpollenol	$C_{30}H_{52}O_3$	$CDCl_3$	[56]
11-5-26	euphorbol acetate	$C_{33}H_{54}O_2$	$CDCl_3$	[52]



11-5-1 R = α-OH
11-5-2 R = β-OH



11-5-3



11-5-4

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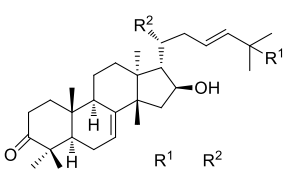
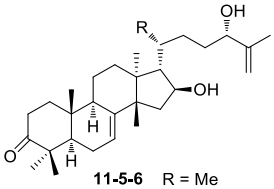
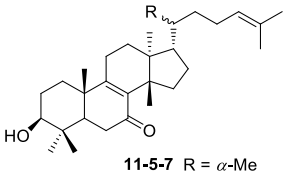


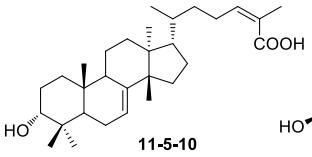
	R^1	R^2
11-5-5	OH	Me
11-5-14	OH	COOMe
11-5-15	OOH	COOMe



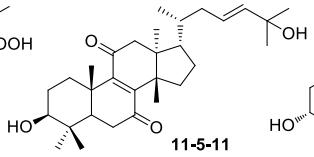
11-5-6 R = Me
11-5-16 R = COOMe



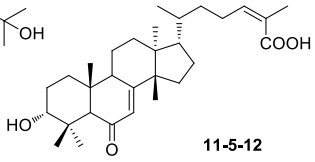
11-5-7 R = α-Me
11-5-8 R = β-Me



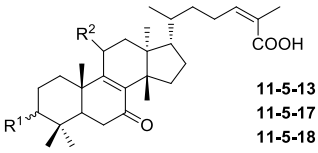
11-5-10



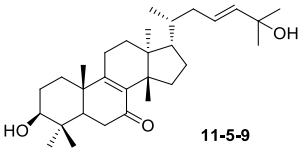
11-5-11



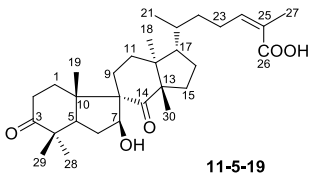
11-5-12



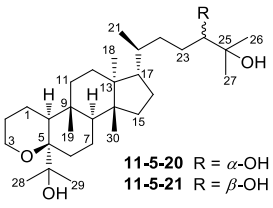
	R^1	R^2
11-5-13	α-OH	H
11-5-17	=O	H
11-5-18	α-OH	=O



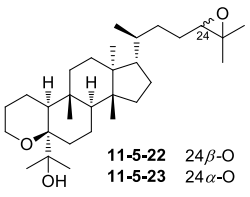
11-5-9



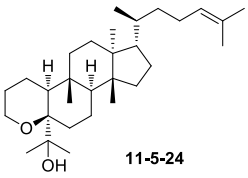
11-5-19



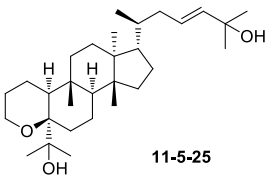
11-5-20 R = α-OH
11-5-21 R = β-OH



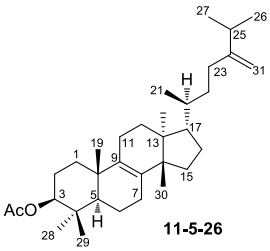
11-5-22 24β-O
11-5-23 24α-O



11-5-24



11-5-25



11-5-26

Table 11-5-2: ^{1}H NMR spectroscopic data of tirucallane-type triterpenoids **11-5-1**~**11-5-5**.

H	11-5-1	11-5-2	11-5-3	11-5-4	11-5-5
1	–	–	1.66	α 1.56 m	α 1.45 br td(14.4, 3.9)
			1.80	β 1.82 dt(13.1, 3.3)	β 1.98 ddd(14.4, 5.5, 3.2)
2	1.82 m,	1.85 m,	1.69, 1.76	1.66 m, 1.73 m	α 2.25 ddd(14.4, 3.9, 3.2)
	2.00 m	2.01 m			
					β 2.76 td(14.4, 5.5)

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Table 11-5-2 (continued)

H	11-5-1	11-5-2	11-5-3	11-5-4	11-5-5
3	3.64 br s	3.45 t(8.1)	4.51 dd(4.4, 10.8)	*α* 3.24 dd(4.0, 11.3)	
5	2.18 m	1.45 m	1.36 dd(4.8, 11.3)	*α* 1.28 dd(4.6, 11.6)	1.72 dd(10.3, 7.3)
6	2.00 m	2.02 m	2.20	*α* 2.21 dt(18.0, 4.9)	*α* 2.11 ddd(14.0, 7.3, 3.2)
			2.07	*β* 2.08 m	*β* 2.10 ddd(14.0, 10.3, 3.2)
7	5.29 br s	5.28 br s	5.33 br s	5.34 m	5.29 br q(3.2)
9	2.46 m	2.27 m			2.29 m
11	1.56 m	1.52 m	5.20 br s	*α* 5.19 br s	*α* 1.60 m
					β 1.64 m
12	–	–	2.18(2H)	2.16 d(4.0)(2H)	*α* 1.63 m
					β 1.9 br ddd(13.0, 10.0, 4.0)
15	–	–	1.64	*α* 1.65 m	*α* 2.10 br ddq(13.3, 8.5, 0.9)
			1.31	*β* 1.35 m	*β* 1.57 br dd(13.3, 0.9)
16	–	–	1.95	*α* 1.96 m	4.06 br ddd(8.5, 5.5, 0.9)
			1.34	*β* 1.31 m	
17	1.65 m	1.66 m	1.6	1.62 m	1.58 dd(9.8, 5.5)
18	0.78 s	0.78 s	0.62 s	0.65 s	0.85 s
19	0.83 s	0.86 s	0.94 s	0.92 s	1.020 s
20	1.71 m	1.73 m	1.45	1.52 m	1.68 ddqd(9.8, 9.2, 6.2, 3.2)
21	1.10 d(5.6)	1.12 d(5.8)	0.86 d(6.0)	0.82 d(7.0)	1.019 d(6.2)
22	2.19 m	2.18 m	1.05	1.73 m	*α* 2.33 br ddd(13.3, 5.0, 3.2)
			1.59	2.33 m	*β* 1.76 br ddd(13.3, 9.2, 6.2)
23	4.42 m	4.41 m	1.87	5.59 m	5.59 ddd(15.6, 6.2, 5.0)
			2.06		
24	3.63 s	3.65 s	5.11 t(6.0)	5.59 m	5.61 br d(15.6)
26	1.39 s	1.41 s	1.69 s	1.32 s	1.32 s
27	1.41 s	1.43 s	1.61 s	1.32 s	1.32 s
28	0.94 s	1.09 s	0.87 s	0.99 s	1.05 s
29	1.14 s	1.15 s	0.96 s	0.89 s	1.12 s
30	0.99 s	0.98 s	0.84 s	0.85 s	1.26 br d(0.9)
OAc			2.06 s		
25-OMe	3.20 s	3.22 s			
OH					1.58 br s(16-OH)
					1.58 br s(25-OH)

Table 11-5-3: ^{1}H NMR spectroscopic data of tirucallane-type triterpenoids **11-5-6**~**11-5-10**.

H	11-5-6	11-5-7	11-5-8	11-5-9	11-5-10
1	*α* 1.45 br td(14.6, 3.9)	*α* 1.45 m	*α* 1.45 m	*α* 1.45 m	1.45 m, 1.98 m
	β 1.98 ddd(14.6, 5.7, 3.0)	*β* 1.86 dt(13.1, 3.3)	*β* 1.86 dt(13.1, 3.3)	*β* 1.86 dt(13.1, 3.3)	
2	*α* 2.25 ddd(14.6, 3.9, 3.0)	1.67 m, 1.75 m	1.67 m, 1.75 m	1.67 m, 1.75 m	1.84 bd(9.6)
	β 2.76 td(14.6, 5.7)				2.01 m

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Table 11-5-3 (continued)

H	11-5-6	11-5-7	11-5-8	11-5-9	11-5-10
3		*α* 3.29 dd(4.6, 11.6)	*α* 3.29 dd(4.6, 11.6)	*α* 3.29 dd(4.6, 11.6)	3.69 bs
5	1.71 dd(10.4, 7.0)	*α* 1.67 m	*α* 1.67 m	*α* 1.67 m	2.22 dd(12.5, 5.5)
6	*α* 2.11 ddd(14.0, 7.0, 3.2) *β* 2.09 ddd(14.0, 10.4, 3.2)	*α* 2.40 dd(3.9, 15.8) *β* 2.38 dd(12.4, 15.8)	*α* 2.41 dd(3.9, 15.8) *β* 2.38 dd(12.4, 15.8)	*α* 2.41 dd(3.9, 15.8) *β* 2.38 dd(12.4, 15.8)	1.98 m 2.13 m
7	5.29 q(3.2)				5.36 bs
9	2.29 m				2.50 bd(12.5)
11	*α* 1.598 m *β* 1.607 m	*α* 2.37 m *β* 2.24 ddd(4.2, 4.2, 20.4)	*α* 2.37 m *β* 2.24 ddd(4.2, 4.2, 20.4)	*α* 2.37 m *β* 2.24 ddd(4.2, 4.2, 20.4)	1.50 m, 1.60 m
12	*α* 1.604 m *β* 1.90 br dd(13.0, 10.0)	*α* 1.76~1.80 m	*α* 1.76~1.80 m	*α* 1.76~1.80 m	1.57 m, 1.75 m
15	*α* 2.10 br ddq(13.5, 8.0, 0.9) *β* 1.564 br dd(13.5, 0.9)	*α* 1.56 m, *β* 2.13 m	*α* 1.56 m, *β* 2.13 m	*α* 1.56 m, *β* 2.13 m	1.47 m, 1.60 m
16	4.04 br ddd(8.0, 5.9, 0.9)	*α* 1.33 m, *β* 1.93 m	*α* 1.33 m, *β* 1.93 m	*α* 1.33 m, *β* 1.93 m	1.32 m, 2.03 m
17	1.559 dd(9.8, 5.9)	1.43 m	1.47 m	1.57 m	1.57 m
18	0.82 s	0.72 s	0.73 s	0.75 s	0.80 s
19	1.02 s	1.05 s	1.05 s	1.05 s	0.87 s
20	1.612 m	1.43 m	1.43 m	1.55 m	1.47 m
21	1.054 d(7.0)	0.88 d(6.0)	0.93 d(6.1)	0.84 d(6.1)	0.97 d(5.8)
22	*α* 1.67 m, *β* 0.98 m	1.13 m, 1.56 m	1.06 m, 1.49 m	1.82 m, 2.32 m	1.30 m, 1.68 m
23	*α* 1.43 m, *β* 1.68 m	1.90 m, 2.04 m	1.83 m, 2.04 m	5.58 m	2.78 m, 2.88 m
24	4.03 br t(6.0)	5.08 m	5.10 m	5.58 m	6.06 d(7.3)
26	4.85 quint(1.6) 4.94 d quint(0.8, 1.6)	1.68 s	1.68 s	1.32 s	
27	1.73 dd(1.6, 0.8)	1.61 s	1.60 s	1.32 s	2.14 s
28	1.046 s	0.99 s	0.99 s	1.00 s	1.17 s
29	1.12 s	0.88 s	0.88 s	0.89 s	0.98 s
30	1.25 br d(0.9)	0.97 s	0.96 s	0.97 s	1.05 s
OH	1.55 br s(16-OH) 1.55 br s(24-OH)				

Table 11-5-4: ^{1}H NMR spectroscopic data of tirucallane-type triterpenoids **11-5-11**~**11-5-15**.

H	11-5-11	11-5-12	11-5-13	11-5-14	11-5-15
1	*α* 1.10 m, *β* 2.55 m	1.38 m, 2.27 bt(9.5)	1.52 m, 2.24 m	*α* 1.45 br td(14.6, 3.9) *β* 1.98 ddd(14.6, 5.7, 3.0)	*α* 1.45 br td(14.6, 3.9) *β* 1.98 ddd(14.6, 5.7, 3.0)

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Table 11-5-4 (continued)

H	11-5-11	11-5-12	11-5-13	11-5-14	11-5-15
2	1.67 m, 1.76 m	1.83 dd(3.0, 14.0) 2.00 m	1.87 dd(3.2, 14.1) 2.07 m	*α* 2.25 ddd(14.6, 3.9, 3.0) *β* 2.76 td(14.6, 5.7)	*α* 2.25 ddd(14.6, 3.9, 3.0) *β* 2.76 td(14.6, 5.7)
3	*α* 3.30 dd(5.8, 10.5)	3.60 br s	3.63 br s		
5	*α* 1.62 m	3.06 s	2.60 m	1.71 dd(10.3, 7.1)	1.71 dd(10.4, 7.0)
6	*α* 2.45 m *β* 2.50 m		2.54 m, 2.58 m	*α* 2.12 ddd(14.0, 7.1, 3.2) *β* 2.10 ddd (14.0, 10.3, 3.2)	*α* 2.12 ddd (14.0, 7.0, 3.2) *β* 2.10 ddd (14.0, 10.4, 3.2)
7		5.88 d(3.0)		5.32 br q(3.2)	5.32 br q(3.2)
9		2.95 m		2.28 m	2.28 m
11		1.50 m 1.66 m	2.23 m 2.44 m	*α* 1.59 m *β* 1.63 m	*α* 1.61 m *β* 1.64 m
12	*α* 2.42 d(20.0) *β* 2.66 d(20.0)	1.60 m, 1.73 m	1.30 m, 1.72 m	*α* 1.60 m *β* 1.96 br ddd(13.0, 10.0)	*α* 1.59 m *β* 1.96 br t(13.0)
15	*α* 1.65 m *β* 2.17 m	1.40 m, 1.50 m	1.75 m, 2.50 m	*α* 2.06 br ddq (13.5, 8.5, 0.9) *β* 1.63 br dd(13.5, 0.9)	*α* 2.06 br ddq (13.5, 8.5, 0.9) *β* 1.64 br dd(13.5, 0.9)
16	*α* 1.41 m *β* 2.02 m	1.26 m, 1.98 m	1.38 m, 2.09 m	3.99 br ddd(8.5, 5.7, 0.9)	3.99 br ddd(8.5, 5.7, 0.9)
17	1.65 m	1.50 m	1.55 m	2.11 dd(10.3, 5.7)	2.14 dd(11.0, 5.7)
18	0.94 s	0.70 s	0.73 s	0.86 s	0.87 s
19	1.31 s	0.94 s	1.05 s	1.02 s	1.03 s
20	1.55 m	1.41 m	1.48 m	2.68 td(10.3, 4.1)	2.73 ddd(11.0, 10.0, 4.1)
21	0.86 d(6.6)	0.95 d(6.6)	1.01 d(6.0)		
22	1.75 m, 2.24 m	1.24 m, 1.65 m	1.26 m, 1.67 m	*α* 2.43 dddd (14.0, 6.4, 4.1, 1.2) *β* 2.30 br ddd (14.0, 10.3, 7.6)	*α* 2.47 dddd (13.8, 4.1, 6.6, 1.2) *β* 2.30 br ddd (13.8, 10.0, 7.6)
23	5.58 m	2.78 m 2.87 m	2.76 bs 2.89 bs	5.54 ddd(15.6, 7.6, 6.4)	5.64 ddd(15.8, 7.6, 6.6)
24	5.58 m	6.05 t(6.6)	5.97 t(6.6)	5.63 br dt(15.6, 1.2)	5.54 br dt(15.8, 1.2)
26	1.31 s			1.28 s	1.306 s
27	1.31 s	2.16 bs	2.16 bs	1.28 s	1.312 s
28	1.03 s	1.73 s	1.10 s	1.05 s	1.05 s
29	0.90 s	1.41 s	0.92 s	1.12 s	1.12 s
30	1.08 s	0.98 s	1.15 s	1.28 s	1.29 br s
OMe				3.68 s	3.68 s
OH				1.57 br s(16-OH)	7.55 br s(16-OH)

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Table 11-5-5: ^{1}H NMR spectroscopic data of tirucallane-type triterpenoids **11-5-16**~**11-5-20**.

H	11-5-16	11-5-17	11-5-18	11-5-19	11-5-20
1	*α* 1.44 br td(14.5, 3.9) *β* 1.98 ddd(14.5, 5.5, 3.0)	1.79 m 2.17 m	1.46 m 2.24 m	1.41 m 2.41 m	1.80(2H)
2	*α* 2.25 ddd(14.5, 3.9, 3.0) *β* 2.76 td(14.5, 5.5)	2.42 m 2.78 bt(5.9, 14.7)	1.67 m 2.07 m	2.32 m 2.77 m	*α* 1.73 *β* 1.65
3			3.51 t (2.6)		*α* 3.82 ddd(4.6, 8.0, 12.1) *β* 3.65 ddd(6.4, 8.7, 11.9)
5	1.708 dd(10.4, 7.0)	2.14 m	2.21 m	3.25 dd(3.9, 6.6)	
6	*α* 2.10 ddd(14.0, 7.0, 3.2) *β* 2.09 ddd(14.0, 10.4, 3.2)	2.38 m, 2.50 m	2.42 m	1.52 m, 2.23 m	1.85(2H)
7	5.31 br q(3.2)			4.36 t(6.6)	*α* 1.31, *β* 1.71
8					1.56
9	2.28 m				
10					1.58
11	*α* 1.60 m *β* 1.605 m	2.27 dd(5.9, 11.3) 2.36 m		1.69 m, 2.18 m	*α* 1.36, *β* 1.61
12	*α* 1.59 m *β* 1.94 br dd(13.0, 10.0)	1.80 m	2.46 d(19.1) 2.65 d(19.1)	1.81 m, 1.92 m	*α* 1.57, *β* 1.76
15	*α* 2.06 br ddq(13.5, 8.0, 0.9) *β* 1.613 br dd(13.5, 0.9)	1.54 m, 2.15 m	1.66 m, 2.16 m	1.34 m, 1.77 m	*α* 1.07, *β* 1.17
16	3.99 br ddd(8.0, 5.9, 0.9)	1.38 m, 1.98 m	1.38 m, 2.04 m	1.28 m, 1.94 m	*α* 1.28, *β* 1.95
17	2.07 dd(10.4, 5.9)	1.48 m	1.66 m	1.60 m	1.48
18	0.84 s	0.72 s	0.95 s	0.73 s	0.80 s
19	1.02 s	1.28 s	1.31 s	0.90 s	1.08 s
20	2.60 td(10.4, 3.9)	1.44 m	1.42 m	1.42 m	1.47
21		0.94 d(6.0)	0.89 d(6.6)	0.94 d(6.6)	0.91 d(6.0)
22	*α* 1.78 m *β* 1.51 dtd(14.6, 10.4, 4.0)	1.18 m, 1.56 m	1.16 m, 1.56 m	1.16 m, 1.50 m	1.26, 1.50
23	*α* 1.43 m *β* 1.52 br dddd(15.5, 10.4, 6.0, 4.0)	2.44 m, 2.60 m	2.45 m, 2.54 m	2.42 m, 2.56 m	1.38(2H)
24	4.03 br t(6.0)	6.07 t(6.6)	6.06 t(7.0)	6.07 t(6.6)	3.34 t(7.6)
26	4.86 quint(1.6) 4.94 d quint(0.8, 1.6)				1.17 s
27	1.706 dd(0.8, 1.6)	1.92 s	1.92 bs	1.92 bs	1.22 s
28	1.04 s	1.09 s	0.98 s	1.10 s	1.27 s

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Table 11-5-5 (continued)

H	11-5-16	11-5-17	11-5-18	11-5-19	11-5-20
29	1.12 s	1.13 s	0.96 s	1.08 s	1.30 s
30	1.27 br d(0.9)	0.99 s	1.08 s	1.20 s	0.86 s
OH	1.56 br s(16-OH)				
	1.56 br s(24-OH)				
OMe	3.72				

Table 11-5-6: ^{1}H NMR spectroscopic data of tirucallane-type triterpenoids **11-5-21**~**11-5-25**.

H	11-5-21	11-5-22	11-5-23	11-5-24	11-5-25
1	1.80(2H)	1.80(2H)	1.80(2H)	1.80(2H)	1.79(2H)
2	*α* 1.72, *β* 1.63	*α* 1.74, *β* 1.63	*α* 1.74, *β* 1.63	*α* 1.75, *β* 1.64	*α* 1.73, *β* 1.62
3	*α* 3.82 ddd(4.4, 7.8, 11.9)	*α* 3.82 ddd(4.6, 7.9, 11.9)	*α* 3.82 ddd(4.6, 7.9, 11.9)	*α* 3.82 ddd(4.1, 8.2, 11.9)	*α* 3.82 ddd(4.2, 7.9, 11.9)
	β 3.64 ddd(6.4, 8.7, 11.9)	*β* 3.65 ddd(6.4, 8.5, 11.9)	*β* 3.65 ddd(6.4, 8.5, 11.9)	*β* 3.65 ddd(6.4, 8.7, 11.9)	*β* 3.65 ddd(6.4, 8.5, 11.6)
6	1.85	1.85	1.85	1.86	1.87
7	*α* 1.29, *β* 1.68	*α* 1.31, *β* 1.68	*α* 1.31, *β* 1.68	*α* 1.34, *β* 1.69	*α* 1.32, *β* 1.69
8	1.55	1.56	1.56	1.56	1.55
10	1.55	1.57	1.57	1.57	1.57
11	*α* 1.35, *β* 1.59	*α* 1.36, *β* 1.61	*α* 1.36, *β* 1.61	*α* 1.34, *β* 1.61	*α* 1.35, *β* 1.60
12	*α* 1.55, *β* 1.75	*α* 1.55, *β* 1.76	*α* 1.55, *β* 1.76	*α* 1.58, *β* 1.75	*α* 1.57, *β* 1.75
15	*α* 1.06, *β* 1.15	*α* 1.05, *β* 1.18	*α* 1.05, *β* 1.18	*α* 1.04, *β* 1.16	*α* 1.06, *β* 1.17
16	*α* 1.32, *β* 1.92	*α* 1.28, *β* 1.93	*α* 1.28, *β* 1.93	*α* 1.28, *β* 1.90	*α* 1.32, *β* 1.93
17	1.49	1.50	1.50	1.48	1.49
18	0.79 s	0.80 s	0.80 s	0.79 s	0.79 s
19	1.08 s	1.08 s	1.08 s	1.08 s	1.08 s
20	1.45	1.50	1.47	1.43	1.49
21	0.92 d(6.0)	0.92 d(6.1)	0.92 d(6.1)	0.91 d(6.4)	0.89 d(6.1)
22	1.00, 1.77	1.10, 1.62	1.20, 1.47	1.05, 1.43	1.75, 2.17
23	1.14, 1 58	1.41, 1.55	1.36, 1.62	1.86, 2.04	5.59
24	3.29 d(9.8)	2.68 dt(1.5, 6.4)	2.68 dt(1.5, 6.4)	5.09 tt(1.4, 6.0)	5.59
26	1.16 s	1.26 s	1.26 s	1.68 s	1.31 s
27	1.22 s	1.31 s	1.31 s	1.60 s	1.31 s
28	1.27 s	1.27 s	1.27 s	1.27 s	1.27 s
29	1.30 s	1.31 s	1.31 s	1.30 s	1.30 s
30	0.86 s	0.86 s	0.86 s	0.85 s	0.85 s

Table 11-5-7: ^{1}H NMR spectroscopic data of tirucallane-type triterpenoid **11-5-26**.

H	11-5-26	H	11-5-26	H	11-5-26
1	1.30, 1.77	15	1.55, 1.19	23	1.89, 2.10
2	1.72, 1.63	16	1.33, 1.91	25	2.23 sept(6.7)
3	4.50 dd(4.3, 11.6)	17	1.51	26	1.02 d(6.7)
5	1.22 br d(11.9)	18	0.75 s	27	1.03 d(7.0)

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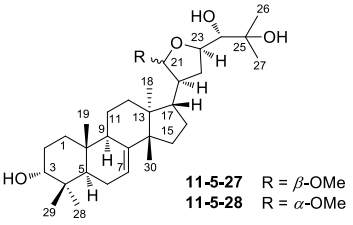
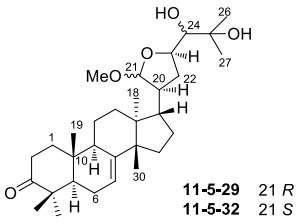
Table 11-5-7 (continued)

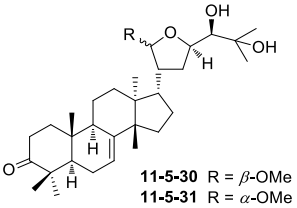
H	11-5-26	H	11-5-26	H	11-5-26
6	1.69, 1.43	19	0.88 s	28	0.88 s
7	1.94, 2.11	20	1.42	29	0.87 s
11	2.06, 1.91	21	0.93 d(6.4)	30	0.87 s
12	1.70 (2H)	22	1.11, 1.56	31	4.66 s, 4.71 s
OAc	2.05 s				

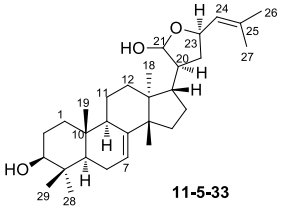
Table 11-5-8: Compounds, MFs, and test solvents of tirucallane-type triterpenoids **11-5-27**~**11-5-35**.

No.	Compounds	MFs	Test solvents	References
11-5-27	agladupol D	$C_{31}H_{52}O_5$	$CDCl_3$	[57]
11-5-28	agladupol E	$C_{31}H_{52}O_5$	$CDCl_3$	[57]
11-5-29	–	$C_{31}H_{50}O_5$	$CDCl_3$	[58]
11-5-30	21β-methylmelianodiol	$C_{31}H_{50}O_5$	$CDCl_3$	[51]
11-5-31	21α-methylmelianodiol	$C_{31}H_{50}O_5$	$CDCl_3$	[51]
11-5-32	–	$C_{31}H_{50}O_5$	$CDCl_3$	[58]
11-5-33	3-*epi*-flindissol	$C_{30}H_{48}O_3$	$CDCl_3$	[59]
11-5-34	dubione B	$C_{30}H_{44}O_4$	$CDCl_3$	[54]
11-5-35	dubione A	$C_{30}H_{44}O_4$	$CDCl_3$	[54]









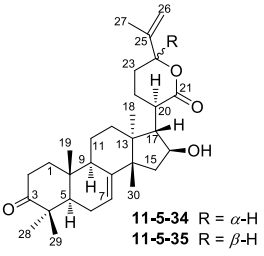


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Table 11-5-9: ^{1}H NMR spectroscopic data of tirucallane-type triterpenoids **11-5-27**~**11-5-31**.

H	11-5-27	11-5-28	11-5-29	11-5-30	11-5-31
1	*α* 1.45 m	*α* 1.46 m	*α* 1.46 td(14.1, 4.0)	–	–
	β 1.33 m	*β* 1.36 m	*β* 1.98 m		
2	*α* 1.58 m	*α* 1.58 m	*α* 2.25 dt(14.1, 3.5)	2.25 m	2.23 m
	β 1.89 m	*β* 1.90 m	*β* 2.76 td(14.5, 5.5)	2.75 dt(14.4, 5.4)	2.74 dt(14.4, 5.4)
3	3.47 br s	3.43 d(2.9)			
5	1.73 m	1.76 m	1.72 dd(9.9, 7.5)	1.71 m	1.70 m
6	*α* 1.98 m, *β* 1.91 m	*α* 1.92 m, *β* 2.02 m	2.05~2.15 m	2.05 m	2.07 m
7	5.27 br s	5.23 br s	5.31 q(3.2)	5.28 br d(2.8)	5.27 br d(2.8)
9	2.30 m	2.34 m	2.31 m	2.27 m	2.28 m
11	*α* 1.55 m, *β* 1.47 m	*α* 1.50 m, *β* 1.57 m	1.51~1.65 m	1.55 m	1.56 m
12	*α* 1.27 m, *β* 1.84 m	*α* 1.51 m, *β* 1.71 m	*α* 1.33 m, *β* 1.90 m	–	–
15	1.49 m	*α* 1.71 m, *β* 1.92 m	1.48~1.62 m	–	–
16	*α* 1.26 m, *β* 1.84 m	*α* 1.25 m, *β* 1.90 m	*α* 1.32 m, *β* 1.90 m	–	–
17	1.98 m	1.74 m	2.04 m	1.98 m	1.73 m
18	0.85 s	0.86 s	0.83 s	0.98 s	0.98 s
19	0.78 s	0.77 s	1.01 s	0.81 s	0.82 s
20	1.96 m	2.15 m	1.98 m	1.98 m	1.98 m
21	4.71 br s	4.76 d(3.3)	*α* 4.69 d(3.7)	4.71 br s	4.75 br s
22	1.88 m	1.49 m	1.85~1.98 m	1.90 m	1.90 m
23	4.43 m	4.19 m	4.42 m	4.40 dt(2.8, 8.4)	4.20 dt(2.9, 8.3)
24	3.18 br d(7.9)	3.22 d(5.4)	3.17 dd(8.1, 2.0)	3.31 br s	3.22 br s
26	1.28 s	1.27 s	1.26 s	1.22 s	1.24 s
27	1.28 s	1.30 s	1.27 s	1.24 s	1.27 s
28	0.94 s	0.93 s	1.12 s	1.09 s	1.09 s
29	0.92 s	0.91 s	1.02 s	1.01 s	1.01 s
30	1.00 s	0.98 s	1.04 s	1.00 s	0.99 s
OMe	3.37 s	3.31 s	3.35 s	3.31 s(C21)	3.31 s(C21)

Table 11-5-10: ^{1}H NMR spectroscopic data of tirucallane-type triterpenoids **11-5-32**~**11-5-35**.

H	11-5-32	11-5-33	11-5-34	11-5-35
1	*α* 1.46 m	*α* 1.13	*α* 1.45 br td(14.4, 3.9)	*α* 1.44 br td(14.4, 3.9)
	β 1.99 ddd(13.4, 5.5, 3.1)	*β* 1.66	*β* 1.99 ddd(14.4, 5.5, 3.0)	*β* 1.99 ddd(14.4, 5.5, 3.0)
2	*α* 2.25 dt(14.1, 3.5)	*α* 1.64	*α* 2.25 ddd(14.4, 3.9, 3.0)	*α* 2.24 ddd(14.4, 3.9, 3.0)
	β 2.76 td(14.5, 5.5)	*β* 1.60	*β* 2.77 td(14.4, 5.5)	*β* 2.76 td(14.4, 5.5)

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Table 11-5-10 (continued)

H	11-5-32	11-5-33	11-5-34	11-5-35
3		3.24 dd(11.2, 3.9)		
5	1.72 m	1.31	1.72 dd(10.8, 6.8)	1.71 dd(10.8, 6.8)
6	*α* 2.06~2.13 m	*α* 2.14	*α* 2.113 ddd(14.0, 6.8, 3.2)	*α* 2.11 ddd(14.0, 6.8, 3.2)
	β 2.06~2.13 m	*β* 1.97	*β* 2.107 ddd(14.0, 10.8, 3.2)	*β* 2.10 ddd(14.0, 10.8, 3.2)
7	5.31 q(3.1)	5.27	5.37 br q(3.2)	5.38 br q(3.2)
9	2.32 m	2.22~2.24	2.26 m	2.22 m
11	1.54~1.66 m	1.54, 1.50	*α* 1.57 m, *β* 1.67 m	*α* 1.58 m, *β* 1.66 m
12	*α* 1.57 m	1.72, 1.74	*α* 1.56 m	*α* 1.59 m
	β 1.76 m		*β* 1.90 br dd(13.0)	*β* 1.92 br dd(13.0)
15	1.47~1.60 m	1.48, 1.54	*α* 2.06 br dd(13.3, 8.5)	*α* 2.09 br dd(13.3, 8.6)
			β 1.76 br d(13.3)	*β* 1.76 br d(13.3)
16	*α* 1.30 m	1.30, 1.88	4.01 br dd(8.6, 4.8)	4.20 br dddd(8.6, 4.8, 1.6, 1.0)
	β 1.94 m			
17	1.79 m	1.79	2.09 dd(10.8, 4.8)	2.04 dd(11.6, 4.8)
18	0.85 s	0.90 s	0.91 s	0.89 s
19	1.01 s	0.75 s	1.03 s	1.03 s
20	2.17 m	2.20	2.68 td(10.8, 8.2)	2.56 td(11.6, 6.4)
21	*β* 4.78 d(3.6)	5.30 d(3.3)		
22	*α* 1.94 m	1.26, 2.12	*α* 2.27 dddd(14.0, 10.2, 8.2, 6.9)	*α* 2.22 ddt(14.4, 6.4, 4.3)
	β 1.75 m		*β* 1.57 dtd(14.0, 10.8, 4.0)	*β* 1.65 dtd(14.4, 11.6, 4.3)
23	4.22 ddd(10.6, 5.0, 1.7)	4.81 ddd(10.4, 8.6, 4.6)	*α* 2.00 ddt(14.4, 10.2, 4.0)	*α* 1.80 br dddd(14.4, 11.6, 10.0, 4.3)
			β 1.804 dddd(14.4, 11.7, 10.8, 6.9)	
				β 2.05 ddt(14.4, 5.0, 4.3)
24	3.24 br s	5.14 dm(7.3, 1.2)	4.75 br dd(11.7, 4.0)	4.79 br dd(10.0, 5.0)
26	1.26 s	1.73 s	4.99 br quint(1.2)	4.97 br qd(2.0, 1.0)
			5.09 br sept(1.2)	5.04 br sept(1.0)
27	1.29 s	1.70 s	1.806 s	1.79 br s
28	1.11 s	0.97 s	1.05 s	1.05 s
29	1.01 s	0.86 s	1.13 s	1.13 s
30	1.04 s	0.98 s	1.33 br d(0.9)	1.31 br d(0.9)
OMe	3.34 s			
OH			4.81 br s(16-OH)	4.55 br s(16-OH)

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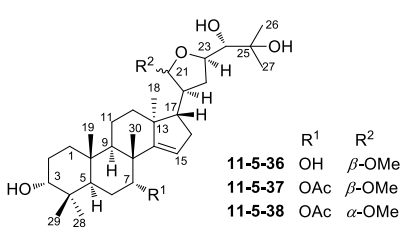
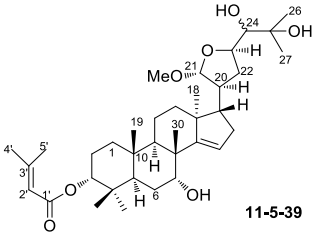
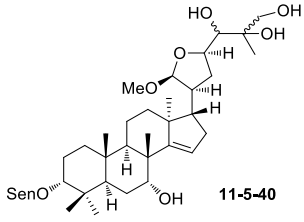
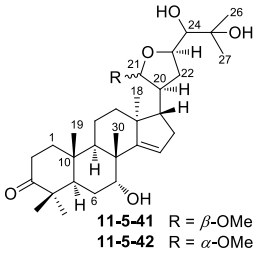
Table 11-5-11: Compounds, MFs, and test solvents of tirucallane-type triterpenoids **11-5-36**~**11-5-52**.

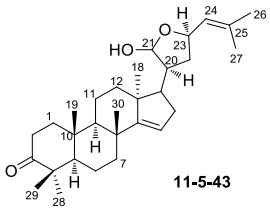
No.	Compounds	MFs	Test solvents	References
11-5-36	agladupol A	$C_{31}H_{52}O_6$	$CDCl_3$	[57]
11-5-37	agladupol B	$C_{33}H_{54}O_7$	$CDCl_3$	[57]
11-5-38	agladupol C	$C_{33}H_{54}O_7$	$CDCl_3$	[57]
11-5-39	–	$C_{36}H_{58}O_7$	$CDCl_3$	[58]
11-5-40	–	$C_{36}H_{58}O_8$	$CDCl_3$	[58]
11-5-41	–	$C_{31}H_{50}O_6$	$CDCl_3$	[58]
11-5-42	–	$C_{31}H_{50}O_6$	$CDCl_3$	[58]
11-5-43	21,23-epoxy-7*α*,21-dihydroxyapotirucalla-14,24-dien-3-one	$C_{30}H_{46}O_3$	$CDCl_3$	[59]
11-5-44	dysorone B	$C_{30}H_{46}O_4$	$CDCl_3$	[60]
11-5-45	dysorone D	$C_{30}H_{44}O_3$	$CDCl_3$	[60]
11-5-46	dysorone A	$C_{30}H_{44}O_4$	$CDCl_3$	[60]
11-5-47	dysorone E	$C_{30}H_{42}O_4$	$CDCl_3$	[60]
11-5-48	dysorone C	$C_{30}H_{42}O_3$	$CDCl_3$	[60]
11-5-49	3-*epi*-skimmiarepin A	$C_{35}H_{56}O_6$	$CDCl_3$	[59]
11-5-50	–	$C_{35}H_{56}O_6$	$CDCl_3$	[58]
11-5-51	–	$C_{35}H_{58}O_7$	$CDCl_3$	[58]
11-5-52	–	$C_{35}H_{52}O_6$	$CDCl_3$	[58]

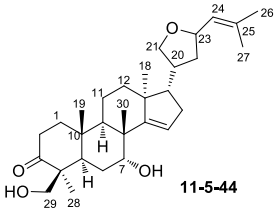


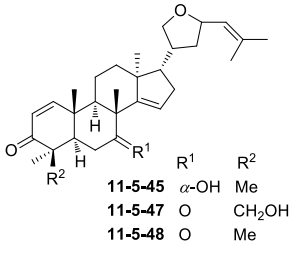












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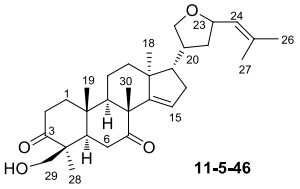

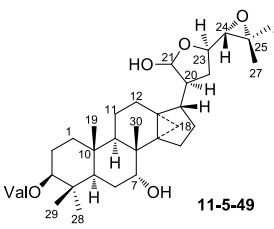

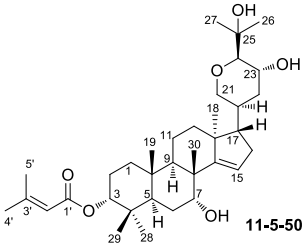

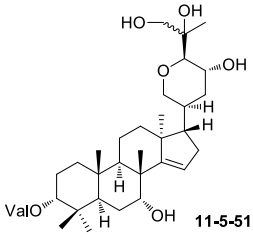

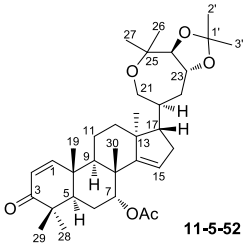

Table 11-5-12: ^{1}H NMR spectroscopic data of tirucallane-type triterpenoids **11-5-36**~**11-5-40**.

H	11-5-36	11-5-37	11-5-38	11-5-39	11-5-40
1	*α* 1.34 m, *β* 1.31 m	*α* 1.36 m, *β* 1.36 m	*α* 1.32 m, *β* 1.32 m	*α* 1.28 m, *β* 1.36 m	*α* 1.27 m, *β* 1.37 m
2	*α* 1.55 m, *β* 1.90 m	*α* 1.57 m, *β* 1.94 m	*α* 1.51 m, *β* 1.90 m	*α* 1.62 m, *β* 1.91 m	*α* 1.62 m, *β* 1.92 m
3	3.42 dd(2.9, 2.4)	3.42 br s	3.37 br s	4.70 t(2.6)	4.70 t(2.6)
5	1.94 m	1.83 m	1.78 m	2.02 m	2.01 m
6	*α* 1.69 m *β* 1.69 m	*α* 1.62 m *β* 1.74 m	*α* 1.60 m *β* 1.70 m	*α* 1.68~1.79 m *β* 1.68~1.79 m	*α* 1.66~1.79 m *β* 1.66~1.79 m
7	3.92 dd(2.8, 2.6)	5.17 br s	5.11 br s	3.91 s-like	3.92 s-like
9	1.99 m	2.02 m	1.99 m	2.03 m	1.99 m
11	*α* 1.48 m, *β* 1.71 m	*α* 1.71 m, *β* 1.48 m	*α* 1.68 m, *β* 1.42 m	*α* 1.73 m, *β* 1.51 m	*α* 1.71 m, *β* 1.51 m
12	*α* 1.58 m, *β* 1.50 m	*α* 1.58 m, *β* 1.48 m	*α* 1.41 m, *β* 1.41 m	*α* 1.80 m, *β* 1.46 m	*α* 1.50 m, *β* 1.59 m
15	5.46 br s	5.21 br s	5.15 br s	*α* 5.45 d(2.2)	*α* 5.48 br s
16	*α* 2.13 m *β* 2.13 m	*α* 1.94 m *β* 2.05 m	*α* 1.91 m *β* 2.05 m	*α* 2.13 m *β* 2.22 ddd(15.5, 7.3, 3.6)	*α* 2.10~2.22 m *β* 2.10~2.22 m

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Table 11-5-12 (continued)

H	11-5-36	11-5-37	11-5-38	11-5-39	11-5-40
17	1.97 m	1.91 m	1.62 m	1.73 m	1.98 m
18	1.03 s	1.00 s	0.98 s	1.08 s	1.04 s
19	0.90 s	0.90 s	0.86 s	0.92 s	0.92 s
20	2.16 m	2.14 m	2.25 m	2.35 m	2.20 m
21	4.77 d(4.1)	4.75 br d(4.2)	4.75 d(3.6)	*β* 4.80 d(3.7)	*α* 4.80 d(4.2)
22	*α* 1.90 m *β* 1.95 m	*α* 1.87 m *β* 1.87 m	*α* 1.84 m *β* 1.73 m	*α* 1.92 m *β* 1.82 m	*α* 1.87~2.04 m *β* 1.87~2.04 m
23	4.45 ddd(1.9, 6.7 8.9)	4.43 m	4.19 m	4.26 ddd(10.6, 4.8, 1.6)	4.51 br t(8.7)
24	3.18 d(1.9)	3.16 d(8.1)	3.20 d(7.2)	3.25 dd(9.9, 1.7)	3.35 dd(7.2, 1.1)
26	1.25 s	1.26 s	1.21 s	1.27 s	3.57 d-like(6.6)(2H)
27	1.25 s	1.26 s	1.25 s	1.30 s	1.23 s
28	0.96 s	0.85 s	0.80 s	0.86 s	0.86 s
29	0.86 s	0.83 s	0.78 s	0.91 s	0.91 s
30	1.05 s	1.08 s	1.04 s	1.06 s	1.06 s
OMe	3.35 s	3.36 s	3.31 s	3.36 s	3.40 s
OAc		1.95 s	1.91 s		
2′				5.77 m	5.77 m
4′				1.89 d(1.1)	1.89 d(1.2)
5′				2.17 d(1.1)	2.17 d(1.2)

Table 11-5-13: ^{1}H NMR spectroscopic data of tirucallane-type triterpenoids **11-5-41**~**11-5-45**.

H	11-5-41	11-5-42	11-5-43	11-5-44	11-5-45
1	*α* 1.52 m, *β* 1.87 m	*α* 1.52 m, *β* 1.86 m	1.86, 1.52	–	7.14 d(10)
2	*α* 2.43 ddd(15.9, 7.3, 3.8) *β* 2.53 ddd(15.9, 10.2, 7.5)	*α* 2.43 ddd(16.0, 7.3, 3.9) *β* 2.52 ddd(16.0, 10.1, 7.3)	2.53 2.44	–	5.82 d(10)
5	2.08 m	2.09 dd(12.4, 3.2)	2.08	–	–
6	*α* 1.74~1.89 m *β* 1.74~1.89 m	*α* 1.74~1.88 m *β* 1.74~1.88 m	1.84 1.79	–	–
7	3.95 s-like	3.95 s-like	3.96	*β* 3.94 t(3, 3)	*β* 3.97 t(3, 3)
9	2.03 m	2.04 dd(11.9, 7.3)	2.03	–	–
11	*α* 1.72 m, *β* 1.61 m	*α* 1.75 m, *β* 1.59 m	1.72, 1.58	–	–
12	*α* 1.54 m, *β* 1.61 m	*α* 1.82 m, *β* 1.48 m	2.00, 1.48	–	–
15	*α* 5.49 d(1.6)	*α* 5.47 d(2.3)	5.48	*β* 5.48 m(8)	*β* 5.49 m(8)
16	*α* 2.14 m *β* 2.17 m	*α* 2.12 m *β* 2.22 ddd(15.6, 7.3, 3.7)	2.20~2.10	–	–
17	2.01 m	1.74 m	1.74	–	–

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Table 11-5-13 (continued)

H	11-5-41	11-5-42	11-5-43	11-5-44	11-5-45
18	1.02 s	1.06 s	1.10	*α* 0.95 s	*α* 1.02 s
19	1.01 s	1.00 s	1.01 s	*β* 1.04 s	*β* 1.09 s
20	2.19 m	2.34 m	2.37	–	–
21	*α* 4.76 d(4.3)	*β* 4.80 d(3.6)	5.30	4.09 t(8, 8) 3.50 t(8, 8)	4.09 t(8, 8) 3.25 t(8, 8)
22	*α* 1.86~2.01 m *β* 1.86~2.01 m	*α* 1.92 m *β* 1.81 m	2.10 1.30	–	–
23	4.44 m	4.26 ddd(10.5, 4.6, 1.4)	4.84	4.62 m	4.61 m
24	3.17 d(6.2)	3.25 br s	5.13	5.22 d(10)	5.22 d(10)
26	1.27 s	1.26 s	1.74 s	1.72 s	1.71 s
27	1.28 s	1.30 s	1.72 s	1.69 s	1.69 s
28	1.10 s	1.10 s	1.10 s	1.08 s	*α* 1.16 s
29	1.05 s	1.05 s	1.05 s	3.94 d(12) 3.50 d(12)	*β* 1.13 s
30	1.09 s	1.09 s	1.10 s	1.30 s	*β* 1.09 s
OMe	3.37 s	3.35 s			

Table 11-5-14: ^{1}H NMR spectroscopic data of tirucallane-type triterpenoids **11-5-46**~**11-5-50**.

H	11-5-46	11-5-47	11-5-48	11-5-49	11-5-50
1	*α* 1.40 m *β* 2.01 m	7.33 d(10)	7.17 d(10)	1.61 1.04	*α* 1.26 m *β* 1.37 dt(12.8, 3.2)
2	2.58 m 2.58 m	6.05 d(10)	5.91 d(10)	1.67 1.61	*α* 1.62 m *β* 1.91 m
3				4.54 dd(11.4, 4.7)	4.69 t(2.6)
5	*α* 2.01 m	–	–	1.59	1.99 m
6	*α* 2.38 m *β* 2.89 t(14, 14)	*α* 2.48 dd(14, 3) *β* 2.96 t(14, 14)	*β* 2.89 t(14, 14)	1.73 1.59	*α* 1.69~1.78 m *β* 1.69~1.78 m
7				3.77 m	3.91 s-like
9	*α* 1.89 dd(12, 7)	–	–	1.23	2.02 m
11	1.73 m	–	–	1.28~1.33	*α* 1.68 m, *β* 1.49 m
12	1.60 m	–	–	2.10, 1.77	*α* 1.90 m, *β* 1.49 m
15	*β* 5.83 dd(2, 3)	6.08 m(8)	*β* 5.97 m(8)	1.92, 1.55	*α* 5.49 d(2.6)
16	2.65 dd(10, 3) 2.40 d(10)	–	–	1.67 0.89	*α* 2.11 m *β* 2.35 ddd(15.1, 7.1, 3.7)
17	*β* 1.50 m	–	–	2.20	2.02 m
18	*α* 0.98 s	*α* 0.98 s	0.98 s	0.66 d(4.3) 0.47 d(4.9)	1.00 s
19	*β* 1.23 s	*β* 1.48 s	1.10 s	0.90 s	0.91 s
20	2.38 m	2.35 m		1.88	1.92 m

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Table 11-5-14 (continued)

H	11-5-46	11-5-47	11-5-48	11-5-49	11-5-50
21	4.05 t(8, 8)	4.07 t(8, 8)	4.06 t(8, 8)	5.43 d(3.7)	*α* 3.44 dd(11.6, 2.5)
	3.26 t(8, 8)	3.28 t(8, 8)	3.28 t(8, 8)		*β* 3.99 d(11.6)
22	1.50 m	–	–	1.99, 1.69	*α* 1.55 m, *β* 2.05 m
23	4.62 m	4.64 m	4.63 m	3.89 dt(9.7, 7.2)	3.88 ddd(10.9, 9.0, 4.7)
24	5.23 dd(9, 1.2)	5.23 d(10)	5.23 d(10)	2.81 d(7.3)	2.90 d(9.0)
26	1.74 s	1.72 s	1.72 s	1.32 s	1.27 s
27	1.73 s	1.69 s	1.69 s	1.31 s	1.31 s
28	1.24 s	*α* 1.29 s	1.14 s	0.87 s	0.86 s
29	3.88 d(11)	3.85 d(12)	1.35 s	0.85 s	0.91 s
	3.58 d(11)	3.62 d(12)			
30	1.37 s	1.48 s	1.38 s	1.04 s	1.08 s
2′				2.18 d(6.7)	5.77 m
3′				2.10 m	
4′				0.96 d(6.7)	1.89 d(1.1)
5′				0.96 d(6.7)	2.17 d(1.1)

Table 11-5-15: ^{1}H NMR spectroscopic data of tirucallane-type triterpenoids **11-5-51** and **11-5-52**.

H	11-5-51	11-5-52	H	11-5-51	11-5-52
1	*α* 1.22 m	7.16 d(10.2)	20	1.94 m	1.81 m
	β 1.37 dt(12.7, 3.2)				
2	*α* 1.60 m	5.85 d(10.2)	21	*α* 3.46 dd(11.5, 2.2)	3.62 s(2H)
	β 1.90 m			*β* 4.00 d(11.5)	
3	4.65 t(2.5)		22	*α* 1.57 m	*α* 1.56 m
				β 2.08 m	*β* 2.10 m
5	1.98 dd(11.9, 3.3)	2.19 dd(13.1, 2.1)	23	3.94 ddd(11.1, 9.1, 4.8)	4.03 ddd(11.2, 9.0, 2.9)
6	*α* 1.67-1.78 m	*α* 1.78 dt(14.8, 2.8)	24	3.09 d(9.1)	3.66 d(9.0)
	β 1.67-1.78 m	*β* 1.95 m			
7	3.91 s-like	5.23 s-like	26	3.70 d(11.2)	1.17 s
				3.49 d(11.2)	
9	2.01 m	2.21 m	27	1.23 s	1.30 s
11	*α* 1.69 m, *β* 1.49 m	*α* 1.90 m, *β* 1.69 m	28	0.85 s	1.07 s
12	*α* 1.89 m, *β* 1.48 m	*α* 1.90 m, *β* 1.69 m	29	0.90 s	1.07 s
15	*α* 5.50 d(2.5)	*α* 5.31 d(2.2)	30	1.08 s	1.20 s
16	*α* 2.12 m	*α* 1.98 m	2′	2.23 dd(14.6, 7.5)	1.38 s
	β 2.35 ddd(15.3, 7.1, 3.7)	*β* 2.27 ddd(14.8, 6.9, 3.6)		2.21 dd(14.6, 6.9)	
17	2.01 m	2.08 m	3′	2.10 m	1.39 s
18	1.01 s	0.97 s	4′	0.95 d(6.6)	
19	0.90 s	1.17 s	5′	0.95 d(6.5)	
OAc		1.94 s			

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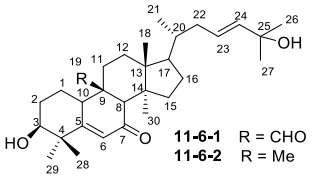
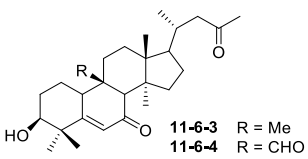
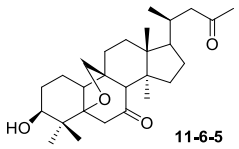
11.6 Cucurbitane-type triterpenoids

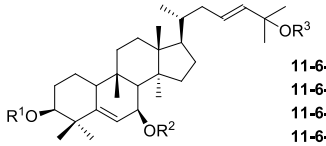
Table 11-6-1: Compounds, MFs, and test solvents of cucurbitane-type triterpenoids **11-6-1**~**11-6-14**.

No.	Compounds	MFs	Test solvents	References
11-6-1	kuguacin A	$C_{30}H_{46}O_4$	–	[61]
11-6-2	kuguacin B	$C_{30}H_{48}O_3$	–	[61]
11-6-3	kuguacin C	$C_{27}H_{42}O_3$	C_5D_5N	[61]
11-6-4	kuguacin D	$C_{27}H_{40}O_4$	$CDCl_3$	[61]
11-6-5	kuguacin E	$C_{27}H_{42}O_4$	C_5D_5N	[61]
11-6-6	cucurbita-5,23(*E*)-diene-3β,7β,25-triol	$C_{30}H_{50}O_3$	$CDCl_3$	[62]
11-6-7	3β-acetoxy-7β-methoxycucurbita-5,23(*E*)-dien-25-ol	$C_{33}H_{54}O_4$	$CDCl_3$	[62]
11-6-8	3β,25-dihydroxy-7β-methoxycucurbita-5,23(*E*)-diene	$C_{31}H_{52}O_3$	$CDCl_3$	[62]
11-6-9	3β-hydroxy-7β,25-dimethoxycucurbita-5,23(*E*)-diene	$C_{32}H_{54}O_3$	$CDCl_3$	[62]
11-6-10	cucurbita-5(10),6,23(*E*)-triene-3β,25-diol	$C_{30}H_{48}O_2$	$CDCl_3$	[62]
11-6-11	cucurbita-5,24-diene-3,7,23-trione	$C_{30}H_{44}O_3$	$CDCl_3$	[62]
11-6-12	antiquol B acetate	$C_{32}H_{52}O_2$	$CDCl_3$	[63]
11-6-13	leucopaxillone A	$C_{34}H_{54}O_7$	$CDCl_3$	[64]
11-6-14	leucopaxillone B	$C_{34}H_{52}O_8$	$CDCl_3$	[64]

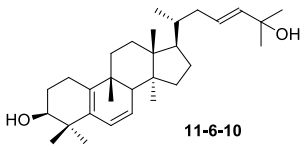


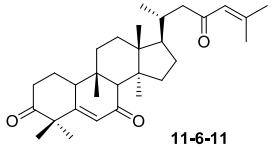


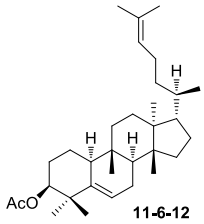


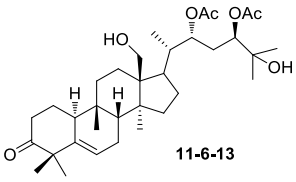


	R^1	R^2	R^3
11-6-6	H	H	H
11-6-7	Ac	Me	H
11-6-8	H	Me	H
11-6-9	H	Me	Me









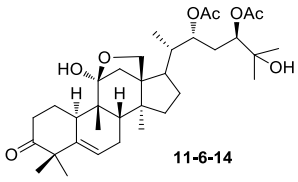


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Table 11-6-2: ^{1}H NMR spectroscopic data of cucurbitane-type triterpenoids **11-6-1**~**11-6-5**.

H	11-6-1	11-6-2	11-6-3	11-6-4	11-6-5
1	1.74 m, 1.84 m	1.75 m	1.76 m	1.93 m, 2.06 m	1.51 m, 1.76 m
2	1.85 m, 2.01 m	1.78 m, 1.97 m	1.81 m, 2.00 m	1.93 m, 2.09 m	1.78 m, 1.80 m
3	3.67 s	3.64 s	3.65 br s	3.82 br s	3.56 s
6	6.19 br s	6.08 br s	6.08 s	6.48 s	2.49 d(17.9) 2.96 d(17.9)
8	2.47 s	2.38 s	2.40 s	2.71 s	2.72 s
10	2.89 m	2.67 t-like(8.3)	2.70 m	3.06 br s	2.70 dd(6.7, 11.6)
11	1.77 m, 2.16 m	1.45 m, 1.74 m	1.49 m, 1.77 m	1.78 m, 2.20 m	1.27 m, 1.61 m
12	1.66 m	1.57 m, 1.73 m	1.56 m, 1.72 m	1.63 m	1.50 m, 1.61 m
15	1.26 m, 1.65 m	1.09 m, 1.57 m	1.08 m, 1.55 m	1.26 m, 1.74 m	1.41 m, 1.77 m
16	1.29 m, 1.77 m	1.27 m, 1.81 m	1.28 m, 1.82 m	1.20 m, 1.78 m	1.26 m, 1.78 m
17	1.53 m	1.45 m	1.46 m	1.49 m	1.49 m
18	0.87 s	0.86 s	0.90 s	0.74 s	0.76 s
19	9.56 s	0.95 s	0.96 s	9.91 s	3.55 d(8.5) 3.85 d(8.5)
20	1.56 m	1.47 m	2.03 m	2.05 m	2.12 m
21	0.90 d(6.0)	0.87 d(6.5)	0.90 d(6.4)	0.94 d(6.1)	0.92 (ov)
22	1.78 m, 2.14 m	1.76 m, 2.13 m	2.10 m 2.44 br d(15.7)	2.07 (ov) 2.43 d(14.2)	2.10 m 2.43 d(13.5)
23	5.56 m	5.56 m			
24	5.56 m	5.56 m	2.11 s	2.09 s	2.10 s
26	1.29 s	1.28 s			
27	1.29 s	1.28 s			
28	1.28 s	1.23 s	1.24 s	1.41 s	1.27 s
29	1.15 s	1.12 s	1.13 s	1.19 s	0.86 s
30	0.83 s	0.81 s	0.82 s	0.92 s	0.92 s

Table 11-6-3: ^{1}H NMR spectroscopic data of cucurbitane-type triterpenoids **11-6-6**~**11-6-10**.

H	11-6-6	11-6-7	11-6-8	11-6-9	11-6-10
1	1.52 m, 1.56 m	1.46 m, 1.60 m	1.46 m, 1.56 m	1.44 m, 1.56 m	2.10 m, 2.22 m
2	1.74 m, 1.94 m	1.75 m, 1.84 m	1.70 m, 1.86 m	1.60 m, 1.84 m	1.90 m
3	3.53 br s	4.73 br s 1.98 s(OAc)	3.47 br s	3.48 t(3.2)	3.42 dd(10.0, 3.2)
6	5.80 d(6.4)	5.75 d(5.2)	5.80 d(5.2)	5.81 d(5.2)	6.02 d(9.6)
7	3.92 d(6.4)	3.40 d(5.2)	3.39 d(5.2)	3.39 d(4.4)	5.54 m
8	1.98 s	2.04 s	2.08 s	2.02 s	2.17 m
10	2.28 dd(10.0, 6.0)	2.25 dd(9.2, 5.2)	2.23 dd(12.0, 4.8)	2.24 dd(12.0, 4.8)	
11	1.44 m, 1.62 m	1.48 m, 1.60 m	1.40 m, 1.60 m	1.40 m, 1.60 m	1.38 m, 1.76 m
12	1.48 m, 1.62 m	1.48 m, 1.58 m	1.47 m, 1.64 m	1.45 m, 1.60 m	1.36 m, 1.48 m
15	1.30 m, 1.34 m	1.32 m	1.30 m	1.28 m, 1.32 m	1.16 m, 1.24 m
16	1.32 m, 1.88 m	1.30 m, 1.88 m	1.36 m, 1.88 m	1.36 m, 1.90 m	1.28 m, 1.86 m

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Table 11-6-3 (continued)

H	11-6-6	11-6-7	11-6-8	11-6-9	11-6-10
17	1.48 m	1.48 m	1.45 m	1.45 m	1.45 m
18	0.88 s	0.91 s	0.89 s	0.90 s	0.85 s
19	1.04 s	0.96 s	0.95 s	0.96 s	0.92 s
20	1.48 m	1.50 m	1.50 m	1.52 s	1.48 m
21	0.85 d(6.4)	0.87 d(6.0)	0.85 d(6.0)	0.87 d(6.0)	0.84 d(7.2)
22	1.70 m, 2.14 m	1.73 m, 2.11 m	1.70 m, 2.12 m	1.76 m, 2.16 m	1.73 m, 2.13 m
23	5.56 m	5.57 m	5.55 m	5.48 m	5.55 m
24	5.56 m	5.57 m	5.55 m	5.36 d(16.0)	5.59 m
26	1.28 s	1.29 s	1.26 s	1.22 s	1.28 s
27	1.28 s	1.29 s	1.26 s	1.22 s	1.28 s
28	1.01 s	1.04 s	1.00 s	1.00 s	1.02 s
29	1.18 s	1.09 s	1.17 s	1.18 s	0.95 s
30	0.66 s	0.69 s	0.66 s	1.00 s	0.70 s
OMe		3.34 s(7-OMe)	3.31 s(7-OMe)	3.31 s(7-OMe) 3.12 s(25-OMe)	

Table 11-6-4: ^{1}H NMR spectroscopic data of cucurbitane-type triterpenoids **11-6-11**~**11-6-14**.

H	11-6-11	11-6-12	11-6-13	11-6-14
1	1.62 m, 2.10 m	1.47, 1.57	*α* 2.09 br *β* 1.38~1.48 m	*α* 1.79~1.93 m *β* 1.66~1.72 m
2	2.50 m, 2.64 m	1.76, 1.84	*α* 2.52~2.61 m *β* 2.34~2.43 m	*α* 2.60 m(11.6, 6.5) *β* 2.35 m
3		4.70 t(3.1)		
6	6.15 d(2.0)	5.56 d(5.2)	5.67 br	5.67 br d(4.2)
7		1.65, 2.08	*α* 2.34~2.43 m *β* 1.74~1.86 m	*α* 1.79~1.93 m *β* 2.42 m
8	2.41 s	1.67 dd(4.4, 11.4)	1.74~1.86 m	1.66~1.72 m
10	2.88 ddd(11.2, 4.8, 2.0)	2.10 br d(11.0)	2.52~2.61 m	2.66 br d(11.3)
11	1.60 m, 1.78 m	1.53 (2H)	*α* 1.38~1.48 m *β* 1.74~1.86 m	
12	1.62 m, 1.72 m	1.55, 1.76	*α* 1.51~1.57 m *β* 2.03 br	*α* 2.48 d(12.1) *β* 1.79~1.93 m
15	1.12 m, 1.58 m	1.13, 1.22	*α* 2.01 br *β* 1.62~1.73 m	2.54 br
16	1.32 m, 1.82 m	1.30, 1.88	*α* 1.00 br *β* 1.32 dd(10.6, 12.5)	1.40 br
17	1.50 m	1.54	1.51~1.57 m	1.79~1.93 m
18	0.92 s	0.81 s	4.07 d(13.6) 3.53 d(13.6)	3.90 d(8.5) 3.66 d(8.5)
19	0.93 s	0.84 s	0.89 s	1.02 s
20	2.08 s	1.52	2.11 br	1.77 d(12.2)
21	0.90 d(5.6)	0.86 d(6.1)	1.03 d(7.5)	1.00 d(7.5)

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Table 11-6-4 (continued)

H	11-6-11	11-6-12	11-6-13	11-6-14
22	2.10 m, 2.50 m	1.11, 1.58	4.89 d(10.0)	4.79 d(9.8)
23		1.83, 2.01	1.62~1.86 m	1.79~1.93 m 1.46~1.56 m
24	6.02 br s	5.10 t(7.0)	4.86 d(10.0)	4.86 d(9.7)
26	1.86 s	1.69 s	1.22 s	1.22 s
27	1.86 s	1.61 s	1.21 s	1.21 s
28	1.31 s	1.08 s	0.89 s	0.86 s
29	1.33 s	1.05 s	1.20 s	1.26 s
30	0.87 s	0.88 s	1.25 s	1.24 s
OH			1.14 br	1.46~1.56 br
OAc		2.02 s	2.03 s, 2.09 s	2.04 s, 2.07 s

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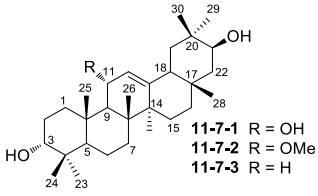
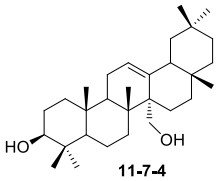
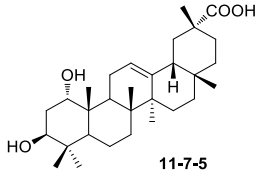
11.7 Oleanane-type triterpenoids

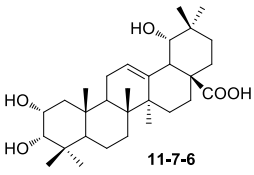
Table 11-7-1: Compounds, MFs, and test solvents of oleanane-type triterpenoids **11-7-1**~**11-7-14**.

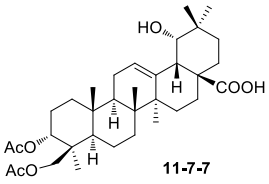
No.	Compounds	MFs	Test solvents	References
11-7-1	3*α*,11*α*,21*β*-trihydroxy olean-12-ene	$C_{30}H_{50}O_3$	$CDCl_3$	[65]
11-7-2	3*α*,21*β*-dihydroxy-11*α*-methoxy-olean-12-ene	$C_{31}H_{52}O_3$	$CDCl_3$	[65]
11-7-3	3*α*,21*β*-dihydroxy olean-12-ene	$C_{30}H_{50}O_2$	$CDCl_3$	[65]
11-7-4	3*β*,27-dihydroxyolean-12-ene	$C_{30}H_{50}O_2$	$CDCl_3$	[66]
11-7-5	1*α*,3*β*-dihydroxyolean-12-en-29-oic acid	$C_{30}H_{48}O_4$	C_5D_5N	[67]
11-7-6	2*α*,3*α*,19*α*-trihydroxy-olean-12-en-28-oic acid	$C_{30}H_{48}O_5$	C_5D_5N	[68]
11-7-7	3,24-diacetate 3-*epi*-spathodic acid	$C_{34}H_{52}O_7$	C_5D_5N	[69]
11-7-8	3*β*,16*β*,23-triacetoxyolean-12-en-28-oic acid	$C_{36}H_{54}O_8$	$CDCl_3$	[70]
11-7-9	3,23-disulfate ester of 29-hydroxyhederagenin	$C_{30}H_{48}O_{11}S_2$	CD_3OD	[71]
11-7-10	3,23-disulfate ester of stachlic acid A	$C_{30}H_{48}O_{12}S_2$	CD_3OD	[71]
11-7-11	3*α*,23-isopropylidenedioxyolean-12-en-27-oic acid	$C_{33}H_{52}O_4$	$CDCl_3$	[72]
11-7-12	3*β*-acetoxy-1*β*-(2-hydroxy-2-propoxy)-11*α*-hydroxy-olean-12-ene	$C_{35}H_{58}O_5$	CD_3COCD_3	[73]
11-7-13	3*β*-acetoxy-11*α*-ethoxy-1*β*-hydroxy-olean-12-ene	$C_{34}H_{56}O_4$	CD_3COCD_3	[73]
11-7-14	3*β*-acetoxy-1*β*-hydroxy-11*α*-methoxy-olean-12-ene	$C_{33}H_{54}O_4$	$CDCl_3$	[73]

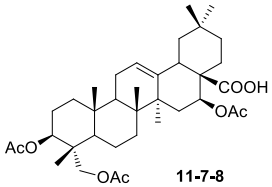


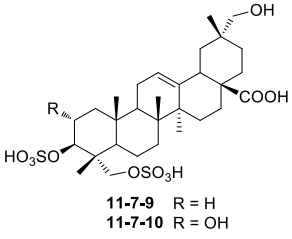


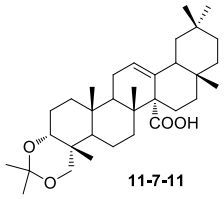












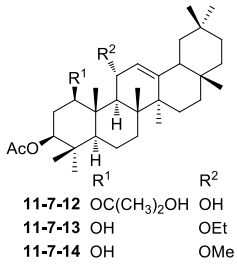


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Table 11-7-2: ^{1}H NMR spectroscopic data of oleanane-type triterpenoids **11-7-1**~**11-7-5**.

H	11-7-1	11-7-2	11-7-3	11-7-4	11-7-5
1	1.60, 1.77 m	1.54, 1.67 m	1.90, 1.95 m	1.60 m	3.86 br s
2	1.60, 1.98 m	1.53, 1.97 m	1.52, 1.95 m	1.21 m, 1.21 m	2.19, 2.23
3	3.42 br s	3.40 br s	3.41 t(2.4)	3.20 dd(10.5, 4.8)	4.35 dd(4.5, 11.5)
5	1.30 m	1.27 m	1.32 m	0.50 m	1.75
6	1.40, 1.47 m	1.40, 1.47 m	1.40, 1.47 m	1.41 m	1.72, 1.35
7	1.27, 1.53 m	1.25, 1.53 m	1.30 1.53 m	1.34 m	1.60, 1.36
9	1.68 m	1.83 m	1.69 m	1.49 m	2.88 m
11	4.21 dd(8.2, 3.8)	3.88 dd(9, 3.5)	1.86, 1.87 m	1.89 m, 2.01 m	2.02, 2.31
12	5.28 d(3.4)	5.37 d(3.4)	5.21 t(3.6)	5.09 t(3.5)	5.36 br s
15	0.98, 1.68 m	0.97, 1.68 m	0.95, 1.12 m	1.21 m	1.85, 1.05
16	1.03, 1.96 m	1.00, 1.96 m	1.53, 1.93 m	1.85 m	0.87, 2.13
18	2.02 m	2.04 m	2.00 m	1.83 dd(14.0, 3.7)	2.16
19	1.21, 1.75 m	1.22, 1.76 m	1.14, 1.76 m	1.49 m	1.71, 2.50 t(13.5)
21	3.53 dd(11.9, 4.6)	3.53 dd(12.0, 4.6)	3.53 dd(12.0, 4.8)	1.35 m	2.20, 1.72
22	1.37, 1.50 m	1.40, 1.50 m	1.35 1.46 m	1.51 m	1.53, 1.5
23	0.97 s	0.97 s	0.96 s	0.96 s	0.97 s
24	0.87 s	0.87 s	0.85 s	0.78 s	1.10 s
25	1.08 s	1.06 s	0.94 s	0.72 s	1.32 s
26	0.99 s	0.99 s	0.94 s	0.89 s	1.07 s
27	1.23 s	1.22 s	1.13 s	3.15 d(11.0), 3.52 d(11.0)	1.31 s
28	0.87 s	0.87 s	0.86 s	1.06 s	1.32 s
29	0.98 s	0.97 s	0.96 s	0.98 s	
30	0.87 s	0.88 s	0.86 s	0.91 s	1.45 s
OMe		3.23 s			

Table 11-7-3: ^{1}H NMR spectroscopic data of oleanane-type triterpenoids **11-7-6** and **11-7-7**.

H	11-7-6	11-7-7	H	11-7-6	11-7-7
1	1.80 t(12.1) 1.95 dd(3.9, 12.1)	1.23~1.37 m	19	3.61 br s	3.64 m
			21	2.10~2.20	2.04~2.10 m, 1.23~1.37 m
2	4.34 dt(3.9, 12.1)	1.95~2.03 m, 1.67~1.72 m	22	2.05 m, 2.21 m	2.10~2.13 m, 1.23~1.37 m
3	3.79 br s	5.29 br s	23	1.28 s	1.12 s
5	1.69	1.55~1.61 m	24	0.93 s	2.10~2.13 m
6	1.42 m, 1.58 m	1.23~1.37 m, 1.55~1.61 m			1.23~1.37 m
7	1.39 m, 1.61 m	1.23~1.37 m	25	1.02 s	0.87 s
9	2.13	1.95~2.03 m	26	1.09 s	1.03 s
11	2.12 m	1.95~2.03 m	27	1.39 s	1.59 s
12	5.57 br s	5.59 br s	29	1.20 s	1.13 s

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Table 11-7-3 (continued)

H	11-7-6	11-7-7	H	11-7-6	11-7-7
15	2.10~2.20	2.10~2.23 m, 1.23~1.37 m	30	1.13 s	1.19 s
16	2.16 m, 2.83 m	2.83 m, 2.10~2.23 m	OH		5.96 d(5.4, 19-OH)
18	3.64 br s	3.64 m	OAc		2.00 s(3-OAc) 2.01 s(24-OAc)

Table 11-7-4: ^{1}H NMR spectroscopic data of oleanane-type triterpenoids **11-7-8**~**11-7-12**.

H	11-7-8	11-7-9	11-7-10	11-7-11	11-7-12[①]
1	1.82 m, 0.94 m	1.02 m, 1.66 m	0.97 m, 2.01 m	1.22 m, 1.40 m	3.80 dd(4.8, 11.9)
2	1.38 m, 2.28 m	1.81 m, 2.19 m	4.01 ddd(3.0, 9.3, 13.0)	1.44 m, 1.46 m	1.66 m, 1.74 m
3	5.14 dd(10.6, 4.8)	4.39 dd(4.4, 11.7)	4.31 d(9.3)	3.63 br s	4.70 dd(4.6, 12.1)
5	0.98 m	1.48 m	1.48 m	1.84 m	1.04
6	1.46 m, 0.96 m	1.41 m, 1.68 m	1.43 m, 1.55 m	1.30 m, 1.42 m	
7	1.56 m, 1.12 m	1.29 m, 1.58 m	1.31 m, 1.69 m	1.32 m, 1.34 m	1.81 m, 1.46 m
9	1.42 m	1.68 m	1.66 m	2.01 m	1.93 d(8.5)
11	2.14 m, 1.62 m	1.62 m, 1.95 m	1.71 m, 1.98 m	1.90 m, 1.94 m	4.43 dd(3.9, 8.5)
12	5.27 t(3.4)	5.26 t(3.5)	5.28 t(3.5)	5.70 dd(2.4, 2.8)	5.26 d(3.9)
15	1.94 m, 1.24 m	1.12 m, 1.46 m	0.95 m, 1.98 m	1.70 m, 1.74 m	–
16	5.07 dd(10.4, 2.2)	1.76 m, 2.10 m	1.76, 2.10 m	2.02 m, 2.05 m	–
18	2.81 dd(14.6, 3.4)	2.94 dd(3.6, 13.7)	2.96 dd(3.6, 13.7)	2.25 m	2.23 m
19	2.02 m, 1.08 m	1.06 m, 1.77 m	1.04 m, 1.74 m	1.01 m, 1.32 m	1.90 m, 1.26 m
21	1.66 m, 1.28 m	1.05 m, 1.88 m	1.04 m, 1.86 m	1.24 m, 1.27 m	1.60 m, 1.29 m
22	2.10 m, 1.62 m	1.69 m, 1.76 m	1.70 m, 1.78 m	1.20 m, 1.40 m	1.61 m, 1.46 m
23	3.84 d(11.6) 3.57 d(11.9)	3.98 d(9.5) 3.84 d(9.5)	3.97 d(9.7) 3.81 d(9.7)	3.24 d(12.0) 3.65 d(12.0)	1.03 s
24	1.12 s	0.81 s	0.84 s	1.00 s	1.03 s
25	0.92 s	1.03 s	1.08 s	1.06 s	1.23 s
26	0.75 s	0.89 s	0.92 s	1.04 s	1.19 s
27	1.08 s	1.21 s	1.20 s		1.43 s
28				0.86 s	1.02 s
29	0.87 s	3.18 s	3.19 s	0.84 s	1.07 s
30	0.90 s	0.97 s	0.98 s	0.85 s	1.07 s
OAc	2.08 s(3-OAc) 2.02 s(16-OAc) 1.98 s(23-OAc)				2.16 s(3-OAc)
Me				1.38 s, 1.41 s	1.42 s, 1.41 s

[①] Typographic error exists in the literature, assigning the signal at δ 1.82 (m) to H-8. But C-8 was a quaternary carbon.

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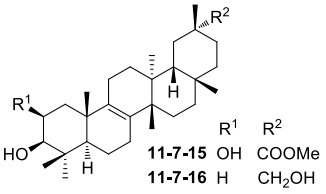
Table 11-7-5: ^{1}H NMR spectroscopic data of oleanane-type triterpenoids **11-7-13** and **11-7-14**.

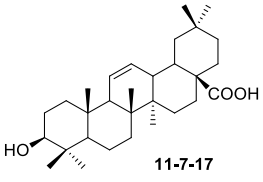
H	11-7-13	11-7-14	H	11-7-13	11-7-14
1	3.46 dd(11.4, 4.6)	3.44 ddd(3.1, 4.7, 11.2)	22	1.51 m, 1.24 m	1.45 m, 1.22 m
2	1.78 m, 1.66 m	1.84 m, 1.71 m	23	0.87 s	0.87 s
3	4.49 dd(12.2, 4.6)	4.56 dd(4.5, 12.2)	24	0.87 s	0.87 s
5	0.87 m	0.74 dd(10.8, 4.5)	25	1.05 s	1.07 s
6	–	1.50 m, 1.61 m	26	1.30 s	1.23 s
7	–	1.50 m, 1.33 m	27	1.04 s	1.01 s
9	2.05 m	1.87 d(8.9)	28	0.88 s	0.84 s
11	4.39 dd(3.7, 8.9)	4.35 dd(3.7, 8.9)	29	0.92 s	0.90 s
12	5.32 d(3.7)	5.25 d(3.7)	30	0.90 s	0.90 s
15	1.74 m	1.66 m	OAc	2.01 s	2.09 s
16	2.15 m	2.01 m	OH	5.94 d(3.2)	
18	2.11 m	2.07 dd(4.1, 13.6)	OMe		3.28 s
19	2.06 m, 1.10 m	1.68 m, 1.02 m	OCH_2CH_3	3.66 dq(7.0, 8.7) 3.50 dq(7.0, 8.7)	
21	1.47 m, 1.24 m	1.34 m, 1.12 m	OCH_2CH_3	1.15 t(7.0)	

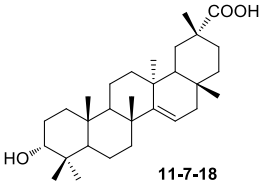
Table 11-7-6: Compounds, MFs, and test solvents of oleanane-type triterpenoids **11-7-15**~**11-7-23**.

No.	Compounds	MFs	Test solvents	References
11-7-15	methyl 2*β*,3*β*-dihydroxy-D:C-friedoolean-8-en-29-oate	$C_{31}H_{50}O_4$	$CDCl_3$	[74]
11-7-16	bryonolol	$C_{30}H_{50}O_2$	$CDCl_3$	[74]
11-7-17	elucalyptanoic acid①	$C_{30}H_{46}O_3$	C_5D_5N	[75]
11-7-18	esculentoic acid A	$C_{30}H_{48}O_3$	$CDCl_3$-CD_3OD (9:1)	[76]
11-7-19	2*α*,3*α*,16*α*-trihydroxy-24-nor-4(23),12-oleandien-28-oic acid	$C_{29}H_{44}O_5$	CD_3OD	[77]
11-7-20	3*β*-*O*-(*E*)-feruloyl-D:C-friedooleana-7,9(11)-dien-29-ol	$C_{40}H_{56}O_5$	$CDCl_3$	[74]
11-7-21	3*β*-*O*-(*E*)-coumaroyl-D:C-friedooleana-7,9(11)-dien-29-ol	$C_{39}H_{54}O_4$	$CDCl_3$	[74]
11-7-22	3*β*-*O*-(*E*)-coumaroyl-D:C-friedooleana-7,9(11)-dien-29-oic acid	$C_{39}H_{52}O_5$	$CDCl_3$	[74]
11-7-23	3*α*,21*β*-dihydroxy-olean-9(11),12-diene	$C_{30}H_{48}O_2$	$CDCl_3$	[65]

① Typographic error exists in the literature. Judging on the NMR data, this is a C-11-alkene product, rather than C-12-alkene.







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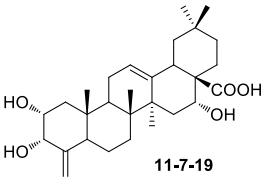
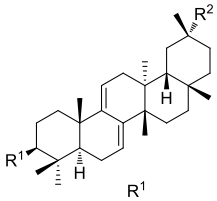
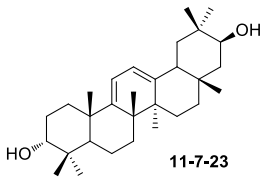


11-7-19



	R^1	R^2
11-7-20	O-(*E*)-Fer	CH_2OH
11-7-21	O-(*E*)-Coum	CH_2OH
11-7-22	O-(*E*)-Coum	COOH



11-7-23

Table 11-7-7: ^{1}H NMR spectroscopic data of oleanane-type triterpenoids **11-7-15**~**11-7-19**.

H	11-7-15	11-7-16	11-7-17	11-7-18	11-7-19
1	1.32 m	1.19 m	1.98 m	1.94 m	1.33 dd(12.8, 11.6)
	2.15 m	1.78 m	1.89 m	1.36 m	1.74 dd(12, 4.5)
2	4.10 dd(4.0, 6.8)	0.88 m, 1.70 m	2.05 m, 2.15 m	1.60 m, 1.78 m	3.70 ddd(11.6, 4.5,4.0)
3	3.18 d(4.0)	3.21 dd(4.8, 11.6)	3.42 dd(10.2, 5.2)	3.38 t(2.8)	4.17 d(4.0)
5	1.12 m	1.08 m	0.93 m	1.32 m	1.80 dd(11.0, 3.0)
6	1.47 m, 1.69 m	0.94 m, 1.68 m	1.58 m, 1.50 m	1.44 m	1.29 m, 1.50 m
7	1.88 m, 2.07 m	1.94 m, 2.08 m	1.30 m	1.56 m, 1.32 m	1.60 m, 1.40 m
9				1.58 m	1.86 dd(2.3, 11.8)
11	1.94 m	1.84 m, 2.04 m	5.70 d(5.8)	1.48 m	1.98 m
12	1.23 m, 1.58 m	1.37 m, 1.50 m	5.75 d(5.8)	1.42 m, 0.98 m	5.30 t(3.5)
15	1.29 m, 1.48 m	1.49 m, 1.68 m	1.85 m, 1.70 m	5.52 dd(8.0, 3.2)	1.37 dd(13.2, 2.0)
					1.98 dd(13.2, 5.5)
16	1.32 m, 1.64 m	1.47 m, 1.54 m	2.10 m, 1.90 m	2.02 m, 1.91 m	3.95 br s
18	1.48 m	1.55 m	3.25 dd(13.9, 3.4)	1.22 m	2.94 dd(13.8, 4.5)
19	1.61 m, 2.35 d(15.6)	1.20 m, 1.58 m	1.75 m, 1.26 m	1.87 m	1.24 (ov), 1.78 (ov)
21	1.35 m, 2.16 m	1.28 m, 1.42 m	1.15 m, 1.12 m	1.98 m	1.80 (ov), 1.54 (ov)
22	0.88 m, 2.06 m	0.92 m, 1.54 m	1.52 m, 1.45	1.36 m	1.40 (ov), 1.20 (ov)
23	0.98 s	0.98 s	1.18 s	0.93 s	5.08 dd(1.4, 1.2)
					4.70 t(1.4)
24	0.98 s	0.78 s	0.98 s	0.86 s	
25	1.20 s	0.93 s	1.15 s	0.89 s	0.85 s
26	0.93 s	1.08 s	1.26 s	1.08 s	0.94 s
27	0.71 s	0.94 s	1.24 s	0.91 s	1.35 s
28	1.00 s	1.10 s		0.90 s	
29	3.59 s(COOMe)	3.23 d(10.4)	0.90 s		0.93 s
		3.40 d(10.4)			
30	1.15 s	0.96 s	0.96 s	1.38 s	0.98 s

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Table 11-7-8: ^{1}H NMR spectroscopic data of oleanane-type triterpenoids **11-7-20**~**11-7-23**.

H	11-7-20	11-7-21	11-7-22	11-7-23
1	1.63 m, 1.82 m	1.62 m, 1.82 m	1.59 m, 1.80 m	1.60 m, 1.80 m
2	1.64 m, 1.76 m	1.63 m, 1.75 m	1.65 m, 1.84 m	1.66 m, 2.00 m
3	4.62 dd(3.6, 11.2)	4.61 dd(4.0, 10.4)	4.58 dd(4.4, 11.6)	3.42 br s
5	1.39 m	1.36 m	1.32 m	1.32 m
6	2.08 m, 2.22 m	2.01 m, 2.25 m	2.06 m, 2.20 m	1.52 m
7	5.47 br s	5.47 br s	5.41 br s	1.36 m, 1.70 m
11	5.24 br s	5.22 br s	5.20 br s	5.61 d(5.8)
12	1.71 m, 2.11 m	1.71 m, 2.10 m	1.70 m, 2.16 m	5.54 d(5.8)
15	1.36 m, 1.67 m	1.35 m, 1.66 m	1.27 m, 1.55 m	1.03 m, 1.85 m
16	1.41 m, 1.69 m	1.42 m, 1.70 m	1.40 m, 1.70 m	1.06 m, 1.95 m
18	1.58 m	1.58 m	1.53 m	2.18 m
19	1.35 m, 1.68 m	1.30 m, 1.70 m	1.72 m, 2.34 br d(16.0)	1.20 m, 1.75 m
21	1.24 m, 1.46 m	1.24 m, 1.46	1.43 m, 2.22 m	3.53 dd(12.0, 4.5)
22	0.88 m, 1.63 m	0.89 m, 1.65 m	0.89 m, 2.02 m	1.42 m, 1.55 m
23	0.89 s	0.87 s	0.86 s	1.00 s
24	1.02 s	1.00 s	0.99 s	0.87 s
25	0.93 s	0.93 s	0.92 s	1.20 s
26	0.90 s	0.90 s	0.72 s	1.12 s
27	0.83 s	0.83 s	0.84 s	1.01 s
28	1.06 s	1.06 s	1.00 s	0.93 s
29	3.21 d(10.4), 3.51 d(10.4)	3.21 d(10.8), 3.51 d(10.8)		0.95 s
30	0.97 s	0.97 s	1.23 s	0.89 s
2′	7.02 d(1.6)	7.42 d(8.4)	7.42 d(8.8)	
3′		6.81 d(8.4)	6.82 d(8.8)	
5′	6.89 d(8.0)	6.81 d(8.4)	6.82 d(8.8)	
6′	7.05 dd(1.6, 8.0)	7.42 d8.4)	7.42 d(8.8)	
7′	7.58 d(16.0)	7.59 d(16.0)	7.61 d(16.0)	
8′	6.28 d(16.0)	6.29 d(16.0)	6.29 d(16.0)	
OMe	3.92 s			

Table 11-7-9: Compounds, MFs, and test solvents of oleanane-type triterpenoids **11-7-24**~**11-7-41**.

No.	Compounds	MFs	Test solvents	References
11-7-24	(6α)-6-hydroxyolean-12-en-3-one	$C_{30}H_{48}O_2$	$CDCl_3$	[78]
11-7-25	adiantuoleanone	$C_{29}H_{48}O_2$	$CDCl_3$	[79]
11-7-26	laxifolone A	$C_{31}H_{50}O_2$	$CDCl_3$	[80]
11-7-27	21β-hydroxy-β-amyrenone①	$C_{30}H_{48}O_2$	$CDCl_3$	[65]
11-7-28	11β,21β-dihydroxy-olean-12-en-3-one①	$C_{30}H_{48}O_3$	$CDCl_3$	[65]
11-7-29	27-hydroxy-olean-12-en-3-one	$C_{30}H_{48}O_2$	$CDCl_3$	[66]
11-7-30	3-oxo-23-hydroxyolean-12-en-27-oic acid	$C_{30}H_{46}O_4$	$CDCl_3$	[72]

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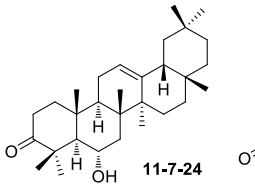
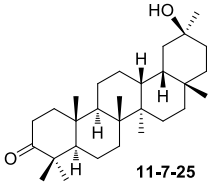
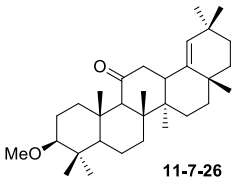
Table 11-7-9 (continued)

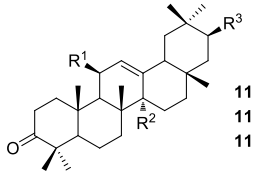
No.	Compounds	MFs	Test solvents	References
11-7-31	3-oxo-11α-methoxyolean-12-en-30-oic acid	$C_{31}H_{48}O_4$	$CDCl_3$	[81]
11-7-32	–	$C_{32}H_{50}O_4$	$CDCl_3$	[81]
11-7-33	3-oxo-11α-hydroxyolean-12-en-30-oic acid	$C_{30}H_{46}O_4$	CD_3COCD_3	[81]
11-7-34	–	$C_{31}H_{48}O_4$	$CDCl_3$	[81]
11-7-35	3,11-dioxoolean-12-en-30-oic acid	$C_{30}H_{44}O_4$	$CDCl_3$	[81]
11-7-36	3-oxo-11α-ethoxyolean-12-en-30-oic acid	$C_{32}H_{50}O_4$	$CDCl_3$	[81]
11-7-37	3β,23-dihydroxy-1-oxo-olean-12-en-28-oic acid	$C_{30}H_{46}O_5$	C_5D_5N	[82]
11-7-38	3β-hydroxy-1-oxo-olean-12-en-28-oic acid	$C_{30}H_{46}O_4$	C_5D_5N	[82]
11-7-39	3β,6β-dihydroxy-11-oxo-olean-12-en-28-oic acid	$C_{30}H_{46}O_5$	C_5D_5N	[83]
11-7-40	esculentoic acid B	$C_{30}H_{46}O_3$	$CDCl_3$-CD_3OD (9:1)	[76]
11-7-41	3-oxoolean-9(11),12-dien-30-oic acid	$C_{30}H_{44}O_3$	$CDCl_3$	[81]

① Typographic error exists in the literature, typing the C-21 substituent as R^1. Judging on the NMR and MS data, the substituent of C-21 should be a hydroxyl group.

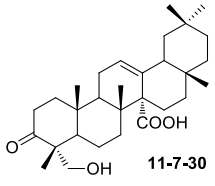


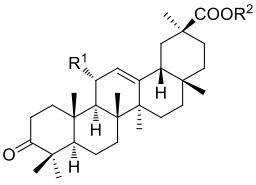




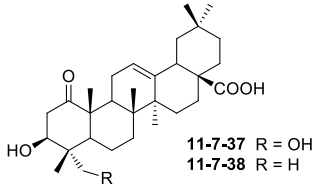


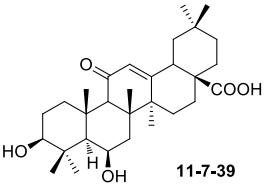
	R^1	R^2	R^3
11-7-27	H	Me	OH
11-7-28	OH	Me	OH
11-7-29	H	CH_2OH	H

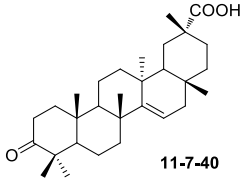




	R^1	R^2
11-7-31	OMe	H
11-7-32	OMe	Me
11-7-33	OH	H
11-7-34	OH	Me
11-7-35	=O	H
11-7-36	OEt	H







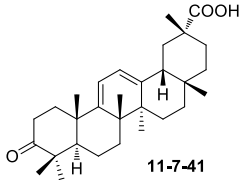


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Table 11-7-10: ^{1}H NMR spectroscopic data of oleanane-type triterpenoids **11-7-24**~**11-7-27**.

H	11-7-24	11-7-25	11-7-26	11-7-27
1	1.63, 1.80	*α* 0.75 dddd(4.8, 9.4, 5.8, 8.4) *β* 1.55 dddd(1.8, 3.6, 5.8, 9.4)	0.80 m, 2.26 m	1.41 m, 1.90 m
2	2.28, 2.68	*α* 2.66 dddd(6.2, 9.4, 5.8,8.4) *β* 2.02 dddd(2.2, 3.6, 5.8, 8.4)	1.47 m, 1.72 m	2.36 ddd(16.0, 6.8, 3.7) 2.55 ddd(16.0, 11.0, 7.3)
3			2.61 m	
5	1.65	0.67 m	0.55 m	1.33 m
6	3.94 td(10.4, 4.5)	*α* 1.51 m, *β* 1.58 m	1.44 m	1.48 m, 1.55 m
7	1.63	*α* 1.08 dddd(9.5, 4.0, 9.5, 8.2) *β* 1.28 m	1.49 m	1.35 m, 1.52 m
9	2.00	1.12 dd(4.5, 5.5)	2.25 s	1.65 dd(11.5, 6.3)
10	1.80 dd(3.0, 9.4)			
11	1.93	*α* 1.33 m, *β* 1.51 m		1.88 m, 1.97 m
12	5.23	*α* 1.20 m, *β* 1.28 m	2.05 m, 2.12 m	5.24 t(3.5)
13		1.20 m	2.65 m	
15	1.90	*α* 1.12 m, *β* 1.49 m	1.38 m, 1.46 m	1.00 m,1.76 m
16	2.02	*α* 1.23 m, *β* 1.49 m	1.56 m	1.00 m, 1.96 m
18	1.68	1.12 m		2.00 dd(14.8, 3.5)
19	1.62	*α* 1.23 m, *β* 2.02 d(5.1)	4.74 s	1.15 m, 1.75 m
21	1.15, 1.41	*α* 1.20 m, *β* 1.33 m	1.11 m, 1.38 m	3.53 dd(12.0, 4.7)
22	1.30, 1.46	*α* 1.12 m, *β* 1.35 m	1.40 m	1.37 m, 1.50 m
23	1.34 s	0.99 s	0.94 s	1.10 s
24	1.37 s	1.04 s	0.75 s	1.06 s
25	1.02 s	0.76 s	1.23 s	1.07 s
26	1.02 s	0.78 s	1.02 s	1.01 s
27	1.20 s	0.82 s	0.96 s	1.14 s
28	0.83 s	0.92 s	0.98 s	0.88 s
29	0.86 s	1.23 s	0.90 s	0.97 s
30	0.88 s		0.92 s	0.86 s
OH		3.90 s		
OMe			3.32 s	

Table 11-7-11: ^{1}H NMR spectroscopic data of oleanane-type triterpenoids **11-7-28**~**11-7-31**.

H	11-7-28	11-7-29	11-7-30	11-7-31
1	1.65 m, 1.85 m	–	1.45 m, 1.87 m	2.29 m, 1.62 m
2	2.40 m, 2.55 m	–	2.42 m, 2.50 m	2.49 ddd(15.7, 10.7, 7.3) 2.38 m
5	1.37 m	2.36 m, 2.27 m	1.85 m	1.31 m
6	1.05 m, 1.52 m	–	1.32 m, 1.42 m	1.49 m
7	1.34 m, 1.52 m	–	1.25 m, 1.34 m	1.94 m, 1.33 m
9	1.96 m	–	1.98 m	1.81 d(9.3)

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Table 11-7-11 (continued)

H	11-7-28	11-7-29	11-7-30	11-7-31
11	4.54 dd(9.6, 3.2)	–	1.90 m, 1.95 m	3.94 dd(9.3, 3.1)
12	5.50 d(4.0)	5.40 t(3.3)	5.60 dd(3.6, 3.9)	5.46 d(3.1)
15	1.05 m, 1 69 m	–	1.67 m, 1.72 m	1.72 m, 1.01 m
16	1.04 m,1.96 m	–	2.01 m, 2.05 m	1.98 m, 0.92 m
18	2.10 dd(13.6, 3.6)	1.87 dd(12.8, 4.8)	2.28 m	2.07 dd(13.0, 3.9)
19	1.22 m, 1.77 m	–	0.99 m, 1.30 m	1.94 m, 1.63 m
21	3.52 dd(12.0, 4.8)	–	1.22 m, 1.26 m	1.50 m, 1.33 m
22	1.36 m, 1.52 m	–	1.17 m, 1.40 m	1.37 m
23	1.09 s	0.96 s	3.30 d(11.8) 3.55 d(11.8)	1.11 s
24	1.05 s	0.84 s	0.89 s	1.06 s
25	1.15 s	0.79 s	1.02 s	1.21 s
26	1.05 s	0.86 s	1.03 s	1.05 s
27	1.21 s	3.38 d(11.0), 3.26 d(11.0)		1.22 s
28	0.87 s	1.08 s	0.80 s	0.82 s
29	0.97 s	0.98 s	0.78 s	1.15 s
30	0.87 s	0.93 s	0.79 s	
OMe				3.26 s

Table 11-7-12: ^{1}H NMR spectroscopic data of oleanane-type triterpenoids **11-7-32**~**11-7-36**.

H	11-7-32	11-7-33	11-7-34	11-7-35	11-7-36
1	1.62 m, 2.24 m	2.59 ddd(13.2, 7.3, 3.9) 1.62 m	1.43 m, 2.22 m	1.42 m, 2.96 m	1.67 m, 2.36 m
2	2.49 ddd(15.9, 10.8, 7.5) 2.35 m	2.31 ddd(15.7, 6.8, 3.6) 2.52 m	2.13 m, 2.33 m	2.33 m, 2.61 m	2.41 m, 2.51 m
5	1.33 m	1.43 m	1.12 m	1.28 m	1.38 m
6	1.45 m	1.53 m	1.28 m	1.56 m	1.50 m
7	1.92 m, 1.28 m	1.89 m, 1.35 m	1.71 m, 1.07 m	2.02 m, 1.38 m	1.95 m, 1.37 m
9	1.76 d(9.4)	1.76 d(9.2)	1.41 m	2.44 s	1.84 d(9.5)
11	3.87 dd(9.4, 3.2)	4.25 dd(9.2, 3.0)	4.02 dd(8.9, 3.6)		4.02 dd(9.5, 2.9)
12	5.41 d(3.2)	5.30 d(3.2)	5.10 br s	5.75 s	5.44 d(2.9)
15	1.67 m, 0.95 m	1.73 m, 1.03 m	1.52 m, 0.78 m	1.83 m, 1.22 m	1.73 m, 1.01 m
16	1.95 m, 0.78 m	2.05 m, 1.01 m	1.72 m, 0.67 m	2.03 m, 1.21 m	1.95 m, 0.91 m
18	1.93 m	1.99 dd(13.1, 3.9)	1.68 m	2.19 m	2.04 m
19	1.88 m, 1.52 m	1.85 m, 1.68 m	1.85 m, 1.68 m	1.91 m, 1.68 m	1.93 m, 1.66 m
21	1.46 m, 1.33 m	1.53 m, 1.35 m	1.65 m, 1.36 m	1.75 m, 1.45 m	1.50 m, 1.35 m
22	1.35 m, 1.20 m	1.37 m	1.13 m, 1.02 m	1.43 m	1.38 m
23	1.05 s	1.07 s	0.87 s	1.10 s	1.10 s
24	1.00 s	1.04 s	0.83 s	1.06 s	1.06 s

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Table 11-7-12 (continued)

H	11-7-32	11-7-33	11-7-34	11-7-35	11-7-36
25	1.11 s	1.21 s	0.96 s	1.27 s	1.21 s
26	0.96 s	1.10 s	0.82 s	1.17 s	1.05 s
27	1.18 s	1.26 s	0.99 s	1.38 s	1.22 s
28	0.74 s	0.80 s	0.56 s	0.85 s	0.81 s
29	1.09 s	1.15 s	0.90 s	1.22 s	1.15 s
OMe	3.21 s(11-OMe) 3.64 s(29-COOMe)		3.45 s		
OEt					3.62 dq(15.8, 6.9) 3.36 dq(15.6, 7.1) 1.15 dd(7.1, 6.8)

Table 11-7-13: ^{1}H NMR spectroscopic data of oleanane-type triterpenoids **11-7-37**~**11-7-41**.

H	11-7-37	11-7-38	11-7-39	11-7-40	11-7-41
1			1.35 m, 1.25 m	2.16 m, 1.58 m	1.91 m, 1.60 m
2	*α* 2.79.dd(11.6, 4.9) *β* 3.44 t-like(11.9)	*α* 2.69 dd(12.1, 4.9) *β* 3.37 t-like(11.9)	2.00 m, 2.21 m	2.48 m	2.51 m, 2.60 m
3	4.55 dd(11.9, 4.9)	3.74 dd(11.9, 4.9)	3.51 dd(10.8, 3.6)		
5	1.91 br d-like(10.7)	1.09 br d-like(11.6)	1.02 br s	1.53 m	1.51 m
6	–	–	4.85 br s	1.36 m	1.60 m
7	1.29 dd-like(9.5, 3.1)		1.95 m, 1.84 m	1.58 m, 1.34 m	1.41 m
9	2.65 dd(11.0, 5.8)	2.56 dd(11.1, 4.5)	2.74 s	1.56 m	
11	*α* 2.72 dt-like(18.1, 5.5,4.6) *β* 1.99 ddd(18.3, 11.3, 3.1)	*α* 2.73 dt-like(18.0, 5.2, 4.6) *β* –		1.46 m	5.65 s
12	5.50 t-like	5.52 t-like(3.7)	6.11 s	1.40 m, 1.00 m	5.65 s
15	1.12 dd-like(13.1) –	–	1.21 m, 1.82 m	5.54 dd(8.0, 3.3)	1.10 m, 1.90 m
16	–	–	2.12 m, 1.97 m	2.04 m, 1.86 m	1.97 m, 0.95 m
18	3.26 dd(13.7, 4.0)	3.29 dd(13.7, 4.9)	3.37 m	1.28 m	2.19 br d(10.8)
19	*α* 1.73 d-like(13.7) *β* 1.21 d-like(4.6)	*α* 1.78 d(13.7) *β* –	1.75 m, 1.23 m	1.91 m	1.43 m
21	1.41 td(13.6, 3.7)	–	1.95 m, 1.84 m	2.02 m	1.95 m, 1.75 m
22	–	–	1.43 m	1.44 m	2.22 m, 1.88 m
23	3.71 d(10.7), 4.12 d(10.7)	1.21 s	1.44 s	1.10 s	1.12 s
24	1.17 s	1.20 s	1.75 s	1.02 s	1.08 s
25	1.36 s	1.27 s	2.01 s	0.87 s	0.98 m
26	1.08 s	1.07 s	1.82 s	1.07 s	1.16 m
27	1.23 s	1.31 s	1.44 s	0.91 s	1.27 s
28					0.88 s
29	0.93 s	0.96 s	0.92 s	0.89 s	1.21 s
30	0.99 s	1.01 s	0.91 s	1.36 s	

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Table 11-7-14: Compounds, MFs, and test solvents of oleanane-type triterpenoids **11-7-42**~**11-7-51**.

No.	Compounds	MFs	Test solvents	References
11-7-42	oleanderolide	$C_{30}H_{48}O_4$	$CDCl_3$	[84]
11-7-43	6*β*-hydroxy-3-oxo-11*α*,12*α*-epoxyolean-28,13*β*-olide	$C_{30}H_{44}O_5$	$CDCl_3$	[83]
11-7-44	3*β*,6*β*-dihydroxy-11*α*,12*α*-epoxyolean-28,13*β*-olide	$C_{30}H_{46}O_5$	C_5D_5N	[83]
11-7-45	microfokienoxane D	$C_{30}H_{46}O_3$	C_5D_5N	[85]
11-7-46	3*β*-hydroxy-12-oxo-13*Hα*-olean-28,19*β*-olide	$C_{30}H_{46}O_4$	C_5D_5N	[83]
11-7-47	3*β*,25-epoxy-3*α*,21*α*-dihydroxy-22*β*-(3-methylbut-2-en-1-oyl-oxy)olean-12-en-28-oic acid	$C_{35}H_{52}O_7$	C_5D_5N	[86]
11-7-48	3*β*,25-epoxy-3*α*,21*α*-dihydroxy-22*β*-angeloyloxyolean-12-en-28-oic acid	$C_{35}H_{52}O_7$	C_5D_5N	[86]
11-7-49	3*β*,25-epoxy-3*α*,21*α*-dihydroxy-22*β*-tigloyloxyolean-12-en-28-oic acid	$C_{35}H_{52}O_7$	C_5D_5N	[86]
11-7-50	3*β*,25-epoxy-3*α*-hydroxy-22*β*-(2-methylbutan-1-oyloxy)-olean-12-en-28-oic acid	$C_{35}H_{54}O_6$	C_5D_5N	[86]
11-7-51	lantanoic acid	$C_{30}H_{44}O_5$	$CDCl_3$	[87]

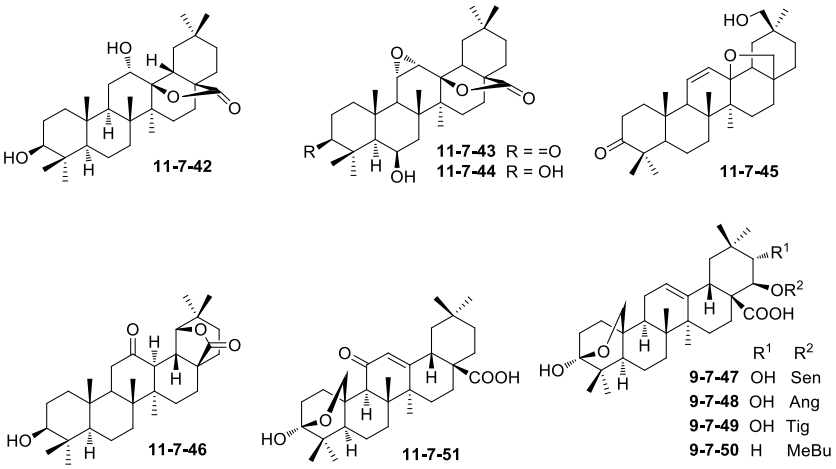

Table 11-7-15: ^{1}H NMR spectroscopic data of oleanane-type triterpenoids **11-7-42**~**11-7-45**.

H	11-7-42	11-7-43	11-7-44	11-7-45
1	1.73 ddd(11.1, 3.4, 3.4) 0.95 m	1.49 m, 2.21 m	1.59 m, 1.67 m	1.33 m, 1.97 m
2	1.68 m, 1.65 m	2.39 td(14.6, 6.0), 2.31 m	2.11 m, 1.93 m	2.44 m, 2.60 m

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Table 11-7-15 (continued)

H	11-7-42	11-7-43	11-7-44	11-7-45
3	3.23 dd(11.5, 4.6)		3.46 dd(12.0, 3.9)	
5	0.76 m	1.10 br s	0.91 br s	1.35 m
6	1.50 m	4.53 br s	4.79 br s	1.43 m, 1.62 m
7	1.56 m, 1.26 m	1.53 m, 1.18 m	1.89 m, 1.26 m	1.57 m, 1.67 m
9	1.54 m	1.64 m	1.85 m	2.00 br s
11	2.00 m, 1.48 m	3.16 br d(3.6)	3.29 m	5.60 dd(10.4, 2.8)
12	3.90 br s($W_{1/2}$ = 9.0)	3.10 d(3.6)	3.30 m	5.85 d(10.4)
15	1.89 m, 1.18 m	1.75 td(13.2, 5.6), 1.34 m	1.80 m, 1.04 m	α 1.88 m, β 1.85 m
16	2.13 ddd(13.3, 13.4, 5.6)	1.08 m, 2.13 td(13.2, 5.6)	1.25 m, 2.12 m	α 2.12 td(13.2, 4.8)
	1.25 m			β 1.82 m
18	2.04 m	2.32 m	2.52 br d(13.8)	1.94 br d(12.8)
19	2.00 m, 1.85 m	1.84 t(13.6), 1.63 m	1.95 m, 1.73 m	1.83 m, 1.94 m
21	1.39 m, 1.36 m	1.33 m	1.31 m, 1.12 m	1.25 m, 1.44 m
22	1.62 m, 1.59 m	1.65 m	1.73 m, 1.67 m	1.29 m, 1.34 m
23	1.00 s	1.17 s	1.38 s	1.16 s
24	0.78 s	1.45 s	1.69 s	1.04 s
25	0.88 s	1.64 s	1.61 s	0.96 s
26	1.15 s	1.48 s	1.80 s	1.33 s
27	1.30 s	1.04 s	1.19 s	1.08 s
28				3.36 d(6.4), 3.76 d(6.4)
29	0.99 s	0.93 s	0.84 s	1.23 s
30	0.91 s	1.00 s	0.76 s	3.70 d(10.4), 3.84 d(10.4)

Table 11-7-16: ^{1}H NMR spectroscopic data of oleanane-type triterpenoids **11-7-46** and **11-7-51**.

H	11-7-46	11-7-51	H	11-7-46	11-7-51
1	1.43 m	3.02 ddd(12.3,12. 3,4 7)	19	5.03 d(4.8)	1.59 m, 1.18 m
	0.95 m	1.16 m			
2	1.78 m, 1.23 m	2.11 m, 1.76 m			
3	3.41 t(7.8)		21	1.51 m, 1.24 m	1.36 m, 1.25 m
5	0.83 m	1.20 m	22	1.93 td(13.8, 5.6)	1.76 m, 1.63 m
				1.35 m	
6	1.52 m, 1.33 m	1.54 m, 1.48 m	23	1.19 s	1.02
7	1.33 m, 1.25 m	1.52 m, 1.36 m	24	0.98 s	0.96
9	2.06 dd(9.5, 9.5)	2.43 s	25	0.85 s	4.52 br d(8.3)
					4.03 br d(8.3)
11	2.39 m, 2.44 m		26	0.80 s	0.84 s
12		5.65 s	27	1.28 s	1.32 s
13	2.77 d(12.6)		28		11.65(COOH)
15	2.32 m, 1.68 m	1.62 m, 1.31 m	29	0.95 s	0.90 s
16	1.42 dt(14.4, 4.8)	1.71 m, 2.03 m	30	0.92 s	0.91 s
	0.99 td(14.4, 5.8)				
18	2.54 dd(12.6, 4.8)	2.96 dd(13.4,3.7)	OH		2.67 br s

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Table 11-7-17: ^{1}H NMR spectroscopic data of oleanane-type triterpenoids **11-7-47**~**11-7-50**.

H	11-7-47	11-7-48	11-7-49	11-7-50
1*α*	1.23 m (ov)	1.21 m (ov)	1.22 m (ov)	1.20 m (ov)
1*β*	2.20 ddd(12.3, 12.3, 5.2)	2.18 ddd(12.3, 12.3, 5.1)	2.19 ddd(12.3, 12.3, 5.1)	2.18 ddd(12.4, 12.4, 5.2)
2*α*	2.36 ddd(12.3, 12.3,5.2)	2.34 ddd(12.3, 12.3, 5.1)(ov)	2.35 ddd(12.3, 12.3, 5.1)(ov)	2.35 m (ov)
2*β*	2.05 m (ov)	2.02 m (ov)	2.04 m (ov)	2.05 m (ov)
5	1.26 m (ov)	1.23 m (ov)	1.24 m (ov)	1.24 m (ov)
6*α*	1.47 m	1.47 m (ov)	1.48 m (ov)	1.51 m
6*β*	1.54 m (ov)	1.53 dddd(13.0, 13.0, 13.0, 2.5, ov)	1.53 dddd(13.0, 13.0, 13.0, 3.0)	1.55 dddd(13.0, 13.0, 13.0, 2.5)
7*α*	1.38 m (ov)	1.36 m (ov)	1.36 m (ov)	1.39 m (ov)
7*β*	1.31 m (ov)	1.32 m (ov)	1.33 m (ov)	1.31 br d(13.0)
9	1.82 m (ov)	1.79 dd(12.5, 4.5, ov)	1.80 m (ov)	1.79 m (ov)
11*α*	2.08 m (ov)	2.05 dd(12.5, 3.5, ov)	2.08 m (ov)	2.04 m (ov)
11*β*	1.86 m (ov)	1.80 m	1.85 m (ov)	1.83 m (ov)
12	5.67 br s	5.62 br s	5.65 br s	5.57 br s
15*α*	1.29 m (ov)	1.26 m (ov)	1.28 m (ov)	1.22 m (ov)
15*β*	1.87 m (ov)	1.86 m (ov)	1.88 m (ov)	1.84 m (ov)
16*α*	3.03 br dd(13.7, 13.7)	3.03 dd(13.4, 13.4)	3.04 dd(13.5, 13.5)	1.96 m (ov)
16*β*	2.41 br d(13.7)	2.38 dd(13.4, 4.0)	2.39 br d(13.5)	2.02 m (ov)
18	3.66 dd(14.5, 3.5)	3.61 dd(14.1, 3.2)	3.67 dd(14.0, 3.3)	3.47 dd(13.8, 3.6)
19*α*	2.65 t(13.9)	2.64 t(14.0)	2.66 t(14.0)	1.92 m (ov)
19*β*	1.39 m (ov)	1.37 m (ov)	1.38 m (ov)	1.43 m (ov)
21	4.03 br(ov)	4.03 br s(ov)	4.07 br s	1.66 dd(14.9, 3.5) 1.87 m (ov)
22	5.89 d(3.2)	5.92 d(2.9)	5.89 d(2.9)	5.50 br s
23	1.26 s	1.27 s	1.27 s	1.26 s
24	1.27 s	1.28 s	1.28 s	1.28 s
25	4.42 dd(8.5, 2.5) 4.02 d(8.5)(ov)	4.22 dd(8.5, 2.0) 4.02 m (ov)	4.43 dd(8.5, 2.5) 4.03 d(8.2)	4.40 br d(7.2) 3.99 br d(8.7)
26	1.00 s	0.98 s	1.00 s	0.97 s
27	1.35 s	1.34 s	1.35 s	1.25 s
29	1.29 s(ov)	1.30 s	1.30 s	0.96 s
30	1.33 s	1.31 s	1.32 s	1.20 s(ov)
2′	5.78 t(1.1)			2.38 m
3′		5.84 q(7.0)	7.06 dq(7.0, 1.5)	1.78 m (ov), 1.40 m (ov)
4′	1.54 br s	1.93 s	1.81 s	0.83 t(7.2)
5′	2.12 br s	2.00 d(7.0)	1.44 d(7.0)	1.01 d(6.9)

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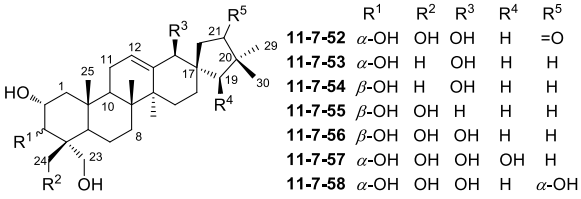
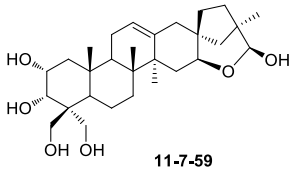
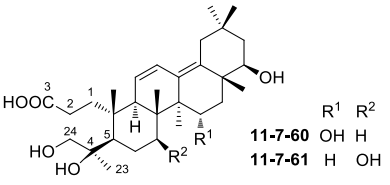
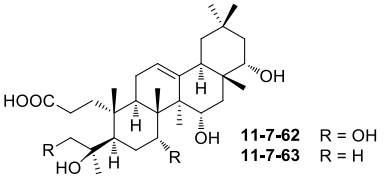
Table 11-7-18: Compounds, MFs, and test solvents of oleanane-type triterpenoids **11-7-52**~**11-7-66**.

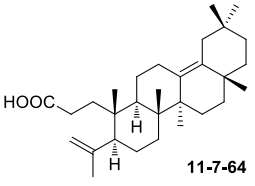
No.	Compounds	MFs	Test solvents	References
11-7-52	phlomisone	$C_{29}H_{46}O_6$	C_5D_5N	[88]
11-7-53	phlomistetraol A	$C_{29}H_{48}O_4$	CD_3OD	[88]
11-7-54	phlomistetraol B	$C_{29}H_{48}O_4$	CD_3OD	[88]
11-7-55	phlomistetraol C	$C_{29}H_{48}O_4$	C_5D_5N	[88]
11-7-56	phlomispentaol	$C_{29}H_{48}O_5$	CD_3OD	[88]
11-7-57	phlomishexaol A	$C_{29}H_{48}O_6$	C_5D_5N	[88]
11-7-58	phlomishexaol B	$C_{29}H_{48}O_6$	C_5D_5N	[88]
11-7-59	phlomisin	$C_{29}H_{46}O_6$	C_5D_5N	[88]
11-7-60	3,4-*seco*-olean-11,13-dien-4,15*α*,22*β*,24-tetraol-3-oic acid	$C_{30}H_{48}O_6$	DMSO-d_6	[89]
11-7-61	3,4-*seco*-olean-11,13-dien-4,7*β*,22*β*,24-tetraol-3-oic acid	$C_{30}H_{48}O_6$	DMSO-d_6	[89]
11-7-62	3,4-*seco*-olean-13-en-4,7*α*,15*α*,22*α*,24-pentaol-3-oic acid	$C_{30}H_{50}O_7$	DMSO-d_6	[89]
11-7-63	3,4-*seco*-olean-13-en-4,15*α*,22*α*-triol-3-oic acid	$C_{30}H_{50}O_5$	DMSO-d_6	[89]
11-7-64	3,4-*seco*-olean-4(23),13(18)-dien-3-oic acid	$C_{30}H_{48}O_2$	C_5D_5N	[90]
11-7-65	3,4-*seco*-olean-4(23),12-diene-3,29-dioic acid	$C_{30}H_{46}O_4$	$CDCl_3$	[81]
11-7-66	–	$C_{32}H_{50}O_4$	$CDCl_3$	[81]











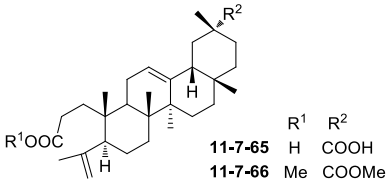


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Table 11-7-19: ^{1}H NMR spectroscopic data of oleanane-type triterpenoids **11-7-52**~**11-7-56**.

H	11-7-52	11-7-53	11-7-54	11-7-55	11-7-56
1	1.85 m, 2.06 m	1.31 m, 1.65 m	1.30 m, 0.94 m	1.42 m, 2.35 m	0.92 m, 1.41 m
2	4.47 m	3.90 m	3.73 m	4.52 m	4.03 m
3	4.88 br s	3.61 br s	3.36 d(9.6)	4.40 d(9.6)	3.46 d(9.6)
5	2.16 m	1.55 m	2.01 m	2.03 m	2.02 m
6	1.63 m, 1.92 m	1.40 m	1.45 m	1.45 m, 1.75 m	1.42 m, 1.57 m
7	1.55~1.75 m	1.40~1.50 m	1.40~1.50 m	1.70~1.80 m	1.38 m, 1.45 m
9	1.86 m	1.68 m	1.58 m	1.75 m	1.58 m
11	2.08 m	2.02 m	2.02 m	2.05 m	1.98 m
12	6.23 br s	5.77 br s	5.77 br s	5.30 br s	5.77 br s
15	1.12 m, 1.72 m	1.06 m, 1.70 m	1.10 m, 1.75 m	1.07 m, 1.71 m	1.02 m, 1.21 m
16	1.55~1.75 m	1.65 m	1.63 m	1.63 m	1.56 m, 1.63 m
18	4.23 br s	3.90 br s	3.89 br s	2.60(ov), 1.78(ov)	4.05 br s
19	2.53, 1.70 d(13.3)	1.13, 1.97 d(12.9)	1.13, 1.97 d(12.9)	1.03, 2.56 d(12.9)	1.97, 1.13 d(12.7)
21		1.36 m, 1.47 m	1.35 m, 1.46 m	1.85 m, 2.60 m	1.32 m, 1.46 m
22	2.74, 2.27 d(17.5)	1.30 m	1.29 m	2.40 m	1.31 m
23	4.43, 4.63 d(11.0)	3.40, 3.54 d(11.0)	3.26, 3.50 d(11.0)	4.93, 4.33 d(11.0)	3.52, 4.04 d(11.4)
24	4.09, 4.25 d(11.1)	0.79 s	0.70 s	4.04, 4.67 d(11.3)	3.63, 4.04 d(11.4)
25	1.17 s	1.08 s	0.98 s	1.19 s	1.08 s
26	0.96 s	0.98 s	1.09 s	1.27 s	0.96 s
27	1.08 s	1.13 s	1.12 s	1.21 s	1.12 s
29	1.20 s	1.01 s	1.01 s	0.97 s	1.03 s
30	1.37 s	1.03 s	1.03 s	0.91 s	1.01 s

Table 11-7-20: ^{1}H NMR spectroscopic data of oleanane-type triterpenoids **11-7-57**~**11-7-59**.

H	11-7-57	11-7-58	11-7-59	H	11-7-57	11-7-58	11-7-59
1	1.87 m	1.86 m	1.84 m	18	4.52 br s	4.16 br s	1.02 m, 1.81 m
	2.06 m	2.05 m	2.05 m				
2	4.47 m	4.46 m	4.47 m	19	4.74 s	2.45 d(13.1)	2.27 d(12.5)
						1.37 d(13.1)	1.20 d(12.5)
3	4.92 br s	4.89 br s	4.89 br s	21	1.55 m, 1.77 m	3.82 m	1.54 m, 2.25 m
5	2.15 m	2.18 m	2.15 m	22	1.73 m, 2.23 m	1.82 m	1.21 m, 1.62 m
6	1.65 m	1.69 m	1.67 m	23	4.48 d(11.0)	4.45 d(11.1)	4.43 d(11.0)
	1.88 m	1.92 m	1.93 m		4.64 d(11.0)	4.64 d(11.1)	4.63 d(11.0)
7	1.50 m	1.53 m	1.55 m	24	4.14 d(11.0)	4.11 d(11.1)	4.09 d(11.1)
	1.73 m	1.78 m	1.75 m		4.27 d(11.0)	4.24 d(11.1)	4.25 d(11.1)
9	1.88 m	1.86 m	1.85 m	25	1.19 s	1.20 s	1.18 s
11	2.13 m	2.05 m	2.07 m	26	1.11 s	1.03 s	1.04 s

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Table 11-7-20 (continued)

H	11-7-57	11-7-58	11-7-59	H	11-7-57	11-7-58	11-7-59
12	6.35 br s	6.25 br s	6.12 br s	27	1.08 s	1.09 s	1.02 s
15	1.13 m 1.87 m	1.10 m 1.81 m	2.05 m	29	1.31 s	1.31 s	1.23 s
16	1.53 m 1.98 m	1.44 m 1.72 m	4.67 br s	30	1.27 s	1.06 s	5.17 s

Table 11-7-21: ^{1}H NMR spectroscopic data of oleanane-type triterpenoids **11-7-60**~**11-7-64**.

H	11-7-60	11-7-61	11-7-62	11-7-63	11-7-64
1	1.78 m 2.24ddd(4.0, 11.0, 14.0)	1.66 m, 2.14 m	1.48 m, 2.06 m	1.48 m, 2.10 m	1.91 m, 1.96 m
2	1.97 ddd(4.0, 11.0, 14.5) 2.38 ddd(4.5, 11.0, 14.5)	1.98 m, 2.35 m	2.04 m, 2.48 m	1.96 m, 2.40 m	2.56 m, 2.68 m
5	1.43	1.61 m	1.96 br d(12.5)	1.35 m	2.15 br d(10.5)
6	1.45 m, 1.56 m	1.58 m, 1.65 m	1.50 br d(13.5) 1.80 dd(12.5, 13.5)	1.34 m, 1.44 m	1.35 m, 1.42 m
7	1.40 dd(12.0, 13.5) 1.58 m	3.50 dd(4.5, 12.0)	3.71 br	1.43 m, 1.74 m	1.31 m, 1.36 m
9	2.04 br s	1.95 br s	2.18 dd(8.5, 9.0)	1.62 dd(6.0, 11.0)	1.83 m
11	6.30 d(10.5)	6.35 d(10.5)	1.86 m	1.80 m	1.53 m, 1.81 m
12	5.52 d(10.5)	5.50 d(10.5)	5.15 br	5.28 s	1.80 m, 2.60 m
15	3.85 dd(4.0, 12.0)	1.40 m, 1.78 m	4.05 dd(5.5, 11.5)	3.92 dd(4.5, 11.0)	1.72 m
16	1.42 dd(12.0, 12.5) 1.75 dd(4.0, 12.5)	1.36 m, 1.66 m	1.28 dd(5.5, 13.0) 1.69 dd(11.5, 13.0)	1.24 m, 1.63 m	1.28 m, 1.44 m
18			2.00 br d(13.0)	1.96 br d(13.5)	
19	1.63 d(14.0) 2.24 d(14.0)	1.62 d(13.5) 2.35 d(13.5)	0.92 br d(14.5) 1.63 dd(13.0, 14.5)	0.94 br d(14.5) 1.68 dd(13.5, 14.5)	1.68 d(13.5) 2.28 d(13.5)
21	1.30 dd(5.0, 12.0) 1.37 dd(12.0, 12.0)	1.30 dd(4.5, 12.0) 1.36 dd(12.0, 12.0)	1.32 dd(3.0, 12.0) 1.33 dd(4.0, 12.0)	1.26 dd(2.5, 14.0) 1.31 dd(3.0, 14.0)	1.34 m
22	3.21 dd(5.0, 12.0)	3.20 dd(4.5, 12.0)	3.21 dd(3.0, 4.0)	3.23 dd(2.5, 3.0)	1.11 m, 1.16 m
23	1.16 s	1.12 s	1.15 s	1.16 s	4.87 br s, 4.96 br s

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Table 11-7-21 (continued)

H	11-7-60	11-7-61	11-7-62	11-7-63	11-7-64
24	3.29 d(11.0) 3.26 d(11.0)	3.30 d(10.5) 3.38 d(10.5)	3.24 d(11.0) 3.32 d(11.0)	3.30 d(10.5) 3.33 d(10.5)	1.80 s
25	0.91 s	0.87 s	1.00 s	1.01 s	0.88 s
26	0.68 s	0.64 s	0.85 s	0.97 s	0.90 s
27	0.87 s	0.94 s	1.34 s	1.03 s	1.20 s
28	0.94 s	0.91 s	0.81 s	0.79 s	1.04 s
29	0.71 s	0.72 s	0.98 s	0.96 s	0.97 s
30	0.93 s	0.94 s	0.83 s	0.85 s	0.75 s

Table 11-7-22: ^{1}H NMR spectroscopic data of oleanane-type triterpenoids **11-7-65** and **11-7-66**.

H	11-7-65	11-7-66	H	11-7-65	11-7-66
1	2.40 m, 2.17 m	2.36 m, 2.12 m	19	2.17 m, 1.80 m	2.22 m, 1.80 m
2	1.74 m, 1.42 m	1.74 m, 1.45 m	21	2.06 dd(16.7, 3.7), 0.91 m	1.98 m, 0.93 m
5	2.03 m	1.80 m	22	1.93 m	1.76 m
6	1.75 m, 1.42 m	1.76 m, 1.42 m	23	4.87 br s, 4.67 br s	4.87 br s, 4.67 br s
7	1.99 m, 1.50 m	1.98 m, 1.52 m	24	1.75 br s	1.77 br s
9	2.02 m	1.95 m	25	0.94 s	0.85 s
11	1.75 m	1.75 m	26	1.02 s	1.20 s
12	5.23 br s	5.23 br s	27	1.19 s	1.02 s
15	1.79 m, 1.03 m	1.77 m, 1.02 m	28	0.86 s	0.93 s
16	1.52 m, 1.28 m	1.53 m, 1.29 m	30	1.24 s	1.21 s
18	2.23 m	2.17 m	OMe		3.64 s(3-OMe) 3.66 s(29-COOMe)

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11.8 Ursane- and taraxastane-type triterpenoids

Table 11-8-1: Compounds, MFs, and test solvents of ursane-type triterpenoids **11-8-1**~**11-8-36**.

No.	Compounds	MFs	Test solvents	References
11-8-1	3*α*,21*β*-diacetoxy-11*α*-methoxy-urs-12-ene	$C_{35}H_{56}O_5$	$CDCl_3$	[91]
11-8-2	1*β*,2*α*-dihydroxy-3*β*-acetoxyurs-9(11),12-diene	$C_{32}H_{50}O_4$	$CDCl_3$	[92]
11-8-3	guajavolide	$C_{30}H_{46}O_6$	C_5D_5N	[93]
11-8-4	guavenoic acid	$C_{30}H_{46}O_6$	CD_3OD	[93]
11-8-5	salvistamineol	$C_{30}H_{50}O_3$	$CDCl_3$	[94]
11-8-6	cheiranthic acid	$C_{30}H_{46}O_5$	$CDCl_3$	[95]
11-8-7	diospyric acid A	$C_{30}H_{44}O_6$	C_5D_5N	[96]
11-8-8	diospyric acid B	$C_{30}H_{46}O_6$	C_5D_5N	[96]
11-8-9	cladocalol	$C_{30}H_{48}O_3$	$CDCl_3$	[97]
11-8-10	28-*nor*-urs-12-ene-3*β*,17*β*-diol	$C_{29}H_{48}O_2$	$CDCl_3$	[97]
11-8-11	17*β*-formyloxy-3*β*-acetyloxy-28-*nor*-urs-12-ene	$C_{32}H_{50}O_4$	$CDCl_3$	[97]
11-8-12	2*α*,3*β*,19*α*-trihydroxy-28-norurs-12-ene	$C_{29}H_{48}O_3$	CD_3OD	[98]
11-8-13	2*α*,3*α*,19*α*-trihydroxy-28-norurs-12-ene	$C_{29}H_{48}O_3$	CD_3OD	[98]
11-8-14	2*α*,3*α*,19*α*-trihydroxy-24-norurs-4(23),12-dien-28-oic acid	$C_{29}H_{44}O_5$	C_5D_5N	[99]
11-8-15	4(*R*),23-epoxy-2*α*,3*α*,19*α*-trihydroxy-24-norurs-12-en-28-oic acid	$C_{29}H_{44}O_6$	C_5D_5N	[99]
11-8-16	12-ursene-3*β*,11*α*-diol 3-*O*-palmitate	$C_{46}H_{80}O_3$	$CDCl_3$	[100]
11-8-17	1*α*,3*β*-dihydroxybauer-7-en-28-oic acid	$C_{30}H_{48}O_4$	DMSO-d_6	[101]
11-8-18	3,4-*seco*-urs-4(23),20(30)-dien-3-oic acid	$C_{30}H_{48}O_2$	C_5D_5N	[102]
11-8-19	3,23-disulfate ester of rotundic acid	$C_{30}H_{48}O_{11}S_2$	CD_3OD	[103]
11-8-20	3,23-disulfate ester of 23-hydroxytormentic acid	$C_{30}H_{48}O_{12}S_2$	CD_3OD	[103]
11-8-21	microfokienoxane A	$C_{30}H_{48}O_3$	CD_3OD	[104]
11-8-22	microfokienoxane B	$C_{30}H_{48}O_3$	C_5D_5N	[104]
11-8-23	microfokienoxane C	$C_{30}H_{48}O_4$	C_5D_5N	[104]
11-8-24	3*β*,28-dihydroxy-11*α*-methoxyurs-12-ene	$C_{31}H_{52}O_3$	C_5D_5N	[104]
11-8-25	coussaric acid	$C_{30}H_{46}O_5$	C_5D_5N	[105]
11-8-26	–	$C_{34}H_{50}O_7$	C_5D_5N	[105]
11-8-27	–	$C_{32}H_{48}O_6$	C_5D_5N	[105]
11-8-28	–	$C_{31}H_{48}O_5$	$CDCl_3$	[105]
11-8-29	–	$C_{33}H_{50}O_6$	C_5D_5N	[105]
11-8-30	3,24-diacetate barbinervic acid	$C_{34}H_{52}O_7$	C_5D_5N	[105]
11-8-31	1*β*,2*α*,19*α*-trihydroxy-3-oxo-12-ursen-28-oic acid	$C_{30}H_{46}O_6$	C_5D_5N	[106]
11-8-32	28-*nor*-urs-12-ene-3*β*,17*β*-diol	$C_{29}H_{48}O_2$	$CDCl_3$	[107]
11-8-33	1*β*,2*α*-dihydroxy-3*β*-acetoxy-11-oxours-12-ene	$C_{32}H_{50}O_5$	$CDCl_3$	[92]
11-8-34	2*α*,20*β*-dihydroxy-3*β*-acetoxyurs-9(11),12-diene	$C_{32}H_{50}O_4$	$CDCl_3$	[92]
11-8-35	camaranoic acid	$C_{30}H_{44}O_5$	$CDCl_3$	[108]
11-8-36	3*β*,20*α*-dihydroxyurs-21-en-28-oic acid	$C_{30}H_{48}O_4$	$CDCl_3$	[109]

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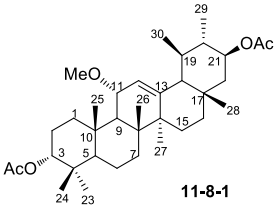
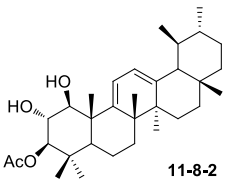


11-8-1



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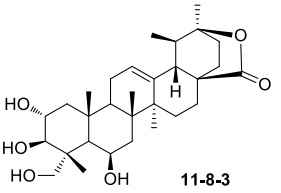

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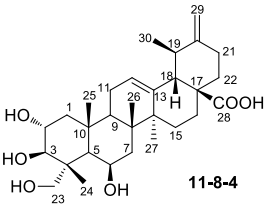

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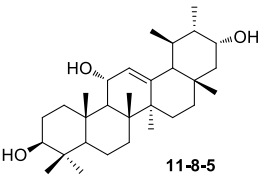

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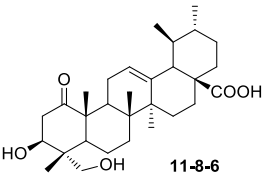
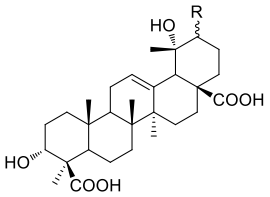
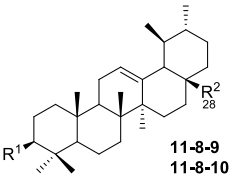


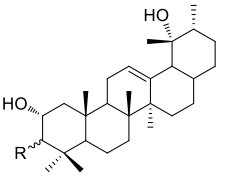
11-8-6



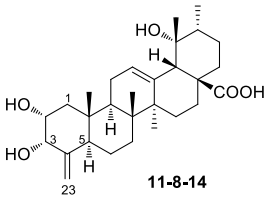
11-8-7 R = CH_2
11-8-8 R = α-Me



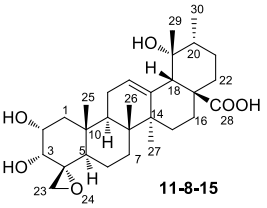
	R1	R2
11-8-9	OH	OCHO (1')
11-8-10	OH	OH
11-8-11	OAc	OCHO (1')



11-8-12 R = β-OH
11-8-13 R = α-OH



11-8-14



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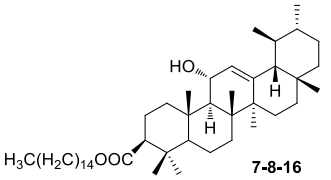
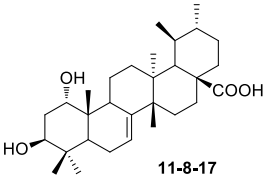
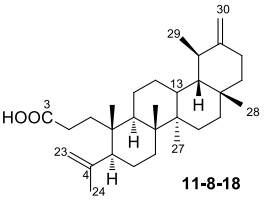


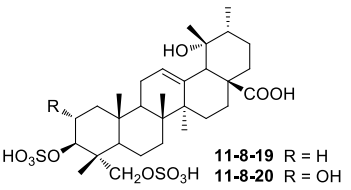
7-8-16



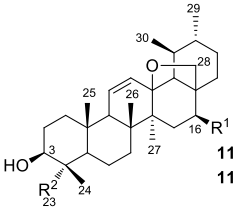
11-8-17



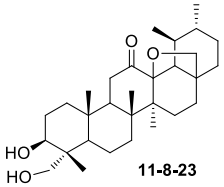
11-8-18



11-8-19 R = H
11-8-20 R = OH



	R^1	R^2
11-8-21	OH	Me
11-8-22	H	CH_2OH



11-8-23

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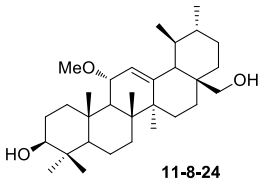

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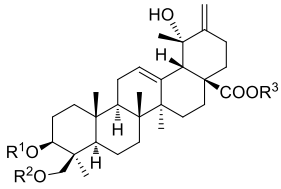
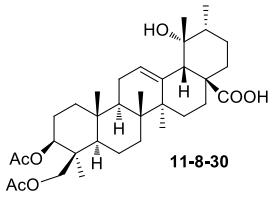
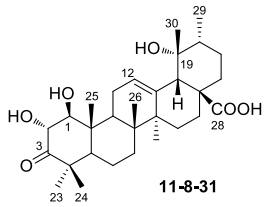


	R^1	R^2	R^3
11-8-25	H	H	H
11-8-26	Ac	Ac	H
11-8-27	H	Ac	H
11-8-28	H	H	Me
11-8-29	H	Ac	Me



11-8-30



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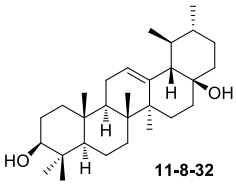

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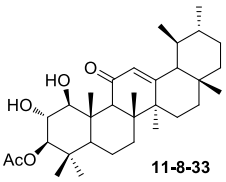
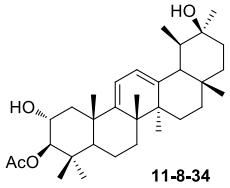


11-8-33



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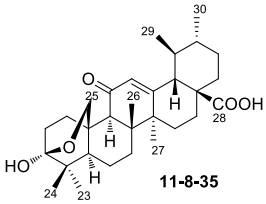
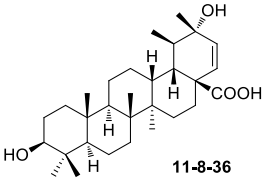


11-8-35



11-8-36

Table 11-8-2: ^{1}H NMR spectroscopic data of ursane-type triterpenoids **11-8-1**~**11-8-5**.

H	11-8-1	11-8-2	11-8-3	11-8-4	11-8-5
1	1.53, 1.66 m	*α* 3.56 d(9.2)	1.45 m, 2.32 m	0.85 m, 1.88 m	1.70 m 1.88 dt(6.5, 6.5, 12)
2	1.58, 1.90 m	*β* 3.54 dd(9.0, 9.2)	4.40 ddd(10.5, 9.5, 4.5)	3.72 ddd(11.5, 9.6, 4.5)	1.95 dt(5, 6, 12) 1.92 m
3	4.61 br s	*α* 4.50 d(9.0)	4.22 d(9.5)	3.27 d(9.6)	3.29 dd(4.5, 12.2)
5	1.27 m		1.98 m	1.27 m	0.77 br d(11)
6	1.40, 1.47 m		5.06 br s($W_{1/2}$ = 6.6)	4.38 br s($W_{1/2}$ = 6.6)	1.48 m, 1.57 m
7	1.30, 1.56 m		1.99 m, 1.80 m	1.75 m, 1.53 m	0.84 m, 1.55 m
9	1.78 m		1.99 m	1.68 m	1.68 d(8.7)
11	3.77 dd(8.8, 3.2)	6.59 d(5.9)	2.15 m	2.02 m	4.35 dd(4, 8.7)

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Table 11-8-2 (continued)

H	11-8-1	11-8-2	11-8-3	11-8-4	11-8-5
12	5.43 d(3.6)	5.40 d(5.9)	5.54 t(3.4)	5.28 t(4.1)	5.24 d(4)
15	1.02, 1.74 m		2.35 m	1.99 m, 1.06 m	
16	1.15, 2.00 m		2.21 m	1.73 m, 1.62 m	0.97 m, 1.40 m
18	1.44 m	1.42 d(11.1)	2.61 d(11.4)	2.47 d(11.2)	1.42 d(9)
19	1.55 m, 1.12 m		1.45 m	2.37 m	0.86 m
20					1.38 m
21	4.73 td(11.2, 3.8)		1.25 m	2.01 m, 1.65 m	3.53 dd(5, 11)
22	1.28, 1.80 m		1.36 m	1.75 m, 1.52 m	1.72 m, 1.80 m
23	0.92 s	0.81 s	4.38 d(10.7) 4.03 d(10.7)	3.58 d(11.0) 3.43 d(11.0)	0.81 s
24	0.86 s	0.84 s	1.71 s	1.05 s	1.08 s
25	1.09 s	1.24 s	1.75 s	1.38 s	0.99 s
26	1.03 s	0.86 s	1.60 s	1.10 s	1.04 s
27	1.18 s	1.10 s	1.15 s	1.15 s	1.18 s
28	0.86 s	0.78 s			0.80 s
29	0.93 d(6)	0.75 d(6.3)	1.70 s	4.68 br s, 4.63 br s	0.87 d(6.4)
30	0.96 d(6)	0.84 d(6.6)	1.05 d(6.1)	1.01 d(6.3)	0.98 d(5.8)
OMe	3.30 s				
OAc	2.05 s, 2.07 s	2.08 s			

Table 11-8-3: ^{1}H NMR spectroscopic data of ursane-type triterpenoids **11-8-6**~**11-8-10**.

H	11-8-6	11-8-7	11-8-8	11-8-9	11-8-10
1		1.61 m, 1.96 m	1.58 m, 1.93 m	1.68 m	1.66 m
2	*α* 2.40 dd(12.0, 5.0) *β* 3.05 dd(12.0, 12.0)	1.87 m, 2.76 t(14.1)	1.90 m, 2.75 t(13.0)	1.76 m	1.65 m
3	*α* 3.92 dd(12.0, 5.0)	4.73 br s	4.72 br s	3.22 dd(4.9, 11.0)	3.22 dd(4.6, 10.7)
5	1.12	2.17 m	2.15 m	0.75 m	0.74 br d(11.7)
6	1.42, 1.54	2.02 m, 2.36 m	2.13 m, 2.39 m	1.60 m	1.55 m
7	1.30, 1.43	1.60 m, 1.89 m	1.60 m, 1.81 m	1.50 m, 1.38 m	1.51 m, 1.40 m
9	*α* 2.23 dd(11.4, 5.4)	2.16 m	2.14 m	1.52 m	1.54 m
11	1.84, 2.40	1.82 m, 2.10 m	2.14 m, 2.20 m	1.90 m, 1.82 m	1.94 dd(3.8, 11.1)
12	5.27 t-like(3.5)	5.68 br s	5.65 br s	5.20 t(3.6)	5.29 t(3.7)
15	1.06, 1.84	1.40 br d(13.2) 2.80 m	1.35 m, 2.38 m	1.80 m, 1.10 m	1.04 m, 2.04 m
16	*α* 2.02 ddd(13.8, 13.8, 4.8) *β* 1.68	2.18 m, 3.24 m	2.06 m 3.13 td(13.5, 4.0)	2.10 m	2.02 m, 2.04 m

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Table 11-8-3 (continued)

H	11-8-6	11-8-7	11-8-8	11-8-9	11-8-10
18	β 2.20 d(11.4)	3.27 s	3.08 s	2.08 m	1.58 m
19	1.33			1.30 m	1.66 dd(3.7, 2.7)
20	1.01 m		1.51 m	1.47 m	1.28 m
21	1.28, 1.51	2.30 m 3.17 td(12.6, 3.9)	2.10 m, 2.13 m	1.23 m, 1.65 m	1.17 m, 1.60 m
22	1.66 1.72 ddd(13.0, 13.0, 3.5)	2.16 m 2.38 m	2.08 m 2.17 m	2.34 dt(3.2, 6.5) 1.94 m	1.72 dt(3.9, 6.3) 1.53 m
23	3.44 d(10.4) 3.75 d(10.4)	1.80 s	1.80 s	1.00 s	1.00 s
24	1.08 s			0.76 s	0.79 s
25	1.35 s	1.27 s	1.26 s	0.96 s	0.93 s
26	0.85 s	1.24 s	1.25 s	0.96 s	0.99 s
27	1.11 s	1.76 s	1.72 s	1.08 s	1.08 s
29	0.90 d(6.6)	1.67 s	1.45 s	0.85 d(6.5)	0.82 d(6.4)
30	0.95 d(6.3)	5.02 s, 4.82 s	1.13 d(6.5)	0.95 d(6.5)	0.94 d(5.6)
1′				8.00 s	
OH		5.74 s(C19)	5.01 s(C19)		

Table 11-8-4: ^{1}H NMR spectroscopic data of ursane-type triterpenoids **11-8-11**~**11-8-15**.

H	11-8-11	11-8-12	11-8-13	11-8-14	11-8-15
1	1.66 m	0.93 dd(12.6, 10.5) 1.94 dd(12.6, 4.2)	1.26 m, 1.59 m	1.87 t(12.0), 2.08	1.85 t(11.7), 2.11
2	1.65 m	3.62 ddd(10.5, 9.6, 4.2)	3.92 m	4.12 br dt(11.4, 4.2)	4.22 br dt(11.7, 3.6)
3	4.49 br t(8.5)	2.91 d(9.6)	3.30 br s	4.66 (2.4)	3.85 d(3.0)
5	0.82 m	1.22 m	1.23 m	2.69 br d(11.4)	2.53 br d(11.4)
6	1.50 m, 1.38 m	1.65 m, 1.32 m	1.52 m, 1.30 m	1.48, 1.56	1.09, 1.55
7	1.52 m, 1.40 m	1.50 m, 1.30 m	1.48 m, 1.33 m	1.41, 1.67	1.33, 1.57
9	1.55 m	1.75 m	1.66 m	2.17	2.11
11	1.90 m	2.00 m	1.99 m	2.11 br d(13.2) 2.28 br d(13.2)	2.12 2.24
12	5.20 br s	5.29 br s	5.29 br s	5.62 br s	5.60 br s
15	1.10 m, 1.82 m	1.02 m, 1.51 m	1.01 m, 1.49 m	1.26 br d(13.2) 2.34 dt(13.2, 2.4)	1.21 br d(13.8) 2.26
16	2.10 m	1.82 m, 2.56 m	1.85 m, 2.57 m	2.05 3.12 dt(12.8, 3.0)	2.05 3.09 dd(13.2, 4.0)
17		1.50 m	1.50 m		

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Table 11-8-4 (continued)

H	11-8-11	11-8-12	11-8-13	11-8-14	11-8-15
18	2.10 m	2.50 br s	2.50 br s	3.06 s	3.06 s
19	1.35 m				
20	1.42 m	1.42 m	1.41 m	1.52	1.50
21	1.62 m, 1.20 m	1.31 m, 0.99 m	1.30 m, 0.99 m	1.35, 2.12	1.34, 2.11
22	2.34 dt(3.2, 6.5) 1.90 m	1.30 m, 1.51 m	1.31 m, 1.50 m	2.07, 2.18	2.06, 2.17
23	0.86	1.01 s	0.99 s	4.77 s	2.67 d(4.8)
				5.14 s	2.83 d(4.8)
24	0.86	0.81 s	0.87 s		
25	0.93 s	1.00 s	0.99 s	0.84 s	0.93 s
26	0.96 s	0.80 s	0.78 s	1.16 s	1.12 s
27	1.07 s	1.33 s	1.35 s	1.66 s	1.61 s
29	0.86	1.19 s	1.19 s	1.44 s	1.42 s
30	0.86	0.92 d(6.9)	0.92 d(6.6)	1.13 d(6.6)	1.11 d(6.6)
OH				5.00 br s(19-OH)	4.92 br s(19-OH)
OAc	2.01 s				
1′	8.00 s				

Table 11-8-5: ^{1}H NMR spectroscopic data of ursane-type triterpenoids **11-8-16**~**11-8-20**.

H	11-8-16	11-8-17	11-8-18	11-8-19	11-8-20
1		3.50 s	1.95 m	1 01 m, 1.65 m	0.98 m, 2.02 m
2		1.62, 1.67 m	2.49, 2.65 m	1.79, 2.16 m	4.03 ddd(3, 9.2, 13.0)
3	4.53 dd(8.9, 7.6)	3.59 d		4.39 dd(4.8, 11.7)	4.32 d(9.2)
5		1.57 s	2.11 br d(10)	1.41 m	1.51 m
6		1.92 m, 2.08 m	1.35,1.74 m	1.40, 1.63 m	1.43, 1.66 m
7		5.35 s	1.28 m	1.28, 1.70 m	1.32, 1.73 m
9	1.52 d(8.8)	1.60 m	1.52 m	1.75 m	1.81 m
11	4.25 m	1.50 m	1.23, 1.59 m	1.98, 1.73 m	2.04, 1.94 m
12	5.19 d(3.3)	1.52 m	1.10, 1.60 m	5.28 t(3.5)	5.31 t(3.5)
13			1.66 m		
15		1.43 m, 1.73 m	0.92 m	0.93, 1.94 m	0.96, 1.98 m
16		1.30 m, 1.75 m	1.09 m, 1.21 m	1.52, 2.40 m	2.44, 1.54 m
18		2.31 s	0.95 m	2.60 s	2.63 s
19		1.05	2.11 m		
20		1.10		1.37 m	1.40 m
21		1.07 m, 1.54 m	2.19, 2.47 m	1.16, 1.69 m	1.18, 1.72 m
22		1.60 m, 2.15 m	1.33, 1.39 m	2.15, 1.70 m	1.63, 1.81 m
23	0.88 s	0.75 s	4.88 br s	3.95 d(9.7)	3.97 d(9.6)
			4.96 br s	3.82 d(9.7)	3.82 d(9.6)

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Table 11-8-5 (continued)

H	11-8-16	11-8-17	11-8-18	11-8-19	11-8-20
24	0.89 s	0.87 s	1.80 s	0.80 s	0.84 s
25	1.12 s	0.66 s	0.88 s	1.01 s	1.08 s
26	1.06 s	1.02 s	1.02 s	0.87 s	0.89 s
27	1.16 s	0.98 s	0.95 s	1.32 s	1.35 s
28	0.80 s		0.90 s		
29	0.86 d(7.0)	0.82 d	1.04 d(6.5)	1.20 s	1.23 s
30	0.93 br s	1.00 d	4.72, 4.77 br s	0.92 d(6.9)	0.95 d(6.5)
2′	2.29 t(7.8)				
4′-13′	1.25 m				
16′	0.88 t(7.0)				

Table 11-8-6: ^{1}H NMR spectroscopic data of ursane-type triterpenoids **11-8-21**~**11-8-24**.

H	11-8-21	11-8-22	11-8-23	11-8-24
1	*α* 1.86 dt(12.8, 3.6)	*α* 1.84 br d(13.0)	*α* 1.89 m	*α* 2.09 dt(13.6, 3.2)
	β 1.00 m	*β* 1.06 m	*β* 1.53 m	*β* 1.52 m
2	*ca*. 1.64, *ca*. 1.67	1.97 m, *ca*. 2.00	*α* 1.88 m, *β* 1.93 m	*α* 1.92 m, *β* 1.96 m
3	3.15 dd(11.6, 4.4)	4.25 dd(11.2, 4.8)	4.22 dd(10.4, 5.2)	3.50 br d(10.4)
5	0.78 m	*ca*. 1.56	1.56 m	0.92 s
6	1.63 m(2H)	*ca*. 1.03, *ca*. 1.76	*β* 1.03 m, *α* 1.74 m	1.40 m, 1.58 m
7	*ca*. 1.24, *ca*. 1.26	*ca*. 1.26, *ca*. 1.36	*β* 1.56 m, *α* 1.67 m	*α* 1.52 m, *β* 1.24 m
9	1.91 br s	2.11 br s	1.83 dd(13.2, 4.4)	1.87 d(8.8)
11	5.53 dd(10.4, 3.2)	5.70 dd(10.4, 2.8)	2.71 dd(17.2, 13.2)	3.76 dd(8.8, 3.2)
			2.54 dd(17.2, 4.4)	
12	5.83 d(10.4)	5.89 d(10.4)		5.45 d(3.2)
15	*ca*. 1.21, *ca*. 1.45	0.93 m, 1.82 m	*β* 0.98 m, *α* 1.91 m	*β* 1.05 m, *α* 2.00 m
16	4.20 dd(9.4, 6.4)	1.03 m, 1.97 m	0.98 m, 1.91 m	*β* 1.29 m, *α* 1.60 m
18	1.38 d(12.0)	1.22 d(12.4)	2.21 d(11.6)	1.66 br d(11.2)
19	1.78 m	1.71 m	1.66 m	0.96 m
20	*ca*. 0.96	1.23 m	1.22 m	1.50 m
21	1.29 m, *ca*. 2.20	*ca*. 1.24, *ca*. 1.26	*ca*. 1.35, *ca*. 1.50	1.37 m, 1.53 m
22	1.49 m	1.48 m	*β* 1.47 m	*β* 2.01 m
	1.52 m	1.50 m	*α* 1.92 m	*α* 1.76 td(13.6, 4.0)
23	0.97 s	3.76 dd(10.8, 4.4)	3.74 dd(10.4, 4.8)	1.27 s
		4.22 dd(10.8, 4.4)	4.24 dd(10.4, 4.8)	
24	0.78 s	1.08 s	1.06 s	1.09 s
25	0.92 s	1.05 s	0.95 s	1.10 s
26	1.08 s	1.36 s	1.35 s	1.05 s
27	1.13 s	1.08 s	1.03 s	1.29 s
28	3.00 d(6.8)	3.25 d(6.8)	3.29 d(6.8)	3.52 br d(10.4)
	3.87 d(6.8)	3.67 d(6.8)	3.70 d(6.8)	3.88 br d(10.4)
29	1.00 d(6.0)	1.05 d(5.6)	1.08 d(6.4)	1.03 d(6.4)
30	*ca*. 0.96	0.88 d(6.4)	*ca*. 0.88	0.96 br s

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Table 11-8-7: ^{1}H NMR spectroscopic data of ursane-type triterpenoids **11-8-25**~**11-8-28**.

H	11-8-25	11-8-26	11-8-27	11-8-28
1	1.90 m	1.30~1.44 m	1.80~1.85 m	1.44~1.62 m
	1.41~1.48 m		1.27~1.45 m	1.30~1.39 m
2	2.11~2.17 m	1.94~1.97 m	2.00~2.18 m	1.65~1.75 m
	1.86 m	1.65~1.72 m	1.80~1.85 m	1.44~1.62 m
3	4.46 br s	5.30 br s	4.08 br s	3.87 br s
5	1.95 br d(12.6)	1.54~1.61 m	1.92 br d(12.0)	1.30~1.39 m
6	1.72~1.76 m	1.54~1.61 m	1.64~1.73 m	1.44~1.62 m
	1.56 m		1.27~1.45 m	1.30~1.39 m
7	1.72~1.76 m	1.30~1.40 m	1.64~1.73 m	1.44~1.62 m
	1.41~1.48 m		1.27~1.45 m	1.30~1.39 m
9	2.11~2.17 m	1.94~1.97 m	2.00~2.18 m	1.65~1.75 m
11	2.11~2.17 m	2.06~2.18 m	2.00~2.18 m	2.00~2.04 m
	2.06 m			1.84~1.96 m
12	5.64 br s	5.64 br s	5.63 br s	5.43 t(3.5)
15	2.31~2.35 m	2.24~2.36 m	2.23~2.36 m	1.44~1.62 m
	1.33 m	1.30~1.44 m	1.27~1.45 m	1.05 m
16	3.20~3.27 m	3.14~3.28 m	3.14~3.29 m	2.47 td(13.6, 4.3)
	2.11~2.17 m	2.24~2.36 m	2.00~2.18 m	1.65~1.75 m
18	3.25 br s	3.26 br s	3.22 br s	2.88 br s
21	3.17 td(12.7, 4.1)	3.14~3.29 m	2.68 td(13.0, 5.7)	3.09 td(13.2, 4.2)
	3.14~3.28 m	2.24~2.36 m	2.23~2.36 m	2.21 ddd(13.0, 5.6, 2.6)
22	2.31~2.35 m	2.24~2.36 m	2.23~2.36 m	1.84~1.96 m
	2.11~217 m	2.14~2.18 m	2.00~2.18 m	1.65~1.75 m
23	1.64 s	1.12 s	1.41 s	1.09 s
24	3.17 td(12.7, 4.1)	3.14~3.28 m	3.14~3.29 m	2.68 td(13.0, 5.7)
	2.45 ddd(11.9, 4.1, 4.1)	2.24~2.36 m	2.23~2.36 m	2.21 ddd(13.0, 5.6, 2.6)
25	1.01 s	0.86 s	0.94 s	0.90 s
26	1.12 s	1.06 s	1.09 s	0.70 s
27	1.70 s	1.72 s	1.68 s	1.22 s
29	1.66 s	1.68 s	1.65 s	1.41 s
30	5.01 s, 4.81 s	5.02 s, 4.83 s	5.01 s, 4.82 s	5.01 s, 4.78 d(1.2)
OH	5.74 s(19-OH)	5.85 br s(19-OH)		1.55 s(19-OH)
OAc		2.10 s(3-OAc)	2.05 s(24-OAc)	
		2.01 s(24-OAc)		
OMe				3.61 s

Table 11-8-8: ^{1}H NMR spectroscopic data of ursane-type triterpenoids **11-8-29**~**11-8-32**.

H	11-8-29	11-8-30	11-8-31	11-8-32
1	1.64~1.67 m,	1.25~1.41 m	3.70 d(9.6)	β 1.66 m, α 1.02 m
	1.33~1.38 m			
2	1.89~2.00 m,	2.04~2.10 m,	4.88 d(9.6)	α 1.63 m, β 1.59 m
	1.81~1.84 m	1.66~1.71 m		

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Table 11-8-8 (continued)

H	11-8-29	11-8-30	11-8-31	11-8-32
3	4.07 br s	5.29 br s		3.22 dd(11.0, 5.1)
5	1.89~2.00 m	1.50~1.63 m	1.16	α 0.76 br d(11.7)
6	1.64~1.67 m, 1.47 m	1.50~1.63 m, 1.25~1.41 m	1.52 m, 1.59 m	α 1.54 m, β 1.39 m
7	1.81~1.84 m, 1.33~1.38 m	1.66~1.71 m, 1.37~1.41 m	1.41 m, 1.57 m	α 1.43 m, β 1.52 m
9	2.04 m	1.92~1.98 m	2.23 dd(7.4, 10.8)	α 1.54 m
11	2.09~2.17 m, 1.89~2.00 m	2.00~2.07 m	2.65 m, 3.28 m	1.94 dd(9.0, 3.6)
12	5.52 t(3.3)	5.63 br s	5.73 br s	5.30 t(3.6)
15	1.22 m, 2.09~2.17 m	1.25~1.41 m, 2.33 td(13.4, 4.4)	1.31 m, 2.35 m	α 1.05 m, β 2.04 m
16	3.19 td(13.5, 4.2), 1.89~2.00 m	3.13 td(13.5, 4.3), 2.04~2.10 m	2.10 m, 3.15 m	α 2.02 m, β 1.25 m
18	3.01 br s	3.07 br s	3.08 s	α 1.59 m
19				β 1.27 m
20		1.50~1.63 m	1.50 m	0.92 m
21	2.10~2.13 m, 1.89~2.00 m	1.25~1.41 m	1.36 m, 2.12 m	α 1.18 m, β 1.57 m
22	2.09~2.17 m, 1.81~1.84 m	2.18 m, 2.04~2.10 m	2.08 m, 2.18 m	α 1.73 m, β 1.57 m
23	1.41 s	1.12 s	1.24 s	1.01 s
24	3.04 td(13.2, 4.2) 1.89~2.00 m	2.04~2.10 m 1.25~1.41 m	1.02 s	0.80 s
25	0.99 s	0.85 s	1.43 s	0.95 s
26	0.89 s	1.07 s	1.23 s	0.99 s
27	1.61 s	1.68 s	1.70 s	1.08 s
29	1.58 s	1.47 s	1.13 d(6.5)	0.82 d(6.6)
30	4.79 s, 4.96 s	1.13 d(5.1)	1.45 s	1.10 d(6.1)
OH	5.82 s(19-OH) 5.83 br d(3, 3-OH)	5.10 s(19-OH)		
OAc	2.07 s(24-OAc)	2.07 s(3-OAc) 2.00 s(24-OAc)		
OMe	3.71 s			

Table 11-8-9: ^{1}H NMR spectroscopic data of ursane-type triterpenoids **11-8-33**~**11-8-36**.

H	11-8-33	11-8-34	11-8-35	11-8-36
1	α 3 22 d(9.0)	α 1.33 dd(10.9, 12.5)	2.95 ddd(12.6, 12.6, 4.7)	α 1.69 ddd(12.5, 3.0, 3.0)
		2.35 dd(4.3, 12.5)	1.17 m	β 0.92 m
2	β 3.75 dd(9.0, 11.0)	β 3.78 ddd(4.3, 9.8, 10.9)	2.12 m, 1.76 m	α 1.62 m, β 1.57 m
3	α 4.72 d(11.0)	α 4.42 d(9.8)		3.21 dd(11.5, 5.0)

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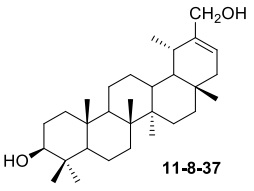
Table 11-8-9 (continued)

H	11-8-33	11-8-34	11-8-35	11-8-36
5	0.92 m		1.17 m	0.68 br d(11.5)
6			1.53 m, 1.46 m	*α* 1.52 m, *β* 1.30 m
7			1.51 m, 1.37 m	*α* 1.44 m, *β* 1.38 m
9	2.66 s		2.42 s	1.28 m
11		5.56 d(5.9)		1.27 m(2H)
12	5.72 s	5.38 d(5.9)	5.62 s	*α* 1.60 m, *β* 1.10 m
13				1.34 m
15			1.77 m, 1.32 m	*α* 1.15 br d(14.0)
				β 2.12 ddd(14.0, 13.5, 4.5)
16			2.06 m, 1.76 m	*α* 1.61 m
				β 2.25 ddd(13.5, 4.5, 3.0)
18	1.45 d(11.2)	1.38 d(11.1)	2.38 d(11.8)	0.98 m
19			1.36 m	1.72 dq(7.0, 7.0)
20			0.94 m	
21			1.56 m, 1.31 m	6.07 d(7.6)
22			1.78 m, 1.64 m	6.10 d(7.6)
23	0.92 s	0.82 s	1.02 s	0.97 s
24	0.93 s	0.83 s	0.97 s	0.76 s
25	1.03 s	0.87 s	4.59 br d(8.2)	0.83 s
			4.04 br d(8.2)	
26	1.33 s	0.86 s	0.83 s	0.95 s
27	1.20 s	1.11 s	1.27 s	0.95 s
28	0.83 s	0.78 s	11.68	
29	0.82 d(6.3)	0.73 d(6.3)	0.84 d(6.1)	0.85 d(7.1)
30	0.91 d(6.9)	1.22 s	0.94 d(6.2)	1.54 s
OAc	2.14 s	2.07 s		
OH			2.64 br s(OH-3)	

Table 11-8-10: Compounds, MFs, and test solvents of taraxastane-type triterpenoids **11-8-37**~**11-8-41**.

No.	Compounds	MFs	Test solvents	References
11-8-37	taraxast-20-ene-3*β*,30-diol	$C_{30}H_{50}O_2$	$CDCl_3$	[110]
11-8-38	20*β*,28-epoxy-28*α*-methoxytaraxasteran-3*β*-ol	$C_{31}H_{52}O_3$	$CDCl_3$	[107]
11-8-39	20*β*,28-epoxytaraxaster-21-en-3*β*-ol	$C_{30}H_{48}O_2$	$CDCl_3$	[107]
11-8-40	punicanolic acid	$C_{30}H_{50}O_4$	C_5D_5N	[111]
11-8-41	(20*R*)-taraxastane-3*β*,20-diol 3-acetate	$C_{32}H_{54}O_3$	$CDCl_3$	[112]



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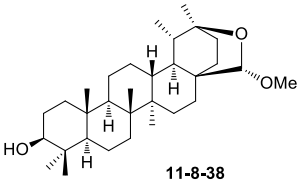

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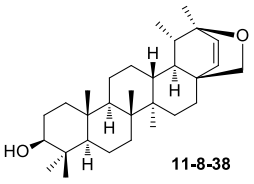

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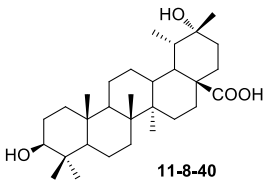

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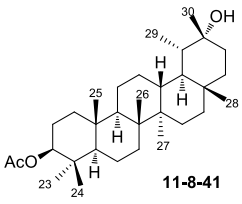

11-8-41

Table 11-8-11: ^{1}H NMR spectroscopic data of taraxastane-type triterpenoids **11-8-37**~**11-8-41**.

H	11-8-37	11-8-38	11-8-39	11-8-40	11-8-41
1	*α* 0.91 m	*α* 0.95 m	*α* 0.92 m	*α* 0.98 m	*α* 0.99
	β 1.73 m	*β* 1.69 m	*β* 1.70 m	*β* 1.70 ddd(3.2, 3.6, 14.0)	*β* 1.64
2	*α* 1.55 m,	*α* 1.62 m,	*α* 1.62 m,	1.86 m(2H)	1.62(2H)
	β 1.54 m	*β* 1.59 m	*β* 1.58 m		
3	3.21 dd(11.2, 4.9)	*α* 3.19 dd(11.5, 4.4)	*α* 3.19 dd(11.2, 4.4)	3.46 dd(5.8, 10.3)	4.47 dd(5.7, 10.8)
5	0.76 m	*α* 0.69 br d(11.2)	*α* 0.69 m	0.81 dd(1.9, 11.6)	0.78 br d(9.6)
6	1.54 m	*α* 1.52 m,	*α* 1.54 m,	1.41 m, 1.55 m	*α* 1.50, *β* 1.35
		β 1.37 m	*β* 1.40 m		
7	1.36 m	*α* 1.34 m,	1.38 m(2H)	1.40 m(2H)	*α* 1.34, *β* 1.39
		β 1.40 m			
9	1.36 dd(11.7, 4.7)	1.37 m	*α* 1.33 m	1.30 m	1.25
11	*α* 1.27 m,	1.25 m	1.27 m	*α* 1.53 m, *β* 1.28 m	*α* 1.44, *β* 1.26
	β 1.59 m				
12	*α* 0.92 m,	*α* 1.69 m,	*α* 1.10 m,	*α* 1.37 m, *β* 2.03 m	*α* 1.15, *β* 1.99
	β 1.62 m	*β* 1.64 m	*β* 1.64 m		
13	1.55 m	*β* 1.56 m	1.73 m	2.77 ddd(4.0, 10.4, 14.0)	1.82 ddd(4.1, 10.1, 13.3)
15	*α* 1.68 m,	*α* 1.02 m,	*α* 1.04 m,	1.22 m, 1.27 m	*α* 0.97, *β* 1.73
	β 1.11 m	*β* 1.56 m	*β* 1.52 m		
16	1.54 m	*α* 1.15 m	*α* 1.76 m	*α* 1.60 ddd(4.0, 13.5, 14.2)	*α* 1.32, *β* 1.17
		β 1.56 m	*β* 1.50 m	*β* 2.38 ddd(2.9, 4.1, 14.2)	
18	1.25 m	*α* 0.88 m	*α* 0.74 m	1.79 dd(10.4, 10.5)	1.02
19	2.04 d(7.1)	*β* 1.38 m	*β* 1.47 m	2.50 dq(10.5, 6.2)	1.51
20					*α* 1.47, *β* 1.70
21	5.59 dd(6.6, 1.8)	*α* 1.62 m	5.98 d(8.2)	*α* 1.86 m	*α* 1.28
		β 1.64 m		*β* 2.10 ddd(3.2, 12.9, 16.9)	*β* 1.28
22	*α* 1.88 m	*α* 0.91 m	6.10 d(8.2)	*α* 2.32 ddd(2.9, 12.9, 14.9)	
	β 1.88 m	*β* 1.73 m		*β* 2.03 m	

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Table 11-8-11 (continued)

H	11-8-37	11-8-38	11-8-39	11-8-40	11-8-41
23	0.75 s	0.97 s	0.97 s	1.23 s	0.85 s
24	0.96 s	0.77 s	0.77 s	1.01 s	0.84 s
25	0.85 s	0.84 s	0.85 s	0.86 s	0.86 s
26	1.04 s	0.98 s	1.00 s	1.09 s	1.03 s
27	0.95 s	0.93 s	0.95 s	1.02 s	0.93 s
28	0.76 s	β 4.87 s	α 2.81 dd(7.8, 1.5) β 4.17 d(7.8)		0.89 s
29	1.00 d(6.4)	0.87 d(7.1)	0.69 d(6.8)	1.41 d(6.2)	1.05 d(6.2)
30	α 4.13 d(12.3) β 4.02 d(12.3)	1.10 s	1.30 s	1.43 s	1.07 s
OMe		3.43 s			
OAc					2.03 s

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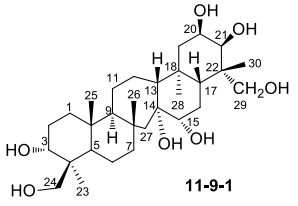
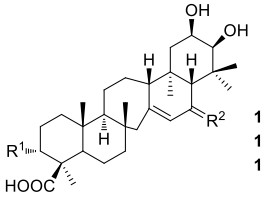
11.9 Ferrtane-type triterpenoids

Table 11-9-1: Compounds, MFs, and test solvents of ferrtane-type triterpenoids **11-9-1**~**11-9-24**.

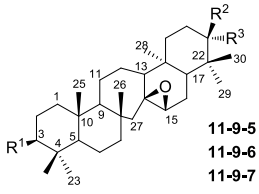
No.	Compounds	MFs	Test solvents	References
11-9-1	serratane-3*α*,14*α*,15*α*,20*β*,21*β*,24,29-heptol	$C_{30}H_{52}O_7$	C_5D_5N	[113]
11-9-2	3*α*,20*β*,21*β*-trihydroxyserrat-14-en-24-oic acid	$C_{30}H_{48}O_5$	C_5D_5N	[113]
11-9-3	3*β*,20*β*,21*β*-trihydroxyserrat-14-en-24-oic acid	$C_{30}H_{48}O_5$	C_5D_5N	[113]
11-9-4	3*α*,20*β*,21*β*-trihydroxy-16-oxoserrat-14-en-24-oic acid	$C_{30}H_{46}O_6$	C_5D_5N	[113]
11-9-5	14*β*,15*β*-epoxy-3*β*-hydroxyserratan-21*β*-ol	$C_{30}H_{50}O_3$	C_5D_5N	[114]
11-9-6	14*β*,15*β*-epoxy-3*β*-hydroxyserratan-21*α*-ol	$C_{30}H_{50}O_3$	C_5D_5N	[114]
11-9-7	14*β*,15*β*-epoxy-3*β*-hydroxyserratan-21*α*-ol-3*β*-*O*-acetate	$C_{32}H_{52}O_4$	$CDCl_3$	[114]
11-9-8	3*β*-methoxyserrat-13-en-21*β*-ol	$C_{31}H_{52}O_2$	$CDCl_3$	[115]
11-9-9	13*β*,14*β*-epoxy-3*β*-methoxyserratan-21*β*-ol	$C_{31}H_{52}O_3$	$CDCl_3$	[115]
11-9-10	jezananal A	$C_{31}H_{52}O_3$	$CDCl_3$	[116]
11-9-11	jezananal B	$C_{31}H_{52}O_3$	$CDCl_3$	[116]
11-9-12	lycernuic acid C	$C_{30}H_{50}O_7$	C_5D_5N	[117]
11-9-13	lycernuic acid D	$C_{30}H_{50}O_6$	C_5D_5N	[117]
11-9-14	lycernuic acid E	$C_{30}H_{50}O_5$	C_5D_5N	[117]
11-9-15	lycernuic ketone A	$C_{31}H_{48}O_6$	C_5D_5N	[117]
11-9-16	lycernuic ketone B	$C_{31}H_{48}O_6$	C_5D_5N	[117]
11-9-17	lycernuic ketone C	$C_{30}H_{48}O_4$	C_5D_5N	[117]
11-9-18	lycernuic acid A	$C_{30}H_{48}O_4$	C_5D_5N	[117]
11-9-19	lycernuic acid B	$C_{30}H_{48}O_5$	C_5D_5N	[117]
11-9-20	21*α*-hydroxyserrat-14-en-3*β*-yl propanedioic acid monoester	$C_{33}H_{52}O_5$	C_5D_5N	[118]
11-9-21	3*α*,21*α*-dihydroxyserrat-14-en-24-oic acid	$C_{30}H_{48}O_4$	C_5D_5N	[118]
11-9-22	16-oxo-3*α*,21*β*-dihydroxyserrat-14-en-24-al	$C_{30}H_{46}O_4$	C_5D_5N	[118]
11-9-23	16-oxo-3*α*,21*β*-dihydroxyserrat-14-en-24-oic acid	$C_{30}H_{46}O_5$	C_5D_5N	[118]
11-9-24	16-oxo-21*β*-hydroxyserrat-14-en-3*α*-yl acetate	$C_{32}H_{50}O_4$	$CDCl_3$	[118]



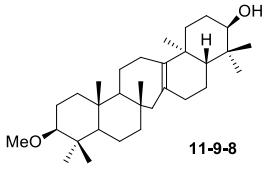
11-9-1



	R^1	R^2
11-9-2	*α*-OH	H_2
11-9-3	*β*-OH	H_2
11-9-4	*α*-OH	O



	R^1	R^2	R^3
11-9-5	OH	OH	H
11-9-6	OH	H	OH
11-9-7	OAc	H	OH



11-9-8

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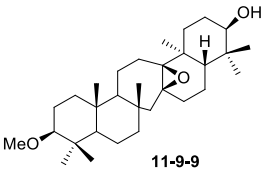
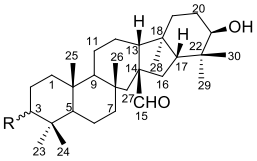
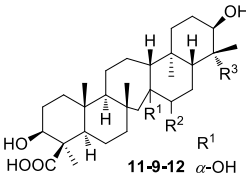


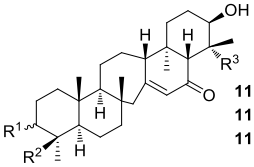
11-9-9



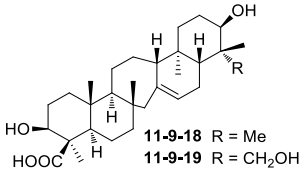
11-9-10 R = β-OMe
11-9-11 R = α-OMe



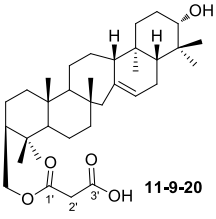
	R^1	R^2	R^3
11-9-12	α-OH	α-OH	CH_2OH
11-9-13	α-OH	α-OH	Me
11-9-14	β-OH	H	Me



	R^1	R^2	R^3
11-9-15	β-OH	COOMe	CH_2OH
11-9-16	α-OH	COOMe	CH_2OH
11-9-17	α-OH	CH_2OH	Me



11-9-18 R = Me
11-9-19 R = CH_2OH



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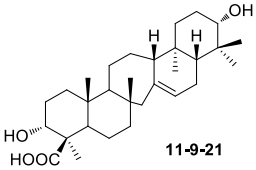
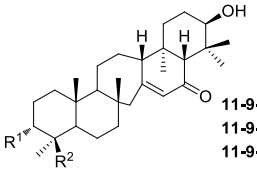


11-9-21



	R^1	R^2
11-9-22	OH	CHO
11-9-23	OH	COOH
11-9-24	OAc	Me

Table 11-9-2: ^{1}H NMR spectroscopic data of ferrtane-type triterpenoids **11-9-1**~**11-9-5**.

H	11-9-1	11-9-2	11-9-3	11-9-4	11-9-5
1	1.71 m, 1.86 m	1.75 m, 1.82 m	2.01 m, 2.17 m	1.70 m, 1.80 m	1.82, 1.01 m
2	1.88 m, 2.19 m	2.03 m, 2.75 m	2.00 m, 2.50 m	2.03 m, 2.72 m	1.89, 1.86 m
3	4.41 br s	4.68 br s	3.40 dd(4.0, 11.0)	4.69 br s	α 3.46 dd(7.0, 9.1)
5	1.90 m	2.01 m	1.02 m	2.05 m	α 0.84 m
6	1.59 m, 1.80 m	1.98 m, 2.44 m	1.98 m, 2.44 m	1.93 m, 2.42 m	1.54, 1.48 m
7	1.52 m, 1.60 m	1.30 m, 1.50 m	1.30 m, 1.50 m	1.29 t(12.0), 1.47 m	1.46, 1.27 m
9	1.39 m	1.05 m	1.05 m	1.05 m	α 0.93 m
11	1.70 m, 1.78 m	1.73 m, 1.86 m	1.73 m, 1.86 m	1.72 m, 1.82 m	1.92, 1.23 m
12	1.05 m, 2.05 m	1.10 m, 2.01 m	1.05 m, 2.02 m	1.07 m, 2.02 m	1.93, 1.10 m
13	1.75 m	2.08 m	2.08 m	2.54 m	β 1.66 m
15	3.65 dd(3.9, 9.5)	5.45 br s	5.45 br s	5.94 s	α 2.84 s

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Table 11-9-2 (continued)

H	11-9-1	11-9-2	11-9-3	11-9-4	11-9-5
16	2.18 m	1.99 m, 2.11 m	1.99 m, 2.11 m		2.05, 1.72 m
17	2.00 m	2.10 m	2.10 m	2.99 s	*β* 1.97 m
19	1.95 m, 2.16 m	1.97 m, 2.07 m	1.95 m, 2.10 m	2.07 m, 2.30 m	1.88, 1.56 m
20	4.56 d(8.9)	4.37 d(8.8)	4.40 d(8.8)	4.39 d(10.3)	1.86, 1.76 m
21	4.64 br s	3.82 br s	3.85 br s	3.73 br s	3.61 t(2.6)
23	1.60 s	1.86 s	1.86 s	1.70 s	1.23 s
24	3.84 d(10.8) 4.06 d(10.8)				1.03 s
25	0.92 s	1.12 s	1.12 s	1.05 s	0.87 s
26	0.97 s	0.95 s	0.96 s	0.82 s	1.26 s
27	1.90 m	1.92 m, 2.28 m	1.90 m, 2.30 m	1.92 m, 2.37 m	*α* 1.97 d(14.5) *β* 0.83 d(14.5)
28	1.34 s	0.92 s	0.92 s	0.94 s	0.83 s
29	3.91 d(10.9) 4.23 d(10.9)	0.84 s	0.84 s	1.43 s	0.95 s
30	1.68 s	1.19 s	1.19 s	1.73 s	1.14 s

Table 11-9-3: ^{1}H NMR spectroscopic data of ferrtane-type triterpenoids **11-9-6**~**11-9-10**.

H	11-9-6	11-9-7	11-9-8	11-9-9	11-9-10
1	1.98, 1.16 m	1.83, 1.07 m	*α* 0.85 m *β* 1.81 m	*α* 0.84 m *β* 1.86 dt(16.2, 3.2)	*α* 0.86 m *β* 1.84 m
2	1.74, 1.64 m	1.58, 1.48 m	*α* 1.79 m, *β* 1.41 m	*α* 1.78 m, *β* 1.42 m	*α* 1.80 m, *β* 1.42 m
3	*α* 3.29 dd(4.1, 11.4)	*α* 4.46 dd(5.4, 11.4)	*α* 2.63 dd(11.9, 4.1)	2.61 dd(11.9, 4.3)	*α* 2.62 dd(12.2, 4.4)
5	*α* 0.87 m	*α* 0.83 m	*α* 0.78 m	*α* 0.67 dd(10.1, 3.9)	*α* 0.71 m
6	1.62, 1.53 m	1.48, 1.48 m	*α* 1.49 m, *β* 1.44 m	*α* 1.44 m, *β* 1.44 m	*α* 1.48 m, *β* 1.40 m
7	1.53, 1.23 m	1.42, 1.15 m	*α* 1.21 ddd (13.3, 13.3, 4.3) *β* 1.41 m	*α* 1.43 m *β* 1.14 td(13.3, 5.3)	*α* 1.15 m *β* 1.46 m
9	*α* 0.88 m	*α* 0.72 m	*α* 0.91 d(11.9)	*α* 0.55 d(10.5)	*α* 0.67 m
11	2.11, 1.43 m	1.94, 1.29 m	*α* 1.64 m, *β* 1.03 m	*α* 1.50 m, *β* 1.32 m	*α* 0.90 m, *β* 1.66 m
12	1.78, 1.76 m	1.84, 1.03 m	*α* 1.73 m *β* 2.26 dd(14.2, 7.8)	*α* 1.56 m *β* 2.14 ddd(14.6, 7.6, 1.8)	*α* 1.18 m *β* 1.93 m
13	*β* 1.51 m	*β* 1.37 m			*β* 2.44 dd(13.7, 6.8)
15	*α* 3.00 s	*α* 2.83 s	*α* 1.90 dd(17.8, 5.5) *β* 2.07 m	*α* 1.91 m *β* 1.74 m	*β* 9.53 s

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Table 11-9-3 (continued)

H	11-9-6	11-9-7	11-9-8	11-9-9	11-9-10
16	2.18, 1.83 m	2.02, 1.07 m	*α* 1.36 m	*α* 1.28 m	*α* 1.30 dd(13.7, 13.5)
			β 1.52 m	*β* 1.28 m	*β* 1.61 dd(13.5, 5.0)
17	*β* 1.23 m	*β* 1.11 m	*β* 1.52 m	*β* 1.81 dd(9.6, 5.0)	*β* 1.13 dd(13.5, 5.0)
19	1.99, 1.20 m	1.84, 1.04 m	*α* 1.61 m, *β* 1.61 m	*α* 1.54 m, *β* 1.68 m	*α* 1.36 m, *β* 1.50 m
20	2.03, 1.20 m	1.67, 1.60 m	*α* 1.98 dddd (12.6,12.6, 5.5, 2.3)	*α* 1.65 m	*α* 1.60 m
			β 1.64 m	*β* 1.89 m	*β* 1.86 m
21	3.30 dd(4.5, 8.8)	3.18 dd(2.3, 11.2)	*α* 3.44 t(2.8)	*α* 3.36 t(2.7)	*α* 3.40 t(2.7)
23	1.08 s	0.89 s	0.94 s	0.95 s	0.94 s
24	0.90 s	0.89 s	0.74 s	0.73 s	0.72 s
25	0.97 s	0.89 s	0.76 s	0.77 s	0.69 s
26	1.21 s	1.08 s	0.84 s	1.02 s	0.80 s
27*α*	2.07 d(14.9)	1.91 d(14.7)	2.16 d(14.2)	1.62 d(15.1)	1.50 d(14.7)
27*β*	0.91 d(14.9)	1.78 d(14.7)	1.35 d(14.2)	1.42 d(15.1)	1.76 d(14.7)
28	0.87 s	0.73 s	0.89 s	1.00 s	0.84 s
29	0.97 s	0.89 s	0.85 s	0.83 s	0.87 s
30	1.09 s	0.96 s	0.97 s	0.91 s	0.83 s
OAc		2.04 s			
OMe			3.35 s	3.35 s	3.35 s

Table 11-9-4: ^{1}H NMR spectroscopic data of ferrtane-type triterpenoids **11-9-11**~**11-9-15**.

H	11-9-11	11-9-12	11-9-13	11-9-14	11-9-15
1	*α* 1.42 m, *β* 1.18 m	1.10 m, 1.90 m	1.12 m, 1.91 m	1.05 m, 1.88 m	0.98 m, 1.84 m
2	*α* 1.73 m, *β* 1.73 m	1.98 m, 2.45 m	2.00 m, 2.52 m	1.97 m, 2.55 m	1.94 m, 2.46 m
3	*α* 2.77 t(2.6)	3.27 dd(12, 4)	3.31 dd(11.5, 4.0)	3.24 dd(12, 4)	3.34 dd(11, 4)
5	*α* 1.20 m	1.07 m	1.05 m	1.00 m	0.98 m
6	*α* 1.43 m, *β* 1.20 m	1.92 m, 2.30 m	2.02 m, 2.56 m	2.03 m, 2.58 m	1.82 m(2H)
7	*α* 1.23 m, *β* 1.42 m	1.49 m, 1.67 m	1.54 m, 1.63 m	1.49 m, 1.66 m	1.36 m, 1.40 m
9		1.27 m	1.30 m	1.29 m	0.81 m
11	*α* 0.87 m, *β* 1.67 m	1.16 m, 1.76 m	1.18 m, 1.80 m	1.16 m, 1.80 m	1.10 m, 1.85 m
12	*α* 1.23 m	1.98 m	1.95 m	1.93 m	1.24 m
	β 1.82 td(6.9, 2.7)	2.05 m	2.10 m	2.10 m	1.31 m
13	*β* 2.42 dd(13.7, 6.8)	1.70 m	1.70 m	1.56 m	2.54 m
15	*β* 9.52 s	3.62 t(7.9)	3.69 t(8.0)	1.93 m(2H)	5.96 s
16	*α* 1.31 dd(13.7, 6.8)	2.20 m	2.10 m	1.52 m	
	β 1.62 dd(13.5, 5.0)			2.00 m	
17	*β* 1.13 dd(13.7, 5.0)	2.08 m	1.88 m	1.80 m	3.27 s

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Table 11-9-4 (continued)

H	11-9-11	11-9-12	11-9-13	11-9-14	11-9-15
19	α 1.42 m, β 1.42 m	1.65 m, 1.93 m	1.66 m, 1.88 m	1.66 m, 1.85 m	1.61 m, 2.29 m
20	α 1.63 m	1.98 m	1.95 m	1.85 m	1.96 m
	β 1.88 tdd(13.2, 4.1, 2.9)	2.05 m	2.10 m	2.10 m	2.18 m
21	α 3.40 t(2.7)	4.50 br s	3.66 br s	3.65 br s	4.58 br s
23	0.92 s	1.64 s	1.70 s	1.66 s	1.55 s
24	0.792 s				
25	0.70 s	1.04 s	1.13 s	1.11 s	0.76 s
26	0.798 s	0.98 s	1.02 s	0.99 s	0.76 s
27	α 1.55 d(14.7)	1.78	1.90	1.52	1.91
	β 1.73 d(14.7)	2.05	2.05	1.78	2.36
28	0.85 s	1.36 s	1.32 s	1.33 s	0.89 s
29	0.92 s	3.92 d(10.9)	0.97 s	0.95 s	4.11 d(10.2)
		4.21 d(10.9)			4.76 d(10.2)
30	0.74 s	1.63 s	1.23 s	1.23 s	1.98 s
OMe	3.32 s				3.63 s

Table 11-9-5: ^{1}H NMR spectroscopic data of ferrtane-type triterpenoids **11-9-16**~**11-9-20**.

H	11-9-16	11-9-17	11-9-18	11-9-19	11-9-20
1	1.60 m, 1.75 m	1.56 m, 1.83 m	1.09 m, 1.95 m	1.09 m, 1.94 m	0.93, 1.69 m
2	1.92 m, 2.43 m	1.91 m, 2.16 m	2.00 m, 2.51 m	1.99 m, 2.45 m	1.75, 1.92 m
3	4.49 br s	4.45 br s	3.38 dd(12.0, 4.2)	3.38 dd(12, 4)	4.84 dd(11.8, 4.5)
5	1.99 m	1.87 m	1.05 m	1.06 m	0.82 m
6	1.78 m(2H)	1.65 m(2H)	2.00 m, 2.35 m	1.98 m, 2.32 m	1.38, 1.40 m
7	1.22 m, 1.42 m	1.25 m, 1.38 m	1.25 m, 1.50 m	1.25 m, 1.44 m	1.17, 1.37 m
9	0.98 m	1.03 m	0.81 m	0.78 m	0.74 m
11	1.08 m, 1.80 m	1.10 m, 1.80 m	1.17 m, 1.86 m	1.15 m, 1.85 m	1.09, 1.74 m
12	1.10 m, 1.93 m	1.11 m, 1.90 m	1.99 m, 2.06 m	1.95 m, 2.01 m	1.10, 1.89 m
13	2.54 m	2.48 m	2.06 m	2.08 m	1.82 m
15	5.94 s	5.94 s	5.50 br s	5.47 br s	5.46 br s
16			2.05 m, 2.16 m	2.15 m, 2.25 m	2.03, 2.15 m
17	3.26 s	3.03 s	2.15 m	2.35 m	1.37 m
19	1.56 m, 2.31 m	1.58 m, 2.25 m	1.70 m, 2.00 m	1.70 m, 2.03 m	1.17, 1.87 m
20	1.93 m, 2.19 m	1.90 m, 2.05 m	1.86 m, 2.05 m	1.85 m, 2.10 m	1.75, 1.84 m
21	4.56 br s	3.59 br s	3.68 br s	4.56 br s	3.51 dd(9.8, 5.6)
23	1.53 s	1.60 s	1.72 s	1.69 s	1.04 s
24		3.86 d(10.5)			0.95 s
		4.08 d(10.5)			
25	0.80 s	0.90 s	1.05 s	1.02 s	0.79 s
26	0.81 s	0.74 s	0.89 s	0.87 s	0.90 s
27	1.87, 2.36	1.89, 2.34	1.87, 2.36	1.86, 2.32	1.85, 2.31 d(14.3)
28	0.87 s	0.89 s	0.85 s	0.87 s	0.79 s

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Table 11-9-5 (continued)

H	11-9-16	11-9-17	11-9-18	11-9-19	11-9-20
29	4.09 d(10.7) 4.74 d(10.7)	1.38 s	0.96 s	3.93 d(10.9) 4.16 d(10.9)	1.09 s
30	1.97 s	1.71 s	1.16 s	1.54 s	1.18 s
OMe	3.67 s				
2′					3.83 s

Table 11-9-6: ^{1}H NMR spectroscopic data of ferrtane-type triterpenoids **11-9-21**~**11-9-24**.

H	11-9-21	11-9-22	11-9-23	11-9-24
1	1.88, 1.94 m	1.15, 1.56 m	1.79, 1.93 m	1.12, 1.47 m
2	2.14, 2.85 m	1.89, 2.04 m	2.12, 2.82 m	1.58, 1.86 m
3	4.80 br s	4.47 br s	4.80 br s	4.56 t(2.6) 2.03 s(OAc)
5	2.21 m	1.98 m	2.18 m	1.26 m
6	2.11, 2.45 m	1.67, 1.74 m	2.08, 2.52 m	1.38, 1.51 m
7	1.62, 1.62 m	1.20, 1.41 m	1.39, 1.55 m	1.26, 1.42 m
9	1.14 m	0.97 m	1.15 m	0.98 m
11	1.23, 1.85 m	1.08, 1.83 m	1.20, 1.91 m	1.19, 1.83 m
12	1.21, 2.20 m	1.09, 2.13 m	1.20, 2.18 m	1.20, 2.04 m
13	1.93 m	2.46 m	2.59 m	2.31 m
15	5.54 br s	5.94 s	6.04 s	5.65 s
16	2.08, 2.22 m			
17	1.45 m	3.02 s	3.11 s	2.48 s
19	1.23, 1.94 m	1.56, 2.24 m	1.66, 2.33 m	1.48, 1.72 m
20	1.23, 2.01 m	1.86, 2.00 m	1.97, 2.11 m	1.56, 1.82 m
21	3.58 dd(9.6, 5.8)	3.58 br s	3.67 br s	3.29 t(2.9)
23	1.85 s	1.29 s	1.83 s	0.78 s
24		9.99 s		0.82 s
25	1.25 s	0.74 s	1.18 s	0.77 s
26	1.12 s	0.72 s	0.92 s	0.81 s
27	1.97, 2.40 d(14.3)	1.88, 2.34 d(14.5)	1.83, 2.49 d(14.9)	1.87, 2.43 d(14.9)
28	0.86 s	0.87 s	0.98 s	0.73 s
29	1.18 s	1.36 s	1.45 s	1.06 s
30	1.26 s	1.69 s	1.78 s	1.09 s

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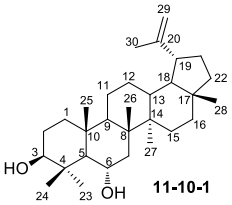
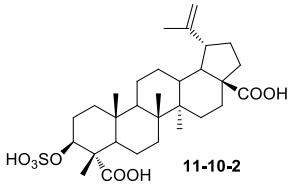
11.10 Lupane-type triterpenoids

Table 11-10-1: Compounds, MFs, and test solvents of lupane-type triterpenoids **11-10-1**~**11-10-19**.

No.	Compounds	MFs	Test solvents	References
11-10-1	3*β*,6*α*-dihydroxylup-20(29)-ene	$C_{30}H_{50}O_2$	$CDCl_3$	[119]
11-10-2	gypsophilin	$C_{30}H_{46}O_8S$	C_5D_5N	[120]
11-10-3	7*β*-hydroxymethyl betulinate	$C_{31}H_{50}O_4$	C_5D_5N	[121]
11-10-4	28-norlup-20(29)-en-3*β*-hydroxy-17*β*-hydroperoxide	$C_{29}H_{48}O_3$	$CDCl_3$	[122]
11-10-5	28-norlup-20(29)-en-3*β*-hydroxy-17*α*-hydroperoxide	$C_{29}H_{48}O_3$	$CDCl_3$	[122]
11-10-6	20*S*-17*β*,29-epoxy-28-norlupan-3*β*-ol	$C_{29}H_{48}O_2$	$CDCl_3$	[122]
11-10-7	6*β*-hydroxybetulin	$C_{30}H_{50}O_3$	$CDCl_3$	[123]
11-10-8	3*β*,6*β*-dihydroxylup-20(29)-ene	$C_{30}H_{50}O_2$	$CDCl_3$	[123]
11-10-9	3*β*,29-dihydroxylup-20(30)-en-28-al	$C_{30}H_{48}O_3$	$CDCl_3$	[124]
11-10-10	lup-20(29)-en-3*α*,28-diol	$C_{30}H_{50}O_2$	$CDCl_3$	[125]
11-10-11	lup-20(29)-en-3*α*,28,30-triol	$C_{30}H_{50}O_3$	$CDCl_3$	[125]
11-10-12	3*β*-hydroxy-lup-20(29)-en-28-oic acid	$C_{30}H_{48}O_3$	C_5D_5N	[126]
11-10-13	2*α*-hydroxy-3*β*-*O*-acetyllup-20(29)-en-28-oic acid	$C_{32}H_{50}O_5$	C_5D_5N	[127]
11-10-14	D:C-friedolupane-3*β*-acetoxy-7-ene	$C_{32}H_{52}O_2$	$CDCl_3$	[128]
11-10-15	3*β*-acetoxylup-20(30)-en-29-al	$C_{32}H_{52}O_3$	$CDCl_3$	[129]
11-10-16	3*β*-acetoxy-16*β*-hydroxybetulinic acid	$C_{32}H_{50}O_5$	$CDCl_3$	[130]
11-10-17	3*β*,16*β*-diacetoxybetulinic acid	$C_{34}H_{52}O_6$	$CDCl_3$	[130]
11-10-18	3*β*-acetoxy-16*β*-hydroxybetulinic acid methyl ester	$C_{33}H_{52}O_5$	$CDCl_3$	[130]
11-10-19	3*β*,16*β*-diacetoxybetulinic acid methyl ester	$C_{35}H_{54}O_6$	$CDCl_3$	[130]



11-10-1



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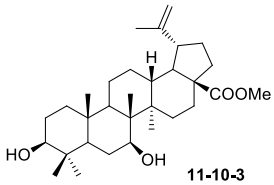

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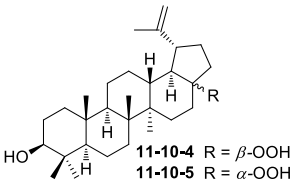
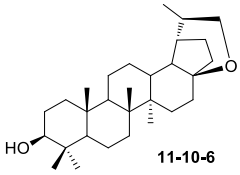
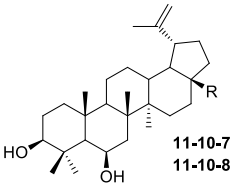


11-10-4 R = *β*-OOH
11-10-5 R = *α*-OOH



11-10-6



11-10-7 R = CH_2OH
11-10-8 R = Me

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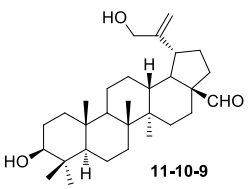

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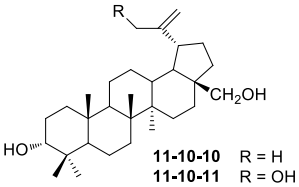
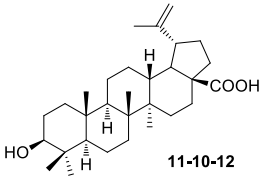


11-10-10 R = H
11-10-11 R = OH



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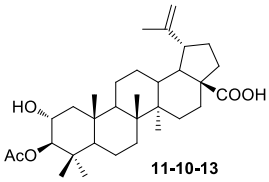

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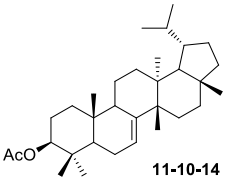

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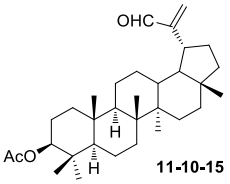
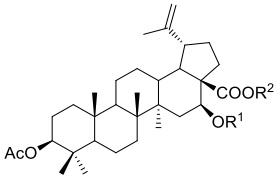


11-10-15



	R^1	R^2
11-10-16	H	H
11-10-17	Ac	H
11-10-18	H	Me
11-10-19	Ac	Me

Table 11-10-2: ^{1}H NMR spectroscopic data of lupane-type triterpenoids **11-10-1**~**11-10-4**.

H	11-10-1	11-10-2	11-10-3	11-10-4
1	1.62 m (ov)	1.48	*α* 1.67 dt(12.8, 3.2)	1.71 m
	0.89 m	0.90	*β* 0.94 m	0.94 m
2	1.57 m, 1.67 m (ov)	1.84, 2.58	1.88 m(2H)	1.59 m, 1.67 m
3	3.20 dd(5.6, 10.7)	5.41 dd(7.9, 2.7)	*α* 3.49 br t(6.0)	3.16 dd(11.4, 5.1)
5	0.78 d(10.3)	1.82	1.00 m	0.66 m
6	4.10 td(3.4, 10.3)	1.46 nd	*α* 2.00 m, *β* 1.82 m	1.60 m, 1.34 m
7	1.40 m, 1.67 m (ov)	1.08 br d(10.7), 1.42	4.12 m	1.38 m
9	1.27 m	1.28	1.35 m	1.23 m
11	1.65 m, 1.66 m	1.12 nd	1.45 m(2H)	1.16 m, 1.46 m
12	1.03 m, 1.64 m	1.02, 1.74	*α* 1.16 m, *β* 1.95 m	1.62 m
13	1.61 m (ov)	2.52 t-like	2.60 td(11.2, 3.2)	1.82 m
15	0.99 m	1.63, 1.01	*α* 2.41 m, *β* 2.00 m	1.99 m, 1.35 m
16	1.34 m, 1.46 m (ov)	1.40, 2.46 d(12.4)	*α* 1.57 m, *β* 2.44 m	1.05 m, 1.83 m
18	1.46 m (ov)	1.61	1.76 t (11.2)	1.65 m
19	2.35 dt(10.3, 6.5)	3.33 m	3.38 td(11.2, 4.8)	2.57 ddd(10.6, 10.4, 5.9)
21	1.20 m, 1.88 m	1.38, 2.08 m	1.47 m, 2.00 m	1.37 m, 2.16 m
22	1.16 m, 1.37 m	1.43, 2.10 t-like	1.49 m, 1.98 m	1.29 m, 2.12 m
23	1.32 s		1.23 s	0.95 s
24	0.98 s	1.38 s	1.03 s	0.75 s
25	0.85 s	0.65 s	0.90 s	0.81 s
26	1.08 s	0.85 s	1.32 s	1.01 s
27	0.96 s	0.91 s	1.23 s	0.92 s

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Table 11-10-2 (continued)

H	11-10-1	11-10-2	11-10-3	11-10-4
28	0.75 s			
29	4.58 d(2.3)	4.68 br s	4.77 br s	4.58 dd(2.2, 1.4)
	4.68 d(2.3)	4.78 br s	4.93 br s	4.69 d(2.2)
30	1.68 s	1.70 s	1.78 s	1.65 s

Table 11-10-3: ^{1}H NMR spectroscopic data of lupane-type triterpenoids **11-10-5**~**11-10-8**.

H	11-10-5	11-10-6	11-10-7	11-10-8
1	1.73 m, 0.94 m	1.76 m, 0.95 m	1.67, 0.90	1.67, 0.91
2	1.52 m, 1.56 m	1.56 m, 1.61 m	1.61 (ov)	1.59
3	3.17 dd(11.4, 4.4)	3.17 dd(11.4, 5.1)	3.12 t(7.3)	3.14 t(7.3)
5	0.68 m	0.68 m	0.68 br s	0.68 br s
6	1.40 m, 1.33 m	1.52 m, 1.38 m	4.51 br s	4.53 br s
7	1.28 m	1.24 m, 1.45 m	1.61 (ov)	1.61
9	1.34 m	1.34 m	1.30 (ov)	1.30
11	1.24 m, 1.39 m	1.25 m	1.45, 1.30 (ov)	
12	0.84 m, 1.72 m	1.53 m, 1.60 m	1.64, 1.03 (ov)	
13	1.97 ddd(13.2, 12.8, 5.1)	1.38 m	1.74	1.76
15	1.67 m, 0.97 m	1.64 m, 1.23 m	1.65	
16	1.51 m, 1.82 m	1.44 m, 1.88 m	1.03 (ov), 1.85	
18	1.68 m	1.55 m	1.58	1.38
19	2.34 ddd(8.1, 7.7, 3.7)	1.86 m	2.39 dt (5.6, 10.4)	2.39 m
21	1.58 m, 1.61 m	1.32 m, 1.58 m	1.40	
22	1.24 m, 1.75 m	1.45 m, 1.95 m	1.90	
23	0.94 s	0.96 s	1.04 s	1.06 s
24	0.75 s	0.75 s	1.14 s	1.15 s
25	0.83 s	0.83 s	1.18 s	1.20 s
26	0.96 s	0.92, s	1.34 s	1.36 s
27	0.94 s	0.96 s	0.94 s	0.92 s
28			3.32 d(10.7)	0.80 s
			3.79 d(10.7)	
29	4.67 dd(1.8, 1.4)	3.18 dd(11.4, 11.4)	4.57 br s	4.59 br s
	4.78 d(1.8)	3.24 dd(11.3, 5.8)	4.68 br s	4.70 br s
30	1.73 s	0.71 d(6.4)	1.67 s	1.69 s

Table 11-10-4: ^{1}H NMR spectroscopic data of lupane-type triterpenoids **11-10-9**~**11-10-12**.

H	11-10-9	11-10-10	11-10-11	11-10-12
1	1.60 m	2.40	2.50	α 0.99 m
	0.89 td(13.0, 3.9)		2.41	β 1.67 br d(12.9)
2	1.55 dd(11.9, 3.4)	1.95	1.95	1.85 m
	1.07 m	1.55	1.55	
3	3.18 dd(11.5, 4.6)	3.39	3.40	3.45 t(7.2)

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Table 11-10-4 (continued)

H	11-10-9	11-10-10	11-10-11	11-10-12
5	0.67 d(9.8)	1.22	1.22	0.82 m
6	1.49 m, 1.36 m	1.50, 1.42	1.45	α 1.56 m, β 1.38 m
7	1.35 m, 1.35 m	1.40	1.40	α 1.45 m, β 1.38 m
9	1.24 m	1.43	1.41	1.38 m
11	1.41 m, 1.23 m	1.40, 1.15	1.45, 1.20	α 1.43 m, β 1.21 m
12	1.60 m, 1.55 dd(11.9, 3.4)	1.40, 1.02	1.40, 1.11	α 1.21 m, β 1.94 m
13	2.02 m	1.65	1.66	2.74 m
15	2.10 m, 1.51 m	1.70, 1.08	1.72, 1.10	α 1.26 m, β 1.88 m
16	1.98 m, 1.45 m	1.30	1.50, 1.40	α 1.55 m, β 2.63 m
18	1.84 td (11.7, 1.1)	1.61	1.71	1.77 t(11.5)
19	2.77 td(11.5, 5.5)	2.41	2.31	3.52 m
21	1.47 m, 1.20 m	1.40, 1.98	1.42, 2.12	α 1.53 m, β 2.24 m
22	1.76 dd(12.6, 10.1), 1.39 m	1.82, 1.02	1.88, 1.12	α 1.57 m, β 2.25 m
23	0.96 s	0.95	0.95	1.22 s
24	0.75 s	0.85	0.84	1.00 s
25	0.91 s	0.86	0.86	0.83 s
26	0.81 s	1.04	1.04	1.06 s
27	0.98 s	1.00	1.01	1.07 s
28	9.64 d(1.6)	3.35, 3.80	3.33, 3.80	
29	4.12 s, 4.12 s	4.68, 4.57	4.97, 4.92	α 4.95 s, β 4.77 s
30	5.00 s, 4.94 s	1.70	4.14	1.79 s

Table 11-10-5: ^{1}H NMR spectroscopic data of lupane-type triterpenoids **11-10-13**~**11-10-15**.

H	11-10-13	11-10-14	11-10-15	H	11-10-13	11-10-14	11-10-15
1	1.28 m	1.67 s	1.43 m	19	3.52 dt(6.0, 12.0)	1.57 m	1.64 m
	2.32 m	1.18 dd(3.0, 7.0)	1.26 m				
2	4.17 dt(6.0, 12.0)	1.65 s	1.62 m	20		1.52 s	
		1.57 d(3.0)	0.94 m				
3	5.06 d(12.0)	4.50 dd(4.0, 11.5)	4.46 m	21	1.53 m	1.76 s	1.41 m
					2.26 m	1.78 s	1.39 m
5	0.98 m	1.35 dd(5.5, 12.0)	0.82 m	22	1.53 m	1.74 s	1.47 m
					2.26 m	1.16 d(3.0)	1.39 m
6	1.36 m	2.16 m	1.72 m	23	0.94 s	0.92 s	0.86 s
	1.43 m	1.96 m	1.53 m				
7	1.36 m	5.47 dd(2.5, 4.0)	1.54 m	24	0.91 s	0.84 s	0.86 s
			1.38 m				
9	1.43 m	2.18 m	1.28 m	25	0.85 s	0.76 s	0.86 s
11	1.28 m	1.56 d(7.0)	2.16 m	26	1.00 s	0.95 s	1.03 s
	1.43 m	1.44 s	1.43 m				
12	1.28 m	1.45 s	2.76 m	27	1.03 s	0.90 s	0.83 s
	1.89 m	1.59 m	1.22 m				

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Table 11-10-5 (continued)

H	11-10-13	11-10-14	11-10-15	H	11-10-13	11-10-14	11-10-15
13	2.72 m		1.40 m	28		0.91 s	0.93 s
15	1.28 m	1.51 s	1.46 m	29	4.98 br s	0.87 d(2.0)	9.52 br s
	1.83 m	1.77 s	1.38 m		4.74 br s		
16	1.53 m	1.50 s	1.68 m	30	1.76 s	0.90 d(7.5)	6.31 br s
	2.26 m	1.60 m	1.42 m				5.93 br s
18	1.72 m	1.49 d(4.0)	1.41 m	OAc	2.06 s	2.04 s	2.05 s

Table 11-10-6: ^{1}H NMR spectroscopic data of lupane-type triterpenoids **11-10-16**~**11-10-19**.

H	11-10-16①	11-10-17②	11-10-18③	11-10-19④
3	4.61 br t	4.62 br m(1.3)	4.61 br t(1.7)	4.60 br d
12	2.05 m		1.80~2.06 m	
13			2.15 m	2.50 ddd(5.2, 10.7, 11.3)
15	2.13 m	2.12~2.40 m		2.13~2.44 m
16	3.74 dd(4.4, 11.3)	5.08 dd(4.9, 11.7)	3.60 br t(2.4)	5.1 dd(5.0, 11.4)
18	1.90 m	1.70~1.98 m		
19	3.20 ddd(5.2, 10.8, 12.8)	2.78 ddd(5.4, 11.3, 13.7)	2.99 ddd(5.3, 10.9, 12.9)	3.06 br m
21	2.15 m	2.12~2.40 m	1.80~2.06 m	2.13~2.44 m
22		1.70~1.98 m		
23	0.87 s	0.83 s	0.88 s	0.88 s
24	0.82 s	0.83 s	0.83 s	0.87 s
25	0.83 s	1.10 s	0.83 s	0.86 s
26	1.10 s	1.07 s	1.08 s	1.17 s
27	0.98 s	0.83 s	0.92 s	1.14 s
29	4.76 br d(1.3)	4.78 br d(1.4)	4.90 br d(3.0)	4.70 br d(0.8)
	4.64 br d(1.3)	4.62 br m(1.3)	4.75 br d(3.0)	4.60 br d
30	1.70 s	1.68 s	1.70 s	1.67 s

① Overlapping multiplets at 1.72, 1.67, 1.62, 1.61, 1.60, 1.58, 1.48, 1.39, 1.38, 1.20, 1.10 (m,15H, H-1, 2, 5, 6, 7, 9, 11, 13, 22).
② 1.65~1.12 (m,15H, H-1, 2, 5, 6, 7, 9, 11, 13).
③ 1.68~1.11 (m,16H, H-1, 2, 5, 6, 7, 9, 11, 15, 22).
④ 1.60~1.18 (m,7H, H-1, 12, 18, 22), 1.60~1.18 (m,12H, H-2, 5, 6, 7, 9, 11, 21).

Table 11-10-7: Compounds, MFs, and test solvents of lupane-type triterpenoids **11-10-20** and **11-10-21**.

No.	Compounds	MFs	Test solvents	References
11-10-20	3-*epi*-thurberogenin	$C_{30}H_{46}O_3$	C_5D_5N	[121]
11-10-21	11α-hydroxy-*epi*-betulin	$C_{30}H_{50}O_3$	$CDCl_3$	[123]

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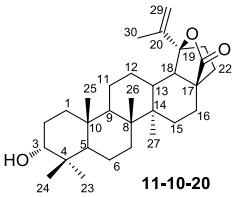

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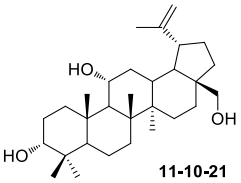


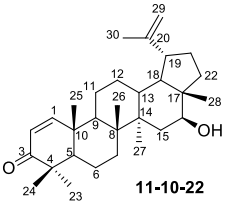
11-10-21

Table 11-10-8: ^{1}H NMR spectroscopic data of lupane-type triterpenoids **11-10-20** and **11-10-21**.

H	11-10-20	11-10-21	H	11-10-20	11-10-21
1	1.70 m, 1.44 m	2.28, 1.47	11	*α* 1.43 m	3.92 dt(5.3, 10.7)
				β 1.16 dd(12.4, 4.0)	
2	*α* 1.78 m, *β* 2.00 m	1.98, 1.48	12	*α* 1.03 td(12.4, 3.6)	1.10
				β 1.82 m	1.91
3	*β* 3.61 m	3.36 br s	13	1.66 m	1.75
5	1.63 m	1.24	15	*α* 1.69 m, *β* 1.15 m	1.62, 1.10
6	*α* 1.45 m, *β* 1.32 m	1.42	16	*α* 2.11 m, *β* 1.44 m	1.85, 0.99
7	1.33 m, 2.13 m	1.47	18	1.81 d(10.8)	1.59
9	1.49 m	1.45 (ov)	19		2.39 dt(4.9, 10.8)
21	2.13 m, 1.61 m	1.95	26	0.87 s	1.02 s
22	1.64 m, 1.60 m	1.45 (ov)	27	0.75 s	1.01 s
23	1.21 m	0.94 s	28		3.33, 3.74 d(10.8)
24	0.88 s	0.85 s	29	5.01 br s, 5.50 br s	4.60 br s, 4.71 br s
25	0.82 s	1.05 s	30	1.74 s	1.68 s

Table 11-10-9: Compounds, MFs, and test solvents of lupane-type triterpenoids **11-10-22**~**11-10-30**.

No.	Compounds	MFs	Test solvents	References
11-10-22	16*β*-hydroxylupane-1,20(29)-dien-3-one	$C_{30}H_{46}O_2$	$CDCl_3$	[131]
11-10-23	lantabetulal	$C_{30}H_{46}O_3$	$CDCl_3$	[132]
11-10-24	6*β*-hydroxyl-3,20-dioxo-30-norlupane-28-oic acid	$C_{29}H_{44}O_5$	$CDCl_3$	[133]
11-10-25	24-hydroxybetulone	$C_{30}H_{48}O_3$	$CDCl_3$	[123]
11-10-26	rigidenol-28-aldehyde	$C_{30}H_{46}O_3$	$CDCl_3$	[123]
11-10-27	28-hydroxyglochidone	$C_{30}H_{46}O_2$	$CDCl_3$	[123]
11-10-28	6*β*,30-dihydroxy-3-oxolup-20(29)-en-28-oic acid	$C_{30}H_{46}O_5$	C_5D_5N	[134]
11-10-29	28-hydroxy-3-oxo-lup-20-(29)-en-30-al	$C_{30}H_{46}O_3$	$CDCl_3$	[135]
11-10-30	3-oxo-lup-20-(29)-en-30-al	$C_{30}H_{46}O_2$	$CDCl_3$	[135]



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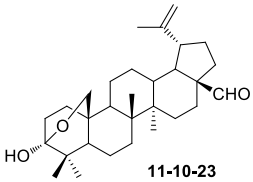

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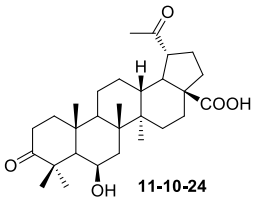

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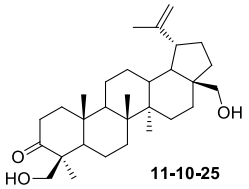

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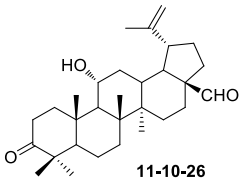

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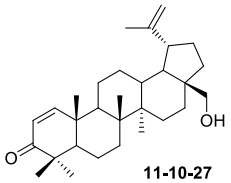

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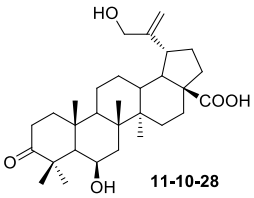

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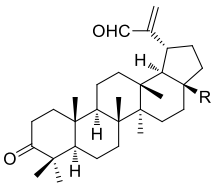

11-10-29 R = CH_2OH
11-10-30 R = Me

Table 11-10-10: ^{1}H NMR spectroscopic data of lupane-type triterpenoids **11-10-22**~**11-10-26**.

H	11-10-22	11-10-23	11-10-24	11-10-25	11-10-26
1	7.11 d(10.0)	1.65, 2.16	*α* 1.62 m, *β* 1.93 m	1.52, 1.90 (ov)	2.66
2	5.81 d(10.0)	1.08, 2.14	*α* 2.19 m, *β* 2.72 ddd(14.2, 6.3, 5.6)	2.40 (ov), 2.60	2.42
5	1.54 m (ov)	1.18	1.20 m	1.60	1.48 (ov)
6	1.22 m, 1.85 m	1.42, 1.48	*α* 4.47 br s	1.43, 1.50	1.52
7	1.48 m, 1.54 m (ov)	1.30, 1.42	*α* 1.63 m	1.45	1.55
9	1.58 m (ov)	1.40	1.48 dd(8.9, 5.7)	1.40 (ov)	1.48 (ov)
11	1.38 m (ov), 1.64 m (ov)	1.28, 1.54	1.49 m	1.40 (ov)	3.90 dt(5.3, 10.7)
12	1.09 m, 1.77 m	1.72, 1.78	*α* 1.22 m	1.67	2.10
13	1.58 m (ov)	2.04	*β* 2.16 m	1.70 (ov)	2.25
15	1.28 m, 1.66 m (ov)	1.38, 2.08	*α* 1.56 m, *β* 2.13 m	1.70 (ov)	0.75
16	3.65 dd(4.5, 11.5)	1.20, 1.39	*α* 1.50 m, *β* 2.30 m	1.05, 1.87	2.08
18	1.41 m	1.74	2.20 m	1.65	1.75
19	2.52 dt(6.0, 11.0)	2.85 dt(5.6, 10.8)	3.26 m	2.40 m (ov)	2.89 dt(4.9, 10.8)
21	1.39 m (ov), 1.99 m	1.36, 1.40	*α* 1.60 m, *β* 2.30 m	1.95	2.01
22	1.31 m, 1.72 m	1.62, 1.74	*α* 1.65 m, *β* 2.00 m	1.90 (ov)	1.80
23	1.10 s	1.00 s	1.20 s	1.26 s	1.08 s
24	1.05 s	0.95 s	1.32 s	3.43, 3.97 d(11.2)	1.04 s
25	1.03 s	3.70 dd(1.6, 8.4) 4.21 dd(2.4, 8.4)	1.22 s	0.86 s	1.06 s
26	1.14 s	0.80 s	1.32 s	1.02 s	0.95 s (ov)
27	0.95 s	0.94 s	0.97 s	0.99 s	0.95 s (ov)

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Table 11-10-10 (continued)

H	11-10-22	11-10-23	11-10-24	11-10-25	11-10-26
28	0.83 s	9.63 br s		3.33, 3.78 d(10.6)	9.61 s
29	4.62 br s	4.62 br s	2.19 s	4.58 br s	4.65 br s
	4.73 br d(1.5)	4.74 br s		4.68 br s	4.78 br s
30	1.70 s (ov)	1.68 s		1.68 s	1.73 s

Table 11-10-11: ^{1}H NMR spectroscopic data of lupane-type triterpenoids **11-10-27**~**11-10-30**.

H	11-10-27	11-10-28	11-10-29	11-10-30
1	7.09 d(10.1)	*α* 1.26 m	*α* 1.38 m	*α* 1.36 m
		β 1.90 ddd(12.8, 6.2, 2.7)	*β* 1.85 ddd(4.4, 7.8, 13.3)	*β* 1.84 ddd(4.4, 7.5, 12.9)
2	5.79 d(10.1)	*α* 2.35 ddd(14.7, 4.4, 2.5)	*α* 2.36 ddd(4.4, 7.5, 16.0)	*α* 2.35 ddd(4.4, 7.5, 15.7)
		β 2.92 m	*β* 2.46 ddd(7.5, 9.9, 16.0)	*β* 2.46 ddd(7.5, 9.9. 15.7)
5	1.55	*α* 1.26 m	1.31 m	1.34 m, 1.42~1.53 m
6	1.39	*α* 4.65 br s	1.49 m, 1.44 m	
7	1.56	*α* 1.68 m, *β* 1.84 m	1.45 m	1.37 m, 1.43 m
9	1.65 (ov)	*α* 1.47 dd(8.2, 5.5)	1.33 m	1.33 m
11	1.48	*α* 1.40 m	1.35 m, 1.25 m	1.35 m, 1.26 m
12	1.65 (ov)	*α* 1.29 m, *β* 1.83 m	0.91 m, 1.05 m	0.93 m, 1.06 m
13	1.72	*β* 2.89 ddd(12.6, 12.6, 3.5)	1.66 ddd(12.3, 12.3, 3.8)	1.68 m
15	1.80	*α* 1.30 m	*α* 1.09 m	1.02 m, 1.70 m
		β 1.97 m	*β* 1.71 ddd(13.6, 13.6, 4.4)	
16	1.52	*α* 1.58 m	*α* 1.26 m	1.45 m, 1.51 m
		β 2.63 dt(12.6, 3.2)	*β* 1.71 ddd(13.6, 4.4, 2.4)	
18	1.68	*α* 2.04 dd(11.2, 11.2)	1.87 m	1.67 m
19	2.40 dt(5.7, 10.7)	*β* 3.55 ddd(11.4, 11.4, 4.1)	2.76 ddd(11.4, 11.3, 5.5)	2.75 ddd(10.8, 10.8, 5.5)
21	1.98	*α* 1.69 m	*α* 1.32 m	1.29 m, 2.17 m
		β 2.42 m	*β* 2.17 dddd(11.3, 12.3, 9.9, 8.5)	
22	1.91	*α* 1.70 m	*α* 1.23 m	1.37 m
		β 2.26 m	*β* 1.91 dd(2.0, 8.5)	
23	1.13 s	1.36 s	1.05 s	1.05 s
24	1.08 s	1.66 s	1.00 s	1.00 s
25	1.06 s	1.58 s	0.90 s	0.91 s
26	1.04 s	1.69 s	1.04 s	1.04 s
27	0.99 s	1.06 s	0.95 s	0.92 s
28	3.35 d(10.6)		3.36 d(10.6)	0.82 s
	3.80 d(10.6)		3.78 d(10.6)	
29	4.60 br s	5.21 d(1.8)	5.91 s	5.89 s
	4.69 br s	5.55 d(1.8)	6.27 s	6.27 s
30	1.69 s	4.55 t (1.4)	9.49 s	9.49 s

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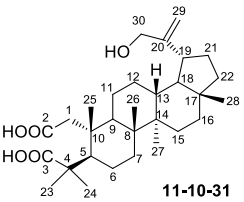
Table 11-10-12: Compounds, MFs, and test solvents of lupane-type triterpenoids **11-10-31**~**11-10-36**.

No.	Compounds	MFs	Test solvents	References
11-10-31	30-hydroxy-2,3-*seco*-lup-20(29)-ene-2,3-dioic acid	$C_{30}H_{48}O_5$	C_5D_5N	[121]
11-10-32	gouanic acid A	$C_{30}H_{46}O_5$	$CDCl_3$	[136]
11-10-33	gouanic acid B	$C_{29}H_{42}O_5$	$CDCl_3$	[136]
11-10-34	16β-hydroxy-2,3-*seco*-lup-20(29)-ene-2,3-dioic acid	$C_{30}H_{48}O_5$	CD_3OD	[131]
11-10-35	3,4-secolup-4,20-dihydroxy-3,28-dioic acid-3-oic acid methyl ester	$C_{31}H_{52}O_6$	$CDCl_3$	[133]
11-10-36	2β-carboxyl,3β-hydroxyl-norlupA(1)-20(29)-en-28-oic acid	$C_{30}H_{46}O_5$	C_5D_5N	[137]



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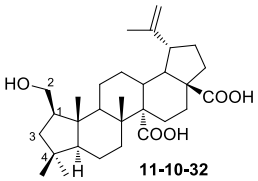

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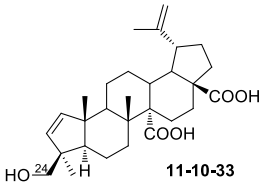
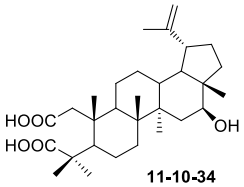


11-10-33



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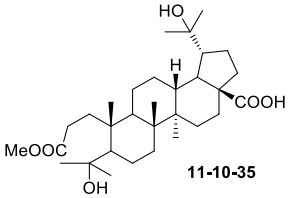
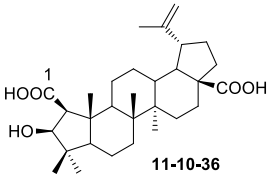


11-10-35



11-10-36

Table 11-10-13: ^{1}H NMR spectroscopic data of lupane-type triterpenoids **11-10-31**~**11-10-33**.

H	11-10-31	11-10-32	11-10-33
1	3.09 d(18.0), 2.73 d(18.0)	1.82 m	
2		3.21 dd(4.1, 8.5), 3.66 dd(4.1, 8.5)	5.49 d(5.8)
3		1.78 dd(4.3, 8.1)	6.07 d(5.8)
5	3.13 m		1.29 m
6	1.74 m, 1.72 m	α 1.43 m, β 1.37 m	α 1.63 m, β 1.56 m

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Table 11-10-13 (continued)

H	11-10-31	11-10-32	11-10-33
7	*α* 1.73 m, *β* 1.42 m	*α* 2.43 m, *β* 2.07 m	*α* 2.21 m, *β* 2.05 m
9	3.00 d(10.4)	1.79 dd(6.2, 6.6)	1.75 dd(6.4, 6.7)
11	1.14 m, 1.56 m	*α* 1.54 m, *β* 1.35 m	1.64 m, 1.52 m
12	1.63 m, 1.34 m	*α* 2.14 m, *β* 1.62 m	*α* 2.16 m, *β* 1.66 m
13	1.68 dd(13.2, 3.2)	2.38 m	2.47 m
15	1.63 m, 1.01 br d(13.6)	1.19 m(2H)	1.97 m, 1.49 m
16	1.44 m, 1.36 m	*α* 1.94 m, *β* 1.72 m	*α* 1.94 m, *β* 1.41 m
18	1.65 d(10.4)	1.73 dd(6.1, 6.8)	1.77 dd(6.3, 6.5)
19	2.43 td(10.8, 4.8)	3.11 m	3.12 m
21*α*	2.12 dddd(13.2, 11.6, 9.6, 4.4)	1.98 m	1.92 m
21*β*	1.48 dd(13.2, 4.4)	1.91 m	1.89 m
22	1.37 brt (3.6), 1.29 t(10.8)	*α* 1.66 m, *β* 1.51 m	*α* 1.67 m, *β* 1.63 m
23	1.54 s	1.04 s	
24	1.59 s	0.91 s	3.45, 3.59 dd(6.4, 10.4)
25	1.10 s	0.99 s	1.02 s
26	1.10 s	0.90 s	1.06 s
27	1.13 s		
28	0.81 s		
29	5.05 br s, 5.42 br s	4.61 s, 4.73 s	4.73 s, 4.48 s
30	4.42 br s	1.71 s	1.71 s

Table 11-10-14: ^{1}H NMR spectroscopic data of lupane-type triterpenoids **11-10-34**~**11-10-36**.

H	11-10-34	11-10-35	11-10-36
1	2.43 d(17.5, ov), 2.57 d(17.5)	*α* 1.28 m, *β* 1.72 m	
2		*α* 2.20 m *β* 2.40 ddd(13.3, 5, 4)	2.89 d(7.4)
3			4.67 d(7.4)
5	2.50 m (ov)	1.30 m	1.17 m
6	1.96 m, 1.94 m	1.41 m	1.56 m, 1.46 m
7	1.53 m, 1.38 m	*α* 1.40 m, *β* 1.80 m	1.41 m, 1.14 m
9	2.44 m	1.42 m	1.81 m
11	1.63 m (ov), 1.46 m	1.5 m	2.00 m, 1.83 m
12	1.23 m, 1.19 m	*α* 1.3 m, *β* 1.74 m	1.28 m
13	1.64 m (ov)	*β* 2.27 m	2.74 m
15	1.57 m, 1.30 m	*α* 1.44 m, *β* 1.92 m	1.94 m, 1.23 m
16	3.54 dd(11.5, 4.5)	*α* 1.44 m, *β* 2.29 m	1.58 m, 2.61 m
18	1.43 m	1.61 dd(11, 9.0)	1.71 br s
19	2.51 m (ov)	2.20 m	3.46 m
21	1.75 m, 1.04 m (ov)	1.94 m	2.21 m, 1.49 m
22	1.68 m (ov), 1.28 m	*α* 1.4 m, *β* 1.8 m	2.21 m, 1.57 m
23	1.24 s	1.22 s	1.14 s
24	1.26 s	1.28 s	1.20 s

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Table 11-10-14 (continued)

H	11-10-34	11-10-35	11-10-36
25	0.96 s	1.00 s	1.07 s
26	1.09 s	0.95 s	1.14 s
27	1.04 s	1.00 s	1.67 s
28	0.80 s	①	
29	4.59 d(2.0), 4.71 d(2.0)	1.13 s	4.86 br s, 4.69 br s
30	1.68 br s(ov)	1.24 s	1.74 s
OAc		3.66 s	

① Typographic error exists in the original literature, typing the ^{1}H NMR chemical shift of H-28 as 179.6 s.

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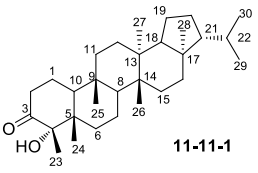
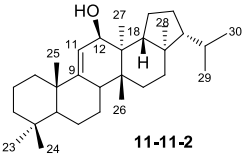
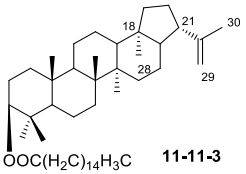
11.11 Hopane- and fernane-type triterpenoids

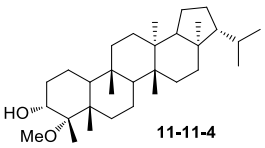
Table 11-11-1: Compounds, MFs, and test solvents of hopane- and fernane-type triterpenoids **11-11-1**~**11-11-5**.

No.	Compounds	MFs	Test solvents	References
11-11-1	4*α*-hydroxyfilican-3-one	$C_{30}H_{50}O_2$	$CDCl_3$	[138]
11-11-2	fern-9(11)-en-12*β*-ol	$C_{30}H_{50}O$	$CDCl_3$	[138]
11-11-3	hopenyl palmitate	$C_{46}H_{80}O_2$	$CDCl_3$	[139]
11-11-4	3*α*-hydroxy-4*α*-methoxyfilicane	$C_{31}H_{54}O_2$	$CDCl_3$	[140]
11-11-5	3*β*-acetoxy-15*α*, 22-dihydroxyhopane	$C_{32}H_{54}O_4$	$CDCl_3$	[141]









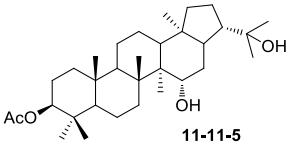


Table 11-11-2: ^{1}H NMR spectroscopic data of hopane- and fernane-type triterpenoids **11-11-1**~**11-11-5**.

H	11-11-1	11-11-2	11-11-3	11-11-4	11-11-5
1			1.78 m, 1.22 m		1.03 m, 1.70 m
2	*α* 2.970 ddd(2.1, 4.9, 13.4)		1.68 m		1.51 m, 1.78 m
			1.46 m		
3			4.49 dd(8.1, 7.2)	3.803 dd(2.8, 2.9)	4.49 dd(10.9, 5.4) 2.05 s(OAc)
5			1.18 m	3.176 s(OMe)	0.81 dd(12.2, 2.0)
6			1.38 m		1.30 m, 1.54 m
7			1.46 m		1.56 m
9			1.34 m		1.22 m
10	*α* 2.167 dd(3.4, 12.8)				
11		5.511 dd(2.4, 4.8)	1.28 m		1.54 m
12		3.476 br s	1.46 m		1.45 m, 1.65 m
13			1.30 m		1.31 m
15			1.42 m		3.83 m

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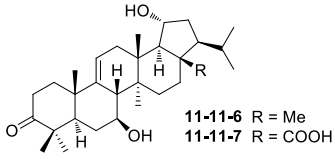
Table 11-11-2 (continued)

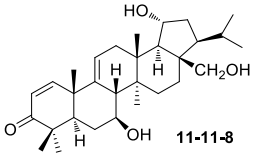
H	11-11-1	11-11-2	11-11-3	11-11-4	11-11-5
16			1.30 m		2.28 m
17			1.08 m		2.26 m
19			1.38 m		0.92 m, 1.53 m
20			1.46 m		1.53 m, 1.65 m
21			2.61 m		1.49 m
23	1.154	0.848	0.82 s	1.153 s	0.87 s
24	0.792	0.899	0.86 s	1.084 s	0.86 s
25	0.907	1.095	0.98 s	0.887 s	0.84 s
26	0.907	0.942	0.73 s	0.887 s	1.05 s
27	1.000	0.812	0.94 s	0.965 s	0.99 s
28	0.796	0.792	0.99 s	0.780 s	0.78 s
29	0.889 d(6.7)	0.907 d(6.4)	4.76 s	0.881 d(6.7)	1.18 s
30	0.829 d(6.7)	0.842 d(6.4)	1.76 s	0.822 d(6.7)	1.21 s
2′			2.27 t(6.6)		
3′			1.74 m		
4′-13′			1.28 br s		
14′			1.28 br s		
15′			1.28 br s		
16′			0.89 t(7.0)		

Table 11-11-3: Compounds, MFs, and test solvents of hopane- and fernane-type triterpenoids **11-11-6**~**11-11-12**.

No.	Compounds	MFs	Test solvents	References
11-11-6	rubiarbonone D	$C_{30}H_{48}O_3$	$CDCl_3$	[142]
11-11-7	rubiarbonone F	$C_{30}H_{46}O_5$	CD_3OD	[142]
11-11-8	rubiarbonone E	$C_{30}H_{46}O_4$	CD_3OD	[142]
11-11-9	crotalic acid	$C_{30}H_{48}O_3$	$CDCl_3$-CD_3OD	[143]
11-11-10	emarginellic acid	$C_{30}H_{48}O_5$	$CDCl_3$-CD_3OD	[143]
11-11-11	8α-hydroxyfernan-25,7β-olide	$C_{30}H_{48}O_3$	$CDCl_3$	[140]
11-11-12	19α-hydroxyferna-7,9(11)-diene	$C_{30}H_{48}O$	$CDCl_3$	[140]



11-11-6 R = Me
11-11-7 R = COOH



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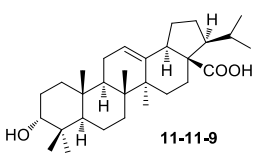

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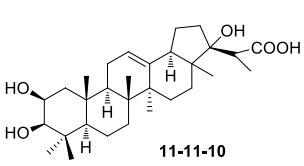

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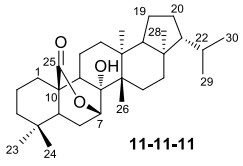
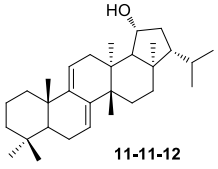


11-11-11



11-11-12

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Table 11-11-4: ^{1}H NMR spectroscopic data of hopane- and fernane-type triterpenoids **11-11-6**~**11-11-10**.

H	11-11-6	11-11-7	11-11-8	11-11-9	11-11-10
1	*α* 1.72 m	*α* 1.69 m	7.37 d(10.5)	1.99 ddd(14.0, 9.5, 4.5)	0.96 ddd(15.0, 9.0, 4.5)
	β 2.04 m	*β* 2.10 m		2.11 ddd(14.0, 5.5, 4.5)	1.89 ddd(15.0, 5.5, 4.5)
2	*α* 2.38 ddd	*α* 2.34 ddd	5.92 d(10.5)	1.64 ddd(14.5, 8.5, 5.5)	*α* 3.65 ddd(10.5, 5.0, 5.5)
	(15.1, 4.6, 3.1)	(15.0, 4.6, 3.1)		1.91 ddd(14.5, 9.0, 5.0)	
	β 2.74 td(15.1, 5.8)	*β* 2.84 td(15.0, 5.8)			
3				*β* 3.55 dd(5.0, 5.5)	*α* 3.53 dd(10.5)
5	1.34 dd(12.8, 2.5)	1.34 dd(12.6, 2.9)	1.67 dd(13.1, 1.7)	0.84 dd(8.5, 4.5)	0.85 dd(8.0, 4.5)
6	*α* 1.86 m	*α* 1.82 m	*α* 2.02 m	1.35 ddd(15.0, 8.5, 5.5)	0.97 m
	β 1.73 m	*β* 1.77 m	*β* 1.82 m	1.51 ddd(15.0, 10.5, 4.5)	1.71 ddd(14.5, 10.5, 4.5)
7	3.79 td(10.4, 5.5)	3.68 td(10.4, 5.3)	3.81 td(10.1, 6.2)	1.64 m	1.20 ddd(14.0, 10.5, 4.5)
				1.17 m	1.44 ddd(14.0, 9.5, 5.5)
8	2.14 br d(10.4)	2.11 br d(10.4)	2.30 br d(10.1)		
9				2.19 dd(7.5, 5.5)	1.57 dd(8.0, 5.0)
11	5.35 dd(4.4, 1.8)	5.43 d(6.4)	5.54 d(6.1)	1.34 ddd(13.5, 7.5, 6.0)	1.59 ddd(14.5, 7.0, 5.5)
				1.56 ddd(13.5, 5.5, 4.5)	2.4 ddd(13.5, 5.5, 5.0)
12	*α* 1.98 m, *β* 1.84 m	*α* 2.10 m, *β* 1.80 m	*α* 2.05 m, *β* 1.96 m	5.26 t(7.0)	5.20 t(7.0)
15	*α* 2.01 m	*α* 2.19 m	*α* 2.05 m	1.09 m	1.44 ddd(14.5, 9.5, 5.0)
	β 1.64 m	*β* 1.85 m	*β* 1.62 td(13.3, 4.1)	1.68 m	1.68 ddd(14.5, 5.5, 4.5)
16	*α* 1.53 td(13.8, 3.9)	*α* 1.37 td(13.3, 4.2)	*α* 1.39 td(13.3, 3.6)	1.02 m	1.47 ddd(15.0, 9.5, 4.5)
	1.62 m	*β* 2.45 br dt(13.3, 3.1)	*β* 1.76 m	1.68 m	1.66 m
18	1.63 d(9.4)	2.09 d(9.4)	1.90 d(9.7)	1.53 dd(8.5, 5.5)	1.53 dd(8.0, 5.0)
19	4.21 td(9.4, 3.2)	4.55 td(9.4, 2.9)	4.39 td(9.7, 2.9)	1.67 m, 1.92 m	1.75 m, 1.38 m
20	*α* 1.69 m	*α* 1.69 m	*α* 1.64 m	1.74 m	1.41 m
	β 1.87 m	*β* 2.17 m	*β* 2.15 td(10.0, 2.9)	1.89 m	1.67 m
21	1.30 br t(9.5)	1.57 br q(9.8)	1.35 m	0.95 m	

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Table 11-11-4 (continued)

H	11-11-6	11-11-7	11-11-8	11-11-9	11-11-10
22	1.43 m	1.35 m	1.76 m	1.33 sept (25.0)	1.25 d(6.5)
23	1.06 s	1.05 s	1.14 s	0.88 s	0.77 s
24	1.07 s	1.08 s	1.06 s	0.96 s	0.77 s
25	1.27 s	1.29 s	1.33 s	0.96 s	0.93 s
26	0.97 s	1.02 s	1.03 s	0.89 s	0.59 s
27	0.94 s	0.92 s	1.10 s	1.06 s	1.12 s
28	0.81 s		3.75, 3.80 d(11.9)		1.06 s
29	0.88 d(6.5)	0.96 d(6.5)	0.97 d(6.5)	0.87 d(6.0)	
30	0.83 d(6.5)	0.85 d(6.5)	0.88 d(6.5)	0.87 d(6.0)	0.82 d(6.5)

Table 11-11-5: ^{1}H NMR spectroscopic data of hopane- and fernane-type triterpenoids **11-11-11** and **11-11-12**.

H	11-11-11	11-11-12	H	11-11-11	11-11-12
5	*α* 1.66 s		25		0.916 s
7*α*	4.315 dd(4.5, 4.5)	5.436 dd(2.6, 2.6)	26	1.153 s	0.885 s
9	*α* 2.71 s		27	1.088 s	1.089 s
11		5.195 dd(2.4, 2.4)	28	0.758 s	1.110 s
19		4.347 dd(8.2, 5.8, 2.6)	29	0.848 d(6.4)	0.939 d(6.4)
23	0.848 s	0.862 s	30	0.824 d(6.4)	0.864 d(6.4)
24	0.883 s	0.916 s			

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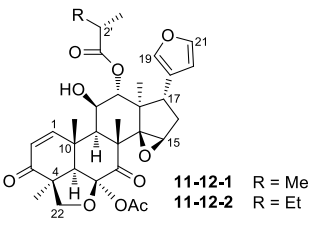
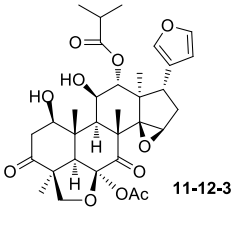
11.12 Limonoids

Table 11-12-1: Compounds, MFs, and test solvents of limonoids **11-12-1**~**11-12-13**.

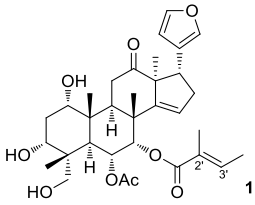
No.	Compounds	MFs	Test solvents	References
11-12-1	malleastrone A	$C_{32}H_{38}O_{10}$	$CDCl_3$	[144]
11-12-2	malleastrone B	$C_{33}H_{40}O_{10}$	$CDCl_3$	[144]
11-12-3	malleastrone C	$C_{32}H_{40}O_{11}$	$CDCl_3$	[144]
11-12-4	toosendone	$C_{33}H_{44}O_9$	$CDCl_3$	[145]
11-12-5	12-ethoxynimbolinin A	$C_{34}H_{46}O_9$	$CDCl_3$	[145]
11-12-6	12-ethoxynimbolinin B	$C_{39}H_{48}O_9$	$CDCl_3$	[145]
11-12-7	12-ethoxynimbolinin C	$C_{33}H_{46}O_8$	$CDCl_3$	[145]
11-12-8	12-ethoxynimbolinin D	$C_{35}H_{44}O_8$	$CDCl_3$	[145]
11-12-9	granaxylocarpin A	$C_{34}H_{44}O_{12}$	$CDCl_3$	[146]
11-12-10	granaxylocarpin B	$C_{32}H_{38}O_{10}$	$CDCl_3$	[146]
11-12-11	cipadesin D	$C_{33}H_{40}O_{13}$	$CDCl_3$	[147]
11-12-12	cipadesin E	$C_{31}H_{38}O_{12}$	$CDCl_3$	[147]
11-12-13	cipadesin F	$C_{31}H_{40}O_{11}$	$CDCl_3$	[147]



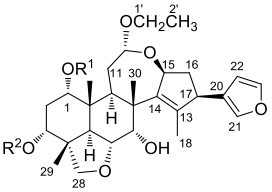
11-12-1 R = Me
11-12-2 R = Et



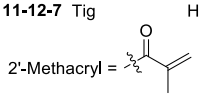
11-12-3

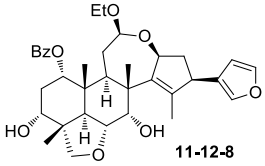


11-12-4

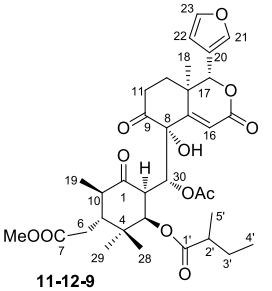


	R^1	R^2
11-12-5	2'-Methylacryl	Ac
11-12-6	Cinn	Ac
11-12-7	Tig	H

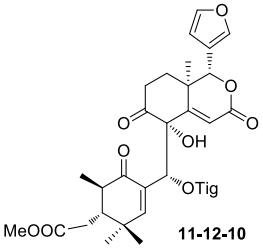




11-12-8



11-12-9



11-12-10

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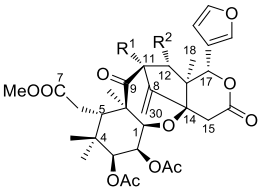
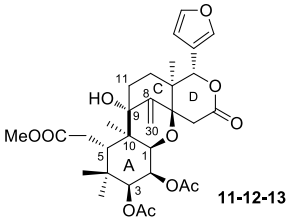


	R^1	R^2
11-12-11	H	OAc
11-12-12	OH	H



11-12-13

Table 11-12-2: ^{1}H NMR spectroscopic data of limonoids **11-12-1**~**11-12-4**.

H	11-12-1	11-12-2	11-12-3	11-12-4
1	7.51 d(10)	7.50 d(10)	4.35 d(8.4)	3.45 m
2	6.03 d(10)	6.03 d(10)	2.35 d(17), 3.04 dd(17, 8.4)	2.10 m, 2.29 m
3				3.81 s
5	2.91 s	2.91 s	3.68 s	3.06 d(2.0)
6				5.63 d(2.3)
7				5.60 m
9	3.38 d(3.5)	3.38 d(4.0)	3.26 s	3.56 m
11	4.27 t(3.0)	4.27 t(3.0)	4.07 br s	2.68 m, 2.27 m
12	5.01 d(3.5)	5.01 d(3.5)	4.90 br s	
15	3.84 s	3.84 s	4.02 s	5.52 s
16	2.12 dd(13, 6.5) 1.83 dd(13, 11)	2.12 dd(13, 6.5) 1.83 dd(13, 11)	2.12 dd(14, 6.5) 1.94 dd(14, 11)	1.55 m, 2.41 m
17	3.00 dd(11, 6)	3.00 dd(11, 6)	2.89 dd(11, 6.8)	3.45 m
18				1.03 s
19	7.16 br s	7.16 br s	7.12 d(1.0)	1.03 s
20	6.17 br d(1.0)	6.18 br s	6.12 br s	
21	7.34 br t(1.5)	7.34 br t(1.6)	7.31 d(1.6)	7.26 s
22	4.15 d(9.5), 4.34 d(9.5)	4.15 d(9.5), 4.34 d(9.5)	4.08 d(9.0), 4.48 d(9.0)	6.49 s
23	1.50 s	1.50 s	1.49 s	7.30 s
24	1.62 s	1.62 s	1.29 s	
25	1.73 s	1.73 s	1.51 s	
26	1.33 s	1.33 s	1.12 s	
28				3.67 m, 3.42 m
29				0.76 s
30				1.20 s
2′	2.44 m	2.24 m	2.43 m	
3′	1.07 d(6.5)	1.60 m, 1.36 m	1.03 d(7.0)	6.92 dd(1.2, 7.1)
4′	1.06 d(7.5)	0.90 t(7.0)	1.04 d(7.0)	1.86 s
5′		1.03 d(7.5)		1.81 d(7.1)
OAc	2.10 s	2.10 s	2.13 s	2.02 s
OH	4.09 br s(11-OH)	4.14 s(11-OH)	3.11 br s(1-OH) 3.49 s(11-OH)	

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Table 11-12-3: ^{1}H NMR spectroscopic data of limonoids **11-12-5**~**11-12-8**.

H	11-12-5	11-12-6	11-12-7	11-12-8
1	4.69 m	4.80 m	4.93 m	5.24 m
2	2.20 m	2.27 m	2.06 m, 2.25 m	2.38 m, 2.11 m
3	4.92 t	4.94 s	3.81 d(9.2)	3.90 s
5	2.89 d(12.6)	2.97 d(12.6)	2.80 d(12.4)	2.92 d(12.5)
6	4.02 dd(12.6, 2.8)	4.08 dd(12.6, 2.9)	4.07 dd(12.4, 2.7)	4.09 dd(12.5, 2.6)
7	4.37 d(2.8)	4.43 d(2.8)	4.41 d(2.7)	4.42 d(2.6)
9	3.16 d(10.4)	3.25 d(10.3)	3.08 d(10.4)	2.72 d(9.7)
11	1.79 m, 1.53 m	1.78 m, 1.58 m	1.81 m, 1.51 m	1.63 m
12	4.74 m	4.75 br s	4.74 br s	3.92 br s
15	5.03 d(8.0)	5.10 d(7.8)	5.02 d(7.8)	4.27 d(7.9)
16	2.55 m	2.54 m	2.56 m	2.45 m
	1.57 m	1.58 m	1.57 m	1.52 m
17	3.43 m	3.45 d(9.8)	3.40 m	3.37 d(8.6)
18	1.72 s	1.76 s	1.74 s	1.71 s
19	0.95 s	0.99 s	0.96 s	1.02 s
21	7.25 s	7.26 s	7.27 s	7.24 s
22	6.39 s	6.41 s	6.40 s	6.42 s
23	7.29 s	7.30 s	7.31 s	7.26 s
28	3.57 br s	3.63 m	4.10 d(7.4), 3.62 d(7.5)	4.15 d(7.4), 3.65 d(7.4)
29	1.18 s	1.21 s	1.14 s	1.16 s
30	1.13 s	1.37 s	1.34 s	1.36 s
1′	3.43 m	3.37 m	3.40 m	3.18 m, 3.59 m
2′	1.01 t(7.0)	0.94 t(7.0)	0.99 t(7.1)	1.05 t(7.0)
OAc	1.92 s	1.88 s		
OCOC(Me)CH_2	5.54, 6.22 d(2.0, CH_2) 2.03 s(Me)			
OCinn or OBz		6.49 d(16.0) 7.76 d(16.0) 7.52 m(*o*-) 7.39 m(*m*-, *p*-)		8.11 d(7.2, *o*-) 7.50 t(*m*-) 7.62 t(*p*-)
OTig			6.94 dd(1.2, 7.0, CH) 1.90 s(2″-Me) 1.81 d(7.0, 3″-Me)	

Table 11-12-4: ^{1}H NMR spectroscopic data of limonoids **11-12-9** and **11-12-10**.

H	11-12-9	11-12-10	H	11-12-9	11-12-10
2	3.63 dd(9.1, 2.1)		22	6.42 d(1.1)	6.46 d(1.5)
3	5.33 d(2.1)	7.0 s	23	7.41 d(1.1)	7.45 d(1.5)
5	2.20 m	2.26 m	28	0.89 s	1.19 s

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Table 11-12-4 (continued)

H	11-12-9	11-12-10	H	11-12-9	11-12-10
6	*α* 2.24 m, *β* 2.44 m	*α* 2.25 m, *β* 2.45 m	29	1.23 s	1.13 s
10	2.38 m	2.28 m	30	5.79 d(9.1)	6.60 s
11	*α* 2.63 m *β* 3.41 ddd(13.6, 13.7, 13.6)	*α* 2.55 m *β* 3.08 dd(19.8, 7.0)	2′	2.28 m	
12	*α* 1.57 dd(9.4, 3.6) *β* 2.56 m	*α* 1.63 dd(13.7, 7.3) *β* 2.66 ddd(13.2, 13.2, 7.0)	3′	1.36 qd (7.3, 7.3) 1.68 m	6.95 qq(6.6, 0.7)
15	6.11 s	6.08 s	4′	0.89 t(7.3)	1.83 d(6.6)
17	5.25 s	5.36 s	5′	1.07 d(7.2)	1.84 s
18	0.94 s	0.96 s	8-OH	4.11 s	3.88 s
19	0.95 d(6.2)	1.03 d(5.5)	30-OAc	2.04 s	
21	7.51 s	7.55 s	7-OMe	3.67 s	3.69 s

Table 11-12-5: ^{1}H NMR spectroscopic data of limonoids **11-12-11**~**11-12-13**.

H	11-12-11	11-12-12	11-12-13
1	4.08 d(3.1)	4.05 d(3.2)	3.48 d(4.6)
2	5.25 dd(3.7, 3.1)	5.24 dd(3.4, 3.2)	5.17 dd(4.6, 3.0)
3	5.13 d(3.7)	5.14 d(3.4)	5.05 d(3.0)
5	3.13 dd(6.9, 2.2)	2.95 dd(5.9, 3.5)	2.91 (ov)
6	2.89 dd(18.5, 2.2) 2.25 dd(18.5, 6.9)	2.84 dd(18.5, 5.9) 2.33 dd(18.5, 3.5)	3.04 d(17.1) 2.43 (ov)
11	3.33 d(2.1)		*α* 1.38 (ov), *β* 2.73 m
12	5.55 d(2.1)	*α* 1.55 d(14.1), *β* 3.22 d(14.1)	*α* 1.38 (ov), *β* 2.38 (ov)
15	*α* 2.85 s, *β* 2.85 s	*α* 2.84 s, *β* 2.84 s	*α* 2.52 d(17.8), *β* 2.91 d(17.8)
17	6.51 s	6.32 s	5.79 s
18	0.94 s	0.98 s	0.84 s
19	1.12 s	1.14 s	0.90 s
21	7.59 s	7.53 s	7.43 s
22	6.42 s	6.42 d(0.8)	6.40 s
23	7.44 s	7.45 s	7.42 s
28	1.09 s	1.09 s	1.12 s
29	0.97 s	0.90 s	0.84 s
30	5.40 s, 5.22 s	5.58 s, 5.28 s	5.35 s, 5.01 s
OMe	3.69 s	3.67 s	3.70 s
2-OAc	2.11 s	2.12 s	2.00 s
3-OAc	2.09 s	2.08 s	2.15 s
12-OAc	1.87 s		

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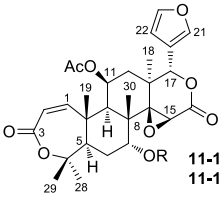
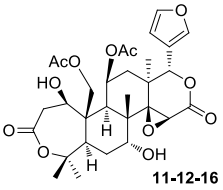
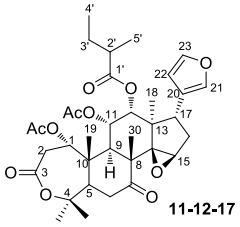
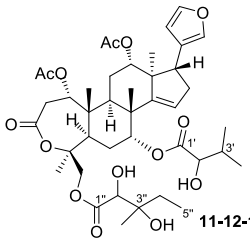
Table 11-12-6: Compounds, MFs, and test solvents of limonoids **11-12-14**~**11-12-33**.

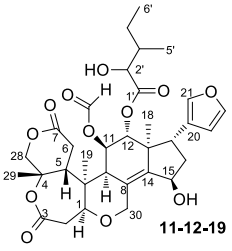
No.	Compounds	MFs	Test solvents	References
11-12-14	odoratin A	$C_{30}H_{36}O_{10}$	$CDCl_3$	[148]
11-12-15	odoratin C	$C_{28}H_{34}O_9$	$CDCl_3$	[148]
11-12-16	odoratin B	$C_{30}H_{38}O_{12}$	$CDCl_3$	[148]
11-12-17	amotsangin G	$C_{35}H_{46}O_{11}$	$CDCl_3$	[149]
11-12-18	rubralin D	$C_{41}H_{58}O_{14}$	$CDCl_3$	[150]
11-12-19	cipadessalide	$C_{33}H_{42}O_{12}$	$CDCl_3$	[150]
11-12-20	amotsangin A	$C_{34}H_{44}O_{10}$	$CDCl_3$	[149]
11-12-21	amotsangin B	$C_{33}H_{42}O_{10}$	$CDCl_3$	[149]
11-12-22	amotsangin C	$C_{35}H_{46}O_{11}$	$CDCl_3$	[149]
11-12-23	amotsangin D	$C_{32}H_{40}O_{10}$	$CDCl_3$	[149]
11-12-24	amotsangin E	$C_{36}H_{40}O_{10}$	$CDCl_3$	[149]
11-12-25	amotsangin F	$C_{35}H_{38}O_{10}$	$CDCl_3$	[149]
11-12-26	odoratin D	$C_{33}H_{44}O_{13}$	$CDCl_3$	[148]
11-12-27	toonaciliatin E	$C_{29}H_{38}O_9$	$CDCl_3$	[151]
11-12-28	toonaciliatin D	$C_{27}H_{36}O_8$	$CDCl_3$	[151]
11-12-29	toonaciliatin A	$C_{25}H_{28}O_{10}$	CD_3OD	[151]
11-12-30	toonaciliatin B	$C_{26}H_{30}O_8$	C_5D_5N	[151]
11-12-31	toonaciliatin C	$C_{29}H_{36}O_{10}$	$CDCl_3$	[151]
11-12-32	toonaciliatin F	$C_{25}H_{32}O_{10}$	CD_3OD	[151]
11-12-33	toonaciliatin G	$C_{25}H_{32}O_9$	CD_3OD	[151]

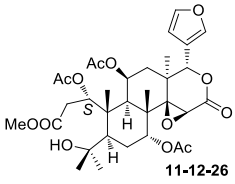


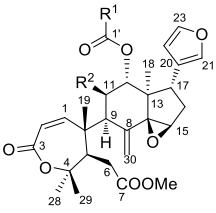




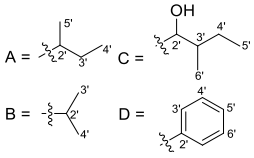








	R^1	R^2
11-12-20	A	OAc
11-12-21	B	OAc
11-12-22	C	OAc
11-12-23	Et	OAc
11-12-24	D	OAc
11-12-25	D	OCHO



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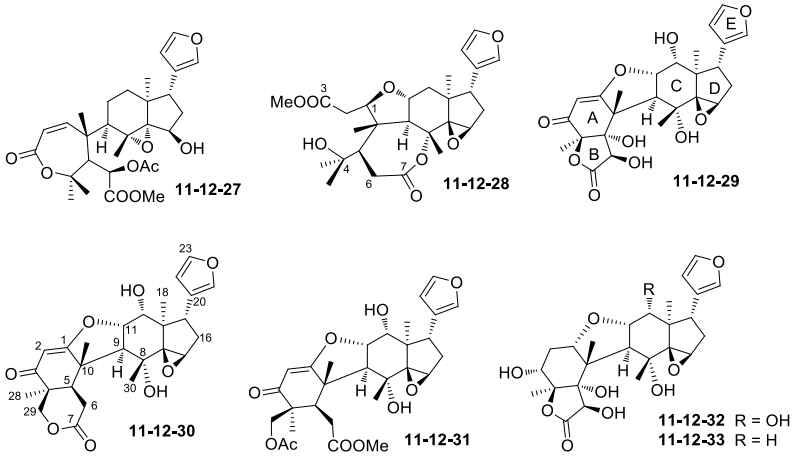

Table 11-12-7: ^{1}H NMR spectroscopic data of limonoids **11-12-14**~**11-12-16**.

H	11-12-14	11-12-15	11-12-16
1	6.29 d(12.6)	6.35 d(12.5)	4.09 dd(3.7, 1.4)
2	5.94 d(12.6)	5.92 d(12.5)	*α* 2.92 dd(17.1, 3.7) *β* 2.33 dd(17.2, 1.4)
5	2.50 dd(13.1, 2.4)	2.81 dd(13.3, 2.6)	2.21 dd(11.9, 4.8)
6*α*	2.12 ddd(15.4, 2.6, 2.4)	1.83 dt(14.4, 3.2)	1.90 m
6*β*	1.94 ddd(15.4, 13.1, 2.4)	2.02 br t(14.0)	1.89 m
7	4.56 dd(2.6, 2.4)	3.54 br s	4.60 t(2.3)
9	2.49 d(4.6)	2.54 d(4.1)	2.67 d(4.6)
11*α*	5.60 ddd(9.8, 5.5, 4.6)	5.61 dt(9.4, 4.6)	5.30 ddd(9.8, 5.1, 4.6)
12*α*	2.33 dd(14.3, 9.8)	2.27 dd(14.4, 9.6)	2.43 dd(14.6, 9.8)
12*β*	1.51 dd(14.3, 5.5)	1.51 dd(14.4, 5.4)	1.41 dd(14.6, 5.1)
15*α*	3.55 s	3.77 s	3.56 s
17	5.59 s	5.58 s	5.58 s
18	1.21 s	1.22 s	1.29 s
19	1.53 s(*pro-R*)	1.49 s(*pro-R*)	4.48 d(13.1, *pro-R*) 5.10 d(13.1, *pro-S*)
21	7.40 t(1.6)	7.39 t(1.7)	7.41 t(1.6)
22	6.32 br d(1.0)	6.32 br s	6.31 d(1.5)
23	7.39 br s	7.39 br s	7.40 br s
28	1.34 s	1.41 s	1.25 s
29	1.45 s	1.26 s	1.14 s
30	*α* 1.34 s	*α* 1.26 s	*α* 1.13 s
OAc	2.13 s(7-OAc) 2.15 s(11-OAc)	3.55 s(1-OAc) 2.13 s(11-OAc)	2.13 s(11-OAc) 2.13 s(19-OAc)
OH		1.87 br d(3.0)	

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Table 11-12-8: ^{1}H NMR spectroscopic data of limonoids **11-12-17**~**11-12-20**.

H	11-12-17	11-12-18	11-12-19	11-12-20
1	5.11 d(7.0)	4.75 d(6.1)	3.62(d 5.1)	6.92 d(13.2)
2	3.28 dd(15.9, 7.0)	3.19 dd(6.1, 15.5),	2.96 m, 3.34 m	6.25 d(13.2)
		3.28 d(15.5)		
	3.19 d(15.9)			
5	2.61 d(8.4)	2.55 dd(2.1, 12.6)	2.96 m	3.27 d(9.2)
6	2.83 d(14.8)	2.03 m, 2.11 m	3.08 m, 3.20 m	2.29 d(16.6)
	2.61 dd(14.8, 8.4)			2.18 dd(16.6, 9.2)
7		5.29 br s		3.71 s(COOMe)
9	2.96 s	2.70 dd(8.6, 11.8)	2.84 d(7.8)	3.06 d(7.3)
11	4.98 s	1.21 m, 2.12 m	5.66 dd(7.9, 11.8)	5.62 dd(10.8, 7.3)
12	5.19 s	5.50 t(8.4)	5.37 d(11.9)	5.84 d(10.8)
15	3.71 s	5.05 s	4.86 d(6.3)	3.86 s
16	α 2.04 dd(13.1, 11.3)	2.38 d(11.3)	2.32 m	α 1.81 dd(14.0, 10.9)
	β 2.24 dd(13.1, 6.8)	2.43 dd(3.3, 11.3)	1.94 m	β 2.22 dd(14.0, 6.9)
17	2.90 dd(11.3, 6.8)	3.01 dd(8.0, 10.5)	3.12 m	3.07 dd(10.9, 6.9)
18	0.96 s	0.94 s	1.00 s	0.95 s
19	1.46 s	1.20 s	1.13 s	1.00 s
21	7.09 s	7.18 s	7.24 s	7.11 s
22	6.14 s	6.20 s	6.25 d(0.8)	6.17 s
23	7.28 s	7.25 t(1.7)	7.39 s	7.27 s
28	1.47 s	1.45 s	4.28 d(4.8), 4.17 d(4.8)	1.28 s
29	1.56 s	5.12 d(14.8),	1.81 s	1.55 s
		3.94 d(14.9)		
30	1.43 s	1.24 s	3.77 d(12.2),	5.34 s, 5.22 s
			5.03 d(12.2)	
2′	2.09 m	4.04 s	3.23 m	1.94 m
3′	1.40 m, 1.17 m	2.08 m	1.52 m	1.41 m, 1.17 m
4′	0.73 t(7.5)	1.09 d(6.8)	1.08 m, 1.10 m	0.79 t(7.5)
5′	1.05 d(6.9)	0.86 d(6.8)	0.83 d(6.8)	0.76 d(8.6)
6′			0.78 t(7.4)	
2″		4.08 s		
4″		1.60 m, 1.69 m		
5″		0.95 t(7.5)		
6″		1.18 s		
OAc	2.16 s, 2.05 s	2.08 s(1-OAc)		2.10 s
		1.94 s(12-OAc)		
CHO			8.14 s	

Table 11-12-9: ^{1}H NMR spectroscopic data of limonoids **11-12-21**~**11-12-24**.

H	11-12-21	11-12-22	11-12-23	11-12-24
1	6.93 d(12.9)	6.95 d(13.1)	6.93 d(12.9)	7.00 d(13.1)
2	6.26 d(12.9)	6.28 d(13.1)	6.27 d(12.9)	6.35 d(13.1)
5	3.29 d(9.2)	3.31 d(8.8)	3.33 d(9.1)	3.35 d(8.9)

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Table 11-12-9 (continued)

H	11-12-21	11-12-22	11-12-23	11-12-24
6	2.29 d(16.8)	2.30 d(17.2)	2.28 d(17.3)	2.32 d(16.6)
	2.18 dd(16.8, 9.2)	2.20 dd(17.2, 8.8)	2.18 dd(17.3, 9.1)	2.20 dd(16.6, 8.9)
9	3.07 d(7.3)	3.08 d(7.1)	3.07 d(7.3)	3.13 d(7.3)
11	5.62 dd(10.9, 7.3)	5.69 dd(11.0, 7.1)	5.60 dd(10.8, 7.3)	5.77 d(10.8, 7.3)
12	5.83 d(10.9)	6.00 d(11.0)	5.86 d(10.8)	6.10 d(10.8)
15	3.86 s	3.86 s	3.88 s	3.91 s
16α	1.81 dd(13.8, 11.1)	1.84 dd(14.0, 11.0)	1.83 dd(13.3, 10.4)	1.86 dd(13.6, 11.2)
16β	2.22 dd(13.8, 7.0)	2.27 dd(14.0, 7.1)	2.22 dd(13.3, 7.0)	2.26 dd(13.6, 6.9)
17	3.00 dd(11.0, 7.0)	3.06 dd(11.0, 7.1)	3.04 dd(10.4, 7.0)	3.13 dd(11.2, 6.9)
18	0.95 s	0.97 s	0.93 s	1.00 s
19	1.00 s	1.02 s	1.01 s	1.04 s
21	7.11 s	7.12 s	7.11 s	7.00 s
22	6.17 s	6.17 s	6.15 s	6.05 s
23	7.28 s	7.33 s	7.30 s	7.01 s
28	1.29 s	1.30 s	1.29 s	1.28 s
29	1.55 s	1.58 s	1.56 s	1.57 s
30	5.34 s, 5.22 s	5.37 s, 5.25 s	5.35 s, 5.23 s	5.39 s, 5.26 s
OMe	3.71 s	3.73 s	3.72 s	3.70 s
OAc	2.09 s	2.14 s	2.10 s	1.89 s
2′	2.17 m	3.45 s	1.96 m	
3′	0.85 d(7.1)	1.41 m	0.93 t(7.6)	7.75 dd(8.1, 1.4)
4′	0.82 d(7.1)	1.40 m, 1.23 m		7.33 dd(8.1, 7.4)
5′		0.82 t(7.1)		7.48 tt(7.4, 1.4)
6′		0.69 d(6.6)		7.33 dd(8.1, 7.4)
7′				7.75 dd(8.1, 1.4)

Table 11-12-10: ^{1}H NMR spectroscopic data of limonoids **11-12-25**~**11-12-28**.

H	11-12-25	11-12-26	11-12-27	11-12-28
1	6.96 d(12.9)	6.76 br d(9.6)	6.07 d(13.0)	4.44 br d(7.6)
2	6.34 d(12.9)	α 2.55 br d(14.9)	6.74 d(13.0)	2.32 dd(15.7, 7.6)
		β 2.35 dd(14.9, 9.6)		3.58 dd(15.7, 1.0)
5	3.32 d(8.4)	1.78 dd(11.9, 3.3)	3.57 s	1.90 d(13.8)
6	2.32 d(16.6)	α 1.93 dt(14.5, 3.5)	5.42 s	2.59 d(12.2)
	2.23 dd(16.6, 8.4)	β 1.89 dt(2.0, 13.9)		2.96 dd(13.8, 12.2)
7		4.50 br t(2.5)		
9	3.19 d(7.5)	2.49 br d(3.1)	2.06 br s	2.59 d(12.2)
11	5.89 d(10.6, 7.5)	α 5.70 dt(9.8, 4.0)	α 1.93 m, β 1.65 m	4.17 ddd(12.2, 8.3, 7.7)
12	6.13 d(10.6)	α 2.46 dd(14.9, 10.0)	α 0.97 ddd(13.1, 6.3, 2.6)	α 1.60 dd(13.1, 8.3)
		β 1.47 dd(14.9, 4.0)	β 1.57 m	β 2.38 dd(13.1, 7.7)
15	3.92 s	3.58 s	4.30 d(5.5)	3.61 s

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Table 11-12-10 (continued)

H	11-12-25	11-12-26	11-12-27	11-12-28
16	*α* 1.86 dd(14.0, 10.7)		*α* 2.13 td(13.5, 5.5)	*α* 1.85 dd(13.5, 11.2)
	β 2.28 dd(14.0, 7.0)		*β* 1.79 dd(13.5, 5.5)	*β* 2.24 dd(13.5, 6.4)
17	3.14 dd(10.7, 7.0)	5.57 s	3.24 dd(13.5, 5.5)	2.74 dd(11.2, 6.4)
18	1.02 s	1.29 s	0.69 s	1.00 s
19	1.06 s	1.42 s(*pro-R*)	1.42 s	1.24 s
21	6.98 s	7.40 s	7.25 dd(1.6, 1.0)	7.12 br s
22	6.05 s	6.33 s	6.26 dd(1.7, 1.0)	6.17 br s
23	6.98 s	7.40 s	7.34 dd(1.7, 1.6)	7.37 br s
28	1.28 s	1.22 s	1.51 s	1.15 s
29	1.56 s	1.29 s	1.73 s	1.41 s
30	5.41 s, 5.28 s	1.30 s	1.76 s	1.41 s
3′	7.74 dd(8.1, 1.3)			
4′	7.32 dd(8.1, 7.6)			
5′	7.47 tt(7.6, 1.4)			
6′	7.32 dd(8.1, 7.6)			
7′	7.74 dd(8.1, 1.3)			
COOMe	3.71 s		3.77 s	3.68 s
OAc		1.95 s(1-OAc) 2.11 s(7-OAc) 2.10 s(11-OAc)	2.19 s	
OCHO	7.98 s			

Table 11-12-11: ^{1}H NMR spectroscopic data of limonoids **11-12-29**~**11-12-33**.

H	11-12-29	11-12-30	11-12-31	11-12-32	11-12-33
1				4.10 dd(11.5, 6.6)	4.11 dd(11.4, 6.5)
2	5.40 s	5.58 s	5.43 s	*α* 2.14 ddd(13.6, 13.2, 11.5) *β* 1.93 ddd(13.6, 6.6, 4.5)	*α* 1.59 ddd(13.3, 13.1, 11.4) *β* 2.04 ddd(13.3, 6.5, 4.7)
3				4.41 dd(13.2, 4.5)	4.40 dd(13.1, 4.7)
5		3.45 dd(6.6, 6.9)	2.78 d(10.1)		
6	4.89 s	*α* 3.48 dd(16.4, 6.9) *β* 3.42 dd(16.7, 6.6)	2.72 dd(14.2, 10.1) 3.12 d(14.2)	3.89 s	3.89 s
9	4.11 d(12.4)	3.40 d(12.4)	2.91 d(12.2)	3.05 d(12.0)	3.03 d(12.3)
11	4.82 dd(12.4, 4.8)	5.09 dd(12.4, 4.7)	4.73 dd(12.2, 4.7)	4.12 dd(12.0, 6.2)	4.20 dd(12.3, 9.8, 7.2)

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Table 11-12-11 (continued)

H	11-12-29	11-12-30	11-12-31	11-12-32	11-12-33
12	4.43 d(4.8)	4.78 br s	4.43 d(4.7)	4.09 d(6.2)	α 1.53 dd(12.6, 9.8) β 2.17 dd(12.8, 7.2)
15	3.61 s	3.69 s	3.60 s	3.57 s	3.59 s
16α	1.94 dd(13.4, 11.0)	1.91 dd(13.4, 11.3)	1.86 dd(13.5, 11.1)	1.88 dd(13.5, 10.9)	1.88 dd(13.2, 11.0)
16β	2.24 dd(13.4, 6.6)	2.26 dd(13.4, 6.6)	2.35 dd(13.5, 6.6)	2.21 dd(13.5, 7.1)	2.17 dd(13.2, 6.4)
17	2.83 dd(11.0, 6.6)	3.08 dd(10.9, 6.6)	2.85 dd(11.1, 6.6)	2.75 dd(10.9, 7.1)	2.71 dd(11.0, 6.4)
18	1.05 s	1.58 s	1.05 s	0.98 s	1.06 s
19	1.46 s	1.54 s	1.41 s	1.47 s	1.45 s
21	7.29 dd(1.4, 1.0)	7.51 br s	7.21 br s	7.26 d(1.0)	7.27 d(1.3)
22	6.39 dd(2.0, 1.0)	7.17 d(1.3)	6.35 br s	6.41 d(1.5)	6.28 d(1.7)
23	7.41 dd(2.0, 1.4)	7.61 dd(1.8, 1.3)	7.41 dd(1.6, 1.4)	7.39 dd(1.5, 1.0)	7.43 dd(1.7, 1.3)
28	1.55 s	1.18 s	1.05 s	1.47 s	1.49 s
29		4.44 d(11.5) 4.74 d(11.5)	4.21 d(11.8) 4.41 d(11.8)		
30	1.27 s	1.58 s	1.26 s	1.25 s	1.25 s
8-OH		6.98 s		4.59 s	4.60 s
COOMe			3.71 s		
29-OAc			2.05 s		

Table 11-12-12: Compounds, MFs, and test solvents of limonoids **11-12-34**~**11-12-50**.

No.	Compounds	MFs	Test solvents	References
11-12-34	granaxylocarpin C	$C_{32}H_{40}O_{11}$	$CDCl_3$	[146]
11-12-35	granaxylocarpin D	$C_{35}H_{44}O_{15}$	$CDCl_3$	[146]
11-12-36	granaxylocarpin E	$C_{35}H_{44}O_{14}$	$CDCl_3$	[146]
11-12-37	xylocarpin A	$C_{35}H_{44}O_{14}$	$CDCl_3$	[152]
11-12-38	xylocarpin B	$C_{33}H_{42}O_{12}$	$CDCl_3$	[152]
11-12-39	xylocarpin C	$C_{33}H_{42}O_{13}$	$CDCl_3$	[152]
11-12-40	xylocarpin D	$C_{35}H_{44}O_{15}$	$CDCl_3$	[152]
11-12-41	xylocarpin E	$C_{35}H_{44}O_{15}$	$CDCl_3$	[152]
11-12-42	xyloccensin U	$C_{35}H_{44}O_{14}$	$CDCl_3$	[152]
11-12-43	8β,14α-dihydroswietendide	$C_{27}H_{36}O_8$	$CDCl_3$	[148]
11-12-44	2′*R*-cipadesin A	$C_{32}H_{42}O_9$	$CDCl_3$	[153]
11-12-45	2′*S*-cipadesin A	$C_{32}H_{42}O_9$	$CDCl_3$	[153]
11-12-46	2′*R*-cipadesin	$C_{32}H_{42}O_8$	$CDCl_3$	[153]
11-12-47	2′*S*-cipadesin	$C_{32}H_{42}O_8$	$CDCl_3$	[153]
11-12-48	tigloylseneganolide A	$C_{32}H_{38}O_8$	$CDCl_3$	[153]
11-12-49	2′*R*-methylbutanoylproceranolide	$C_{32}H_{42}O_8$	$CDCl_3$	[153]
11-12-50	2′*S*-methylbutanoylproceranolide	$C_{32}H_{42}O_8$	$CDCl_3$	[153]

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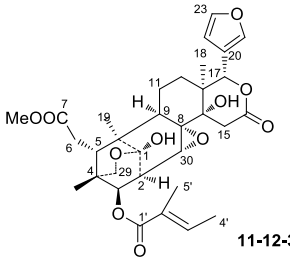
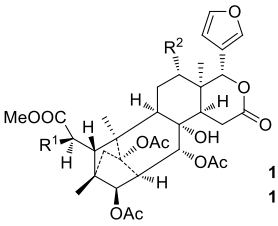
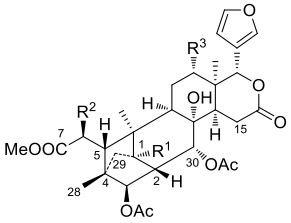


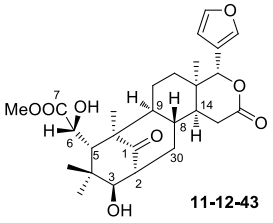
11-12-34



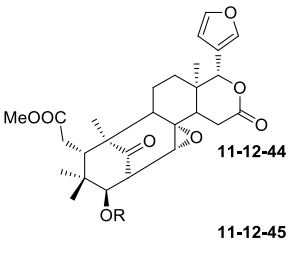
	R^1	R^2
11-12-35	OH	OAc
11-12-36	OAc	H



	R^1	R^2	R^3
11-12-37	OAc	OAc	H
11-12-38	OAc	H	H
11-12-39	OH	H	OAc
11-12-40	OAc	OH	OAc
11-12-41	OAc	OAc	OH
11-12-42	OAc	H	OAc

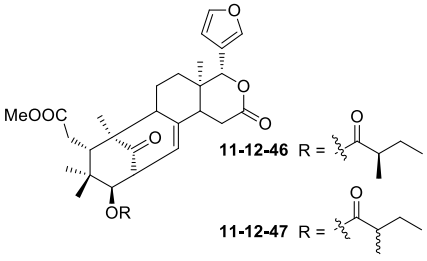


11-12-43



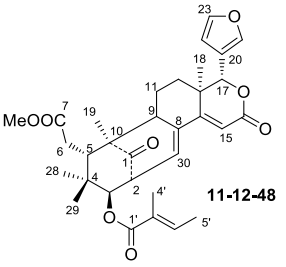
11-12-44 R =

11-12-45 R =

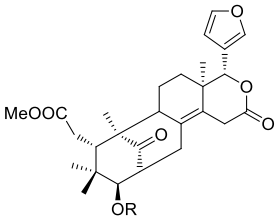


11-12-46 R =

11-12-47 R =



11-12-48



11-12-49 R =

11-12-50 R =

Table 11-12-13: ^{1}H NMR spectroscopic data of limonoids **11-12-34**~**11-12-37**.

H	11-12-34	11-12-35	11-12-36	11-12-37
2	3.03 dd(10.2, 2.7)	2.98 dd(11.4, 2.7)	2.99 dd(11.4, 2.6)	3.00 dd(2.3, 11.4)
3	5.11 d(10.2)	5.20 d(11.4)	5.27 d(11.4)	5.30 d(11.4)
5	2.85 br d(10.7)	2.88 s	3.23 s	3.26 br s
6	*α* 2.40 dd(16.8, 10.7) *β* 2.30 m	4.24 s	5.38 s	5.40 br s
9	2.25 dd(11.8, 5.5)	2.19 dd(13.8, 8.8)	1.88 m	1.90 m

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Table 11-12-13 (continued)

H	11-12-34	11-12-35	11-12-36	11-12-37
11	*α* 1.77 m	*α* 2.01 m	*α* 1.75 m	1.76 m
	β 1.77 m	*β* 1.84 ddd(14.6, 4.0, 4.0)	*β* 1.86 m	1.43 m
12	*α* 1.75 m, *β* 1.67 m	5.01 br s	*α* 1.41 m, *β* 1.88 m	1.91 m, 1.45 m
14		2.40 d(8.6)	2.02 br d(8.9)	2.04 d(8.4)
15	*α* 2.98 br d(16.8)	*α* 2.64 dd(19.4, 8.6)	*α* 2.73 dd(19.4, 8.9)	*α* 3.38.d(19.2)
	β 2.60 d(16.8)	*β* 3.33 d(19.4)	*β* 3.35 br d(19.4)	*β* 2.76 dd(8.4, 19.2)
17	5.27 s	5.72 s	5.71 s	5.74 s
18	0.93 s	0.99 s	0.98 s	1.00 s
19	1.03 s	1.37 s	1.16 s	1.19 s
21	7.63 s	7.41 br s	7.42 s	7.45 br s
22	6.46 br s	6.32 d(1.0)	6.35 s	6.38 br s
23	7.39 t(1.6)	7.43 t(1.0)	7.43 s	7.44 br s
28	0.62 s	0.92 s	1.00 s	1.03 s
29	*α* 3.87 d(10.0)	2.38 br s	*α* 2.45 br d(10.6)	2.49 d(11.0)
	β 3.49 br d(10.0)		*β* 2.25 br d(10.6)	2.27 d(11.0)
30	3.34 d(2.8)	5.41 d(2.7)	5.41 d(2.6)	5.45 d(2.3)
3′	7.0 qq(7.0, 1.5)			
4′	1.75 dd(7.0, 1.5)			
5′	1.86 br s			
OH	3.95 s(1-OH)	2.97 s(6-OH)	4.27 s(8-OH)	4.34 s(8-OH)
	2.70 s(14-OH)	4.42 s(8-OH)		
7-OMe	3.69 s	3.82 s	3.75 s	3.78 s
OAc		2.07 s(1-OAc)	2.13 s(1-OAc)	2.15 s(1-OAc)
		2.07 s(3-OAc)	2.12 s(3-OAc)	2.17 s(3-OAc)
		2.13 s(12-OAc)	2.18 s(6-OAc)	2.21 s(6-OAc)
		2.02 s(30-OAc)	2.04 s(30-OAc)	2.07 s(30-OAc)

Table 11-12-14: ^{1}H NMR spectroscopic data of limonoids **11-12-38**~**11-12-42**.

H	11-12-38	11-12-39	11-12-40	11-12-41	11-12-42
2	3.00 dd(2.3, 11.4)	2.36 dd(2.8, 11.4)	3.03 dd(2.5, 11.5)	3.03 dd(2.5, 11.4)	3.02 dd(2.5, 11.5)
3	5.37 d(11.4)	5.31 d(11.4)	5.26 d(11.5)	5.30 d(11.4)	5.36 d(11.5)
5	3.03 dd(3.5, 10.0)	2.94 dd(3.0, 9.5)	2.92 s	3.20 s	2.97 dd(3.0, 9.0)
6	2.31 dd(3.5, 16.5)	2.29 dd(3.0, 16.0)	4.29 s	5.40 s	2.23 dd(3.0, 16.0)
	2.25 dd(10.0, 16.5)	2.24 dd(9.5, 16.0)			2.25 dd(9.0, 16.0)
9	1.83 m	2.06 m	2.24 dd(4.0, 14.0)	2.19 m	2.14 m

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Table 11-12-14 (continued)

H	11-12-38	11-12-39	11-12-40	11-12-41	11-12-42
11	1.80 m, 1.92 m	2.00 m, 2.20 m	1.86 ddd(4.0, 4.0, 15.0) 2.05 m	1.90 m, 2.00 m	1.97 m, 2.12 m
12	1.94 m 1.42 ddd(2.5, 11.5, 11.5)	4.99 br s	5.03 br s	3.84 br s	5.01 br s
14	2.03 dd(1.5, 8.5)	2.44 d(8.2)	2.44 d(8.5)	2.44 d(8.3)	2.43 d(8.5)
15α	3.27 dd(1.5, 19.5)	3.13 br d(19.2)	3.40 d(19.5)	3.35 d(19.5)	3.36 d(19.4)
15β	2.75 dd(8.5, 19.5)	2.72 dd(8.2, 19.2)	2.69 dd(8.5, 19.5)	2.67 dd(8.3, 19.5)	2.68 dd(8.5, 19.4)
17	5.73 s	5.77 s	5.76 s	5.73 s	5.80 s
18	0.99 s	1.04 s	1.03 s	1.11 s	1.03 s
19	1.11 s	1.06 s	1.42 s	1.19 s	1.09 s
21	7.46 br s	7.53 br s	7.45 br s	7.46 br s	7.51 br s
22	6.40 br s	6.41 br s	6.37 br s	6.38 br s	6.41 br s
23	7.44 br s	7.47 br s	7.47 br s	7.46 br s	7.46 br s
28	0.88 s	0.85 s	0.96 s	1.02 s	0.88 s
29	2.44 d(11.0) 1.98 d(11.0)	1.96 d(10.8) 1.46 d(10.8)	2.43 br 2.43 br	2.49 d(10.5) 2.26 d(10.5)	2.01 d(10.5) 2.46 d(10.5)
30	5.50 d(2.3)	5.44 d(2.8)	5.45 d(2.5)	5.46 d(2.5)	5.51 d(2.5)
8-OH	4.34 s		4.49 s	4.19 s	4.43 br s
7-OMe	3.71 s	3.71 s	3.87 s	3.78 s	3.71 s
OAc	2.16 s(1-OAc) 2.18 s(3-OAc) 2.07 s(30-OAc)	2.16 s(3-OAc) 2.11 s(12-OAc) 2.11 s(30-OAc)	2.17 s(1-OAc) 2.12 s(3-OAc) 2.12 s(12-OAc) 2.08 s(30-OAc)	2.26 s(1-OAc) 2.15 s(3-OAc) 2.22 s(6-OAc) 2.08 s(30-OAc)	2.10 s(1-OAc) 2.17 s(3-OAc) 2.17 s(12-OAc) 2.09 s(30-OAc)

Table 11-12-15: ^{1}H NMR spectroscopic data of limonoids **11-12-43**~**11-12-47**.

H	11-12-43	11-12-44	11-12-45	11-12-46; 11-12-47
2	2.97 dt(9.8, 3.8)	3.57 dd(9.5, 2.5)	3.56 dd(9.5, 2.5)	3.48 m
3	3.61 dd(9.8, 4.1)	5.08 d(9.7)	5.08 d(9.4)	4.81 d(9.5)
5	3.31 br s	3.23 dd(8.0, 2.8)	3.22 dd(7.9, 3.4)	3.41 m
6	4.46 br s	2.34 m	2.34 m	2.36 m
8	2.43 dq(4.4, 11.7)			
9	1.24 m	1.92 m	1.91 m	2.23 m
11	1.60~1.66	α 1.78 m, β 1.84 m	α 1.78 m, β 1.83 m	2.08 m, 1.68 m
12	α 1.20 ddd(16.0, 12.2, 6.2)	α 1.18 m	α 1.17 m	1.46 m, 1.66 m
	β 1.64 m	β 1.95 m	β 1.95 m	
14	1.44 ddd(11.4, 7.2, 1.4)	1.57 m	1.55 m	2.19 br s

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Table 11-12-15 (continued)

H	11-12-43	11-12-44	11-12-45	11-12-46; 11-12-47
15	*α* 2.84 dd(18.8, 7.2) *β* 2.77 dd(18.7, 1.4)	*α* 2.79 dd(15.8, 4.7) *β* 3.65 dd(15.6, 14.7)	*α* 2.79 dd(15.7, 4.6) *β* 3.66 dd(15.4, 15.1)	2.89 dd(18.7, 6.0) 2.81 br d(18.8)
17	5.80 s	5.16 s	5.15 s	5.68 s
18	0.96 s	1.00 s	1.00 s	1.08 s
19	1.33 s	1.06 s	1.06 s	1.14 s
21	7.42 s	7.47 d(1.0)	7.46 s	7.78 s
22	6.37 s	6.45 dd(1.1, 0.7)	6.44 d(1.2)	6.46 d(0.7)
23	7.42 s	7.42 dd(2.0, 1.5)	7.42 dd(1.7, 1.2)	7.41 s
28	0.92 s	0.80 s	0.80 s	0.78 s
29	1.00 s	0.79 s	0.78 s	0.82 s
30	*α* 1.27 dt(4.5, 12.8) *β* 2.65 dt(12.9, 4.1)	3.29 d(2.5)	3.31 d(2.7)	5.37 d(6.3)
2′		2.59 m	2.59 m	2.44 m
3′		1.78 m, 1.55 m	1.78 m, 1.54 m	1.66 m, 1.44 m
4′		1.24 d(7.0)	1.24 d(7.1)	1.143 d(5.6) 1.136 d(7.0)
5′		0.94 t(7.0)	0.96 t(7.4)	0.92 t(7.5) 0.86 t(7.4)
OH	3.53 s			
OMe		3.72 s	3.72 s	3.71 s
OAc	3.57 s(1-OAc) 2.80 s(7-OAc)			

Table 11-12-16: ^{1}H NMR spectroscopic data of limonoids **11-12-48**~**11-12-50**.

H	11-12-48	11-12-49	11-12-50
2	3.72 m	3.17 ddd(9.8, 6.1, 2.0)	3.16 ddd(9.8, 6.1, 2.0)
3	4.90 d(9.2)	4.95 d(10.1)	4.97 d(10.0)
5	3.33 dd(9.9, 2.2)	3.23 dd(9.3, 3.3)	3.24 dd(9.3, 3.6)
6	2.37 m	2.35 m	2.37 m
9	2.25 m	2.04 br s	2.05 br s
11	*α* 1.75 m, *β* 1.49 m	1.79 m	1.79 m
12	*α* 1.27 m, *β* 1.95 m	*α* 1.09 m, *β* 1.75 m	*α* 1.10 m, *β* 1.75 m
15	6.16 s	*α* 3.45 dt(20.9, 2.9) *β* 3.74 d(21.1)	*α* 3.44 dt(20.6, 2.7) *β* 3.77 d(20.7)
17	5.15 s	5.64 s	5.67 s
18	1.03 s	1.05 s	1.06 s
19	1.20 s	1.14 s	1.15 s
21	7.50 dd(0.8, 0.7)	7.54 d(0.7)	7.55 d(0.7)
22	6.48 dd(1.8, 0.7)	6.47 d(1.2)	6.47 d(1.2)
23	7.43 dd(1.6, 1.7)	7.40 dd(1.8, 1.5)	7.41 dd(1.7, 1.7)
28	0.82 s	0.81 s	0.81 s
29	0.79 s	0.72 s	0.72 s

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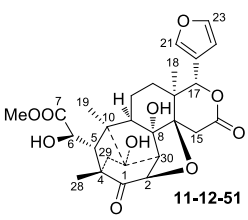
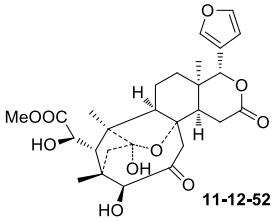
Table 11-12-16 (continued)

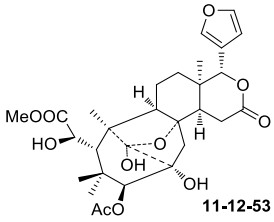
H	11-12-48	11-12-49	11-12-50
30	6.25 dd(6.0, 2.8)	*α* 2.12 dd(16.1, 5.4) *β* 2.77 dd(14.9, 1.9)	*α* 2.13 br d(15.2) *β* 2.78 dd(15.5, 1.9)
2′		2.46 m	2.43 m
3′	7.00 q(7.0, 1.4)	1.70 m, 1.51 m	1.71 m, 1.50 m
4′	1.92 t(1.2)	1.23 d(6.9)	1.19 d(7.3)
5′	1.90 dd(6.9, 1.2)	0.90 t(7.4)	1.00 t(7.3)
OMe	3.69 s	3.70 s	3.70 s

Table 11-12-17: Compounds, MFs, and test solvents of limonoids **11-12-51**~**11-12-71**.

No.	Compounds	MFs	Test solvents	References
11-12-51	deacetylkhayanolide E	$C_{27}H_{32}O_{10}$	C_5D_5N	[154]
11-12-52	6*S*-hydroxykhayalactone	$C_{27}H_{34}O_{10}$	C_5D_5N	[154]
11-12-53	grandifolide A	$C_{29}H_{38}O_{11}$	C_5D_5N	[154]
11-12-54	khayanolide A	$C_{27}H_{32}O_{10}$	C_5D_5N	[154]
11-12-55	anthothecanolide	$C_{26}H_{34}O_{10}$	CD_3OD	[154]
11-12-56	3-*O*-acetylanthothecanolide	$C_{28}H_{36}O_{11}$	C_5D_5N	[154]
11-12-57	xylocarpin F	$C_{31}H_{38}O_{11}$	$CDCl_3$	[152]
11-12-58	xylocarpin G	$C_{34}H_{42}O_{11}$	$CDCl_3$	[152]
11-12-59	6-*O*-acetylswietephragmin E	$C_{39}H_{48}O_{14}$	$CDCl_3$	[155]
11-12-60	12*α*-acetoxyswietephragmin C	$C_{39}H_{48}O_{14}$	$CDCl_3$	[155]
11-12-61	3*β*-*O*-destigloyl-3*β*-*O*-benzoyl-6-*O*-acetylswietephragmin E	$C_{41}H_{46}O_{14}$	$CDCl_3$	[155]
11-12-62	3*β*-*O*-destigloyl-3*β*-*O*-benzoyl-12*α*-acetoxyswietephragmin C	$C_{41}H_{46}O_{14}$	$CDCl_3$	[155]
11-12-63	12*α*-acetoxyswietephragmin D	$C_{38}H_{46}O_{14}$	$CDCl_3$	[155]
11-12-64	3*β*-*O*-destigloyl-3*β*-*O*-benzoyl-12*α*-acetoxyswietephragmin D	$C_{40}H_{44}O_{14}$	$CDCl_3$	[155]
11-12-65	xyloccensin Q	$C_{35}H_{40}O_{16}$	CD_3COCD_3	[156]
11-12-66	xyloccensin R	$C_{33}H_{38}O_{15}$	CD_3COCD_3	[156]
11-12-67	xyloccensin S	$C_{35}H_{40}O_{16}$	CD_3COCD_3	[156]
11-12-68	xyloccensin T	$C_{33}H_{38}O_{14}$	CD_3COCD_3	[156]
11-12-69	xyloccensin U	$C_{33}H_{38}O_{14}$	CD_3COCD_3	[156]
11-12-70	xyloccensin V	$C_{35}H_{40}O_{15}$	CD_3COCD_3	[156]
11-12-71	xylocarpin I	$C_{37}H_{44}O_{16}$	$CDCl_3$	[152]







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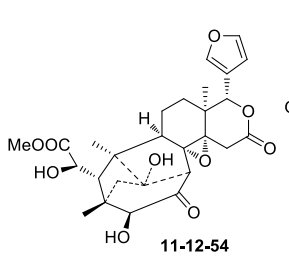

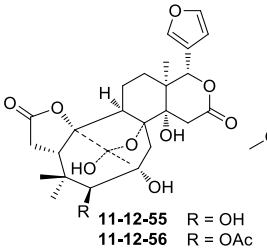

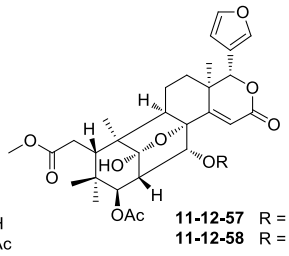

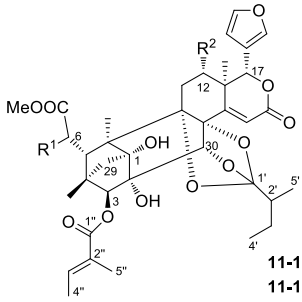

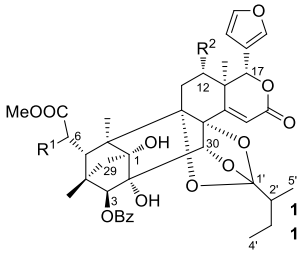

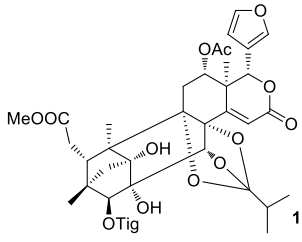

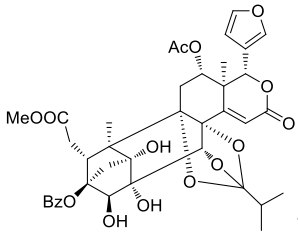

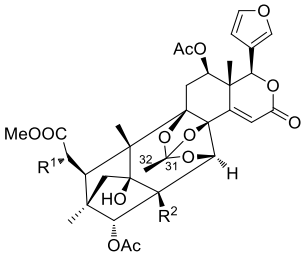

	R1	R2
11-12-65	OAc	OH
11-12-66	OH	OH
11-12-67	OH	OAc
11-12-68	OH	H
11-12-69	H	OH
11-12-70	H	OAc

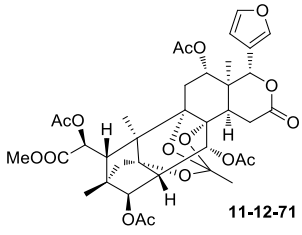

Table 11-12-18: ^{1}H NMR spectroscopic data of limonoids **11-12-51**~**11-12-54**.

H	11-12-51	11-12-52	11-12-53	11-12-54
2	4.83 d(10.4)			
3		4.01 s	5.74 s	4.25 s
5	4.09 br s	4.22 d(1.6)	3.32 d(7.9)	2.61 d(6.5)
6	4.90 br s	4.92 br s	4.93 d(7.9)	4.86 d(6.5)

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Table 11-12-18 (continued)

H	11-12-51	11-12-52	11-12-53	11-12-54
9	3.07 d(8.7)	2.44 (ov)	2.78 m	2.49 dd(13.2, 5.6)
11	2.16 (ov), 1.92 (ov)	2.15 m, 2.04 m	2.32 m, 2.02 m	1.52 (ov), 1.33 m
12	2.22 (ov)	1.35 m	1.87 (ov)	1.60 m
	1.08 br d(11.2)	1.10 dd(14.3, 8.7)	1.37 m	1.47 (ov)
14		1.89	2.42 (ov)	
15	3.83 d(18.6)	3.60 dd(15.0, 13.0)	3.48 d(19.1)	3.52 d(18.2)
	3.36 d(18.6)	3.00 dd(15.0, 6.0)	3.02 dd(19.1, 8.0)	3.15 d(18.2)
17	5.85 s	5.37 s	6.10 s	5.87 s
18	1.39 s	0.87 s	1.02 s	1.18 s
19	1.94 s	1.92 s	2.11 s	1.94 s
21	7.65 (ov)	7.65 br s	7.53 br s	7.35 br s
22	6.55 br s	6.51 d(1.2)	6.49 d(1.0)	6.45 d(1.2)
23	7.64 (ov)	7.63 t(1.6)	7.61 t(1.5)	7.61 t(1.7)
28	1.72 s	1.89 s	1.23 s	1.66 s
29	2.67 d(12.2)	2.60 d(13.7)	1.83 s	2.79 d(12.1)
	2.17 d(12.2)	2.46 d(13.7)		2.40 d(12.1)
30	3.49 d(10.4)	4.03 d(12.6), 2.78 d(12.6)	3.60 d(14.1), 2.41 (ov)	3.41 s
OMe	3.73 s	3.92 s	3.83 s	3.67 s
OH	6.99 br s(1-OH)	8.05(1-OH)		
	7.57 (ov, 6-OH)	8.04(3-OH)		
	7.36 br s(8-OH)	7.23 br s(6-OH)		
OAc			1.74 s	

Table 11-12-19: ^{1}H NMR spectroscopic data of limonoids **11-12-55**~**11-12-58**.

H	11-12-55	11-12-56	11-12-57	11-12-58
2	3.60 s	5.73 s	2.95 dd(4.4, 9.1)	3.01 dd(4.5, 9.1)
3			5.03 d(9.1)	5.04 d(9.1)
5	2.26 dd(9.6, 7.7)	2.26 dd(9.0, 7.2)	2.65 d(9.5)	2.68 d(9.8)
6	2.70 dd(15.6, 9.6)	2.92 dd(14.2, 9.0)	2.38 dd(9.6, 16.0)	2.39 dd(9.8, 16.0)
	2.41 dd(15.6, 7.7)	2.74 dd(14.2, 7.2)	2.18 d(16.0)	2.16 d(16.0)
9	2.48 br d(12.0)	3.22 br d(11.4)	2.17 m	2.17 m
11	1.65 m, 1.39 (ov)	2.32 m, 2.00 (ov)	1.80 ddd(11.0, 1.0, 13.5)	1.82 m, 2.38 m
			2.39 m	
12	1.39, 1.69 m	1.97 (ov)	1.43 dd(8.5, 13.5)	1.44 dd(8.5, 13.5)
		1.54 br d(14.7)	2.10 m	2.17 m
15	3.35 d(19.2)	3.80 d(18.7)	6.09 s	6.00 s
	2.73 d(19.2)	3.15 d(18.7)		
17	5.56 s	6.11 s	5.00 s	4.98 s
18	0.98 s	0.75 s	1.24 s	1.22 s
19	4.42 d(11.6)	4.83 d(11.2)	1.08 s	1.09 s
	4.15 d(11.6)	4.59 d(11.2)		
21	7.62 br s	7.66 br s	7.51 br s	7.51 br s
22	6.48 d(1.2)	6.54 dd(1.7, 0.6)	6.43 br s	6.44 br s
23	7.52 t(1.8)	7.60 t(1.8)	7.44 br s	7.43 br s

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Table 11-12-19 (continued)

H	11-12-55	11-12-56	11-12-57	11-12-58
28	0.94 s	1.18 s	0.82 s	0.83 s
29	1.29 s	1.64 s	1.26 s	1.26 s
30	2.93 d(13.9) 1.50 dd(13.9, 1.5)	3.59 d(13.8) 2.40 dd(13.8, 1.4)	5.61 d(4.4)	5.68 d(4.5)
3′				6.88 qq(1.4, 7.0)
4′				1.85 d(7.0)
5′				1.81 d(1.4)
OMe			3.72 s	3.72 s
OAc		1.74 s	2.01 s(3-OAc) 2.04 s(30-OAc)	1.94 s(3-OAc)
OH		7.23 br s(1-OH) 10.08 br s(2-OH) 7.08 s(14-OH)		

Table 11-12-20: ^{1}H NMR spectroscopic data of limonoids **11-12-59**~**11-12-63**.

H	11-12-59	11-12-60	11-12-61	11-12-62	11-12-63
3	4.78 s	4.83 s	5.00 s	5.03 s	4.83 s
5	2.81 br s	2.41 br s	2.97 br s	2.58 d(12)	2.42 d(12.2)
6	5.48 br s	3.19 d 2.36 d(15.8)	5.55 s	3.25 d(16.5) 2.41 dd(16.5, 12)	3.19 d(15.6) 2.37 m
11		2.21 m 1.90 m	2.17 m		2.18 m
12	1.19 m, 1.68 m	4.79 dd(13.5, 4.0)	1.75 m, 1.21 m	4.79 dd(13.2, 4.2)	4.79 dd(13.2, 3.9)
15	5.94 s	6.01 s	5.75 s	6.02 s	6.02 s
17	5.64 s	5.82 s	5.74 s	5.83 s	5.83 s
18	1.31 s	1.51 s	1.24 s	1.51 s	1.51 s
19	1.27 s	1.31 s	1.31 s	1.31 s	1.31 s
21	7.50 br s	7.46 d(1.0)	7.52 br s	7.52 br s	7.41 t(1.7)
22	6.45 d(1.0)	6.55 d(1.1)	6.43 d(1.1)	6.42 br s	6.55 d(1.2)
23	7.43 t(1.5)	7.41 t(1.7)	7.44 m	7.44 m	7.46 br s
28	0.98 s	0.82 s	1.07 s	0.82 s	0.82 s
29	2.08 d(10.8) 1.79 m	2.43 d 1.78 d(11.3)	2.16 d 1.89 d(11.1)	1.89 m	1.85 m
30	4.47 s	4.48 s	4.52 s	4.52 s	4.49 s
2′	1.92 m	1.92 m	1.88 m	1.92 m	2.19 m
3′	1.70 m	1.70 m, 1.22 m	1.69 m		1.04 d(6.6)
4′	0.92 t(7.5)	0.93 t(7.5)	0.91 t(7.4)	0.93 t(7.8)	1.04 d(6.6)
5′	1.01 d(6.6)	1.02 d(6.9)	1.01 d(6.8)	1.01 d(6.9)	
2″			7.99 dd(7.5, 1.8)	8.08 dd(8.5, 1.5)	
3″	6.76 dq(7.2, 1.1)	6.93 qq(7.0, 1.4)	7.44 m	7.45 m	6.94 qq(7.0, 1.5)
4″	1.73 dd(7.2, 1.1)	1.72 dd(7.0, 1.1)	7.59 t(7.5)	7.45 m	1.73 dd(7.0, 1.1)
5″	1.83 t(1.1)	1.84 dd(1.4, 1.1)	7.44 m	7.45 m	1.84 br s
6″			7.99 dd(7.5, 1.8)	8.08 dd(8.5, 1.5)	

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Table 11-12-20 (continued)

H	11-12-59	11-12-60	11-12-61	11-12-62	11-12-63
1-OH	3.51 s	3.40 s	3.56 s	3.72 s	3.41 s
2-OH	3.54 s	3.56 s	3.62 s	3.44 s	3.58 s
OMe	3.75 s	3.74 s	3.82 s	3.79 s	3.74 s
OAc	2.22 s	1.53 s	2.25 s	1.52 s	1.53 s

Table 11-12-21: ^{1}H NMR spectroscopic data of limonoids **11-12-64**~**11-12-67**.

H	11-12-64	11-12-65	11-12-66	11-12-67
3	5.04 s	4.80 s	4.77 s	5.14 s
5	2.58 d(12)	2.53 br s	2.38 br s	2.33 br s
6	3.26 d(16.7)	6.24 br s	4.95 dd(4.0, 1.0)	5.19 d(4.0)
	2.41 dd(16.7, 12)			
11	2.23 dd(13.4, 4.0)	α 2.03 (ov)	α 2.04 (ov)	α 2.01 (ov)
	1.90 m	β 2.33 dd(14.0, 4.5)	β 2.36 dd(14.0, 4.5)	β 2.39 dd(14.0, 4.5)
12	4.84 dd(13.4, 4.0)	4.99 dd(14.0, 4.5)	4.89 dd(14.0, 4.5)	4.92 dd(14.0, 4.5)
15	5.83 s	6.89 s	6.86 s	6.53 s
17	5.91 s	5.90 s	5.94 s	5.93 s
18	1.43 s	1.59 s	1.59 s	1.59 s
19	1.35 s	1.28 s	1.53 s	1.53 s
21	7.49 br s	7.54 br s	7.50 br s	7.51 br s
22	6.50 d(1.3)	6.65 dd(2.0, 1.0)	6.63 dd(2.0, 1.0)	6.63 dd(2.0, 1.0)
23	7.40 t(1.6)	7.62 br s	7.61 br s	7.61 br s
28	0.92 s	0.92 s	0.92 s	0.91 s
29	1.93, 1.85 d(10.1)	2.16 d(11.0)	2.28 d(10.0)	2.37 d(11.0)
		1.71 dd(11.0, 1.0)	1.62 dd(10.0, 1.5)	1.69 dd(11.0, 1.0)
30	4.54 s	5.11 s	5.07 s	5.38 s
32		1.70 s	1.69 s	1.71 s
2′	2.18 m			
3′	1.04 d(6.8)			
4′	1.04 d(6.8)			
5′				
2″	8.08 dd(8.5, 1.3)			
3″	7.44 t(7.9)			
4″	7.57 t(7.9)			
5″	7.44 t(7.9)			
6″	8.08 dd(8.5, 1.3)			
OH	3. 44 s(1-OH)	3.49 s(1-OH)	3.48 s(1-OH)	3.35 s(1-OH)
	3.58 s(2-OH)	3.87 s(2-OH)	3.82 s(2-OH)	5.00 d(4.5, 6-OH)
			5.22 d(4.5, 6-OH)	
OMe	3.80 s	3.81 s(7-OMe)	3.82 s(7-OMe)	3.81 s(7-OMe)
OAc	1.53 s	1.99 s(3-OAc)	1.98 s(3-OAc)	2.08 s(2-OAc)
		2.22 s(6-OAc)	1.52 s(12-OAc)	1.98 s(3-OAc)
		1.52 s(12-OAc)		1.52 s(12-OAc)

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Table 11-12-22: ^{1}H NMR spectroscopic data of limonoids **11-12-68**~**11-12-71**.

H	11-12-68	11-12-69	11-12-70	11-12-71
2	3.09 dd(12.0, 4.0)			2.80 dd(4.5, 10.2)
3	5.27 d(12.0)	4.80 s	5.23 s	4.78 d(10.2)
5	2.48 br s	2.22 d(10.5)	2.22 d(10.5)	3.22 br s
6	4.88 dd(4.0, 1.0)	*α* 3.18 dd(17.0, 1.0)	*α* 3.15 dd(17.0, 1.0)	6.08 br s
		β 2.52 dd(17.0, 10.5)	*β* 2.53 dd(17.0, 10.5)	
11	*α* 2.01 (ov)	*α* 2.04 (ov)	*α* 2.04 (ov)	2.41 dd(1.0, 13.5)
	β 2.39 dd(14.0, 4.5)	*β* 2.33 dd(14.0, 4.5)	*β* 2.33 dd(14.0, 4.5)	1.82 dd(13.5, 14.0)
12	*α* 4.92 dd(14.0, 4.5)	*α* 4.83 dd(14.0, 4.5)	*α* 4.83 dd(14.0, 4.5)	4.64 dd(1.0, 14.0)
14				2.30 d(10.5)
15	6.65 s	6.89 s	6.57 s	3.35 d(19.5)
				2.80 dd(10.5, 19.5)
17	5.96 s	5.95 s	5.93 s	5.69 s
18	1.59 s	1.58 s	1.59 s	1.23 s
19	1.47 s	1.30 s	1.31 s	1.18 s
21	7.50 br s	7.48 br s	7.50 br s	7.48 br s
22	6.63 dd(2.0, 1.0)	6.63 dd(2.0, 1.0)	6.64 dd(2.0, 1.0)	6.45 br s
23	7.61 br s	7.60 br s	761 br s	7.41 br s
28	0.93 s	0.73 s	0.72 s	1.14 s
29	2.35 d(10.5)	2.18 d(11.5)	2.18 d(11.5)	2.12 d(10.8)
	1.38 dd(10.5, 1.5)	1.75 dd(11.5, 1.5)	1.75 dd(11.5, 1.5)	2.52 d(10.8)
30	4.95 d(4.0)	5.15 s	5.39 s	6.02 d(4.5)
32	1.67 s	1.69 s	1.70 s	1.66 s
OH	3.43 s(1-OH)	3.48 s(1-OH)	3.36 s(1-OH)	
	5.23 d(4.5, 6-OH)	3.85 s(2-OH)		
OMe	3.80 s(7- OMe)	3.75 s(7- OMe)	3.74 s(7- OMe)	3.86 s
OAc	1.95 s(3-OAc)	2.01 s(3-OAc)	2.08 s(2-OAc)	2.18 s(3-OAc)
	1.52 s(12-OAc)	1.52 s(12-OAc)	2.00 s(3-OAc)	2.05 s(6-OAc)
			1.52 s(12-OAc)	1.65 s(12-OAc)
				2.21 s(30-OAc)

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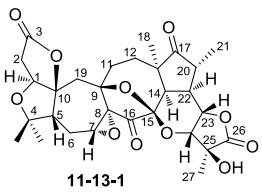
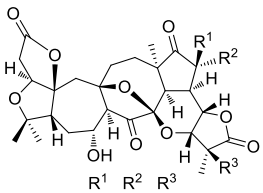
11.13 Some other triterpenoids

Table 11-13-1: Compounds, MFs, and test solvents of triterpenoids **11-13-1**~**11-13-25**.

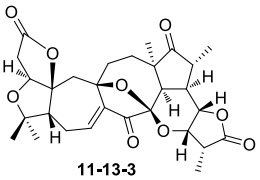
No.	Compounds	MFs	Test solvents	References
11-13-1	lancifodilactone B	$C_{29}H_{34}O_{11}$	C_5D_5N	[157]
11-13-2	ancifodilactone C	$C_{29}H_{36}O_{10}$	C_5D_5N	[157]
11-13-3	lancifodilactone D	$C_{29}H_{34}O_9$	C_5D_5N	[157]
11-13-4	lancifodilactone E	$C_{29}H_{36}O_{11}$	C_5D_5N	[157]
11-13-5	kadcoccilactone A	$C_{30}H_{44}O_7$	C_5D_5N	[158]
11-13-6	kadcoccilactone B	$C_{29}H_{42}O_7$	C_5D_5N	[158]
11-13-7	kadcoccilactone C	$C_{30}H_{44}O_7$	C_5D_5N	[158]
11-13-8	kadcoccilactone D	$C_{30}H_{40}O_7$	C_5D_5N	[158]
11-13-9	kadcoccilactone E	$C_{29}H_{40}O_7$	C_5D_5N	[158]
11-13-10	kadcoccilactone F	$C_{31}H_{44}O_{10}$	C_5D_5N	[158]
11-13-11	kadcoccilactone G	$C_{30}H_{42}O_8$	C_5D_5N	[158]
11-13-12	kadcoccilactone H	$C_{31}H_{44}O_{10}$	C_5D_5N	[158]
11-13-13	kadcoccilactone I	$C_{31}H_{44}O_{10}$	C_5D_5N	[158]
11-13-14	kadcoccilactone J	$C_{28}H_{36}O_{10}$	C_5D_5N	[158]
11-13-15	alisolide	$C_{26}H_{36}O_4$	$CDCl_3$	[159]
11-13-16	alisol O	$C_{30}H_{48}O_5$	$CDCl_3$	[159]
11-13-17	alisol P	$C_{30}H_{48}O_7$	$CDCl_3$	[159]
11-13-18	notohamosin A	$C_{29}H_{46}O_5$	C_5D_5N	[160]
11-13-19	notohamosin B	$C_{29}H_{46}O_4$	C_5D_5N	[160]
11-13-20	kairatenyl palmitate	$C_{46}H_{80}O_2$	$CDCl_3$	[161]
11-13-21	trichomycin A	$C_{31}H_{48}O_5$	CD_3OD	[162]
11-13-22	iritectol A	$C_{30}H_{50}O_5$	$CDCl_3$	[163]
11-13-23	iritectol B	$C_{30}H_{50}O_5$	$CDCl_3$	[163]
11-13-24	iridobelamal A	$C_{30}H_{50}O_4$	$CDCl_3$	[163]
11-13-25	isoiridogermanal	$C_{30}H_{50}O_4$	$CDCl_3$	[163]



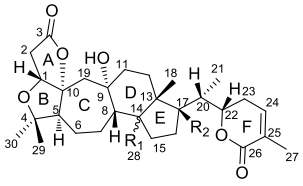
11-13-1



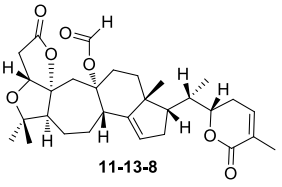
	R^1	R^2	R^3
11-13-2	H	Me	H
11-13-4	Me	H	OH



11-13-3



	R^1	R^2
11-13-5	α-Me	OH
11-13-6	β-OH	H
11-13-7	α-CH_2OH	H



11-13-8

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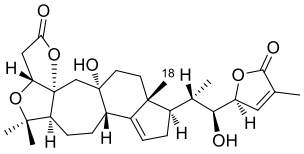
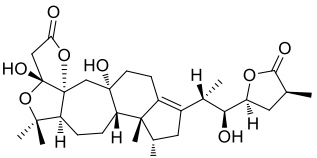
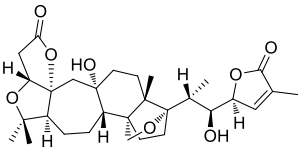


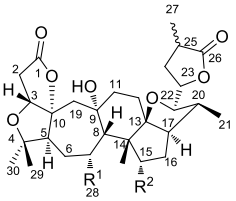
11-13-9



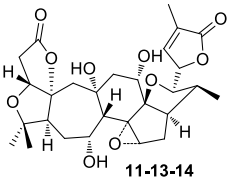
11-13-10



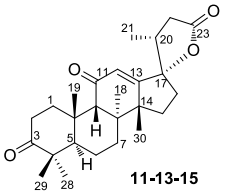
11-13-11



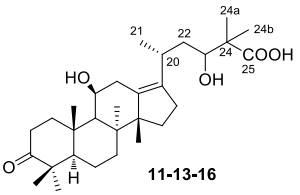
	R^1	R^2
11-13-12	OAc	OH
11-13-13	OH	OAc



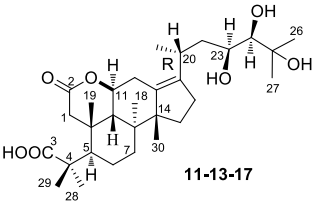
11-13-14



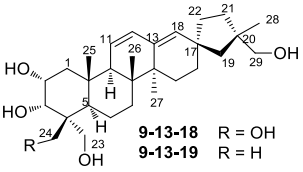
11-13-15



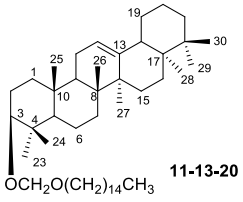
11-13-16



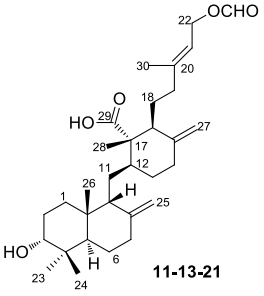
11-13-17



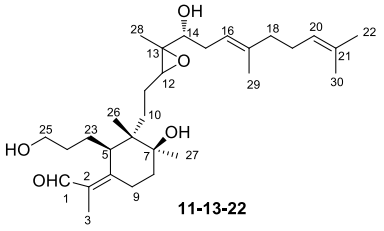
9-13-18 R = OH
9-13-19 R = H



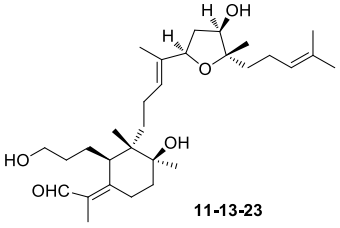
11-13-20



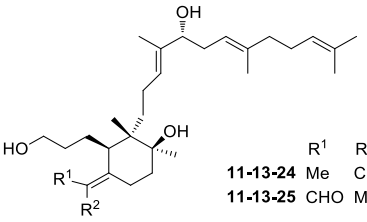
11-13-21



11-13-22



11-13-23



	R^1	R^2
11-13-24	Me	CHO
11-13-25	CHO	Me

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Table 11-13-2: ^{1}H NMR spectroscopic data of triterpenoids **11-13-1**~**11-13-4**.

H	11-13-1	11-13-2	11-13-3	11-13-4
1	4.22 d(6.0)	4.23 d(6.3)	4.24 d(6.5)	4.25 d(6.1)
2*α*	2.77 d(18.4)	2.73 d(18.6)	2.78 d(18.6)	2.76 d(18.7)
2*β*	3.15 dd(6.0, 18.4)	3.04 dd(6.3, 18.6)	3.14 dd(6.5,18.6)	3.05 dd(6.1, 18.7)
5	2.42 dd(2.8, 14.6)	2.45 dd(4.6, 13.4)	2.16	2.50 dd(4.4, 13.3)
6*α*	1.42 m	2.05 m	2.14 m	2.10 m
6*β*	2.22 m	2.17 m	2.14 m	2.23 m
7	3.92 dd(6.0, 7.3)	4.49 dd(9.3, 9.6)	7.03 m	4.56 dd(9.2, 9.6) 5.11 (ov, OH)
8		2.87 d(9.6)		2.87 d(9.6)
11*α*	1.92 m	1.66 m	1.65 m	1.55 m
11*β*	1.92 m	1.92 m	2.03 m	2.15(ov)
12*α*	1.68 m	1.56 m	1.41 m	1.64 m
12*β*	1.99 m	1.82 m	1.85 m	1.79 m
14	2.72 d(7.3)	2.79(ov)	2.71 d(5.8)	2.85 d(8.2)
18	0.93 s	0.91 s	0.93 s	0.96 s
19*α*	2.29 ABd(16.1)	2.39 ABd(15.8)	2.33 ABd(15.8)	2.45 ABd(16.0)
19*β*	2.17 ABd(16.1)	2.27 ABd(15.8)	2.24 ABd(15.8)	2.17 ABd(16.0)
20	2.52 m	2.62 m	2.52 m	2.81 m
21	1.13 d(7.0)	1.10 d(7.0)	1.23 d(6.8)	1.48 d(7.8)
22	2.91 dd(7.3, 13.3)	2.80 m	2.83 dd(5.8, 10.3)	3.46 dd(8.2, 11.6)
23	5.24 br s	4.63 br s	4.49 br s	5.40 br s
24	4.94 d(1.5)	5.25 dd(1.5, 2.0)	4.69 dd(1.8, 2.0)	4.98 d(1.4)
25		3.19 m	3.08 m	8.79 s(OH)
27	2.12 s	1.21 d(7.3)	1.60 d(7.0)	1.60 s
29	1.23 s	1.23 s	1.22 s	1.22 s
30	0.96 s	1.05 s	1.01 s	1.06 s

Table 11-13-3: ^{1}H NMR spectroscopic data of triterpenoids **11-13-5**~**11-13-9**.

H	11-13-5	11-13-6	11-13-7	11-13-8	11-13-9
1	4.25 d(4.4)	4.24 d(4.8)	4.31 d(4.4)	4.20 d(5.0)	4.26 d(4.4)
2*α*	2.73 d(17.8)	2.75 d(17.9)	2.76 d(17.6)	2.70 d(18.0)	2.74 d(17.6)
2*β*	2.94 dd(17.8, 4.4)	2.98.dd(17.9, 4.9)	3.01.dd(17.6, 4.4)	2.93 dd(18.0, 5.1)	2.98.dd(17.6, 4.9)
5	2.55 dd(13.5, 4.0)	2.55 dd(13.4, 4.2)	2.55 dd(13.6, 4.0)	2.31 dd(13.4, 4.5)	2.51 dd(13.2, 3.9)
6*α*	1.60~1.62 m	1.72~1.76 (ov)	1.64~1.69 (ov)	1.61~1.65 m	1.63~1.66 (ov)
6*β*	1.29~1.33 (ov)	1.25~1.28 (ov)	1.33~1.38 (ov)	1.29~1.33 m	1.34~1.37 m
7*α*	1.98~2.03 (ov)	2.59~2.62 m	2.07~2.10 (ov)	1.78~1.80 m	1.98~2.03 (ov)
7*β*	1.51~1.54 m	1.91~1.94 m	1.55~1.60 m	1.94~1.96 m	1.98~2.03 (ov)
8	1.75~1.80 (ov)	1.72~1.76 (ov)	1.78~1.83 (ov)	2.10~2.13 (ov)	2.12~2.13 m
11*α*	1.75~1.80 (ov)	1.48~1.50 m	1.33~1.38 (ov)	2.77 dt(14.4, 3.0)	1.63~1.66 (ov)

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Table 11-13-3 (continued)

H	11-13-5	11-13-6	11-13-7	11-13-8	11-13-9
11*β*	1.93~1.95 m	1.77~1.80 m	1.85~1.88 (ov)	1.75~1.78 m	1.92~1.96 m
12*α*	2.59~2.63 (ov)	2.17 dd(13.7, 3.0)	2.91~2.95 m	1.47 dd(14.0, 3.8)	2.33~2.36 (ov)
12*β*	1.66 dd(12.3,4)	1.42~1.45 m	1.10~1.12 m	1.56~1.60 m	2.18~2.22 m
15*α*	1.57~1.60 m	1.95~1.98 m	1.46~1.50 m		
15*β*	1.31~1.33 (ov)	1.62~1.68 m	1.33~1.38 (ov)	5.33 br s	5.39 br s
16	2.59~2.63 (ov)	2.64~2.69 m	1.81~1.86 (ov)	2.14~2.16 (ov)	2.24~2.27 m
16	1.89~1.91 m	1.84~1.87 m	1.33~1.38 (ov)	1.97~1.99 m	1.84~1.90 m
17		1.50~1.53 m	1.92~1.96 (ov)	1.50~1.54 m	2.07~2.12 (ov)
18	1.34 s	1.36 s	0.87 s	0.91 s	1.05 s
19*α*	1.98 ABd(5.2)	2.00 ABd(6.1)	2.12 ABd(9.6)	2.97 ABd(15.7)	2.06~2.09 (ov)
19*β*	2.00 ABd(5.2)	2.02 ABd(6.1)	2.14 ABd(9.6)	2.06 ABd(15.7)	2.06~2.09 (ov)
20	2.89~2.91 m	2.34~2.38 m	2.04~2.07 m	2.10~2.13 (ov)	2.33~2.36 (ov)
21	1.24 d(7.2)	1.08 d(6.5)	0.99 d(6.8)	0.91 d(6.4)	1.38 d(6.8)
22	5.16 dd(12.7, 2.8)	4.74 dt(12.9, 3.6)	4.46 dt(12.7, 3.2)	4.36 dt(13.2, 3.4)	4.04 br s
23*α*	2.45~2.51 m	2.22~2.26 m	2.07~2.10 (ov)	2.14~2.16 (ov)	5.06 br s
23*β*	2.77~2.81 m	2.03~2.07 m	1.92~1.96 (ov)	1.81~1.84 m	
24	6.44 d(6.4)	6.46 d(6.4)	6.42 d(6.4)	6.40 d(6.4)	7.19 br s
27	1.87 s	1.89 s	1.92 s	1.90 s	1.82 s
28	1.28 s		3.88 s		
29	1.12 s	1.06 s	1.14 s	1.06 s	1.12 s
30	1.29 s	1.26 s	1.29 s	1.24 s	1.28 s
OH	4.78 s(9-OH) 5.44 s(17-OH)	4.65 s(9-OH) 5.00 s(14-OH)	6.33 s(9-OH) 6.55 br s(28-OH)		4.65 s(9-OH) 6.63 d(6.9, 22-OH)
CHO				8.37 s	

Table 11-13-4: ^{1}H NMR spectroscopic data of triterpenoids **11-13-10**~**11-13-14**.

H	11-13-10	11-13-11	11-13-12	11-13-13	11-13-14
1		4.30 d(4.3)	4.35 d(4.8)	4.37 d(4.1)	4.22-4.24
2*α*	3.10 s	2.74 d(17.7)	2.80 d(18.0)	2.75 d(17.6)	2.75 d(18.0)
2*β*	3.10 s	2.95 dd(17.7, 4.4)	3.06 dd(18.0, 5.0)	3.00 d(17.6, 4.2)	3.03 dd(18.0, 5.6)
5	2.54 dd(9.6, 3.4)	2.61 dd(13.4, 3.4)	2.90 dd(13.7, 3.8)	2.95 dd(11.2, 2.4)	3.16 dd(13.2, 4.7)
6*α*	1.74~1.76 m	1.64~1.67 (ov)	2.36~2.41 m	1.97~1.99 m	1.98~1.99 m
6*β*	1.45~1.48 m	1.64~1.67 (ov)	1.70~1.73 m	1.66~1.70 (ov)	1.45 t(13.9)
7*α*	1.77~1.80 m	1.60~1.64 (ov)			
7*β*	1.81~1.84 (ov)	1.60~1.64 (ov)	5.95 d(7.8)	4.45 br d(8.8)	4.38 br d(6.0)
8	1.69~1.72 m	1.38~1.40 (ov)	1.98~2.00 m	1.82 d(10.4)	2.61~2.63
11*α*	1.72~1.74 m	1.71~1.74 m	1.76~1.79 (ov)	2.17~2.12 m	2.14~2.18 (ov)

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Table 11-13-4 (continued)

H	11-13-10	11-13-11	11-13-12	11-13-13	11-13-14
11*β*	1.81~1.84 (ov)	1.71~1.74 m	1.54~1.56 m	1.94~1.97 m	2.20~2.23 (ov)
12*α*	2.42~2.45 m	2.49~2.51 m	2.56~2.62 m	1.70~1.76 m	
12*β*	1.89~1.92 m	1.37~1.39 (ov)	1.90~1.93 m	1.34~1.37 m	4.22~4.24 (ov)
15*α*		1.19~1.22 m			
15*β*	5.18 d(4.0)	1.19~1.22 m	3.98 br s	6.15 d(3.2)	3.75 br s
16*α*	2.49~2.52 (ov)	1.26~1.29 m	1.76~1.79 (ov)	1.88~1.91 m	2.00~2.02 m
16*β*	3.16 br d(17.1)	1.62~1.65 (ov)	1.76~1.79 (ov)	1.63~1.68 m	1.63 dd(14.2, 8.1)
17			2.84~2.86 m	2.45~2.49 m	2.94 dd(14.2, 8.1)
18	1.11 s	0.90 s	1.10 s	1.55 s	
19*α*	2.34 ABd(15.9)	2.00 br s	2.08 ABd(15.6)	1.80 ABd(15.6)	2.18~2.20 (ov)
19*β*	2.49~2.53(ov)	2.00 br s	2.28 ABd(15.6)	2.06 ABd(15.6)	2.18~2.20 (ov)
20	3.01~3.03 m	2.46~2.48 m	2.49~2.54 m	2.50~2.54 m	2.61~2.63 (ov)
21	1.20 d(7.2)	1.39 d(7.2)	0.85 d(7.0)	0.84 d(6.4)	0.87 d(6.8)
22	3.58 dd(7.2,2.8)	4.64 br d(1.8)	3.62 br d(9.8)	3.59 d(9.5)	3.90 dd(10.2, 3.0)
23	4.64 dt(8.6,3.6)	5.76 br d(1.8)	4.42 br d(8.8)	4.45 br d(8.8)	4.99 (ov)
24*α*	2.45~2.48 m	7.34 br s	2.32~2.34 m	2.39~2.43 m	7.19 (ov)
24*β*	1.85~1.88 (ov)		1.93~1.97 m	1.99~2.02 m	
25	2.98~3.01 m		3.02~3.05 m	3.13~3.18 m	
27	1.20 d(7.2)	1.85 s	1.24 d(7.2)	1.24 d(7.2)	1.80 s
28*α*		5.30 dd(7.2, 3.8)			
28*β*		3.49 d(7.2)			
29	1.44 s	1.32 s	1.15 s	1.14 s	1.00 s
30	1.35 s	1.15 s	1.30 s	1.18 s	1.20 s
OH	9.14 br s(1-OH)	5.07 s(9-OH)	6.04 s(9-OH)	4.51 s(9-OH)	5.90 br d(3.2, 7-OH)
	3.75 s(9-OH)	7.04 br d(4.4, 22-OH)	6.03 s(15-OH)		5.71 s(9-OH)
					5.24 d(10.6, 12-OH)
OAc	2.09 s		2.12 s	2.11 s	

Table 11-13-5: ^{1}H NMR spectroscopic data of triterpenoids **11-13-15**~**11-13-17**.

H	11-13-15	11-13-16	11-13-17	H	11-13-15	11-13-16	11-13-17
1	1.92, 2.45	2.09, 2.22	2.56 s	5	2.20 m	2.08	2.67 m
2	2.31, 2.70	2.31, 2.66		6	1.55 m	1.23, 1.42	1.60, 1.75
7	1.40, 2.18	1.23, 2.01	1.40, 1.58	22	2.84 dd(8.0, 17.6) 2.41 dd(7.2, 17.6)	1.18 m, 1.37 m	1.39 m, 1.60 m

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Table 11-13-5 (continued)

H	11-13-15	11-13-16	11-13-17	H	11-13-15	11-13-16	11-13-17
9	2.59 m	1.74 d(10.8)	1.73 d(11.0)	23		3.47 d(10.4)	3.77 dd(3.5, 9.3)
11		3.82 m	4.16 dt(5.2, 11.0)	24			3.00 br s
12	5.82 s	2.78, 2.00	2.05, 3.03	26		1.05 s	1.28 s
15	1.45, 2.13	1.31, 1.85	1.37, 1.83	27		1.08 s	1.22 s
16	2.03, 2.17	2.11	2.22 br s	28	1.10 s	1.05 s	1.22 s
18	1.27 s	0.98 s	1.03 s	29	1.11 s	1.03 s	1.23 s
19	1.07 s	1.01 s	1.15 s	30	1.29 s	1.13 s	1.15 s
20	2.62 m	2.82 m	2.80 m				
21	1.07 d(7.0)	0.97 d(5.6)	1.03 d(7.0)				

Table 11-13-6: ^{1}H NMR spectroscopic data of triterpenoids **11-13-18** and **11-13-19**.

H	11-13-18	11-13-19	H	11-13-18	11-13-19
1	2.27 dd(11.2, 3.6) 1.92 m	2.22 dd(12.0, 4.0) 1.86 t(12.0)	18	5.52 s	5.53 s
2	4.50 br d(11.2)	4.34 br d(12.0)	19	1.97 d(13.2) 1.37 d(13.2)	1.93 d(13.2) 1.35 d(13.2)
3	4.91 s	4.17 s	21	1.97 m, 1.50 m	2.00 m, 1.55 m
5	2.23 br d(12.4)	2.21 br d(11.6)	22	1.68 m, 1.60 m	1.68 m, 1.60 m
6	1.01 m, 0.82 m	1.02 m, 0.82 m	23	4.63 d(10.8) 4.43 d(10.8)	3.91 d(10.8) 3.77 d(10.8)
7	1.35 m, 1.50 m	1.34 m, 1.48 m	24	4.21 d(11.0) 4.09 d(11.0)	0.90 s
9	2.37 s	2.33 s	25	1.13 s	1.13 s
11	5.73 d(10.0)	5.71 d(10.0)	26	0.84 s	0.85 s
12	6.00 d(10.0)	6.00 d(10.0)	27	0.92 s	0.93 s
15	1.66 m, 1.03 m	1.66 m, 1.03 m	28	1.27 s	1.27 s
16	1.58 m, 1.90 m	1.63 m, 1.73 m	29	3.66 d(10.2) 3.60 d(10.2)	3.66 d(10.0) 3.60 d(10.0)

Table 11-13-7: ^{1}H NMR spectroscopic data of triterpenoids **11-13-20** and **11-13-21**.

H	11-13-20	11-13-21	H	11-13-20	11-13-21
1	1.84 m, 1.25 m	2.04 m	13		1.72 m, 1.12 m
2	1.76 m, 1.54 m	1.93 m, 1.56 m	14		2.26 m, 1.94 m
3	4.52 dd(8.6, 7.2)	3.35 br s	15	1.42 m	
5	1.22 m	1.64 m	16	1.38 m	2.37 d(10.8)
6	1.42 m	1.54 m 1.34 ddd(12.4, 5.6, 5.2)	18	1.36 m	1.64 m, 1.18 m
7	1.52 m	2.10 m	19	1.03 m	2.13 m, 1.93 m

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Table 11-13-7 (continued)

H	11-13-20	11-13-21	H	11-13-20	11-13-21
9	1.38 m	1.55 m	20	1.18 m	
11	1.48 m	1.64 m, 1.00 dt(14.2, 8.3)	21	1.34 m	5.30 t(6.8)
12	5.17 ddd(2.4, 2.6, 4.4)	1.90 m	22		4.65 d(6.8)
23	0.86 s	0.92 s	30	0.81 s	1.69 s
24	0.88 s	0.80 s	31		8.07 s
25	0.91 s	4.63 br s	2′	2.28 t(6.6)	
26	0.73 s	0.90 s	3′	1.74 m	
27	1.07 s	4.91 br s, 4.63 br s	4′ ~ 15′	1.28 br s	
28	0.99 s	0.83 s	16′	0.89 t(7.0)	
29	0.93 s				

Table 11-13-8: ^{1}H NMR spectroscopic data of triterpenoids **11-13-22**~**11-13-25**.

H	11-13-22	11-13-23	11-13-24	11-13-25
1	10.15 s	10.16 s	10.24 s	10.18 s
3	1.84 s	1.83 s	1.80 s	1.83 s
5	3.22 br d(10.1)	3.30 br d(11.0)	2.79 br d(9.9)	3.31 br d(11.1)
8	1.72 m, 1.87 m	1.67 m, 1.85 m	1.62~1.71 m, 1.79~1.87 m	1.65 m, 1.87 m
9	2.57 br t(13.6) 2.60 td(13.6, 4.7)	2.54 br t(13.5) 2.59 br td(13.5, 4.6)	3.22 br d(13.9) 2.59 br td(13.9, 2.3)	2.55 br t(13.8, 2.6) 2.60 td(13.8, 4.7)
10	1.29~1.46 m	1.17~1.21 m, 1.28~1.32 m	1.13~1.32 m	1.18 m, 1.32 m
11	1.33~1.49 m	1.82~1.68 m, 1.93~1.98 m	1.90~1.96 m, 1.99~2.10 m	1.86 m, 1.96 m
12	2.75 m	5.32 t(6.9)	5.26 t(6.8)	5.25 t(7)
14	3.26 dd(7.8, 5.7)	4.19 t(7.8)	3.93 dd(7.5, 5.1)	3.92 dd(7.8, 5.1)
15	2.18~2.29 m	2.35 ddd(13.3, 7.8, 5.6) 1.75 m	2.13~2.33 m	2.22 m
16	5.08 m	4.03 t(5.6)	5.07 m	5.07 m
18	2.02 br d(6.3)	1.38~1.53 m	2.02 br d	2.02 m
19	2.07 m	2.04 m	2.07 m	2.07 m
20	5.06 m	5.10 t(7.0)	5.06 m	5.06 m
22	1.68 s	1.68 s	1.68 s	1.68 s
23	1.79 m, 2.03 m	1.78 m, 2.05 m	1.80 m, 2.10 m	1.79 s, 2.03 m
24	1.21~1.28 m	1.23~1.29 m, 1.35~1.39 m	1.33~1.41 m	1.26 m, 1.40 m
25	3.61 t(6.4)	3.61 t(6.4)	3.61 td(6.3, 2.3)	3.61 t(6.4)
26	1.08 s	1.08 s	1.09 s	1.10 s
27	1.18 s	1.15 s	1.16 s	1.16 s
28	1.20 s	1.56 s	1.60 s	1.55 s
29	1.62 s	1.23 s	1.63 s	1.62 s
30	1.60 s	1.61 s	1.60 s	1.60 s

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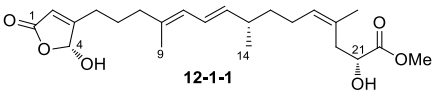
12 Sesterterpenoids, tetraterpenoids, and carotenoids

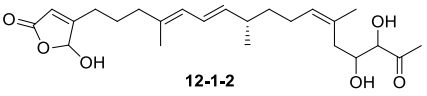
12.1 Sesterterpenoids

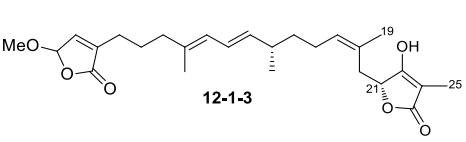
12.1.1 Long-chain-type sesterterpenoids

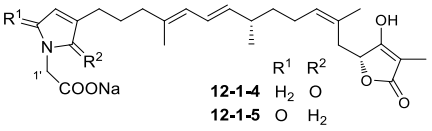
Table 12-1-1: Compounds, MFs, and test solvents of long-chain-type sesterterpenoids **12-1-1**~**12-1-17**.

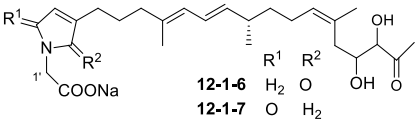
No.	Compounds	MFs	Test solvents	References
12-1-1	sarcotin N	$C_{23}H_{34}O_6$	CD_3OD	[1]
12-1-2	sarcotin O	$C_{24}H_{36}O_6$	CD_3COCD_3	[1]
12-1-3	*epi*-sarcotin F	$C_{26}H_{36}O_6$	CD_3OD	[1]
12-1-4	sarcotrine E	$C_{27}H_{36}NNaO_6$	CD_3OD	[1]
12-1-5	isosarcotrine E	$C_{27}H_{36}NNaO_6$	CD_3OD	[1]
12-1-6	sarcotrine F	$C_{26}H_{38}NNaO_6$	CD_3OD	[1]
12-1-7	isosarcotrine F	$C_{26}H_{38}NNaO_6$	CD_3OD	[1]
12-1-8	hippospongin A	$C_{25}H_{32}O_5$	$CDCl_3$	[2]
12-1-9	hippospongin B	$C_{25}H_{30}O_5$	$CDCl_3$	[2]
12-1-10	hippospongin C	$C_{27}H_{34}N_2O_4$	$CDCl_3$	[2]
12-1-11	hippospongin D	$C_{24}H_{28}O_4$	$CDCl_3$	[2]
12-1-12	hippospongin E	$C_{24}H_{30}N_2O_4$	$CDCl_3$	[2]
12-1-13	hippospongin F	$C_{26}H_{32}N_2O_5$	$CDCl_3$	[2]
12-1-14	muqubilone	$C_{24}H_{40}O_6$	$CDCl_3$	[3]
12-1-15	psammocinin A_1	$C_{25}H_{32}O_4$	CD_3OD	[4]
12-1-16	psammocinin A_2	$C_{25}H_{34}O_4$	CD_3OD	[4]
12-1-17	psammocinin B	$C_{27}H_{40}O_6$	CD_3OD	[4]











https://doi.org/10.1515/9783110634723-012

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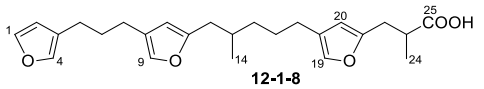
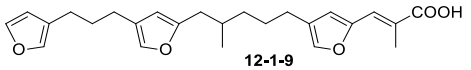
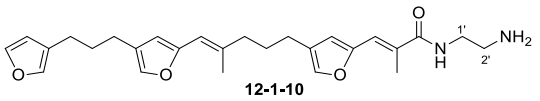


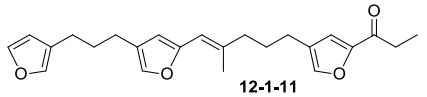
12-1-8



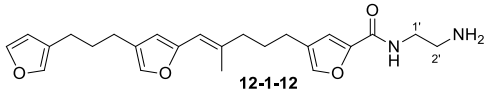
12-1-9



12-1-10



12-1-11



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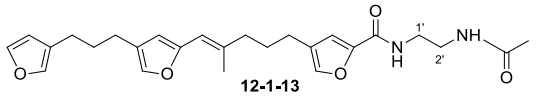

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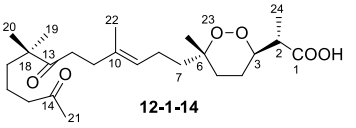
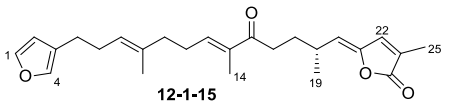


12-1-14



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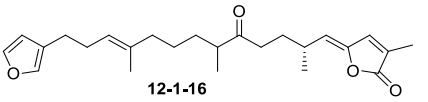
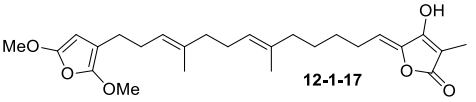


12-1-16



12-1-17

Table 12-1-2: ^{1}H NMR spectroscopic data of long-chain-type sesterterpenoids **12-1-1**~**12-1-5**.

H	12-1-1	12-1-2	12-1-3	12-1-4	12-1-5
1			5.83 br s	4.05 br s	
2	5.90 br s	5.90 br s	6.96 br s	6.83 br s	5.81 br s
4	6.04 br s	6.09 br s			4.12 d(1.5)
5	2.39 t(7.5)	2.40 t(7.5)	2.23 t(7.5)	2.22 t(7.5)	2.38 t(7.5)
6	1.76 m	1.76 m	1.67 m	1.69 m	1.68 m
7	2.13 t(7.0)	2.14 m	2.07 t(7.5)	2.08 t(7.0)	2.06 t(7.0)
9	1.73 s	1.75 s	1.71 s	1.72 s	1.70 s
10	5.81 d(11.0)	5.85 d(11.0)	5.77 d(11.0)	5.79 d(11.0)	5.78 d(11.0)

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Table 12-1-2 (continued)

H	12-1-1	12-1-2	12-1-3	12-1-4	12-1-5
11	6.20 dd(15.0, 11.0)	6.25 dd(15.0, 11.0)	6.18 dd(15.0, 11.0)	6.19 dd(15.0, 11.0)	6.18 dd(15.0, 11.0)
12	5.41 dd(15.0, 7.5)	5.48 dd(15.0, 7.5)	5.40 dd(15.0, 8.5)	5.39 dd(15.0, 8.0)	5.40 dd(15.0, 8.0)
13	2.19 m	2.19 m	2.15 m	2.15 m	2.12 m
14	0.99 d(7.0)	0.99 d(6.5)	0.98 d(7.0)	0.98 d(6.0)	0.98 d(7.0)
15	1.32 m	1.32 m	1.33 m	1.31 m	1.32 m
16	1.97 q(7.0)	2.12 m	1.99 q(7.0)	2.01 q(8.0)	2.00 q(8.0)
17	5.25 t(7.0)	5.26 t(7.0)	5.23 t(7.0)	5.23 t(7.0)	5.23 t(7.0)
19	1.73 s	1.76 s	1.76 s	1.76 s	1.76 s
20	2.43 dd(13.0, 6.0)	2.42 dd(13.0, 6.5)	2.57 dd(14.0, 2.5)	2.60 dd(14.0, 2.0)	2.58 dd(14.0, 2.5)
	2.39 dd(13.0, 8.0)	2.30 dd(13.0, 7.5)	2.25 dd(14.0, 9.5)	2.14 dd(14.0, 10.0)	2.14 dd(14.0, 10.0)
21	4.22 dd(8.0, 6.0)	4.14 t(6.5)	4.34 dd(9.5, 2.5)	4.34 dd(10.0, 2.0)	4.34 dd(10.0, 2.5)
22		4.00 br s			
23		2.21 s			
25			1.54 s	1.54 s	1.54 s
$1'$				4.01 s	3.97 s
1-OMe			3.51 s		
21-OAc	3.64 s				

Table 12-1-3: ^{1}H NMR spectroscopic data of long-chain-type sesterterpenoids **12-1-6**~**12-1-10**.

H	12-1-6	12-1-7	12-1-8	12-1-9	12-1-10
1	4.04 br s		7.34 s	7.35 s	7.35 s
2	6.83 br s	5.83 br s	6.27 s	6.27 s	6.26 s
4		4.11 d(1.5)	7.21 s	7.21 s	7.21 s
5	2.22 t(7.5)	2.38 t(7.5)	2.40 m	2.42 m	2.42 m
6	1.68 m	1.68 m	1.79 m	1.80 m	1.80 m
7	2.09 t(7.0)	2.06 t(7.0)	2.40 m	2.42 m	2.42 m
9	1.72 s	1.72 s	7.07 s	7.07 s	7.12 s
10	5.79 d(11.0)	5.79 d(11.0)	5.86 s	5.86 s	6.08 s
11	6.19 dd(15.0, 11.0)	6.19 dd(15.0, 11.0)			
12	5.41 dd(15.0, 8.0)	5.41 dd(15.0, 8.0)	2.54 dd(5.9, 14.8)	2.54 dd(6.1, 14.8)	6.02 s
			2.32 m	2.42 m	
13	2.16 m	2.16 m	1.79 m	1.80 m	–
14	0.99 d(7.0)	0.99 d(7.0)	0.88 d(6.5)	0.90 d(6.6)	1.95 s
15	1.33 m	1.33 m	1.38 m, 1.20 m	1.39 m, 1.20 m	2.17 br (7.5)
16	2.05 m	2.05 m	1.54 m	1.59 m	1.75 m

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Table 12-1-3 (continued)

H	12-1-6	12-1-7	12-1-8	12-1-9	12-1-10
17	5.27 t(7.0)	5.27 t(7.0)	2.32 m	2.42 m	2.42 m
19	1.75 s	1.75 s	7.05 s	7.31 s	7.25 s
20	2.40 dd(13.5, 7.0) 2.28 dd(13.5, 7.0)	2.40 dd(13.5, 7.0) 2.28 dd(13.5, 7.0)	5.93 s	6.53 s	6.40 s
21	4.05 td(7.0, 2.0)	4.05 td(7.0, 2.0)			
22	3.93 d(2.0)	3.93 d(2.0)	3.02 dd(5.8, 15.0) 2.68 dd(7.3, 15.0)	7.50 s	7.13 s
23			2.83 m		
24	2.20 s	2.22 s	1.20 d(6.1)	2.21 s	2.21 s
1′	4.02 s	3.98 s			3.51 dt (4.7, 4.8)
2′					3.75 br (5.0)
NH_2					3.35 br s
CONH					6.64 br (5.5)

Table 12-1-4: ^{1}H NMR spectroscopic data of long-chain-type sesterterpenoids **12-1-11**~**12-1-14**.

H	12-1-11	12-1-12	12-1-13	12-1-14
1	7.35 s	7.35 s	7.35 br t(1.7)	
2	6.27 s	6.26 s	6.26 s	2.66 m
3				4.15 br s
4	7.21 s	7.21 s	7.22 s	1.76 m
5	2.44 m	2.44 m	2.42 m	1.65 m, 1.44 m
6	1.80 m	1.80 m	1.80 m	
7	2.44 m	2.44 m	2.42 m	1.44 m, 1.29 m
8				2.00 m
9	7.12 s	7.12 s	7.12 s	5.09 dd(6.7, 6.4)
10	6.08 s	6.08 s	6.08 s	
11	6.02 s	6.00 s	6.01 s	2.19 dd(7.7, 7.4)
12				2.53 dd(7.8, 7.4)
14	1.95 s	1.94 s	1.94 s	
15	2.17 m	2.15 br(7.0)	2.17 br t(7)	2.40 dd(6.6, 6.2)
16	1.80 m	1.75 m	1.75 m	1.44 m
17	2.44 m	2.44 m	2.42 m	1.42 m
19	7.35 s	7.21 s	7.22 s	1.11 s
20	7.05 s	7.00 s	7.01 s	1.11 s
21				2.12 s
22				1.60 s
23	2.82 q(7.5)			1.28 s
24	1.20 br(7.5)			1.26 d(7.6)
1′		3.56 br dt(5.0, 5.0)	3.67 dt(5.7, 5.6)	
2′		3.78 br (5.0)	4.23 br t(5)	
CONH		6.93 br m	6.64 br t(5.7)	
NH_2		3.20 br s, 3.35 br s		
NHAc			2.09 s	

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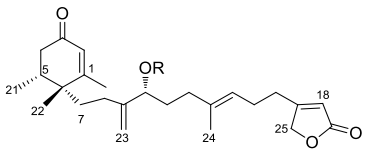
Table 12-1-5: ^{1}H NMR spectroscopic data of long-chain-type sesterterpenoids **12-1-15**~**12-1-17**.

H	12-1-15	12-1-16	12-1-17
1	7.35 br s	7.35 br s	5.39 br s
2	6.28 br s	6.28 br s	5.66 br s
4	7.23 br s	7.23 br s	5.51 br s
5	2.42 t(7.5)	2.42 t(7.5)	2.20 m
6	2.23 q(7.5)	2.23 q(7.5)	2.20 m
7	5.18 t(7.5)	5.13 br t(7.5)	5.12 m
9	1.59 s	1.53 s	1.60 s
10	2.11 t(7.5)	1.94 m	1.98 t(7.5)
11	2.32 q(7.5)	1.29 m	2.08 q(7.5)
12	6.61 br t(7.5)	1.52 m	5.08 m
13		2.52 m	
14	1.70 s	0.97 d(7.0)	1.55 s
15			1.94 m
16	2.67 ddd(16.5, 8.0, 7.0)	2.45 m	1.38 m
	2.57 ddd(16.5, 8.5, 6.5)		
17	1.78 dddd(14.0, 8.0, 7.0, 5.0)	1.74 dtd(13.0, 7.5, 5.0)	1.35 m
	1.60 dddd(14.0, 9.2, 8.0, 5.4)	1.53 m	
18	2.78 m	2.77 m	2.72 m
19	1.08 d(7.0)	1.08 d(7.0)	1.05 d(7.0)
20	5.05 d(10.5)	5.07 d(10.0)	5.26 d(10.0)
22	7.22 br s	7.22 br s	
25	1.92 s	1.93 s	1.73 s
1-OMe			3.35 s
4-OMe			3.34 s

12.1.2 Monocycle-type sesterterpenoids

Table 12-1-6: Compounds, MFs, and test solvents of monocycle-type sesterterpenoids **12-1-18** and **12-1-19**.

No.	Compounds	MFs	Test solvents	References
12-1-18	cyclolinteinol	$C_{25}H_{40}O_4$	$CDCl_3$	[5]
12-1-19	cyclolinteinol acetate	$C_{27}H_{38}O_5$	$CDCl_3$	[5]



12-1-18 R = H
12-1-19 R = COMe

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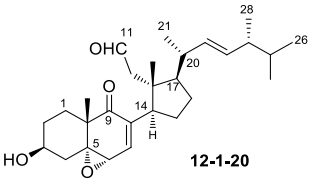
Table 12-1-7: ^{1}H NMR spectroscopic data of monocycle-type sesterterpenoids **12-1-18** and **12-1-19**.

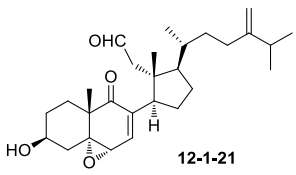
H	12-1-18	12-1-19	H	12-1-18	12-1-19
2	5.88 d(1.0)	5.89 d(1.0)	15	2.31q(7.0)	2.31 q(7.1)
4α	2.49 dd(5.1, 17.7)	2.50 dd(5.1, 17.7)	16	2.46 br t(7.0)	2.45 br t(7.1)
4β	2.30 dd(9.6, 17.7)	2.29 dd(9.6, 17.7)	18	5.85 m	5.85 m
5	2.14 (ov)	2.13 (ov)	20	1.95 d(1.0)	1.94 d(1.0)
7	1.73 dt(5.1, 13.2, 13.2)	1.73 dt(5.1, 13.2, 13.2)	21	1.03 d(6.7)	1.03 d(6.8)
	1.64 (ov)	1.59 (ov)			
8	2.08 (ov)	2.00 (ov)	22	1.23 s	1.23 s
10	4.04 m	5.12 dd(6.0, 7.5)	23	4.87 br s, 5.03 br s	4.91 br s, 5.03 br s
			24	1.63 br s	1.62 br s
11	1.60(ov)	1.68~1.78(ov)	25	4.73 d(1.7)	4.73 d(1.4)
12	2.00-2.06(ov)	2.00(ov)	27		2.05 s
14	5.13 dt(1.0, 7.0, 17.0)	5.09 br t(7.1)			

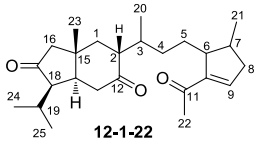
12.1.3 Dicycle-type sesterterpenoids

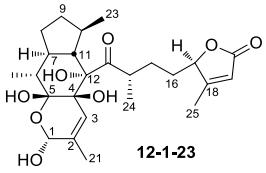
Table 12-1-8: Compounds, MFs, and test solvents of dicycle-type sesterterpenoids **12-1-20**~**12-1-25**.

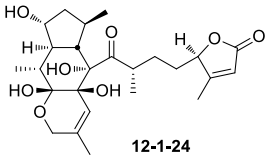
No.	Compounds	MFs	Test solvents	References
12-1-20	3-*O*-deacetylluffasterol B	$C_{28}H_{42}O_4$	$CDCl_3$	[6]
12-1-21	3-*O*-deacetyl-22,23-dihydro-24,28-dehydro-luffasterol B	$C_{28}H_{42}O_4$	$CDCl_3$	[6]
12-1-22	alborosin	$C_{25}H_{38}O_3$	$CDCl_3$	[7]
12-1-23	1α-hydroxyleucosceptrine	$C_{25}H_{36}O_8$	$CDCl_3$	[8]
12-1-24	8α-hydroxyleucosceptrine	$C_{25}H_{36}O_8$	$CDCl_3$	[8]
12-1-25	palauolol	$C_{25}H_{38}O_4$	CD_3OD	[9]











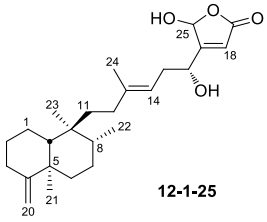


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Table 12-1-9: ^{1}H NMR spectroscopic data of dicycle-type sesterterpenoids **12-1-20**~**12-1-22**.

H	12-1-20	12-1-21	12-1-22
1	–	–	α 1.46 t(12.8), β 1.85 dd(6.2, 12.8)
2	2.09 m, 1.68 m	2.13 m, 1.68 m	2.49 ddd(3.5, 6.2, 12.8)
3	3.98 m	3.98 m	2.26 m
4	2.18 m, 1.56 m	2.18 m, 1.54 m	1.15 m
5			1.42 m
6	3.40 d(4.6)	3.40 d(4.5)	2.84 m
7	6.84 dd(4.6, 1.0)	5.86 dd(4.5, 1.1)	2.45 m
8			2.17 ddt(2.2, 8.8, 17.6)
			2.51 ddd(2.2, 8.1, 17.6)
9			6.72 br t(2.2)
11	9.88 dd(3.8, 1.7)	9.88 dd(3.8, 1.5)	
12	2.27 dd(15.9, 3.8)	2.30 dd(16.2, 3.8)	
	2.00 dd(15.9, 1.7)	1.98 dd(16.2, 1.5)	
13			α 2.65 dd(5.5, 15.3), β 2.61 t(15.3)
14	3.51 dd(10.3, 9.2)	3.53 dd(10.3, 9.8)	2.32 m
15	1.78 m, 1.71 m	2.08 m, 1.73 m	
16	–	–	α 2.02 d(17.2), β 2.28 d(17.2)
18	0.76 s	0.76 s	1.98 m
19	1.21 s	1.21 s	1.95 m
20	2.18 m	1.94 m	0.79 d(6.6)
21	1.00 d(6.8)	0.97 d(6.8)	1.05 d(7.0)
22	5.20 dd(17.6, 7.4)	–	2.29 s
23	5.24 dd(17.6, 7.4)	–	1.19 s
24	1.87 m		1.02 d(6.6)
25	1.47 m	2.21 m	0.96 d(6.2)
26	0.83 d(6.8)	–	
27	0.82 d(6.8)	–	
28	0.91 d(7.0)	4.73 br s, 4.65 d(1.5)	

Table 12-1-10: ^{1}H NMR spectroscopic data of dicycle-type sesterterpenoids **12-1-23**~**12-1-25**.

H	12-1-23	12-1-24	12-1-25
1	5.82 s	3.99 d(17.1), 4.21 d(17.1)	1.41 m, 1.58 m
2			1.2 m, 1.86 m
3	5.61 br s	4.96 br s	2.1 m, 2.3 m
6	1.95 m	2.10 m	1.6 m
7	1.55 m	3.01 m	1.43 m
8	1.45 m, 1.91 m	4.29 m	1.42 m
9	1.23 m, 1.44 m	1.19 m, 1.52 m	
10	1.67 m	1.85 m	1.14 dd(12, 2.5)
11	1.55 m	2.19 m	1.24 m, 1.34 m
12			1.74 m, 1.86 m
14	3.01 m	3.37 m	5.21 t(6.5)

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Table 12-1-10 (continued)

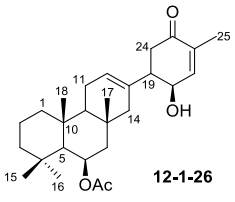
H	12-1-23	12-1-24	12-1-25
15	1.25 m, 1.86 m	1.21 m, 2.01 m	2.35 m, 2.45 m
16	1.15 m, 1.75 m	1.15 m, 1.85 m	4.54 t(5)
17	4.81 br d(6.2)	4.81 br d(6.7)	
18			5.98 br s
19	5.94 m	5.81 m	
20			4.49 br s
21	1.80 br d(1.3)	1.65 br s	1.05 s
22	1.15 d(6.4)	0.99 d(6.7)	0.81 d(6.5)
23	1.06 d(6.8)	0.71 d(6.9)	0.74 s
24	1.23 d(7.1)	1.06 d(6.7)	1.62 s
25	2.05 s	2.05 s	6.01 br s

12.1.4 Tricycle-type sesterterpenoids

Table 12-1-11: Compounds, MFs, and test solvents of tricycle-type sesterterpenoids **12-1-26**~**12-1-41**.

No.	Compounds	MFs	Test solvents	References
12-1-26	suberitenone C	$C_{27}H_{40}O_4$	CD_3COCD_3	[10]
12-1-27	suberitenone D	$C_{29}H_{44}O_6$	$CDCl_3$	[10]
12-1-28	suberiphenol	$C_{27}H_{38}O_3$	$CDCl_3$	[10]
12-1-29	oxaspirosuberitenone	$C_{27}H_{42}O_5$	$CDCl_3$	[11]
12-1-30	19-episuberitenone	$C_{27}H_{42}O_4$	$CDCl_3$	[11]
12-1-31	suberitenone B	$C_{27}H_{42}O_5$	$CDCl_3$	[11]
12-1-32	jaspiferal A	$C_{27}H_{36}O_5$	$CDCl_3$-CD_3OD (9:1)	[12]
12-1-33	jaspiferal B	$C_{27}H_{36}O_5$	$CDCl_3$-CD_3OD (9:1)	[12]
12-1-34	jaspiferal C	$C_{25}H_{34}O_5$	$CDCl_3$-CD_3OD (9:1)	[12]
12-1-35	jaspiferal D	$C_{25}H_{34}O_5$	$CDCl_3$-CD_3OD (9:1)	[12]
12-1-36	jaspiferal E	$C_{22}H_{30}O_5$	$CDCl_3$-CD_3OD (9:1)	[12]
12-1-37	jaspiferal F	$C_{22}H_{30}O_5$	$CDCl_3$-CD_3OD (9:1)	[12]
12-1-38	auroral 1①	$C_{25}H_{36}O_4$	$CDCl_3$	[13]
12-1-39	auroral 2①	$C_{25}H_{36}O_4$	$CDCl_3$	[13]
12-1-40	auroral 3①	$C_{22}H_{32}O_4$	$CDCl_3$	[13]
12-1-41	auroral 4①	$C_{22}H_{32}O_4$	$CDCl_3$	[13]

① These nomenclatures are following the use in the original literature.



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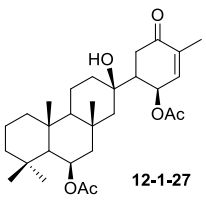

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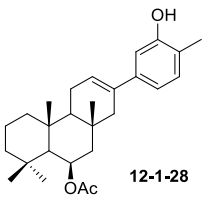

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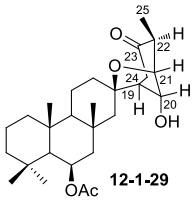

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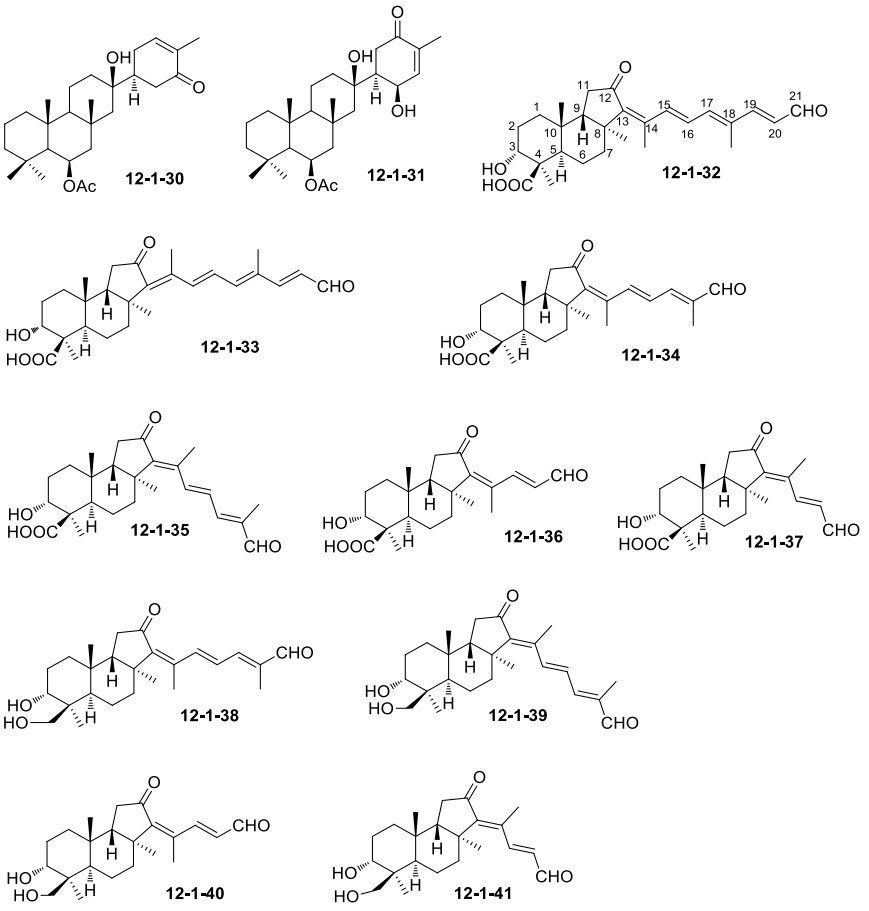

Table 12-1-12: ^{1}H NMR spectroscopic data of tricycle-type sesterterpenoids **12-1-26**~**12-1-30**.

H	12-1-26	12-1-27	12-1-28	12-1-29	12-1-30
1	1.70 m	1.76 br d(13.7)	1.70 br dd(13.2, 2.9)	0.77 d(4.0)	0.88 m
	0.96 m	0.83 ddd(13.7, 13.7, 3.4)	0.93 ddd(13.2, 12.2, 3.9)	1.70 m	1.68 m
2	1.73 m, 1.44 m	1.71 m, 1.46 m	1.72 m, 1.47 m	1.40 m, 1.70 m	1.45 m, 1.70 m
3	1.38 m	1.36 m	1.38 m	1.18 m	1.15 m
	1.23 m	1.16 m	1.18 ddd(13.2, 12.2, 2.9)	1.35 m	1.35 m
5	1.19 d(2.1)	1.01 d(2.4)	1.10 d(2.0)	0.98 m	0.88 m
6	5.49 ddd(3.4, 2.4, 2.4)	5.45 ddd(3.4, 2.4, 2.4)	5.53 br d(2.0)	5.44 dd(2.7, 2.7, 2.7)d	5.46 ddd(2.7, 2.7, 2.7)

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Table 12-1-12 (continued)

H	12-1-26	12-1-27	12-1-28	12-1-29	12-1-30
7	1.92 dd(14.2, 2.4)	1.92 dd(14.7, 2.4)	2.05 dd(13.7, 2.5)	*α* 1.19 m	*α* 1.29 m
	1.44 dd(14.2, 3.4)	1.20 dd(14.7, 3.4)	1.46 dd(13.7, 3.4)	*β* 1.85 dd(2.6, 14.7)	*β* 1.92 dd(2.5, 14.8)
9	1.35 dd(11.2, 5.9)	0.87 dd(11.7, 2.0)	1.37 dd(11.2, 5.4)	0.82 dd(2.2, 15.7)	1.04 m
11	2.10 m	1.67 dddd(13.2, 13.2, 11.7, 3.4)	2.23 m	1.45 m	1.30 m
			2.10 m	1.70 m	1.68 m
		1.58 m			
12	5.53 br s	2.02 m, 1.13 m	6.06 dt(5.4, 2.5)	1.39 m, 1.49 m	1.30 m, 2.25 m
14	1.86 d(16.5)	1.35 dd(13.7, 2.9)	2.14 m	*α* 0.98 m	*α* 1.00 m
	1.77 d(16.5)	1.16 d(13.7)	2.12 m	*β* 2.30 m	*β* 1.88 dd(2.5, 13.6)
15	0.95 s	0.91 s	0.96 s	0.90 s	0.91 s
16	1.04 s	1.00 s	1.01 s	0.99 s	0.98 s
17	1.07 s	1.31 s	1.07 s	1.28 s	1.17 s
18	1.30 s	1.18 s	1.28 s	1.17 s	1.12 s
19	2.58 br dd(13.1, 3.4)	1.97 ddd(13.7, 3.4, 3.4)		2.15 m	2.50 m
20	4.34 br d(5.4)	5.50 dd(5.9, 3.4)	6.84 dd(7.8, 2.0)	4.40 s	2.50 m, 2.40 m
21	6.79 dq(5.4, 1.5)	6.80 dq(5.9, 1.5)	7.04 d(7.8)	4.09 br s	6.75 m
22				2.25 m	
24	2.80 dd(17.1, 13.1)	2.82 dd(17.1, 13.7)	6.76 d(2.0)	*α* 2.64 dd(2.9, 18.0)	*α* 2.58 dd(2.7, 15.4)
	2.19 dd(17.1, 3.4)	2.57 dd(17.1, 3.4)		*β* 2.35 dd(3.6, 18.0)	*β* 2.39 m
25	1.71 br s	1.80 d(1.5)	2.22 s		
27				2.02 s	2.02 s
6-OAc	2.01 s	2.04 s	2.06 s		
20-OAc		2.10 s			

Table 12-1-13: ^{1}H NMR spectroscopic data of tricycle-type sesterterpenoids **12-1-31**~**12-1-35**.

H	12-1-31	12-1-32	12-1-33	12-1-34	12-1-35
1	0.84 m, 1.75 m	1.00 br d(14.7)	1.00 br d(14.7)	1.06 br d(13.1)	1.06 br d(13.1)
		1.81 m	1.81 m	1.81 m	1.81 m
2	1.43 m, 1.72 m	1.63 br d(13.7)	1.63 br d(13.7)	1.63 br d(13.7)	1.63 br d(13.7)
		2.12 m	2.12 m	2.12 m	2.12 m
3	1.12 m, 1.35 m	4.07 dd(2.2, 4.4)	4.07 dd(2.2, 4.4)	4.07 dd(2.2, 4.4)	4.07 dd(2.2, 4.4)
5	1.02 d(2.4)	2.40 br t(10.3)	2.40 br t(10.3)	2.40 br t(10.3)	2.40 br t(10.3)
6	5.45 br d(2.9)	1.82 m, 1.77 m	1.82 m, 1.77 m	1.82 m	1.82 m

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Table 12-1-13 (continued)

H	12-1-31	12-1-32	12-1-33	12-1-34	12-1-35
7	1.24 dd(3.6, 14.4) 1.94 dd(2.7, 14.4)	2.05 m	2.11 m	2.08 m	2.15 m
9	0.88 m	1.82 m	1.82 m	1.82 m	1.82 m
11	1.58 m, 1.68 m	2.35 dd(4.4, 15.6) 2.11 m	2.35 dd(4.4, 15.6) 2.11 m	2.19 dd(3.9, 15.6) 2.12 m	2.19 dd(3.9, 15.6) 2.12 m
12	1.11 m, 2.02 m				
14	1.07 d(13.5) 1.85 dd(2.7, 13.5)				
15	0.90 s	8.16 d(15.1)	6.82 d(14.6)	8.30 d(14.7)	6.99 d(14.7)
16	0.99 s	6.86 dd(11.2, 15.1)	6.94 dd(10.7, 14.6)	7.00 dd(11.2, 14.7)	6.90 dd(11.2, 14.7)
17	1.33 s	6.63 br d(11.2)	6.60 br d(10.7)	7.00 br d(11.2)	6.97 br d(11.2)
18	1.18 s				
19	1.72 m	7.16 d(15.6)	7.15 d(15.6)	9.40 s	9.43 s
20	4.65 dd(2.9, 5.5)	6.15 dd(7.8, 15.6)	6.19 dd(7.8, 15.6)		
21	6.67 dq(1.5, 5.5)	9.49 d(7.8)	9.51 d(7.8)		
24	2.50 dd(3.0, 16.8) 2.81 dd(13.4, 16.8)				
25	1.79 br s				
27	2.04 s				
4-Me		1.23 s	1.22 s	1.23 s	1.22 s
8-Me		1.36 s	1.39 s	1.36 s	1.39 s
10-Me		0.88 s	0.88 s	0.88 s	0.88 s
14-Me		2.00 s	2.25 s	2.01 s	2.26 s
18-Me		1.96 br s	1.92 br s	1.82 br s	1.86 br s

Table 12-1-14: ^{1}H NMR spectroscopic data of tricycle-type sesterterpenoids **12-1-36**~**12-1-38**.

H	12-1-36	12-1-37	12-1-38
1	1.81 m, 1.06 br d(13.1)	1.81 m, 1.06 br d(13.1)	1.12~1.85 m
2	2.12 br d(13.0), 1.65 m	2.12 br d(13.0), 1.65 m	1.70~1.85 m
3	4.06 br s	4.06 br s	4.04 dd(2.7, 7.2)
5	2.42 dd(8.2, 2.4)	2.39 dd(8.2, 2.4)	2.24 m
6	1.80 m	1.80 m	1.47~1.72 m
7	2.05 m	2.12 m	2.18 m
9	1.92 m	1.87 m	1.75 m
11	2.26 m, 2.12 m	2.24 m, 2.12 m	2.22 m
15	8.75 d(16.1)	7.53 d(15.6)	8.35 d(14.4)
16	6.30 dd(7.8, 16.1)	6.41 dd(7.3, 15.6)	6.97 dd(14.4, 15.0)
17	9.60 d(7.8)	9.62 d(7.3)	6.98 d(15.0)
19			9.47 s
4-Me	1.25 s	1.25 s	1.08 s

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Table 12-1-14 (continued)

H	12-1-36	12-1-37	12-1-38
4-CH_2OH			3.76 d(10.4), 3.57 d(10.4)
8-Me	1.37 s	1.42 s	1.37 s
10-Me	0.94 s	0.94 s	1.02 s
14-Me	1.97	2.20 s	2.04 s
18-Me			1.87 s

Table 12-1-15: ^{1}H NMR spectroscopic data of tricycle-type sesterterpenoids **12-1-39**~**12-1-41**.

H	12-1-39	12-1-40	12-1-41
1	1.12~1.85 m	1.22~1.82 m	1.22~1.82 m
2	1.70~1.85 m	1.81~1.98 m	1.81~1.98 m
3	4.04 dd(2.7, 7.2)	4.01 br s	4.01 br s
5	2.17 m	2.24 m	2.28 m
6	1.47~1.72 m	1.42~1.69 m	1.42~1.69 m
7	2.29 m	2.08 m	2.18 m
9	1.78 m	1.80 m	1.80 m
11	2.22 m	2.12~2.25 m	2.12~2.25 m
15	7.01 d(14.4)	8.79 d(15.9)	7.52 d(15.7)
16	7.00 dd(14.4, 15.0)	6.35 dd(7.8, 16.0)	6.45 dd(7.5, 15.6)
17	6.96 d(15.0)	9.66 d(7.8)	9.68 d(7.5)
19	9.50 s		
4-Me	1.08 s	1.07 s	1.07 s
4-CH_2OH	3.76 d(10.4), 3.57 d(10.4)	3.72 d(10.5), 3.58 d(10.5)	3.72 d(10.5), 3.58 d(10.5)
8-Me	1.39 s	1.36 s	1.42 s
10-Me	1.02 s	1.03 s	1.03 s
14-Me	2.31 s	2.00 s	2.26 s
18-Me	1.91 s		

12.1.5 Tetracycle-type sesterterpenoids

Table 12-1-16: Compounds, MFs, and test solvents of tetracycle-type sesterterpenoids **12-1-42**~**12-1-66**.

No.	Compounds	MFs	Test solvents	References
12-1-42	honu′enone	$C_{30}H_{44}O_5$	$CDCl_3$	[14]
12-1-43	phyllofenone C	$C_{32}H_{50}O_6$	$CDCl_3$	[14]
12-1-44	phyllofolactone H	$C_{31}H_{48}O_5$	$CDCl_3$	[14]
12-1-45	phyllofolactone J	$C_{32}H_{50}O_5$	$CDCl_3$	[14]
12-1-46	phyllofolactone I	$C_{31}H_{48}O_5$	$CDCl_3$	[14]
12-1-47	phyllofolactone K	$C_{32}H_{50}O_5$	$CDCl_3$	[14]
12-1-48	12-*O*-deacetylscalarafuran	$C_{25}H_{38}O_2$	$CDCl_3$	[15]

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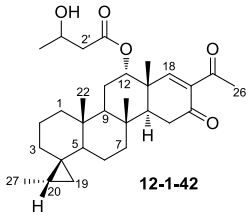
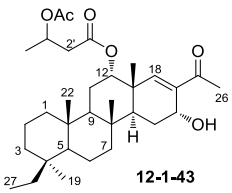
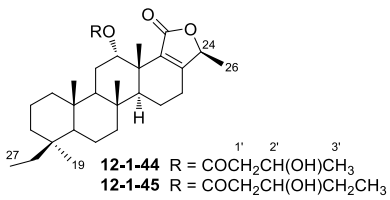
Table 12-1-16 (continued)

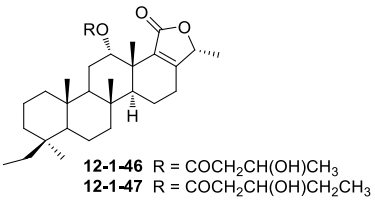
No.	Compounds	MFs	Test solvents	References
12-1-49	12–*O*-deacetyl-12-*epi*-scalarin	$C_{25}H_{38}O_4$	DMSO-d_6	[15]
12-1-50	12-*O*-acetyl-16-*O*-methylhyrtiolide	$C_{28}H_{42}O_6$	$CDCl_3$	[15]
12-1-51	sesterstatin 7①	$C_{27}H_{40}O_5$	$CDCl_3$	[16]
12-1-52	sesterstatin 6①	$C_{25}H_{38}O_5$	$CDCl_3$-DMSO-d_6	[17]
12-1-53	hyrtiolide	$C_{25}H_{38}O_5$	CD_3OD	[18]
12-1-54	16-hydroxyscalarolide	$C_{25}H_{38}O_4$	$CDCl_3$	[18]
12-1-55	12-deacetyl-Δ^{17}-hyrtial	$C_{24}H_{38}O_2$	$CDCl_3$	[18]
12-1-56	3-acetylsesterstatin 1①	$C_{27}H_{40}O_5$	$CDCl_3$	[19]
12-1-57	19-acetylsesterstatin 3①	$C_{27}H_{40}O_5$	$CDCl_3$	[19]
12-1-58	salmahyrtisol B	$C_{25}H_{36}O_3$	$CDCl_3$	[19]
12-1-59	sesterstatin 1①	$C_{25}H_{38}O_4$	DMSO-d_6	[20]
12-1-60	sesterstatin 2①	$C_{25}H_{38}O_4$	DMSO-d_6	[20]
12-1-61	sesterstatin 3①	$C_{25}H_{38}O_4$	DMSO-d_6	[20]
12-1-62	12-*O*-desacetylfuroscalar-16-one	$C_{25}H_{36}O_3$	$CDCl_3$	[21]
12-1-63	12α-acetoxy-19β-hydroxyscalara-15,17-dien-20,19-olide	$C_{27}H_{38}O_5$	$CDCl_3$	[22]
12-1-64	12α-acetoxy-16β-hydroxyscalarolbutenolide	$C_{27}H_{40}O_5$	$CDCl_3$	[22]
12-1-65	3-hydroxy-20,22-dimethyl-20-deoxoscalarin	$C_{29}H_{46}O_5$	$CDCl_3$	[23]
12-1-66	3-oxo-20,22-dimethyl-20-deoxoscalarin 8	$C_{29}H_{44}O_5$	$CDCl_3$	[23]

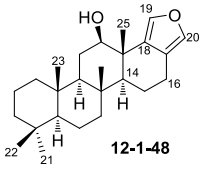
① These nomenclatures are following the use in the original literature.

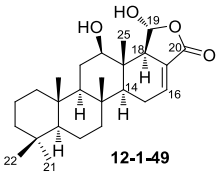


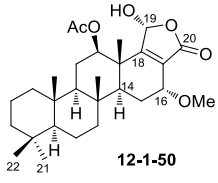


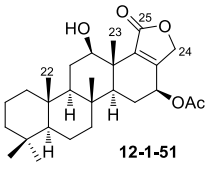


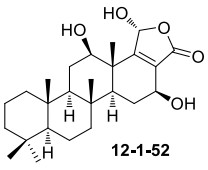


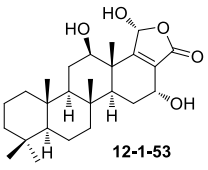












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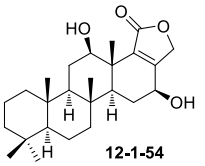
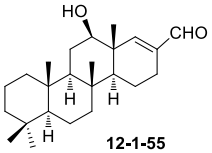


12-1-54



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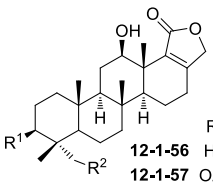
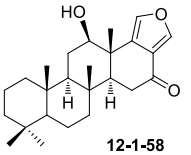
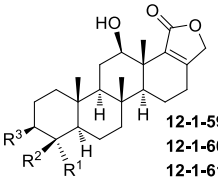


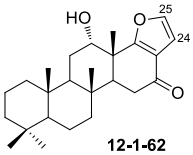
	R^1	R^2
12-1-56	H	OAc
12-1-57	OAc	H



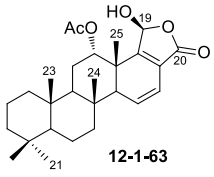
12-1-58



	R^1	R^2	R^3
12-1-59	Me	Me	OH
12-1-60	Me	CH_2OH	H
12-1-61	CH_2OH	Me	H



12-1-62



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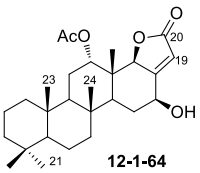

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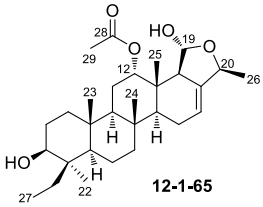

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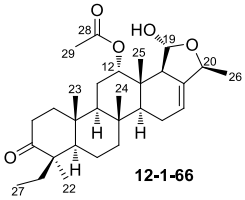

12-1-66

Table 12-1-17: ^{1}H NMR spectroscopic data of tetracycle-type sesterterpenoids **12-1-42**~**12-1-44**.

H	12-1-42	12-1-43	12-1-44
1eq	1.68 m	1.60 m	1.68 m
1ax	0.73 m	0.68 ddd(4, 13, 13)	0.58 ddd(4, 13, 13)
2	1.45 m	1.40 m	–
3eq	1.54 m	1.67 ddd(3, 14, 14)	–
3ax	1.22 m	0.83 m	–
5	1.40 m	0.94 dd(2.2, 13)	0.86 dd(2, 13)
6	1.05 m	eq 1.55 m, ax 1.45 m	–
7eq	1.65 m	1.71 m	1.83 dt(3, 13)
7ax	1.00 m	0.88 m	0.99 ddd(4, 13, 13)
9	1.27 dd(2.0, 15)	1.31 dd(3.1, 12.3)	1.16 m
11eq	1.97 dt(2.6, 15)	1.79 m	2.01 dt(3, 15)
11ax	1.76 ddd(2.4, 15, 15)	–	1.69 m
12	5.09 t(2.6)	5.11 t(2.6)	5.60 t(2.7)
14	2.07 dd(3.9, 14)	1.76 m	1.49 m

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Table 12-1-17 (continued)

H	12-1-42	12-1-43	12-1-44
15eq	2.52 m	1.88 d(15)	1.91 dd(6.5, 12)
15ax	2.41 m	1.60 ddd(4.4, 15, 15)	1.55 m
16eq	–	5.75 dd(1.5, 4.2)	2.35 m
16ax	–	–	2.19 ddd(7, 12, 15)
18	7.33 s	6.70 s	
19	*cis* 0.59 dd(4.4, 8.9) *trans* −0.48 t(5)	0.82 s	0.79 s
20	0.69 m	1.5 m, 1.17 m	1.51 m, 1.17 m
21	0.94 s	0.85 s	0.82 s
22	0.80 s	0.84 s	0.88 s
23	1.17 s	1.05 s	1.17 s
24			4.77 q(6.7)
26	2.45 s	2.21 s	1.35 d(7)
27	1.08 d(6.3)	0.74 t(7.3)	0.73 t(7.4)
2′	2.45 m	2.46 dd(8.8, 16), 2.53 dd(3.3, 16)	2.31 dd(8.5, 16), 2.36 dd(4, 16)
3′	4.15 m	4.18 m	4.09 m
4′	1.23 d(6.3)	1.25 d(6.4)	1.18 d(6.3)
3′-OH		2.85 s	3.08 s
3′-OAc		2.04 s	

Table 12-1-18: ^{1}H NMR spectroscopic data of tetracycle-type sesterterpenoids **12-1-45**∼**12-1-47**.

H	12-1-45	12-1-46	12-1-47
1eq	1.65 m	1.66 m	1.66 m
1ax	0.59 ddd(4, 13, 13)	0.58 ddd(4, 13, 13)	0.59 ddd(4, 13, 13)
5	0.86 m	0.86 dd(2, 13)	0.87 m
7eq	1.83 dt(3, 13)	1.83 dt(3, 13)	1.83 dt(3, 13)
7ax	0.99 ddd(4, 13, 13)	1.01 ddd(4, 13,13)	1.01 ddd(4, 13,13)
9	1.17 m	1.17 m	1.18 m
11eq	2.02 dt(3, 15)	2.02 dt(3, 15)	2.03 dt(3, 15)
11ax	1.71 m	1.69 m	1.69 m
12	5.60 t(2.7)	5.58 t(3)	5.58 t(2.7)
14	1.50 m	1.50 m	1.50 m
15eq	1.91 dd(7, 12)	1.91 dd(7, 13)	1.91 dd(7, 12)
15ax	1.54 m	1.56 m	1.53 m
16eq	2.36 m	2.31 m	2.32 m
16ax	2.20 ddd(7, 12, 15)	2.24 m	2.24 ddd(7, 11, 15)
19	0.79 s	0.79 s	0.79 s
20	1.50 m, 1.15 m	1.52 m, 1.14 m	1.49 m, 1.15 m
21	0.83 s	0.83 s	0.83 s
22	0.89 s	0.89 s	0.89 s
23	1.17 s	1.18 s	1.18 s
24	4.77 q(7)	4.75 q(6.5)	4.76 q(6.6)

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Table 12-1-18 (continued)

H	12-1-45	12-1-46	12-1-47
26	1.36 d(6.8)	1.34 d(6.8)	1.35 d(6.9)
27	0.73 t(7.4)	0.73 t(7.4)	0.73 t(7.4)
2′	2.30 dd(9, 16), 2.38 dd(3, 16)	2.33 d(6)	2.36 dd(3, 15.5) 2.30 dd(9, 15.5)
3′	3.82 m	4.11 q(6.3)	3.83 m
4′	1.45 m	1.18 d(6.3)	1.45 m
5′	0.94 t(7.5)		0.94 t(7.4)
3′-OH	3.00 s	3.04 s	2.99 s

Table 12-1-19: ^{1}H NMR spectroscopic data of tetracycle-type sesterterpenoids **12-1-48**~**12-1-52**.

H	12-1-48	12-1-49	12-1-50	12-1-51	12-1-52
1	0.80 m, 1.69 m	0.80 m, 1.62 m	0.87 m, 1.64 m	1.73 m, 0.79 m	1.64 m, 0.74 m
2	1.42 m, 1.59 m	1.57 m, 1.63 m	1.42 m, 1.60 m	1.56 m, 1.42 m	1.54 m, 1.32 m
3	1.14 m, 1.35 br d(13.2)	1.10 m, 1.33 m	1.13 m, 1.35 m	1.79 m 1.11 ddd(13.5, 13.5, 4.0)	1.04 m, 1.30 m
5	0.80 m	0.79 m	0.86 m	0.79 m	0.74 m
6	1.44 m, 1.60 m	1.38 m, 1.46 m	1.42 m, 1.60 m	1.57 m, 1.41 m	1.58 m, 1.35 m
7	0.93 m, 1.86 dt(13.2, 4.0)	0.88 m, 1.63 m	0.95 m, 1.78 m	0.94 m, 1.41 m	0.84 m, 1.77 m
9	0.92 dd(13.2, 2.0)	0.80 m	1.02 m	0.88 m	0.84 m
11	1.52 m, 1.78 m	1.30 m, 1.55 m	1.55 m, 1.80 m	1.88 ddd(11.5, 4.2, 1.8) 1.50 m	1.48 m, 1.73 m
12	3.64 dd(11.2, 4.4)	3.39 dt(12.0, 4.4)	4.93 dd(11.0, 4.9)	3.66 dd(11.5, 4.4)	3.68 dd(11.0, 4.0)
14	1.13 m	1.20 m	1.55 m	1.21 m	1.10 m
15	1.64 m, 1.80 m	2.12 m, 2.25 m	1.56 m, 2.11 m	2.25 dd(11.7, 7.1) 1.74 m	2.11 dd(12.5, 6.5) 1.49 m
16	2.41 ddd(16.1, 5.9, 1.5) 2.75 dd(16.1, 5.9)	6.67 q(2.9)	4.02 dd(3.1, 0.5)	5.50 br dd(10.3, 7.1)	4.47 dd(18.0, 2.0)
18		2.40 br s			6.11 s
19	7.53 br s	5.72 t(5.9)	6.03 s	0.83 s	7.80 br s
20	7.04 br s			0.80 s	
21	0.84 s	0.63 s	0.81 s	0.89 s	0.78 s

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Table 12-1-19 (continued)

H	12-1-48	12-1-49	12-1-50	12-1-51	12-1-52
22	0.82 s	0.77 s	0.83 s	0.83 s	0.76 s
23	0.85 s	0.80 s	0.85 s	1.19 s	0.78 s
24	0.89 s	0.81 s	0.92 s	4.76 dd(18.3, 1.3) 4.71 d(18.3)	0.84 s
25	1.20 s	0.83 s	1.21 s		1.15 s
27				2.12 s	
12-OH		4.28 d(4.4)		5.75 s	
19-OH		7.73 d(5.9)			
12-OAc			2.12 s		
16-OMe			3.40 s		

Table 12-1-20: ^{1}H NMR spectroscopic data of tetracycle-type sesterterpenoids **12-1-53**~**12-1-57**.

H	12-1-53	12-1-54	12-1-55	12-1-56	12-1-57
1	0.87 m, 1.73 m	0.78 m 1.72 br d(13.0)	0.81 m, 1.67 m	0.78 m, 1.74 m	1.43 m, 1.77 m
2	1.48 m, 1.61 m	1.42 m, 1.62 m	1.42 m, 1.58 m	1.64 m, 1.50 m	1.66 m
3	1.20 m, 1.40 m	1.09 m, 1.38 m	1.12 dt(3.8, 13.8) 1.38 br d(13.8)	1.33 m	4.46 dd(11.2, 5.4)
5	0.85 m	0.75 m	0.80 m	1.06 m	0.85 m
6	1.48 m, 1.61 m	1.40 m, 1.58 m	1.42 m, 1.58 m	1.44 m	1.56 m
7	0.98 m, 1.83 m	0.92 m 1.80 td(3.3, 12.4)	0.91 m, 1.81 m	0.85 m, 1.82 m	0.92 m, 1.83 m
9	1.00 m	0.88 m	0.92 m	0.88 m	0.84 m
11	1.62 m, 1.82 m	1.49 dd(2.1, 13.2) 1.88 m	1.50 m, 1.81 m	1.69 m, 1.85 m	1.50 m, 1.82 m
12	3.64 dd(4.3, 11.1)	3.64 dd(4.5, 10.9)	3.46 dd(4.3, 11.1)	3.67 dd(10.9, 3.8)	3.66 dd(10.5, 4.6)
14	1.51 m	1.14 m	1.00 dd(1.8, 12.5)	1.09 m	1.05 d(12.2)
15	1.82 m, 1.88 m	1.66 dd(2.1, 12.4) 2.23 dd(6.7, 12.5)	1.46 m, 1.82 m	1.69 m, 1.90 m	1.91 dd(13.6, 7.3) 1.66 m
16	4.42 br d(2.9)	4.50 m	2.02 dddd(2.2, 7.2, 11.3, 18.2) 2.41 dd(6.1, 18.2)	2.28 ddd(19.0, 10.9, 7.0) 2.43 dd(19.0, 5.6)	2.43 dd(19.4, 5.9) 2.27 ddd(19.4, 11.0, 7.0)

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Table 12-1-20 (continued)

H	12-1-53	12-1-54	12-1-55	12-1-56	12-1-57
18			6.93 t(1.0)		
19	6.34 br s			3.61 d(10.9) 3.86 d(10.9)	0.84 s
20		4.81 d(17.8) 4.99 d(17.8)	9.42 s	0.83 s	0.85 s
21	0.87 s	0.84 s	0.84 s	0.88 s	0.89 s
22	0.85 s	0.81 s	0.81 s	0.88 s	0.87 s
23	0.91 s	0.84 s	0.85 s	1.12 s	1.13 s
24	0.94 s	0.90 s	0.88 s	4.70 d(17.6) 4.65 d(17.6)	4.72 d(17.5) 4.65 d(17.5)
25	1.16 s	1.19 s	1.03 s		
27				2.05 s	2.04 s
12-OH				5.93 s	5.94 s

Table 12-1-21: ^{1}H NMR spectroscopic data of tetracycle-type sesterterpenoids **12-1-58**~**12-1-62**.

H	12-1-58	12-1-59	12-1-60	12-1-61	12-1-62
1	1.69 td(11.2, 3.0)	0.86 m	0.76 m	0.72 m	0.84 m
	0.81 m	1.60 m	1.63 m	1.60 m	1.66 m
2	1.59 m, 1.40 m	1.49 m, 1.58 m	1.31 m, 1.50 m	1.34 m, 1.39 m	1.44 m, 1.63 m
3	1.36 m	2.95 m	0.76 m	1.09 m	1.13 m
	1.11 ddd(13.4, 13.4, 4.2)		1.73 m	1.73 m	1.37 m
5	0.79 m	0.69 m	0.85 m	1.11 m	0.99 dd(14.0, 2.2)
6	1.61 m, 1.44 m	1.41 m, 1.50 m	1.40 m, 1.54 m	1.31 m, 1.43 m	1.41 m, 1.59 m
7	1.75 ddd(12.4, 3.4, 3.1)	0.86 m	0.81 m	0.88 m	1.07 m
	0.95 m	1.77 m	1.75 m	1.71 m	1.74 dt(12.0, 2.4)
9	0.98 dd(12.4, 2.0)	0.77 m	0.80 m	0.84 m	1.54 dd(12.0, 4.0)
11	1.82 ddd(12.6, 4.3, 2.0)	1.35 m	1.34 m	1.34 m	1.80 m
	1.57 m	1.59 m	1.58 m	1.61 m	1.84 m
12	3.76 dd(11.4, 4.4)	3.50 dd(11.0, 4.5)	3.50 dd(11.0, 4.5)	3.51 dd(11.0, 4.0)	4.43 dd(2.8, 2.6)
14	1.64 dd(12.0, 4.4)	1.01 m	1.01 m	1.02 m	2.40 dd(13.6, 2.8)
15	2.55 m	1.56 m	1.55 m	1.55 m	2.43 dd(16.4, 13.6)
	2.52 m	1.79 m	1.79 m	1.81 m	2.58 dd(16.4, 2.8)

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Table 12-1-21 (continued)

H	12-1-58	12-1-59	12-1-60	12-1-61	12-1-62
16		2.26 ddd(19.5, 11.5, 7.0) 2.46 dd(19.5, 5.5)	2.27 ddd(19.5, 11.5, 7.0) 2.45 dd(19.5, 5.5)	2.26 ddd(19.0, 11.0, 7.0) 2.45 dd(19.0, 5.5)	
19	0.83 s	0.86 s	0.83 s	2.84 dd(10.5, 3.0) 3.17 dd(10.5, 3.0)	0.85 s
20	0.80 s	0.66 s	3.19 dd(10.5, 5.0) 3.46 dd(10.5, 5.0)	0.65 s	0.82 s
21	0.94 s	0.81 s	0.79 s	0.81 s	0.98 s
22	0.86 s	0.77 s	0.77 s	0.81 s	0.86 s
23	1.23 s	0.98 s	0.98 s	0.98 s	1.27 s
24	7.60 d(1.5)	4.81 d(18.0) 4.86 d(18.0)	4.81 d(18.0) 4.86 d(18.0)	4.81 d(18.0) 4.86 d(18.0)	6.63 d(2.0)
25	7.89 d(1.5)				7.33 d(2.0)
OH		4.28 d(5.0, 3-OH) 5.65 s(12-OH)	5.65 s(12-OH) 4.11 t(5.0, 20-OH)	5.65 s(12-OH) 4.36 s(19-OH)	

Table 12-1-22: ^{1}H NMR spectroscopic data of tetracycle-type sesterterpenoids **12-1-63**~**12-1-66**.

H	12-1-63	12-1-64	12-1-65	12-1-66
1	0.56 m	0.56 m	1.6 m	1.88 m
	1.57 m	1.59 m	0.76 m	1.18 dt(3.5, 14.5, 14.5)
2	1.40 m	1.38 m	1.63 m	2.65 dt(3.5, 14.5, 14.5)
	1.60 m	1.57 m	1.46 m	2.21 dt(14.5, 3.5, 3.0)
3	1.11 m, 1.36 m	1.08 m, 1.36 m	3.20 dd(12, 3.5)	
5	0.83 m	0.82 m	1.3~1.5 m	1.28 dd(12.5, 3.0)
6	1.40 m	1.38 m	1.6 m	1.61 dq(3.5, 12.5, 12.5, 12.5)
	1.60 m	1.57 m	1.58 m	1.52 br d(12.5)
7	1.00 m	1.04 m	1.67 m	1.78 dt(12.5, 3.5, 3.5)
	1.91 m	1.82 dt(12.5, 3)	0.92 m	1.06 dt(12.5, 12.5, 3)
9	1.25 dd(13, 3)	1.22 dd(14.5, 1.5)	1.20 dd(13, 2.5)	1.35 br d(12.5)
11	1.64 m	1.62 m	1.63 m	1.85 br t(14.5)
	1.95 ddd(15, 4, 2)	1.92 ddd(14.5, 4, 2)	1.53 m	1.7 br d(14.5)
12	5.30 dd(4, 2)	4.86 dd(4, 3)	4.90 t(3)	4.96 t(3)
14	2.60 t(2.5)	1.40 dd(12, 2)	1.54 m	1.62 d(11)
15	6.10 dd(8, 2.5)	1.49 ddd(12.5, 12, 11)	2.20 m	2.14 dq(17, 3, 3.3)
		2.18 ddd(12.5, 7, 2)	1.86 m	1.93 m
16	6.29 dd(8, 2.5)	4.50 ddd(11, 7, 1.5)	5.28 t(3)	5.34 t(3)
18		4.89 d(1.5)	2.77 br s	2.84 br s
19	6.07 br d(6)	5.93 t(1.5)	5.15 d(3.5)	5.21 d(3)
20			4.47 br s	4.62 br s
21	0.85 s	0.84 s	0.96 s	1.05 s
22	0.80 s	0.78 s	1.86 m	1.86 dq(12, 7)
			1.35 dq(12, 7)	1.39 dq(12, 7)
23	0.81 s	0.78 s	0.79 s	1.13 s

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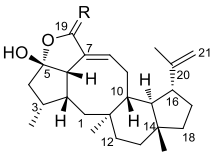
Table 12-1-22 (continued)

H	12-1-63	12-1-64	12-1-65	12-1-66
24	1.04 s	0.87 s	0.86 s	0.97 s
25	1.17 s	0.74 s	0.71 s	0.79 s
26			1.20 d(5.5)	1.26 d(6)
27			0.88 t(7.5)	0.68 t(7.5)
29			2.04 s	2.06 s
12-OAc	2.12 s	2.09 s		
19-OH	4.40 d(6)			

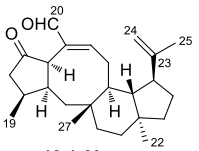
12.1.6 Sesterterpenoids of complex structure

Table 12-1-23: Compounds, MFs, and test solvents of sesterterpenoids of complex structure **12-1-67**~**12-1-79**.

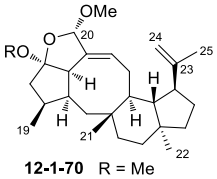
No.	Compounds	MFs	Test solvents	References
12-1-67	variecolol	$C_{25}H_{38}O_2$	$CDCl_3$	[24]
12-1-68	variecolactone	$C_{25}H_{36}O_3$	$CDCl_3$	[24]
12-1-69	variecolin	$C_{25}H_{36}O_2$	$CDCl_3$	[25]
12-1-70	variecoacetal A	$C_{27}H_{42}O_3$	$CDCl_3$	[25]
12-1-71	variecoacetal B	$C_{28}H_{44}O_3$	$CDCl_3$	[25]
12-1-72	6-*epi*-ophiobolin G	$C_{25}H_{34}O_2$	$CDCl_3$	[26]
12-1-73	ophiobolin G	$C_{25}H_{34}O_2$	$CDCl_3$	[26]
12-1-74	6-*epi*-ophiobolin N	$C_{25}H_{36}O_2$	$CDCl_3$	[26]
12-1-75	ophiobolin H	$C_{25}H_{38}O_3$	$CDCl_3$	[26]
12-1-76	6-*epi*-ophiobolin C	$C_{25}H_{38}O_3$	$CDCl_3$	[26]
12-1-77	ophiobolin C	$C_{25}H_{38}O_3$	$CDCl_3$	[26]
12-1-78	6-*epi*-ophiobolin K	$C_{25}H_{36}O_3$	$CDCl_3$	[26]
12-1-79	ophiobolin K	$C_{25}H_{36}O_3$	$CDCl_3$	[26]



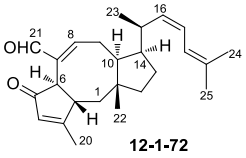
12-1-67 R = H_2
12-1-68 R = O



12-1-69



12-1-70 R = Me
12-1-71 R = Et



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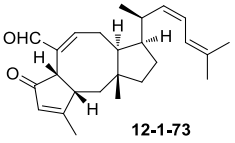

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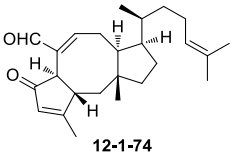

12-1-74

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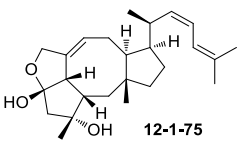
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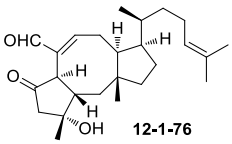
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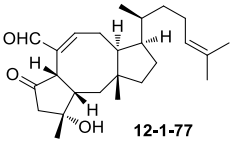
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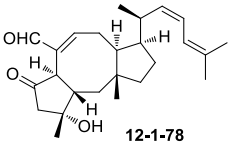
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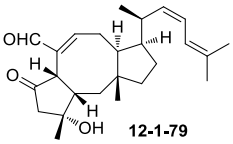
12-1-79

Table 12-1-24: ^{1}H NMR spectroscopic data of sesterterpenoids of complex structure **12-1-67**~**12-1-70**.

H	12-1-67	12-1-68	12-1-69	12-1-70
1	1.00 br d(14)	1.09 br d(14)	1.20 br d(14.3)	0.99 br d(13.5)
	1.76 dd(14, 13)	1.51 m	1.53 dd(14.3, 11.9)	1.66 m
2	2.67 br ddd(13, 11, 5)	2.78 m	2.62 m	2.61 m
3	2.16 qdd(7, 7, 5)	2.22 m	2.38 m	2.20 m
4	1.90 br d(13)	2.13 m	2.38 m	2.00 m
	2.41 br dd(13, 7)	2.22 m	2.50 dd(18.6, 8.3)	
6	3.37 br d(11)	3.59 dd(10, 2)	3.55 d(10.3)	3.49 d(11.4)
8	5.44 m	6.96 m	6.89 dd(5.1, 1.1)	5.77 dd(5.8, 2.9)
9	2.08 m	2.13 m	2.19 m	1.90 m
	2.10 dd(13, 3)	2.76 ddd(14, 3, 3)	2.83 br d(17.0)	2.49 br d(19.8)
10	1.93 m	2.13 m	2.19 m	2.15 m
12	0.94 m	0.99 ddd(14, 3, 3)	1.01 dt(13.8, 2.6)	0.90 dt(13.6, 3.3)
	1.97 m	1.98 m	1.85 td(13.8, 4.4)	1.97 m
13	1.21 br dd(11, 10)	1.51 m	1.42 m	1.50 m
	1.38~1.52 m			
15	1.38~1.52 m	1.51 m	1.42 m	1.45 m
16	2.37 ddd(11, 11, 5)	2.39 ddd(11, 11, 6)	2.38 m	2.29 td(11.2, 5.3)
17	1.33 br ddd(14, 10, 6)	1.37 m	1.20 m	1.37 m
	1.97 m	1.98 m	1.95 m	2.00 m
18	1.38~1.52 m	1.24 m, 1.51 m	1.20 m, 1.42 m	1.20 m, 1.45 m
19	4.55 br d(12)	–	0.77 d(7.3)	0.74 d(7.6)
	4.62 dddd(12, 2, 2, 2)			
20			9.16 s	5.26 s
21	4.58 br s	4.63 br s	0.91 s	0.87 s
	4.69 br s	4.71 br s		
22	–	–	0.81 s	0.78 s
24			4.61 br t(1.5)	4.52 d(1.6)
			4.70 br d(1.5)	4.62 d(1.6)
25			1.69 br s	1.63 s
3-Me	0.81 d(7)	0.69 d(8)		

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Table 12-1-24 (continued)

H	12-1-67	12-1-68	12-1-69	12-1-70
5-OMe				3.38 s
11-Me	0.90 s	0.91 s		
14-Me	0.85 s	0.87 s		
20-Me	1.68 br s	1.70 br s		
20-OMe				3.42 s

Table 12-1-25: ^{1}H NMR spectroscopic data of sesterterpenoids of complex structure **12-1-71**~**12-1-74**.

H	12-1-71	12-1-72	12-1-73	12-1-74
1	1.02 br d(12.7)	*α* 1.15 t(13.2)	*α* 1.34 m	*α* 1.16 t(13.0)
	1.69 br t(12.7)	*β* 2.03 m	*β* 1.89 m	*β* 2.04 m
2	2.65 m	2.65 m	3.11 br s	2.68 m
3	2.11 br t(11.4)			
4	2.01 m	6.02 s	6.05 s	6.04 s
6	3.48 br d(8.6)	3.38 br s	4.16 br s	3.45 d(4.3)
8	5.79 dd(6.0, 3.2)	6.79 d(6.1)	7.06 m	6.84 d(4.4)
9	1.92 m	*α* 2.92 d(20.6)	*α* 2.88 d(19.1)	*α* 2.71 m
	2.49 br d(19.5)	*β* 2.20 m	*β* 2.30 m	*β* 2.23 m
10	2.16 m	2.61 m	1.90 m	2.71 m
12	0.93 m	1.44 m	1.34 m	1.43 m
	1.95 m	1.52 m	1.40 m	1.51 m
13	1.46 m	*α* 1.28 m	*α* 1.27 m	*α* 1.25 m
		β 1.67 m	*β* 1.66 m	*β* 1.61 m
14		1.88 m	1.83 m	1.74 m
15	1.48 m	2.58 m	2.51 m	1.43 m
16	2.35 td(11.0, 5.3)	5.10 t(10.5)	5.11 m	0.99 m
				1.43 m
17	1.30 m	6.09 t(10.5)	5.98 m	1.93 m
	1.96 m			1.93 m
18	1.20 m	6.00 d(10.5)	5.98 m	5.12 t(6.9)
	1.42 m			
19	0.76 d(6.6)			
20	5.28 s	2.06 s	2.21 s	2.07 s
21	0.90 s	9.27 s	9.38 s	9.31 s
22	0.83 s	0.85 s	0.78 s	0.86 s
23		0.96 d(6.6)	0.86 d(6.6)	0.90 d(6.6)
24	4.54 d(2.1)	1.76 s	1.74 s	1.61 s
	4.64 d(2.1)			
25	1.65 s	1.82 s	1.82 s	1.69 s
5-OEt	1.24 t(7.3)			
	3.59 dq(9.0, 7.3)			
	3.78 dq(9.0, 7.3)			
20-OMe	3.42 s			

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Table 12-1-26: ^{1}H NMR spectroscopic data of sesterterpenoids of complex structure **12-1-75**~**12-1-79**.

H	12-1-75	12-1-76	12-1-77	12-1-78	12-1-79
1*α*	1.42 m	1.56 m	1.23 m	1.51 m	1.21 m
1*β*	1.52 m	1.76 m	1.78 m	1.83 m	1.77 m
2	2.24 m	2.15 m	2.36 m	2.13 m	2.36 m
4	2.06 d(13.5)	2.42 d(16.5)	2.47 d(20.1)	2.44 d(16.4)	2.51 d(18.9)
	2.15 d(13.5)	3.08 d(16.5)	2.77 d(20.1)	3.04 d(16.4)	2.78 d(18.9)
6	3.15 m	3.35 d(10.3)	3.24 d(9.6)	3.24 d(11.0)	3.26 d(10.3)
8	5.62 m	6.89 d(5.5)	7.18 t(8.5)	6.80 d(4.9)	7.11 t(8.5)
9*α*	2.46 m	2.61 m	2.28 m	2.79 m	2.11 m
9*β*	1.69 m	2.21 m	2.42 m	2.36 d(17.1)	2.95 m
10	1.59 m	2.61 m	2.63 m	2.49 m	1.59 m
12	1.36 m, 1.42 m	1.47 m, 1.47 m	1.39 m, 1.43 m	1.40 m, 1.45 m	1.40 m, 1.40 m
13*α*	1.27 m	1.16 m	1.43 m	1.18 m	1.25 m
13*β*	1.73 m	1.56 m	1.52 m	1.61 m	1.61 m
14	2.06 m	1.76 m	2.36 m	1.82 m	2.07 m
15	2.67 m	1.47 m	1.62 m	2.47 m	2.71 m
16	5.19 m	0.98 m, 1.47 m	1.15 m, 1.23 m	5.06 t(11.2)	5.18 t(9.7)
17	5.98 m	1.91 m, 2.07 m	1.95 m, 2.07 m	6.02 t(11.2)	6.01 m
18	5.98 m	5.12 t(6.9)	5.07 t(6.9)	5.95 d(11.2)	5.97 m
20	1.22 s	1.44 s	1.33 s	1.37 s	1.34 s
21	4.59 d(12.1)	9.20 s	9.20 s	9.09 s	9.21 s
	4.78 d(12.1)				
22	0.89 s	0.84 s	0.88 s	0.76 s	0.95 s
23	0.87 d(6.6)	0.89 d(6.6)	0.76 d(6.6)	0.91 d(6.6)	0.92 d(6.6)
24	1.72 s	1.60 s	1.58 s	1.69 s	1.74 s
25	1.80 s	1.69 s	1.66 s	1.76 s	1.81 s

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12.2 Tetraterpenoids and carotenoids

12.2.1 Tetraterpenoids

Table 12-2-1: Compounds, MFs, and test solvents of tetraterpenoids **12-2-1**~**12-2-60**.

No.	Compounds	MFs	Test solvents	References
12-2-1	1′-*β*-glucopyranosyl-3,4,3′,4′-tetradehydro-1′,2′-dihydro-*β*,*ψ*-caroten-2-one	$C_{46}H_{62}O_7$	CD_3OD	[27]
12-2-2	(3*R*,3′*R*,5*S*)-3,3′,5,19′-tetrahydroxy-7′,8′-didehydroxy-*γ*,*ε*,-carotene-8-one	$C_{40}H_{54}O_5$	$CDCl_3$	[28]
12-2-3	sapotexanthin	$C_{40}H_{56}O$	$CDCl_3$	[29]
12-2-4	adonixanthin diglucoside	$C_{52}H_{74}O_{13}$	CD_3OD	[30]
12-2-5	(3*S*,5*R*,6*R*,6′*S*)-3,5,6′-trihydroxy-3′-oxo-6,7-didehydro-5,6-dihydro-10,11,20-trinor-*β*,*ε*-caroten-19′,11′-olide 3-acetate	$C_{39}H_{48}O_7$	$CDCl_3$	[31]
12-2-6	(3*S*,5*R*,6*R*)-5-hydroxy-3,6:3′,6′-diepoxy-5,6,1′,2′,5′,6′,7′,8′-octahydro-6′-methyl-16′-nor-*β*,*φ*-carotene-1′,8′-dione	$C_{40}H_{56}O_5$	$CDCl_3$	[31]
12-2-7	(3*S*,5*R*,6*R*,3′*R*)-3,6-epoxy-7′,8′-didehydro-5,6-dihydro-*β*,*β*-carotene-5,3′-diol	$C_{40}H_{54}O_3$	$CDCl_3$	[31]
12-2-8	(3*S*,5*R*,6*R*,3′*S*,5′*R*)-5,3′,8′-trihydroxy-3,6-epoxy-5,6-di-hydro-*β*,*κ*-caroten-6′-one	$C_{40}H_{56}O_5$	$CDCl_3$	[31]
12-2-9	(3*S*,5*R*,6*R*,3′*S*,5′*R*)-3,5,3′,8′-tertahydroxy-6,7-didehydro-5,6-dihydro-*β*,*κ*-caroten-6′-one	$C_{40}H_{56}O_5$	$CDCl_3$	[31]
12-2-10	(all-*E*)-(3*S*,5*R*,3′*S*)-4′,5-retro-*β*,*β*-carotene-3,5,3′-triol	$C_{40}H_{56}O_3$	$CDCl_3$	[32]
12-2-11	salmoxanthin	$C_{40}H_{56}O_4$	$CDCl_3$	[33]
12-2-12	deepoxysalmoxanthin	$C_{40}H_{56}O_3$	$CDCl_3$	[33]
12-2-13	salinixanthin	$C_{61}H_{92}O_9$	$CDCl_3$-CD_3OD (1:1)	[34]
12-2-14	(all-*E*,2′*S*)-2′-hydroxy-1′-*β*-D-glucopyranosyloxy-3′,4′-di-dehydro-1′,2′-dihydro-*β*,*ψ*-caroten-4-one	$C_{46}H_{64}O_8$	$CDCl_3$-CD_3OD (1:1)	[34]
12-2-15	(4*S*,5*S*,6*S*,4′*S*,5′*S*,6′*S*)-5,6,5′,6′-tetrahydro-*β*,*β*-carotene-4,4′-diol	$C_{40}H_{60}O_2$	$CDCl_3$	[35]
12-2-16	(3*S*,4*R*,5*S*,6*S*,4′*S*,5′*S*,6′*S*)-5,6,5′,6′-tetrahydro-*β*,*β*-carotene-3,4,4′-triol	$C_{40}H_{60}O_3$	$CDCl_3$	[35]
12-2-17	(3*S*,4*R*,5*S*,6*S*,3′*S*,4′*R*,5′*S*,6′*S*)-5,6,5′,6′-tetrahydro-*β*,*β*-car-otene-3,4,3′,4′-tetrol	$C_{40}H_{60}O_4$	$CDCl_3$	[35]
12-2-18	(5*S*,6*S*,4′*S*,5′*S*,6′*S*)-4′-hydroxy-5,6,5′,6′-tetrahydro-*β*,*β*-caroten-4-one	$C_{40}H_{58}O_2$	$CDCl_3$	[35]
12-2-19	(4′*S*,5′*S*,6′*S*)-4′-hydroxy-5′,6′-dihydro-*β*,*β*-caroten-4-one	$C_{40}H_{56}O_2$	$CDCl_3$	[35]
12-2-20	3′-deoxycapsanthin	$C_{40}H_{56}O_2$	$CDCl_3$	[36]
12-2-21	3, 4-didehydroxy-3′-deoxycapsanthin	$C_{40}H_{54}O$	$CDCl_3$	[36]
12-2-22	(3*S*,3′*S*)-astaxanthin-*β*-D-glucoside	$C_{46}H_{62}O_9$	$CDCl_3$	[37]

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Table 12-2-1 (continued)

No.	Compounds	MFs	Test solvents	References
12-2-23	(3*S*,3′*R*)-adonixanthin-*β*-D-glucoside	$C_{46}H_{64}O_8$	$CDCl_3$	[37]
12-2-24	corbiculaxanthin	$C_{40}H_{56}O_4$	$CDCl_3$	[38]
12-2-25	corbiculaxanthin 3′-acetate	$C_{42}H_{58}O_5$	$CDCl_3$	[38]
12-2-26	6-epiheteroxanthin	$C_{40}H_{56}O_4$	$CDCl_3$	[38]
12-2-27	7′,8′-didehydrodeepoxyneoxanthin	$C_{40}H_{54}O_3$	$CDCl_3$	[38]
12-2-28	cyclopyrrhoxanthin	$C_{39}H_{48}O_6$	$CDCl_3$	[38]
12-2-29	hydratoperidinin	$C_{39}H_{52}O_8$	$CDCl_3$	[38]
12-2-30	(3*R*,6′*R*)-*α*-cryptoxanthin	$C_{40}H_{56}O$	$CDCl_3$	[39]
12-2-31	(3*R*)-*β*-cryptoxanthin	$C_{40}H_{56}O$	$CDCl_3$	[39]
12-2-32	(3*R*,5′*RS*,6′*R*)-3′,4′-didehydro-5′,6′-dihydro-*β*,*β*-caroten-3-ol	$C_{40}H_{56}O$	$CDCl_3$	[39]
12-2-33	4-ketodeepoxyneoxanthin	$C_{40}H_{54}O_4$	$CDCl_3$	[40]
12-2-34	4-keto-4′-hydroxydiatoxanthin	$C_{40}H_{52}O_4$	$CDCl_3$	[40]
12-2-35	3′-epigobiusxanthin	$C_{40}H_{54}O_3$	$CDCl_3$	[40]
12-2-36	7,8-dihydrodiadinoxanthin	$C_{40}H_{56}O_3$	$CDCl_3$	[40]
12-2-37	(9*Z*)-capsanthin-5,6-epoxide	$C_{40}H_{56}O_4$	$CDCl_3$	[41]
12-2-38	synechoxanthin dimethyl ester	$C_{42}H_{48}O_4$	CD_2Cl_2	[42]
12-2-39	cucumariaxanthin A	$C_{40}H_{56}O_2$	C_6D_6	[43]
12-2-40	cucumariaxanthin B	$C_{40}H_{58}O_2$	C_6D_6	[43]
12-2-41	cucumariaxanthin C	$C_{40}H_{60}O_2$	C_6D_6	[43]
12-2-42	(all-*E*,3*R*,3′*R*)-zeaxanthin-di-*β*-D-glucopyranoside	$C_{52}H_{76}O_{12}$	CD_3OD	[44]
12-2-43	(all-*E*,3*R*,3′*R*)-zeaxanthin-di-*α*-L-rhamnopyranoside	$C_{52}H_{76}O_{10}$	CD_3OD	[44]
12-2-44	(9*Z*,3*R*,3′*R*)-zeaxanthin-di-*α*-L-rhamnopyranoside	$C_{52}H_{76}O_{10}$	CD_3OD	[44]
12-2-45	(all-*E*,3*R*,3′*R*)-zeaxanthin-*α*-L-rhamnopyranoside	$C_{46}H_{66}O_6$	CD_3OD	[44]
12-2-46	(9*Z*,3*R*,3′*R*)-zeaxanthin-*α*-L-rhamnopyranoside	$C_{46}H_{66}O_6$	CD_3OD	[44]
12-2-47	(13*Z*,3*R*,3′*R*)-zeaxanthin-*α*-L-rhamnopyranoside	$C_{46}H_{66}O_6$	CD_3OD	[44]
12-2-48	diadinoxanthin B	$C_{40}H_{54}O_3$	$CDCl_3$	[45]
12-2-49	antheraxanthin A	$C_{40}H_{56}O_3$	$CDCl_3$	[45]
12-2-50	antheraxanthin B	$C_{40}H_{56}O_3$	$CDCl_3$	[45]
12-2-51	gobiusxanthin	$C_{40}H_{54}O_3$	$CDCl_3$	[45]
12-2-52	pittosporumxanthin B1	$C_{69}H_{104}O_5$	$CDCl_3$	[46]
12-2-53	pittosporumxanthin B2	$C_{69}H_{104}O_5$	$CDCl_3$	[46]
12-2-54	pittosporumxanthin C1	$C_{69}H_{104}O_6$	$CDCl_3$	[46]
12-2-55	pittosporumxanthin C2	$C_{69}H_{104}O_6$	$CDCl_3$	[46]
12-2-56	pittosporumxanthin A3	$C_{69}H_{104}O_6$	$CDCl_3$	[46]
12-2-57	pittosporumxanthin A4	$C_{69}H_{104}O_6$	$CDCl_3$	[46]
12-2-58	(3*S*,5*R*,6*R*,3′*S*,5′*R*,6′*S*)-13-*cis*-7′,8′-dihydroneoxantbin-20′-al 3′*β*-lactoside (P457)	$C_{53}H_{78}O_{14}$	CD_3OD	[47]
12-2-59	P457 octaacetate	$C_{69}H_{94}O_{22}$	$CDCl_3$	[47]
12-2-60	P457 heptaacetate	$C_{67}H_{92}O_{21}$	$CDCl_3$	[47]

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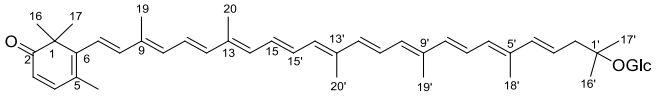

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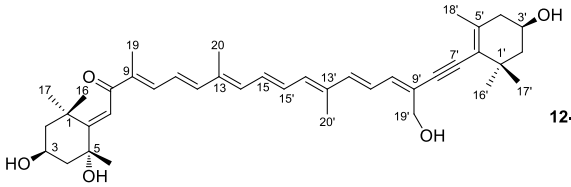

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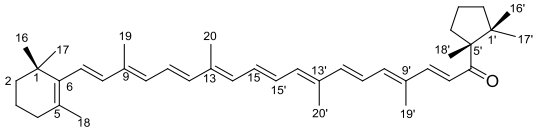

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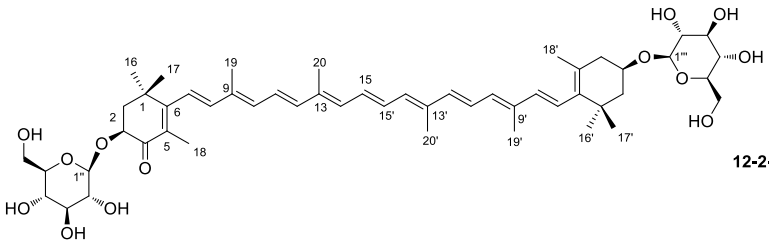
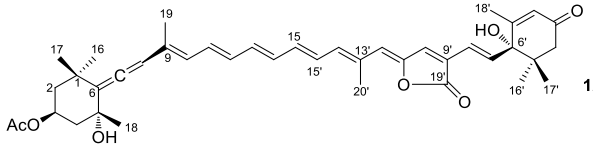
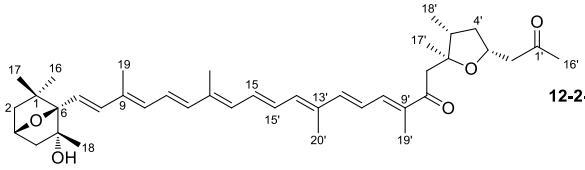


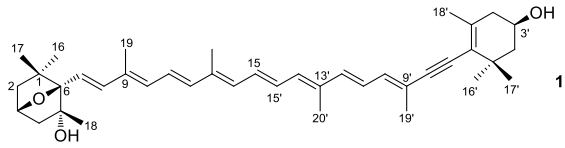
12-2-4



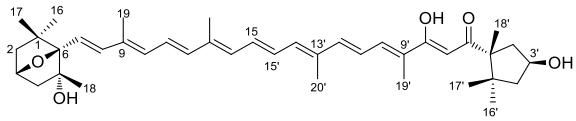
12-2-5



12-2-6



12-2-7



12-2-8

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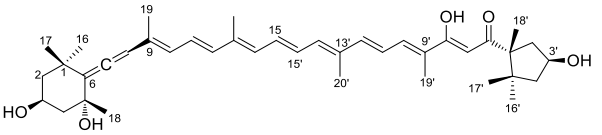
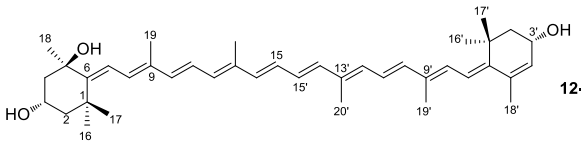
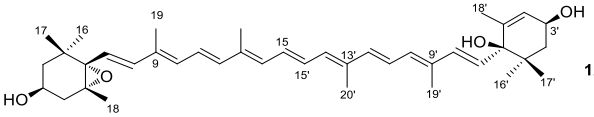


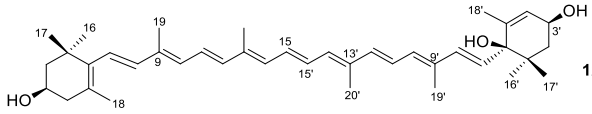
12-2-9



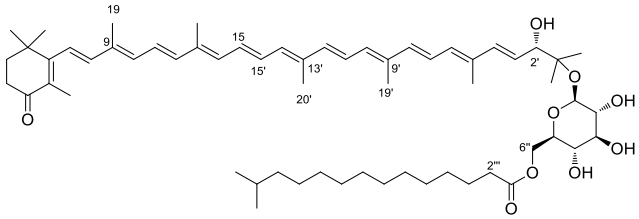
12-2-10



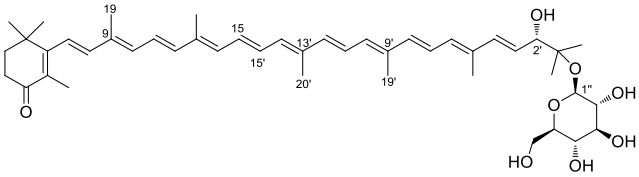
12-2-11



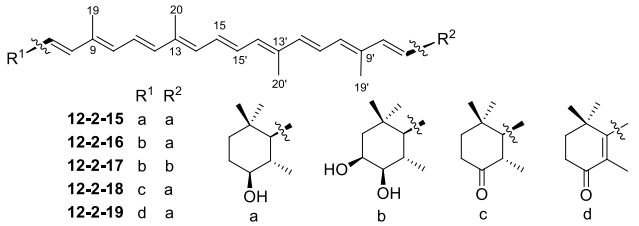
12-2-12



12-2-13

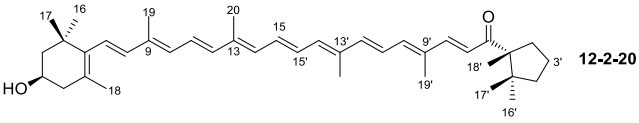


12-2-14



	R^1	R^2
12-2-15	a	a
12-2-16	b	a
12-2-17	b	b
12-2-18	c	a
12-2-19	d	a

a b c d



12-2-20

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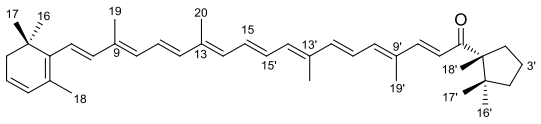
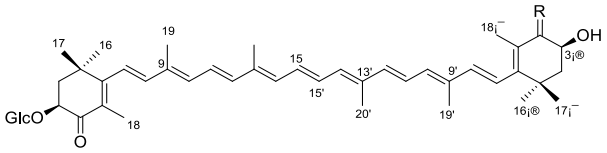
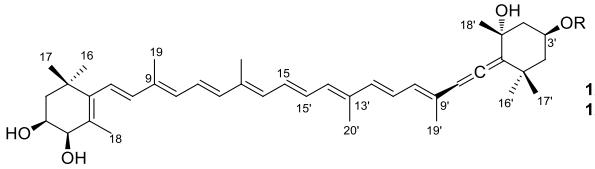


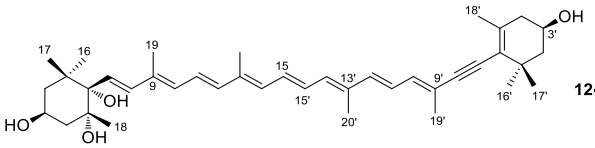
12-2-21



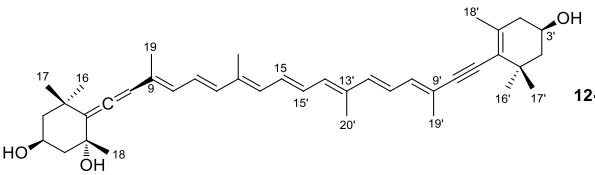
12-2-22 R = O
12-2-23 R = H_2



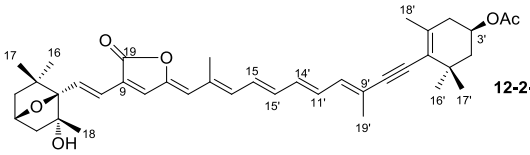
12-2-24 R = H
12-2-25 R = Ac



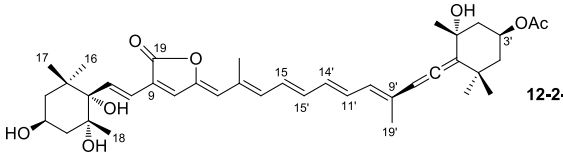
12-2-26



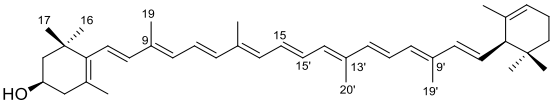
12-2-27



12-2-28



12-2-29



12-2-30

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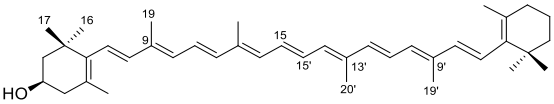
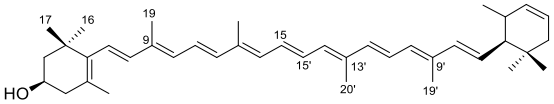
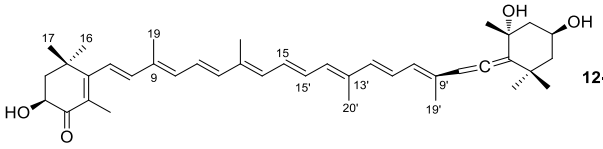


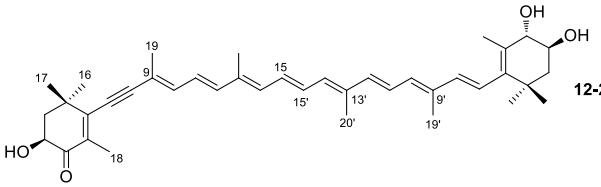
12-2-31



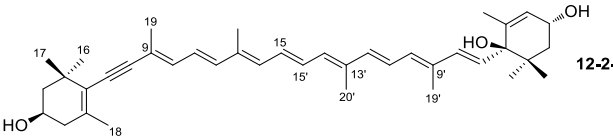
12-2-32



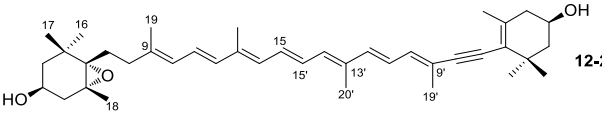
12-2-33



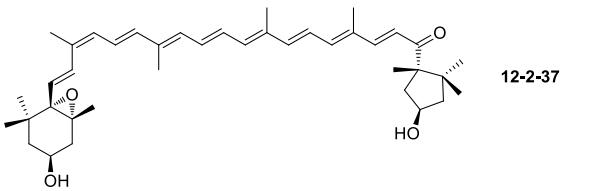
12-2-34



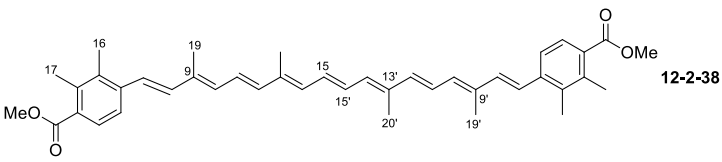
12-2-35



12-2-36



12-2-37



12-2-38

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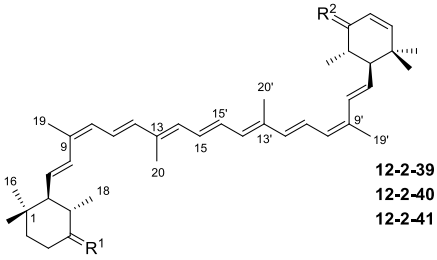
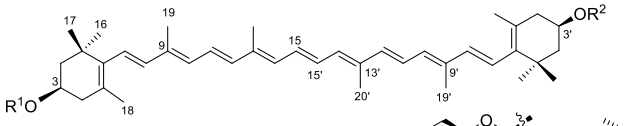
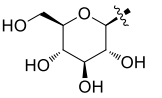


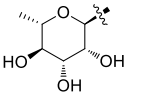
	R^1	R^2
12-2-39	O	O
12-2-40	O	β-OH, α-H
12-2-41	β-OH, α-H	β-OH, α-H



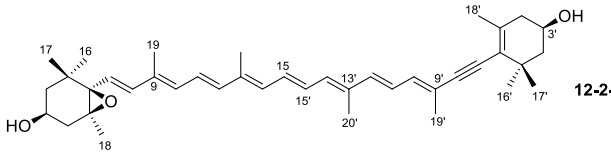
	R^1	R^2		R^1	R^2	
12-2-42	a	a	(All *E*)	**12-2-45**	b	H	(All *E*)
12-2-43	b	b	(All *E*)	**12-2-46**	b	H	(9*Z*)
12-2-44	b	b	(9*Z*)	**12-2-47**	b	H	(13*Z*)



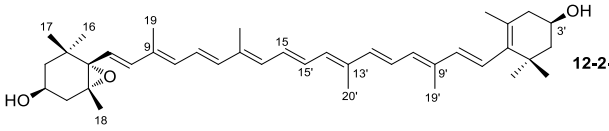
a(β-D-Glc)



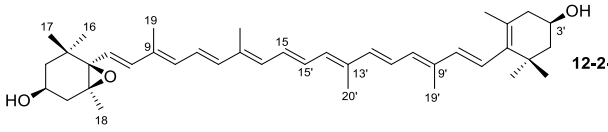
b(α-L-Rha)



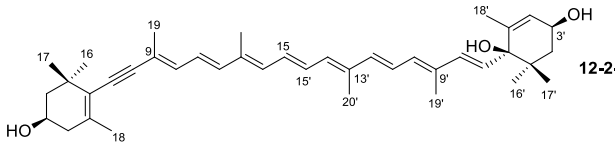
12-2-48



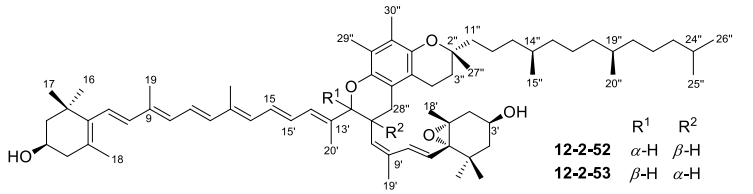
12-2-49



12-2-50



12-2-51



	R^1	R^2
12-2-52	α-H	β-H
12-2-53	β-H	α-H

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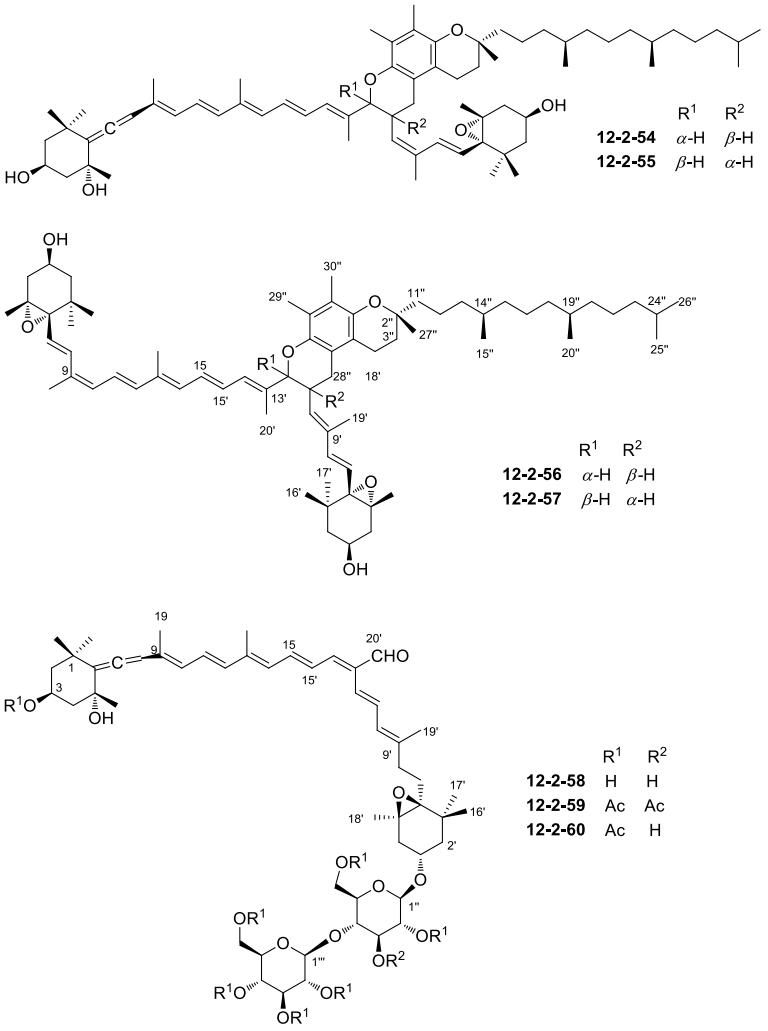

Table 12-2-2: ^{1}H NMR spectroscopic data of tetraterpenoids **12-2-1**~**12-2-4**.

H	12-2-1	12-2-2	12-2-3	12-2-4
2		ax 1.42 ddd(12.8, 4.4, 2.0) eq 1.73 ddd(12.8, 4.4, 2.0)	1.47	1.94 dd(14, 14) 2.24 dd(14, 5)
3	6.19 d(9.9)	4.28 m	1.62	4.62 dd(14, 5)
4	6.98 d(9.9)	ax 1.53 ddd(12.8, 4.4, 1.6) eq 2.22 ddd(12.8, 4.4, 1.6)	2.03 (5.7)	
7	6.39 d(15.8)	6.33 s	6.17	6.32 d(16)
8	6.58 d(15.8)		6.14	6.50 d(16)

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Table 12-2-2 (continued)

H	12-2-1	12-2-2	12-2-3	12-2-4
10	6.24 d(11.3)	7.12 d(9.2)	6.17 d(12.7)	6.32 d(11)
11	6.71 dd(ov)	6.25~6.75	6.66 dd(12.7, 14.4)	6.72 (ov)
12	6.40 d(ov)	6.25~6.75	6.35 d(14.4)	6.50 d(15.5)
14	6.35 m(ov)	6.25~6.75	6.27	6.32 d(11)
15	6.65 m(ov)	6.25~6.75	6.63 m	6.72 (ov)
16	1.31 s	1.04 s	1.03 s	1.354 s
17	1.31 s	1.35 s	1.03 s	1.223 s
18	2.07 s	1.53 s	1.71 s	1.891 s
19	2.01 s	1.94 s	1.96 s	2.012 s
20	1.98 s	1.98 s	1.97 s	1.986 s
2′	2.42 d(7.4)	ax 1.44 ddd(12.4, 3.6, 2.4)	ax 1.68 m eq 1.57 m	1.54 dd(11, 11)
		eq 1.82 ddd(12.4, 3.6, 2.4)		1.94 (ov)
3′	5.88 dt(7.4, 15.4)	3.98 m	1.68 m	4.12 m
4′	6.17 d(15.4)	ax 2.06 ddd(17.6, 9.6, 1.2)	ax 1.48 m	2.12 dd(18, 11)
		eq 2.42 ddd(17.6, 5.6, 1.6)	eq 2.52 m	2.49 dd(18, 6)
6′	6.11 d(11.6)			
7′	6.65 dd(11.6, 14.8)		6.48 d(15.0)	6.13 d(16)
8′	6.35 d(14.8)		7.32 d(15.0)	6.16 d(16)
10′	6.32 d(11.4)	*ca.* 6.5	6.56 d(11.0)	6.17 d(11.5)
11′	6.72 dd(11.4, 14.9)	6.25~6.75	6.63 dd(11.0, 15.5)	6.72 (ov)
12′	6.50 d(14.9)	6.25~6.75	6.53 d(15.5)	6.40 d(15.5)
14′	6.35 m(ov)	6.25~6.75	6.34 d(10.9)	6.32 d(11)
15′	6.65 m(ov)	6.25~6.75	6.63 m	6.72 (ov)
16′	1.26 s	1.19 s	0.85 s	1.082 s
17′	1.26 s	1.13 s	1.11 s	1.065 s
18′	1.93 s	1.92 s	1.18 s	1.741 s
19′	2.00 s	4.37 d(6.0)	1.97 s	1.980 s
20′	1.98 s	1.95 s	1.98 s	1.986 s
1″	4.52 d(7.8)			4.52 d(7.5)
2″	3.15 dd(7.8, 9.0)			3.66 dd(10, 7.5)
3″	3.36 dd(9.0, 9.0)			3.52 (ov)
4″	3.28 dd(9.0, 4.5)			3.83 m
5″	3.25 m			3.52 (ov)
6″	3.65 dd(2.4, 11.8)			3.74 m
	3.52 dd(4.4, 11.8)			
1‴				4.40 d(6.5)
2‴				3.50 dd(10, 6.5)
3‴				3.53 (ov)
4‴				3.83 m
5‴				3.52 (ov)
6‴				3.74 m

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Table 12-2-3: ^{1}H NMR spectroscopic data of tetraterpenoids **12-2-5**~**12-2-9**.

H	12-2-5	12-2-6	12-2-7	12-2-8	12-2-9
2α	2.00 ddd(12, 4, 2)	1.61 d(11.5)	1.61 d(11.5)	1.61 d(11.5)	1.95 ddd(12, 4, 2)
2β	1.41 dd(12, 12)	1.84 ddd(11.5, 6, 2)	1.84 dm(11.5)	1.84 ddd(11.5, 6, 2)	1.34 dd(12, 12)
3	5.37 m	4.39 t(6)	4.39 t(6)	4.39 t(6)	4.32 m
4α	2.29 ddd(13, 4, 2)	1.67 d(12)	1.67 d(12)	1.67 d(12)	2.26 ddd(13, 4, 2)
4β	1.51 dd(13, 13)	2.06 ddd(12, 6, 2)	2.06 ddd(12, 6, 2)	2.06 ddd(12, 6, 2)	1.41 dd(13, 13)
7		5.75 d(16)	5.75 d(16)	5.75 d(16)	
8	6.06 s	6.38 d(16)	6.38 d(16)	6.38 d(16)	6.04 s
10		6.21 d(11.5)	6.20 d(11.5)	6.21 d(11.5)	6.12 d(11.5)
11		6.66 dd(15, 11.5)	6.63 dd(15, 11.5)	6.64 dd(15, 11.5)	6.59 dd(15, 11.5)
12	6.12 d(11.5)	6.37 d(15)	6.36 d(15)	6.37 d(15)	6.35 d(15)
13	6.62 dd(14.5, 11.5)				
14	6.36 dd(14.5, 11.5)	6.27 d(11.5)	6.26 d(10)	6.28 d(11)	6.26 d(11.5)
15	6.53 dd(14.5, 11.5)	6.74 dd(14.5, 11.5)	6.63 m	6.72 dd(14.5, 11.5)	6.72 dd(14.5, 11.5)
16	1.39 s	1.44 s	1.44 s	1.44 s	1.34 s
17	1.07 s	0.89 s	0.89 s	0.89 s	1.07 s
18	1.35 s	1.22 s	1.22 s	1.22 s	1.35 s
19	1.80 s	1.96 s	1.96 s	1.96 s	1.81 s
20		1.99 s	1.97 s	1.98 s	1.98 s
Ac	2.04 s				
2′α	2.55 d(18)	2.52 dd(15, 5)	1.84 ddd(12.5, 4, 2)	2.19 dd(13.5, 8)	2.19 dd(13.5, 8)
2′β	2.30 d(18)	2.69 dd(15, 7)	1.46 dd(12.5, 12.5)	1.72 dd(13.5, 4.5)	1.72 dd(13.5, 4.5)
3′		4.21 m	4.00 m	4.53 m	4.53 m
4′α	5.95 br s	1.31 ddd(12, 11, 10)	2.43 ddd(18, 5.5, 2)	2.88 dd(14.5, 8.5)	2.88 dd(14.5, 8.5)
4′β		2.17 ddd(12, 7, 5)	2.09 dd(18, 9)	1.55 dd(14.5, 2.5)	1.55 dd(14.5, 2.5)
5′		2.32 ddq(11, 7, 7)			
7′	6.97 d(15)	2.86 d(13.5) 2.93 d(13.5)		5.86 s	5.86 s
8′	6.55 d(15)				
10′	7.10 s	7.26 d(11)	6.46 d(11)	7.24 d(11)	7.24 d(11)
11′		6.59 dd(15, 11)	6.51 dd(14.5, 11.5)	6.60 dd(15, 11)	6.59 dd(15, 11)
12′	5.72 s	6.68 d(15)	6.36 d(14.5)	6.66 d(15)	6.65 d(15)

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Table 12-2-3 (continued)

H	12-2-5	12-2-6	12-2-7	12-2-8	12-2-9
14′	6.48 d(11.5)	6.42 d(11.5)	6.27 d(10)	6.38 d(11.5)	6.37 d(11.5)
15′	6.61 dd(14.5, 11.5)	6.66 dd(14.5, 11.5)	6.63 m	6.63 dd(14.5, 11.5)	6.63 dd(14.5, 11.5)
16′	1.11 s	2.14 s	1.15 s	0.85 s	0.85 s
17′	1.04 s	1.10 s	1.20 s	1.19 s	1.19 s
18′	1.91 d(1.2)	0.99 d(7)	1.92 s	1.35 s	1.35 s
19′		1.93 s	1.95 s	1.99 s	1.98 s
20′	2.23 s	1.99 s	2.01 s	1.99 s	1.99 s
8-OH				16.30 s	16.30 s

Table 12-2-4: ^{1}H NMR spectroscopic data of tetraterpenoids **12-2-10**~**12-2-14**.

H	12-2-10	12-2-11	12-2-12	12-2-13	12-2-14
2	ax 1.56 dd(13.5, 7.5) eq 1.87 ddd① (13.5, 5, 2)	*α* 1.63 ddd(14.5, 3, 1.5)	*α* 1.77 ddd(11.5, 3.5, 1.5)	1.89 t(6.8)	1.89 t(6.8)
		β 1.25 dd(14.5, 10)	*β* 1.48 dd(11.5, 11.5)		
3	4.25 m	3.91 m	4.00 m	2.51 t(6.8)	2.51 t(6.8)
4	ax 1.65 dd(13.5, 7.5) eq 2.18 ddd(13.5, 6.5, 2)①	*α* 2.39 ddd(14.5, 5, 1.5)	*α* 2.39 ddd(17, 5, 1.5)		
		β 1.63 dd(14.5, 8.5)	*β* 2.04 dd(17, 10)		
7	6.76 d(12)	5.88 d(15.5)	6.12	6.30 d(15.9)	6.30 d(15.9)
8	6.46 d(12)	6.29 d(15.5)	6.12	6.42 d(15.9)	6.42 d(15.9)
10	6.42 d(15)	6.20 d(11.5)	6.15 d(11.5)	6.32 m	6.32 m
11	6.65 dd(15, 11)	6.63 dd(15, 11.5)	6.64 dd(15, 11.5)	6.70 m	6.70 m
12	6.22 d(11)	6.37 d(15)	6.36 d(15)	6.47 d(15.0)	6.47 d(15.0)
14	6.40 m	6.26 m	6.25 m	6.33 m	6.33 m
15	6.40 m	6.64 m	6.64 m	6.69 m	6.69 m
16	1.41 s	0.98 s	1.07 s	1.23 s	1.23 s
17	1.37 s	1.15 s	1.07 s	1.23 s	1.23 s
18	1.54 s	1.19 s	1.74 s	1.86 s	1.86 s
19	1.95 s	1.93 s	1.97 s	2.02 s	2.02 s
20	1.97 s	1.97 s	1.97 s	2.00 s	2.00 s
2′	ax 1.51 dd(12, 8)	*α* 1.81 dd(14, 5.5)	*α* 1.81 dd(14, 5.5)	4.13 d(7.3)	4.13 d(7.3)
	eq 1.81 dd(12, 5)	*β* 1.66 dd(14, 7)	*β* 1.66 dd(14, 7)		
3′	4.35 m	4.24 m	4.24 m	5.70 dd(7.3, 15.6)	5.70 dd(7.3, 15.6)

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Table 12-2-4 (continued)

H	12-2-10	12-2-11	12-2-12	12-2-13	12-2-14
4′	5.75 br s	5.64 br s	5.64 br s	6.40 d(15.6)	6.40 d(15.6)
6′				6.20 d(11.3)	6.20 d(11.3)
7′	6.48 d(12)	5.63 d(15.5)	5.63 d(15.5)	6.63 dd(11.2, 14.9)	6.63 dd(11.2, 14.9)
8′	6.73 d(12)	6.38 d(15.5)	6.38 d(15.5)	6.39 d(15.0)	6.39 d(15.0)
10′	6.43 d(15)	6.22 d(11.5)	6.22 d(11.5)	6.25 d(11.3)	6.25 d(11.3)
11′	6.66 dd(15, 11)	6.62 d(15, 11.5)	6.62 d(15, 11.5)	6.68 m	6.68 m
12′	6.23 d(11)	6.37 d(15)	6.37 d(15)	6.41 d(15.5)	6.41 d(15.5)
14′	6.40 m	6.26 m	6.26 m	6.31 m	6.31 m
15′	6.40 m	6.64 m	6.64 m	6.70 m	6.70 m
16′	1.25 s	0.94 s	0.94 s	1.23 s	1.23 s
17′	1.45 s	1.02 s	1.02 s	1.28 s	1.28 s
18′	1.95 s	1.68 br s	1.68 br s	1.93 s	1.93 s
19′	1.97 s	1.92 s	1.92 s	1.99 s	1.99 s
20′	1.97 s	1.97 s	1.97 s	2.01 s	2.01 s
1″				4.55 d(7.8)	4.56 d
2″				3.26 dd(7.8, 9.1)	3.23 dd
3″				3.42 dd(9.1, 9.1)	3.40 dd
4″				3.28 dd(9.1, 9.1)	3.25 dd
5″				3.51 ddd	3.31 ddd(2.1, 7.7, 9.1)
6″				4.17 dd(7.7, −13.0)	3.68 dd
				4.44 dd(2.1, −13.0)	3.85 dd
2‴				2.34 t	
3‴				1.61 m	
4‴				1.29 m	
5‴-12‴				*ca.* 1.25 m	
13‴				1.51 m	
14‴-15‴				0.87 d	

① Typographic errors maybe exist in the original literature, giving two data of H-2eq.

Table 12-2-5: ^{1}H NMR spectroscopic data of tetraterpenoids **12-2-15**~**12-2-19**.

H	12-2-15	12-2-16	12-2-17	12-2-18	12-2-19
2ax	1.30 ddd(14.5, 10, 3.5)	1.43 dd(15, 3)	1.43 dd(15, 3)		1.85 t(6.5)
2eq	1.56 ddd(14.5, 3.5, 3.5)	1.84 dd(15, 3)	1.84 dd(15, 3)		1.85 t(6.5)
3ax	1.50 dddd(13.5, 10, 10, 3.5)	4.01 ddd(3.5, 3, 3)	4.01 ddd(3.5, 3, 3)		2.15 t(6.5)

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Table 12-2-5 (continued)

H	12-2-15	12-2-16	12-2-17	12-2-18	12-2-19
3eq	1.79 dddd(13.5, 3.5, 3.5, 3.5)				2.15 t(6.5)
4	3.14 ddd(10, 10, 3.5)	3.17 dd(10, 3.5)	3.17 dd(10, 3.5)		
5	1.41 ddq(10, 9, 6.5)	1.84 ddq(10, 9.5, 6.5)	1.84 ddq(10, 9.5, 6.5)		
6	1.48 dd(10, 9)	1.53 dd(9.5, 9.5)	1.53 dd(9.5, 9.5)		
7	5.40 dd(15.5, 9)	5.45 dd(15.5, 9.5)	5.45 dd(15.5, 9.5)	5.45 dd(15.5, 9.5)	6.24 d(15.5)
8	6.05 d(15.5)	6.02 d(15.5)	6.02 d(15.5)	6.07 d(15.5)	6.37 d(15.5)
10	6.12 d(11)	6.11 d(11)	6.11 d(11)	6.14 d(11)	6.28 d(11)
11	6.63 dd(15, 11)	6.62 dd(15, 11)	6.62 dd(15, 11)	6.62 dd(15, 11)	6.66 dd(15, 11)
12	6.34 d(15)	6.35 d(15)	6.35 d(15)	6.36 d(15)	6.43 d(15)
14	6.24 m	6.24 m	6.24 m	6.24 m	6.31 m
15	6.63 m	6.63 m	6.63 m	6.63 m	6.66 m
16	0.82 s	0.81 s	0.81 s	0.91 s	1.20 s
17	0.88 s	1.06 s	1.06 s	1.06 or 1.12 s	1.20 s
18	0.91 d(6.5)	0.93 d(6.5)	0.93 d(6.5)	0.94 d(6.5)	1.88 s
19	1.93 s	1.93 s	1.93 s	1.93 s	2.00 s
20	1.97 s	1.97 s	1.97 s	1.97 s	1.99 s
2′ax	1.30 ddd(14.5, 10, 3.5)	1.30 ddd(14.5, 10, 3.5)	1.43 dd(15, 3)	1.30 ddd(14.5, 10, 3.5)	1.30 ddd(14.5, 10, 3.5)
2′eq	1.56 ddd(14.5, 3.5, 3.5)	1.56 ddd(14.5, 3.5, 3.5)	1.84 dd(15, 3)	1.56 ddd(14.5, 3.5, 3.5)	1.56 ddd(14.5, 3.5, 3.5)
3′ax	1.50 dddd(13.5, 10, 10, 3.5)	1.50 dddd(13.5, 10, 10, 3.5)	4.01 ddd(3.5, 3, 3)	1.50 dddd(13.5, 10, 10, 3.5)	1.50 dddd(13.5, 10, 10, 3.5)
3′eq	1.79 dddd(13.5, 3.5, 3.5, 3.5)	1.79 dddd(13.5, 3.5, 3.5, 3.5)	1.79 dddd(13.5, 4.5, 3.5, 3.5)	1.79 dddd(13.5, 3.5, 3.5, 3.5)	1.79 dddd(13.5, 3.5, 3.5, 3.5)
4′	3.14 ddd(10, 10, 3.5)	3.14 ddd(10, 10, 3.5)	3.17 dd(10, 3.5)	3.14 ddd(10, 10, 3.5)	3.14 ddd(10, 10, 3.5)
5′	1.41 ddq(10, 9, 6.5)	1.41 ddq(10, 9, 6.5)	1.84 ddq(10, 9.5, 6.5)	1.41 ddq(10, 9, 6.5)	1.41 ddq(10, 9, 6.5)
6′	1.48 dd(10, 9)	1.48 dd(10, 9)	1.53 dd(9.5, 9.5)	1.48 dd(10, 9)	1.48 dd(10, 9)
7′	5.40 dd(15.5, 9)	5.40 dd(15.5, 9)	5.45 dd(15.5, 9.5)	5.40 dd(15.5, 9)	5.40 dd(15.5, 9)
8′	6.05 d(15.5)	6.05 d(15.5)	6.02 d(15.5)	6.05 d(15.5)	6.05 d(15.5)
10′	6.12 d(11)	6.12 d(11)	6.11 d(11)	6.12 d(11)	6.12 d(11)
11′	6.63 dd(15, 11)	6.63 dd(15, 11)	6.62 dd(15, 11)	6.63 dd(15, 11)	6.63 dd(15, 11)
12′	6.34 d(15)	6.34 d(15)	6.35 d(15)	6.34 d(15)	6.34 d(15)
14′	6.24 m	6.24 m	6.24 m	6.24 m	6.24 m
15′	6.63 m	6.63 m	6.63 m	6.63 m	6.63 m
16′	0.82 s	0.82 s	0.81 s	0.82 s	0.82 s
17′	0.88 s	0.88 s	1.15 s	0.88 s	0.88 s
18′	0.91 d(6.5)	0.91 d(6.5)	0.93 d(6.5)	0.91 d(6.5)	0.91 d(6.5)
19′	1.93 s	1.93 s	1.93 s	1.93 s	1.93 s
20′	1.97 s	1.97 s	1.97 s	1.97 s	1.97 s

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Table 12-2-6: ^{1}H NMR spectroscopic data of tetraterpenoids **12-2-20**~**12-2-24**.

H	12-2-20	12-2-21	12-2-22	12-2-23	12-2-24
2	*α* 1.77 ddd(11.5, 4, 2)	2.02 dd(4.5, 1.5)	2.04 t(14)	2.04 m	*α* 1.57 ddd(12.5, 4, 1)
	β 1.48 dd(11.5, 11.5)		2.15 dd(6, 14)	2.15 dd(6, 14)	*β* 1.68 dd(12.5, 12.5)
3	4.01 m	5.73 dt(9.5, 4.5)	4.40 dd(6, 14)	4.40 dd(6, 14)	3.87 m
4	*α* 2.39 ddd(17, 5, 2)	5.86 dt(9.5, 1.5)			3.96 d(3.5)
	β 2.05 dd(17, 9.5)				
7	6.10 d(16)	6.21 d(16)	6.21 d(16)	6.20 d(16)	6.07 d(16)
8	6.15 d(16)	6.30 d(16)	6.44 d(16)	6.44 d(16)	6.17 d(16)
10	6.16 d(11)	6.20 d(11)	6.30 m	6.30 m	6.10 d(11.5)
11	6.68 dd(15.5, 11)	6.70 dd(15.5, 11)	6.65 m	6.65 m	6.55 dd(15.5, 11.5)
12	6.37 d(15.5)	6.37 d(15.5)	6.45 d(15)	6.45 d(15)	6.34 d(15.5)
14	6.27 d(11)	6.27 d(11)	6.30 m	6.30 m	6.27 m
15	6.69 m	6.67 m	6.67 m	6.67 m	6.64 m
16	1.07 s	1.05 s	1.35 s	1.35 s	1.09 s
17	1.74 s	1.88 s	1.23 s, 1.91 s	1.23 s, 1.91 s	1.07 s, 1.90 s
18					
19	1.98 s	1.98 s	1.99~2.01 s	1.98~2.00 s	
20	1.99 s	1.99 s	1.99~2.01 s	1.98~2.00 s	1.97 s
2′	*α* 1.55 m	*α* 1.55 m	1.81 t(13)	1.48 t(12)	*α* 1.95 (ov)
	β 1.68 m	*β* 1.68 m	2.16 dd(6, 13)	1.77 ddd(2, 4, 12)	*β* 1.34 (ov)
3′	1.68 m	1.68 m	4.32 ddd(2, 6, 13)	4.00 m	4.31 m
4′	*α* 2.53 m	*β* 1.49 m		2.05 m	*α* 2.27 ddd(12.5, 4.5, 2)
	β 1.49 m			2.39 ddd(2, 6, 17)	*β* 1.41 dd(12.5, 12.5)
7′	6.48 d(15)	6.48 d(15)	6.22 d(16)	6.12 s	
8′	7.33 d(15)	7.33 d(15)	6.44 d(16)	6.12 s	6.03 s
10′	6.55 d(11)	6.55 d(11)	6.30 m	6.16 d(11)	6.12 d(11.5)
11′	6.63 dd(15.5, 11)	6.63 dd(15.5, 11)	6.65 m	6.67 m	6.63 dd(15.5, 11.5)
12′	6.52 d(15.5)	6.52 d(15.5)	6.45 d(15)	6.36 d(15)	6.38 d(15.5)
14′	6.36 d(11)	6.36 d(11)	6.30 m	6.26 d(11)	6.26 m
15′	6.63 m	6.63 m	6.67 m	6.66 m	6.64 m
16′	0.85 s	0.85 s	1.32 s	1.08 s	1.34 s
17′	1.12 s	1.12 s	1.21 s	1.08 s	1.07 s
18′	1.19 s	1.19 s	1.94 s	1.74 s	1.35 s
19′	1.96 s	1.96 s	1.99~2.01 s	1.98~2.00 s	1.80 s
20′	1.98 s	1.98 s	1.99~2.01 s	1.98~2.00 s	1.97 s
1″			4.57 d(8)	4.57 d(8)	1.97 s
2″			3.45 dd(8, 9)	3.45 dd(8, 9)	

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Table 12-2-6 (continued)

H	12-2-20	12-2-21	12-2-22	12-2-23	12-2-24
3″			3.61 m	3.61 m	
4″			3.61 m	3.61 m	
5″			3.41 m	3.41 m	
6″			3.83 m	3.83 m	
			3.93 m	3.93 m	

Table 12-2-7: ^{1}H NMR spectroscopic data of tetraterpenoids **12-2-25**~**12-2-29**.

H	12-2-25	12-2-26	12-2-27	12-2-28	12-2-29
2*α*	1.57 ddd(12.5, 4, 1)	1.77 ddd(12.5, 4, 2.5)	1.95 (ov)	1.84 (ov)	
2*β*	1.68 dd(12.5, 12.5)	1.54 dd(12.5, 12.5)	1.34 (ov)	1.63 d(12)	
3	3.87 m	4.28 m	4.28 m	4.41 t(6)	4.24 m
4	3.96 d(3.5)	*α* 2.11 ddd(13.5, 4, 2.5) *β* 1.61 dd(13.5, 11)	*α* 2.27 ddd(12.5, 4, 2) *β* 1.41 dd(12.5, 12.5)	*α* 2.04 ddd(12, 6, 2) *β* 1.71 d(12)	
7	6.07 d(16)	5.87 d(16)		6.96 d(16)	7.09 d(16)
8		6.42 d(16)	6.03 s	6.44 d(16)	6.56 d(16)
10	6.10 d(11.5)	6.22 d(11.5)	6.12 d(11.5)		7.03 s
11	6.55 dd(15.5, 11.5)	6.62 dd(15.5, 11.5)	6.55 or 6.63 dd(15.5, 11.5)		
12	6.34 d(15.5)	6.38 d(15.5)	6.38 d(15.5)	5.72 s	5.73 s
14	6.27 m	6.27 m	6.26 m	6.44 d(11.5)	6.45 d(11.5)
15	6.64 m	6.65 m	6.64 m	6.50 dd(14.5, 11.5) 6.64 dd(14.5, 11.5)①	6.61 dd(14.5, 11.5)
16	1.09 s	1.25 s	1.34 s	1.47 s	0.83 or 1.12 s
17	1.07 s	0.82 s	1.07 s	0.89 s	0.83 or 1.12 s
18	1.90 s	1.01 s	1.35 s	1.22 s	1.43 s
19		1.92 s	1.80 s		
20	1.97 s	1.97 s	1.96 s	2.00 s, 2.24 s①	2.23 s
2′*α*	1.99 (ov)	1.84 ddd(12.5, 4, 1.5)	1.84 ddd(12.5, 4, 1.5)	1.84 (ov)	
2′*β*	1.41 dd(12.5, 12.5)	1.45 dd(12.5, 12.5)	1.45 dd(12.5, 12.5)	1.57 dd(12.5, 12.5)	
3′	5.38 m	3.99 m	3.99 m	5.40 m	5.38 m
4′*α*	2.28 ddd(12.5, 4.5, 2)	2.43 ddd(18, 5, 1.5)	2.43 ddd(18, 5, 1.5)	2.50 ddd(18, 5.5, 2)	
4′*β*	1.51 dd(12.5, 12.5)	2.07 dd(18, 10)	2.07 dd(18, 10)	2.13 dd(18, 9)	

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Table 12-2-7 (continued)

H	12-2-25	12-2-26	12-2-27	12-2-28	12-2-29
8′	6.05 s, 6.17 d(16)①				6.06 s
10′	6.15 d(11.5)	6.46 d(11.5)	6.46 d(11.5)	7.01 s, 6.44 d(11.5)①	6.12 d(11.5)
11′	6.63 dd(15.5, 11.5)	6.51 dd(15.5, 11.5)	6.55 or 6.63 dd(15.5, 11.5)	6.57 dd(14.5, 11.5)	6.61 dd(14.5, 11.5)
12′	6.38 d(15.5)	6.36 d(15.5)	6.36 d(15.5)		
14′	6.26 m	6.27 m	6.27 m	6.41 dd(14.5, 11.5)	6.39 dd(14.5, 11.5)
15′	6.64 m	6.65 m	6.64 m		6.51 dd(14.5, 11.5)
16′	1.38 s	1.14 s	1.15 s	1.18 s	1.39 s
17′	1.07 s	1.20 s	1.20 s	1.20 s	1.07 s
18′	1.35 s	1.92 s		1.91 s	1.35 s
19′	1.80 s, 1.97 s①	2.01 s	1.92 s, 2.01 s①		1.80 s
20′	1.97 s	1.96 s	1.96 s		
OAc	2.04 s			2.05 s	2.04 s

① Typographic errors maybe exist in the original literature, giving two data for several single protons.

Table 12-2-8: ^{1}H NMR spectroscopic data of tetraterpenoids **12-2-30**~**12-2-34**.

H	12-2-30	12-2-31	12-2-32	12-2-33	12-2-34
2*α*	1.77 ddq(12.0, 2.8, 2.1)	1.77 m	1.78 ddq(12, 2.8, 2.1)	2.16 dd(13, 6)	2.22 dd(13, 6)
2*β*	1.48 m	1.48 m	1.49 t(12.0)	1.82 dd(13, 13)	1.82 dd(13, 13)
3	4.01 m	1.62 m, 4.01 m	4.03 m	4.30 (ov)	4.33 ddd(13, 6, 1.5)
4*α*	2.39 br dd(16.6, 4.3)	2.39 br dd(16.6, 4.3)	2.39 br dd(16.5, 5.0)		
4*β*	2.04 dd(16.6, 10.0)	2.04 m	2.05 dd(16.5, 10.0)		
7	6.11 d(15.5)	6.10~6.20 m	6.11 d(15.5)	6.22 d(15.5)	
8	6.15 d(15.5)	6.10~6.20 m	6.15 d(15.5)	6.43 d(15.5)	
10	6.16 d(12.0)	6.10~6.20 m	6.16 d(12.0)	6.30 d(11)	6.62 d(11)
11	*ca.* 6.63 br dd(15, 12)	*ca.* 6.63 br dd(15, 12)	6.63 br dd(15, 12)	6.62 dd(15, 11)	6.52 dd(14, 11)
12	6.34 d(15.0)	6.37 d(15.0)	6.37 d(14.6)	6.45 d(15)	6.45 d(14)
14	6.25 br m	6.26 br m	6.25 br m	6.30 d(11)	6.34 d(11)
15	*ca.* 6.63 br dd(15, 12)	*ca.* 6.63 br dd(15, 12)	6.63 br dd(15, 12)	6.66 m	6.66 m
16	1.08 s	1.08 s	1.08 s	1.32 s	1.35 s
17	1.08 s	1.08 s	1.08 s	1.23 s	1.31 s
18	1.75 s	1.78 s	1.75 s	1.95 s	2.03 s
19	1.97 s	1.98 s	1.98 s	2.00 s	2.05 s

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Table 12-2-8 (continued)

H	12-2-30	12-2-31	12-2-32	12-2-33	12-2-34
20	1.97 s	1.98 s	1.98 s	1.97 s	1.99 s
2′	*α* 1.46 m	1.46 m	*α* 1.93 dd(16.0, 5.0)	*α* 1.95 (ov)	*α* 1.75 dd(13, 3.5)
	β 1.20 br m		*β* 1.65 br dd(16.0)	*β* 1.34 (ov)	*β* 1.59 dd(13, 13)
3′	2.02 br		5.61 m	4.32 (ov)	3.80 ddd(13, 7, 3.5)
4′	5.42 br	2.02 m	5.42 br	*α* 2.27 ddd(13, 5, 15) *β* 1.51 (ov)	3.95 d(7.5)
5′			2.51 br		
6′	2.18 d(9.3)		1.87 dd(10.0, 5.3)		
7′	5.54 dd(15.3, 9.3)	6.10~6.20 m	5.45 dd(15.5, 10.0)		6.07 d(15.5)
8′	6.12 d(15.3)	6.10~6.20 m	6.12 d(15.5)	6.04 s	6.16 d(15.5)
10′	6.10 d(12.0)	6.10~6.20 m	6.10 d(12.0)	6.12 d(11)	6.17 d(11)
11′	*ca*. 6.63 br dd(15, 12)	*ca*. 6.63 br dd(15, 12)	6.63 br dd(15, 12)	6.57 dd(15, 11)	6.62 dd(15, 11)
12′	6.37 d(15.0)	6.36 d(15.0)	6.34 d(14.6)	6.35 d(15)	6.38 d(15)
14′	6.25 br m	6.26 br m	6.25 br m	6.26 d(11)	6.28 d(11)
15′	*ca*. 6.63 br dd(15, 12)	*ca*. 6.63 br dd(15, 12)	6.63 br dd(15, 12)	6.66 m	6.66 m
16′	0.83 or 0.91 s	1.04 s	0.85 or 0.98 s	1.34 s	1.10 s
17′	0.83 or 0.91 s	1.04 s	0.85 or 0.98 s	1.07 s	1.08 s
18′	1.59 d(1.8)	1.76 s	0.86 d(7.7)	1.35 s	1.81 s
19′	1.92 s	1.98 s	1.98 s	1.81 s	1.97 s
20′	1.97 s	1.98 s	1.98 s	1.98 s	1.97 s
OH				3.69 d(1.5)	3.69 d(1.5)

Table 12-2-9: ^{1}H NMR spectroscopic data of tetraterpenoids **12-2-35**~**12-2-39**.

H	12-2-35	12-2-36	12-2-37	12-2-38	12-2-39
2	*α* 1.84 ddd(12, 3, 1.5)	*α* 1.45 dd(12, 12) *β* 1.23 (ov)	eq 2.00 dd(13.7, 7.8)①		1.32 m
	β 1.45 dd(12, 12)		eq 1.62 ddd(14.7, 3.6, 1.7)① ax 1.25 dd(14.7, 10.2)		
3	3.39 m	3.84 m	3.92 m		ax 2.10 ddd(13.5, 11.5, 5.0) eq 2.21 dt(13.5, 3.8)

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Table 12-2-9 (continued)

H	12-2-35	12-2-36	12-2-37	12-2-38	12-2-39
4	*α* 2.43 ddd(18, 5, 1.5) *β* 2.07 dd(18, 10)	*α* 2.32 ddd(14, 5, 1.5) *β* 1.63 dd(14, 9)	eq 2.39 ddd(14.2, 4.9, 1.6) ax 1.63 dd(14.2, 8.8)	7.57 d(8.2)	
5				7.40 d	1.96 dq(11.8, 6.5)
6					1.61 dd(11.8, 9.8)
7		*ca.* 2.28	5.95 d(15.6), 6.44 d(15.0)	6.89 d(15.7)	5.34 dd(15.3, 9.8)
8		*ca.* 2.25	6.84 d(15.8)	6.83 d	6.70 d(15.3)
10	6.46 d(11)	5.94 d(11)	6.08 d(11.4)	6.39 m(11.5, 0.9)	6.15 d(11.4)
11	6.51 dd(15, 11)	6.51 dd(15, 11)	6.75 dd(11.4, 14.8)	6.73 dd(14.8)	6.99 dd(14.8, 11.4)
12	6.37 d(15)	6.24 d(15)	6.30 d(13.0)	6.47 m(<0.9)	6.44 d(14.8)
14	6.29 m	6.20 d(11)	6.25 m	6.33 m(*ca.* 11.9)	6.34 d(7.8)
15	6.64 m	6.64 m	6.63 m	6.69 m(*ca.* 14.3)	6.66 dm(7.8)
16	1.15 s	1.07 s	1.17 s	2.33 s	0.72 s
17	1.20 s	1.20 s	1.01 s	2.47 s	0.78 s
18	1.92 s	1.37 s	1.21 s		1.08 d(6.6)
19	2.03 s	1.81 s	1.93 s	2.08 d	1.88 s
20	1.97 s	1.95 s	1.96 s	2.01 d	1.88 s
2′	*α* 1.79 dd(13, 6) *β* 1.58 (ov)	*α* 1.84 ddd(12, 3, 1.5) *β* 1.45 dd(12, 12)	eq 2.00 dd(13.7, 7.8) ax 1.71 dd(13.7, 4.6)		
3′	4.30 m	3.39 m	4.51 m		
4′	5.57 br s	*α* 2.43 ddd(18, 5, 1.5) *β* 2.07 dd(18, 10)	eq 2.96 dd(14.4, 8.5) ax 1.49 dd(14.4, 3.2)		
7′	5.73 d(15.5)				
8′	6.30 d(15.5)		7.32 d(15.0)		
10′	6.22 d(11)	6.46 d(11)	6.56 d(11.4)		
11′	6.62 dd(15, 11)	6.51 dd(15, 11)	6.61 dd(11.4, 14.6)		
12′	6.35 d(15)	6.37 d(15)	6.51 d(14.6)		
14′	6.26 m	6.29 m			
15′	6.66 m	6.64 m	6.69 m		
16′	1.04 s	1.15 s	0.84 s		
17′	0.93 s	1.20 s	1.21 s		
18′	1.67 s	1.92 s	1.37 s		
19′	1.93 s	2.03 s	1.96 s		
20′	1.96 s	1.97 s	1.98 s		
18-OMe				3.86 s	

① Typographic errors maybe exist in the original literature, giving two data of H-2eq.

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Table 12-2-10: ^{1}H NMR spectroscopic data of tetraterpenoids **12-2-40**~**12-2-44**.

H	12-2-40	12-2-41	12-2-42	12-2-43	12-2-44
2	1.32 m	eq 1.30 ddd(13.7, 3.5, 3.5)	eq 1.48 m	1.48 m	eq 1.48 m
		ax 1.12 ddd(13.7, 13.5, 3.9)	ax 1.77 m	1.77 m	ax 1.77 m
3	2.10 ddd(13.5, 11.5, 5.0)	ax 1.41 dddd(13.5, 12.5, 9.8, 3.5)	ax 4.05 br m	4.05 br m	4.05 br m
	2.21 dt(13.5, 3.8)	eq 1.62 dddd(12.5, 4.6, 3.5, 3.5)			
4		2.90 ddd(10.2, 9.8, 4.6)	eq 2.39 m	2.04 m, 2.39 m	eq 2.39 m
			ax 2.04 m		ax 2.04 m
5	21.96 dq(11.8, 6.5)	1.31 ddq(10.2, 10.2, 6.0)			
6	1.61 dd(11.8, 9.8)	1.40 dd(10.2, 9.8)			
7	5.34 dd(15.3, 9.8)	5.45 dd(15.4, 9.8)	6.10 d	6.10 d	6.10 d
8	6.70 d(15.3)	6.82 d(15.4)	6.14 d	6.14 d	6.14 d
10	6.15 d(11.4)	6.15 d(11.9)	6.15 d	6.15 d	6.15 d, 6.05 d
11	6.99 dd(14.8, 11.4)	7.05 dd(14.7, 11.9)	6.64 m	6.64 m	6.74
12	6.44 d(14.8)	6.43 d(14.7)	6.36 d	6.36 d	6.31 d
14	6.34 d(7.8)	6.31 d(8.0)	6.25 m	6.25 m	6.25 m
15	6.66 dm(7.8)	6.64 dm(8.0)	6.63 m	6.63 m	6.63 m
16	0.72 s	0.80 s	1.07 s	1.07 s	1.07 s
17	0.78 s	0.83 s	1.08 s	1.08 s	1.08 s
18	1.08 d(6.6)	1.01 d(6.0)	1.74 s	1.74 s	1.74 s
19	1.88 s	1.91 s	1.97 s	1.97 s	1.97 s
20	1.88 s	1.85 s	1.98 s	1.98 s	1.98 s
2′	*α* 1.30 ddd(13.7, 3.5, 3.5)				eq 1.48 m
	β 1.12 ddd(13.7, 13.5, 3.9)				ax 1.77 m
3′	1.41 dddd (13.5, 12.5, 9.8, 3.5) 1.62 dddd (12.5, 4.6, 3.5, 3.5)				4.05 br m
4′	2.90 ddd(10.2, 9.8, 4.6)				eq 2.39 m
					ax 2.04 m
5′	1.31 ddq(10.2, 10.2, 6.0)				
6′	1.40 dd(10.2, 9.8)				
7′	5.45 dd(15.4, 9.8)				6.10 d
8′	6.82 d(15.4)				6.68 d
10′	6.15 d(11.9)				
11′	7.05 dd(14.7, 11.9)				6.64 dd
12′	6.43 d(14.7)	6.43 d(14.7)	6.36 d	6.36 d	6.36 d

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Table 12-2-10 (continued)

H	12-2-40	12-2-41	12-2-42	12-2-43	12-2-44
14′	6.31 d(8.0)	6.31 d(8.0)	6.25 m	6.25 m	6.25 m
15′	6.64 dm(8.0)	6.64 dm(8.0)	6.63 m	6.63 m	6.63 m
16′	0.80 s	0.80 s	1.07 s	1.07 s	1.07 s
17′	0.83 s	0.83 s	1.08 s	1.08 s	1.08 s
18′	1.01 d(6.0)	1.01 d(6.0)	1.74 s	1.74 s	1.74 s
19′	1.91 s	1.91 s	1.97 s	1.97 s	1.97 s
20′	1.85 s	1.85 s	1.98 s	1.98 s	1.98 s
1″			4.48 d	4.93 d	4.93 d
2″			3.31 dd	5.21 dd	5.21 dd
3″			3.59 dd	5.32 dd	5.32 dd
4″			3.56 m	5.07 m	5.07 m
5″			3.38 m	3.92 m	3.92 m
6″			1.23 d	1.23 d	1.23 d

Table 12-2-11: ^{1}H NMR spectroscopic data of tetraterpenoids **12-2-45**~**12-2-49**.

H	12-2-45	12-2-46	12-2-47	12-2-48	12-2-49
2eq	1.48 m	1.48 m	1.48 m		
2ax	1.77 m	1.77 m	1.77 m		
3	ax 4.05 br m	4.05 br m	ax 4.05 br m	3.88 m	3.91 m
4eq	2.39 m	2.39 m	2.39 m		
4ax	2.04 m	2.04 m	2.04 m		
7	6.10 d	6.10 d	6.10 d	5.83 d(15.5)	5.88 d(15.5)
8	6.14 d	6.14 d	6.14 d	6.30 d(15.5)	6.29 d(15.5)
10	6.15 d	6.15 d, 6.05 d	6.20 d		
11	6.64 m	6.74	6.64 dd		
12	6.36 d	6.31 d	6.88 d		
14	6.25 m	6.25 m	6.11 m		
15	6.63 m	6.63 m	6.68 m		
16	1.07 s	1.07 s	1.07 s	1.16 s	0.98 s
17	1.08 s	1.08 s	1.08 s	1.01 s	1.15 s
18	1.74 s	1.74 s	1.74 s	1.19 s	1.19 s
19	1.97 s	1.97 s	1.97 s	1.92 s	1.93 s
20	1.98 s	1.98 s	1.98 s	1.97 s	1.97 s
2′eq		1.48 m	1.48 m		
2′ax		1.77 m	1.77 m		
3′		4.05 br m	ax 4.05 br m	4.00 m	4.00 m
4′eq		2.39 m	2.39 m		
4′ax		2.04 m	2.04 m		
7′		6.10 d	6.10 d		6.12 br s
8′		6.68 d	6.14 d		6.12 br s
10′			6.15 d		
11′		6.64 dd	6.64 dd		
12′		6.36 d	6.36 d		
14′		6.25 m	6.25 m		

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Table 12-2-11 (continued)

H	12-2-45	12-2-46	12-2-47	12-2-48	12-2-49
15′		6.63 m	6.53 m		
16′		1.07 s	1.07 s	1.15 s	1.07 s
17′		1.08 s	1.08 s	1.20 s	1.07 s
18′		1.74 s	1.74 s	1.93 s	1.74 s
19′		1.97 s	1.97 s	2.01 s	1.97 s
20′		1.98 s	1.98 s	1.97 s	1.97 s
1″	4.93 d	4.93 d	4.93 d		
2″	5.21 dd	5.21 dd	5.21 dd		
3″	5.32 dd	5.32 dd	5.32 dd		
4″	5.07 m	5.07 m	5.07 m		
5″	3.92 m	3.92 m	3.92 m		
6″	1.23 d	1.23 d	1.23 d		
Olefin-H				6.20~6.64 m(11H)	6.15~6.64 m(11H)

Table 12-2-12: ^{1}H NMR spectroscopic data of tetraterpenoids **12-2-50**~**12-2-54**.

H	12-2-50	12-2-51	12-2-52	12-2-53	12-2-54
2		*α* 1.84 ddd(12, 3, 1.5)	eq *ca.*1.77	eq 1.77	eq 1.95 ddd(12, 3, 1.5)
		β 1.45 dd(12, 12)	ax 1.48 dd(12, 12)	ax 1.48 dd(12, 12)	ax *ca.*1.34
3	3.88 m	4.00 m	4.00 m	4.00 m	4.32 m
4		*α* 2.43 ddd(18, 6, 1.5)	eq 2.39 ddd(17, 5, 1.5)	eq 2.39 ddd(17, 5, 1.5)	eq 2.26 ddd(13, 4, 1.5)
4		*β* 2.07 dd(18, 10)	ax 2.04 dd(17, 10)	ax 2.04 dd(17, 10)	ax 1.41 dd(13, 12.5)
7	5.83 d(15.5)		6.11 d(16)	6.11 d(16)	
8	6.30 d(15.5)		6.13 d(16)	6.13 d(16)	6.03 s
10		6.45 d(10)	6.15 d(11.5)	6.15 d(11.5)	6.11 d(11.5)
11		6.54 dd(15, 11)	6.63 dd(15.5, 11.5)	6.63 dd(15.5, 11.5)	6.57 dd(15.5, 11.5)
12		6.38 d(15)	6.35 d(15.5)	6.35 d(15.5)	6.33 d(15.5)
14		6.29 m	6.20 d(11)	6.20 d(11)	6.20 d(11)
15		6.64 m	6.56 dd(15, 11)	6.56 dd(15, 11)	6.52 dd(15, 11)
16	1.16 s	1.15 s	1.07 s	1.07 s	1.33 s
17	1.01 s	1.20 s	1.07 s	1.07 s	1.07 s
18	1.19 s	1.93 s	1.74 s	1.74 s	1.35 s
19	1.92 s	2.01 s	1.96 s	1.96 s	1.80 s
20	1.97 s	1.99 s	1.96 s	1.96 s	1.94 s
2′		*α* 1.84 dd(14, 5.5)	eq 1.61 ddd(14, 3.5, 1.5)	eq 1.61 ddd(14, 3.5, 1.5)	eq 1.61 ddd(14, 3.5, 1.5)
		β 1.66 dd(14, 7)			
			ax 1.22	ax 1.22	ax 1.22 dd(14, 13)

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Table 12-2-12 (continued)

H	12-2-50	12-2-51	12-2-52	12-2-53	12-2-54
3′	4.00 m	4.24 m	3.88 m	3.88 m	3.88 m
4′		5.64 br s	eq 2.35 ddd (14, 5.5, 1.5) ax 1.61 dd(14, 8.5)	eq 2.35 ddd (14, 5.5, 1.5) ax 1.61 dd(14, 8.5)	eq 2.35 ddd (14, 5.5, 1.5) ax 1.61 dd(14, 8.5)
7′	6.12 br s	5.63 d(15.5)	5.89 d(15.5)	5.89 d(15.5)	5.89 d(15.5)
8′	6.12 br s	6.38 d(15.5)	6.58 d(15.5)	6.58 d(15.5)	6.58 d(15.5)
10′		6.22 d(11.5)	5.12 d(10)	5.12 d(10)	5.12 d(10)
11′		6.62 d(15, 11.5)	3.13 dddd(10, 10, 9, 5.5)	3.13 dddd(10, 10, 9, 5.5)	3.13 dddd(10, 10, 9, 5.5)
12′		6.37 d(15)	4.08 d(9)	4.08 d(9)	4.08 d(9)
14′		6.26 m	6.16 d(11)	6.14 d(11)	6.16 d(11)
15′		6.64 m	6.51 dd(15, 11)	6.48 dd(15, 11)	6.51 dd(15, 11)
16′	1.07 s	0.94 s	0.96 s	0.96 s	0.96 s
17′	1.07 s	1.02 s	1.12 s	1.13 s	1.12 s
18′	1.74 s	1.68 br s	1.18 s	1.16 s	1.18 s
19′	1.97 s	1.92 s	1.81 d(1)	1.81 d(1)	1.80 d(1)
20′	1.97 s	1.97 s	1.80 s	1.77 s	1.82 s
Olefin-H	6.15~6.64 m(11H)				
3″ax			*ca.*1.74	1.75	1.74 m
3″eq			*ca.*1.74	1.75	1.74 m
4″ax			2.43 dd(16.5)	2.46 dd(16.5)	2.43 dd(16.5)
4″eq			2.51 dd(16.5, 10)	2.53 dd(16.5, 10)	2.51 dd(16.5, 10)
15″			0.85 d(6.5)	0.85 d(6.5)	0.85 d(6.5)
20″			0.84 d(6.5)	0.84 d(6.5)	0.84 d(6.5)
25″			0.87 d(6.5)	0.87 d(6.5)	0.87 d(6.5)
26″			0.87 d(6.5)	0.87 d(6.5)	0.87 d(6.5)
27″			1.25 s	1.21 s	1.25 s
28″			2.35 dd(16.5, 10)	2.37 dd(16.5, 10)	2.35 dd(16.5, 10)
28″			2.60 dd(16.5, 5.5)	2.64 dd(16.5, 5.5)	2.60 dd(16.5, 5.5)
29″			2.10 s	2.10 s	2.10 s
30″			2.09 s	2.09 s	2.09 s

Table 12-2-13: ^{1}H NMR spectroscopic data of tetraterpenoids **12-2-55**~**12-2-57**.

H	12-2-55	12-2-56	12-2-57
2ax	1.34	1.26 dd(14, 13)	1.26 dd(14, 13)
2eq	1.95 ddd(12, 3, 1.5)	1.64 ddd(14, 3.5, 1.5)	1.64 ddd(14, 3.5, 1.5)
3	4.32 m	3.90 m	3.90 m
4ax	1.41 dd(13, 12.5)	1.65 dd(14, 9)	1.65 dd(14, 9)

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Table 12-2-13 (continued)

H	12-2-55	12-2-56	12-2-57
4eq	2.26 ddd(13, 4, 1.5)	2.40 ddd(14, 5, 1.5)	2.40 ddd(14, 5, 1.5)
7		5.93 d(15.5)	5.93 d(15.5)
8	6.03 s	6.84 d(15.5)	6.83 d(15.5)
10	6.11 d(11, 5)	6.06 d(11.5)	6.06 d(11.5)
11	6.57 dd(15.5, 11.5)	6.74 dd(15.5, 11.5)	6.74 dd(15.5, 11.5)
12	6.33 d(15.5)	6.26 d(15.5)	6.27 d(15.5)
14	6.20 d(11)	6.16 d(11)	6.18 d(11)
15	6.52 dd(15, 11)	6.50 dd(15, 11)	6.53 dd(15, 11)
16	1.33 s	1.01 s	1.01 s
17	1.07 s	1.17 s	1.16 s
18	1.35 s	1.22 s	1.22 s
19	1.80 s	1.93 s	1.93 s
20	1.94 s	1.93 s	1.93 s
2′ax	1.22 dd(14, 13)	*ca.*1.26 dd(14, 13)	*ca.*1.26 dd(14, 13)
2′eq	1.61 ddd(14, 3.5, 1.5)	*ca.*1.64	*ca.*1.64
3′	3.88 m	3.90 m	3.90 m
4′ax	1.61 dd(14, 8.5)	*ca.*1.64	*ca.*1.64
4′eq	2.35 ddd(14, 5.5, 1.5)	2.37 dd(14, 5.5, 1.5)	2.37 dd(14, 5.5, 1.5)
7′	5.89 d(15.5)	5.73 d(15.5)	5.72 d(15.5)
8′	6.58 d(15.5)	6.17 d(15.5)	6.16 d(15.5)
10′	5.12 d(10)	5.24 d(10)	5.24 d(10)
11′	3.13 dddd(10, 10, 9, 5.5)	2.95 dddd(10, 10, 9, 5.5)	2.94 dddd(10, 10, 9, 5.5)
12′	4.08 d(9)	4.10 d(9)	4.11 d(9)
14′	6.14 d(11)	6.10 d(11)	6.13 d(11)
15′	6.48 dd(15, 11)	6.46 dd(15, 11)	6.47 dd(15, 11)
16′	0.96 s	0.96 s	0.92 s
17′	1.13 s	1.12 s	1.09 s
18′	1.16 s	1.11 s	1.18 s
19′	1.82 d(1)	1.75 s	1.74 s
20′	1.77 s	1.80 s	1.82 s
3″ax	1.75 m	1.75 m	1.75 m
3″eq	1.75 m	1.75 m	1.75 m
4″ax	2.46 dd(16.5)	2.47 dd(16.5)	2.45 dd(16.5)
4″eq	2.53 dd(16.5, 10)	2.57 dd(16.5, 10)	2.54 dd(16.5, 10)
15″	0.85 d(6.5)	0.85 d(6.5)	0.85 d(6.5)
20″	0.84 d(6.5)	0.84 d(6.5)	0.84 d(6.5)
25″	0.87 d(6.5)	0.87 d(6.5)	0.87 d(6.5)
26″	0.87 d(6.5)	0.87 d(6.5)	0.87 d(6.5)
27″	1.21 s	1.25 s	1.21 s
28″	2.37 dd(16.5, 10)	2.35 dd(16.5, 10)	2.37 dd(16.5, 10)
28″	2.64 dd(16.5, 5.5)	2.68 dd(16.5, 5.5)	2.64 dd(16.5, 5.5)
29″	2.10 s	2.10 s	2.10 s
30″	2.09 s	2.09 s	2.09 s

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Table 12-2-14: ^{1}H NMR spectroscopic data of tetraterpenoids **12-2-58**~**12-2-60**.

H	12-2-58	12-2-59	12-2-60
2ax	1.29 t(12, 11)	1.42 dd(13.2, 9.9)	1.42 dd(13.0, 11.1)
2eq	*ca.* 1.90 ddd(12.5, 3.5, 1)	*ca.* 2.00 m	2.01 m
3	4.20 m	*ca.* 5.39 m	*ca.* 5.39 m
4ax	1.35 dd(13, 11.5)	1.52 t(12.0, 12.0)	1.52 dd(13.0, 11.0)
4eq	2.18 ddd(12.5, 5.5, 1)	2.29 m	2.29 m
8	6.072 s	6.066 s	6.067 s
10	6.17 d(11.5)	6.15 d(11.5)	6.15 d(11.7)
11	6.81 ddd(15, 11.5)	6.70 dd(14.9, 11.4)	6.71 dd(15.0, 11.4)
12	6.42 d(15)	6.37 d(15.0)	6.37 d(15.1)
14	6.41 d(11.8)	6.32 d(11.9)	6.32 d(11.8)
15	7.24 m	7.06 dd(13.8, 11.8)	7.06 dd(14, 11)
16	1.336 s	1.390 s	1.390 s
17	1.064 s	1.077 s	1.077 s
18	1.309 s	1.358 s	1.358 s
19	1.852 s	1.832 s	1.832 s
20	2.062 s	2.043 s	2.044 s
2′ax	1.34 dd(13.3, 10.5)	1.29 dd(12.5, 10.1)	1.30 dd(13.1, 9.3)
2′eq	1.66 ddd(13, 3.5, 1.2)	1.62 ddd(11.9, 4.0, 1.5)	1.64 m
3′	3.83 m	*ca.*3.74 m	3.72 m
4′ax	1.78 dd(14.2, 8.3)	1.63 dd(14.2, 8.1)	1.65 dd(15.1, 8.2)
4′eq	2.36 ddd(14, 4.0, 1.4)	2.24 dd(14.6, 5.0)	2.24 dd(15.0, 3.1)
7′	1.69 ddd(17, 10, 7.5) 1.95 ddd(17, 11, 6.5)	*ca.* 1.67 m, *ca.* 1.89 m	*ca.* 1.67 m, *ca.* 1.90 m
8′	*ca.* 2.30 m	*ca.* 2.25 m	*ca.* 2.23 m
10′	5.98 d(11.3)	5.94 d(11.3)	5.95 d(10.9)
11′	7.58 dd(15.3, 11.1)	7.55 dd(15.4, 11.1)	7.55 dd(15.5, 11)
12′	6.46 dd(15, 1.8)	6.39 dd(15.3, 2)	6.39 dd(15.2, 2)
14′	*ca.* 6.97 m	6.80 d(11.9)	6.80 d(11.7)
15′	*ca.* 6.97 m	6.86 dd(13.6, 11.8)	6.87 d(13.7, 11.6)
16′	1.064 s	1.054 s	1.052 s
17′	1.226 s	1.156 s	1.159 s
18′	1.384 s	1.349 s	1.353 s
19′	1.848 s	1.855 s	1.854 s
20′	9.49 d(2.1)	9.535 d(2.0)	9.535 d(2.0)
1″	4.37 d(7.3)	4.50 d(8.1)	4.43 d(8.1)
2″	3.19 dd(8.1, 8.5)	4.84 dd(9.6, 8.1)	4.83 dd(9.6, 8.1)
3″	3.51 dd(10, 10)	5.18 t(9.3)	3.72 dd(9.6, 1.7)
4″	3.57 dd(9, 9)	3.74 dd(9.5, 9.0)	3.49 dd(9.5, 8.0)
5″	3.40 ddd(9.5, 3, 3)	3.59 m	*ca.* 3.56 m
6″	3.86 m	*ca.* 4.09 m, 4.46 dd(11.2, 1.8)	*ca.* 4.00 m, 4.30 dd(11.2, 1.6)
1‴	4.37 d(7.3)	4.48 d(8.0)	4.54 d(8.0)
2‴	3.54 dd(8.8, 7.5)	5.12 dd(10.5, 7.9)	5.25 dd(10.5, 8.0)
3‴	3.48 dd(9.1, 3.1)	4.96 dd(10.4, 3.5)	5.00 dd(10.5, 3.2)
4‴	3.81 d(3.3)	5.35 d(3.3)	5.39 dd(3.5, <1)
5‴	*ca.* 3.58 m	3.87 dd(7.1, 6.5)	4.03 m

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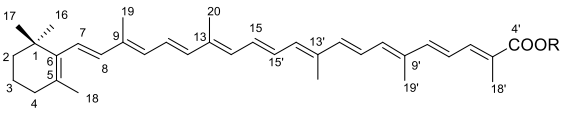
Table 12-2-14 (continued)

H	12-2-58	12-2-59	12-2-60
6‴	3.69 dd(11.5, 4.5)	4.08 m, 4.13 m	4.11 dd(11.5, 7.5), 4.15 dd(12.0, 5.1)
	3.78 dd(11.5, 5.5)		
OH			4.25 d(1.7)
OAc		2.0 s, 2.04 s, 2.05 s	1.99 s, 2.04 s, 2.06 s, 2.09 s
		2.06 s, 2.11 s, 2.15s	2.10 s, 2.10 s, 2.16 s

12.2.2 Carotenoids

Table 12-2-15: Compounds, MFs, and test solvents of carotenoids **12-2-61**~**12-2-81**.

No.	Compounds	MFs	Test solvents	References
12-2-61	neurosporaxanthin	$C_{35}H_{46}O_2$	$CDCl_3$	[48]
12-2-62	neurosporaxanthin β-D-glucopyranoside	$C_{41}H_{56}O_7$	$CDCl_3$-CD_3OD (4:1)	[48]
12-2-63	(3*S*,5*R*,6*S*)-5,6-epoxy-5,6-dihydro-10′-apo-β-carotene-3,10′-diol	$C_{27}H_{38}O_3$	$CDCl_3$	[49]
12-2-64	(3*S*,5*R*,6*S*,all-*E*)-5,6-epoxy-5,6-dihydro-12′-apo-β-carotene-3,12′-diol (persicaxanthin)	$C_{25}H_{36}O_3$	$CDCl_3$	[50]
12-2-65	10′-apo-β-carotin-10′-al	$C_{27}H_{36}O$	$CDCl_3$	[51]
12-2-66	(all-*E*)-10′-apo-β-carotene-10′-ol	$C_{27}H_{38}O$	$CDCl_3$	[51]
12-2-67	(all-*E*,3*R*)-10′-apo-β-carotene-3,10′-diol	$C_{27}H_{38}O_2$	$CDCl_3$	[51]
12-2-68	10′-apo-Ψ-carotin-10′-ol	$C_{27}H_{38}O$	$CDCl_3$	[52]
12-2-69	10′-apo-Ψ-carotin-10′-saure-methylester	$C_{28}H_{38}O_2$	$CDCl_3$	[52]
12-2-70	10′-apo-Ψ-carotin-10′-al	$C_{27}H_{36}O$	$CDCl_3$	[52]
12-2-71	12′-apo-Ψ-carotin-12′-saure-methylester	$C_{26}H_{26}O_2$	$CDCl_3$	[52]
12-2-72	12′-apo-Ψ-carotin-12′-ol	$C_{25}H_{36}O$	$CDCl_3$	[52]
12-2-73	12′-apo-Ψ-carotin-12′-al	$C_{25}H_{34}O$	$CDCl_3$	[52]
12-2-74	8′-apo-Ψ-carotin-8′-al	$C_{30}H_{40}O$	$CDCl_3$	[52]
12-2-75	8′-apo-Ψ-carotin-8′-ol	$C_{30}H_{42}O$	$CDCl_3$	[52]
12-2-76	8′-apo-Ψ-carotin-8′-saure-methylester	$C_{31}H_{42}O_2$	$CDCl_3$	[52]
12-2-77	4-hydroxy-8′-apo-β-carotin-8′-al	$C_{30}H_{40}O_2$	$CDCl_3$	[52]
12-2-78	8′-apo-β-carotin-4,8′-diol	$C_{30}H_{42}O_2$	$CDCl_3$	[52]
12-2-79	5,8-epoxy-5,8-dihydro-8′-apo-β-carotin-8′-saure-methylester	$C_{31}H_{44}O_3$	$CDCl_3$	[52]
12-2-80	5,8-epoxy-5,8-dihydro-8′-apo-β-carotin-8′-ol	$C_{30}H_{44}O_2$	$CDCl_3$	[52]
12-2-81	5,8-epoxy-5,8-dihydro-8′-apo-β-carotin-8′-yl-acetate	$C_{32}H_{46}O_3$	$CDCl_3$	[52]



12-2-61 R = H
12-2-62 R = Glc

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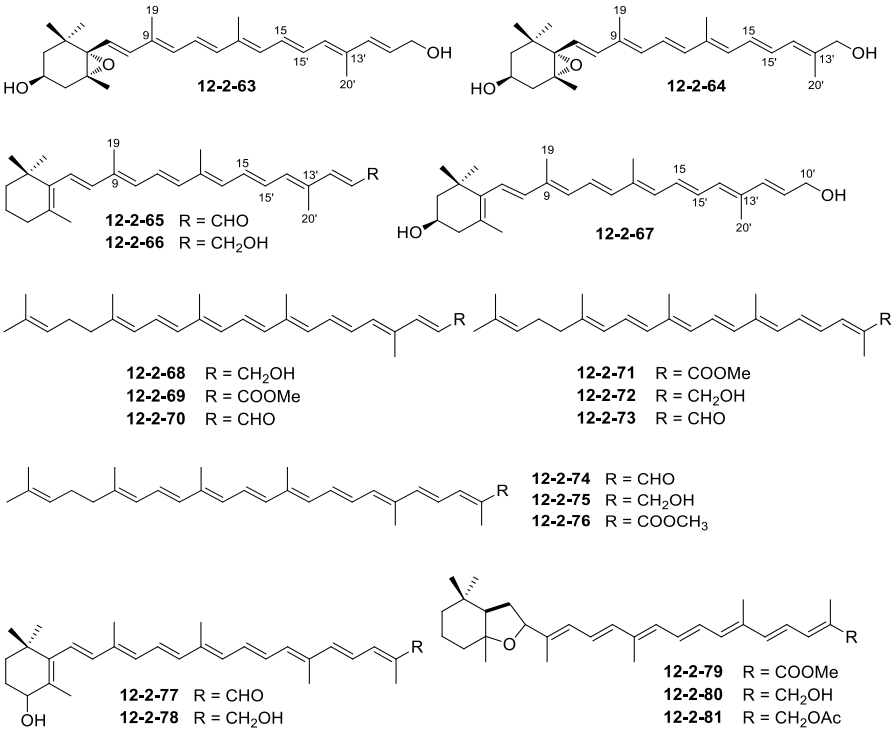

Table 12-2-16: ^{1}H NMR spectroscopic data of carotenoids **12-2-61**~**12-2-65**.

H	12-2-61	12-2-62	12-2-63	12-2-64	12-2-65
2	1.47 m	1.47 m			
3	1.62 m	1.62 m	3. 89 m	3.91 m	
4	2.02 m	2.02 m			
7	6.19 d(16)	6.20 d(16)	5.88 d(15)	5.87 d(15.5)	6.14 d(15)
8	6.13 d(16)	6.13 d(16)	6.29 d(15)	6.29 d(15.5)	6.23 d(15)
10	6.16 d(11)	6.16 d(11)	6.19 d(11)	6.18 br d(11)	6.16 d(11)
11	6.67 dd(15, 11)	6.68 dd(15, 11)	6.60 dd(15, 11)	6.56 dd(15, 11)	6.76 dd(15, 11)
12	6.36 d(15)	6.36 d(15)	6.37 d(15)	6.36 d(15)	6.36 d(15)
14	6.26 d(11)	6.27 d(11)	6.22 m	6.21 br d(11)	6.29 d(10)
15	6.67 m	6.67 m	6.62 m	6.54 dd(15, 11)	6.87 dd(15, 11)
16	1.03 s	1.04 s	0.98 s	0.98 s	1.03 s
17	1.03 s	1.04 s	1.15 s	1.15 s	1.03 s
18	1.72 s	1.72 s	1.19 s	1.19 s	1.72 s
19	1.98 s	1.99 s	1.93 s	1.92 s	1.99 s
20	1.99 s	1.99 s	1.96 s	1.94 s	2.02 s
6′	7.39 d(11)	7.43 d(11)			
7′	6.51 dd(15, 11)	6.52 dd(15, 11)			
8′	6.66 d(15)	6.68 d(15)			

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Table 12-2-16 (continued)

H	12-2-61	12-2-62	12-2-63	12-2-64	12-2-65
10′	6.37 d(11)	6.37 d(11)	4.22 d(6)		9.59 d(8)
11′	6.63 dd(15, 11)	6.64 dd(15, 11)	5.86 dt(15.5, 6)		6.19 dd(15, 8)
12′	6.47 d(15)	6.48 d(15)	6.33 d(15.5)	4.11 d(6)	7.16 d(15)
14′	6.32 d(11)	6.34 d(11)	6.22 m	6.21 br d(11)	6.64 d(10)
15′	6.65 m	6.65 m	6.62 m	6.50 dd(15, 11)	6.61 dd(15, 11)
18′	2.00 s	2.02 s			
19′	2.00 s	2.00 s			
20′	1.98 s	1.99 s	1.91 s	1.83 s	1.96 s
1″		5.58 d(8)			
2″		3.48 m			
3″		3.60 m			
4″		3.51 m			
5″		3.41 m			
6″		3.77 dd(12, 5.5)			
		3.88 dd(12, 2)			
12′-OH				1.42 t(6)	

Table 12-2-17: ^{1}H NMR spectroscopic data of carotenoids **12-2-66**~**12-2-69**.

H	12-2-66	12-2-67	12-2-68	12-2-69
2			5.11 m	5.11 m
3		4.00 m	2.12 s	2.12 s
4			2.12 s	2.12 s
6			5.96 d(11)	5.96 d(11)
7	6.12 d(15)	6.12 d(15)	6.50 dd(15, 11)	6.52 dd(15, 11)
8	6.18 d(15)	6.18 d(15)	6.26 d(15)	6.25 d(15)
10	6.15 d(11)	6.15 d(11)	6.18 d(11)	6.18 d(11)
11	6.65 dd(15, 11)	6.65 dd(15, 11)	6.64 m	6.71 dd(11, 15)
12	6.35 d(15)	6.36 d(15)	6.35 d(15)	6.35 d(15)
14	6.23 d(10)	6.22 d(10)	6.25 d(11)	6.27 d(11)
15	6.61 m	6.61 m	6.64 m	6.79 dd(15, 11)
16	1.03 s	1.07 s	1.69 s	1.69 s
17	1.03 s	1.07 s	1.62 s	1.62 s
18	1.73 s	1.73 s	1.82 s	1.82 s
19	1.97 s	1.98 s	1.97 s	1.98 s
20	1.97 s	1.98 s	1.97 s	2.00 s
10′	4.25 d(6)	4.24 d(6)	4.25 d(6)	
11′	5.87 dt(15.5, 6)	5.87 dt(15.5, 6)	5.87 dt(15, 6)	5.88 d(15.5)
12′	6.34 d(15.5)	6.34 d(15.5)	6.35 d(15)	7.38 d(15.5)
14′	6.23 d(10)	6.22 d(10)	6.25 d(11)	6.52 d(11)
15′	6.61 m	6.61 m	6.64 m	6.60 dd(15, 11)
20′	1.91 s	1.91 s	1.92 s	1.93 s
OAc				3.76 s

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Table 12-2-18: ^{1}H NMR spectroscopic data of carotenoids **12-2-70**~**12-2-74**.

H	12-2-70	12-2-71	12-2-72	12-2-73	12-2-74
2	5.11 m	5.11 m	5.11 m	5.11 m	5.11 m
3	2.12 s	2.12 s	2.12 s	2.12 s	2.12 s
4	2.12 s	2.12 s	2.12 s	2.12 s	2.12 s
6	5.95 d(11)	5.96 d(11)	5.95 d(11)	5.96 d(11)	5.96 d(11)
7	6.53 dd(15, 11)	6.54 dd(15, 11)	6.50 m	6.57 dd(15, 11)	6.52 dd(15, 11)
8	6.25 d(15)	6.25 d(15)	6.25 d(15)	6.25 d(15)	6.25 d(15)
10	6.18 d(11)	6.18 d(11)	6.18 d(11)	6.19 d(11)	6.19 d(11)
11	6.74 dd(15, 11)	6.72 dd(11, 15)	6.60 m	6.81 dd(11, 15)	6.70 dd(11, 15)
12	6.36 d(15)	6.35 d(15)	6.35 d(15)	6.35 d(15)	6.36 d(15)
14	6.28 d(11)	6.27 d(11)	6.27 d(11)	6.29 d(11)	6.27 d(11)
15	6.87 d(15, 11)	6.90 dd(15, 11)	6.60 m	7.06 dd(15, 11)	6.78 dd(15, 11)
16	1.69 s	1.69 s	1.69 s	1.69 s	1.69 s
17	1.62 s	1.62 s	1.62 s	1.62 s	1.62 s
18	1.83 s	1.82 s	1.82 s	1.82 s	1.82 s
19	1.98 br s	1.98 s	1.96 s	1.99 br s	1.98 br s
20	2.02 br s	1.98 s	1.98 s	2.04 br s	2.00 br s
8′					9.45 s
10′	9.59 d(8)				6.95 dd(11, 1)
11′	6.23 dd(15, 8)				6.66 dd(15, 11)
12′	7.16 d(15)		4.06 d(6)	9.45 s	6.74 d(15)
14′	6.62 m	7.31 d(11)	6.27 d(11)	6.97 d(11)	6.45 d(11)
15′	6.62 m	6.54 dd(15, 11)	6.60 m	6.68 dd(15, 11)	6.64 dd(15, 11)
19′					1.90 br s
20′	1.97 s	2.00 s	1.83 s	1.88 br s	2.00 br s
OAc		3.77 s			

Table 12-2-19: ^{1}H NMR spectroscopic data of carotenoids **12-2-75**~**12-2-78**.

H	12-2-75	12-2-76	12-2-77	12-2-78
2	5.11 m	5.11 m		
3	2.12 s	2.11 m		
4	2.12 s	2.11 s	4.02 dd(5, 1)	4.02 dd(5, 1)
6	5.96 d(11)	5.95 d(11)		
7	6.49 dd(15, 11)	6.51 dd(15, 11)	6.12 d(16)	6.12 d(15)
8	6.25 d(15)	6.25 d(15)	6.18 d(16)	6.17 d(15)
10	6.18 d(11)	6.19 d(11)	6.18 d(11)	6.17 d(11)
11	6.63 m	6.67 dd(15, 11)	6.71 dd(15, 11)	6.65 m
12	6.36 d(15)	6.35 d(15)	6.38 d(15)	6.37 d(15)
14	6.25 d(11)	6.26 d(11)	6.29 d(11)	6.26 m
15	6.63 m	6.71 dd(15, 11)	6.78 m	6.65 m

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Table 12-2-19 (continued)

H	12-2-75	12-2-76	12-2-77	12-2-78
16	1.69 s	1.68 s	1.028 s①	1.026 s①
17	1.62 s	1.61 s	1.056 s	1.054 s
18	1.82 s	1.82 s	1.85 s	1.85 s
19	1.97 s	1.97 s	1.98 s	1.98 s
20	1.97 s	1.97 s	2.01 s	1.98 s
8′	4.12 d(6)		9.46 s	4.12 d(6)
10′	6.18 d(11)	7.29 dd(11, 1)	6.95 dd(10, 1)	6.15 d(11)
11′	6.49 dd(15, 11)	6.51 dd(15, 11)	6.67 dd(15, 11)	6.50 dd(15, 11)
12′	6.32 d(15)	6.61 d(15)	6.74 m	6.34 d(15)
14′	6.25 d(11)	6.36 d(11)	6.45 d(11)	6.26 m
15′	6.63 m	6.62 dd(15, 11)	6.64 m	6.62 m
19′	1.86 s	2.00 d(1)	1.91 s	1.86 s
20′	1.96 s	1.99 s	2.01 s	1.98 s
Ac		3.77 s		

①The data was not assigned in the literature, and here, the deployments are only to display the data.

Table 12-2-20: ^{1}H NMR spectroscopic data of carotenoids **12-2-79**~**12-2-81**.

H	12-2-79	12-2-80	12-2-81
7	5.18 s, 5.24 d(2)	5.17 s, 5.23 d(2)	5.17 s, 5.23 d(2)
8	5.16 s, 5.07 br s	5.15 s, 5.06 br s	5.15 s, 5.07 br s
10	6.20 d(11)	6.17 d(11)	6.17 d(11)
11	6.54 dd(15, 11)	6.49 m	6.49 m
12	6.33 d(15)	6.31 d(15)	6.31 d(15)
14	6.23 d(11)	6.22 m	6.21 m
15	6.71 dd(15, 11)	6.62 m	6.61 m
16	1.11, 1.12 s	1.10, 1.11 s	1.10, 1.11 s
17	1.16, 1.18 s	1.15, 1.17 s	1.15, 1.17 s
18	1.43, 1.46 s	1.42, 1.45 s	1.42, 1.47 s
19	1.75, 1.80 s	1.74, 1.79 s	1.74, 1.79 s
20	1.97 s	1.95 s	1.94 s
8′		4.11 d(6)	
10′	7.29 dd(12, 1.5)	6.20 m	6.21 m
11′	6.51 dd(15, 11)	6.51 m	6.51 m
12′	6.62 d(15)	6.33 d(15)	6.33 d(15)
14′	6.36 d(12)	6.22 m	6.21 m
15′	6.61 dd(15, 11)	6.62 m	6.62 m
19′	1.97 s	1.85 s	1.84 s
20′	2.00 s	1.95 s	1.94 s
OAc	3.77 s		2.09 s

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