Electronical Supporting Information

Chemistry and bioactivity of lindenane sesquiterpenoids and their oligomers

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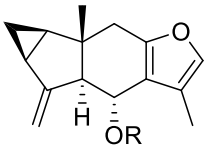

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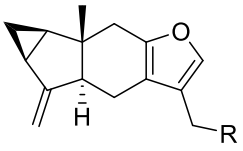
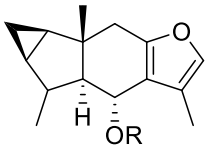
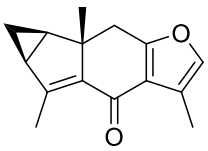
2 R = Ac



3 R = OCH_3
4 R = H



5 R= H CH_3-15 β
6 R= Ac CH_3-15 β
7 R= H CH_3-15 α



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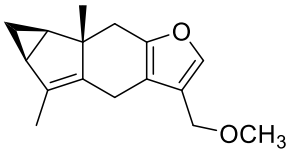

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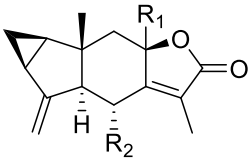
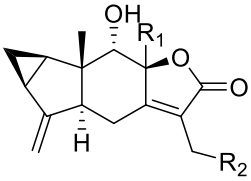
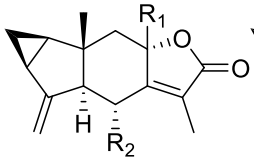


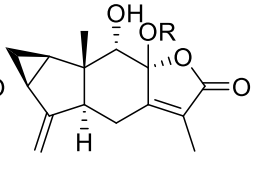
10 R_1 = OH R_2 = OH
11 R_1 = OH R_2 = OAc
12 R_1 = H R_2 = OH
16 R_1 = O**A** R_2 = OH



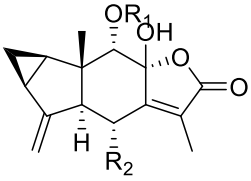
13 R_1 = OCH_3 R_2 = H
14 R_1 = H R_2 = H
15 R_1 = OCH_3 R_2 = OH



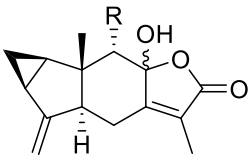
17 R_1 = OH R_2 = OH
18 R_1 = OH R_2 = OAc
19 R_1 = H R_2 = OAc
20 R_1 = H R_2 = H
21 R_1 = OCH_3 R_2 = H
25 R_1 = OGlc R_2 = H



22 R = CH_3
24 R = C_2H_5
26 R = Glc



23 R_1 = H R_2 = OAc
27 R_1 = **B** R_2 = H



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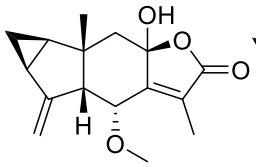
29 R= OH



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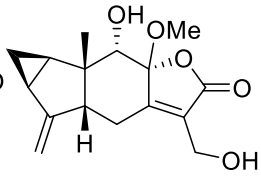

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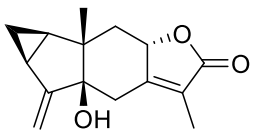

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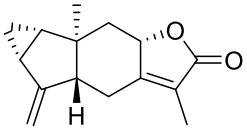

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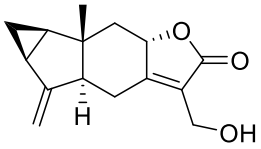

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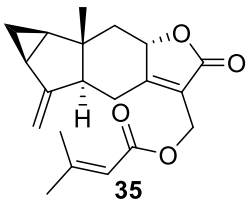

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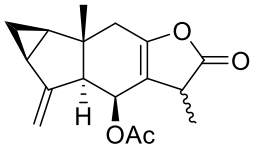

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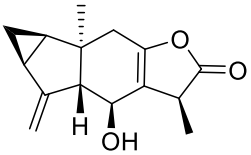

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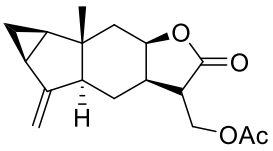

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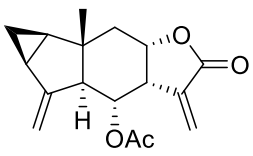

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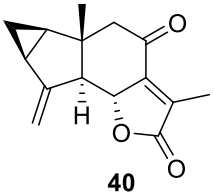

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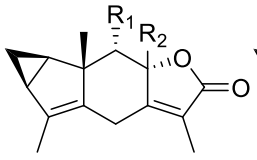

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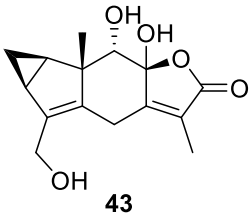
42 R_1 = OH R_2 = OH



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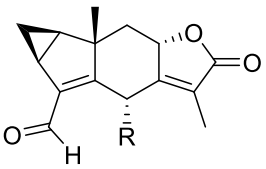

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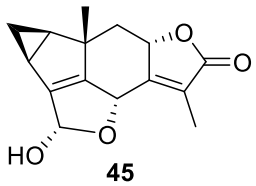
47 R = H



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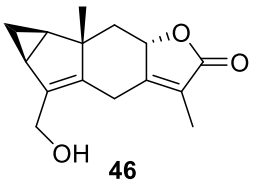

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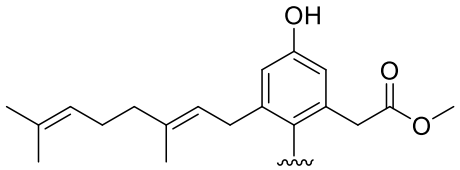

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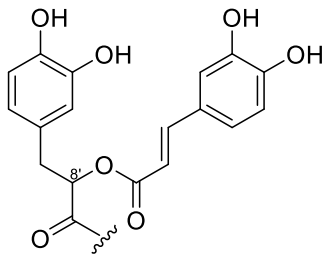

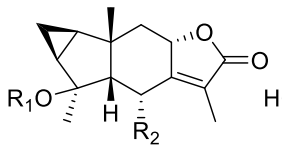

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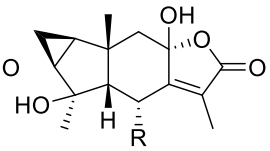
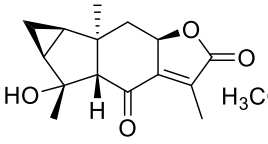
49 R_1 = H R_2 = H
50 R_1 = CH_3 R_2 = H



51 R = H
52 R = OH
53 R = OAc



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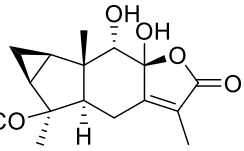

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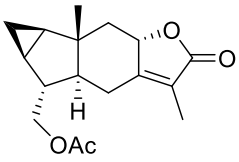

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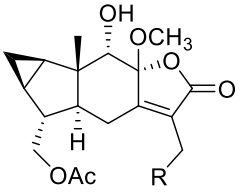
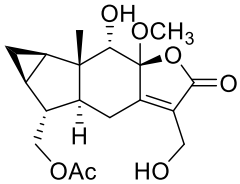


57 R = OH
58 R = H



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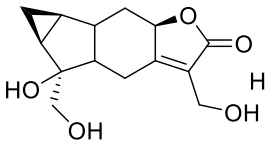

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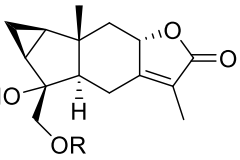
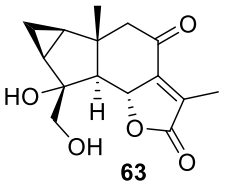


61 R = H
62 R = Glc



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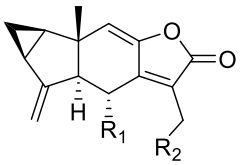
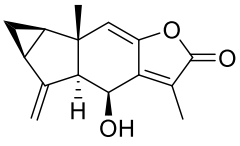


64 R_1 = H R_2 = H
65 R_1 = OAc R_2 = H
66 R_1 = H R_2 = OH



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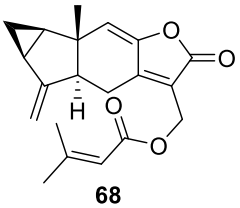

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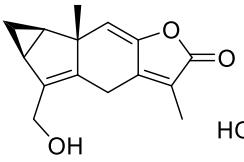

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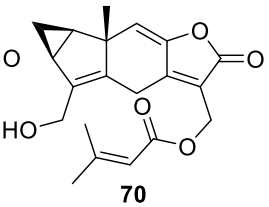

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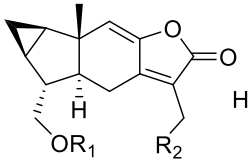
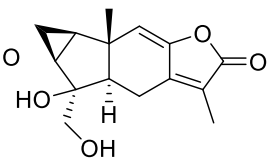


71 R_1 = Ac R_2 = H
72 R_1 = H R_2 = H
73 R_1 = Glc R_2 = OH
76 R_1 = H R_2 = OH
77 R_1 = Ac R_2 = OH



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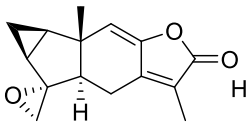

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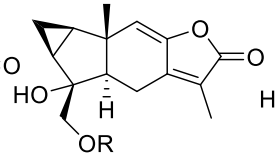
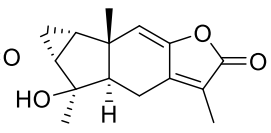


78 R = H
79 R = Glc



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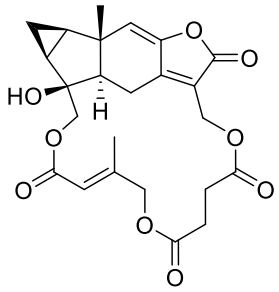

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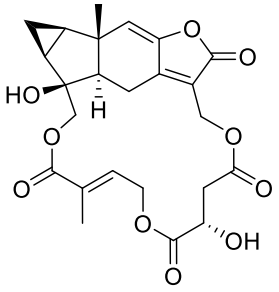

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Table S1-1 Structure names, sources and bioactivity of ring-intact type LS monomers (**1-27**).

No	Compound	Sources	Bioactivity
1	Lindenenol	*Lindera strychnifolia*,[1-4] *L. chunii*,[5] *L. aggregata*[6, 7]	
2	Lindenenyl acetate	*L. strychnifolia*,[2] *L. chunii*,[5] *L. aggregata*[6]	
3	Linderoxide	*L. strychnifolia*[8]	
4	Lindenene	*L. strychnifolia*[4, 9]	
5	Linderene	*L. strychnifolia*[10]	
6	Linderene acetate	*L. strychnifolia*[10]	
7	Isodihydrolinderene	*L. strychnifolia*[10]	
8	Lindenenone	*L. strychnifolia*[10]	
9	Isolinderoxide	*L. strychnifolia*[11]	
10	Strychnistenolide A	*L. strychnifolia*[12]	
11	6α-acetyl-lindenanolide A (Strychnistenolide 6-*O*-acetate B1)	*L. aggregata*,[13] *L. chunii*,[5] *L. strychnifolia*[12]	
12	Strychnilactone 2,6-dihydroxyxanthone	*L. strychnifolia*[3, 13]	
13	Chlorajapolide F	*Chloranthus japonicus*[14]	Cytotoxicity[14]
14	Chlojaponilactone G	*C. japonicus*[15]	
15	Decorone A	*Gochnatia decora*[16]	
16	Linderin A	*L. aggregata*[6]	
17	Strychnistenolide B	*L. strychnifolia*[12]	
18	6α-acetyl-lindenanolides B (Strychnistenolide 6-*O*-acetate B2)	*L. aggregata*,[12] *L. chunii*,[5] *L. strychnifolia*[13]	
19	Lindenanolide H	*L. chunii*,[5] *L. strychnifolia*[4]	
20	Shizukanolide (Shizukanolide A)	*C. japonicus*,[14, 17, 18] *L. strychnifolia*[4]	Cytotoxicity[14]
21	Heterogorgiolide	*Heterogorgia uatumani*[19]	
22	9-hydroxy heterogorgiolide (Chlorajapolide Fa)	*C. japonicus*,[14, 20] *S. glabra*[21]	Collagen inhibitory[20]
23	Chlojaponilactone F	*C. japonicus*[15]	
24	Chlojaponilactone H	*C. japonicus*[15]	Antifungal[15]
25	Chlorajaposide	*C. japonicus*[22]	
26	Chloranthalactone E 8-*O*-β-$_D$-glucopyranoside	Sarcandra glabra[23]	Hepatoprotective23
27	Rosmarylchloranthalactone E	*C. japonicus*[24]	PDE4 inhibitory[24]

Table S1-2 Structure names, sources and bioactivity of ring-intact type LS monomers (**27-55**).

No	Compound	Sources	Bioactivity
28	Chloranthalactone D	*C. japonicus*,[25] *L. strychnifolia*[4, 13]	
29	Chloranthalactone E	*C. japonicus*,[14, 15, 25] *C. glaber*,[26] *S. glabra*[27-29]	Cytotoxicity[14]
30	Linderolide T	*L. strychnifolia*[13]	
31	Decorone B	*G. decora*[16]	
32	Sarcandralactone A	*S. glabra*[28]	
33	Menelloide C	*Gorgonian Coral Menella sp*[30] *L. strychnifolia*[13]	
34	Onoseriolide A*	*Leontopodium leontopodioides*[31]	
35	8*α*,9-dihydroonoseriolide senecioute	*L. leontopodioides*[31]	
36	Lindenanolide A	*L. strychnifolia*[4, 32]	
37	Linderolide V	*L. strychnifolia*[33]	ARE-Inducing activity[33]
38	Onoseriolide acetate	*Hyalis argentea var. latisquama*[34]	
39	Wunderoild	*Wunderlichia Mirabilis*[35]	
40	Sibirolide A	*Xanthium sibiricum*[36]	
41	Isoshizukanolide	*C. fortunei*[37]	
42	8*β*,9*α*-dihydroxylindan-4(5),7(11)-dien-8*α*,12-olide	*S. glabra*[27]	
43	Glabranol A	*S. glabra*,[38] *C. japonicus*[39]	
44	Chlorajapolide A	*C. japonicus*[22]	
45	Chlorajapolide B	*C. japonicus*[22]	
46	Chlorajapolide C	*C. japonicus*[22]	Cytotoxicity[22]
47	Chlojaponilacton D	*C. japonicus*[18]	
48	Linderolide K	*L. strychnifolia*[4]	
49	Linderolide N	*L. strychnifolia*[13]	
50	Linderolide O	*L. strychnifolia*[13]	Anti-Inflammatory[13]
51	Linderolide P	*L. strychnifolia*[13]	Anti-Inflammatory[13]
52	Linderolide Q	*L. strychnifolia*[13]	
53	Linderolide R	*L. strychnifolia*[13]	
54	Linderolide S	*L. strychnifolia*[13]	
55	Sarcandralactone C	*S. glabra*[29]	

*Compound **34** and compound **66** possessing the same name, in order to distinguish them, we named **34** Onoseriolide A.

Table S1-3 Structure names, sources and bioactivity of ring-intact type LS monomers (**56-81**).

No	Compound	Sources	Bioactivity
56	Chlojaponilactone E	*C. japonicus*[14, 18]	Cytotoxicity[14]
57	Chlorajapolide E	*C. japonicus*[22]	
58	Chlorajapolide H	*C. japonicus*[14]	Cytotoxicity[14]
59	Chlojaponilactone I	*C. japonicus*[15]	
60	Decorone D	*G. decora*[16]	
61	Chlorajapolide D	*C. japonicus*,[22] *C. sessilifolius*[40]	
62	Yinxiancaoside A	*C. japonicus*,[41] *S. glabra*[21]	Cytotoxicity[41]
63	Myrrhalindenane B	*L. myrrha*[42]	
64	Chloranthalactone A (Shizukanolide B)	*S. glabra*,[43] *C. glaber*,[26, 44] *C. japonicus*,[15, 17, 25] *C. tianmushanensis*,[45] *Hedyosmum angustifolium*[46]	Cytotoxicity[25]
65	Chlojaponilactone B	*C. japonicus*[18]	
66	Onoseriolid B*	*H. angustifolium*[46]	
67	Sibirolide B	*X. sibiricum*[36]	
68	Onoseriolide senecioate	*L. leontopodioides*,[31] *H. argentea var. latisquama*[34]	
69	Sarcandralactone D	*S. glabra*[29]	
70	15-hydroxyisoonoseriolide senrcioate	*L. leontopodioides*	
71	Chloranthalactone C	*C. japonicus*,[18, 25, 47, 48] *C. fortunei*,[49] *S. glabra*[28]	
72	Shizukanolide C	*C. japonicus*,[18, 47, 48] *C. fortunei*,[49]	
73	Chloranoside B	*C. glaber*[50]	
74	Chlorajaponol F	*C. japonicus*[39]	
75	Chloranthalactone G	*S. glabra*[43]	
76	Shizukanolide F	*C. japonicus*,[47] *C. fortunei*[49]	
77	Shizukanolide H	*C. fortunei*[49]	
78	Shizukanolide E	*C. japonicus*[47]	
79	Chloranoside A	*C. glaber*,[50] *S. glabra*,[21, 23] *C. japonicus*,[41] *C. fortunei*[49]	Hepatoprotective[23] Cytotoxicity[41]
80	Linderaggredin B	*L. aggregata*[51]	
81	Chlorafortulide	*C. fortunei*[52]	
82	Sarglabolide L	*S. glabra*[53]	Anti-Inflammatory[53]

*Compound **66** and compound **34** possessing the same name, in order to distinguish them, we named **66** Onoseriolide B.

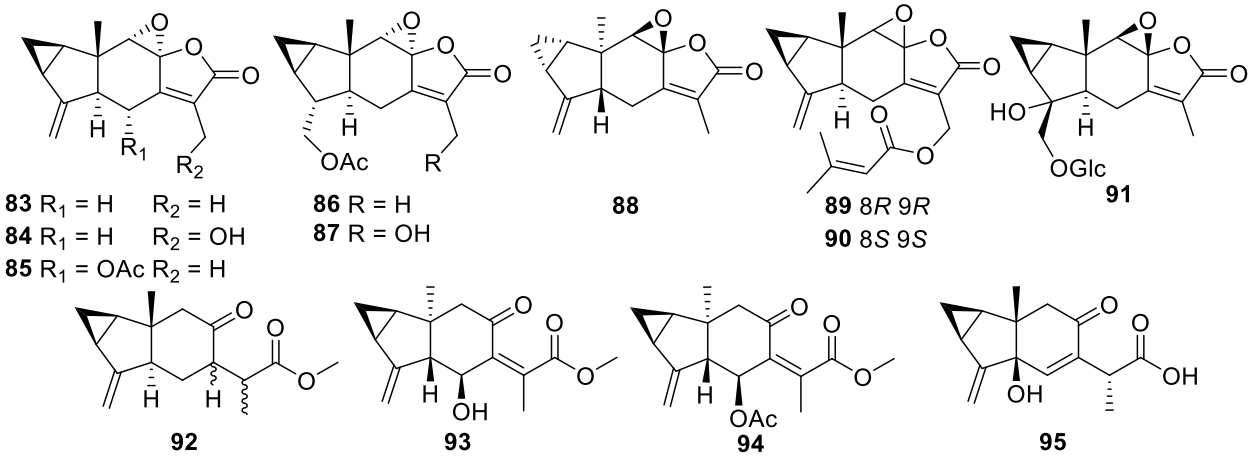


Table S1-4 Structure names, sources and bioactivity of ring-intact type LS monomers (**82-95**).

No	Compound	Sources	Bioactivity
83	Chloranthalactone B	*C. glaber,*[26, 44] *S. glabra,*[21] *C. japonius*[14, 15, 25]	Cytotoxicity[14, 25]
84	Oxyonoseriolide	*H. angustifolium*[46]	Cytotoxicity[46]
85	Chlojaponilactone C	*C. japonicus*[18]	
86	Shizukanolide D	*C. japonicus*[47]	
87	Shizukanolide G	*C. fortunei*[49]	
88	(+)-chloranthalactone B	*Menella sp*[54]	
89	13-desoxyisoonoseriolide	*H. argentea var. latisquama*[34]	
90	8*β*,9*β*-epoxyonoseriolide senecioate	*L. leontopodioides*	
91	Sarcaglaboside F	*S. glabra*[21]	
92	Hedyosmone	*H. angustifolium*[46]	
93	Linderolide U	*L.aggregata,*[7] *L. strychnifolia*[33]	
94	Linderolide L	*L. strychnifolia*[4]	
95	Myrrhalindenane A	*L. myrrha*[42]	

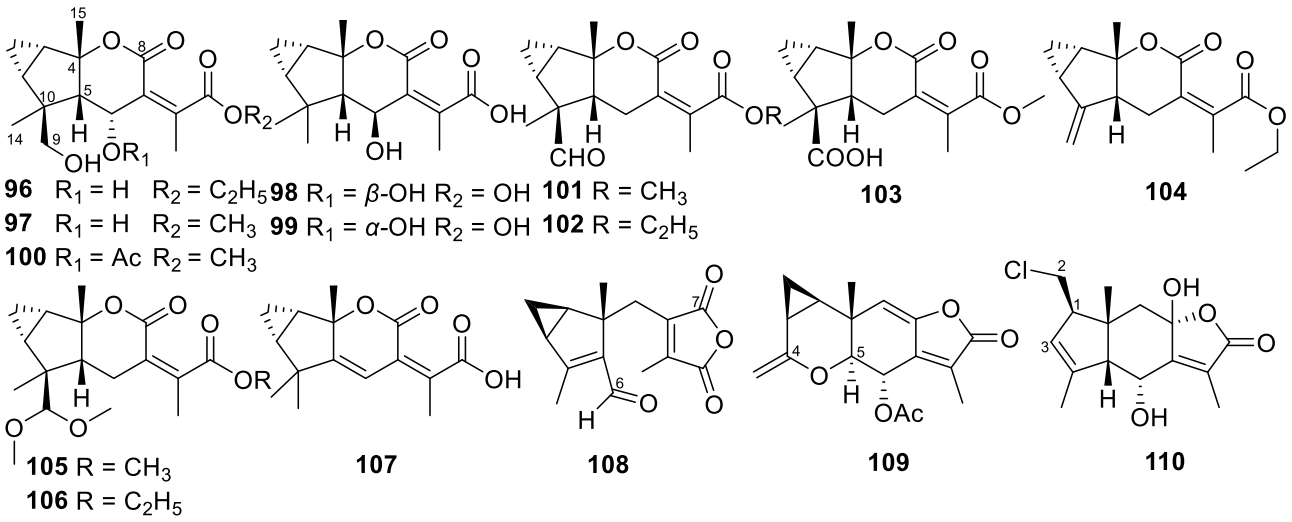
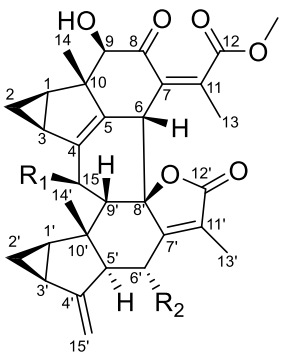
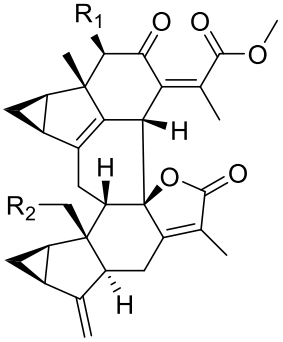


Table S2 Structure names, sources and bioactivity of ring-*seco* type LS monomers (**96-110**).

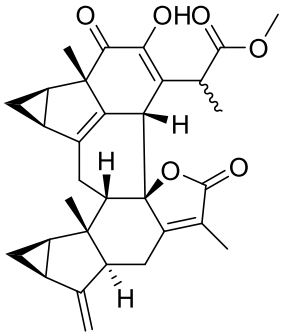
No	Compound	Sources	Bioactivity
96	Strychnilactone	*L. strychnifolia*[12]	
97	Lindenanolide G	*L. chunii*,[5] *L. strychnifolia*[13]	
98	Linderagalactone B	*L. aggregata*[55]	
99	Linderolide M	*L. strychnifolia*[4]	
100	Rotundusolide A	*Cyperus rotundus*[56]	
101	Chloranerectuslactone V	*C. erecyus*[57]	
102	Sarglalactone I	*S. glabra*[58]	Cytotoxicity[58]
103	Sarglalactone J	*S. glabra*[58]	
104	Sarglalactone K	*S. glabra*[58]	
105	Sarglalactone L	*S. glabra*[58]	
106	Sarglalactone M	*S. glabra*[58]	
107	Linderagalactone C	*L. aggregata*[55]	
108	Lindenanolide E	*L. chunii*[5]	
109	Linderaggredin C	*L. aggregata*[51]	
110	Linderagalactone A	*L. aggregata*[55]	



111 R_1 = H R_2 = H
113 R_1 = H R_2 = OAc
114 R_1 = OH R_2 = H



112 R_1 = OAc R_2 = H
115 R_1 = H R_2 = H
117 R_1 = H R_2 = OAc



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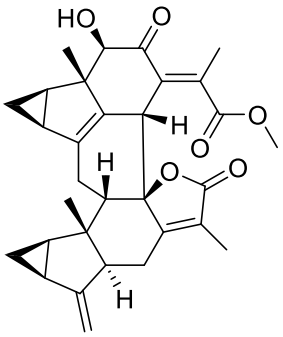

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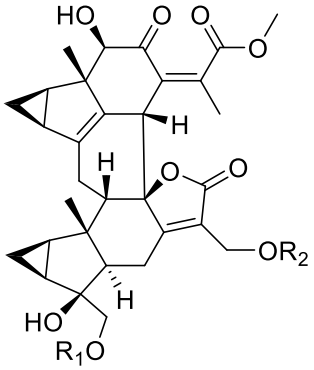
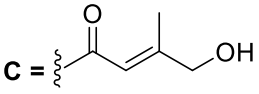


119 R_1 = Ac R_2 = H
121 R_1 = **C** R_2 = H
122 R_1 = **D** R_2 = Ac
123 R_1 = **E** R_2 = Ac
124 R_1 = Ac R_2 = H
126 R_1 = **D** R_2 = H
128 R_1 = **F** R_2 = H
129 R_1 = **D** R_2 = **G**
130 R_1 = **C** R_2 = **L**
131 R_1 = **C** R_2 = **G**
132 R_1 = **I** R_2 = H
133 R_1 = H R_2 = H
134 R_1 = **F** R_2 = **H**
135 R_1 = **F** R_2 = **J**
136 R_1 = **O** R_2 = H
137 R_1 = **D** R_2 = **L**
138 R_1 = **M** R_2 = **G**
139 R_1 = **N** R_2 = H
140 R_1 = **E** R_2 = H
141 R_1 = **C** R_2 = H
142 R_1 = **C** R_2 = **L**
145 R_1 = Ac R_2 = Ac

C =



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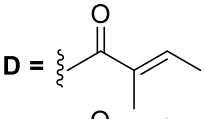

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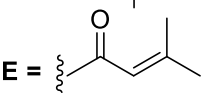

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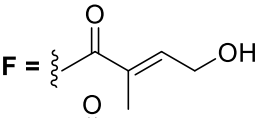

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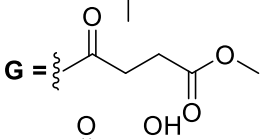

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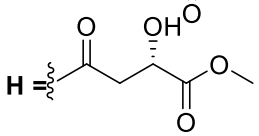

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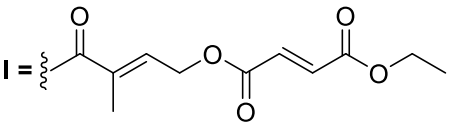

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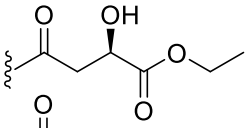
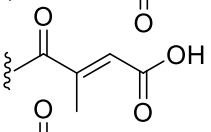


K =



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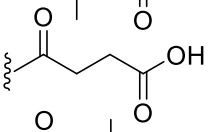

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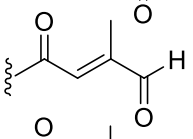

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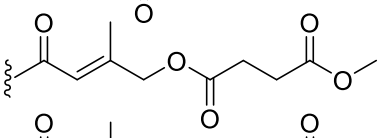

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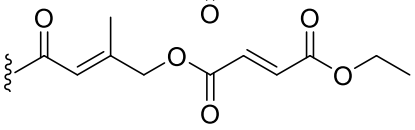
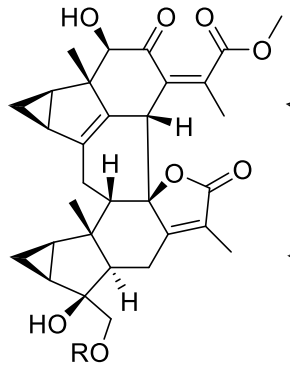
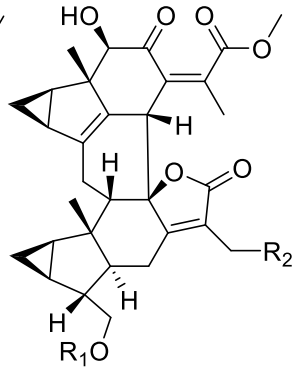
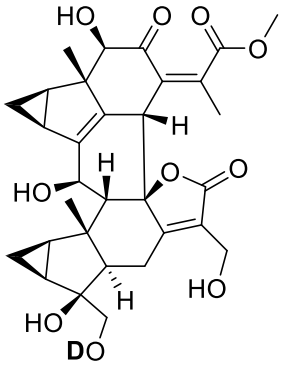




120 R = **C**
125 R = **D**
127 R = **K**



143 R_1 = H R_2 = OH
146 R_1 = Ac R_2 = OH
147 R_1 = Ac R_2 = H



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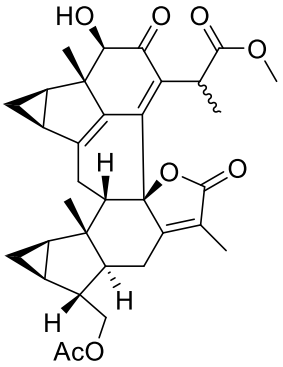

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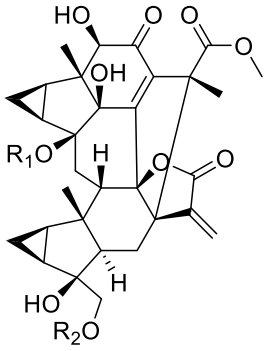
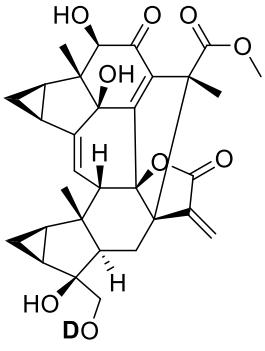


149 R_1 = H R_2 = **D**
150 R_1 = Ac R_2 = **D**



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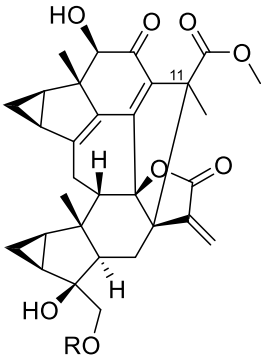
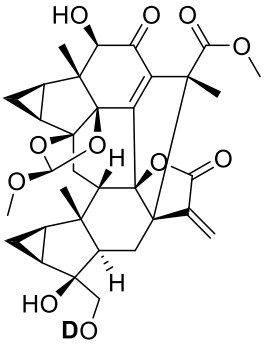


152 R = **C** 11*S*
153 R = **D** 11*R*
154 R = **D** 11*S*
155 R = **P** 11*S*
156 R = **Q** 11*S*



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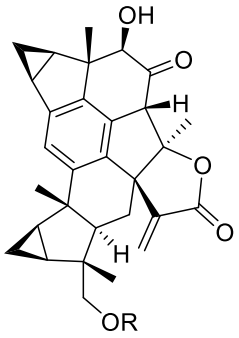
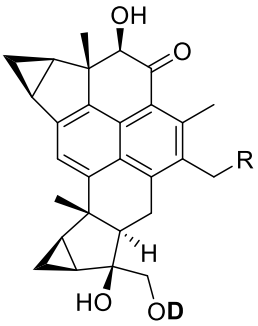
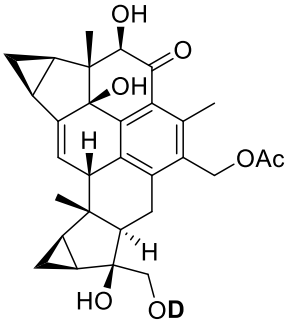


158 R = **F**
159 R = **C**
160 R = H



161 R = OAc
162 R = OH



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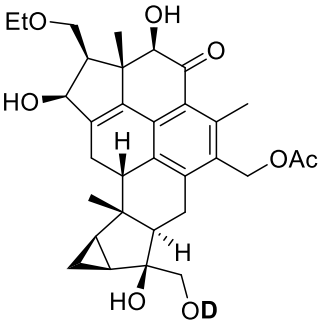

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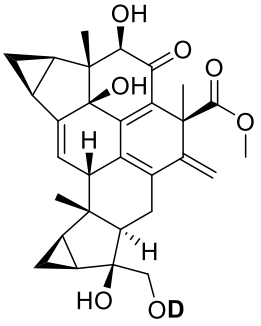

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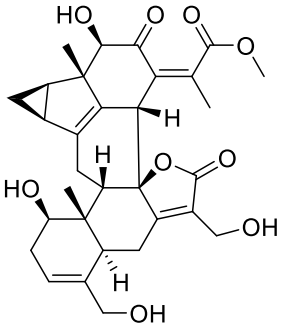

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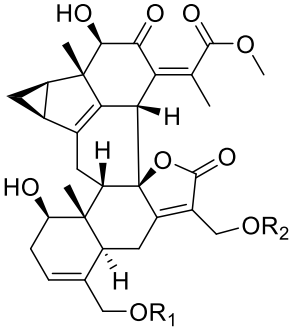
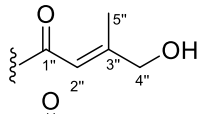


167 R_1 = **F** R_2 = H
168 R_1 = **D** R_2 = **G**

C =



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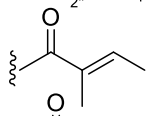

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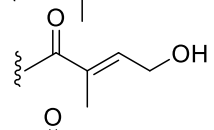

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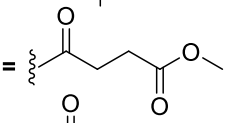

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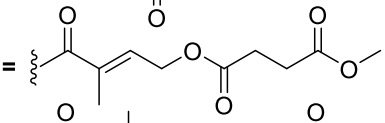

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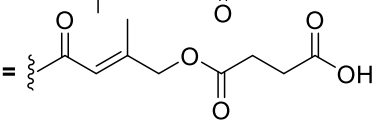


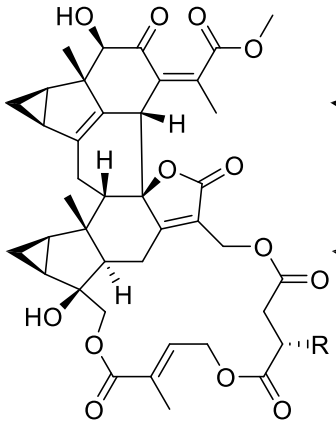
Table S3-1 Structure names, sources and bioactivity of *homo*-[4 + 2] cycloaddition type LS dimers (**111-136**).

No	Compound	Sources	Bioactivity
111	Shizukaol A	*C. japonicus*,[59-61] *C. serratus*,[62] *C. fortunei*[63]	
112	Shizukaol A acetate	*C. japonicus*[64]	
113	Chlojapolide D	*C. japonicus*[59]	
114	Chlojapolide E	*C. japonicus*[59]	
115	Chlojapolide F	*C. japonicus*[59]	
116	Chlojapolide B	*C. japonicus*[59]	
117	Chololactone D	*C. holostegius*[65]	
118	Chlojapolide C	*C. japonicus*[59]	
119	Shizukaol N	*C. fortunei*,[63] *S. glabra*[66]	
120	Shizukaol M	*C. fortunei*[37, 52, 63]	Anti-Inflammatory[52]
121	Shizukaol I	*C. japonicus*,[67] *C. fortunei*[37, 63]	
122	Chloraholide D (henriol D)	*C. holostegius*,[68] *C. henryi*,[69] *C. fortunei*,[37, 63] *C. spicatus*,[70] *S. glabra*,[29] *C. serratus*[71]	Antimalarial[37]
123	Shizukaol K	*C. fortunei*[37, 63]	
124	Multistalide B	*C. multistachys*[72]	
125	Sarcandrolide A	*S. glabra*[28]	Cytotoxicity[28]
126	Shizukaol C	*C. serratus*,[62] *S. glabra*,[28, 29, 66, 73] *C. multistachys*,[74, 75] *C. japonicus*,[14, 60, 76] *C. fortunei*,[37, 52] *C. holostegius*[65]	Anti-HIV[60] Cytotoxicity[52, 60, 73, 76]
127	Shizukaol L	*C. fortunei*[63]	
128	Sarcandrolide B	*S. glabra*[28]	Cytotoxicity[28]
129	13′-*O*-Methyl succinylshizukaol C *	*C. japonicus*[22]	
130	Chololactone E	*C. holostegius*[65]	Anti-Inflammatory[65]
131	Chololactone F	*C. japonicus*,[60] *C. holostegius*[65]	Anti-Inflammatory[65]
132	Sarglabolide H	*S. glabra*[66]	
133	Sarglabolide I	*S. glabra*,[66] *C. fortunei*[37]	
134	Sarglabolide J	*S. glabra*,[66] *C. fortunei*[37]	Antimalarial[37]
135	Sarglabolide K	*S. glabra*[66]	
136	Fortunilide M	*C. fortunei*[77]	

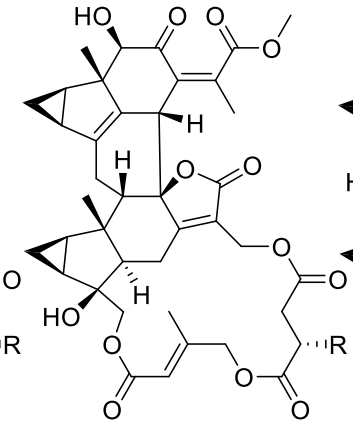
The structure of Chlorajaponol (**129**) with $\Delta^{4,5}$ double bonds should be of *E*-geometry, revised to 3′-*O*-Methyl succinylshizukaol C.

Table S3-2 Structure names, sources and bioactivity of *homo*-[4 + 2] cycloaddition type LS dimers (**137-163**).

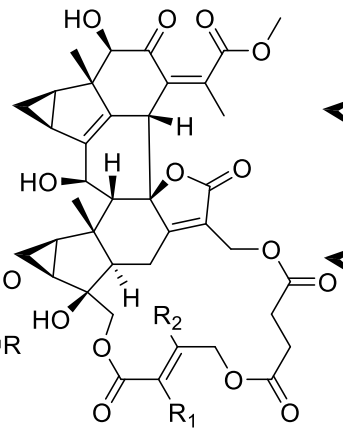
No	Compound	Sources	Bioactivity
137	Chlojapolide A	*C. japonicus*[59]	Anti-Inflammatory[59]
138	Fortunilide A	*C. fortunei*[37]	
139	Fortunilide B	*C. fortunei*[37]	Antimalarial[37]
140	Fortunilide C	*C. fortunei*[37]	
141	Chlorahupetol F	*Chloranthus henryi var. hupehensis*[78]	
142	Shizukaol O	*C. fortunei*[52, 63], *C. japonicus*[14]	Anti-Inflammatory[52] Cytotoxicity[14]
143	Sarcandrolide J	*S. glabra*,[29] *C. fortunei*[37]	
144	Chlomultiol A	*C. multistachys*[74]	Anti-Inflammatory[74]
145	Sarcanolide E	*S. glabra*[79]	Anti-Inflammatory[79]
146	Shizukaol D	*C. serratus*,[62, 71, 80] *C.fortunei*,[52] *C.spicatus*,[70] *C.multistachys*,[75] *S. glabra*,[29, 73] *C. japonicus*[14, 60, 81]	Cytotoxicity[14] Anti-Inflammatory[52]
147	Shizukaol E	*C. japonicus*,[67, 82, 83] *C. fortunei*,[52, 63] *S. glabra*[28]	Anti-Inflammatory[52] Anti-HIV[83] Anti-HCV[83]
148	Chololactone G	*C. holostegius*[65]	Anti-Inflammatory[65]
149	Sarcanolide A	*S. hainanensis*[84]	Cytotoxicity[84]
150	Sarcanolide D	*S. glabra*[79]	Anti-Inflammatory[79]
151	Sarcanolide B	*S. hainanensis*[84]	Cytotoxicity[84]
152	Fortunilide N	*C. fortunei*[77]	
153	Chololactone A	*C. holostegius*[65]	Anti-Inflammatory[65]
154	Fortunilide K	*C. fortunei*[37]	
155	Fortunilide L	*C. fortunei*[37]	
156	Fortunilide O	*C. fortunei*[77]	
157	Sarcanolide C	*S. glabra*[79]	Anti-Inflammatory[79]
158	Chlorahupetone G	*C. henryi var. hupehensis*[85]	Cytotoxicity[85]
159	Chlorahupetone H	*C. henryi var. hupehensis*[85]	Cytotoxicity[85]
160	Chlorahupetone I	*C. henryi var. hupehensis*[85]	Cytotoxicity[85]
161	Sarglaromatic A	*S. glabra*[86]	Anti-Nonalcoholic[86]
162	Sarglaromatic B	*S. glabra*[86]	Anti-Nonalcoholic[86]
163	Sarglaromatic C	*S. glabra*[86]	



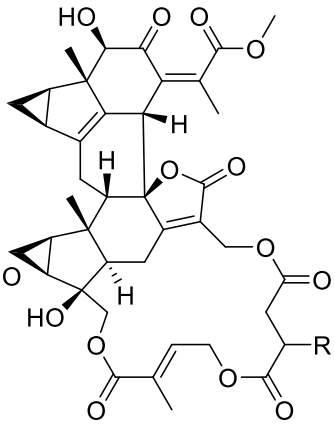
169 R = H
171 R = OH



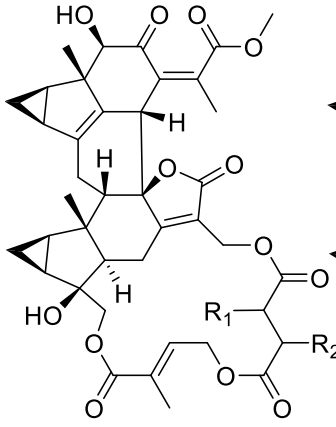
170 R = H
172 R = OH



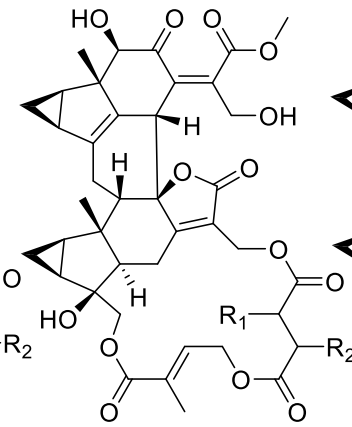
173 R_1 = H R_2 = CH_3
174 R_1 = CH_3 R_2 = H



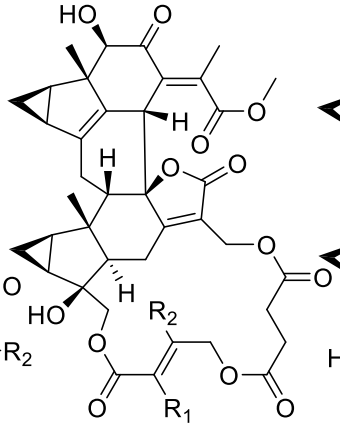
175 R = α–OAc
176 R = β–OH



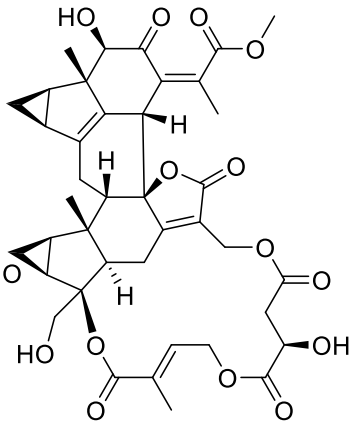
177 R_1 = β–OH R_2 = H
179 R_1 = α–OH R_2 = α–OH



178 R_1 = H R_2 = α–OH
180 R_1 = α–OH R_2 = α–OH
181 R_1 = H R_2 = H



182 R_1 = CH_3 R_2 = H
183 R_1 = H R_2 = CH_3



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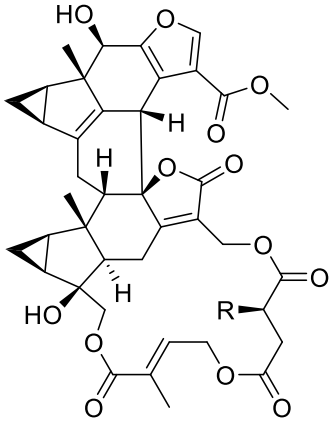
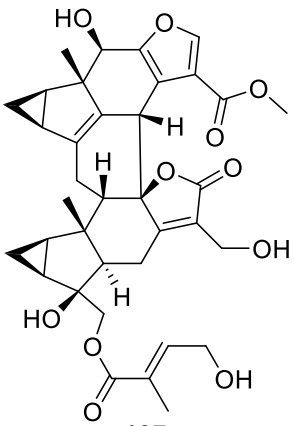


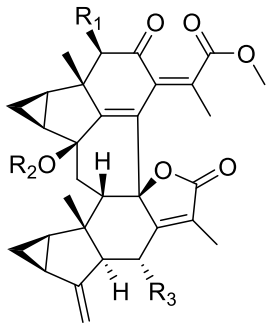
185 R = OH
186 R = H



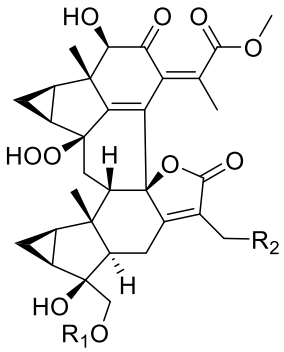
187

Table S3-3 Structure names, sources and bioactivity of *homo*-[4 + 2] cycloaddition type LS dimers (**164-188**).

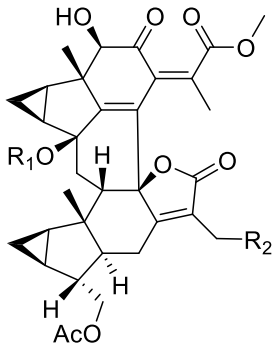
No	Compound	Sources	Bioactivity
164	Sarglaromatic D	*S. glabra*[86]	
165	Sarglaromatic E	*S. glabra*[86]	
166	Fortunoid C	*C. fortunei*[39]	Antimalarial[39]
167	15′-*O*-(4-Hydroxytigloyl)fortunoid C	*C. fortunei*[87]	
168	13′-*O*-Methyl succinyl-15′-*O*-tigloylfortunoid C	*S. glabra*[87]	
169	Shizukaol B	*C. serratus*,[62, 71, 80] *C. fortunei*,[37, 52, 63] *C. japonicus*,[59, 76] *S. glabra*,[28, 66] *C. spicatus*[70], *C. tianmushanensis*[45]	Anti-HIV[60, 70] Cytotoxicity[52, 60, 70] Anti-Inflammatory[14, 66, 76, 88] Antimalarial[37]
170	Shizukaol F	*C. japonicus*,[59, 60, 67, 76] *C. fortunei*,[37, 49, 63] *C. spicatus*[70]	Anti-HIV[70] Cytotoxicity[70] Antimalarial[37]
171	Shizukaol G	*C. japonicus*,[67, 76, 83] *S. glabra*,[28, 66] *C. fortunei*[37, 52]	Anti-Inflammatory[52, 66, 88] Antimalarial[37]
172	Shizukaol H	*C. japonicus*,[60, 67] *S. glabra*[29]	Anti-HIV[60] Cytotoxicity[60]
173	Shizukaol P	*C. fortunei*,[49] *C. spicatus*[70]	
174	Chloramultiol A	*C. multistachys*[75]	Cytotoxicity[75]
175	Sarcandrolide C	*S. glabra*[28]	
176	Sarglabolide B	*S. glabra*[66]	
177	Sarglabolide C	*S. glabra*[66]	Cytotoxicity[66]
178	Sarglabolide D	*S. glabra*[66]	
179	Sarglabolide E	*S. glabra*[66]	
180	Sarglabolide F	*S. glabra*[66]	
181	Sarglabolide G	*S. glabra*[66]	
182	Henriol C	*C. henryi*,[69] *C. serratus*[71]	Cytotoxicity[69]
183	Fortunilide G	*C. fortunei*,[37] *C. holostegius*[65]	
184	Sarglabolide A	*S. glabra*[66]	Anti-Inflammatory[66]
185	Sarglafuran A	*S. glabra*[89]	
186	Chlorahupetol C	*C. henryi var. hupehensis*[78]	
187	Chlorahupetol D	*C. henryi var. hupehensis*[78]	
188	Chloraholide A	*C. holostegius*[90]	Voltagegated potassium activity[90]



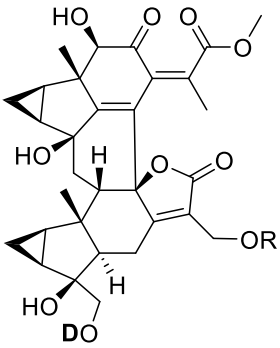
188 R_1 = H R_2 = H R_3 = OAc
189 R_1 = OH R_2 = H R_3 = OAc
190 R_1 = OH R_2 = OH R_3 = H



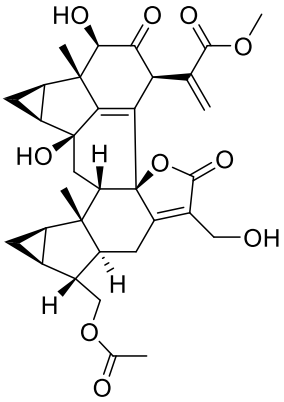
191 R_1 = **D** R_2 = OAc
194 R_1 = **D** R_2 = OH
197 R_1 = **N** R_2 = OH
198 R_1 = **C** R_2 = O**G**
199 R_1 = H R_2 = H



192 R_1 = OH R_2 = OH
195 R_1 = H R_2 = OH
200 R_1 = OH R_2 = H



193 R = Ac
196 R = H



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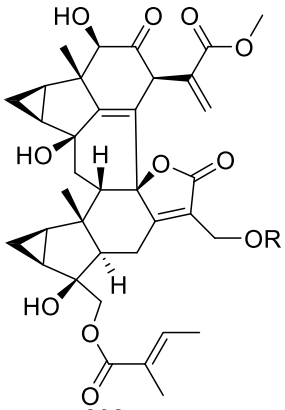
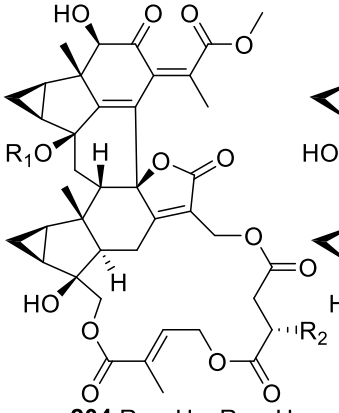
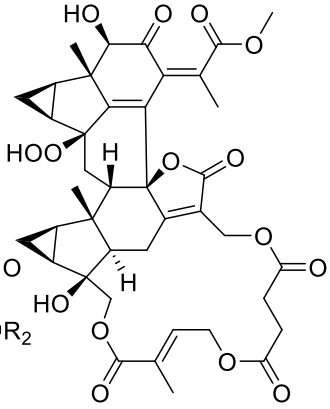


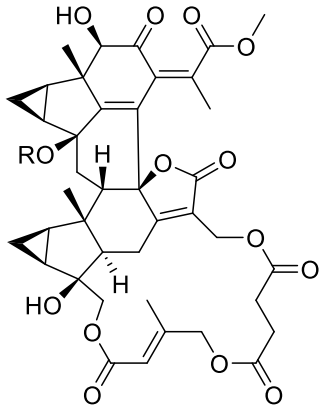
202 R = H
203 R = Ac



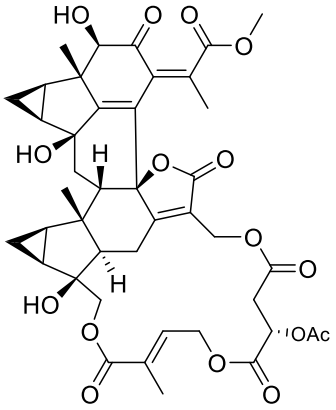
204 R_1 = H R_2 = H
207 R_1 =OH R_2 = OH



205



206 R = OH
209 R = H



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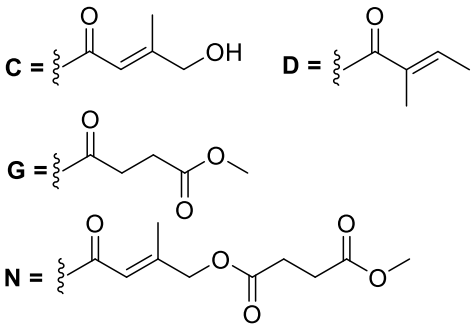
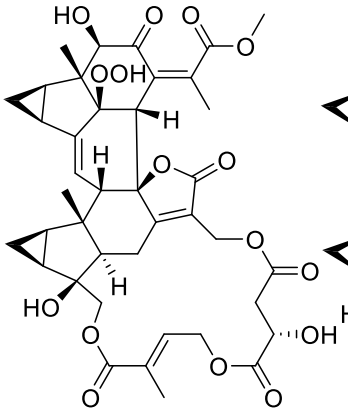


Table S3-4 Structure names, sources and bioactivity of *homo*-[4 + 2] cycloaddition type LS dimers (**189-215**).

No	Compound	Sources	Bioactivity
189	Chloraholide C	*C. holostegius*,[68] *C. japonicus*[59]	
190	Spicachlorantin J	*C. spicatus*,[70] *C. japonicus*[59]	
191	Spicachlorantin E	*C. spicatus*[91]	
192	Spicachlorantin F	*C. spicatus*,[91] *S. glabra*[29]	
193	Sarcandrolide E	*S. glabra*[28, 29, 73]	Cytotoxicity[73]
194	Chlorajaponilide E	*C. japonicus*,[60] *S. glabra*[29]	
195	Spicachlorantin G	*C. spicatus*[70]	
196	Chlorasessilifol A	*C. sessilifolius*[40]	
197	Fortunilide D	*C. fortunei*[37]	
198	Fortunilide E	*C. fortunei*[37]	
199	Fortunilide F	*C. fortunei*[37]	
200	Chololactone B	*C. holostegius*[65]	Anti-Inflammatory[65]
201	Multistalide A	*C. multistachys*[72]	
202	Chlomultiol B	*C. multistachys*[74]	Anti-Inflammatory[74]
203	Sarcaglabrin B	*S. glabra*[73]	
204	Chloramultilide A	*C. multistachys*,[92]*C. spicatus*[70, 93]	
205	Spicachlorantin C	*C. spicatus*[91]	
206	Spicachlorantin D	*C. spicatus*,[91] *C. fortunei*,[37] *C. japonicus*[94]	
207	Sarcandrolide G	*S. glabra*,[29] *C. japonicus*[83]	
208	Sarcandrolide H	*S. glabra*[29]	Cytotoxicity[29]
209	Chlorajaponilide H	*C. japonicus*[83]	
210	Sarcandrolide F	*S. glabra*,[29] *C. japonicus*[83]	Cytotoxicity[29] Anti-HIV[83] Anti-HCV[83]
211	Chlorajaponilide F	*C. japonicus*[83]	Anti-HIV[83] Anti-HCV[83]
212	Chlorajaponilide I	*C. japonicus*[94]	
213	Chlorajaponilide G	*C. japonicus*[83]	
214	Chloraholide E	*C. holostegius*[68]	Voltagegated potassium activity[68]
215	Spicachlorantin H	*C. spicatus*,[70] *C. japonicus*[59, 83]	



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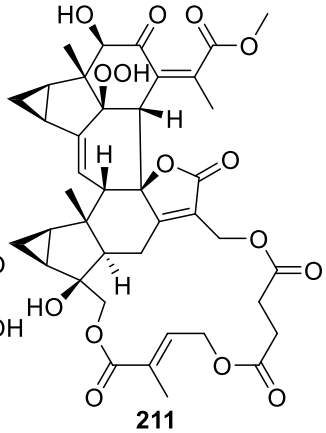

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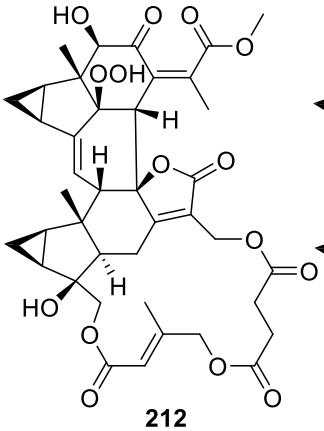

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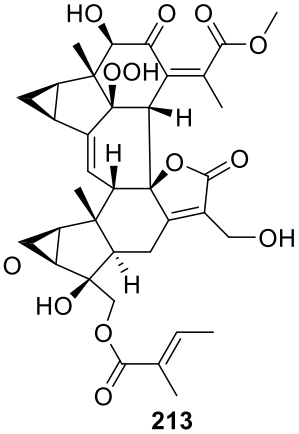
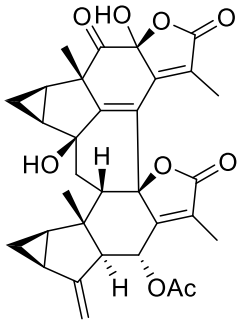
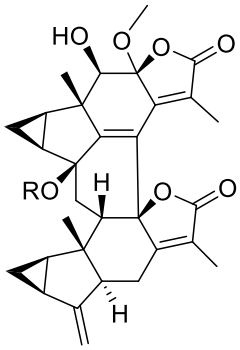


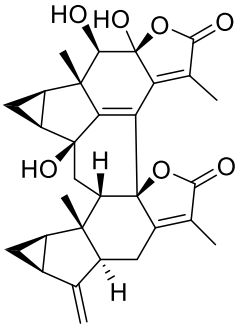
213



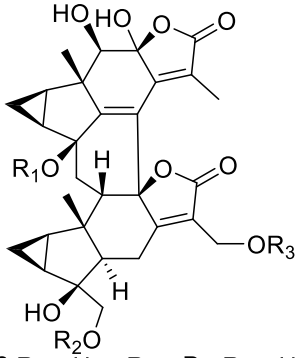
214



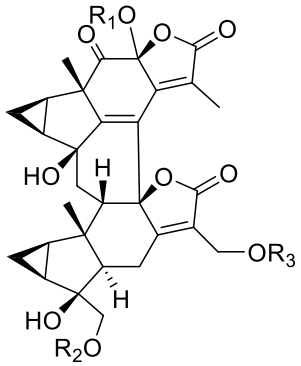
215 R = H
216 R = OH



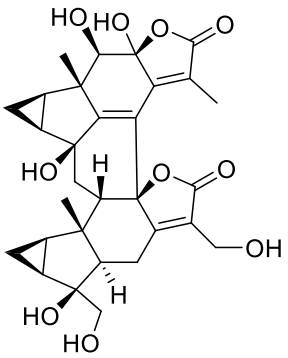
217



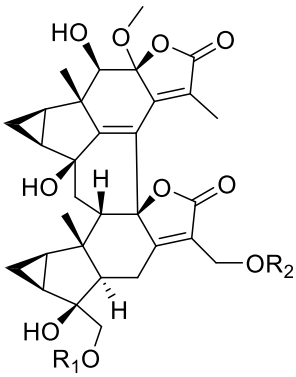
218 R_1 = H R_2 = **D** R_3 = H
224 R_1 = H R_2 = **D** R_3 = Ac
226 R_1 = OH R_2 = **C** R_3 = **G**



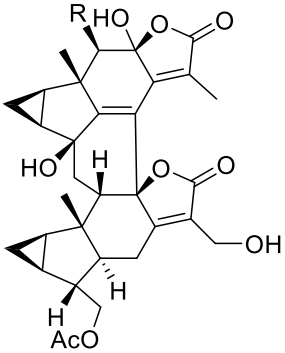
219 R_1 = H R_2 = **D** R_3 = H
222 R_1 = H R_2 = **D** R_3 = Ac



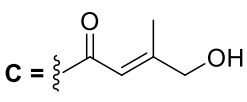
220



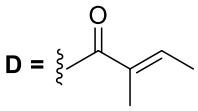
221 R_1 = **D** R_2 = H
227 R_1 = **D** R_2 = Ac
228 R_1 = **F** R_2 = H



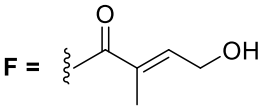
223 R = OH
225 R = =O



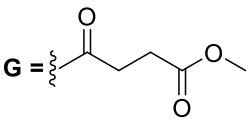
C =



D =



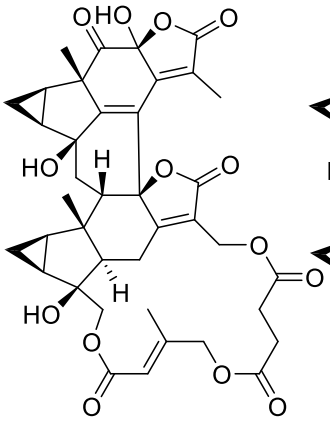
F =



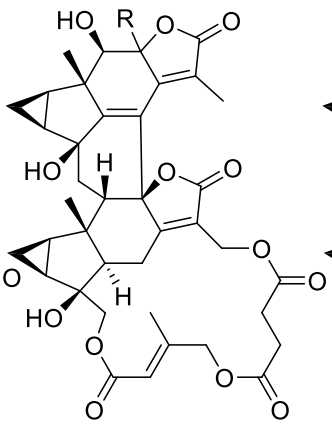
G =

Table S3-5 Structure names, sources and bioactivity of *homo*-[4 + 2] cycloaddition type LS dimers (**216-240**).

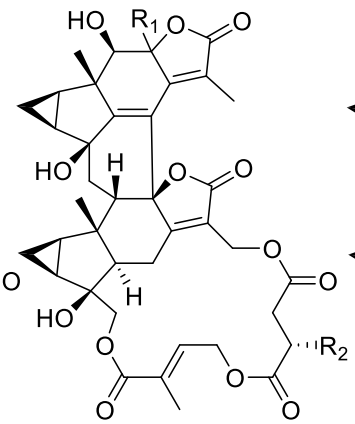
No	Compound	Sources	Bioactivity
216	Spicachlorantin I	*C. spicatus*[70]	
217	Chlojapolide G	*C. japonicus*[83]	
218	Chloramultilide D	*C. spicatus*[95]	
219	Chloramultiol D	*C. multistachys*[75]	Cytotoxicity[75]
220	Chloramultiol B	*C. multistachys*[75]	Cytotoxicity[75]
221	Chloramultiol C	*C. multistachys*[75]	Cytotoxicity[75]
222	Chlorahololide F	*C. holostegius*,[68] *S. glabra*[28]	
223	Chloramultiol E	*C. multistachys*[75]	Cytotoxicity[75]
224	Sarcandrolide D	*S. glabra*,[28, 29, 73] *C. serratus*[71]	Cytotoxicity
225	Chlorasessilifol B	*C. sessilifolius*[40]	
226	Fortunilide I	*C. fortunei*[37]	
227	Sarcaglabrin C	*S. glabra*[73]	
228	chlorahupetol E	*C. henryi var. hupehensis*[78]	
229	Chlorahololide B	*C. holostegius*,[90] *C. japonicus*[60]	Voltagegated potassium activity[90]
230	Chloramultilide B	*C. spicatus*,[95] *C. fortunei*,[49] *C. japonicus*,[59, 83, 94] *C. serratus*[71]	Antifungal[95]
231	Chloramultilide C	*C. spicatus*,[95] *C. henryi*,[69] *C. multistachys*,[75] *C. japonicus*,[60, 94] *C. fortunei*[37]	
232	Tianmushanol	*C. tianmushanensis*,[45] *C. multistachys*[74]	
233	8-*O*-methyltianmushanol	*C. tianmushanensis*,[45] *C. spicatus*,[93] *C. multistachys*,[75] *C. japonicus*,[60, 88] *C. serratus*[71]	Tyrosinase Inhibitory[45]
234	Yinxiancaol	*C. japonicus*,[60, 82] *C. fortunei*[49]	
235	Spicachlorantin A	*C. spicatus*,[93] *C. japonicus*,[59, 60] *C.serratus*,[71] *C. tianmushanensis*,[45] *C. multistachys*[75]	
236	Chlorajaponilide D	*C. japonicus*[60]	
237	chloraserratolide A	*C. serratus*[80]	
238	Sarcandrolide I	*S. glabra*[29]	
239	Chlomultiol C	*C. multistachys*[74]	Anti-Inflammatory[74]
240	chloraserratolide B	*C. serratus*[80]	Anti-Inflammatory[80]



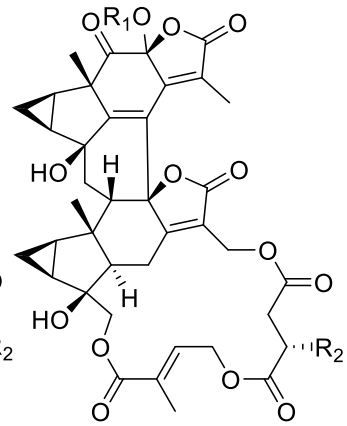
229



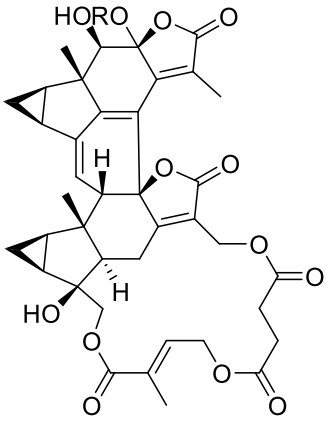
230 R = α–OH
234 R = β–OCH_3



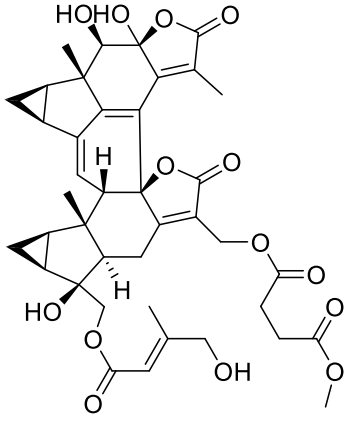
231 R_1 = α–OH R_2 =H
232 R_1 = β–OH R_2 =H
233 R_1 = β–OCH_3 R_2 =H
239 R_1 = α–OH R_2 =OH



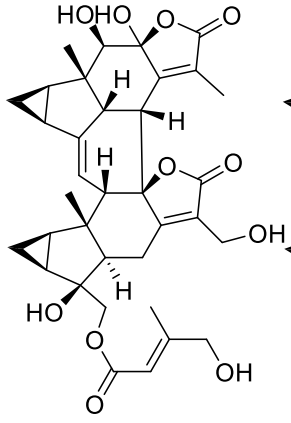
235 R_1 = H R_2 = H
236 R_1 = CH_3 R_2 = H
237 R_1 = C_2H_5 R_2 = H
238 R_1 = H R_2 = OAc



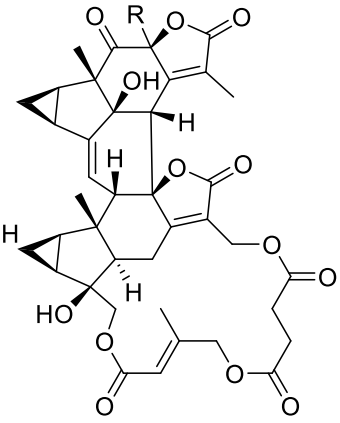
240 R = H
241 R = CH_3



242



243



244 R = H
245 R = OH

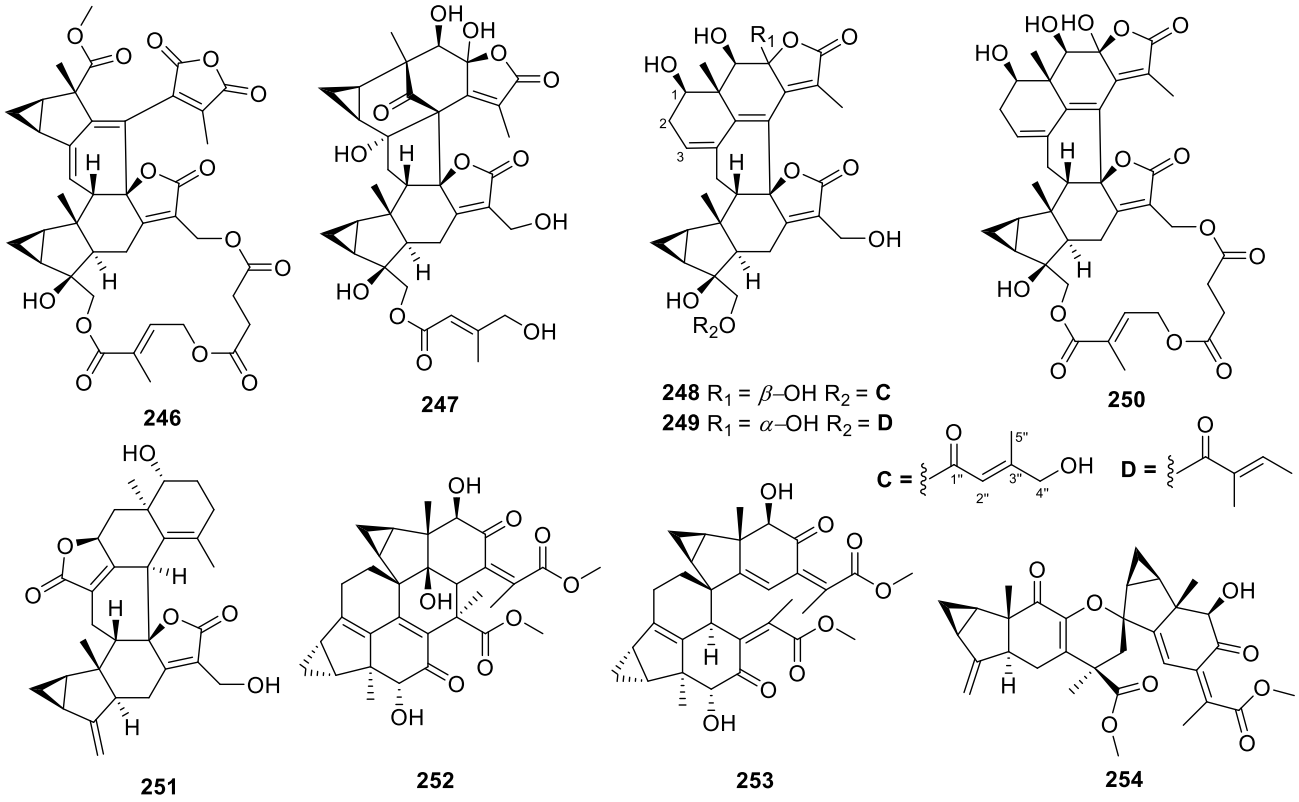
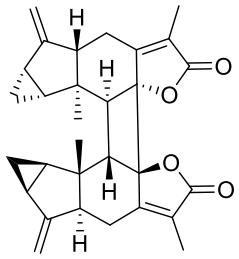
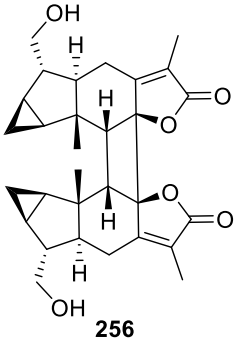


Table S3-6 Structure names, sources and bioactivity of *homo*-[4 + 2] cycloaddition type LS dimers (**241-254**).

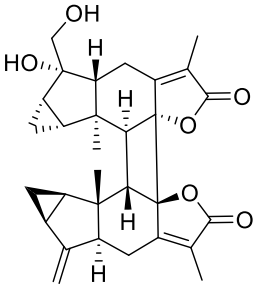
No	Compound	Sources	Bioactivity
241	Chloramultiol F	*C. multistachys*[75]	Cytotoxicity[75]
242	Fortunilide H	*C. fortunei*[37]	
243	Fortunilide J	*C. fortunei*[37]	
244	Chlorajaponilide A	*C. japonicus*[60]	
245	Chlorajaponilide B	*C. japonicus*[60]	
246	Chloramultiol G	*C. multistachys*[60]	
247	Fortunoid A	*C. fortunei*[39]	Antimalarial[39]
248	Fortunoid B	*C. fortunei*[39]	Antimalarial[39]
249	Chlorahupetol B	*C. henryi var. hupehensis*[78]	
250	Chlorahupetol A	*C. henryi var. hupehensis*[78]	
251	Horienoid B	*H. orientale*[96]	Anti-Inflammatory[96]
252	Chlotrichene A	*C. holostegius*[97]	
253	Chlotrichene B	*C. holostegius*[97]	Cytotoxicity[97]
254	Spirolindemer A	*C. henryi*[98]	Anti-Inflammatory[98]



255



256



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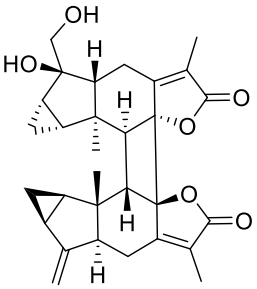
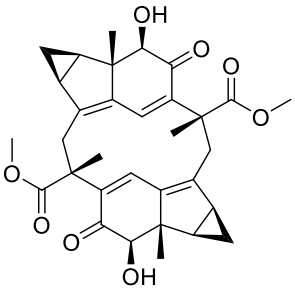
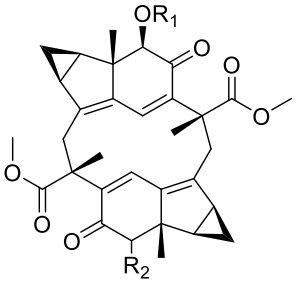


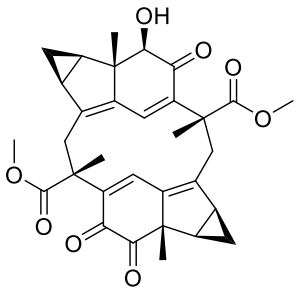
258



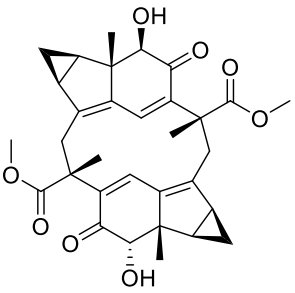
259



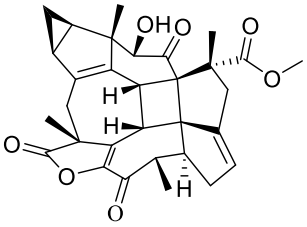
260 R_1 = Glu R_2 = β-OH
261 R_1 = H R_2 = H



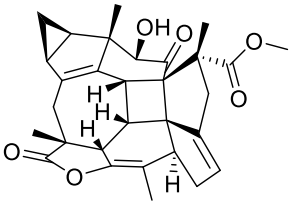
262



263



264



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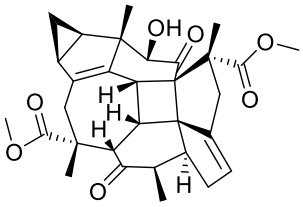
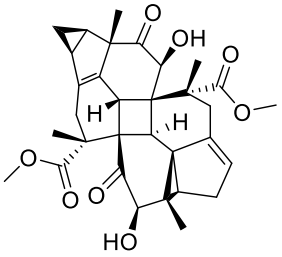


266



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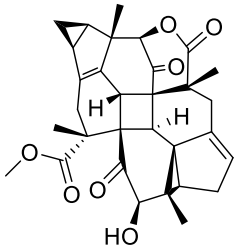
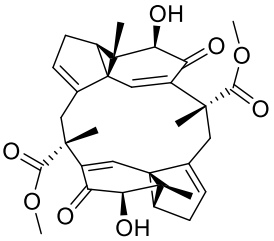
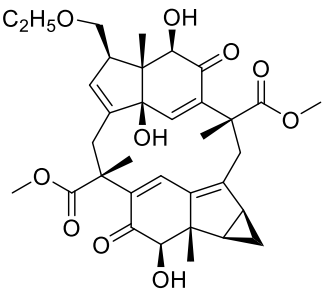


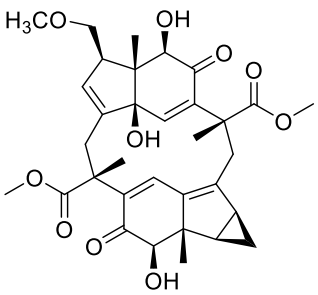
268



269



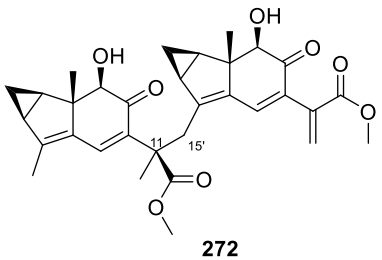
270



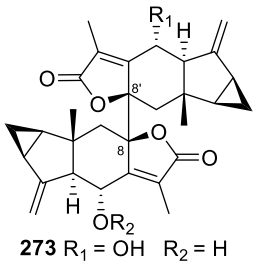
271

Table S4 Structure names, sources and bioactivity of *homo*-[2 + 2] and [6 + 6] cycloaddition type LS dimers (**255-271**).

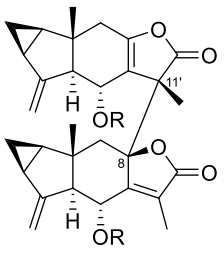
No	Compound	Sources	Bioactivity
255	Chloranthalactone F	*C. japonicus*[64]	
256	Chololactone H	*C. holostegius*[65]	Anti-Inflammatory[65]
257	Sarglalactone N	*S. glabra*[89]	
258	Sarglalactone O	*S. glabra*[89]	
259	Cycloshizukaol A	*C. serratus,*[99] *C. fortunei,*[49] *C. multistachys,*[75] *S. glabra,*[28] *C. spicatus,*[70] *C. japonicus,*[60] *C. sessilifolius*[40]	
260	9-*O*-*β*-glucopyranosylcycloshizukaol A	*C. fortunei,*[49] *C. japonicus*[76]	
261	Japonicone A	*C. japonicus*[100]	
262	Japonicone B	*C. japonicus*[100]	Cytotoxicity[100]
263	Japonicone C	*C. japonicus*[100]	
264	Chlorahupetone A	*C. henryi var. hupehensis* [85]	Cytotoxicity[85]
265	Chlorahupetone B	*C. henryi var. hupehensis* [85]	
266	Chlorahupetone C	*C. henryi var. hupehensis* [85]	
267	Chlorahupetone D	*C. henryi var. hupehensis* [85]	
268	Chlorahupetone E	*C. henryi var. hupehensis* [85]	
269	Chlorahupetone F	*C. henryi var. hupehensis* [85]	
270	Chlospicene A	*C. henryi*[101]	Anti-nonalcoholic[101]
271	Chlospicene B	*C. henryi*[101]	Anti-nonalcoholic[101]



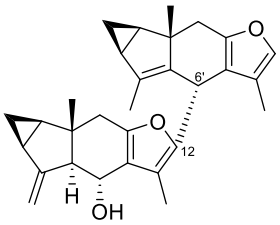
272



273 R_1 = OH R_2 = H
274 R_1 = H R_2 = H
275 R_1 = H R_2 = Ac
276 R_1 = OH R_2 = Ac
277 R_1 = OAc R_2 = Ac



278 R = H
279 R = Ac



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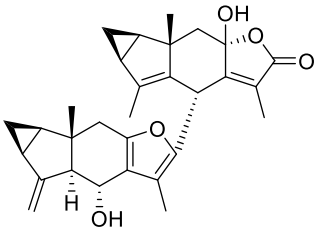
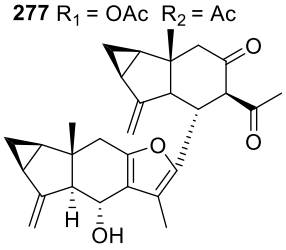
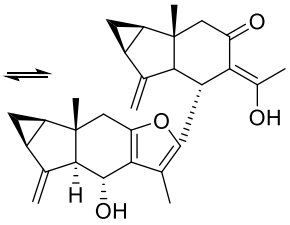


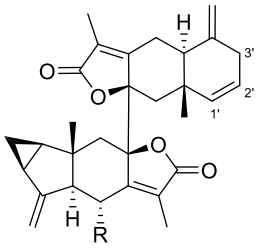
281



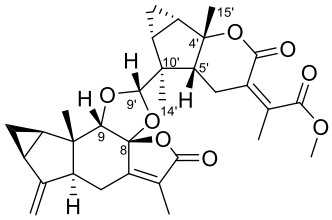
282



283



284 R = H
285 R = OH



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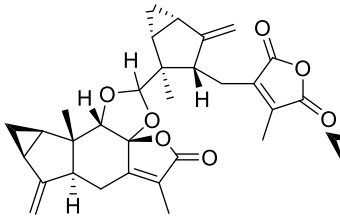
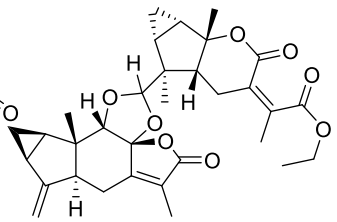
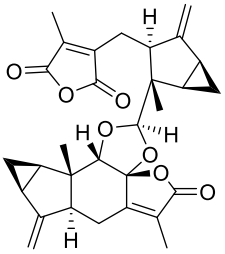


287 9' *S*
288 9' *R*



289 9' *S*
290 9' *R*



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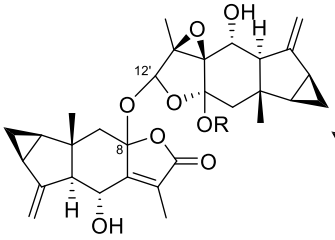
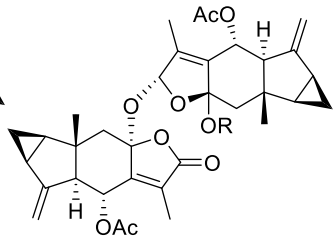
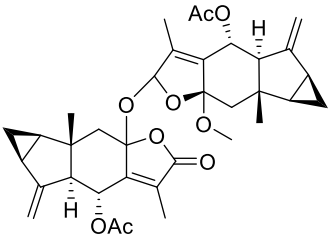


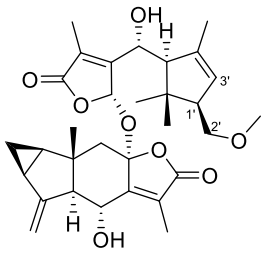
292 R = CH_3 8*R* 12'*S*
293 R = C_2H_5 8*R* 12'*S*
294 R = CH_3 8*S* 12'*R*



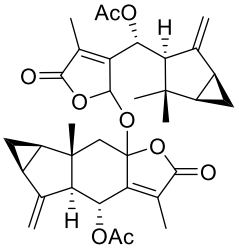
295 R = CH_3
296 R = H



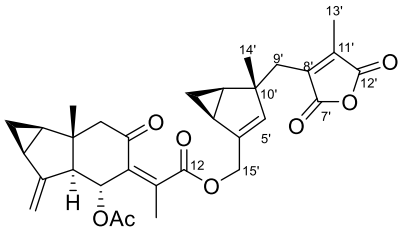
297 8*R* 12'*S*
298 8*S* 12'*R*



299



300 8*R* 8'*R*
301 8*R* 8'*S*
302 8*S* 8'*R*



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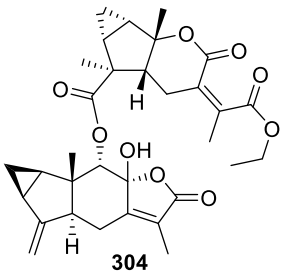


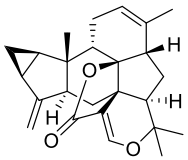
304

Table S5-1 Structure names, sources and bioactivity of *homo*-linear linkage type LS dimers (**272-298**).

No	Compound	Sources	Bioactivity
272	Shizukaol J	*C. japonicus*,[102] *C. fortunei*[563]	
273	Lindenanolide F	*L. aggregata*,[103] *L. chunii*[104]	
274	Linderanoid L	*L. aggregata*[103]	
275	Linderanoid M	*L. aggregata*[103]	
276	Linderanoid N	*L. aggregata*[103]	
277	Linderanoid O	*L. aggregata*[103]	
278	Linderanoid J	*L. aggregata*[103]	
279	Lindenanolide I	*L. chunii*[104]	
280	Linderanoid H	*L. aggregata*[103]	
281	Linderanoid I	*L. aggregata*[103]	
282	Linderanoid Ka	*L. aggregata*[103]	
283	Linderanoid Kb	*L. aggregata*[103]	
284	Linderanoid D	*L. aggregata*[103]	
285	Linderanoid E	*L. aggregata*[103]	
286	Chlojapolactone A	*C. japonicus*[88]	Anti-Inflammatory[88]
287	Sarglalactone D	*S. glabra*[58]	Cytotoxicity[58]
288	Sarglalactone E	*S. glabra*[58]	Cytotoxicity[58]
289	Sarglalactone F	*S. glabra*[58]	Cytotoxicity[58]
290	Sarglalactone G	*S. glabra*[58]	Cytotoxicity[58]
291	Chlojapolactone B	*C. japonicus*[105]	
292	Lindera ggrenolide A	*L. aggregata*[106]	
293	Lindera ggrenolide B	*L. aggregata*[106]	
294	Lindera ggrenolide C	*L. aggregata*[106]	
295	Lindera ggrenolide D	*L. aggregata*[106]	
296	Lindera ggrenolide E	*L. aggregata*[106]	
297	Lindera ggrenolide F	*L. aggregata*[106]	
298	Lindera ggrenolide G	*L. aggregata*[106]	

Table S5-2 Structure names, sources and bioactivity of *homo*-linear linkage type LS dimers (**299-304**).

No	Compound	Sources	Bioactivity
299	Linderaggrenolide J	*L. aggregata*[106]	
300	Linderaggrenolide K	*L. aggregata*[106]	
301	Linderaggrenolide L	*L. aggregata*[106]	
302	Linderaggrenolide M	*L. aggregata*[106]	
303	Linderaggrenolide N	*L. aggregata*[106]	
304	Sarglalactone H	*S. glabra*[58]	Cytotoxicity[58]



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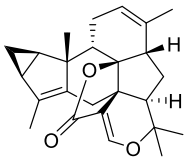
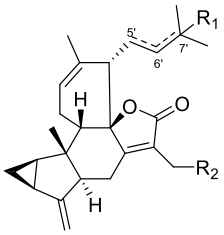
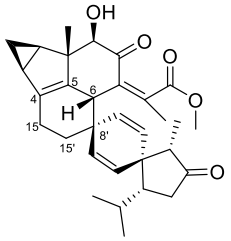


306



307 $\Delta^{6',(7')}$ R_2 = H
308 $\Delta^{5',(6')}$ R_1 = OH R_2 = OH
309 $\Delta^{5',(6')}$ R_1 = OH R_2 = H



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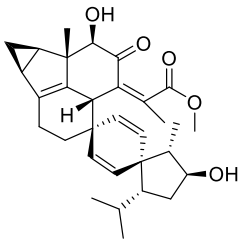


311

Table S6 Structure names, sources and bioactivity of *hetero*-[4 + 2] cycloaddition type LS dimers (**305-311**).

No	Compound	Sources	Bioactivity
305	Bolivianine	*H. angustifolium*[107]	
306	Isobolivianine	*H. angustifolium*[107]	
307	Sarcaglabrin A	*S. glabra*[73]	
308	Dyosmunoid A	*H. orientale*[108]	
309	7′-oxyisosarcaglabrin A	*S. glabra*[109]	
310	Chlorfortunone A	*C. fortunei*[110]	TGF-β Inhibitory[110]
311	Chlorfortunone B	*C. fortunei*[110]	

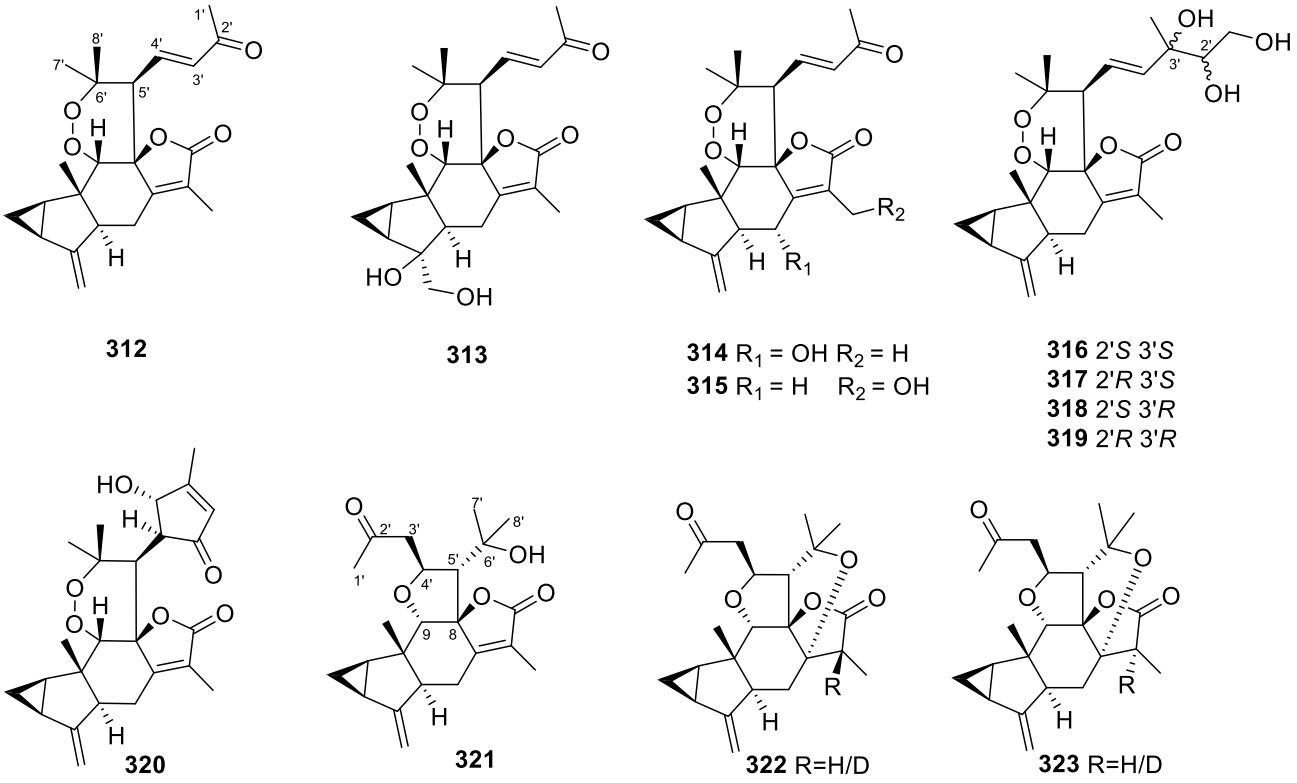


Table S7 Structure names, sources and bioactivity of *hetero*-[2 + 2 + 2] cycloaddition type LS dimers (**312-323**).

No	Compound	Sources	Bioactivity
312	Sarglaperoxide A	*S. glabra*[111]	Anti-Inflammatory[111]
313	6α-hydroxysarglaperoxide A	*S. glabra*[109]	
314	Sarglaperoxide B	*S. glabra*[111]	Anti-Inflammatory[111]
315	Dyosmunoid B	*H. orientale*[108]	Antimalarial[108]
316	Sarcaglarol A	*S. glabra*[112]	
317	Sarcaglarol B	*S. glabra*[112]	
318	Sarcaglarol C	*S. glabra*[112]	
319	Sarcaglarol D	*S. glabra*[112]	
320	Sarcaglarone A	*S. glabra*[109]	
321	Sarglaoxolane A	*S. glabra*[113]	Anti-Inflammatory[113]
322	Sarglaoxolane B	*S. glabra*[113]	
323	Sarglaoxolane C	*S. glabra*[113]	

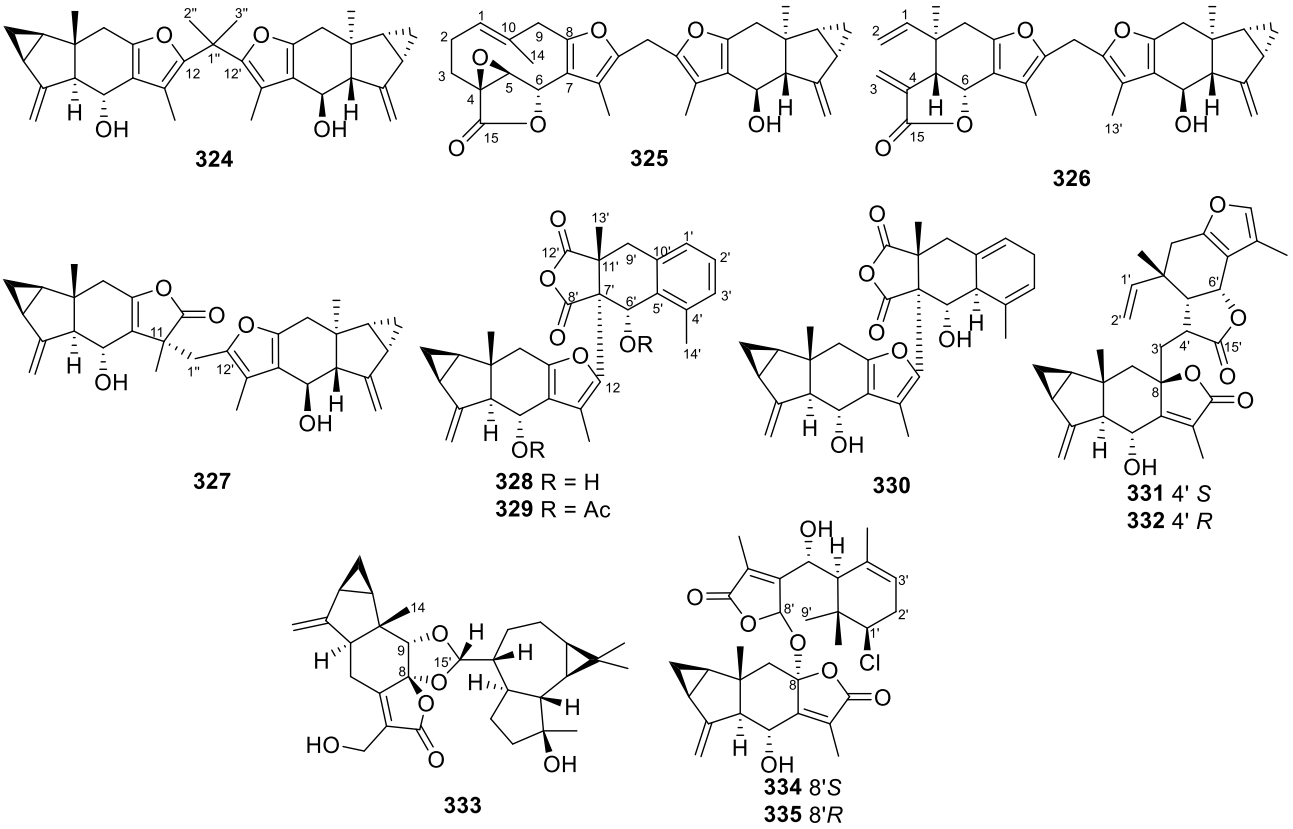


Table S8 Structure names, sources and bioactivity of *hetero*-linear linkage type LS dimers (**324-335**).

No	Compound	Sources	Bioactivity
324	Aggreganoid C	*L. aggregata*[114]	
325	Aggreganoid D	*L. aggregata*[114]	
326	Aggreganoid E	*L. aggregata*[114]	
327	Aggreganoid F	*L. aggregata*[114]	
328	Linderanoid A	*L. aggregata*[103]	
329	Linderanoid B	*L. aggregata*[103]	
330	Linderanoid C	*L. aggregata*[103]	
331	Linderanoid F	*L. aggregata*[103]	TGF-β Inhibitory[103]
332	Linderanoid G	*L. aggregata*[103]	
333	Hedyorienoid A	*H. orientale*[115]	
334	Linderaggrenolide H	*L. aggregata*[106]	
335	Linderaggrenolide I	*L. aggregata*[106]	

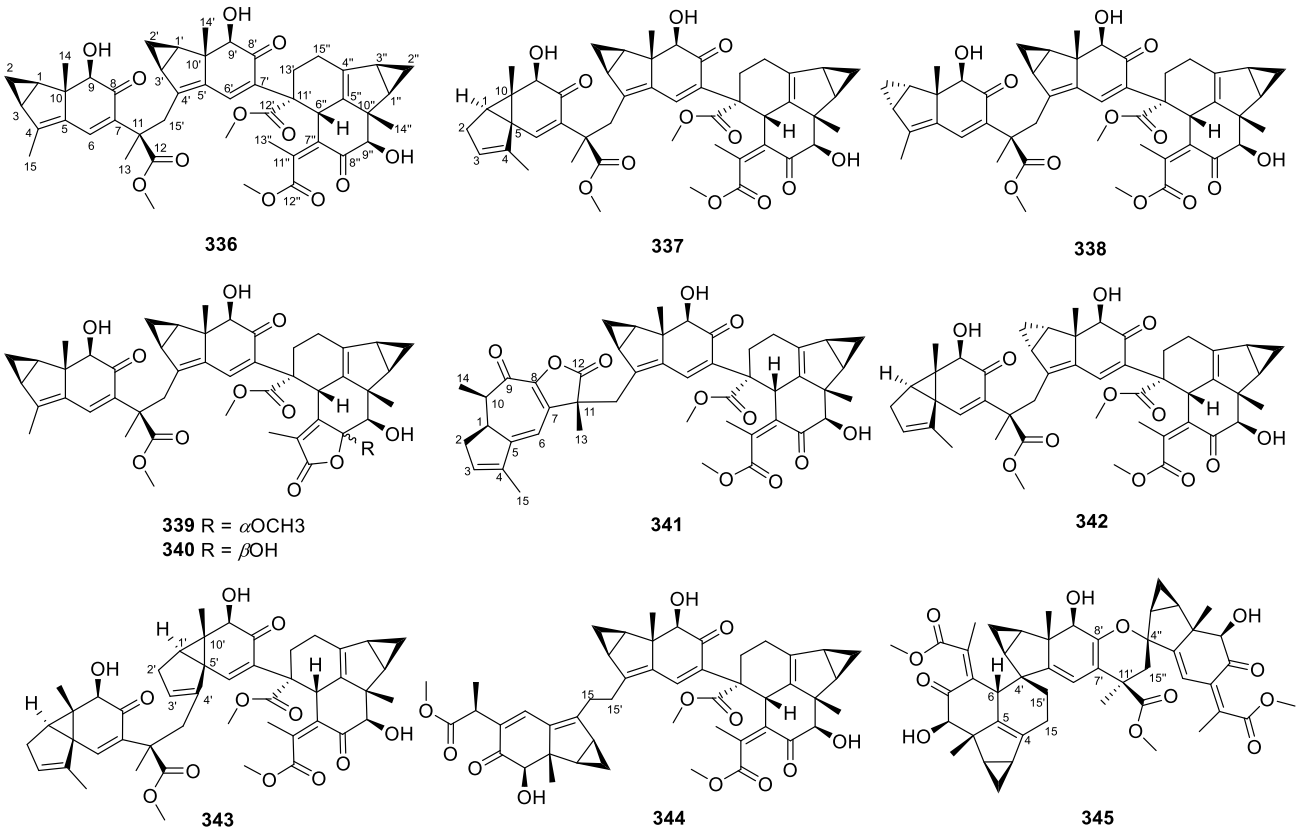
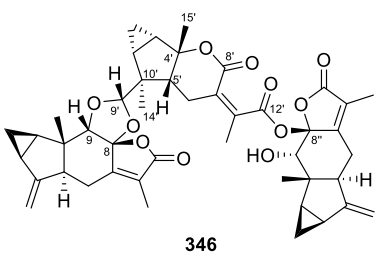


Table S9 Structure names, sources and bioactivity of *homo*-[4 + 2] cycloaddition type LS trimers (**336-345**).

No	Compound	Sources	Bioactivity
336	Trishizukaol A	*C. japonicus,*[102] *C. spicatus,*[116] *C. fortunei*[117]	Antimalarial[116]
337	Trichloranoid A	*C. spicatus*[116]	Antimalarial[116] Anti-Inflammatory[117]
338	Trichloranoid B	*C. spicatus*[116]	Anti-Inflammatory[117]
339	Trichloranoid C	*C. spicatus*[116]	
340	Trichloranoid D	*C. spicatus*[116]	Antimalarial[116]
341	Chlofortunin B	*C. fortunei*[117]	Anti-Inflammatory[117]
342	Chlofortunin C	*C. fortunei*[117]	Anti-Inflammatory[117]
343	Chlofortunin D	*C. fortunei*[117]	Anti-Inflammatory[117]
344	Chlofortunin A	*C. fortunei*[117]	
345	Spirolindemer B	*C. henryi*[98]	



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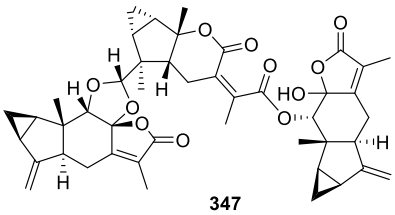

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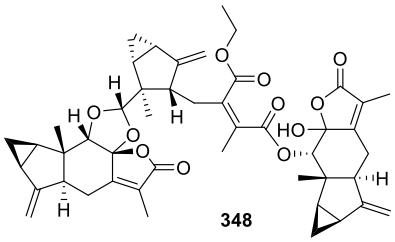
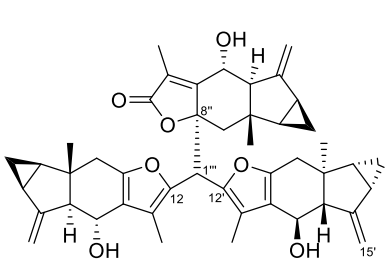


348

Table S10 Structure names, sources and bioactivity of *homo*-linear linkage type LS trimers (**346-348**).

No	Compound	Sources	Bioactivity
346	Sarglalactone A	*S. glabra*[58]	Cytotoxicity[58]
347	Sarglalactone B	*S. glabra*[58]	Cytotoxicity[58]
348	Sarglalactone C	*S. glabra*[58]	Cytotoxicity[58]



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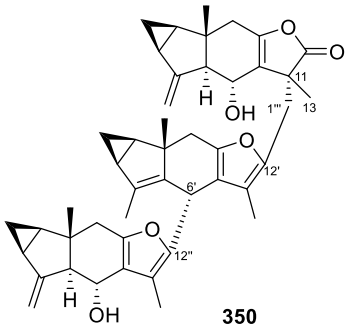

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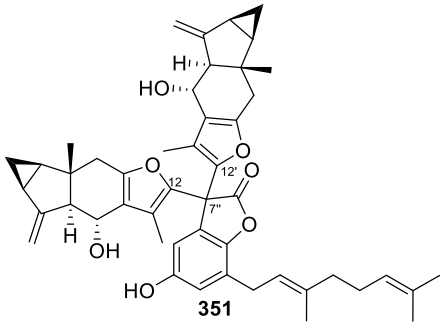

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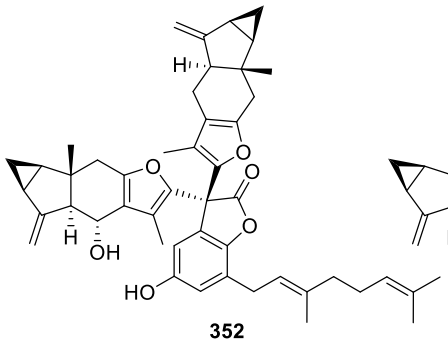

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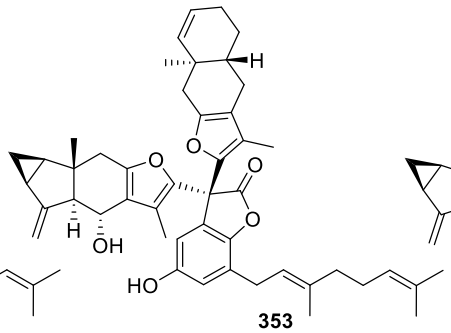

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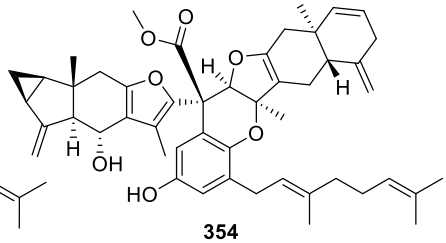

354

Table S11 Structure names, sources and bioactivity of *hetero*-LS trimers (**349-354**).

No	Compound	Sources	Bioactivity
349	Aggreganoid A	*L. aggregata*[114]	TGF-β Inhibitory[114]
350	Aggreganoid B	*L. aggregata*[114]	
351	Linderalide A	*L. aggregata*[118]	
352	Linderalide B	*L. aggregata*[118]	
353	Linderalide C	*L. aggregata*[118]	
354	Linderalide D	*L. aggregata*[118]	Anti-Inflammatory[118]

Reference

1. H. Kondo and T. Sanada, *Yakugaku Zasshi*, 1925, **526**, 1047–1057.
2. K. Takeda, M. Ikuta and M. Miyawaki, *Tetrahedron*, 1964, **20**, 2991–2997.
3. J. B. Li, Y. Ding and W. M. Li, *Chin. Chem. Lett.*, 2002, **13**, 965–967.
4. Q. Liu, J. H. Ahn, S. B. Kim, C. Lee, B. Y. Hwang and M. K. Lee, *Phytochemistry*, 2013, **87**, 112–118.
5. C. F. Zhang, N. Nakamura, S. Tewtrakul, M. Hattori, Q. S. Sun, Z. T. Wang and T. Fujiwara, *Chem. Pharm. Bull.*, 2002, **50**, 1195–1200.
6. S. S. Wen, Y. Wang, J. P. Xu, Q. Liu, L. Zhang, J. Zheng, L. Li, N. Zhang, X. Liu, Y. W. Xu and Z. L. Sun, *Nat. Prod. Res.*, 2022, **36**, 5407–5415.
7. H. J. Yang, E. B. Kwon and W. Li, *Nat. Prod. Res.*, 2022, **36**, 1914–1918.
8. H. Ishii, T. Tozyo, M. Nakamura and K. Takeda, *Tetrahedron*, 1968, **24**, 625–631.
9. K. Takeda, H. Ishii, T. Tozyo and H. Minato, *J. Chem. Soc. C*, 1969, 1920–1921.
10. Y. Cao, B. F. Xuan, B. Peng, C. Li, X. Y. Chai and P. F. Tu, *Phytochem. Rev.*, 2015, **15**, 869–906.
11. K. Takeda, H. Minato, I. Horibe and M. Miyawaki, *J. Chem. Soc., Perkin Trans. 1*, 1967, **7**, 631–634.
12. I. Kouno, A. Hirai, A. Fukushige, Z. H. Jiang and T. Tanaka, *J. Nat. Prod.*, 2001, **64**, 286–288.
13. Q. Liu, Y. H. Jo, S. B. Kim, Q. Jin, B. Y. Hwang and M. K. Lee, *Bioorg. Med. Chem. Lett.*, 2016, **26**, 4950–4954.
14. M. Zhang, J. S. Wang, P. R. Wang, M. Oyama, J. Luo, T. Ito, M. Iinuma and L. Y. Kong, *Fitoterapia*, 2012, **83**, 1604–1609.
15. X. H. Li, H. Y. Li, W. Ni, X. J. Qin, Q. Zhao, Z. Q. Ji and H. Y. Liu, *Phytochem. Lett.*, 2016, **15**, 199–203.
16. Q. H. Cao, W. F. Dai, B. C. Li and M. Zhang, *Phytochem. Lett.*, 2019, **30**, 6–9.
17. J. Kawabata, S.Tahara, J. Mizutani, A. Furusaki, N. Hashiba and T. Matsumoto, *Agric. Biol. Chem.*, 1979, **43**, 885–887.
18. H. Yan, X. H. Li, X. F. Zheng, C. L. Sun and H. Y. Liu, *Helv. Chim. Acta.*, 2013, **96**, 1386–1391.
19. L. F. Maia, R. d. A. Epifanio, T. Eve and W. Fenical, *J. Nat. Prod.*, 1999, **62**, 1322–1324.
20. J. E. Heo, G. L. Jin, Y. Y. Lee and H. S. Y. CHoi, *Nat. Prod. Sci.*, 2005, **11**, 41–44.
21. X. R. Hu, J. S. Yang and X. D. Xu, *Chem. Pharm. Bull.*, 2009, **57**, 418–420.
22. Q. H. Wang, H. X. Kuang, B. Y. Yang, Y. G. Xia, J. S. Wang and L. Y. Kong, *J. Nat. Prod.*, 2011, **74**, 16–20.
23. Y. Li, D. M. Zhang, J. B. Li, S. S. Yu, Y. Li and Y. M. Luo, *J. Nat. Prod.*, 2006, **69**, 616–620.
24. C. S. Jiang, Y. Q. Guo, S. Yin, H. Zhang and G. H. Tang, *J. Asian. Nat. Prod. Res.*, 2019, **21**, 377–383.
25. M. Uchida, Y. Koike, G. Kusano, Y. Kondo, S. Nozoe, C. Kabuto and T. Takemoto, *Chem. Pharm. Bull.*, 1980, **28**, 92–102.
26. Y. Takeda, H. Yamashita, T. Matsumoto and H. Terao, *Phytochemistry*, 1993, **33**, 713–715.
27. L. P. Zhu, Y. Li, J. Z. Yang, L. Zuo and D. M. Zhang, *J. Asian. Nat. Prod. Res*, 2008, **10**, 541–545.
28. X. F. He, S. Yin, Y. C. Ji, Z. S. Su, M. Y. Geng and J. M. Yue, *J. Nat. Prod.*, 2010, **73**, 45–50.
29. G. Ni, H. Zhang, H. C. Liu, S. P. Yang, M. Y. Geng and J. M. Yue, *Tetrahedron*, 2013, **69**, 564–569.
30. S. Y. Kao, J. H. Su, T. L. Hwang, J. H. Sheu, Z. H. Wen, Y. C. Wu and P. J. Sung, *Mar. Drugs*, 2011, **9**, 1534–1542.
31. M. Bittner, J. Jakupovic, F. Bohlmann and M. Silva, *Phytochemistry*, 1989, **28**, 271-273.
32. G. X. Chou, N. Norio, C. M. Ma, Z. T. Wang, H. Masao, L. S. Xu and G. J. Xu, *Zhongguo Yaoke Daxue Xuebao*, 2000, **31**, 339.
33. J. H. Kim, J. S. Jeon, J. H. Kim, E. J. Jung, Y. J. Lee, E. M. Gao, A. S. Syed, R. H. Son and C. Y. Kim, *Molecules*, 2021, **26**, 5269.
34. L. R. Fernandez, E. Butassi, L. Svetaz, S. A. Zacchino, J. A. Palermo and M. Sanchez, *J. Nat. Prod.*, 2014, **77**, 1579–1585.

35. F. Bohlmann, G. W. Ludwig, J. Jakupovic, R. M. King and H. Robinson, *Chemischer Informationsdienst*, 1984, **15**, 304.
36. Y. S. Shi, Y. B. Liu, S. G. Ma, Y. Li, J. Qu, L. Li, S. P. Yuan, Q. Hou, Y. H. Li, J. D. Jiang and S. S. Yu, *J. Nat. Prod.*, 2015, **78**, 1526–1535.
37. B. Zhou, Y. Wu, S. Dalal, E. F. Merino, Q. F. Liu, C. H. Xu, T. Yuan, J. Ding, D. G. Kingston, M. B. Cassera and J. M. Yue, *J. Nat. Prod.*, 2017, **80**, 96–107.
38. T. O. Do, T. K. Pham, T. B. H. Nguyen, H. Y. Pham, H. H. Tran, X. C. Nguyen, V. L. Dang, V. M. Chau and V. K. Phan, *Nat. Prod. Commun.*, 2010, **5**, 1717–1720.
39. B. Zhou, Q. F. Liu, S. Dalal, M. B. Cassera and J. M. Yue, *Org. Lett.*, 2017, **19**, 734–737.
40. L. J. Wang, J. Xiong, C. Lau, L. L. Pan and J. F. Hu, *J. Asian. Nat. Prod. Res.*, 2015, **17**, 1220–1230.
41. H. X. Kuang, Y. G. Xia, B. Y. Yang, Q. H. Wang and S. W. Lu, *Chem. Biodivers.*, 2008, **5**, 1736–1742.
42. T. H. Duong, M. A. Beniddir, N. T. Trung, C. D. Phan, V. G. Vo, V. K. Nguyen, Q. L. Le, H. D. Nguyen and P. L. Pogam, *Molecules*, 2020, **25**, 1830.
43. W. Y. Tsui, *Phytochemistry*, 1996, **43**, 819–821.
44. M. Uchida, G. Kusano, Y. Kondo and S. Nozoe, *Heterocycles*, 1978, **9**, 139–144.
45. B. Wu, J. Chen, H. B. Qu and Y. Y. Cheng, *J. Nat. Prod.*, 2008, **71**, 877–880.
46. L. Acebey, V. Jullian, D. Sereno, S. Chevalley, Y. Estevez, C. Moulis, S. Beck, A. Valentin, A. Gimenez and M. Sauvain, *Planta Med.*, 2010, **76**, 365–368.
47. J. Kawabata and J. Mizutani, *Agric. Biol. Chem.*, 1989, **53**, 203–207.
48. S. Tahara, Y. Fukushi, J. Kawabata and J. Mizutani, *Agric. Biol. Chem.*, 2014, **45**, 1511–1512.
49. X. C. Wang, L. L. Wang, X. W. Ouyang, S. P. Ma, J. H. Liu and L. H. Hu, *Helv. Chim. Acta.*, 2009, **92**, 313–320.
50. H. Okamura, N. Nakashima, T. Iwagawa, N. Nakayama and M. Nakatani, *Chem. Lett.*, 1994, 1541–1542.
51. P. C. Kuo, Y. H. Wu, H. Y. Hung, S. H. Lam, G. H. Ma, L. M. Kuo, T. L. Hwang, D. H. Kuo and T. S. Wu, *Bioorg. Med. Chem. Lett.*, 2020, **30**, 127224.
52. M. Zhang, J. S. Wang, M. Oyama, J. Luo, C. Guo, T. Ito, M. Iinuma and L. Y. Kong, *J. Asian. Nat. Prod. Res.*, 2012, **14**, 708–712.
53. S. Yaermaimaiti, P. Wang, J. Luo, R. J. Li and L. Y. Kong, *Fitoterapia*, 2016, **111**, 7–11.
54. S. Y. Kao, J. H. Su, T. L. Hwang, J. H. Sheu, Y. D. Su, C. S. Lin, Y. C. Chang, W. H. Wang, L. S. Fang and P. J. Sung, *Tetrahedron*, 2011, **67**, 7311–7315.
55. L. S. Gan, Y. L. Zheng, J. X. Mo, X. Liu, X. H. Li and C. X. Zhou, *J. Nat. Prod.*, 2009, **72**, 1497–1501.
56. J. L. Yang and Y. P. Shi, *Planta. Med.*, 2012, **78**, 59–64.
57. T. T. Huong, N. V. Thong, T. T. Minh, L. H. Tram, N. T. Anh, H. D. Cuong, P. V. Cuong and D. V. Ca, *Lett. Org. Chem.*, 2014, **11**, 639–642.
58. J. Chi, S. S. Wei, H. L. Gao, D. Xu, L. Zhang, L. Yang, W. J. Xu, J. Luo and L. Y. Kong, *J. Org. Chem.*, 2019, **84**, 9117–9126.
59. Y. Q. Guo, J. J. Zhao, Z. Z. Li, G. H. Tang, Z. M. Zhao and S. Yin, *Bioorg. Med. Chem. Lett.*, 2016, **26**, 3163–3166.
60. P. L. Fang, Y. L. Cao, H. Yan, L. L. Pan, S. C. Liu, N. B. Gong, Y. Lu, C. X. Chen, H. M. Zhong, Y. Guo and H. Y. Liu, *J. Nat. Prod.*, 2011, **74**, 1408–1413.
61. J. Kawabata, Y. Fukushi, S. Tahara and J. Mizutani, *Phytochemistry*, 1990, **29**, 2332–2334.
62. J. Kawabata and J. Mizutani, *Phytochemistry*, 1992, **31**, 1293–1296.
63. X. C. Wang, Y. N. Zhang, L. L. Wang, S. P. Ma, J. H. Liu and L. H. Hu, *J. Nat. Prod.*, 2008, **71**, 674–677.
64. G. Kusano, M. Abe, Y. Koike, M. Uchida, S. Nozoe and Z. Taira, *Yakugaku Zasshi*, 1991, **111**, 756–764.
65. C. P. Shen, J. G. Luo, M. H. Yang and L. Y. Kong, *Phytochemistry*, 2017, **137**, 117–122.

66. P. Wang, J. Luo, Y. M. Zhang and L. Y. Kong, *Tetrahedron*, 2015, **71**, 5362–5370.
67. J. Kawabata, E. Fukushi and J. Mizutani, *Phytochemistry*, 1995, **39**, 121–125.
68. S. P. Yang, Z. B. Gao, Y. Wu, G. Y. Hu and J. M. Yue, *Tetrahedron*, 2008, **64**, 2027–2034.
69. C. J. Li, D. M. Zhang, Y. M. Luo, S. S. Yu, Y. Li and Y. Lu, *Phytochemistry*, 2008, **69**, 2867–2874.
70. S. Y. Kim, Y. Kashiwada, K. Kawazoe, K. Murakami, H. D. Sun, S. L. Li and Y. Takaishi, *Chem. Pharm. Bull.*, 2011, **59**, 1281–1284.
71. B. Bai, S. X. Ye, D. P. Yang, L. P. Zhu, G. H. Tang, Y. Y. Chen, G. Q. Li and Z. M. Zhao, *J. Nat. Prod.*, 2019, **82**, 407–411.
72. S. Zhang, S. P. Yang, T. Yuan, B. D. Lin, Y. Wu and J. M. Yue, *Tetrahedron Lett.*, 2010, **51**, 764–766.
73. X. R. Yang, N. Tanaka, D. Tsuji, F. L. Lu, X. J. Yan, K. Itoh, D. P. Li and Y. Kashiwada, *Tetrahedron Lett.*, 2020, **61**, 151916.
74. W. M. Huang, Y. T. Bian, F. Y. Chen, T. J. Ning, Z. Y. Zhu, Z. C. Chen and Y. M. Luo, *Phytochemistry*, 2022, **193**, 113001.
75. X. H. Ran, F. Teng, C. X. Chen, G. Wei, X. J. Hao and H. Y. Liu, *J. Nat. Prod.*, 2010, **73**, 972–975.
76. Z. G. Zhuo, G. Z. Wu, X. Fang, X. H. Tian, H. Y. Dong, X. K. Xu, H. L. Li, N. Xie, W. D. Zhang and Y. H. Shen, *Fitoterapia*, 2017, **119**, 90–99.
77. S. Y. Wang, Y. Q. Li, X. L. Wang, X. Q. Zhang, F. Xu, P. Ying, L. Y. Kong and J. Luo, *Fitoterapia*, 2023, **168**, 105547.
78. D. Y. Zhang, Y. R. Hu, H. J. Yang, Y. N. Wang, S. Liu, Y. H. Zou, J. J. Zhou, P. Y. Zhuang, X. X. Wang and H. Liu, *Chin. J. Chem.*, 2023, **41**, 1209–1225.
79. L. G. Xiao, P. Li, H. Yan, W. Ni, L. He and H. Y. Liu, *Org. Biomol. Chem*, 2022, **20**, 1320–1326.
80. M. Zhang, M. Iinuma, J. S. Wang, M. Oyama, T. Ito and L. Y. Kong, *J. Nat. Prod.*, 2012, **75**, 694–698.
81. X. W. Shi, Q. Q. Lu, G. Pescitelli, T. Ivsic, J. H. Zhou and J. M. Gao, *Chirality*, 2016, **28**, 158–163.
82. B. Wu, H. B. Qu and Y. Y. Cheng, *Helv. Chim. Acta.*, 2008, **91**, 725–733.
83. H. Yan, M. Y. Ba, X. H. Li, J. M. Guo, X. J. Qin, L. He, Z. Q. Zhang, Y. Guo and H. Y. Liu, *Fitoterapia*, 2016, **115**, 64–68.
84. X. F. He, S. Zhang, R. X. Zhu, S. P. Yang, T. Yuan and J. M. Yue, *Tetrahedron*, 2011, **67**, 3170–3174.
85. D. Y. Zhang, X. X. Wang, Y. N. Wang, M. Wang, P. Y. Zhuang, Y. Jin and H. Liu, *Org. Chem. Front.*, 2021, **8**, 4374–4386.
86. Y. P. Sun, J. Chi, L. Zhang, S. Y. Wang, Z. H. Chen, H. Zhang, L. Y. Kong and J. Luo, *J. Org. Chem.*, 2022, **87**, 4323–4332.
87. B. Zhou, F. M. Zimbres, J. H. Butler, C. H. Xu, R. S. Haney, Y. Wu, M. B. Cassera and J. M. Yue, *Sci. China: Chem.*, 2021, **65**, 82–86.
88. Y. Q. Guo, G. H. Tang, Z. Z. Li, S. L. Lin and S. Yin, *RSC Adv.*, 2015, **5**, 103047–103051.
89. Y. Y. Wang, Z. H. Chen, Q. R. Li, L. T. Cui, J. Chi, J. X. Li, Y. P. Sun, L. Y. Kong and J. Luo, *Tetrahedron Lett.*, 2022, **98**, 153834.
90. S. P. Yang, Z. B. Gao, F. D. Wang, S. G. Liao, H. D. Chen, C. R. Zhang, G. Y. Hu and J. M. Yue, *Org. Lett.*, 2007, **9**, 903–906.
91. S. Y. Kim, Y. Kashiwada, K. Kawazoe, K. Murakami, H. D. Sun, S. L. Li and Y. Takaishi, *Tetrahedron Lett.*, 2009, **50**, 6032–6035.
92. S. P. Yang and J. M. Yue, *Tetrahedron Lett.*, 2006, **47**, 1129–1132.
93. S. Y. Kim, Y. Kashiwada, K. Kawazoe, K. Murakami, H. D. Sun, S. L. Li and Y. Takaishi, *Phytochem. Lett.*, 2009, **2**, 110–113.
94. Z. G. Zhuo, Z. Y. Cheng, J. Ye, H. L. Li, X. K. Xu, N. Xie, W. D. Zhang and Y. H. Shen, *Phytochem. Lett.*, 2017, **20**, 133–138.

95. Y. J. Xu, C. P. Tang, C. Q. Ke, J. B. Zhang, H. C. Weiss, E. R. Gesing and Y. Ye, *J. Nat. Prod.*, 2007, **70**, 1987–1990.
96. Y. Y. Fan, L. S. Gan, S. X. Chen, Q. Gong, H. Y. Zhang and J. M. Yue, *J. Org. Chem.*, 2021, **86**, 11277–11283.
97. J. Chi, W. J. Xu, S. S. Wei, X. B. Wang, J. X. Li, H. L. Gao, L. Y. Kong and J. Luo, *Org. Lett.*, 2019, **21**, 789–792.
98. J. X. Li, J. Chi, P. F. Tang, Y. P. Sun, W. J. Lu, W. J. Xu, Y. Y. Wang, J. Luo and L. Y. Kong, *Chin. J. Chem.*, 2022, **40**, 603–608.
99. J. Kawabata, E. Fukushi and J. Mizutani, *Phytochemistry*, 1993, **32**, 1347–1349.
100. H. Yan, X. J. Qin, X. H. Li, Q. Yu, W. Ni, L. He and H. Y. Liu, *Tetrahedron Lett.*, 2019, **60**, 713–717.
101. J. X. Li, Z. R. Cui, Y. Y. Li, C. H. Han, Y. Q. Zhang, P. F. Tang, L. T. Cui, H. Zhang, J. Luo and L. Y. Kong, *Chin. Chem. Lett.*, 2022, **33**, 4257–4260.
102. J. Kawabata, E. Fukushi and J. Mizutani, *Phytochemistry*, 1998, **47**, 231–235.
103. X. Liu, J. Fu, R. S. Shen, X. J. Wu, J. Yang, L. P. Bai, Z. H. Jiang and G. Y. Zhu, *Phytochemistry*, 2021, **191**, 112924.
104. Y. X. Li, S. S. Wen, H. Yang, Y. Wang, Y. Wu and Z. L. Sun, *Chem. Nat. Compd.*, 2019, **55**, 1069–1072.
105. Q. Y. Li, Y. Wang, S. S. Wen, Y. Wu, L. H. Xu and Z. L. Sun, *Rec. Nat. Prod.*, 2019, **13**, 483–490.
106. X. Liu, J. Fu, J. Yang, A. C. Huang, R. F. Li, L. P. Bai, L. Liu, Z. H. Jiang and G. Y. Zhu, *ACS. Omega.*, 2021, **6**, 5898–5909.
107. L. Acebey, M. Sauvain, S. Beck, C. Moulis, A. Gimenez and V. Jullian, *Org. Lett.*, 2007, **9**, 4693–4696.
108. Y. Y. Fan, C. Y. Zheng, B. Zhou, F. M. Zimbres, M. B. Cassera and J. M. Yue, *Chin. J. Chem.*, 2022, **41**, 392–398.
109. Y. P. Sun, Y. Y. Wang, Y. Y. Li, S. Y. Wang, D. Y. Zhang, L. Y. Kong and J. Luo, *Org. Biomol. Chem.*, 2022, **20**, 9222–9227.
110. X. J. Wu, D. Cao, F. L. Chen, R. S. Shen, J. Gao, L. P. Bai, W. Zhang, Z. H. Jiang and G. Y. Zhu, *ACS. Omega.*, 2022, **7**, 35063–35068.
111. P. Wang, R. J. Li, R. H. Liu, K. L. Jian, M. H. Yang, L. Yang, L. Y. Kong and J. Luo, *Org. Lett.*, 2016, **18**, 832–835.
112. Y. Y. Wang, Z. R. Cui, J. Chi, P. F. Tang, M. H. Zhang, J. X. Li, Y. Y. Li, H. Zhang, J. Luo and L. Y. Kong, *Chin. J. Chem.*, 2020, **39**, 129–136.
113. Z. R. Cui, Y. Y. Wang, J. X. Li, J. Chi, P. P. Zhang, L. Y. Kong and J. Luo, *Org. Lett.*, 2022, **24**, 9107–9111.
114. X. Liu, J. Yang, J. Fu, X. J. Yao, J. R. Wang, L. Liu, Z. H. Jiang and G. Y. Zhu, *Org. Lett.*, 2019, **21**, 5753–5756.
115. Y. Y. Fan, Y. L. Sun, B. Zhou, J. X. Zhao, L. Sheng, J. Y. Li and J. M. Yue, *Org. Lett.*, 2018, **20**, 5435–5438.
116. J. S. Zhou, Q. F. Liu, F. M. Zimbres, J. H. Butler, M. B. Cassera, B. Zhou and J. M. Yue, *Org. Chem. Front.*, 2021, **8**, 1795–1801.
117. S. Y. Wang, Y. P. Sun, Y. Q. Li, W. J. Xu, Q. Q. Li, Y. B. Mu, L. Y. Kong and J. Luo, *J. Org. Chem.*, 2023, **88**, 347–354.
118. X. Liu, J. Yang, X. J. Yao, X. Yang, J. Fu, L. P. Bai, L. Liu, Z. H. Jiang and G. Y. Zhu, *J. Org. Chem.*, 2019, **84**, 8242–8247.