Available online on www.ijppr.com
International Journal of Pharmacognosy and Phytochemical Research 2019; 11(4); 264-281
doi: 10.25258/phyto.11.4.5

ISSN: 0975-4873

Review Article

Phytochemical Constituents of Plant Species of *Pterocarpus* (F: Leguminosae): A Review

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Received: 21st Nov, 18; Revised 15th May, 19; Accepted 15th Jul, 19; Available Online:25th Aug, 19

ABSTRACT

Fabaceae (Leguminosae) is a large important family of flowering plants, commonly known as the legume, bean, or pea family. It comprises about 18,000 species classified into around 650 genera. Amongst them, plant species of the genus *Pterocarpus* have been shown to produce valuable phytochemical classes including flavonoids, isoflavonoids, pterocapans, aurones, lignans, stilbenes, sterols, triterpenes and sesquiterpenes. A wide spectrum of health benefits and potential biological activities of *Pterocarpus* plants have been reported, including antioxidant, antidiabetic, antimicrobial, anticancer, and anti-inflammatory properties, and protective effects on the liver, gastric mucosa, and nervous system. This review describes the structural diversity of the chemical constituents of *Pterocarpus* plants which could be a guide for further research aspects.

Keywords: Fabaceae, *Pterocarpus*, constituents, review.

INTRODUCTION

Compounds from natural sources have played and still playing a major role as extremely important medicinal agents[1]. Many natural compounds are approved for use as obtained from nature. The naturally occurring compounds have good reputation as therapeutics because of its good patient tolerance, fewer side effects and an acceptable therapeutic index[2]. On the other hand, large number of natural compounds serve as chemical masters for the laboratory synthesis, and semi synthesis of analogous substances for curing or preventing chronic and degenerative diseases[3].

Pea family or Leguminosae has been extensively investigated and thousands of natural products with a considerable diversity in their chemical structures have been reported[4]. The genus *Pterocarpus* comprises 35 species of trees and woody climbers distributed throughout three tropical regions, Neotropics, Tropical Africa and Indomalaya[5]. Many species of *Pterocarpus* are used in ethnomedicinal pattern in treatment of various ailments as diarrhea, toothache, fever, urinary tract and skin infections and to control blood sugar[6]. The bark and resin decoction of many species are used for the treatment of gland tumors, urethral discharges, ringworm of the scalp and chronic ulcers[6-9]. The heartwoods of some species have been reported as anti-inflammatory, anthelmintic, clear jaundice and relieve ulcer besides the controlling of elephantiasis, leucoderma, rectalgia, cough, and greyness of hair[6-9] . From other investigations, the antifungal[10, 11], antioxidant[12-15], analgesic, anti-inflammatory[16-18], hepatoprotective[19, 20], cardiotonic[21] and cytotoxic activities[22-25] have been also reported. These wide arrays of biological effects certainly attributed to richness of *Pterocarpus* with flavonoids, isoflavonoids, pterocarpans, aurones, lignans, stilbenes, sterols, triterpenes and sesquiterpenes, as listed below, which known for their effectiveness in treatment of such diseases.

The isoflavonoids, a major phytochemical classe in *Pterocarpus* genus, have multi-biological activities on cell functions, including activation of estrogen receptors, anti-inflammatory, chemopreventive, antioxidant, antiproliferative, antihemolytic, xenobiotic metabolism modulator[26-28]. Another important phytochemical class in this genus is the pterocarpans which has antiviral, cytotoxic, antimitotic activities[29-33]. This study aims to describe the structural diversity of the chemical constituents isolated from *Pterocarpus* genus that could be useful for the health professionals, scientists and scholars in the field of pharmacology and therapeutics to explore alternative medicine to cure different diseases in human and animals.

MATERIAL AND METHOD

The available literatures in scientific search data bases, ScienceDirect, PubMed, Ebscohost, Medline, Scielo, Scialert, Web of Science, ProQuest, Springer Link, Google Scholar and Google, were used for reviewing data on the genus *Pterocarpus*.

TAXONOMICAL CLASSIFICATION OF THE GENUS PTEROCARPUS [34, 35]

The genus *Pterocarpus* was classified taxonomically as follow:

- Domain: Eukaryote

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- Kingdom: Plantae
- Subkingdom: Viridaeplantae
- Phylum: Magnoliophyte
- Subphylum: Euphyllophyte
- Class: Magnoliopsida
- Subclass: Rosidae
- Order: Fabales
- Family: Fabaceae
- Genus: *Pterocarpus*

The Genus *Pterocarpus* consists of about 35 species; *P. acapulcensis, P. albopubescens, P. mildbraedii, P. amazonum , P. angolensis, P. antunesii , P. brenanii, P. claessensii , P. dalbergioides, P. erinaceus P. echinatus, P. gilletii, P.hockii , P. homblei , P. indicus, P. lucens , P. macroca,pus, P. marsupium , P. mutondo , P. officinalis, P. orbiculatus , P. osun, P. rohrii P. rotundifolius, P. santalinoides , P. santalinus , P. soyauxii , P. ternatus, P. tessmannii , P. tinctorius, P. velutinus , P. villosus , P. violaceus , P.zehntneri* and *P. zenkeri* [36].

PHYTOCHEMICAL CONSTITUENTS

Phytochemical investigations of different morphological parts of plants of the genus *Pterocarpus* indicated that flavonoids, isoflavonoids, pterocarpans, aurones, lignans, stilbenes, sterols, triterpenes and sesquiterpenes are the secondary metabolites commonly isolated from these investigated parts as listed in Table 1.

Table 1: List of the compounds isolated from *Pterocarpus* genus

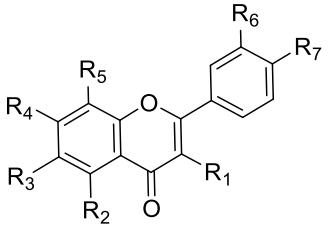
No.	Compound name	Plant Source	Part	Ref.
Flavonoids				
1	Liquiritigenin	*Pterocarpus spp.*	Wood	37-40
		P. marsupium	Root	41
		P. soyauxii	Wood	42
		P. santalinus	Wood	43
2	6-Hydroxy-3,5,7,4′-tetramethoxyflavone -6-*O*-rhamnopyranoside	*P. marsupium*	Root	44
3	5-Deoxykaempferol	*P. marsupium*	Root	41
			Wood	38
4	Vijayoside	*P. marsupium*	Wood	45
5	8-*C*-*β*-D-Glucopyranosyl-3,4′,7-trihydroxyflavone	*P. marsupium*	Wood	40
6	8-*C*-*β*-D-Glucopyranosyl-3,7,3′,4′-tetrahydroxyflavone	*P. marsupium*	Wood	40
7	7,4′-Dihydroxyflavone	*P. marsupium*	Wood	38
8	Garbanzol	*P. marsupium*	Root	41
9	Naringenin	*P. marsupium*	-	46
10	5,7,4′-Trihydroxy-3-(3̍-methyl butyl) flavone	*P. marsupium*	Bark	47
11	7-Hydroxy-6,8-dimethylflavanone-7-*O*-*α*-L-arabinopyranoside	*P. marsupium*	-	48
12	7,8,4′-trihydroxy-3′,5′-dimethoxyflavanone- 4′-*O*-*β*-D-glucopyranoside	*P. marsupium*	-	48
13	5,7,3,5-tetrahydroxy-flavanone	*P. soyauxii*	Wood	42
14	Hetranthin A	*P. soyauxii*	Wood	42
15	7,3′,4′-Trihydroxyflavanone	*P. soyauxii*	Wood	42
16	Bianol	*P. marsupium*	Wood	49
17	Pterocarpinol	*P. marsupium*	Wood	49
18	(2S)-7-Hydroxyflavanone	*P. marsupium*	Wood	38
Isoflavonoids				
19	Prunetin	*P. angolensis*	Wood	37, 50
		P. soyauxii	Wood	40
20	Muningin	*P. angolensis*	Wood	37, 51
21	Formononetin	*P. indicus*	Wood	37, 52
		P. soyauxii	Wood	40
22	3′-Hydroxy formononetin	*P. dalbergioides*	Wood	37
23	Pseudobaptigenin	*P. erinaceous*	Wood	37
		P. marsupium	Root	41
24	Santal	*P. santalinus*	Wood	37
		P. osun	Wood	37
		P. soyauxii	Wood	40
25	3′,7-Di-*O*-methylorobol	*P. soyauxii*	Wood	40
26	5,4′-Dimethoxy-8-methylisoflavone-7-*O*-*α*-L-rhamnopyranoside	*P. marsupium*	Wood	53

27	7-*O*-*α*-L-rhamnopyranosyl-oxy-4′-methoxy-5-hydroxy isoflavone	*P. marsupium*	-	[54]
28	5,7-Dihydroxy-6- methoxyisoflavone-7-rhamnoside	*P. marsupium*	Wood	[55]
29	Irisolidone- *O*-*α*-L-rhamnoside	*P. marsupium*	Wood	[55]
30	Retusin-7-*O*-glucoside	*P. marsupium*	Wood	[55]
31	Retusin-8-*O*-*α*-L-arabinopyranoside	*P. marsupium*	-	[46]
32	Pterosonin A	*P. soyauxii*	Wood	[42]
33	Pterosonin B	*P. soyauxii*	Wood	[42]
34	Pterosonin C	*P. soyauxii*	Wood	[42]
35	Khrinone C	*P. soyauxii*	Wood	[42]
36	7,3′-Dihydroxy-8,2′,4′-trimethoxyisoflavone	*P. soyauxii*	Wood	[42]
37	Khrinone E	*P. soyauxii*	Wood	[42]
38	6,7-Dihydroxy-2′,4′-dimethoxy-3′-hydroxyisoflavone	*P. soyauxii*	Wood	[42]
39	6-Hydroxy-7,2′,4′,5′-tetramethoxyisoflavone	*P. santalinus*	Wood	[43]
40	4′.5-Dihydroxy 7-*O*-methyl isoflavone -3′-*O*-*β*-D-glucoside.	*P. santalinus*	Wood	[56]
41	4′,5-Dihydroxy-7-*O*-methyl isoflavone 3′-*O*-*β*-D-(3″-E-cinnamoyl) glucoside	*P. santalinus*	Wood	[57]
42	Pterosonin D	*P. soyauxii*	Wood	[42]
43	Pterosonin E	*P. soyauxii*	Wood	[42]
44	8-Hydroxy-4′,7-dimethoxyisoflavone	*P. soyauxii*	Wood	[42]
45	Khrinone A	*P. soyauxii*	Wood	[42]
46	Cyclosin	*P. soyauxii*	Wood	[42]
47	Sayanedin	*P. soyauxii*	Wood	[42]
48	8-Hydroxy-4′-methoxy isoflavanone-7-*O*-glucopyranoside	*P. marsupium*	Wood	[39]
49	Macrocarposide	*p. macrocarpus*	Wood	[58]
50	(3*S*)-Vestitol	*P. soyauxii*	Wood	[40]
51	(*R*)-Mucronulatol	*P. soyauxii*	Wood	[40]
52	Pteromarsupone	*P. marsupium*	Wood	[39]
53	Marsupol (4,4′-dihydroxy-*α*-methylhydrobenzoin)	*P. marsupium*	Wood	[59]
54	(3*R*)-Claussequinone	*P. soyauxii*	Wood	[40]
55	Dalbergin	*P. santalinus*	Wood	[60]
56	Melannein	*P. santalinus*	Wood	[23]
57	Pterolinus J	*P. santalinus*	Wood	[23]
58	Pterolinus F	*P. santalinus*	Wood	[23]
59	Pterolinus G	*P. santalinus*	Wood	[23]
60	S-3′-Hydroxy-4,4′-dimethoxydalbergione	*P. santalinus*	Wood	[23]
61	Pterolinus Ha	*P. santalinus*	Wood	[23]
62	Pterolinus Hb	*P. santalinus*	Wood	[23]
63	Pterolinus I	*P. santalinus*	Wood	[23]
Epicatechins				
64	(-)-Epicatechin	*P. marsupium*	Bark	[37, 61]
		P. angolensis	Stem bark	[62]
		P. erinaceus	Stem bark	[63]
65	Epicatechin-3-*O*-galate	*P. angolensis*	Stem bark	[62]
66	Epicatechin (4b–8)-epicatechin (B2)	*P. angolensis*	Stem bark	[62]
67	Hexamer of epicatechin	*P. angolensis*	Stem bark	[62]
Chalcones				
68	Isoliquiritigenin	*Pterocarpus spp.*	Wood	[37-40]
		P. marsupium	Root	[41]
		P. indicus	Wood	[52]
		P. santalinus	Wood	[43]
69	Pterolinus L	*P. santalinus*	Wood	[60]
70	Pterosupin	*P. marsupium*	Root	[41]
71	*α*,2′-Dihydroxy-4,4′-di-methoxychalcone	*P. angolensis*	Wood	[64]
72	Coatline A	*P. marsupium*	Wood	[40, 65, 66]

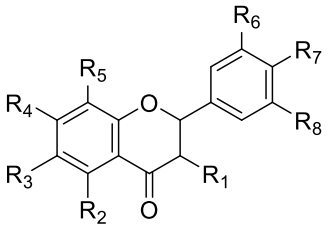
73	Bijayasaline	*P. marsupium*	Wood	[67]
Pterocarpans				
74	3*S*-violanone	*P. soyauxii*	Wood	[42]
75	Bryaflavan	*P. soyauxii*	Wood	[42]
76	Kushenin	*P. soyauxii*	Wood	[42]
77	7,4′-Dimethoxypterocarpan	*P. soyauxii*	Wood	[42]
78	3,8-Dihydroxy-9-methoxypterocarpan	*P. soyauxii*	Wood	[42]
79	(-)-Homopterocarpin	*Pterocarpus spp.*	Wood	[49]
		P. soyauxii	Wood	[40]
		P. erinaceus	Stem bark	[68]
		p. macrocarpus	Wood	[69]
80	(-)-Hydroxy-homopterocarpin	*p. macrocarpus*	Wood	[69]
81	(-)-Pterocarpin	*Pterocarpus spp.*	Wood	[49]
		P. indicus	Wood	[52]
		p. macrocarpus	Wood	[69]
82	(-)-Maackiain	*P. dalbergioides.*	Wood	[49]
Aurones				
83	Carpusin	*P. marsupium*	Wood	[70]
84	Marsupsin	*P. marsupium*	Wood	[38]
85	2-*α*-Hydroxy-2-*p*-hydroxybenzyl-3(2*H*) benzofuranone-7-*C*-*β*-D-glucopyranoside (Marsuposide)	*P. marsupium*	Wood	[45, 71, 72]
86	2*β*-Hydroxy-2-p-hydroxybenzyl-3(2*H*) benzofuranone-7-*C*-*β*-D-glucopyranoside	*P. marsupium*	Wood	[71, 72]
87	6,4′-Dihydroxy-7-methylaurone-6-*O*-*α*-L-rhamnopyranosid	*P. marsupium*	Wood	[73]
88	4,6,3′,4′-Tetrahydroxyaurone- 6-*O*-*α*-L-rhamnopyranoside	*P. marsupium*	Wood	[73]
89	6,4′ Dihydroxyaurone 4-*O*-rutinoside	*P. santalinus*	Wood	[74]
90	6-Hydroxy-5-methyl 3′,4′,5′ trimethoxyaurone 4-*O*-*α*-L-rhamnopyranoside	*P. santalinus*	Wood	[74]
Isoaurones				
91	Pterocarposide	*P. marsupium*	Wood	[75]
92	Pteroisoauroside	*P. marsupium*	Wood	[45]
Arylcoumarins				
93	Pterosonin F	*P. soyauxii*	Wood	[42]
94	Santalin AC	*P. santalinus*	Wood	[76]
Lignans				
95	Savinin	*P. santalinus*	Wood	[77]
96	Calocedrin	*P. santalinus*	Wood	[77]
97	Pteroside	*P. marsupium*	Wood	[45]
98	Pterolinus A	*P. santalinus*	Wood	[23]
99	Pterolinus B	*P. santalinus*	Wood	[23]
100	Dehydromelanoxin	*P. santalinus*	Wood	[23]
101	Pterolinus C	*P. santalinus*	Wood	[23]
102	Melanoxin	*P. santalinus*	Wood	[23]
103	Pterofuran	*P. indicus*	Wood	[37, 52]
104	Piyaline	*P. marsupium*	Wood	[65, 66, 72]
105	Piyaline methyl ester	*P. marsupium*	Wood	[72]
106	Metlaline	*P. marsupium*	Wood	[72]
Xanthenes				
107	Santalins A	*P. osun*	Wood	[78]
		P. soyauxii		[78]
		P. santalinus		[76]
108	Santalins B	*P. osun*	Wood	[78]
		P. soyauxii		[78]
		P. santalinus		[76]
109	*per*-*O*-methylsantalin	*P. osun*	Wood	[78]
		P. soyauxii		[78]

110	Santarubins A	*P. osun*	Wood	78
		P. soyauxii		78
111	Santarubins B	*P. osun*	Wood	78
		P. soyauxii		78
Phenyl propanoids				
112	Propterol	*P. marsupium*	Wood	39, 79
113	Propterol B	*P. marsupium*	Wood	80
Benzophenones				
114	Melanoxoin	*P. santalinus*	Wood	23
115	Cearoin	*P. santalinus*	Wood	60
Deoxybenzoin				
116	Angolensin	*P. angolensis*	Wood	37, 81
		P. indicus	Wood	37, 52
		P. erinaceus	Wood	49
117	(*α S*)-4-*O*-methylangolensin	*P. angolensis*	Wood	82
118	(*αR*,1″*R*,4″*S*,4″*αR*,8″*αR*)-4-*O*-*α*-cadinylangolensin	*P. angolensis*	Wood	82
119	(*αR*,l″*S*,4″*S*,4″*αR*,8″*αR*)-4-*O*- T-cadinylangolensin	*P. angolensis*	Wood	82
Anthracenedione				
120	Santalin	*P. santalinus*	Wood	49
Phenanthrenedione				
121	Pterolinus K	*P. santalinus*	Wood	60
Stilbene				
122	Pterostilbene	*P. santalinus*	Wood	49
		P. marsupium	Wood	37-39, 72, 83
		P. soyauxii	Wood,	40
Sesquiterpenes				
123	*β*-eudesmol	*P. indicus*	Wood	49
		P. marsupium	Root wood	83
		P. santalinus	Wood	84
124	Selin-4(15)-en-1-*β*,11-diol	*P. marsupium*	Root wood	83
			Wood	45
125	(+)-Pterocarpol	*P. macrocarpus*	Wood	37, 69
		P. santalinus	Wood	37, 84, 85
		P. marsupium	Wood	86
126	ent-4(15)-Eudesmen-1á,11-diol	*P. santalinus*	Wood	85
127	Isopterocarpolone	*P. santalinus*	Wood	84, 85
128	Pterocarpdiolone	*P. santalinus*	Wood	84
129	Canusesnol K	*P. santalinus*	Wood	85
130	Cryptomeridiol	*P. santalinus*	Wood	84
131	Canusesnol L	*P. santalinus*	Wood	85
132	Pterocarptriol	*P. santalinus*	Wood	84
Triterpenes				
133	3-Ketooleanane	*P. santalinus*	Stem callus	87
134	*β*-Amyrone	*P. santalinus*	Bark	88
135	Lupenone	*P. santalinus*	Bark	88
136	Lupeol	*P. santalinus*	Bark	88
		P. marsupium	-	46
		P. erinaceus	Stem bark	63
		P. indicus	Leaf	89
137	*epi*-Lupeol	*P. santalinus*	Bark	88
138	2*α*-Hydroxy-*epi*-lupeol	*P. santalinus*	Bark	88
139	Lup-20(29)-en-2*α*,3*β*-diol	*P. santalinus*	Bark	90
140	3-Ketooleanane	*P. santalinus*	Stem callus	87
141	Acetyloleanolic acid	*Pterocarpus spp.*	Wood	49
142	Erythrodiol-3-monoacetate	*P. marsupium*	Root wood	83
143	Paniculatadiol	*P. indicus*	Leaf	89
144	Friedelin	*P. santalinoides*	Leaf	91

		P. erinaceus	Stem bark	63
Alkaloids				
145	(L)-Hypaphorine	*P. officinalis*	Seed	92
Miscellaneous				
146	Pterolinus D	*P. santalinus*	Wood	23
147	Pterolinus E	*P. santalinus*	Wood	23
148	Vijayosin	*P. marsupium*	Wood	45
149	Loliolide	*P. indicus*	Leaf	89
150	2-(3-Glucosyl-2,4-dihydroxyphenyl)-2-oxoacetic acid	*P. marsupium*	Wood	65, 66
151	l-(2,4-Dihydroxyphenyl) propan-2-ol	*P. marsupium*	Wood	39
152	*p*- Hydroxybenzaldehyde	*P. marsupium*	Root	41
			Wood	38
153	(2*R*)-3-(*p*-Hydroxyphenyl)-lactic acid	*P. marsupium*	Wood	38
154	(-)-*p*-Hydroxyhydratropic acid	*P. indicus*	Wood	52
155	1-(2′,6′-Dihydroxyphenyl)-*β*-D-glucopyranoside	*P. marsupium*	Wood	45, 93
156	(±)-2-Hexanol	*P. indicus*	Leaf	94
157	12,15-Dihydroxycurcumene	*P. santalinus*	Wood	85

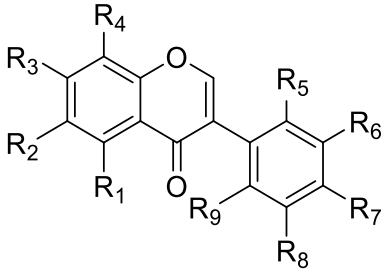


	R_1	R_2	R_3	R_4	R_5	R_6	R_7
1	H	H	H	OH	H	H	OCH_3
2	OCH_3	OCH_3	*O*-Rha.	OCH_3	H	H	OCH_3
3	OH	H	H	OH	H	H	OH
4	H	H	H	OH	Glc.	OH	OH
5	OH	H	H	OH	Glc.	H	OH
6	OH	H	H	OH	Glc.	OH	OH
7	H	*H*	H	OH	H	H	OH

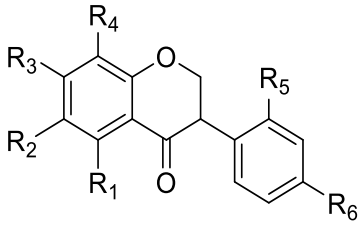


	R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8
8	OH	H	H	OH	H	H	OH	H
9	H	OH	H	OH	H	H	OH	H
10	H	OH	H	OH	H	3-methyl butyl	OH	H
11	H	H	CH_3	*O*-Ara.	CH_3	H	H	H
12	H	H	H	OH	OH	OCH_3	*O*-Glc.	OCH_3
13	H	OH	H	OH	H	OH	H	OH
14	H	H	H	OCH_3	H	OH	OH	H
15	H	H	H	OH	H	OH	OH	H
16	OH	H	H	OH	OH	OH	OH	H

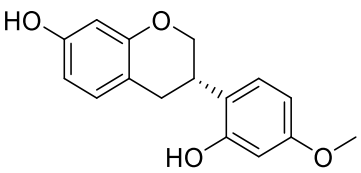
17	OH	CH_3	CH_3	OH	H	H	OH	H
18	H	H	H	OH	H	H	H	H



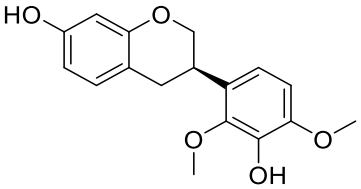
	R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8	R_9
19	OH	H	OCH_3	H	H	H	OH	H	H
20	OCH_3	OH	OCH_3	H	H	H	OH	H	H
21	H	H	OH	H	H	H	OCH_3	H	H
22	H	H	OH	H	H	OH	OCH_3	H	H
23	H	H	OH	H	H	-O-CH_2-O-		H	H
24	OH	H	OCH_3	H	H	OH	OH	H	H
25	OH	H	OCH_3	H	H	OCH_3	OH	H	H
26	OCH_3	H	*O*-α-L-Rha.	CH_3	H	H	OCH_3	H	H
27	OH	H	*O*-α-L-Rha.	H	H	H	OCH_3	H	H
28	OH	OCH_3	*O*-α-L-Rha.	H	H	H	H	H	H
29	OH	OCH_3	*O*-α-L-Rha.	H	H	H	H	H	H
30	H	H	*O*-Glc.	OH	H	H	OCH_3	H	H
31	H	H	OH	*O-α-L-* Ara.	H	H	OCH_3	H	H
32	H	H	OH	OH	OCH_3	OH	OCH_3	H	H
33	H	H	OCH3	OH	OCH_3	OH	OCH_3	H	H
34	H	OCH_3	OH	H	OCH_3	OH	OCH_3	H	H
35	OH	H	H	H	OCH_3	OH	OCH_3	H	H
36	H	H	OH	OCH_3	OCH_3	OH	OCH_3	H	H
37	OH	H	H	H	OCH_3	OH	OCH_3	H	H
38	H	OH	OH	H	OCH_3	OH	OCH_3	H	H
39	H	OH	OCH_3	H	OCH_3	OCH_3	OCH_3	H	H
40	OH	H	OCH_3	H	H	*O*- Glc..	CH_3	H	H
41	OH	H	OCH_3	H	H	O-β-D-(3-E-cinnamoyl) Glc.	OH	H	H
42	H	H	OCH_3	OH	H	OH	H	OCH_3	H
43	H	H	OH	H	H	OH	H	OCH_3	H
44	H	H	OCH_3	OH	H	H	OCH_3	H	H
45	H	H	OH	H	H	OH	OCH_3	H	OH
46	H	H	OH	H	H	OH	OCH_3	H	H
47	H	H	OCH_3	H	H	OCH_3	OH	H	H



	R_1	R_2	R_3	R_4	R_5	R_6
48	H	H	*O*- Glc.	OH	H	OCH_3
49	OH	Glc.	OH	H	OH	OH



50



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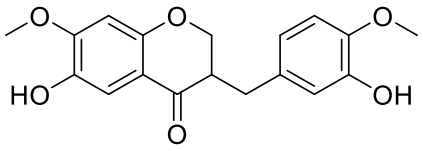

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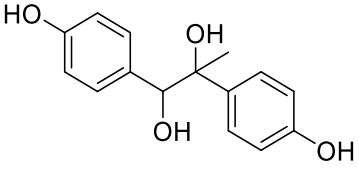

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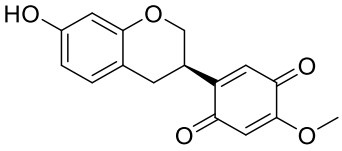
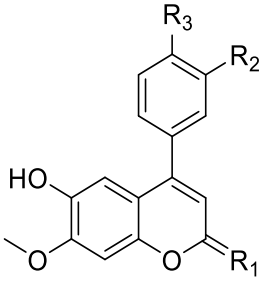
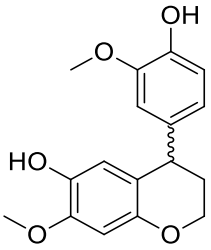


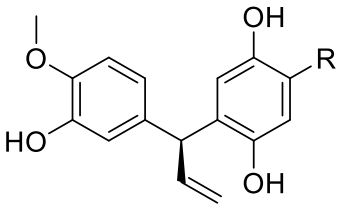
54



	R_1	R_2	R_3
55	O	H	H
56	CH_2	OH	OCH_3

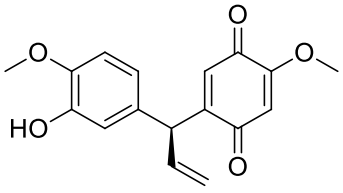


57



58 **R** = $COOCH_3$

59 **R** = OCH_3



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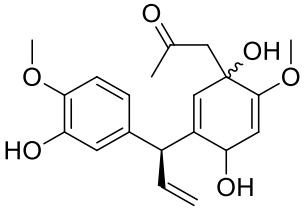
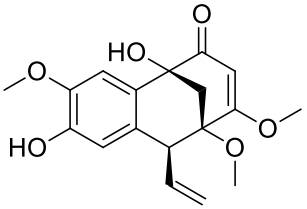
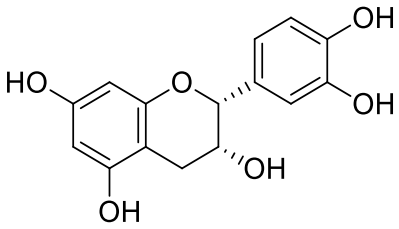


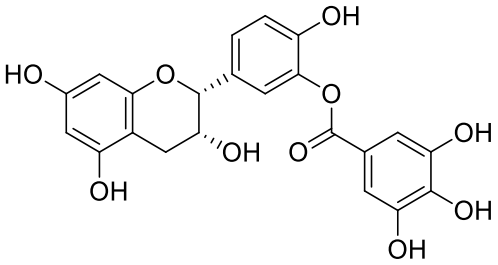
61, 62



63



64



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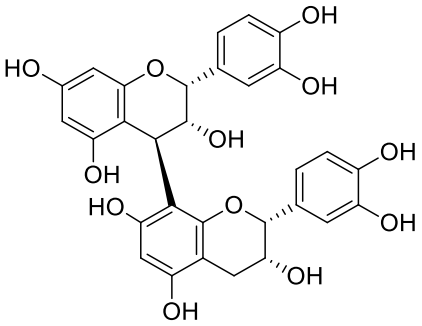

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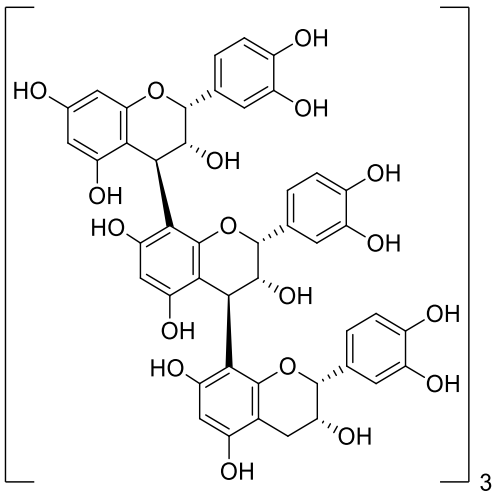
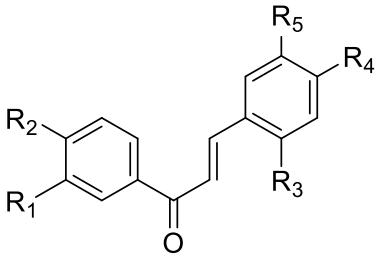
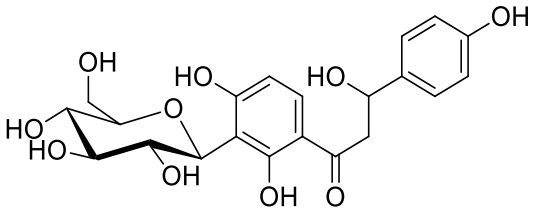


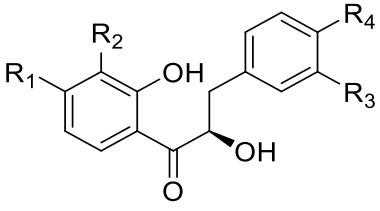
67



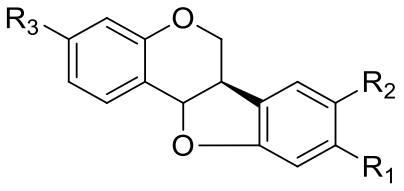
	R_1	R_2	R_3	R_4	R_5
68	H	H	H	OH	H
69	OH	OCH_3	OH	OCH_3	OH



70



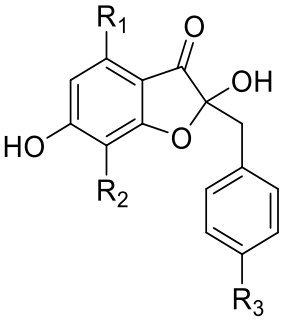
	R_1	R_2	R_3	R_4
71	OCH_3	H	H	OCH_3



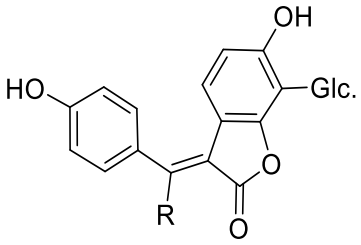
	R_1	R_2	R_3
74	-OCH_2O-		OCH_3
75	OCH_3	H	OCH_3
76	OH	OCH_3	OH
77	OH	OH	OCH_3
78	OCH_3	OH	OH

72	OH	Glc.	H	OH
73	OH	Glc.	OH	OH

79	OCH_3	H	OCH_3
80	OCH_3	OH	OCH_3
81	$-OCH_2O-$		OCH_3
82	$-OCH_2O-$		OH

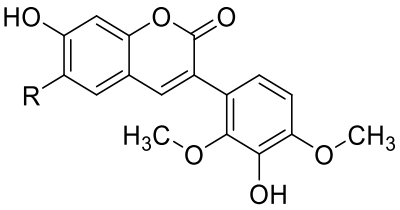


	R_1	**R_2**	**R_3**
83	OCH_3	H	OH
84	OCH_3	H	CH_3
85	H	*O*- Glc.	OH
86	H	*O*- Glc.	OH



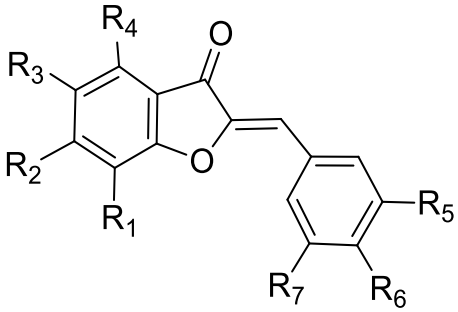
91 **R** = H

92 **R** = OCH_3

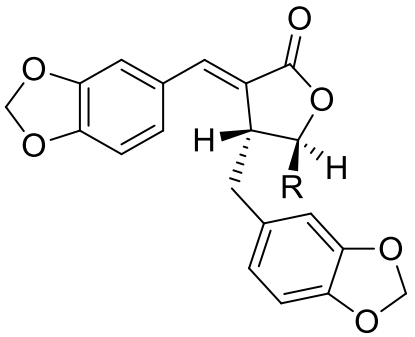


93 **R** = H

94 **R** = OH

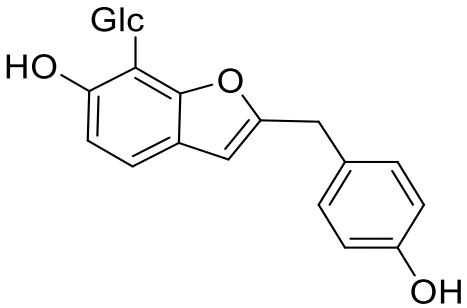


	R_1	**R_2**	**R_3**	**R_4**	**R_5**	**R_6**	**R_7**
87	CH_3	OH	-*O*-Rha.	H	H	OH	H
88	H	-*O*-Rha.	H	OH	OH	OH	H
89	H	OH	H	-*O*-Rut.	H	OH	H
90	H	OH	CH_3	-*O*-Rha.	OCH_3	OCH_3	OCH_3

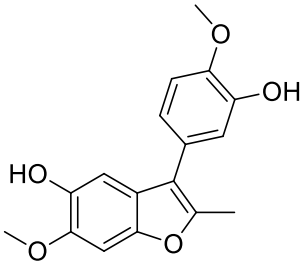


95 **R** = H

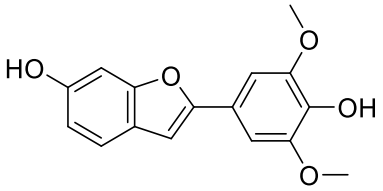
96 **R** = OH



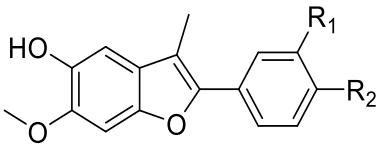
97



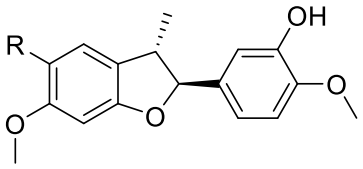
98



103

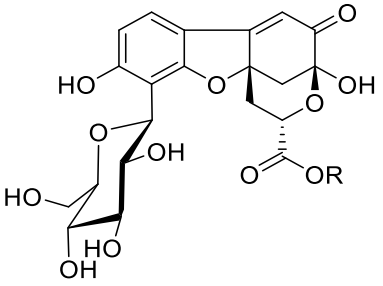


	R_1	R_2
99	H	OH
100	OH	OCH_3



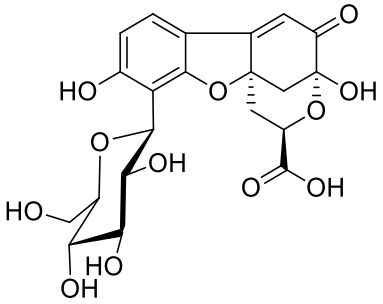
101 **R** = OCH_3

102 **R** = OH

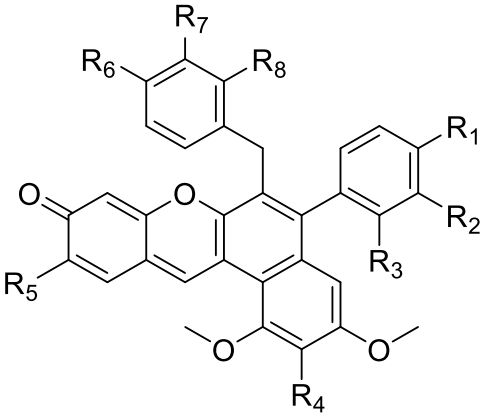


104 **R**= H

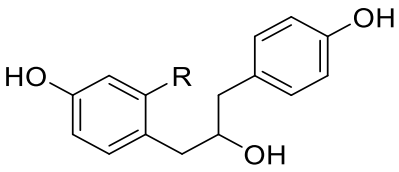
105 **R**= CH_3



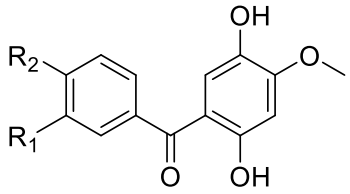
106



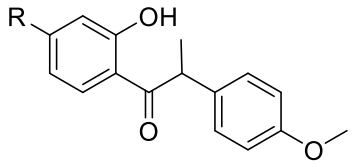
	R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8
107	OH	H	OCH_3	OH	OH	OH	H	H
108	OH	H	OCH_3	OH	OH	OH	CH_3	H
109	OCH_3	H	OCH_3	OCH_3	OCH_3	OCH_3	CH_3	H
110	OH	OCH_3	H	OH	OH	OCH3	H	OCH_3
111	OH	OH	H	OH	OH	OCH3	H	OCH_3



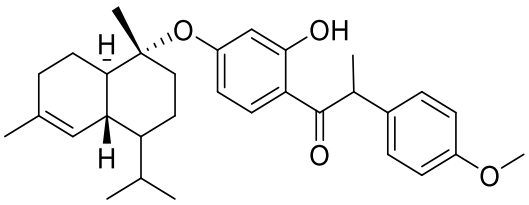
112 **R**= H
113 **R**= OH



	R_1	R_2
114	OH	OCH_3
115	H	H



116 **R** = OH
117 **R** = OCH_3



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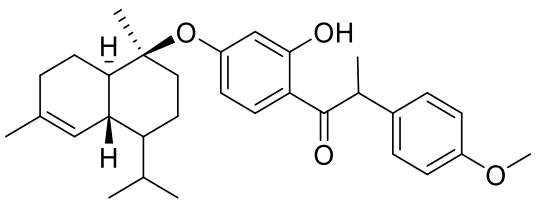
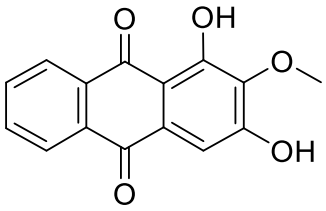


119



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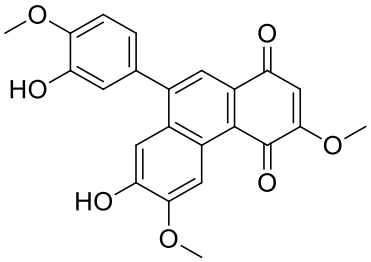

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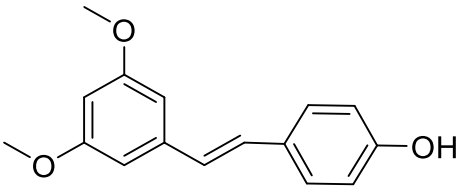
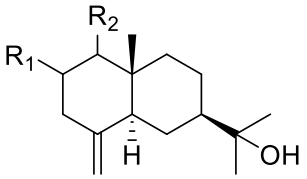
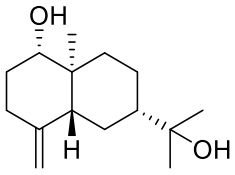


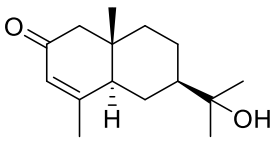
122



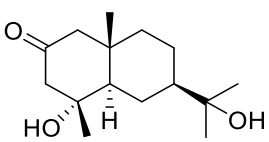
	R_1	R_2
123	H	H
124	H	OH
125	OH	H



126



127



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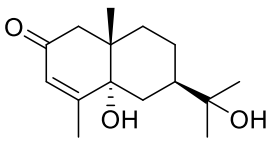

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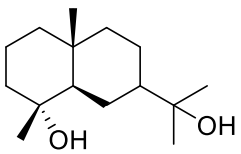

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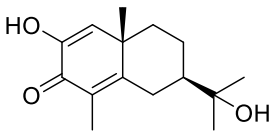

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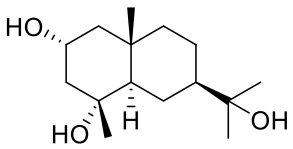

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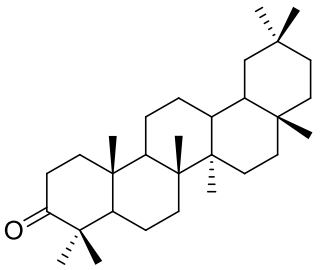
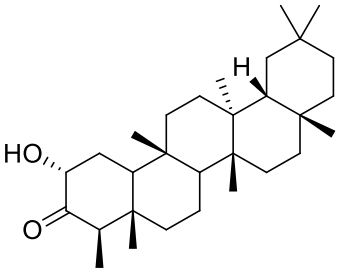


133



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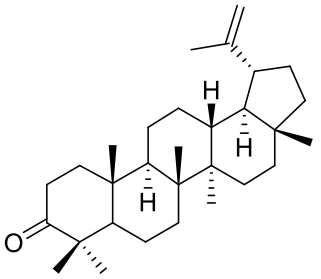

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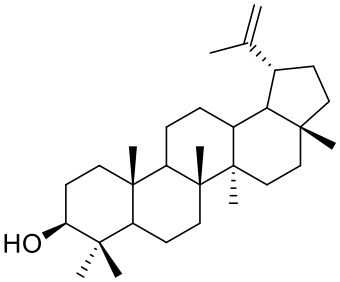

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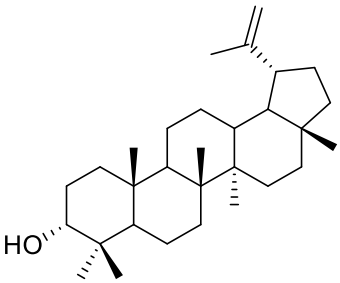

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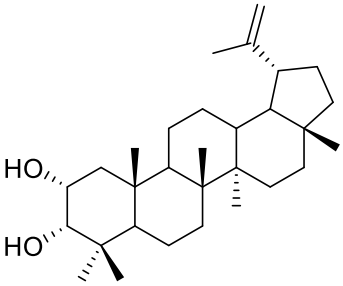

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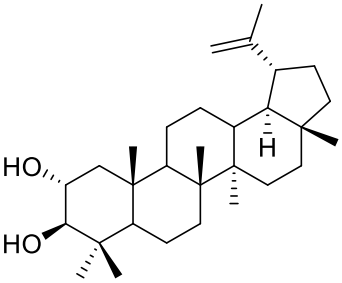

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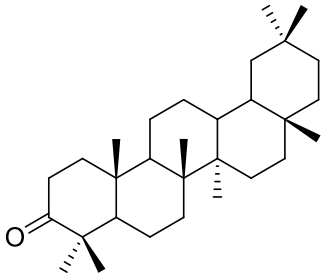

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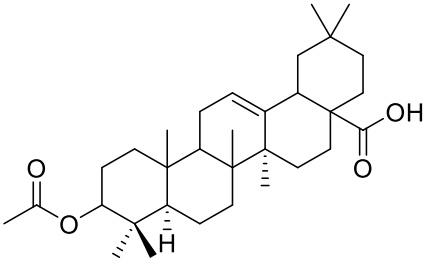

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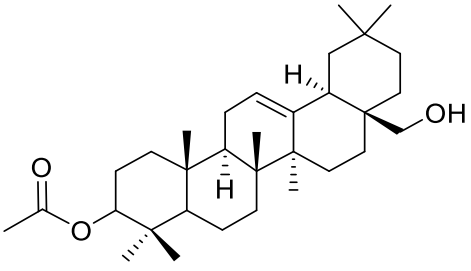

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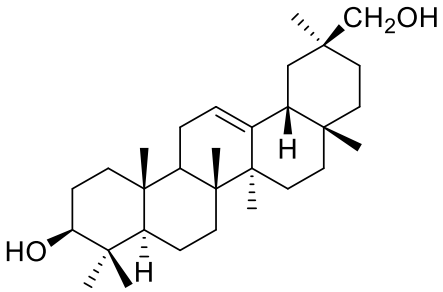

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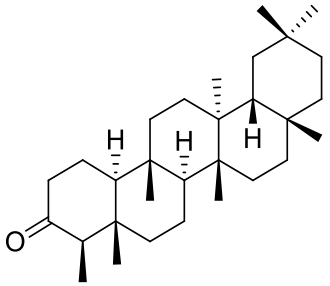

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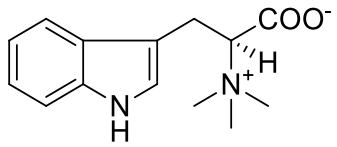

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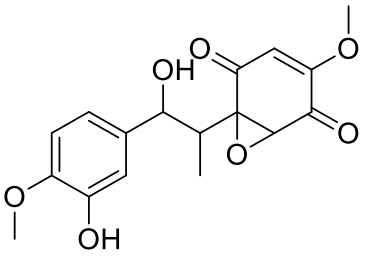

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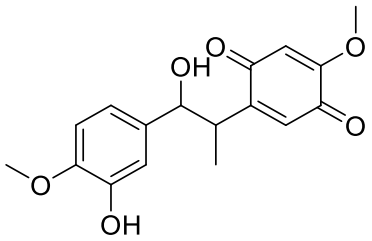

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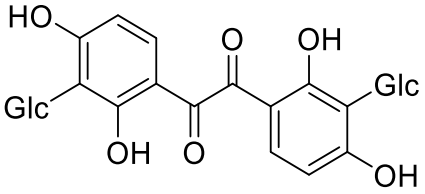

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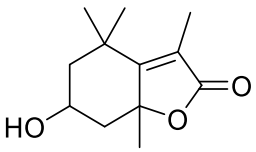

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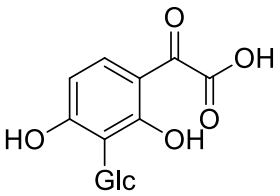

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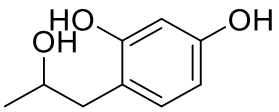

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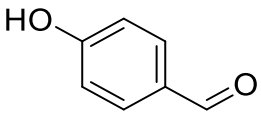

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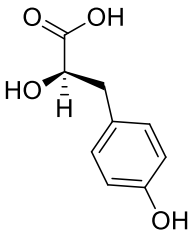

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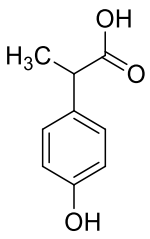

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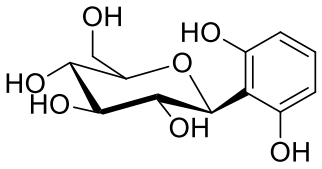

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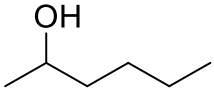

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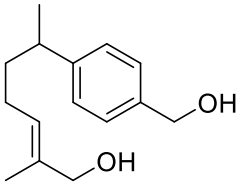

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CONCLUSION

Despite the reviews on metabolites of individual *Pterocarpus* species[7, 8, 95, 96], it is the first one on the entire genus. Compiling the data, revealed that only 11 out of 35 species were phytochemically investigated. The species, *P. marsupium* and *P. santalinus* have been extensively

investigated. The wood, root, bark and stem are the most studied morphological parts for majority of the investigated plants. In turn, only leaves of *P. indicus and P. santalinoides* were investigated.

The phytoconstituents characteristics for the investigated wood, stem, root and bark are isoflavonoids and pterocarpans, while the leaves constituents are majorly triterpenes. The compounds liquiritigenin, isoliquiritigenin, homopterocarpin, pterocarpin, angolensin, santal, santalins A and B, pterostilbene, pterocarpol, *β*-eudesmol, epicatechin and lupeol have been isolated from more than two member of the investigated *Pterocarpus* species, indicating their chemotaxonomic importance.

The ongoing phytochemical studies should focus on the uninvestigated *Pterocarpus* species to explore new phytomolecules that may possess more promising medical benefits.

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