Chapter-3

Literature Review

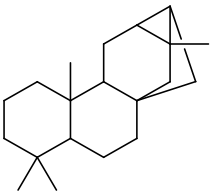
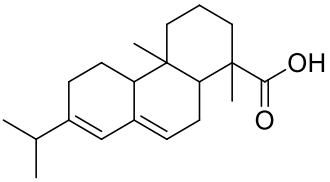
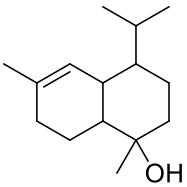
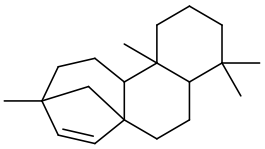
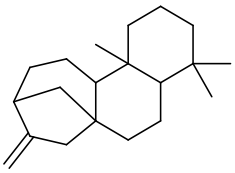
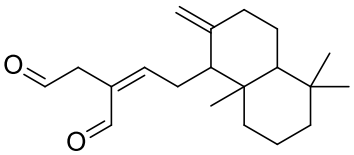
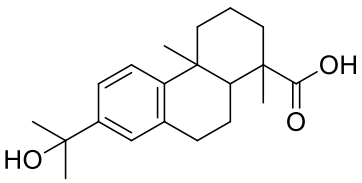
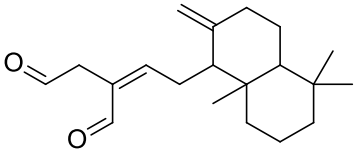
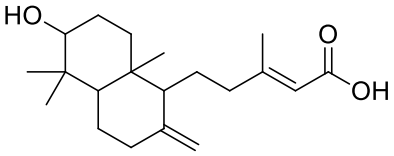
3 Literature Review

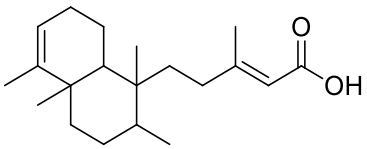
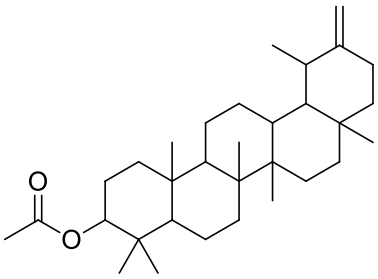
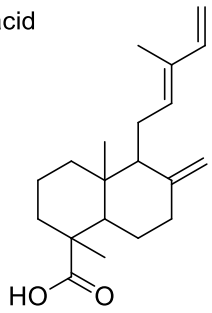
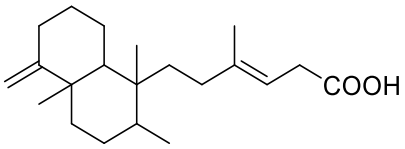
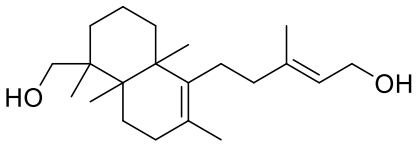
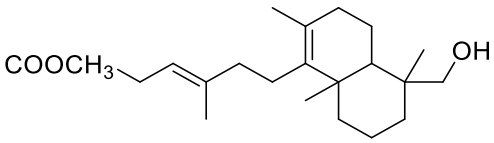
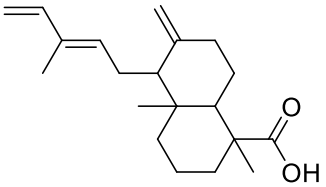
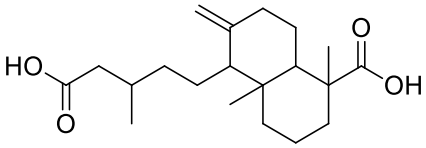
Araucaria cunninghamii is a gymnosperm commonly known as hope pine. It belongs to *Araucariaceae* family. Many of the plant species belongs to this genus are tree in habit and usually with needled leaves in the mature plant. The species widely distributed in the Southern Hemisphere, New Guinea, Australia, but also in Chile, Argentina, Brazil, New Caledonia, and Norfolk Island. Some of the species also native to Himalayan region. Phytochemical work on the different species revealed presence of diverse secondary metabolites from the genus. Apart from the primary metabolites, the major secondary metabolites are present in various part of plant. Such as volatile oils mainly contain monoterpenes, gum-resin is rich source of diterpenoids and leaves are enriched bioflavonoids. Because of these metabolites crude extracts have shown significant biological potentials. The biological activities related with the crude extract of araucaria species are many [37]. A fraction enriched with *A. angustifolia* has shown the significant UV-A UV-B radiation protection potential [38]. The fractions of the whole plant extract of *A. angustifolia* have shown strong antiviral activity against HSV-1 (IC_{50}: 8.19 µM). The petroleum ether and methanol extracts of the leaves and oleo-resin of *A. bidwillii*, possess strong anti-insomnia, analgesic, and anti-inflammatory activities [39]. The crude *A. araucana* resin showed dose-dependent gastroprotective effects on gastric lesions in mice [40]. The ethanol extract of *A. columnaris* showed good antioxidant and antiradical activities when measured for the DRSC (DPPH radical scavenging activity) and NOSC (nitric oxide scavenging capacity) assays, respectively [41]. Different extracts of its leaves showed medium antioxidant properties and good

α-amylase inhibitory and antibacterial effects against Pseudomonas and Klebsiella spp. and Escherichia coli [42].

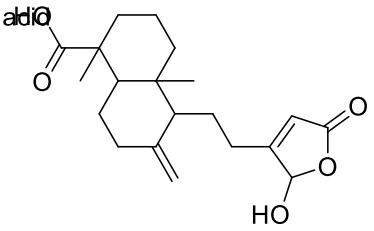
Various class of secondary metabolites are reported from *A. cunninghamii*, such as terpenoids [43], lignans [44], flavonoids [45], phenolic compounds [46], diterpenes [47], monoterpenes [48], along with primary metabolites; lipids [49], carbohydrates [50], and amino acids [47, 51-53]. Diterpenoids are enriched in gum resins among them the labdane and abietane are main class of metabolites. Labdane diterpenoids have developed as novel lead drug discovery and these metabolites have shown wide range biological potential such as anti-bacterial and anti-fungal [54], anti-mutagenic, cytotoxic, and cytostatic effect [55], anti-inflammatory [56]. Another important class of natural products are dimeric form of flavonoids called biflavonoids, which include different compounds: amentoflavone, 2',8''-biapigenin, delicaflavone, ginkgetin, heveaflavone, hinokiflavone, Podocarpusflavone A, robustaflavone, sumaflavone, taiwaniaflavone, ochnaflavone, kayaflavone, and isocryptomerin [57].

Table 3. 1 Various secondary metabolite isolated from *Araucaria species*

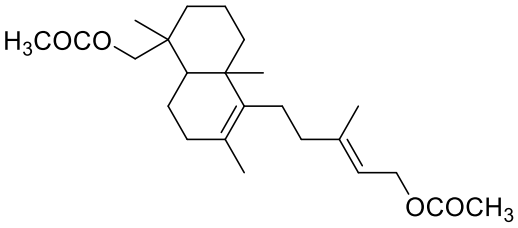
Name	Structure	References
	Terpenoids	
Trachylobane		[58]
Abietic acid		[59]
Cadinol		[60]
Hibaene		[61]
ent-Kaurene		[62]
8(17),12-Labdadiene-15,16-dial		[63]
8(17),12,14-Labdatrien-18-oic acid		[64]
8(17),12-Labdadiene-15,16-dial		[65]
3-Hydroxylabda-8(20),13-dien-15-oic acid		[66]

Kolavenic acid		[67]
15-Hydroxydehydroabietic acid		[68]
8(17),12,14-Labdatrien-18-oic acid		[68, 69]
4(18),13-Clerodadien-15-ol; (ent-13E)-form, 15-Carboxylic acid		[70]
8,13-Labdadiene-15,19-diol		[71]
8,13-Labdadiene-15,19-diol		[72]
Trans-Communic acid		[73]
Junicedric acid		[74]

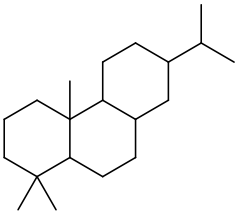
13-labdadien-15,16-olid-19-oic acid [75]



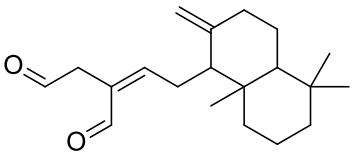
8,13-Labdadiene-15,19-diol [76]



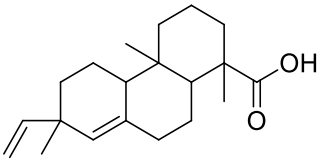
Abietane [77]



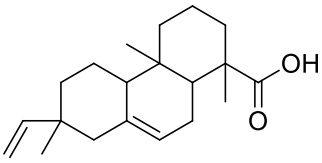
Labda-8(17),12-diene-15,16-dial [72]



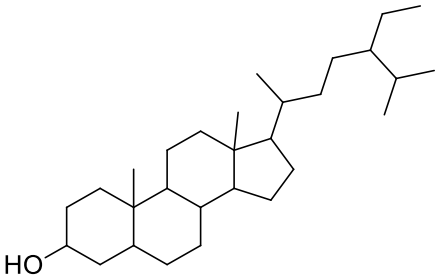
Sandaracopimaric acid [78]



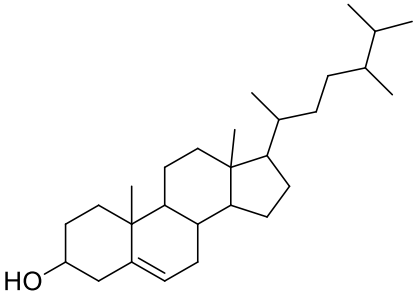
Isopimaric acid [79]



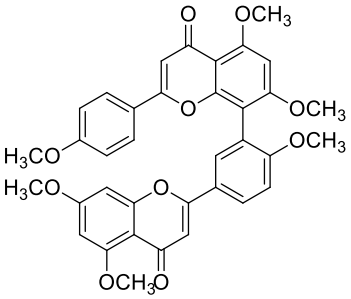
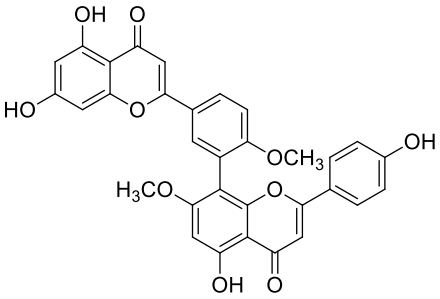
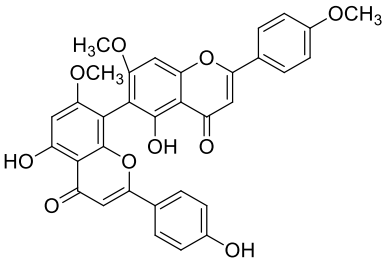
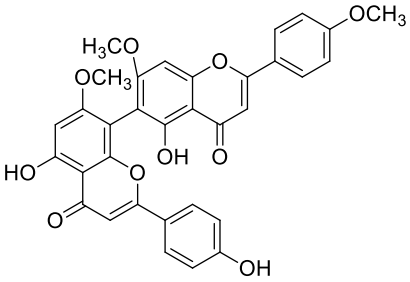
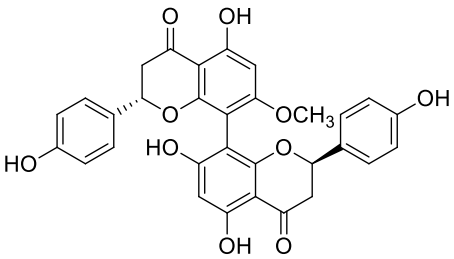
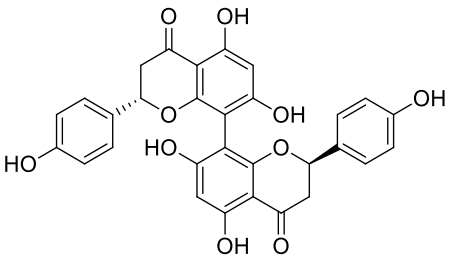
sitosterol [80]

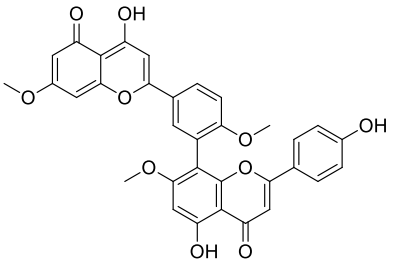
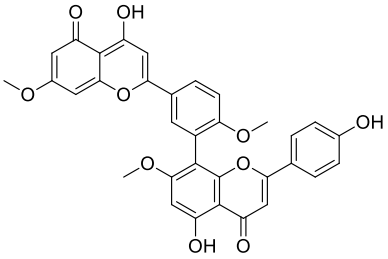
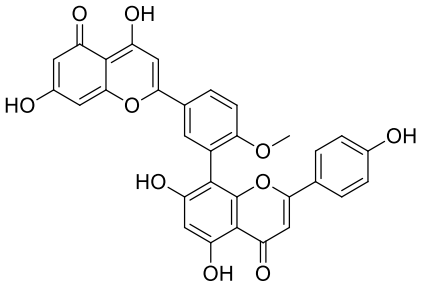
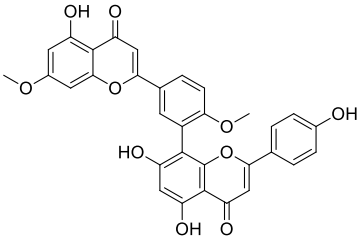
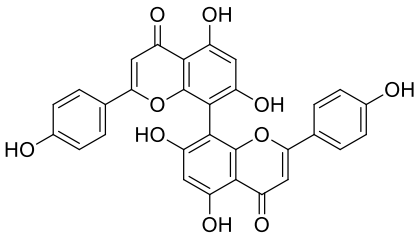
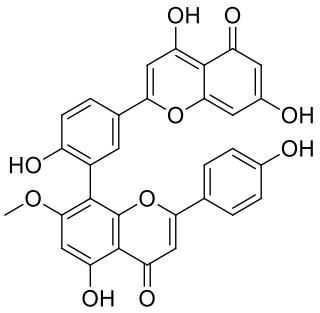


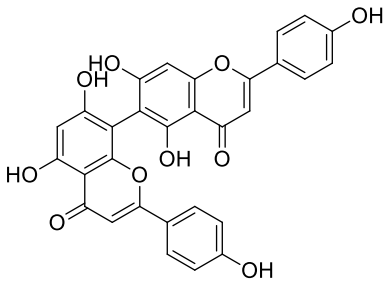
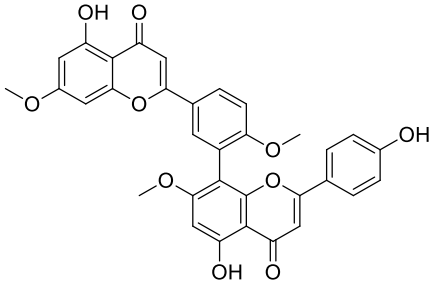
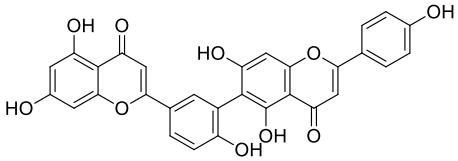
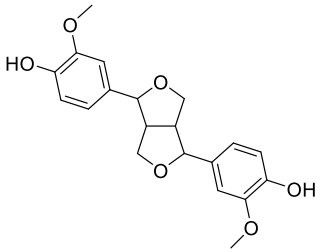
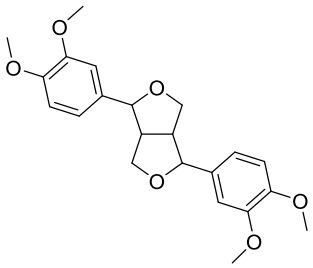
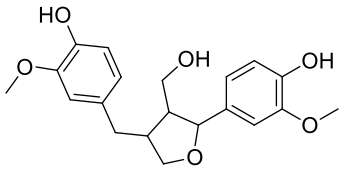
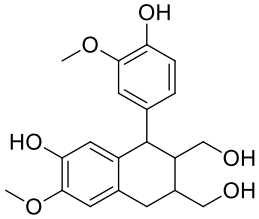
Campesterol [81]

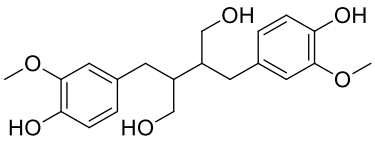
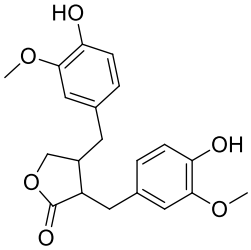
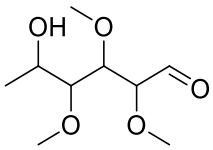
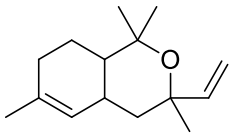
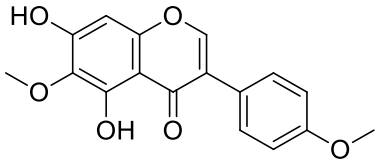
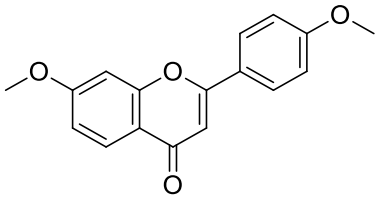
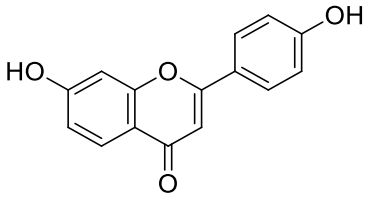
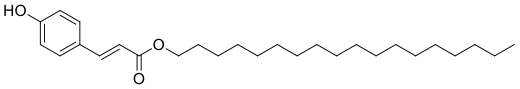


Biflavonoids

Amentoflavone; Hexa-Methyl ether		[72]
Amentoflavone; 4"',7-Di-Methyl ether		[82, 83]
Agathisflavone A		[82, 83]
Agathisflavone; 4"',7,7"-Tri-Methyl ether		[84]
4',4"',5,5",7,7"-Pentahydroxy, methoxy-8,8"-biflavone		[71]
4',4"',5,5",7,7"-Hexahydroxy-8,8"-biflavone		[71]

7,7"",4"-tri-O-methylamentoflavone		[71]
7,4',4"-tri-O Methylamentoflavone		[85]
4"-Methylamentoflavone		[70]
Ginkgetin		[86]
Cupressuflavone		[87]
7""-O-methylamentoflavone		[88]

Agathisflavone		[88]
7,4',7''-tri-O-Methyl Amentoflavone		[89, 90]
Robustaflavone		[89, 90]
Lignan		
Pinoresinol		[91]
(+)-Eudesmin		[92]
(+)-Lariciresinol		[93]
Isolariciresinol		[94]

Secoisolariciresinol		[95]
Matairesinol		[96]
Miscellaneous		
2,3,4-tri-O-methyl-L-rhamnose		[97]
Cabreuva oxide C		[98]
Irisolidone		[99]
7,4'-Dimethoxyflavone		[100]
4',7-Dihydroxyflavone		[101]
Octadecyl p-coumarate		[102]

literature search in genus araucaria revealed its phytochemical and pharmacological potential. Review of literature revealed that leaves are rich source of biflavanoids while the gum resin is enriched bit diteterpenoids.