A Review on biological and phytochemical investigation of plant genus *Callistimom*

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**ABSTRACT**

**Objective:** The large flowering plant genus *Callistemon* is belongs to family Myrtaceae and reported for its medical importance. Various parts of different species exhibit different medicinal importance and yet to be phytochemically investigated. In the different time various scientist have investigated the genus and reported the chemical constituents. A survey of literature on genus *Callistemon* reported the isolation of triterpenoids and steroids from leaves, seeds and stem bark of different species.

**Keywords:** Activity, Flavonoids, *Callistemon* Steroid, Triterpenoid

**1. Introduction**

*Callistemon* is a genus of 34 species of shrubs in the family Myrtaceae, all of which are endemic to Australia. It is sometimes considered a synonym of Melaleuca. *Callistemon* species are commonly referred to as bottlebrushes because of their cylindrical, brush like flowers resembling a traditional bottle brush. They are found in the more temperate regions of Australia, mostly along the east coast and south–west, and typically favour moist conditions so when planted in gardens thrive on regular watering. However, at least some of the species are drought–resistant. *Callistemon* can be propagated either by cuttings (some species more easily than others), or from the rounded seeds. Flowering is normally in spring and early summer (October–December), but conditions may cause flowering at other times of the year. In Australia, *Callistemon* species are sometimes used as food plants by the larvae of hepalid moths of the genus *Aenetus* including *A. ligniveren*. These burrow horizontally into the trunk then vertically down. In India, bottlebrush plants/trees are grown in gardens. Their leaves have a lovely fragrance which gets released on crushing the leaves with hands. The genus *Callistemon* is known in folk medicine for its anticough, antibronchitis, and insecticidal effects and its volatile oils have been used as antimicrobial and antifungal agents[1–3]

**Biological evaluation**

Diverse bioactivity studies on different species of genus *Callistemon* have been reported. *C. lanceolatus* is a small tree, indigenous to Australia and frequently grown in gardens in India. A survey of literature revealed the isolation of some phenolic derivatives, aliphatic acids and steroids from flowers[4–7], fruits[4,5], leaves[8–15], stem bark and seeds[16]. *Callistemon lanceolatus* D.C. (Myrtaceae) is a slow–growing ornamental shrub that grows to a height of around 10 meters. *C. lanceolatus* is a native tree to Australia, but is also widely distributed in Asian countries. It is commonly known as crimson bottle brush tree because of its spiky inflorescence that resembles a bottle brush. The inflorescence is crimson in color and cylindrical, and flowers are borne in spring and summer.
The plant has been used by tribal communities of India for the treatment of gastrointestinal disorders, pain, and infectious diseases. Over the years, *C. lanceolatus* have been extensively analyzed scientifically and reported to possess anticholinesterase activity[17], wound healing activity[18], hepatoprotective activity[19], inhibit elastase activity[20], cardioprotective activity[21], antiinflammatory activity[22], antidiabetic activity, hypolipidemic activity and antioxidant activities[23]. These reports indicate the potential of *C. lanceolatus* to be a good source of bioactive compounds with several medicinal properties. Nitisinone has been isolated from the plant that exhibited a herbicidal activity. Nitisinone has also been successfully used in the management of human tyrosinaemia Type-1. The alpha amylase inhibitory activity of *Callistemon rigidus* in mouse’s gastrointestinal tract has been documented that has blood glucose lowering effect at postprandial state[24]. Similarly antibacterial and anthelmintic activity of *Callistemon viminalis* have also been documented[25,26]. The 1, 8-cineol and alpha-terpineol have been isolated as major compounds from the leaves and flowers of *Callistemon citrinus* that have anthelmintic and antimicrobial activity[27,28]. Moreover, antistaphylococcal activity, hypolipidemic activity and antioxidant activity at postprandial state[24]. Similarly antibacterial and antifungal activity, its essential oils exhibited pesticidal[37], growth inhibitory[38], anthelmintic[39] and fungitoxic[40] activity. The essential oils obtained by hydrodistillation of the leaves of *Callistemon comboyensis* exhibited antioxidant activity and also antimicrobial; activity against both gram positive (Bacillus subtilis and Staphylococcus aureus), gram negative (Proteus vulgaris, Pseudomonas aeruginosa) and a pathogenic fungus *Candida albicans*. Nevertheless, Ce leaf oil extract exhibited high antioxidant activity[41]. An alcoholic extract of the *C. linearis* and leaf extract of *C. macropunctatus* exhibited antibacterial activity against various bacteria[42], while the aqueous extract of the flowers of *C. phoeniceus* and *C. salignus* were active against gram positive bacteria[43]. *Callistemon viminalis* is an ethnomedicinal plant used in Jamaica to treat intestinal illnesses. The oil of C. viminalis exhibited anthelmintic activity against tapeworm and hookworm while the aqueous extract of the flowers and leaves were active against gram positive bacteria[44]. Methanol, hexane and aqueous extracts of *Callistemon*

### Table 1

Compounds isolated from genus *Callistemon*.

<table>
<thead>
<tr>
<th>Plant species</th>
<th>Part investigated</th>
<th>Compounds isolated</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>C. lanceolatus</em> syn. <em>C. citrinus</em></td>
<td>Flowers</td>
<td>Flavonoids: pelargonidin-3,5-diglucoside, cyanidin-3,5-diglucoside; monoterpenoids: β-pinene(V) and α,β-cineol; tannins: pyrogallol(V) and catechol(VI); triterpenoids: β-sitosterol(VII) and oleanolic acid(VI) and β-sitosterol(XI); flavonoids: quercetin(XXII) and quercetin-3-O-glucuronide(XXIII); polyphenols: 2,3-(S)-dihydroxy-6-C-methyl-7-methoxy flavonone, 5,4'-dihydroxy-6,8-di-C-methyl-7-methoxy flavone, 5,7-dihydroxy-3,8,4'-trimethoxy-6-C-methyl flavone, kaempferol-3-O-β-D-galactopyranoside and quercetin-3-O-β-D-galactopyranoside</td>
<td>[4-7]</td>
</tr>
<tr>
<td></td>
<td>Fruits</td>
<td>Flavonoids: 3'-4'-dihydroxy flavonol(VI), 3'-4'-dihydroxy flavone(VII), 3',4',7-trihydroxy flavonone-7-galactoside, 5,7-dihydroxy-3,8,4'-trimethoxy-6-C-methyl flavone, kaempferol-3-O-β-D-galactopyranoside and quercetin-3-O-β-D-galactopyranoside; monoterpenoids: 1,8-cineol, α-pinene and limonene; triterpenoids: α-lupenol, 2α-hydroxy uvaol(XIV), 2α-hydroxy usnic acid(XV), usnic acid(XVI), oleanolic acid(XI), uvaol(XI) and uvaol(XVII) and myrtecommunone and phloroglucinol derivative</td>
<td>[8-15]</td>
</tr>
<tr>
<td></td>
<td>Leaves</td>
<td>Tannins: gallic acid(XIII) and ellagic acid(XIV)</td>
<td>[16]</td>
</tr>
<tr>
<td></td>
<td>Seeds</td>
<td>Tannins: 3,5-dii-O-methyl ellagic acid, 3',5',4-ti-O-methyl ellagic acid and ellagic acid(XIX)</td>
<td>[16]</td>
</tr>
<tr>
<td><em>C. coccineus</em></td>
<td>Leaves</td>
<td>Flavonoids: 5',4'-dihydroxy-6-C-methoxy flavone, 5,4'-dihydroxy-8-C-methyl-7-methoxy flavonone, 5',4'-dihydroxy-6,8-di-C-methyl-7-methoxy flavonone, 5,7-dihydroxy-3,8,4'-trimethoxy-6-C-methyl flavone and 6,8-dimethyl apigenin(XX)</td>
<td>[38]</td>
</tr>
<tr>
<td><em>C. linearis</em></td>
<td>Seeds</td>
<td>Tannins: β-sitosterol(XI)</td>
<td>[39]</td>
</tr>
<tr>
<td><em>C. rigidus</em></td>
<td>Aerial parts</td>
<td>Triterpenoids: β-sitosterol(XI); flavonoids: 3',4'-dihydroxy flavonol(VI), 3',4'-dihydroxy flavone(VII), 3',4'-dihydroxy flavonol-3-glycoside and 3',4'-dihydroxy flavone-7-galactoside; monoterpenepeps: γ-terpinene, α-terpeneph, α-pinene, 1,8-cineol and limonene(XX); melaleucin and melaleucin acetate</td>
<td>[6]</td>
</tr>
<tr>
<td></td>
<td>Leaves</td>
<td>Flavonoids: quercetin(XII) and quercetin-3-O-glucuronide(XIII); polyphenols: 2,3-(S)-hexahydroxy diphenyl-2-glucose; tannins: ellagic acid(XIII), tetragall acid dilactone, catechin and cassurin; triterpenoids: betulinic acid(VII) and ursolic acid(XVI)</td>
<td>[43,44]</td>
</tr>
<tr>
<td><em>C. speciosus</em></td>
<td>Leaves</td>
<td>Monoterpenes: 1,8-cineol, α-pinene(XVIII), linalool(XVII) and α-terpeneph(XI)</td>
<td>[45]</td>
</tr>
<tr>
<td><em>C. viminalis</em></td>
<td>Aerial parts</td>
<td>Viminadione(A XXIV) and viminadione B(XXV)</td>
<td>[46]</td>
</tr>
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</table>
Callistemon lanceolatus was tested against eight common bacteria and a single fungus of medical importance using a quantitative agar well diffusion test and tube dilution assay. All plant extracts showed antimicrobial activities against the selected microorganisms; the methanol extracts were most effective. The aqueous extract on the other hand, was very effective as a bactericidal agent against the intestinal pathogens. These results support the ethnomedicinal claim that C. lanceolatus is an effective treatment for bacterial causes of intestinal illnesses.[45]

Phytochemical evaluation

Phytochemically, this genus has been found to be rich in triterpenoids, flavonoids, steroids and saponins. The compounds isolated from the various species are given in Table 1

![Chemical structures](image)

**Conclusion**

Callistemon, the versatile genus of medicinal plant is the unique source of various types of compounds having diverse chemical structure. A very little work has been done on the biological activity and possible medicinal application of its phytochemicals. It is very useful traditional plant genus, crude extract from various part of various species have a therapeutic uses from time immemorial, so that some active constituent can developed for future studies. The global scenario is changing their face towards herbal medicinal uses due to less side effect and emphasis given to develop a modern drug to cure many acute disease. Therefore this review given to find out new activity or new entity responsible for various therapeutic activity.

**Conflict of interest statement**

We declare that we have no conflict of interest.

**Acknowledgements**

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