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MONOGRAPH OF *CLERODENDRUM PANICULATUM*

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ABSTRACT

Traditional systems of medicine consist of large number of plants with various medicinal and pharmacological importances. Plants are considered as divine and they were worshipped as Mother (Goddess). *Clerodendrum* species are commonly found as ornamental plants Around 450 species are found. *Clerodendrum* genus has been reported in folk medicines as well as in indigenous system of medicines. *Clerodendrum paniculatum* has been found commonly in Kerala. It belongs to Lamiaceae family. They are preferred for inflammation, malaria, typhoid, cancer, jaundice, hypertension etc. Almost all parts of plant like leaf, flower, root and stem reported to be used as medicine.

KEYWORDS: *Clerodendrum paniculatum*, Pagoda plant, *Clerodendrum*, Lamiaceae.

INTRODUCTION

Medicinal plants are considered as a rich source of medicinal ingredients and this can be used as a source of drug and also as a source for drug development. Some plants like ginger, green tea, walnut etc are also considered as rich sources of nutrition too. So plants are the best part of human civilization and economy. Various cultures around the world, for example Chinese medicine and Indian medicine uses, this plants directly as medicines. The genus *Clerodendrum* includes around 450 species. The name *clero* derived from the greek word *kleros* meaning chance or fate and *Dendron* meaning tree. *Clerodendrum* genus has been reported in folk medicines as well as in indigenous system of medicines. They are used for the treatrment of various treatments like inflammation, malaria, typhoid, cancer, jaundice, hypertension etc. Various parts of the plants like leaf, flower, root and stem are repoted to be

used as medicine.[1] The family is closely related to Lamiaceae family. The main difference between the two families is the ovary. Lamiaceae have a deeply four-lobed ovary with gynobasic style while the Verbenaceae have anunlobed ovary and a terminal style.

Clerodendrum paniculatum

HABITAT

waste-water ground to rainforest, often close to fresh water.

GEOGRAPHY AND DISTRIBUTION

Clerodendrum paniculatum, is native to India, Sri Lanka, Malaysia and much of southeastern Asia. It is widely cultivated in tropical gardens throughout the world. It is native to tropical Asia and Papuasia (southern China including Taiwan, Indochina, Bangladesh, Sri Lanka, Andaman & Nicobar Islands, Borneo, Sulawesi, Sumatra, Philippines, Bismarck Archipelago).

COMMON NAMES

English name(s): Clerodendron, Orange Tower Flower, and Pagoda Flower

Malayalam Name: Krishnakireedam, Hanumankireedam

Tamil name: Krishna kireedam

TAXONOMY

Domain: Eukaryota

Kingdom: Plantae

Phylum: Spermatophyta

Subphylum: Angiospermae

Class: Dicotyledones

Order: Lamiales

Superorder: Asteranae

Family: Lamiaceaeor Verbenaceae

Genus: *Clerodendrum*

Species: *Clerodendrum paniculatum*

MACROSCOPY

C.paniculatum commonly known as pagoda flower. It is an erect subshrub or open semi woody shrub with large evergreen leaves and above the foliage huge orange-red or scarlet flowers held. Calyx deeply 5 lobed, red coloured, lobes oblong, having red corolla and oblong ovary. Plant is around 2.5 m tall and stemscarely branched. spreading around 0.6-0.9 m across. The leaves have heart shaped bases; lower leaves are lobed and upper leaves are entire. The leaves can be as large as 30.5 cm across.[2,3] It is a biennial herb that grows up to 1.5 m in height. It has been used for traditional medicine in India, China and Japan in the treatment of rheumatism, neuralgia, ulcer, inflammation, and wound healing. For traditional Thai medicine, it has been used as an antipyretic and anti-inflammatory drug. The plant *Clerodendrum paniculatum* is a plant widely found in Udupi district of Karnataka, India. The genus represents herbs, shrubs and small trees and is well-known for its ornamental uses. *Clerodendrum* is a very large and diverse genus with about 580 identified species is distributed throughout the world. In India 23 species were recorded by Rajendran and Daniel, of which 16 were recorded from Arunachal Pradesh by Srivastava and Choudhary.

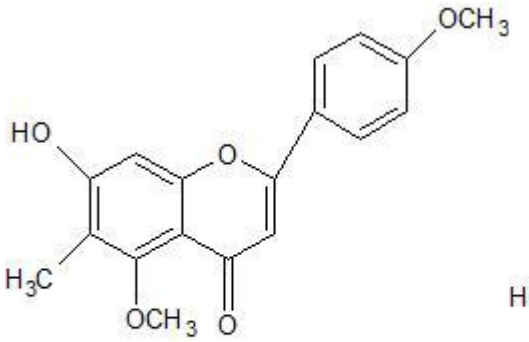
PHYTOCHEMICAL REVIEW

CHEMICAL CONSTITUENTS

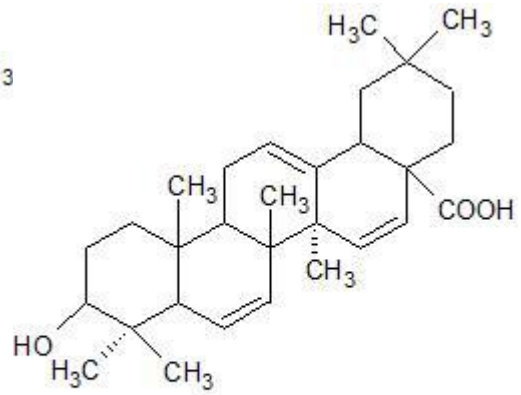
Clerodendrum, is used for the treatment of various diseases. A number of researches have been performed to identify and isolate biologically active compounds from different species of *Clerodendrum*. Research report revealed that steroids, terpenoids and flavonoids are major among them.

C.paniculatum leaves reported the presence of anthraquinone glycosides, flavonoids, saponins, tannins, proteins, lignin and phenol.[4] preliminary phytochemical screening also carried out in the petroleum ether, chloroform, ethyl acetate, methanol and distilled water extracts of the leaves. The study reveals that carbohydrates, glycosides, tannins and phenolic compounds in methanolic and aqueous extract and sterols in all the extracts.[5] Root of this plant posess carbohydrates, starch, mucilage, saponins, flavonoids, tannins, phenolic

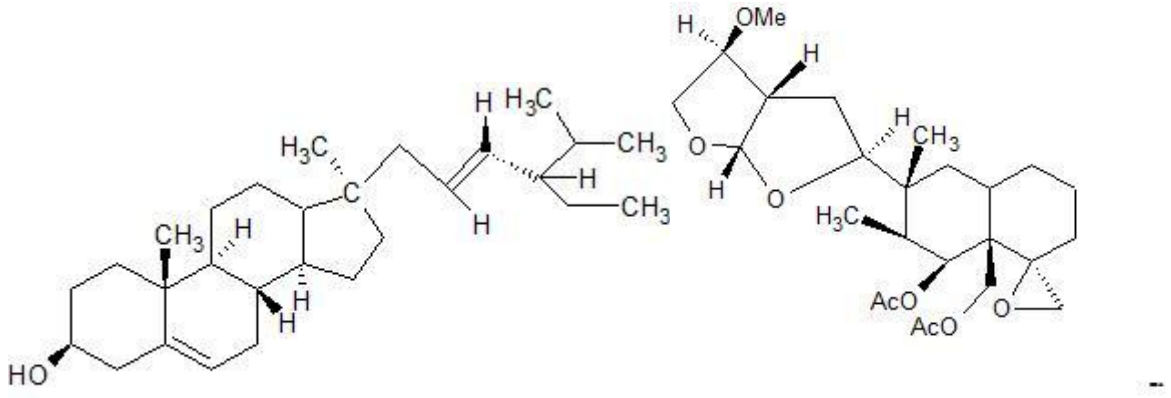
compounds in the ethanolic extract.[6] β-sitosterol, γ-sitosterol, octacosnol, clerosterol, bungein A, acetoside, betulinic acid, clerosterol 3-O-β -D-glucopyranoside, colebrin A-E, campesterol, 4*α*-methyl-sterol, cholesta-5-22-25-trien-3-*β*-ol, 24-*β*-cholesta-5-22-25-trine, cholestanol, 24-methyl-22-dihydrocholestanol, 24-β-22-25-bis-dehydrocholesterol, 24-*α*-methyl-22-dehydro-cholesterol, 24-*β*-methyl-22-dehydrocholesterol, 24-ethyl-22-dehydrocholesterol, 24-ethylcholesterol, 22-dehydro-clerosterol, 24-methyllathosterol, 24-*β*-ethyl-25-dehydro-lathosterol, (24S)-ethylcholesta-5-22-25-triene-3*β*-ol have been isolated from various *Clerodendron* species including *C.paniculatum.*[7] Triacontane, clerodin, (24s) ethylcholesta5, 22, 25-triene-38-01, a-amyrin, j3-sitosterol and clerodoIone. (24s) Ethylcholesta-5, 22, 25-triene-3/l-ol, α-amyrin and 3-sitosterol were obtained from the roots of *Clerodendronpaniculatum* L.[8] *C.paniculatum* leaves reported the presence of terpenes such as Triactane, clerodin, clerodendrin A, 3 β-acetyloleanolicacid, 3 β-acetyloleanolic aldehyde, glutinol.[9] *β*-epimerporiferasterol also reported in the root of this plant.[10] Chloroform extract of the root part also reported six compounds and were found to be identical with β-sitosterol, lupeol, oleanolic aldehyde acetate, stigmasta-4,25-dien-3-one, (22E)-stigmasta-4,22,25-trien-3-one and (3β)- stigmasta-4,22,25-trien-3-ol.[11]



Cleroflavone



Oleanolic acid



Poriferasterol clerodendrin A

PHARMACOLOGICAL ACTIVITY

Clerodendrum paniculatum possesses multiple pharmacological and therapeutical activities such as anti-microbial, anti-inflammatory, anti-cancer, antimutagenic etc.

1. Free radical scavenging and antioxidant activity

The alcoholic extract of the roots was evaluated for free radical scavenging activity by DPPH, ABTS radical scavenging and also by O-phenantrolinemethod. Concentration dependent scavenging activity studied at a concentration of 2µg/ml to 1024 µg/ml and it was comparable with the standard ascorbic acid[12] 10 g each of root and leaves of *C.paniculatum* were macerated with 100 ml methanol in a separated Round bottom flask for 48 hours. Preliminary screening revealed the presence of flavonoids, steroids, triterpenoids, phenols, cardiac and anthraquinone glycosides. Total phenolic content was measured by Folin-Ciocalteau method and antioxidant activity was measured by various methods like DPPH radical scavenging, hydroxyl radical scavenging, superoxide anion radical scavenging, reducing power determination and deoxy ribose degradation inhibitory effect as nonenzymatic methods. Enzymatic studies were carried out by superoxide dismutase, catalase, peroxidase, ascorbate, oxidase and glucose-6-phosphate dehydrogenase. They concluded the study as root extract showed significan activity against DPPH and superoxide anion scavenging activity than leaf. Reducing power and hydroxyl radical activity was more for leaf extract than root. Inhibitory effect of hydroxyl radical induced by deoxyribose degradation was both sit specific and nonsitespecific assay. Using same concentrations antioxidant activity was more in site specific than nonsitespecific. Leaf extracts showed 97.62% in site specific and 65% in nonsitespecific. Root extract activity was 72.52% and 52% respectively.[13]

2. Anticancer activity

The ethanolic extract of roots of *Clerodendrum paniculatum* showed anti-cancer activity by using liquid tumor model but to a lesser extent. The extracts decreased the tumour volume in solid tumour model and that result was not that much significant compared to standard cisplastin. The concentration dependent scavenging of DPPH, ABTS, and O Phenanthroline were studied with the concentrations of 2µg/ml to 1024µg/ml. several antioxidant phenolic compounds have been recognized to have ability to induce apoptosis in various tumour cells of human origin.[12]

3. Antibacterial and antifungal activity

Petroleum ether, chloroform, ethyl acetate, alcohol and aqueous extracts of *C.paniculatum* leaves were evaluated for antibacterial activity. They studied about gram negative bacterias like *Eicherichia coli*, *Salmonella Newport* and *Vibrio parahaemolytics*. Alchoholic extracts had good activity against E.coli compared to streptomycin. *Vibrio parahaemolytics* growth was better inhibited by petroleum ether, chloroform and ethyl acetate extracts.[13] *C.paniculatum* leaves were successively macerated with petroleum ether, chloroform, ethyl acetate, methanol and distilled water. These extracts were tested against *Pseudomonas aerunginosa*, *Streptococcus aureus* and *Candida albicans* at concentrations varies from 100 µg/ml to 2000µg/ml. Amikacin was used as standard. Reports suggests that chloroform extracts shows greater activity.

Antifungal activity against *Candida albicans* suggests that chloroform and methanol extracts shows significant activity and it was comparable with standard drug clotrimazole.[5] Antibacterial comparative study on ethanolic extracts of *C.paniculatum* and *C. infortunatum* were carried out against *S.aureus*, *B.subtilis*, *E.coli* and *Klebsiella pneumonia*. Standard was ciprofloxacin. All the extracts exhibited marked activities against tested organisms. *E.coli*, *K. pneumonia*, *S.aureus* at a concentration 100µg/ml was shown more degree of inhibition as compared to standard. Evidence suggested that *C.paniculatum* possess a better antibacterial activity with a lesser side effect.[6]

4. Anti-inflammatory activity

Petroleum ether, chloroform, ethyl acetate, alcohol, and aqueous extracts of leaves were collected and yield was about 1.16%, 2.17%, 1.05%, 0.89% and 0.5% respectively. Anti-inflammatory activity was studied by both *invitro* and *invivo* method. *Invitro* study was carried out by HRBC membrane stabilization method and it revealed that among all the

extracts petroleum ether and chloroform extract showed significant activity in a concentration dependent manner. Petroleum ether at a concentration of 1000µg/ml showed 57.15% protection and 1000µg/ml of chloroform showed 48.98% protection of HRBC membrane in hypotonic solution and results was comparable to the standard indomethacin. *In vivo* anti-inflammatory activity of these chloroform and petroleum ether extracts were evaluated by carrageenan induced rat paw edema model. Inflammatory inhibition was observed at 1st, 2nd, 3rd and 4th hour. At 4th hour petroleum ether at a dose of 400 mg/kg showed 69.5% inhibition as compared to 10mg/kg of indomethacin which exhibited 81.8% inhibition. Chloroform extracts showed comparatively lesser inhibition as around 49.4%.[14]

5. Hypolipidaemic activity

The methanolic extract of whole plant was administered in single doses of 200mg/kg/day and400mg/kg/day to rats fed with high fat diet to assess its possible lipid-lowering potential. High fat diet (HFD) elevatedthe levels of total cholesterol, ester & free cholesterol, phospholipids, triglycerides, lowdensity lipoprotein, and very low-density lipoprotein. Administration of 400mg/kg methanolic extract was significantly ($P<0.001$) reduced the lipid profile and lipoprotein levels. HDL cholesterol level was significantly reduced in HFD fed groups. Asignificantly increased HDL level was produced by the administration of 400mg/kg methanolic extract. Increase in the body weight in HFD fed group was reduced and also there was a marked decrease of plasma free and ester cholesterol, level of lipoprotein, plama triglycerides level etc. by the extract administration. The extract could protect against atherosclerosis and decrease the atherogenicindex. Therefore, it was concluded that the methanolic extract of leaves of *Clerodendrum paniculatum* has definite cardio protective effect against hyperlipidemia.[15]

6. Anthelmintic activity

Chloroform, ethyl acetate, methanol, and distilled water extracts of *C.paniculatum* leaves were evaluated for anthelmintic activity against piperazine citrate as standard. Methanolic extract showed significan activity comparable with the standard drug. Chloroform and ethyl acetate extracts showed little anthelmintic activity and aqueous does not shown any activity.[16]

7. Mutagenic and ant mutagenic activity

Mutagenic and antimutagenic activity was carried out on the ethanolic extract *C. paniculaum* root. Ames test was used to identify the mutagenic and antimutagenic

potential. It was found that root extract was non mutagenic and capable to inhibit induced mutagenicity. Mutagenic assay was obtained by using nitrite treated 1-aminopyrene mutagen of *S. typhimurium* strains of TA98 and TA100.[17]

CONCLUSION

Clerodendrum paniculatum is an important part of traditional medicine in many countries like China, India, Japan, Korea and Thailand. The genus represents herbs, shrubs and small trees and is well-known for its ornamental uses. *Clerodendrum* is a very large and diverse genus with about 580 identified species is distributed throughout the world. Phytochemical screening of *C.paniculatum* reveals the presence of anthraquinone glycosides, carbohydrates, flavonoids, saponins, tannins, proteins, lignin and phenol in the leaves. Root of this plant posess the presence of carbohydrates, starch, mucilage, saponins, flavonoids, tannins, phenolic compounds.

Some type of terpenes and steroidal compounds are also isolated from various part of this species. *Clerodendrum paniculatum* exhibits various pharmacological activities like antioxidant, anticancer, anti inflammatory, antimutagenic property, anthelmintic activity, hypolipidemic and antibacterial and antifungal activity.

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