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CALLICARPA MACROPHYLLA: A REVIEW UPDATE ON ITS BOTANY, ETHNOBOTANY, PHYTOCHEMISTRY AND PHARMACOLOGY

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ABSTRACT: *Callicarpa macrophylla* (Verbenaceae) has been commonly used in traditional medicine for a wide range of ailments related to the circulatory, digestive, endocrine, respiratory and skeletal systems as well as to infectious diseases. It provides the up-to-date information that is available on the botany, traditional uses, phytochemistry, pharmacology, and toxicology of *Callicarpa macrophylla*. Additionally, to highlight the possible uses of this species to treat different diseases and to provide a basis for future research. The information was collected from scientific journals, books, theses, and reports via a library and electronic search (Google Scholar, Web of Science and Science Direct). The phytochemical studies have shown the presence of many secondary metabolites belonging to terpenoids, flavonoids, carbohydrate, lignans, phenols, and sterols. Crude extracts and isolated compounds from *Callicarpa macrophylla* show a wide spectrum of pharmacological activities, such as anti-diabetic, anti-inflammatory, antifungal, antibacterial, anti-arthritic, anti-pyretic & analgesic activities, as well as a usefulness help in alleviating pain in rheumatism. *Callicarpa macrophylla* has been a widely used a source of medicine for years without any adverse effects. Many studies have provided evidence for various traditional uses. However, there is a need for additional studies of the isolated compounds to validate the traditional uses in human models. The present review on the botany, traditional uses, phytochemistry has provided preliminary information for further studies and commercial exploitations of the plant.

INTRODUCTION: Medicinal plants play a key role in human health care. About 80% of the world population relies on the use of traditional medicine which is predominantly based on plant materials¹.

As per World Health Organisation (WHO) estimates, almost 80% of the population of developing countries relies on traditional medicines, mostly plant drugs, for their primary health care needs^{2, 3, 4}.

It is estimated that about 7,500 plants are used in local health traditions in, mostly, rural and tribal villages of India. Out of these, the real medicinal value of over 4,000 plants is either little known or hitherto unknown to the mainstream population. The classical systems of medicine such as

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Ayurveda, Siddha, Amchi, Unani and Tibetan use about 1,200 plants⁵. Priyangu (*Callicarpa macrophylla* Vahl.) is a shrub. It belongs to family Verbenaceae. It is an important known medicinal plant of the lower warm valleys of the Himalaya. In addition to the Ayurveda system, *C. macrophylla* is widely used in many traditional medical systems, such as the Sidha, homeopathy, and Unani systems⁶. The flower buds of *C. macrophylla* used in the ayurvedic formulation such as Priyangwadi tel, Ashwagandharista, Dasamoolarist, Chandana sava, Draksharista, Eladi churn⁷. According to the present review compiles the fragmented information on the botany, traditional uses, phytochemistry, pharmacology, and toxicology of this plant. We hope that this information will highlight the importance of *Callicarpa macrophylla* and will provide a new direction for researchers in the future.

Taxonomy and Morphology: *Callicarpa macrophylla* Vahl (Symb. Bot. 3: 13 (1794) is used as an accepted name, and A.F. Judd first collected it in 1928 with specimen BISH 71847 and deposited in Royal Botanical Garden, Kew. The synonyms of *Callicarpa dunniana* and *Callicarpa incana* Roxb. *Callicarpa macrophylla* is a small tree 3-5 m high. Stem and branches densely covered with a greyish tomentum of stellate hairs. Leaves: lamina ovate or narrowly elliptic to oblong-lanceolate, acuminate, cuneate, obtuse or rounded at the base, crenate-serrate or crenate-dentate, 10-35 cm long, 2-18 cm broad, mature glabrescent and rugose above or with very numerous stubble-like small hairs, densely greyish-

white stellate-tomentose beneath; petiole 1-2 (-2.5) cm long, densely floccose-tomentose.

The inflorescence is densely stellate-hairy; primary peduncles equal to or a little longer than the petioles, 1-2.5 (-3) cm long. Flowers on short, slender pedicels; pedicel gland-dotted, tomentose, ± 1 mm long. Calyx minutely 4-denticulate, 1-1.5 mm long, glandular outside, with coarse stellate-hairs at the base, glabrous inside. Corolla violet or lilac, thinly hairy or almost glabrous with yellow glandular dots outside, glabrous inside, 2.5-3.5 mm long; lobes 1-1.5 mm long, obtuse or rounded; tube 2-2.5 mm long. Stamens exserted, inserted near the base of the corolla-tube; filaments 4-6 mm long; anthers oblong, ± 0.7 mm long, 0.4-0.5 mm broad, glandular along the connective. Ovary globose, glabrous, densely glandular, 0.5-1 mm in diameter; style exserted, glabrous, 5-8 mm long, stigma capitate. Fruit globular, ± 2 mm in diameter, glabrous, glandular, smooth, white^{8, 9}. *C. macrophylla* flowers from May to August and fruits from September to February¹⁰ **Fig. 1.**

Scientific Classification:

| | | |
|----------|---|-----------------------|
| Kingdom | : | Plantae |
| Unranked | : | Angiosperms |
| Unranked | : | Eudicots |
| Unranked | : | Asterids |
| Order | : | Lamiales |
| Family | : | Verbenaceae |
| Genus | : | <i>Callicarpa</i> |
| Species | : | <i>C. macrophylla</i> |



Priyangu Plant



Image of Flower

FIG. 1: CALLICARPA MACROPHYLLA VAHL PLANT

Distribution and Propagation: *C. macrophylla* is globally distributed across India, China, Bhutan, Myanmar, South East Asia, and Nepal. In India, it is distributed in Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Bihar, Sikkim, West Bengal, Arunachal Pradesh, Assam, Meghalaya, Nagaland, Manipur, Mizoram, Tripura, and Andhra Pradesh, up to an altitude of 1800 meters^{13, 14}. It is cultivated in drained sandy, loamy and clayey soils with acidic and alkaline nature. The hardy zone preferred is majorly cultivated at altitudes of Himalayas. It is also found near swampy areas, waste lands, and roadsides. Plant propagation is by seed on February¹³.

Vernacular Names and Traditional Uses: *C. macrophylla* is commonly known as “Velvety Beauty Berry.” Various vernacular names know it in different geographical regions **Table 1**. Despite their wide use in Chinese medicine¹⁴. In addition to the traditional and medicinal uses for the treatment of different diseases and disorder such as a tumor, polydipsia, diarrhea, diabetes, dysentery, fever, as a blood purifier, anti-pyretic, analgesic, anti-ulcer, gastric stimulants, etc. The juice made from leaves used in gastric troubles, headache and stop bleeding^{15, 16}; and rarely used as food vegetable, spices in Western Chitwan, Nepal¹⁷.

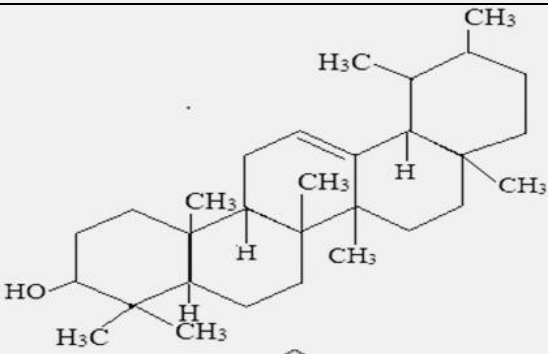
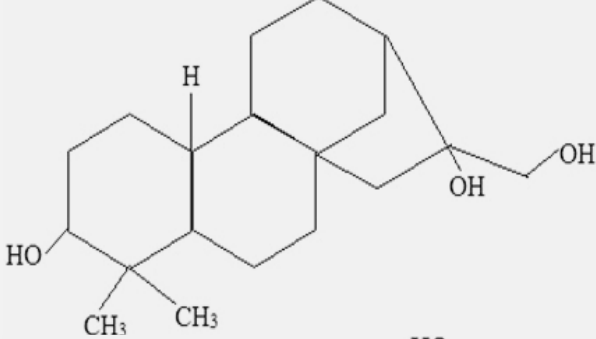
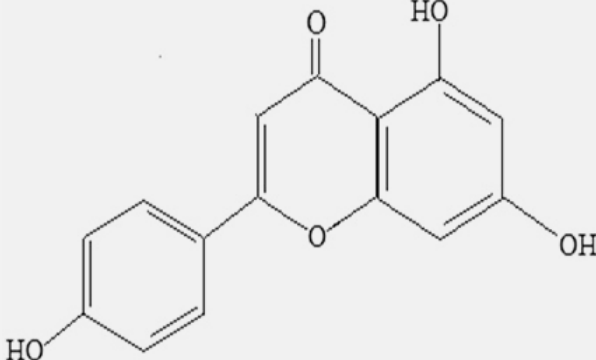
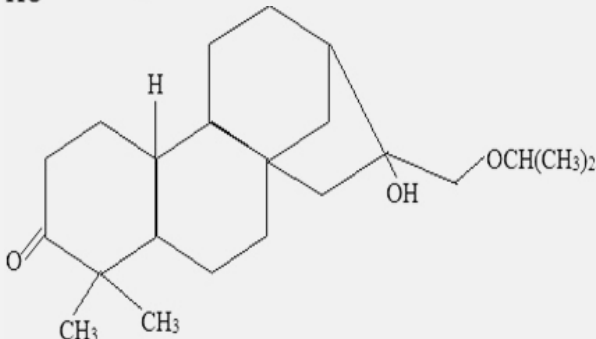
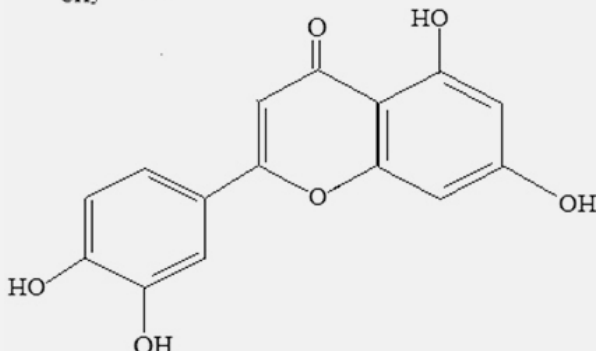
TABLE 1: VERNACULAR NAMES OF *C. MACROPHYLLA* VAHL.

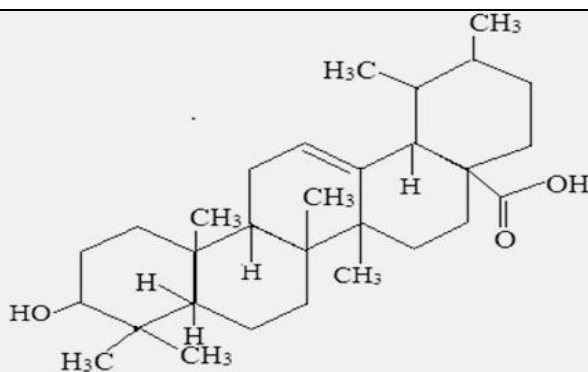
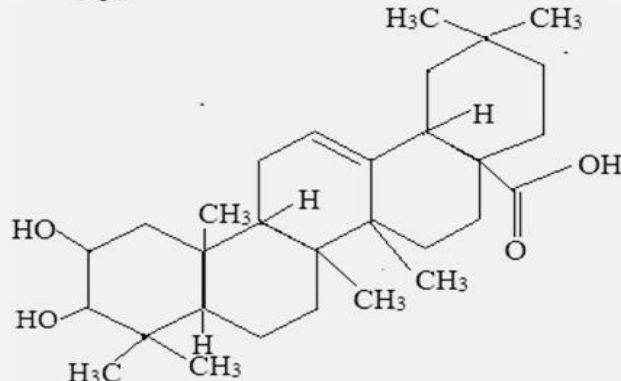
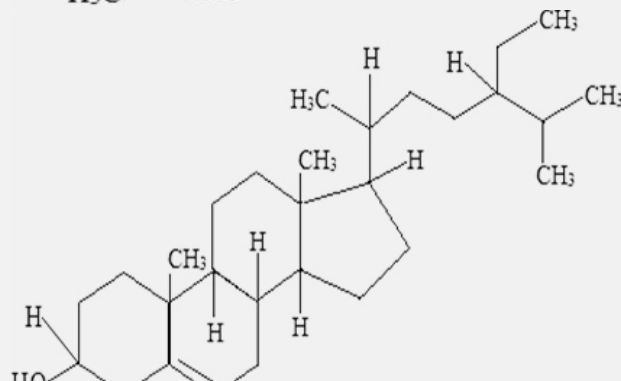
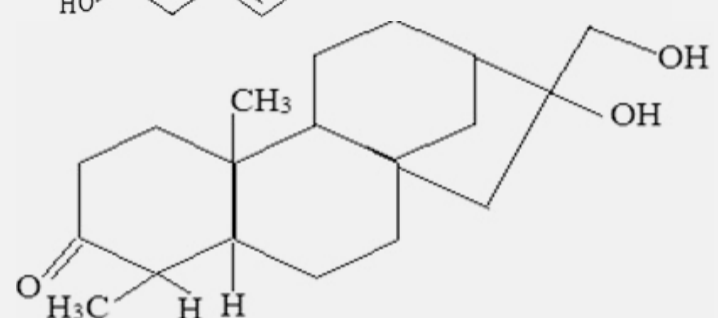
| Vernacular names | Region/language/system of medicine |
|---|------------------------------------|
| Mathara, Barmala, Dhalahuja, Aplotan, Fulujha, Jugga harina. | Bengali |
| bonmala, tong loti | Assamese |
| bhirmoli, dahiya, daia, daiya, daya, priyamgu, bastara | Hindi |
| chimpompil, chinpompil, cimpompil, nalal | Malayalam |
| mondol-panamana | Manipuri |
| huahkhar | Mizoram |
| anganapriya, gandhaphali, kanta, phalin, phalini, priyangu, | Sanskrit |
| priyanguka, syama, vanita | |
| Nalalu, kattu-k-kumil | Tamil |
| ga ndha pri yam ku, gandha pri ya nku (d), gandha priyanku (d), pri | Tibetan |
| yan, pri-yam-ku, pri-yan-ku | |
| Gandha-priyangu | Ayurvedic |
| Dayezizhu | Pinying |
| Big-leaf Beautyberry, urn fruit, Perfumed cherry | English |
| da ye zi zhu | Chinese |
| Guenlo | Nepali |
| Tichangsa | Chepang |
| Dahidhula | Darai |
| Dahigun | Tharu |
| Habb-ul-Mihlb (Prunus mahaleb) | Unani |
| dahigun | Tamang |
| Kanphuli, aesar | Marathi |
| Ibbani, rushipatri | Kannada |
| latapriyangu | Gujarati |
| sungru muuk | Lepcha |
| ayamsar | Konkani |
| Darus, denthar, patthar man | Punjabi |

Phytochemistry: *C. macrophylla* leaves contains α -amyrenol, α -amyrin, ursolic acid, 2 α , 3 α , 19 α -trihydroxy -12-dien-28- ursolic acid, betulinic acid, β -sitosterol, daucosterol¹⁸; flavanoids such as luteolin, apigenin, luteolin-7-O-glucuronide, apigenin -7 -O -glucuronide, β -sitosterol - β -D-glucoside, 2 α -hydroxy ursolic acid, cratogenic acid, docosanoic acid, tricosanoic acid, tetracosanoic acid, ethyl tricosanoate, 3,7,3'-trimethoxy-4',5'-dihydroxyflavone^{19, 20}. The bark contains betulinic

acid¹⁸. The roots and aerial part contains essential oil, (diterpene) calliterpenone, calliterpenone monoacetate²¹; & Seeds contains calliterpenone, calliterpenone-17-acetate, oleanolic acid. Several compounds were isolated from diterpenoid- (16 α , 17-Isopropylideno-3-oxo-phylocladane^{23, 24}; 3 β , 16 α , 17-trihydroxyPhyllocladane^{25, 26}; 16, 17-dihydroxy kauranoids²⁷; terpenoids²⁸; fatty acids & other constituents^{29, 30}. Some structures are illustrated in **Table 2**.

TABLE 2: SOME STRUCTURES ISOLATED FROM *C. MACROPHYLLA* VAHL.

| Chemical names | Isolated from part | Structures | References |
|---|--------------------|--|------------|
| α -amyrenol | Leaves |  | 18 |
| 3 β , 16 α , 17-trihydroxy Phyllocladane | Leaves |  | 25, 26 |
| Apigenin | Leaves |  | 19, 20 |
| 16 α , 17-Isopropylideo-3-oxo-Phyllocladane | Leaves |  | 22, 23, 24 |
| Luteolin | Leaves |  | 19, 20 |

| | | | |
|-----------------|----------------|--|--------|
| Ursolic acid | Leaves |  | 18 |
| Crategolic acid | Leaves |  | 19, 20 |
| Daucosterol | Leaves |  | 25 |
| Calliterpenone | Seeds & Aerial |  | 21 |

Pharmacological Activity:

Antibacterial Activity: The *ex-vivo* antibacterial activity studies on ethanolic (SEE) and aqueous (SAE) stem bark extracts of *C. macrophylla* against some gram-positive and gram-negative strains was done using Kirby bauer agar disc diffusion assay techniques. SEE, showed moderate growth inhibitory activity against all the bacterial strains, but SAE was exceptionally inactive against all strains except *Salmonella typhimurium*. The

phytoconstituents in SAE might be responsible for the inhibition of *S. typhimurium* growth³¹.

Antidiabetic Activity: The study of the antidiabetic activity of the flower extract of *C. macrophylla* was investigated in dexamethasone-induced diabetic rats. Rats were treated with dexamethasone at a dose of 5 mg/kg, S.C., for 10 days to develop insulin resistance. The blood glucose level, body weight, and lipid profile were

estimated. The blood glucose level decreases gradually in the animals treated with *C. macrophylla* flower extract (100 mg/kg b.w. and 200 mg/kg b.w., orally) and the antidiabetic effect was compared with that of Glibenclamide 1 mg/kg, p.o., to conclude with the results that *C. macrophylla* shows antidiabetic activity in dexamethasone model³².

Analgesic and Antipyretic Activity: Aqueous as well as ethanolic extracts of *C. macrophylla* leaves were evaluated for their analgesic as well as antipyretic effect using Tail Immersion Model and Brewer's Yeast Induced Pyrexia Model respectively. Aqueous extract of leaves induced better analgesia and have anti-pyretic potential than ethanolic extract when compared to standard drugs.

Combination of analgesia, as well as anti-pyretic effect, will ascertain its significant role in infection-induced fever³³; and aqueous & ethanolic extracts of roots (at two concentrations 200 & 400 mg/kg) was evaluated for its analgesic potentials using tail immersion test in albino rats respectively. Aqueous extract of roots is having better analgesic activity than that of its ethanolic extract. Results are highly promising and ascertain that roots of *C. macrophylla* have analgesic potential, comparable to that of standards³⁴.

Antifungal Activity: The antifungal activity of ethanolic and aqueous extracts of the stems of *C. macrophylla* Vahl. Agar disc diffusion method was adopted for the antifungal screening against seven fungal strains. The overall results provide promising baseline information for the potential use of the crude antifungal extracts from *C. macrophylla* in the treatment of fungal infection. Further isolation of the responsible phyto-constituents may lead this plant to reach the bedside³⁵.

Anti-Inflammatory Activity: Aqueous as well as ethanolic extracts of leaves of *C. macrophylla* were evaluated for their anti-inflammatory activity using carrageenan paw edema method using diclofenac sodium as standard. Results showed that ethanolic extract of *C. macrophylla* leaves have better anti-inflammatory profile than the aqueous extract and can be the choice to be used as anti-inflammatory drug³⁶, and ethanolic root extract have superior

anti-inflammatory spectrum than aqueous one. Results are highly promising and ascertain that roots of *C. macrophylla* have anti-inflammatory potential, comparable to that of standards³⁴.

Anti-Arthritic Activity: The *in-vitro* anti-arthritic activity of ethanolic extract of *C. macrophylla* flower using inhibition of protein denaturation model and human red blood cell Membrane stabilization model. Diclofenac sodium was used as a standard drug. Results revealed that the ethanolic extract of *C. macrophylla* at different concentrations possessed significant anti-arthritic activity as compared to the standard drug used as Diclofenac sodium. The results obtained in the present investigation indicate that ethanolic extract of *C. macrophylla* flower showed anti-arthritic activity³⁷.

Toxicity: There is no any information reported about toxicity on *C. macrophylla* Vahl. plant according to literature survey in data.

CONCLUSION: The available scientific research on *C. macrophylla* has shown that it is an important medicinal plant used in a wide range of medical treatments. The plant has been in use for a long period of time without any documented serious adverse effects. The detailed information presented in this review provides evidence for its phytochemical, pharmacological & traditional uses. The outcomes of such future studies will provide promising sources of phytochemicals that will have huge potential for the pharmaceutical industry.

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CONFLICT OF INTEREST: Nil

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