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Ethnomedicinal aspects of the genus *Clerodendrum*: a case study

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Abstract

The present study describes the importance and different uses of Clerodendrum genus which is widely used as ornamental plant and also used by tribal as medicinal remedy for the treatment of various diseases such as syphilis, typhoid, cancer, jaundice and hypertension. The various extracts of root, stem and leaves are reported to be used as medicine for the treatment of asthma, pyreticosis, cataract, malaria, and diseases of blood, skin and lung and having values for its chemical constituents such as phenolics, steroids, di- and triterpenes, terpenes, flavonoids etc.

Keywords-

Clerodendrum inerme; Lamiaceae; Garden quinine; antimalarial activities

1. Introduction

Plants have been an integral part of human society since the start of civilization. India is rich in its plants diversity, a number of plants have been documented for their medicinal potential which are in use by the traditional healers, herbals folklorists and in Indian systems of medicine namely, Ayurveda, Unani, Siddha apart from a Homeopathy and Electropathy. These plant species play major role in the health care of the nation's population (Khan AV and Khan AA, 2005); the genus *Clerodendrum* L. as delimited by nineteenth century botanists (Schauer, 1847; Briquet, 1895) is heterogeneous (Yuan *et al*., 2010).

Clerodendrum is a very large and diverse genus and till now five hundred and eighty species of the genus have been identified. It is widely distributed in Asia, Australia, Africa and America (Shrivastava N & Patel T, 2007), which are warm, temperate or tropical climatic regions (Kitajima *et al*., 2008).

Many publications refer to this genus as *Clerodendron* but *Clerodendrum* is the official spelling. In 1763 Adanson changed the Latin name "*Clerodendrum*" to its Greek name "*Clerodendron",* later after a span of about two centuries in 1942 Moldenke readopted the Latinized name "*Clerodendrum*", which is now commonly used by taxonomists for the classification and description of the genus and species (Moldenke 1985; Rueda 1993, Hsaio and Lin 1995, Steane *et al*. 1999). Originally considered as a member of the family *Verbenaceae*, the genus is now considered as a member of the family *Lamiaceae* based on cladistic analysis of the chloroplast DNA and internal transcriber spacer sequences (Steane *et al*., 2004).

A high degree of morphological and cytological variation (from 2n =24 to 2n=184) amongst the species, suggests paraphyletic and polyphyletic origin of the genus. Molecular systematic studies based on chloroplast and nuclear DNA also indicate polyphyletic origin of the genus (Steane *et al*., 1999). The first description of genus was given by Linnaeus in 1753, with identification of *C. infortunatum* (Shrivastava N and Patel T, 2007).

2. Botanical Description of *Clerodendrum inerme* (L.) Gaertn:-

Classification:-

Division	Dicotyledons
Class	Gamopetalae
Series	Bicarpellateae
Order	Lamiales
Family	Lamiaceae
Genus	*Clerodendrum*
Species	*inerme*

Source:-Subrahmanyam NS (1996). Laboratory manual of Plant Taxonomy.

The name is derived from the Greek words "*Clerodendrum"* for chance (klero) and tree (dendrum) and refers back to the original species name"fortunate" (Chance tree). In Siddha medicine, *Clerodendrum* is used under the names of 'Chankankuppi' and 'Pechagnan' (Srinath G., 2009).

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Some other Vernacular names of *C. inerme* are as follows:
English name- Garden quinine (Panda H., 2004).
Latin Name -*Clerodendrum inerme* (L.) Gaertn.
Sanskrit Name -Kshudragnimantha, Kundali, Nir-notsjil, Samudrayuthika, Shangam-kuppi, Vanajai, Vanayuthika.
Kannada Name -Kundali, Nayi takkali, Vishampari, Vishamdhari
Hindi Name-Bataj, Lanjal
(Source: - http://parisaramahiti.kar.nic.in/Medicinal_plants_new/med plants)

3. Chemical constituents

Along with biological studies, isolation and identification studies of chemical constituents and its correlation with the biological activities of the genus has also been studied. The major chemical components reported from the genus are phenolics, steroids (*β*-sitosterol, *γ*-sitosteroloctacosanol, clerosterol, bungein A, acteoside, betulinic acid, clerosterol), di- and triterpenes, terpenes such as α-amyrin, *β*-amyrin, caryoptin, 3-epicaryoptin, 16-hydroxy epicaryoptin, clerodendrin A, B and C, clerodin, clerodermic acid, cleroinermin etc. (Shrivastava N and Patel T, 2007).

4. Aesthetic aspects of the genus *Clerodendrum*

Few species of the genus like *Clerodendrum inerme*, *C. thomsoniae*, *C. indicum*, and *C. speciosum* are ornamental and being cultivated for aesthetic purposes. *Clerodendrum* plants appear as trees, shrubs and scrabbles and are commonly used as ornamentals (KVL, 2006, Kitajima *et al*., 2008). *Clerodendrum thomsoniae* Baulf (bleeding heart), *C. x speciosum* Tiej.et Bin. (Glory bower, Java glory vine, heart vine, Pagoda flower) and *C. splendens* G. Don. (flaming glory bower) are among the most cultivated in home gardens and parks in Brazil and elsewhere, covering fences and walls (Lorenzi & Souza, 2001, Kitajima *et al*., 2008).
C. inerme is also valued in landscaping as topiary or as a bonsai or hedge plant. The ability of the plant to withstand close trimming made it a candidate for cutting and shaping to form geometrical shapes and figures of birds and animals in the gardens. It can be suitably trained on wire frames or barbed wire or independently planted close together to make a thick hedge (Srinath G., 2009).
Clerodendrum speciosum known as bleeding heart is a hybrid of *C. splendens* and *C. thomsoniae*. It is a semi-herbaceous climbing, ever blooming bush, with red flowers, of persistent calyx produced in profusion at the tip of the vine (Kitajima *et al.* 2008).

5. Medicinal aspects of the genus *Clerodendrum*

Medicinal plants played a key role in health promotion of world. It is estimated that about 25% of all modern medicine are directly or indirectly derived from higher plants (Venkatanarasimman *et al.,* 2012).
Ethno-medicinal importance of various species of *Clerodendrum* genus has been reported in various indigenous systems of medicines and as folk medicines. The genus is being used as medicines specifically in Indian, Chinese, Thai, Korean, Japanese systems of medicine for the treatment of various life threatening diseases such as syphilis, typhoid, cancer, jaundice and hypertension (Shrivastava N and Patel T, 2007). It is the largest genus of the tribe Teucrieae (Steane *et al.,* 1999).
In Ghana, the leaves of *C. splendens* are used in the form of poultice to treat burns and wounds (Mshana *et al*., 2000)
In various ancient literature related to healthcare *C. inerme* have been reported for its antimalarial activities because of the presence of bitter principle (Srinath G., 2009).
The powder/paste form and the various extracts of root, stem and leaves are reported to be used as medicine for the treatment of asthma, pyreticosis, cataract, malaria, and diseases of blood, skin and lung. To prove these ethno-medicinal claims, some of these species are being extensively studied for their biological activities using various animal models (Shrivastava N and Patel T, 2007).
Plant species such as *C. indicum* and *C. inerme* were used to treat coughs, serofulous infection, buboes problem, venereal infections, skin diseases and as a vermifuge, febrifuge and also to treat Beriberi disease (Anonymous 1992; Rehman *et al*. 1997;

Kanchanapoom *et al*. 2001). *C. calamitosum* is used for the treatment of kidney, gall and bladder stones. This plant is also reported to have diuretic and antibacterial properties (Cheng *et al*., 2001).

It was also reported that tribal use *C. inerme* as an antidote of poisoning from fish, crabs and toads (Rehman *et al*. 1997; Kanchanapoom *et al*. 2001; Pandey *et al*. 2003).

In the Chinese system of medicine *C. bungei* is used for the treatment of headaches, dizziness, furuncles and hysteroptosis (Shrivastava N and Patel T, 2007).

In India, fruits of *C. petasites* are used to produce sterility, while in China the plant is used as medicine for malaria (Hazekamp *et al*. 2001; Panthong *et al*. 2003).

It was found that *Clerodendron capitatum* is useful for the treatment of erectile dysfunction. The relaxation effect of this plant was tested on phenylephrine precontracted rabbit corpus cavernosum smooth muscle (CCSM) (Siddig I. A. W. *et al*., 2011).

Leaves of *C. buchholzii* are reported in African pharmacopeia for treatment of furunculosis, echymosis and gastritis (Nyegue *et al*. 2005).

Organic extracts of *C. inerme* showed strong uterine stimulant activity when tested in female rats and rabbits (Sharaf *et al*. 1969), and also showed strong antihemolytic activity in human adults at 0.02-2.0 mg/ml, with inhibition of phospholipase at 0.05-1.5 mg/ml 31(Somasundaram and Sidique, 1986, Shrivastava Neeta and Tejas Patel, 2007).

Different species of the genus possess potent anti-inflammatory, antidiabetic, antimalarial, antiviral, antihypertensive, hypolipidemic and antioxidant activities and have potential to be developed as potent remedial agents from natural resources. Various *Clerodendrum* species such as *C. trichotomum*, *C. bungei*, *C. chinense*, *C. colebrookianum*, *C. inerme*, *C. phlomidis*, *C. petasites*, *C. grayi*, *C. indicum*, *C. serratum*, *C. campbellii*, *C. calamitosum* and *C. cyrtophyllum* that can be used both in conventional therapy or as replacement therapies for the treatment of various diseases (Shrivastava N and Patel T, 2007).

The leaf juice *C. phlomidis* of has been reported to possess anthelmintic activity against *Ascaris lumbricoides, Phreitima posthuma* and *Taenia solium* (Garg and Sidique, 1992).

The antidiarrhoeal activity of the methanolic extract of the leaves of *C. multiflorum* was reported by Rani *et al*., (1999).

The methanolic leaf extract of *C. phlomidis* at a dose of 200 mg/ml showed antispasmodic activity in mice (Murugesan *et al*., 2001).

C. phlomidis has been investigated for its antidiabetic properties. A decoction of the entire *C. phlomidis* plant has been reported to have antidiabetic activity. A dose of 1 g/kg showed antidiabetic effect in alloxan-induced hyperglycemia in rats. It further showed antihyperglycemic activity in human adults at a dose of 15-30 g/day (Chaturvedi *et al*., 1984).

6. Biocidal and antimicrobial properties of the genus *Clerodendrum*

Chromatographic separation of a methanolic extract of *Clerodendrum myricoides* led to the isolation of myricoidine (1) whose structure was elucidated using IR, NMR and melting point. The crude fractions as well as 1 were subjected to larvicidal tests using the second instar larvae of *Anopheles gambiae* (malaria vector) at concentrations of 100, 75, 50, and 25 ppm. The crude extract and the compound were found to be active with LC50 values of 14 and 9 ppm, respectively (Kebenei J.S., Ndalut P.K., 2004).

The leaf extracts of C. inerme in ethyl acetate and hexane, at 1mg/ml exhibited activity against both animal and plant fungi, *Epidermophyton floccosum*, *Trichophyton mentagrophytes*, *Trichophyton tonsurans*, *Aspergillus flavus* and *Aspergillus niger* (Anitha and Kannan, 2006)

The different fractions of *Clerodendrum phlomidis* was used for the evaluation of the anti-hepatotoxic activity, by performing biochemical parameters and histopathological studies against toxicity caused by the carbon tetrachloride (Verma A and Bahar A, 2009).

A number of species from the genus *Clerodendrum* were documented in ancient texts for their antimicrobial action (Shrivastava N and Patel T, 2007).

7. Other properties of genus *Clerodendrum*

The aqueous leaf extract of *Clerodendrum aculeatum*, with *Azadirachta indica* or the root extract of the *Boerhaavia diffusa* separately were used for the protection of mungbean and urdbean crops which were suffering from the infection of a vector borne virus which was characterized by severe yellowing of the leaves and extremely reduced growth of the plants, by the regular spraying on crops. It has been observed that the incidence of disease was reduced and a significant increase in plant height, primary and secondary branches, nodulation, pods formation and grain yield. (Singh S.K., 2011).

The leaf extract of *Clerodendrum aculeatum* was found useful in systemic resistance and for the marked enhancement in the plant vegetative growth, rooting, flowering, fruiting and seed formation, when seed of *Jatropha curcas* were soaked in the leaf extract of *Clerodendrum aculeatum*. This can prove to be a miracle plant by turning wasteland into a money making land (Mousumi D and Verma HN, 2008).

Gindin and Borochov (1992) reported about ubiquitin conjugation to protein increases following chilling of *Clerodendrum* leaves. The protein content of *Clerodendrum* (*Clerodendrum speciosum*) leaves declines following chilling (48h, 3ºC). Using western blot and dot blots and fluorescence immunoassays, they found that isolated leaf proteins had more conjugated ubiquitin declined following chilling. On the other hand, the amount of free ubiquitin declined by almost 90% after chilling. The increase in ubiquitin conjugation was greater in the membrane fraction than in the soluble fraction.

Balasubrahmanyam *et al*., (2000), purified two antiviral glycoproteins, active against mechanical transmission of two tobamoviruses, tobacco mosaic virus and sunnhemp rosette virus, and citrus ring spot virus (ungrouped), were purified from the dried leaves of *Celosia cristata*. These proteins, called CCP-25 and CCP-27, have Mr 25 and 27 kDa, respectively. They were resistant to proteases in the native state, but were readily digested when denatured. Both of them imparted actinomycin D sensitive resistance by inhibiting local lesions on *Nicotiana tabacum* cv. Samsun NN by tobacco mosaic virus. Their application, individually, also resulted in high resistance in systemic hosts to sunnhemp rosette virus, and citrus ring spot virus, respectively. The *C. cristata* antiviral proteins seem to be very similar to the antiviral proteins already known from other plants, e.g. *Dianthus*, *caryophyllus Phytolacca americana, M. jalapa, Bougainvillea spectabilis, Clerodendrum inerme* and *Clerodendrum aculeatum*. They have similar molecular weights, are glycoproteinaceous in nature, bind to CM-sepharose, and have high activity in slightly acidic medium.

Chatterjee *et al*., 2009 reported about CAPS analysis as a possible tool to detect and group Gemini viruses infecting some fibre crops and weeds. In the present study, the grouping of begomoviruses based on CAPS analysis revealed that the isolates obtained from the same family *Malvaceae* shared a common phylogenetic relationship, which appears to be in line with the fact that the satellite DNA β molecule of begomoviruses showed greater similarity among related hosts than with begomoviruses infecting distantly related hosts alongwith *Clerodendrum indicum* with yellowing in leaf. The present study indicated that the CAPS technique might be a very useful tool for identification and grouping of begomoviruses especially when sequence information is not available.

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