

Rothea serrata: An Overview

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ABSTRACT

Clerodendrum serratum Linn. (*Rothea serrata*) is a genus of flowering plants in the Lamiaceae family. Members of family Lamiaceae have high potential source of drugs and are used as food all over the world. It is reported as a vulnerable species in North India. Many Ayurvedic and herbal preparations contain the crude form of *R. serrata*. The plant shows poor seed setting and poor seed germination due to which it is categorized in IUCN red list as rare threatened species. Due to high phytochemical content in *Rothea serrata* it is pharmaceutically important. Natural population of the plant species is declining due to habitat destruction, over exploitation along with poor seed setting and poor seed germination. Thus there is urgent need for the conservation of such rare medicinal plant which is on the verge of extinction.

Keywords: *Rothea serrata*, IUCN red, germination.

INTRODUCTION

It is well known that each species has a compound mixture of bioactive ingredients in which each component contributes to its overall bioactivity. One of the species studied in the review is *Rothea serrata*.

In Indian system of medicine the plant is well known as 'Bharangi' (Sanskrit) which means glorious. The plant is commonly known as 'Blue glory' (English). The roots and leaves are used as source of drug in traditional medicine systems like Ayurveda, Siddha and Unani. It is used to cure many life threatening diseases, asthma, cholera, eye diseases, fever, bronchitis, tuberculosis wounds, malaria, ulcers, snakebite, rheumatism, leucoderma, liver disorders. The roots are used in the preparations of many ayurvedic formulations *Bharngyadi churna*, (Kantakaryavaleha) and (Bharangi guda), (*Kanakasava*) and (*Dasamularista*).

Rothea serrata is used in the ayurvedic formulations such as *Lodhrasavam*, *sudarsanasavam*, *abhrabhasmam*, *brihat vaisvanarachurnam*, *yogarajachurnam*, *amritaprasaghritham*, *dhanvantaraghritham*, *kantakarighritham*, *mahapanchagavyaghritham*, *gopichandanadi gulika*, *vayugulika*, *yogarajagugguluvatika*, *haritakyadi rasayanam* etc.

The plant shows antibacterial properties. It is an excellent antihistaminic, antiallergic agent, antinociceptive and anti-inflammatory properties, hepatoprotective activity, anticancer activity. The compounds identified from *Rotheca serrata* are predominantly phenolics, particularly hydrolysable tannins and flavonoids like Stigmasterol, α - spinasterol, luteolin, luteolin 7 - O glucuronide, apigenin, baicalin and scutellarin 7 - O glucuronide found in leaf (Krishna *et al.*, 2007). Phytochemicals like β - sitosterol, 24 (s) - ethyl cholesta - 5, 22, 25 trien - 3 β ol, 5 hydroxy - 7, 4 - dimethoxy flavones, luteolin, apigenin, scutellarien and ursolic acid are present in *Rotheca serrata*.

The plant shows poor seed setting and poor seed germination due to which it is categorized in IUCN red list as rare threatened species. For the conservation and multiplication of plant there is need to go for advanced techniques and tools like tissue culture. Since the roots are highly medicinal, to increase the secondary metabolites hairy root culture technique is helpful.

About the plant



Fig. 1. *Rotheca serrata*. A. habit, B. Inflorescence, C. Immature fruits, D. Single flower, E. Ripened fruits

Clerodendrum serratum Linn. is a genus of flowering plants belonging to family Lamiaceae. Estimates of number of species in *Clerodendrum* vary widely, about 450 (Rahman *et al.*, 2007). The genus *Clerodendrum* was first described by Linnaeus (1753) with one species, *C. infortunatum* L. After a decade later, in 1763, Adanson changed the Latin name "*Clerodendrum*" to its Greek form "*Clerodendron*"; in Greek '*Klero*' means chance and '*dendron*' means tree. After a big gap of about two centuries, in 1942, Moldenke (1980) readopted the Latinised name '*Clerodendrum*', this name currently used for the classification and description of the genus and species.

However, recent phylogenetic studies have reported that genus *Clerodendrum* traditionally classified in Verbenaceae has now been included in the Lamiaceae and *Rotheca serrata* (L.) Steane & Mabb. is widely accepted scientific synonym for the species (Harley *et al.*, 2004; Yuan *et al.*, 2010; Stevens, 2012). *Rotheca* species display a high degree of morphological, cytological (Steane *et al.*, 1997) and chemical variations.

Rotheca (Lamiaceae) was described by Rafinesque (1838) based on *R. ternifolia*. However, the earliest described species now included in the genus is *Rotheca serrata* (L.) Steane & Mabb., originally named by Linnaeus in 1767 as *Volkameria serrata*. This genus comprises some 50 - 60 species worldwide and is common throughout sub-Saharan Africa, Madagascar, Indian Ocean islands and tropical Asia, East to Moluccas (Steane and Mabberley, 1998 and Harley *et al.*, 2004).

The Indian subcontinent is a vast repository of medicinal plants that are used in traditional medicine system. In India around 20,000 medicinal plants have been recorded. However traditional communities are using only 7,000 - 7,500 plants for curing different diseases.

It is a shrub 3 - 8 ft. (Fig 1.A) High, scarcely woody, not much branched; stems bluntly quadrangular; young parts usually glabrous. Leaves often some ternate as well as opposite (passing into bracts above), sometimes reaching as much as 11 in. Long but usually 5 - 6 by 2 ¼ to 2 ½ in., oblong or elliptic, acute, coarsely and sharply serrate (sometimes but rarely only dentate), glabrous, base acute; petioles very stout, 1/4 in. Long. Flowers numerous, showy, in lax pubescent dichotomous cymes, with a pair of acute bracts at each branching and flower in the fork, each in the axil of a large leafy bract and

collectively forming a long lax terminal usually pyramidal erect panicle 6 – 10 in. (Fig 1 B) Long; pedicels often twisted so as to make the larger lower corolla – tube appear uppermost; bracts $\frac{1}{2}$ to $1\frac{1}{2}$ in. Long., from obovate to lanceolate, pubescent, subpersistent, often coloured. Calyx $\frac{1}{5}$ in. Long, puberulous, cup- shaped, truncate, not enlarged in fruit; lobes very small, triangular, acute, ciliolate. Corolla glabrous outside, pale – blue, (Fig 1. D) the large lower lobe (often appearing upper in the flower) dark bluish – purple tube $\frac{3}{8}$ in. Long, cylindric, hairy within at the insertion of the stamens, oblique at the mouth; the 2 upper and 2 lateral lobes elliptic, obtuse, flat, spreading, $\frac{3}{8}$ in. Long., the lower lobe lip - like, more than $\frac{1}{2}$ in. Long, concave deflexed. Filaments much curved, densely hairy at the base. Ovary and style glabrous (Fig 1. Cand E). Drupe $\frac{1}{4}$ in. fig 1 Long, somewhat succulent, broadly obovoid, normally 4 lobed with one pyrene in each lobe (1- 3 often suppressed). (Cooke T. 1904)

Rotheca serrata is used in the ayurvedic formulations such a Lodhrasavam", sudarsanasavam, abhrabhasmam, brihat vaisvanarachurnam, yogarajachurnam, amrita-prasaghritam, dhanvantaraghritam, kantakarighritam, mahapanchagavyaghritam, gopichandanadi gulika, vayugulika, yogarajagugguluvatika, haritakyadi rasayanam etc.

Distribution

It is widely distributed throughout the world, tropical and warm temperate regions like Africa, Southern Asia; Malaysia and distributed throughout in the forests of India and Sri Lanka. In India it is growing in the regions such as Himalayan region, Tamilnadu, Madhya Pradesh and Western Ghats. It is deciduous shrub.

Status

In India, these species have been regionally considered as vulnerable in Northern India (WWF India and ZOO/CBSG India, 1997) and endangered in Chhattisgarh and Madhya Pradesh region (Ved *et al.*, 2003).

Medicinal values

The roots of *R. serrata* have been indicated in conventional systems of medicine like Ayurveda and Unani for the treatment of *swasa* and *kapha* (respiratory ailments) including asthma. As per traditional claims the roots of are potential source of drugs for ailments such as asthma, cholera, eye diseases, fever, bronchitis, tuberculosis wounds, malaria, ulcers, snakebite and rheumatism (Keshavamurthy, 1994).

Many Ayurvedic and herbal preparations containing the crude form of *C. serratum* roots such as solid (*Bharngyadi churna*), semisolid (*Kantakaryavaleha* and *Bharangi guda*) and liquid (*Kanakasava* and *Dasamularista*, *Mahapancagavya ghrita* and *Mahavishgarba taila*) are used for the treatment of various disorders especially asthma. It is one of the ingredients of the ayurvedic drug 'kasadamana' an effective expectorant and an antitussive remedy (CSIR, 2001).

In-vivo and *in-vitro* experiments indicated that *R. serrata* plant extracts contain a wide spectrum of pharmacological properties (Praveenkumar and Nishteswar., 2013) including antibacterial (Narayanan *et al.*, 2004; Vidya *et al.*, 2007), antioxidant (Bhujbal *et al.*, 2010; Ismail and Leelavathi., 2011; Mohamed *et al.*, 2012), anti-asthmatic (Bhujbal *et al.*, 2010; Thalla *et al.*, 2012), anticancer (Zalke *et al.*, 2010), hepatoprotective (Vidya *et al.*, 2007) and anti-inflammatory (Narayanan *et al.*, 1999), anti-nociceptive activity (Narayanan *et al.*, 1999). alpha-glucosidase inhibitory activity (Bachhawat *et al.*, 2011)

Roots of *Rotheca serrata* used as blood purifier by Bhilala tribals of Buldhana district, Maharashtra (Korpenwar 2012), they are reported to be used in malarial fever, nervous disorder and ophthalmic complaints (Korpenwar, 2012, Sahu *et al.*, 2013).

Leaves of the plant are used by many tribal communities some of these are, Malays give a decoction for colic. Flowers are eaten during childbirth. Malays use it mostly externally. A poultice for ringworm, leprosy, headache, persistent fever. Embrocation of leaves is used for stiffness in the joints. Rich in potash it acts as a diuretic. Dutch Indies use the roots eaten to clear the voice. In India the tender leaves are eaten as vegetables. (Oak *et al.*, 2015)

The efficacy of Bharangyadi yoga (30 ml bd with honey for 30 days in 30 clinically diagnosed bronchial asthmatic patients) and its nebulizer (2.5 ml bd for 15 days in 30 clinically diagnosed bronchial asthmatic patients) has been successfully evaluated for the management of chronic persistent asthma as well as acute attack of asthma (Kajaria and Bhalerao, 2012).

R. serrata root powder and trikatu powder (An Ayurvedic formula with equal proportion of three drugs viz. rhizomes of *Zinziber officinale* Roscoe.,

Zingiberaceae and fruits of *Piper longum* Linn. and *Piper nigrum* L., Piperaceae) is used as the best remedy for amenorrhea and uterine tumor (Sharma *et al.*, 2002). Roots are also used against Alzheimer's disease in mice (Babenko *et al.*, 2008 and Fuchs *et al.*, 1993).

Secondary metabolites

Carbohydrates

Generally, D-mannitol has been found in the roots of the plant (Shrivastava *et al.*, 2007).

Terpenes

The genus has been found to contain terpenoids as the major secondary metabolites (Subramanian *et al.*, 1973; Akihisa *et al.*, 1989; Yang *et al.*, 2000d). Some of the terpenes isolated from plant are like betulin, oleanolic acid, clerodermic acid, betulinic acid, friedelin and monomelittoside had weak CNS activity, strong molluscicidal and fungi toxic activities (Shrivastava *et al.*, 2007; Harbone, 1984; Mann *et al.*, 1984), neo clerodane diterpenes (Kumari *et al.*, 2003; Pandey *et al.*, 2005), triterpenes (Rangaswami and Sarangan, 1969; Ganapaty and Rao, 1985) and iridoids (Jacke and Rimpler, 1983).

Phenolics

Phenolic compounds have been frequently reported with phenyl propanoids (Mei *et al.*, 2000; Kim *et al.*, 2001). Some of the phenolic compounds isolated were serratagenic acid, acteoside, indolizino and verbascoside which possess biologically activities such as anti-oxidant, anti-microbial, anti-proliferative, antihypertensive and anti-cancer activities (Shrivastava *et al.*, 2007; Harbone, 1984; Mann *et al.*, 1984).

Flavonoides

Flavonoids as a predominant class (Vendantham *et al.*, 1977; Sinha *et al.*, 1981). Flavonoids isolated from plants are apigenin, 7-hydroxy flavanone, scutellarein and pectolarigenin (Shrivastava *et al.*, 2007; Harbone, 1984; Mann *et al.*, 1984). And few of species have been reported to contain macro cyclic alkaloids (Bashwira and Hootele, 1988; Lumbu and Hootele, 1993) and cyanogenic glycosides.

Steroids

Steroids are terpenes based on the cyclopentane perhydroxy phenanthrene ring. Chiefly, γ -sitosterol, β -sitosterol, cholesterol, clerosterol, campesterol and 24-

ethyl cholesterol were reported to be isolated from the plant (Shrivastava. *et al.*, 2007; Banerjee *et al.*, 1969).

Conservation

Due to high phytochemical content in *Rotheca serrata* it is pharmaceutically important. Natural population of the plant species is declining due to habitat destruction, over exploitation along with poor seed setting and poor seed germination. *In vitro* plant propagation is the promising technology for conservation of rare and endangered plant. A few reports for *in vitro* rapid clonal propagation of *R. serrata* employing nodal stem segments are available (Sharma *et al.*, 2002, Vidya *et al.*, 2005).

Hairy root culture plays an important role to study secondary metabolites. In many plants species, alkaloids are synthesized in roots and latter translocated to aerial parts where they are finally accumulated. Since hairy root lacks any other aerial organ, it results in accumulation of secondary metabolites at high concentrations in roots itself.

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