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Anish Babu VB

Research and Development
Centre Bharathiar University,
Coimbatore, Tamil Nadu,
641046, India.

Antony VT

Research and Development
Centre Bharathiar University,
Coimbatore, Tamil Nadu,
641046, India.

Binu Thomas

PG Department of Botany,
Deva Matha College,
Kuravilangad, Kottayam,
Kerala, 686633, India.

Ethno-pharmacological potentialities of some ornamental plants in the family Bignoniaceae

Anish Babu VB, Antony VT, Binu Thomas

Abstract

Bignoniaceae commonly called the 'trumpet vine' family; in which important ornamental species have large spectacular flowers. Many uses have been found for the plants and trees in this family. Apart from their aesthetic value they used as pharmaceutical or nutraceuticals and it also serve as natural remedies for specific health issues in its native region. In India it is mainly explored for ornamental landscaping or in decorative gardens, as they radiate different colors to the surroundings. Several studies show that they possess wide array of secondary metabolites of medicinal values which offers antioxidant, antifungal and antimicrobial activities. Present review is an attempt to highlight ethno pharmacological potentialities of some ornamental plants in the family Bignoniaceae.

Keywords: Bignoniaceae, Secondary metabolites, Ornamental plants, Ethno pharmacology

1. Introduction

Bignoniaceae, is a family of trees, shrubs or lianas and rarely herbs (Watson and Dallwitz, 1992) [45]. It is distributed in the tropics and forms an important part of the vegetation (Shashina, 1989) [40]. A few of the species are found in the temperate and sub-tropical regions. Several genera include species of horticultural importance in tropical and temperate regions, including *Crescentia*, *Jacaranda*, *Kigelia*, *Mansoa*, *Millingtonia*, *Pyrostegia*, *Spathodea*, *Tabebuia*, *Tecoma* and *Tecomaria*. Relatively few species have economic significance outside horticulture, but numerous species have been used by indigenous peoples for food, timber, containers, medicinal, and ritual purposes (Gentry, 1992) [9]. The use of medicinal plants as a source for aid from illness can be traced back over five millennia to written documents of the early culture in China, India and the Near east, but it is, without a doubt, an art as old as mankind (Ekta, 2012) [7]. Many of these plants and their extracts were used in traditional medicine both as antimicrobial and antifungal agent. Medicinal plants play a key role in health care with about 80% of the world's populations relying on the use of traditional medicine which is predominantly based on plants (Maher *et al.*, 2012) [20]. Herbal products prepared either from single or multiple botanical ingredients are usually complex and variable in nature. Members of Bignoniaceae is a huge reservoir of variety of secondary metabolites like saponins, tannins, flavonoids, quinines, alkaloids, reducing sugars, glycosides, carbohydrates, quercetin, kaempferol, sitosterols, iridoids, terpenes, steroids, coumarins etc., (Solomon *et al.*, 2013) [42]. Phytochemicals like flavonoids and phenolic compounds commonly found in plants have been reported to have multiple biological effects. Among these secondary metabolites, flavonoids have been responsible for the anti-inflammatory, antidiuretic, antiarthritic, antimicrobial activity but flavones are responsible for antioxidant activity (Hussain *et al.*, 2007) [15]. Tannins have been widely used as an application to sprains, bruises and superficial wounds, it also responsible for anti-dysenteric and anti-diarrheal properties. Quinones like Lapachol of Bignoniaceae are reported to have anti-tumour activity, chromones are generally the scavenger for free radicals. But the most common natural antioxidants are flavonoids and phenolic compounds, including antioxidant activities. The high antimicrobial effect of the medicinal plant extract associated with compound such as flavanoids, terpenes, alkaloids, tannins etc., (Choudary *et al.*, 2013) [5]. Presence of such wide range of phytochemicals in this family may open a new dimension in the field of discovery of new drugs.

Description of species and Medico-potentiality

Crescentia cujete L. commonly called calabash tree is usually seen in tropical areas grow well in native to Central America, Senegal, Cameroon and other parts of Africa. It is an evergreen tree reaching 6-10m height with broad, irregular spreading branches with bright green leaves.

Correspondence

Dr. Binu Thomas

PG Department of Botany,
Deva Matha College,
Kuravilangad, Kottayam,
Kerala, 686 633, India.

The tree is outstanding for year out flowers and fruits. Flowers are 5 cm wide which blooms at night, are yellow green and purple red veins, cup shaped and emerges directly from the branches. Large round fruits 12-30 cm in diameter, with hard shell (PI-1A).

Medico-potentiality: Leaves and bark pulp used for their medicinal value. principally plant consist tartaric acid cianhidric acid, citric acid, crescentic acid, triacontanol, palmitic acid flavanoids such as quercetin, apigenin, naphthoquinones, iridodis glucosides 3 hydroxyoctanol, glycosides (Marc, 2008) [22]. In Haiti it is used for inflammation, trauma and diarrhea. In India it is used as pectoral (Julia, 1968) [16]. The extract of fruit pulp effective in treatment of fever, whooping cough and bronchitis. Fresh seeds grounded and mixed with water to make refreshing drink, this drink has sweet and pleasant taste. Binutu and Lajubutu (1994) [2], reported antimicrobial activity on both gram positive and gram negative bacteria and fungi.

Jacaranda mimosifolia D. Don. Is a sub-tropical tree, native to South America that has been widely cultivated in the Indian gardens and also found in Brazil, Bolivia and Argentina. These are good looking, when it is covered with cluster of blue tubular flowers. It is also known as the fern tree. It may be identified by the disposition of the leaves, the type of inflorescence and characteristic of the fruit. Leaves opposite, bipinnate, inflorescence terminal or axillary paniculate, calyx campanulate. The corolla is blue, 5 lobed. ovary bilocular (PI-1B).

Medico-potentiality: This tree gives out some secret natural medical gifts, having antiseptic and antibiotic qualities too. In folk tradition the flowers, leaves and bark are used to treat hepatitis and varicose veins. It is also scientifically proven that its qualities that treat leukemia. Hot Jacaranda leaf baths treat wounds and skin infections. The flowers are used as a substitute for the Unani herba in Pakistan (Khare, 2007) [17]. The bark of *J. mimosifolia* has been used in the treatment of wounds and dermatitis. Astringent and diuretic properties have also been assigned to the bark extracts (Roth and Lindorf, 2002) [38]. The plant has been attributed with properties to treat syphilitic ulcers and also to urinary tract problems. The ground bark is used as a decoction against venereal diseases and rheumatism (Maria and Wolfgang, 2009) [23]. A decoction of the bark of *Jacaranda mimosifolia* is used in Ecuador to treat venereal diseases and to purify the blood. The plant possesses antioxidant (Yu-Fang chen *et al.*, 2006) [47], antihypertensive (Nicasio and Menches, 2005) [28], antimicrobial (Roja *et al.*, 2006) [37] and antitumour activities (Villarreal *et al.*, 1992) [44]. The leaves and flowers contain jacaranone, verbascoside and the flavonoids scutellarin-7-O-glucosylmethylesters, apigenine-7-O-glucosyl-methylester, luteolin-7-O-glucoside and iso-vitexin 9.

Kigelia africana (Lam.) Benth. (**Sausage tree**) belongs to the family Bignoniaceae. It occurs throughout tropical Africa. It is a tree growing up to 20m tall. The bark is grey and smooth at first peeling on older trees. The wood is pale brown or yellowish the leaves are opposite or in whorls of three, 30-50cm long, pinnate, with 6-10 oval leaflets up to 20cm long and 6 cm broad. The flowers hang down from branches on long flexible stems. Flowers are produced in panicles. They are bell shaped, orange to reddish or purplish green and about 10 cm wide. Flowers are pollinated by bats. Fruit is woody bery, 30-100 cm long and 18 cm broad (PI-1C).

Medico-potentiality: Traditional remedies prepared from crushed dried fruits are used for emollient, antieczema, antisoriasis, as dressing for ulcers and wounds, treatment of skin cancer, as aaphrodisiac and also as an active ingredient in skin lightening and breast firming formulations (Maisiri and Gundidza, 1999) [21]. The polar extract of *K. africana* fruit contains verminoside as the major constituent and a series of other phenols, Verbascoside, Caffeic Acid, *p*-Coumaric acid and Caffeic acid methyl ester (Picerno *et al.*, 2005) [33]. Remedies from root bark are also used for the treatment of venereal diseases, hemorrhoids, and rheumatism (Oliver-Bever, 1986) [30]. South-western part of Nigeria hot-infusion preparations of its leaves are popularly used to treat stomach ulcer. *Kigelia* contains lapachol that is effective in treatment of solar keratosis, skin cancer and Kaposi sarcoma (HIV related skin ailment) (Grace *et al.*, 2002) [11].

Mansoa alliace Miers. It is also known as Garlic vine, is a species of tropical liana. It is a native of South America and has spread to Central America and Brazil. it is exported to overseas and grows in favorable climates of India and South Africa (PI-1D).

Medico-potentiality: It is reported to possess antifungal activity and hypocholesterolemic efficacy. It is also used for the pain and inflammation of arthritis and rheumatism as well as cold, flu, fever. Generally leaves are used in the preparation of infusion or decoction. Roots are used in the preparation of cold maceration and tincture and generally taken as a whole body tonic (Kirtikar and Basu, 2005) [18]. An ethnobotanical survey on medicinal plants used in reproductive health related disorders in Rangia subdivision, Kamrup district of Assam was conducted by Choudhury *et al.*, (2011) [4]. Their study results reported that, the root decoction of this plant is used to regulate irregular menstruation, infertility in male and female contraception. It also posses antiaflatoxicogenic potency (Shukla, 2008) [41] and antimicrobial activity (Chaves and Reinhard, 2006) [3].

Millingtonia hortensis Linn. Tree is native to South Asia and commonly known as mara malli or Akash malli. It is a tall deciduous tree grows up to height of between 18 to 25 meters and has a spread of 7 to 11 meters. It can reach height of 80 meters. It has brittle wood liable to damaged by storms. It is a versatile tree which can grow in various soil types and climates with a preference for moist climate. It has corky bark and straight trunk with branches. It flowers at night and shed flowers early in the morning. In the cooler months, the tree blooms in the night and early in the morning; fragrant flowers falling and carpeting the ground around. Flowers have very rich and pleasant scent. Fruit is very long and narrow, pointed at both ends and contains thin, flat seeds (PI-1E).

Medico-potentiality: In Thailand, the flower is called 'peep' and used for the treatment of asthma, sinusitis and as a cholagogue and tonic. The flowers are also used in rituals and have good antimicrobial properties. The stem has brittle wood and liable to damaged by storms, stem bark is used traditionally as mainly lung tonic, antiasthmatic and antimicrobial properties. Leaves and roots of this tree used as antiasthmatic and antimicrobial activity. Root paste is also used for the treatment of tuberculosis (Sharma *et al.*, 2007) [39]. The extract of leaves has good antimicrobial activity. Plant posses antipyretic, antitubercular, antimicrobial, larvicidal, antimutagenic, anticancer, antifungal properties (Nagaraja *et al.*, 2011) [26]. phytochemical studies reveals that plant parts

consists of Hispidulin; Scutellarein, scutellarein, -galactoside, Hortensin, Cornoside, recimic renygolone, renygoside B, renygol, renygoside A and iso renygol, Millingtonine, bitter substances and tannins.

Prostegia venusta (Ker-Gawl) Miers, is a neotropic evergreen vine, introduced from Brazil. Leaves 3-foliolate; petioles densely pubescent; leaflets ovate (rarely lanceolate), slightly subinequilateral, base rounded or truncate (rarely cordate), apex briefly acuminate-mucronulate. A terminal or axillary panicle, generally dense or subcorymbose, with calyces often overlapping in dried specimens; unbranched or 1 or 2 (rarely 3) times branched; corolla narrow tubular-infundibular, orange or reddish orange; stamens inserted 1.3-3.5 cm from base of corolla tube, stigma lobes broadly ovate, ovate, orbicular, or broadly oblong (PI-2A) (Pool, 2008)^[34].

Medico-potentiality: The aerial parts of *P. venusta* for the treatment of cough and flu (Ferreira *et al.*, 2000)^[8]. They administer its decoction orally as a general tonic and also as an infusion to treat diarrhoea and jaundice. Tonics made from the stems of this plant are useful for the treatment of diarrhoea, whereas flower preparations have been used to check vomiting. Chemical investigations have shown that methanolic extracts of the roots of *P. venusta* contain allantoin, steroids, flavonone and myo-inositol as well as several amino acids and sugars also been observed in the flowers (Purabi *et al.*, 2011)^[36]. The phytochemical evaluation of seeds reveals antihelminthic activity (Hoskeri *et al.*, 2012)^[14].

Spathodea campanulata P. Beauv. It is commonly known as the Fountain Tree, African Tulip tree, Pichkari or Nandi Flame. It is a tree that grows between 7–25 m (23–82 ft) tall and is native to tropical dry forests of Africa. This tree is planted extensively as an ornamental tree throughout the tropics and is much appreciated for its very showy reddish-orange or crimson (rarely yellow), campanulate flowers. It has become an invasive species in many tropical areas. The leaflets are oblong-elliptic, about 1 cm long and 0.5 cm broad, entire, broadly acuminate, unequal at the base, glandular swellings at the base of the lamina. The midrib and nerves are yellow, raised and very slightly pubescent; the venation is reticulate. The petiole is short, thick about 0.7 cm long; rachis base is swollen. Flowers are large, red, hermaphrodite, orange with calyx green, about 1 cm long and split on the posterior side, ribbed and tomentos; petals 5, each about 1.5 cm long; stamens 4 with orange filaments; style extruding with a 2-lipped stigma. Flower buds curved and contain a red sap. A yellow-flowered variety has been reported. Fruit upstanding, dark brown, cigar-shaped, woody pod, 15-25 cm long and split on the ground into 2 boat-shaped valves, releasing many flat-winged seeds; 1-4 pods usually develop from 1 flower cluster; seeds thin, flat and surrounded by a filmy wing. Seed is about 2.5 centimeters wide, with a broad, silvery white, transparent wing (PI-2B).

Medico-potentiality: This plant is commonly employed to control epilepsy. This species has many uses in folk medicine. The flowers are employed as diuretic and anti-inflammatory, while the leaves are against kidney diseases, urethra inflammations and as an antidote against animal poisons (Mensah *et al.*, 2006)^[24]. Several phytochemical studies were performed with different parts of *S. campanulata*, including stem barks, leaves, flowers and fruits. The leaves have furnished spathodol, caffeic acid and other phenolic acids and flavonoids, while fruits contain polyphenols, tannins, saponins

and glycosides (Ngouela *et al.*, 1990)^[27]. The plant leaf is used in the treatment of painful inflammation, constipation, dysentery, and also reported to have anti-plasmodial activity, analgesic and anti-inflammatory actions, anti-larvicidal activity and repellent. In Laos, Cambodia and Vietnam, the flowers of this species are used to heal ulcers (Agbovie *et al.*, 2002)^[1]. The stem bark decoction of *Spathodea campanulata* have been displayed hypoglycaemic, anticomplementary, antimalarial and anti-HIV activity in mice (Niyonzima *et al.*, 1999)^[29].

Tabebuia rosea (Bertol.) DC. is commonly grown as an ornamental tree for its grand and majestic pink or purple flowers which offer different shades of colours. Commonly known as “Pink Trumpet Tree” can grow up to 15meter and well known for its beautiful flowers. The fruits are green, long and bean pod-like with a length of 20-40 cm (8-16 inch). The fruits turn dark brown when ripe and contain flat, heart-shaped seeds with tiny wings. The graceful beauty of the tree is attracted attention in the field (PI-2C).

Medico-potentiality: The tea made from the leaves and bark is known to have a fever-reducing effect (Gentry, 1992)^[9]. Species of the *Tabebuia* genus have been used empirically as anti-inflammatory, anti-cancer and anti-microbial agents in rural areas of Colombia, Bolivia, Brazil and other Latin-American countries (Hajdu and Hohmann_2012)^[12]; the *Tabebuia* genus is commonly recognized as a therapeutic alternative by rural or remote populations. The results of ethnobotanical and ethnopharmacological studies indicating the potential use of these plants to treat a large variety of diseases has encouraged the search of new phytotherapeutic drugs using plant biodiversity (Ospina *et al.*, 2011)^[31]. The preliminary phytochemical screening of the leaves revealed the presence of saponins, tannins, phenolic acids, flavonoids and alkaloids. They also possess numerous bioactive compounds like naphthaquinones particularly lapachol and β -lapachone have received most attention. Lapachol showed significant *in vivo* anti-tumor activity in some early mouse models.

Tecoma stans (L.) Kunth. also known as ‘Yellow Trumpet bush’ or ‘Yellow bell’ is an erect ornamental plant with trumpet-shaped yellow flowers. It is a perennial shrub native to the America. It is the official flower of United States Virgin Islands and floral emblem of Bahamas. It has sharply toothed, lance shaped green leaves and bears large showy bright golden yellow flowers. It is drought tolerant and grows well in warm climate. Plant produces pods containing yellow seeds with papery wings. The plant is desirable fodder when it grows in fields grazed by livestock. This species, readily colonizing disturbed areas, rocky, sandy and cleared land and occasionally becoming an invasive weed (PI-2D).

Medico-potentiality: The leaves of *Tecoma stans* contain the alkaloids tecomine and tecostamine, potent hypoglycaemic agents when given intravenously (Hammouday *et al.*, 1964)^[13]. Anthranilic acid is responsible for its antidiabetic activity and the roots exhibit a powerful diuretic and vermifuge activity (Govindappa *et al.*, 2011)^[10]. The plant has been used for a variety of purposes in herbal medicine, treating diabetes and digestive problems. Leaves, bark and root contain many biologically active chemicals and their extracts have been used in folk medicine to treat many disease (Liogier, 1990)^[19]. The saponins and plant based steroids have found to possess potent antioxidant and antimicrobial properties (Das *et al.*, 2010)^[6]. Leaves used throughout Mexico and Central America for

diabetics and urinary disorders (Winkelman, 1986) ^[46]. Roots are used as diuretic, vermifuge (Khare, 2007) ^[17].

Tecomaria capensis (Thunb.) Spach. also known as Cape honey suckle (Nadkarni, 2002) ^[25], a fast growing, scrambling shrub which may grow up to 2-3 m high and spread more than 2.5 m. *Tecomaria capensis* is an evergreen plant in warm climate areas but loses its leaves in colder areas. Flowers are orange in colour and are tubular and bird pollinated, attracting nectar-feeding birds, especially sunbirds (PI-2E).

Medico-potentiality: Traditionally the leaves were used to treat pneumonia, enteritis, diarrhoea and it has analgesic, antimicrobial, antifungal, antipyretic and antioxidant activity. The plant is used as a traditional medicine to relieve pain and sleeplessness. The infusions of dried barks are given for sleeplessness (Tamiljothi *et al.*, 2011) ^[43]. It is included in the list of African plants evaluated for invitro antiplasmodial activity against *Plasmodium falciparum*. Previously methanol extract of *Tecomaria capensis* leaves reported as antimicrobial and antioxidant (Prabhu *et al.*, 2011) ^[35]. *Tecomaria capensis* known to promote the wound healing process mainly due to their astringent, anti-microbial and free radical scavenging activities (Panduraju *et al.*, 2011) ^[32]. *Tecomaria capensis* significantly stimulated wound healing activity (Nadkarni, 2002).

Plate 1



A) *Crescentia cujete* L.



B) *Jacaranda mimosifolia* D. Don.



C) *Kigelia africana* (Lam.) Benth.



D) *Mansoa alliace* Miers.



E) *Millingtonia hortensis* L.

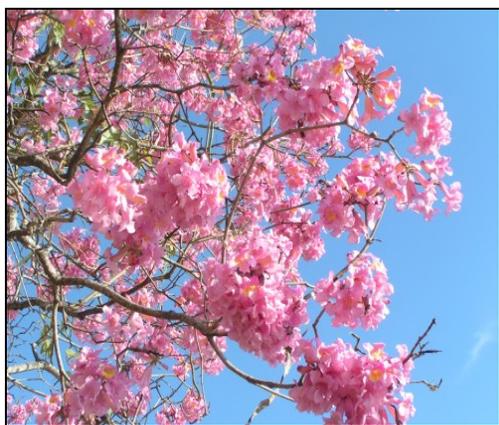
Plate 2



A) *Pyrostegia venusta* (Ker-Gawl) Miers



B) *Spathodea campanulata* P. Beauv.



C) *Tabebuia rosea* (Bertol.) DC.



D) *Tecoma stans* (L.) Kunth.



E) *Tecomaria capensis* (Thunb.) Spach.

Conclusion

The present study highlights the taxonomical, ornamental and medico-potentialities of some plants in the family Bignoniaceae. These are *Crescentia cujete* L., *Jacaranda mimosifolia* D. Don., *Kigelia africana* (Lam.) Benth., *Mansoa alliace* Miers., *Millingtonia hortensis* Linn., *Pyrostegia venusta* (Ker-Gawl) Miers, *Spathodea campanulata* P. Beauv., *Tabebuia rosea* (Bertol.) DC., *Tecoma stans* (L.) Kunth. and *Tecomaria capensis* (Thunb.) Spach. The present observation also noticed that, in addition to the fascinating habit and good looking flowers, these plants also possess valuable medico-potentialities. Such studies also helps to find out more effective phytochemical compounds for drug discovery.

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