A REVIEW: INTRODUCTION TO GENUS DELONIX

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ABSTRACT

Delonix regia is an ornamental tree of Fabaceae family. There is two species of Delonix genus like Delonix regia Rafin. and Delonix elata. Delonix regia is a flowering plant. It containing five petals out of five four are of same colour but one is different having white colour streaking. Delonix regia reported to have anti-diarrhoeal, anti-inflammatory activity, antioxidant, hepatoprotective and antimicrobial activity. It has been used in the folk medicine systems of several civilizations like for the treatment of constipation, inflammation, arthritis, hemiplagia, leucorrhoea and rheumatism. Flowers of Delonix regia have been used as traditional herbal remedies for gynecological disorders and they are also used as tablet binder. Delonix elata has been reported to have antioxidant, anti-arthritic, anti-ulcer and anti-inflammatory activity.

Key words: Delonix regia, Delonix elata, petals, rheumatism and gynecological.

INTRODUCTION

Delonix is a genus of flowering plants in the pea family, Fabaceae and subfamily Caesalpinioideae. This genus contains trees that are native to Madagascar and East Africa. By far the best known species is the Royal Poinciana (D. regia). The name of the genus is derived from the Greek words ‘delos’ meaning ‘evident,’ and ‘onyx’ meaning "claw," that refers to the petals[1]. Delonix erect unarmed tree. Leaves are abruptly bipinnate, leaflets are many but small and stipules are small. Flowers are large, showy, in terminal corymbs, bracts small. Calyx tube is very short, 5 lobes, valvate and subequal. Petals are 5, orbicular, imbricate, clawed, subequal. Margins are fimbriate. Stamens are 10 free, declinate, long-exserted. Filaments are villous below and anthers are uniform. Ovary is subsessile, many-
ovuled. Style filiform and stigma truncate, ciliolate. Seed pods are elongate, flat, woody and dehiscent. Seeds are transverse and oblong[21]. The members of the genus are flowering trees, native to the East Africa, has been used in traditional Indian medicine for the treatment of rheumatism, stomach disorders and its leaves are used in the treatment of bronchitis and pneumonia in infants[3, 4].

**subspecies, varieties, forms and cultivars of *Delonix* genus:**

*D. baccal* (Chiov.) Baker f. (Poinciana); *D. boiviniana* (Baill.) Capuron; *D. brachycarpa* (R.Vig.) Capuron; *D. decaryi* (R.Vig.) Capuron (Flamboyant Tree); *D. elata* (L.) Gamble (Creamy Peacock Flower); *D. floribunda* (Baill.) Capuron (Poinciana); *D. pumila* (Poinciana); *D. regia* (Bojer ex Hook.) Raf. – Royal Poinciana (Flame of the Forest); *D. tomentosa* (R.Vig.) Capuron; *D. velutina* (R.Vig.) Capuron[5]. *D. regia* 'Kampong Yellow' (Flamboyant Tree); *D. regia* 'Smathers Gold' (Royal Poinciana); *D. regia* 'Supernova'; *D. regia* var. flavida; *D. tomentosa* (R.Vig.) Capuron; *D. velutina* (R.Vig.) Capuron; *D. a; D. alata; D. leucantha* (Poinciana); *D. leucantha bemarahensis; D. leucantha gracilis; D. leucantha, leucantha; D. leucantha subsp. bemarahensis; D. leucantha subsp. *Gracilis*[6].

**Indian species of genus *Delonix***

*Delonix*, a genus of tribe Eucaesalpiniea consists of two species growing in India *Delonix elata* and *Delonix regia*[7].

**Delonix elata**

*Delonix elata* (Syn. *Poinciana elata*) commonly known as white gold mohur and family Leguminosae[8]; subfamily Caesalpiniaceae. Commonly known as “Sandesaro” in Gujarati[9].

**Vernacular name**

Sanskrit- Siddeshwara[10]; Mumbai- Vayani; Telugu- Vatanaryana; Tamil- Vadanaryana[11].

**Botanical description:** An erect tree 6-9 m in height. Trunk: Smooth and ash coloured. Leaves: compound, main rachis slender, 10-20 cm long, bipinnate[9, 12, 13].

**Traditional uses**

Leaves are used by traditional practitioners in cases of inflammatory joint disorders as a folklore remedy[9, 14]. *Delonix elata* is used by folklore for joint pains and in flatulence. In Indo-china, the bark is used as febrifuge and antiperiodic. The leaf and bark is used by local
people in the form of paste to reduce inflammation and pain. [8] Delonix elata has anti-inflammatory, antirheumatic [2,15] and antimicrobial [15,16] and antioxidant activity. [15,18]

Reported biological activity

Anti-inflammatory activity: The methanol extract and its, ethyl acetate soluble and insoluble daughter fractions of leaf extract of D. elata also showed significant anti-inflammatory action compared to control but it was lower than the effect of bark extract. [8,9]

Antiulcer activity and antinociceptive activity: The ethanolic extract at a dose of 100 and 200 mg/kg showed a significant reduction in writhing with 55.56% and 54.76% of inhibition respectively and after treating with extract the surface epithelium of gastric mucosa was intact. [19]

In-vitro Antioxidant activity: The IC$_{50}$ value for DPPH free radical scavenging activity was found 375± 176.77 mg/ml and standard was used ascorbic acid. [20]

Anti-arthritic effect: The Hind Limb Bone Mass (HLBM) was significantly reduced on treatment with ethanolic extract (250 and 500 mg.kg^-1 body weight) of Delonix elata. The standard drug Indomethacin (10 mg/kg) was used. As a result we observed that the ethanolic extract of Delonix elata possess potent anti-arthritic activity. [21]

Another species is Delonix regia Rafin.

Delonix regia Rafin.

Delonix regia is a species of flowering plant. According to traditional classification of medicine it belongs to Caesalpiniaeae family but according to the phylogenetic classification it belongs to Fabaceae family (subfamily of Leguminosae). This tree is native to Madagascar. It is an ornamental medium-sized tree, widely planted in avenues and gardens in all warmer and damper parts of India. [22, 23] It is consistently voted among the top five most beautiful flowering trees in the world. Delonix regia is also known as the Royal Poinciana or Flamboyant. This plant was previously placed in the genus Poinciana, named after Phillippe de Longvilliers de Poincy (1583-1660), who is credited with introducing the plant to the America. [24, 25]

Geographical Distribution

Delonix regia Rafin. is native to Madagascar, where it is almost extinct. This plant is now widespread in most tropical and subtropical areas. Plant can grow at higher altitudes than
recommended, but flowering become irregular.

**Native:** Madagascar, Zambia

**Exotic:** Brazil, Cyprus, Egypt, India, Kenya Niger, Sri Lanka, South Africa, Uganda, United State of America and Jamaica.

**Biophysical limits:** *Delonix regia* seems to tolerate many types of soils from clay to sandy but it prefers sandy soils. Mean annual temperature and rainfall for this plant should be 14-26°C and over 700 mm respectively. An altitude for this plant should be 0-2000 m. The plant demands light. It grows weakly and sparsely under shade. *Delonix regia* Rafin. grows more in high rainfall area. It has a superficial root system and competes with neighboring shrubs and flowering plants, rendering ground bare under its canopy. So, this plant should be planted away from other plants in the garden. [26]

**Taxonomical Classification**


**Vernacular names**

English : flamboyant, flamboyant flame tree, flame of the forest, flame tree, gold mohur, gul mohr, peacock flower, royal poinciana; Arabic : goldmore; French : flamboyant, poinciana, royal; Burmese : seinban; Spanish : Acacia roja, Swahili : mjohoro, mkakaya; Hindi : gulmohr; Bengali : chura, radha; Tamil : mayarum, mayirkonrai, panjadi, telugu. [26]

**Morphology**

*Delonix regia* Rafin. is 40 feet in height having umbrella like canopy can be wider than its height. [11, 28]

**Flowers:** Large red-orange in color having five petals, one petal contains also white color streaks and little bit big as compare to other petals, four spreading scarlet or orange-red petals up to 8 cm long having same size and colour, a fifth upright petal called the standard, which is slightly larger and spotted with yellow and white. Sepals 5, thick, green outside and reddish with yellow border within, reflexed when the flowers are open, pointed, finely hairy, about
2.5 cm long. Stamens 5 with 10 red filaments. Pistil has a hairy 1-celled ovary about 1.3 cm long. Style about 3 cm long. \[5, 26, 29, 30\]

**Leaves:** The compound leaves have a feathery appearance and are a characteristic light, alternate, bright green. They are doubly pinnate. Each leaf is 30–50 cm long and has 20 to 40 pairs of primary leaflets on it, and each of these is further divided into 10-20 pairs of secondary leaflets. \[5, 26, 30\]

**Branches:** Horizontal branches forming a diameter that is wider than tree’s height, crown umbrella shaped and spreading long branches \[26\].

**Roots:** shallow. \[26\]

**Seed:** Seed 30-45, hard, grayish, glossy, 2 cm long, oblong and shaped very much like date seeds, transversely mottled with a bony testa. Weighing around 0.4 gm. \[31\]

**Bark:** Smooth, grayish-brown, slightly cracked and having many lenticels; inner bark is light brown. \[26\]

**Fruits (Pods):** Green and flaccid when young, turning to dark brown, hard woody pods, 30-50 cm long, 3.8 cm thick, 5-7.6 cm broad, ending in a short break when mature, with many horizontally partitioned seed chambers inside, indehiscent, finally splitting into two parts. \[31\]

**Wood:** Soft and white in color. \[32\]

**Flowering season:** April to July. \[31, 33\]

**Fruit season:** August to October. \[31\]

**Reported Phytoconstituent**

**Stem bark:** flavonoids, alkaloids, saponins, sterols, stigmasterols, carotene, hydrocarbons phytotoxins β-sitosterol, lupeol, \[32\], p-methoxybenzaldehyde, isolupeol, carotene, hydrocarbons phytotoxins and phenolic acids. \[28, 30, 32, 34, 35\]

**Root bark:** glycosides, tannins, alkaloids, sterols, terpenoids and carbohydrates. \[36\]

**Flowers:** flavonoids, tannins, alkaloids, saponins, steroids \[28, 37\] carotenoids(lycopene, phytoene, phtofluene, β-carotene, prolycopene, neolycopene, δ-lycopene and γ-lycopene), phenolic acid (gallic acid, protocatehuiic acid, salicylic acid, trans-cinnamic acid and
chlorogenic acid), anthocyanins (cyanidin-3-glucoside and cyanidin-3-gentiobioside and β-sitosterol. [28, 35, 38]

Leaves: lupeol, phenolic acids (gallic acid, protocatechuic acid and salicylic acid) and β-sitosterol. [35, 38]

Seeds: saponins and galactomannons. [38, 39]
Traditional Uses
The extract of Delonix regia is known to have medicinal properties.\cite{27,40,41} This plant is used in several countries to prepare extracts with antimicrobial and antifungal activities.\cite{42} Delonix regia Rafin. with an impressive range of medicinal and biological properties, has been used in the folk medicine systems of several civilizations like for the treatment of constipation, inflammation, arthritis, hemiplegia, leucorrhoea and rheumatism.\cite{35,43} Delonix regia Rafin. flower were used in dysmenorrhoea, as antibacterial, antiinflammatriory, broad spectrum antibacterial, analgesic, antimicrobial and antifungal.\cite{10,44,45,46,47} The flowers have been used as traditional herbal remedies for gynecological disorders and they are also used as tablet binder. Seeds of Delonix regia contain flavonoids are used as wound healing agent in households.\cite{48,49,50}

Reported biological activities
Many biological activity have been reported of Delonix regia Rafin.. These are as follows.

Anti-diarrhoeal activity: The flowers of Delonix regia plant have been reported to have in vivo anti-diarrhoeal activity. The experimental models were castor oil induced diarrhoea, prostaglandin-E2 induced enteropooling and charcoal induced gastrointestinal motility test in wistar albino rats. The 70% ethanolic extract of Delonix regia flowers was used for activity. The flowers of Delonix regia shows the dose dependent antidiarrhoeal effects in the all the treated groups.\cite{47}

Anti-inflammatory activity: The powdered leaves of the Delonix regia were used for the anti-inflammatory activity. The models for anti-inflammatory activity were the carrageenan-induced rat paw edema and cotton pellet granuloma. The ethanolic extract of leaves of Delonix regia shows significant activity at 400 mg/kg in the both models when compared with standard group.\cite{51}

Antidiabetic activity: The methanolic extract of Delonix regia leaves were used for reporting glucose tolerance in glucose-induced hyperglycemic mice. Glibenclamide (10 mg/kg) was used as a standard reference drug. At every dose of glucose the statistical data indicated significant oral hypoglycemic activity on the mice. The maximum antihyperglycemic activity was measured at 400 mg/kg of the drug extract.\cite{52}
Antioxidant activity: The various extract of leaves, flowers and bark of *Delonix regia* Rafin. like, absolute methanol, absolute ethanol, absolute acetone, 80% methanol, 80% ethanol, 80% acetone and deionized water were used for antioxidant activity. The extract yields from leaves, flowers and bark were in range of 10.19 to 36.24, 12.97 to 48.47 and 4.22 to 8.48 g/100 g dry weight (DW), respectively. From all extract, 80% methanolic extract produced from the leaves exhibited significantly (P < 0.05) higher antioxidant activity, with high phenolic contents (3.63 g GAE/100 g DW), total flavonoid contents (1.19 g CE/100 g DW), inhibition of peroxidation (85.54%), DPPH scavenging capacity (IC50 value 8.89 µg/mL) and reducing power (1.87). By using 2, 2-diphenyl-1- picrylhydrazyl (DPPH) method the antioxidant activity was evaluated. The ethanolic extract of leaves of *Delonix regia* were used. The leaf extract of *Delonix regia* 10.73mg/100 gm of ascorbic acid equivalent antioxidant capacity (AEAC). [35, 53]

Quantification of total flavonoid and phenolic content: The 70% alcoholic extract (AE) of flower of *Delonix regia* Rafin. were used for quantification of total phenolic (TPC) and flavonoidal content. Catechol and Quercetin reagents were used as standards and they were used for calibration of total phenolic and flavonoids content respectively. This study indicates that the flowers of *Delonix regia* Rafin. to be contain rich source of potentially useful natural antioxidants like poly phenol and flavonoids. [28]

Hepatoprotective activity: The study was designed to evaluate the beneficial effect of methanol extract of aerial parts of *Delonix regia* in CCl4 induced liver damage rats. The methanolic extract of aerial parts of *D. regia* possesses hepatoprotective activity against CCl4 induced hepatotoxicity in rats. [54]

Antimicrobial activity: The dichloromethane extract of *Delonix regia* Rafin. leaf led to separation of scopoletin by silica gel chromatography. Scopoletin shows antifungal activity against *Candida albicans* and also antibacterial activity *Pseudomonas aeruginosa, Esecherichia coli, Staphylococcus aureus and Bubtilis subtilis*. The plant extract was inactive against fungi, *Apergillus niger and Trichophyton mentagrophytes*. Antimicrobial activity of the different extracts (15 µg mm-2) was conducted by the disc diffusion method. The zones of inhibition demonstrated by the petroleum ether, carbon tetrachloride and dichloromethane fractions ranged from 9–14 mm, 11–13 mm and 9–20 mm, respectively. Kanamycin was used as standard drug which shows the zone of inhibition of 20–25 mm. In brine shrimp lethality bioassay, the carbon tetrachloride soluble materials demonstrated the highest toxicity with
LC_{50} of 0.83 mg mL^{-1}, while petroleum ether and dichloromethane soluble constituent of the methanolic extract revealed LC_{50} of 14.94 and 3.29 mg mL^{-1}, respectively. The standard drug used was vincristine sulphate with LC_{50} of 0.812 mg mL^{-1}. [30, 55]

**Anthelminitic activity:** The anthelminitic activity of Delonix regia Rafin. flower, plant belonging to family Caesalpiniaceae was reported against Pheritima posthuma (Indian Earth worm). The aqueous and methanolic extract of Delonix regia Rafin. flower was taken in three concentration (25, 50 and 100 mg/ml) differently. The determination of time of paralysis and time of death of worms was reported. The piperazine citrate (10mg/ml) was taken as standard drug and distilled water was taken as control. Both aqueous and methanolic extract shows considerable anthelminitic activity, but methanolic extract show the highest activity. [56]

**Wound healing activity:** Wound healing study was done to investigate the wound healing properties of Delonix regia in experimental animal models. The ethanolic and aqueous extracts of Delonix regia flowers were prepared to study the effect on wound healing. The animals used were albino rats. The wound models were incision and excision wound. Wound Healing was assessed by the rate of wound contraction, period of epithelization, tensile strength (skin breaking strength) and estimation the hydroxyproline content of skin. The ethanolic and aqueous extracts significantly promoted the healing process. [50]

**Gastroprotective activity:** The ethanolic extract of flower of Delonix regia Rafin. was obtained which was investigated for gastroprotective activity in experimental induced ulcer model. The various parameters like ulcer index, pH of gastric juice, percentage protection in all models and gastric volume, free acidity and total acidity in pylorus ligation induced gastric ulceration model were monitored. The gastroprotective activity of ethanolic extract of flower of Delonix regia Rafin. was in a dose dependent manner. [57]

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