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Review Article

DELONIX ELATA - A POTENT MEDICINAL PLANT: A REVIEW

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ABSTRACT

Objective: The objective of this review article is to highlight all the available information online or offline in the form of books or articles on *Delonix elata* (L.), one of most important medicinal plants.

Methods: This article is a compiled report on medicinal properties and phytochemistry of *D. elata* based on the updated information collected from reviews, literature databases, research articles and books.

Results: Delonix elata (L.) Gamble (Poinciana elata Linn.) commonly known as "white gul mohur" in English and is a reputed folklore remedy for arthritic disorders in many parts of Gujarat, India. The leaf extracts are anti-inflammatory agents. Root decoction of this plant is consumed for abdominal pains. Leaves are reported to be used by traditional practitioners for inflammatory joint disorders as a folklore remedy. Its pychosomatic medicinal use relating to scorpion bite treatment is also reported. The presence of phytochemicals such as alkaloids, tannins, triterpenoids, steroids and glycosides in the extracts of this plant supports its traditional uses as a potent medicinal plant for the treatment of various ailments.

Conclusion: Scientific investigations are needed to be carried out on *D. elata* to bring such unexplored drugs into light to combat with various human diseases.

Keywords: *Delonix elata,* Fabaceae, Medicinal uses, Phytoconstituents, Pharmacological activities.

INTRODUCTION

Delonix elata is a small sized tree found in Gujarat, western peninsular and southern India belonging to the family Fabaceae – Caesalpinioideae. Under Delonix genera three species of tropical origin are present. Two variants are present in eastern part of Africa. Delonix is derived from Greek word Delos, which means a claw that looks like petals and elata means tall. It is commonly called creamy peacock flower, flamboyant tree, tiger bean, white gul mohur in English, sandesaro in Gujarati, flamboyant in French, mseele in Swahili, padenarayan or pandenarayan in Tamil. It is not classically used as Ayurvedic drug, but is included in Shodhala Nighantu with Sanskrit name "Siddeshwara" [1-3]. In India and china, the bark extract of this plant is considered as febrifuge and antiperiodic. The leaf and bark in the form of paste is used by local traditional medicinal practitioners to reduce inflammation and pain [4].

Morphology

D. elata plant is about 2.5-15 m tall, trunk of the tree is smooth, ash colored, leaves compound, 15-30 cm long rachis, bipinnate usually 4-6 pairs, leaflets are 10-20 pairs with spreading, rounded crown, crooked poor stem form and drooping branches. Bark has smooth, shining and flaking appearance. Leaves are 3-8 or more, Leaflets are 1.25-4 mm wide. Flowers yellowish white in terminal corymbiform racemes, small pods, seeds are 4-8 in number [5, 6]. Flowers open one at a time. Sepals are 1.8 cm long with a broadly ovate or rotundate-cun [7]. Petals rounded in outline and crisped on margins 1.6-3.8 cm long, 1.8-4.2 cm wide; upper one smaller than rest, pale yellow; the remainder white; later all turning apricot. Staminal filaments pale brown or reddish, hairy at the base, 5-10 cm long; pedicels up to 3.75 cm. Ovary pubescent or tomentose all over. Pods red-brown or purple-brown, up to 20 cm long and smooth, compressed elliptic-oblong.

Leaf

Diagnostic microscopic characters of the leaf of *D. elata* are long narrow palisade cells, multicellular headed sessile glandular trichomes, crystal fibres and simple unicellular short trichomes.

Macroscopic Structure of Leaf

The leaf of *D. elata* is bipinnate, paripinate, rachis 9 - 18 cm in length, distal end prolonged, base pulvinus, rachis circular in outline, upper narrow longitudinal groove from the base to apex, sub rachis four pairs, opposite, 5-7 cm in length, a gland is seen at the base of the sub rachis. Leaflets are 13-15 pairs, 0.7 to 1.2 cm in length, 0.3 to 0.5 cm in breadth, oblong, obtuse apex. Petiolule sub sessile, veins are not prominent. Colour pale green on upper side and yellow green on lower side, taste astringent and odour is not characteristic [6].

Microscopic Structure of Leaf

Transverse section passing through the midrib has a small meristle in the centre and a continuous layer of palisade cells underneath the upper epidermis, and a narrow band of collenchymatous tissue at the lower side; lamina being dorsiventral with a row of hypodermal cells at the lower side.

Ecology and distribution

D. elata is a native to African countries like Congo, Djibouti, Uganda, Kenya, Sudan, Somalia, Ethiopia, Tanzania and Egypt [8]. Exotically found in India, Sri Lanka and Zambia. It is widely cultivated in the tropical countries. Historically it was first introduced into India in 1792 in the Botanical Garden of Calcutta. Now it is well distributed in western parts of India [9]. Red soils is its natural habitat, normally occurs on rocky, shallow soils. It prefers hot, dry Acacia-Commiphora bush land. It requires 100-1400 m altitude, 27 °C mean annual temperatures, 580 mm mean annual rainfall, rocky soil, *D. elata* is susceptible to water logging areas.

Reproduction

Flowering in this plant is seen in the hot season or during the early rains as it is a hermaphroditic, deciduous tree. Flowering season is August-March in India, in eastern parts of Africa normally around December. Fruits are ripened between May and July.

Cultivation

D. elata is a fast growing tree raised easily from seed. It requires high light, so it is planted in full sunlight. Grown from poles, seeding is a favoured propagation method. Seed is commonly found in animal droppings, some of these germinate to produce seedlings. Pollarding, lopping and trimming are recommended management practices. Browsers are used to protect the young seedlings.

Germ plasm management

Scarification is done to pretreat the seeds of *D. elata*. Seeds are soaked in concentrated nitric acid or in water for 24 h. High

germination rates (75% at 42 and 56 days) were obtained with 7 min acid treatment [10].

Functional uses

D. elata is a multipurpose tree commonly found planted or cultivated. Poles are used for fencing. As it has potential use in soil conservation, it is used for erosion control of soil. In India it has been successfully used in protecting channel and river banks as a low crown, effective as a shelter belt. It is a good tree for reforestation of difficult sites [7]. In South India, the leaves are used as mulch in rice fields [11]. It is a distinct, magnificent tree in bloom, suitable for cultivation in gardens, avenues and amenity parks so it can be used as ornamental. *D. elata* leaves have a green manure, are rich in magnesium, yielding 50-200 kg of mulch per year, so it is used as soil improver.

The wood weighing 90 kg/cu.ft after seasoning is yellow, even-grained and easily worked. It is very promising as a firewood source having high density, calorific value and carbon percentage, low silica and nitrogen, so it is used as fuel source. Tiger bean is a promising source of micronutrients for goats, sheep, camels and cattle which eat the foliage and young pods. It is suitable for cabinet work, carvings and utensils. The tree yields a dark coloured, mucilaginous gum [12]. The seed oil contains small amounts of sterculic and malvalic acids. Beta-Amyrin, hesperitin and neohesperidin have been newly isolated from the dried roots of this plant in India [13].

Medicinal uses

The leaf and bark extracts of *D. elata* are anti-inflammatory agents; a root decoction is drunk for abdominal pains. Leaves are reported to be used by traditional practitioners in cases of inflammatory joint disorders as a folklore remedy. A pychosomatic medicinal use relating to scorpion bite treatment is reported from India. Leaf and seed extracts have anti malarial and antiovicidal activity; hence these extracts are used by traditional practitioners to treat malaria.

Pharmacognosy analysis

Quality parameters of *D. elata* such as total ash (2.48%), water soluble ash (2.06%), acid insoluble ash (0.4%) and methanol soluble extract (25.72%) have been established and reported. Presences of phenolic compounds are also reported. Preliminary chemical tests on this plant are reported for the presence of tannin, glycoside and mucilage.

Antioxidant activity

Ethanolic extract of *Delonix elata* is reported for its free radical scavenging property on different *in vitro* models, *viz*, 1,1-dipheny1-2-picryl hydrazine (DPPH), hydrogen peroxide, total antioxidant capacity and peroxy radical model. The *in vitro* lipid peroxidation (LPO) is also reported to be inhibited to a good extent by the ethanolic leaf extract of *Delonix elata* [14,15]. The medicinal properties of plants have been investigated in the recent scientific developments throughout the world, due to their potential antioxidant activities, no side effects and economic viability. The majority of the active antioxidant compounds flavonoids, isoflavones, flavones, anthocyanins, coumarins, lignans, catechins, and isocatechins. In addition to the above compounds found in natural foods, vitamins C and E, b-carotene, and a-tocopherol are known to possess antioxidant potential [16-18].

Anti – inflammatory activity

Anti-inflammatory activity of this plant is reported using carageenin induced oedema model [19-20]. The paw oedema was measured by using plethysmograph. The LD_{50} values of this plant extracts are reported as more than 100 mg/kg/b.w. in mice and the active principles in extracts are present usually in small quantities. A dose 300 mg/kg/b.w. was administered to assess the validity as known anti- inflammatory agent in comparison with phenylbutazone.

The report indicates that the bark extract showed slight lower response than phenylbutazone (50 mg/kg). The leaf extract also showed significant anti-inflammatory action compared to control but it was lower than the effect of bark extract. Compounds like bioflavonoid are reported to produce anti-inflammatory action by decreasing capillary permeability [21]. Steroids are known to produce anti-inflammatory activity. The extracts tested might contain flavonoids/steriodis which resulted in producing antiinflammatory activity [22].

Antibacterial activity

The antibacterial activity of organic solvent extracts of this plant was determined by disc diffusion and broth dilution techniques against gram-positive bacterial strains (*Bacillus subtilis*, *Staphylococcus aureus*) and gram-negative bacterial strains (*Escherichia coli, Klebsiella pneumoniae*, *Pseudomonas aeruginosa*). The chloroform and methanol extracts exhibited significant antibacterial activity against gram-positive and gram-negative strains with minimum bactericidal concentration (MBC) ranging from 1.5 to 100 mg/ml. The presence of phytochemicals such as alkaloids, tannins, triterpenoids, steroids and glycosides in the extracts of these plants supports their traditional uses as medicinal plants for the treatment of various ailments. The observed antibacterial activity is attributed to the presence of bioactive compounds in the extracts of plants tested. The presence of these bioactive compounds in crude extracts is known to confer antibacterial activity against disease-causing microorganisms [23, 24] and offer protection to plants themselves against pathogenic microbial infections [25].

Larvicidal and ovicidal activity

D. elata is also reported to possess anti-malarial activity. Reports revealed that leaf and seed extracts were tested against malaria, dengue vector mosquitoes. The various extracts of *D. elata viz.,* hexane, benzene, chloroform, ethyl acetate, and methanol extracts are reported to possess larvicidal activity against *Anopheles stephensi* and *Aedes aegypti*. It is also reported that all extracts showed moderate larvicidal effects; the highest larval mortality was found in methanol extract of leaf against the larvae of *A. stephensi* and *A. aegypti*. Leaf extracts showed greater potency than seeds extract. All the five solvent extracts are reported with moderate ovicidal activity; however the methanol extract is reported to possess highest ovicidal activity [26].

Chelating activity

Chelating activity of *Delonix elata* is also reported against *Cyprinus carpio* by mainly two approached *viz.,* inducing oxitative stress and antioxidant enzyme activity [27].

CONCLUSION

The review article has encompassed various phenotypic characterstics and habitat of *Delonix elata* that belongs to Fabaceae family. Based on the rigorous literature survey its can be concluded that *D. elata* possess array of biological and pharmacological properties which includes antibacterial activity , anti-inflammatory activity, pychosomatic medicinal property for scorpion bite, anti-malarial activity, anti-ovicidal activity, antioxidant activities, and chelating activity. This review gives an insight of the reports on medicinal uses of this important plant which holds great therapeutic potential. However, this plant can be used for further investigations to unmask its other unexplored pharmacological properties.

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