



Utilizing the Medicinal Properties of *Delonix regia* for Diseases and Beyond: A Review of its Phytochemistry and Pharmacology

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ABSTRACT

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Delonix regia is a herbaceous plant that belongs to the sedge family. It is a type of blossoming plant near Madagascar. It is renowned for its plant-like leaves and heavenly presentation of orange-red leaves in the summer. It grows as a decorative tree along roadsides and in many tropical areas of the world. It is used to produce bee fodder. In English, it's called Royal Poinciana, Flamboyant, or Flame Tree. In many areas, it is additionally recognized as a forest. Traditionally, it is the repository of natural medicine. Various components of the *Delonix regia* plant are used to treat a number of ailments, like inflammation, bronchitis, joint pain, diabetes, anaemia, fever, and pneumonia. *Delonix regia* can also be used as a treatment for gynaecological problems. *Delonix regia* additionally has anti-inflammatory, antibacterial, anti-microbial, antidiarrheal, hepatoprotective, antidiabetic, anti-ulcer, anticancer, antihelminthic, cytotoxic, antioxidant, gastroprotective, wound healing, hypoglycaemic and antifeedant activities. This work mainly provides support for research work on *Delonix regia* description, traditional uses, economic importance, phytochemical and pharmacological activities. In about 102 articles, quantitative and subjective information was taken from several articles. The quest for this review was completed in the accompanying data sets: Google Scholar, ResearchGate, PubMed, and other applicable distributed materials. The literature review of *Delonix regia* indicates that it has extensive pharmacological properties that really help treat a few disorders. *Delonix regia* plant parts are used as traditional medicine around the world. All parts of a plant, mainly the leaf, flower, bark, and roots, have active and inactive chemical compounds.

Keywords: *Delonix regia*, Forest, Madagascar, Joint pain, Gynaecology

Introduction

Currently, life expectancy as well as death rates have decreased worldwide, and medical science has made amazing advances.¹ In the ultramodern world, there is interest in the improvement of natural medicine, and in a number of laboratories, investigations have been conducted on the pharmacological properties of bioactive components and their ability to deal with a number of ailments.² Traditional medicine and Ayurveda are among the oldest traditional systems, according to Jaiswai and Williams.³ In view of current tests, they assume a significant role in the revelation of new treatments and medications.⁴ Nowadays, scientists enjoy a lot of benefits from the enrichment of traditional medicine, ayurveda, unani, siddha, homeopathy, and yoga exercises using modern science.⁵ All these traditional medicines are based on different herbal plants. A source of herbal medicine is *Delonix regia*. Gulmohar is an ephemeral tree. A large tree with fern-like leaves is additionally stated as Gulmohar shikha and, in addition, scientifically diagnosed as *Delonix regia* (royal poinciana or peacock flower tree).⁶

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Commonly recognized as Krishna Chura, Gulmohar, Tabachin, and Malinche. Commonly grown in one-of-a-kind areas of Bangladesh. It is appropriate and custom-made for moist heat and humidity. *Delonix regia* has large umbrella-shaped crowns that are normally shade-providing and planted as red and yellow ornaments. *Delonix regia* commonly grows to a pinnacle of 30 to 45.⁶ The plant forms pesticides that promote fertility and heal wounds. *Delonix regia* plant existence in addition has antifeedant, anthelmintic projects, and prevents malaria parasites in humans. *Delonix regia* leaves are anti-inflammatory, anti-ulcer, antifungal, and have cytotoxic activity.⁷ *Delonix regia* bloom is utilized as a corrosive base marker and as a natural tone.⁷ Members of the genus Royal Poinciana are flowering plants in East Africa. It is used daily in Indian medicine for various remedies, and its leaves are used to treat juvenile rheumatism, stomach ailments, joint pain, and pneumonia.⁹ Thus, the purpose of this review is to provide support for research work to explore the plant's uses, importance, phytochemistry and pharmacology.

Materials and Methods

Literature search strategy

The literature survey on *Delonix regia* was carried out in the following databases: Google Scholar, PubMed, ResearchGate, Science Direct and other applicable distributed materials. The data extraction and the selection criteria are mentioned in Figure-1.

Results and Discussion

Botanical description

Delonix is a genus of flowering plants in the subfamily Caesalpinioideae of the Fabaceae (pea) family. It's a blossoming

ornamental tree. The gulmohar tree typically reaches a height of 10 to 15 meters (with a maximum height of 18 meters). All along, stems are woody; they might be decumbent, ascending, erect, or arching. Young twigs and stems are either sparsely glabrate or glabrous. The gulmohar fruit is rectangular, elongate, stipitate, and unilocular. When fruit is young, it is green and flaccid; as it ages, it transforms into rigid, a dark brown colour, and woody pods that finish in a short beak. As fruit ages, it divides into two sections. The fruit measures between 30-75 cm in length, 3.8 cm in width, and 5-7.6 cm in thickness.⁹ The stem form that is located above the buttress often has a consistent taper, and the trunk of the tree is buttressed. The trees have open, umbrella-shaped crowns that extend widely and are nearly evergreen. In regions with protracted, noticeable dry seasons, it is deciduous. According to¹⁰ the bark is smooth or slightly rough, peeling, and grey or brown. The seeds have a smooth surface and are either black or olive brown in hue. The seeds resemble date seeds in shape and are firm, shiny, and oblong. They have a length of about 2 cm. The flower is up to 13 cm wide, actinomorphic or irregular, and faintly scented. Five lobed and glabrous calyx. The broad, reddish-colored sepals have a green border outside and a yellow border inside. Five petals are present. The petals are rounder, wider, orbicular, broadly spoon-shaped, 5-6.5 cm long, and 2-3 cm wide. One petal is taller and thinner than the others, with red dots and an orange-red colour that almost looks crimson. There are nine to ten stamens in each. Stamens are monadelphous, distinct, and entirely free. Filaments are red or pink in colour, hairy, and villous. Flavonol, phenolic acid, carotenoid, and anthocyanin are among the components that make up *D. regia*'s extract from its flowers. The leaves are 20-60 cm long, biparipinnate, light green, and a little hairy. The leaflets are 1.5 cm long, oblong, with complete, opposite, stalkless edges that come in 18 to 30 pairs. At the base of the leaf stalk are two compressed stipules with long, narrow teeth that resemble combs.¹⁰

Scientific classification

Kingdom: Plantae; Phylum: Spermatophyta; Subphylum: Angiospermae; Class: Dicotyledonae; Order: Fabales; Family: Fabaceae; Subfamily: Caesalpinioideae; Genus: *Delonix*; Species: *Delonix regia*

Synonym

Delonix regia var. *Flavidastehle*; *Delonix regia* var. *genuinastehle*; *Poinciana regia hook* *Poinciana regia* Bojer

International common names

English: Royal poinciana, Flamboyant, Flamboyant flame tree, flam of the forest, gulmohr, glod mohar, peacock flower; Arabic: Goldmore; French: Flamboyant, Poinciana, royal; Burmese: Seinban; Spanish: *Acacia roja*; Swahili: Mjohoro; Hindi: Gulmohr; Bengali; Chura, radha; Tamil: Mayarium, mayirkonrai, panjadi; Amharic: Dire dawazaf; Thai: Hang nokyungfarang; Yoruba: Sekeseke.^{12, 6}

Major chemical constituents in *Delonix regia*

Considerable work from *Delonix regia* already identified and isolated different chemical elements have been taken out. Numerous studies on different extracts of *Delonix regia* plant contains several active ingredients e.g. flavonols, phenolic acid, glucoside, carotene hydrocarbons, anthocyanins, flavonoids, triterpenoidal saponin, sterols, benzaldehydes, fatty acids and amino acids (Table-1).¹³

Traditional uses

The *Delonix regia* plant incorporates phytochemicals that are used in human medicine. Cattle fitness problems have been referred to globally from historic precedents to the present day. The World Health Organization (WHO) states that there are 250,000 species of medicinal plant life, and greater than 80% of these encompass *Delonix regia*, which relies on herbal remedies for extended health in developing places worldwide.¹⁶ Gulmohar leaves are used by everyday practitioners as a folkloric treatment for inflammatory joint problems, antirheumatic, antimicrobial and antioxidant workouts.^{29,30} *Delonix regia* plants are used in the cure of emesis, CNS depression, anaemia, and fever. *Delonix regia* bark extract treatment for antiperiodic and antipyretic purposes.³¹ In China, *Delonix regia* bark is utilized as a

febrifuge and antipyretic. *Delonix regia* plant leaf and bark paste are additionally used to relieve infection and pain. The bark is likewise utilized as a biosurveillance and bioaccumulator of environmental clue metals and for the evacuation of Ni (II) from fluid arrangements by adsorption utilizing bark.^{32, 33} *Delonix regia* plants are used by people of different civilizations to treat constipation, inflammation, joint pain, hemiplagia and leucorrhoea.^{34,35} Activated carbon organized from *Delonix regia* fruit husk is used for decolorization and has a similar absorption capacity. *Delonix regia* natural product strip can be employed as a biosorbent to take in chromium [Cr] from electroplating waste water and transform it to less harmful product.³⁶ Gulmohar flowers of the tribal community of Andhra Pradesh, India are used in the treatment of dysmenorrhea.³⁷ Also, Gulmohar flowers form a natural sunscreen.^{38,39} Gulmohar root is used in the treatment of stomach aches.⁴⁰

Economic importance

The timber of the gulmohar plant is used in agricultural implements (handles for combs, carpentry tools, etc.) and is used as core fuel. Gulmohar is commonly valued for leaves, seeds, shade, and ornamentals. The timber of the Gulmohar plant has a calorific value of 4600 kcal, and the seeds yield 18 to 27.5% fatty oil, viewed as "pangam" or "karanga" oil. On the whole, it is used in oil, oil soap, tanning industry, insecticidal and anti-bacterial lights, and additionally in pharmaceutical preparations. Gulmohar seed oil cake, moreover, works as a fabulous fertilizer. Gulmohar plant seeds are carminative, blood purifiers, and used in inflammation, earache, and chest complaints. It is a top tree for controlling soil erosion in arid and semi-arid regions. It is also used for lacinators.²⁵ Food prepared from *Delonix regia* seeds can be fed to farm animals. Gulmohar leaves provide fodder for cattle, and they're also used to produce honey bee forage.⁴¹ Fluid concentrates of *Delonix regia* flowers are utilized for brilliant colouring of skin and cotton fabrics, including cotton, to prevent discoloration.^{42,43} Some studies have shown that the polysaccharides in the seeds can be used as a better support in drifting medication conveyance frames.^{44,45} Also, the polymer obtained from the seeds can be utilized for pulsatile drug discharge after a foreordained time, and carboxymethylated seed gum is utilized for microencapsulation of papain.^{46, 47} *Delonix regia* seeds and leaves are separated, reducing the absorption of aluminium in HCl solutions, and the seed gum is made use of as a binder.^{48,49}

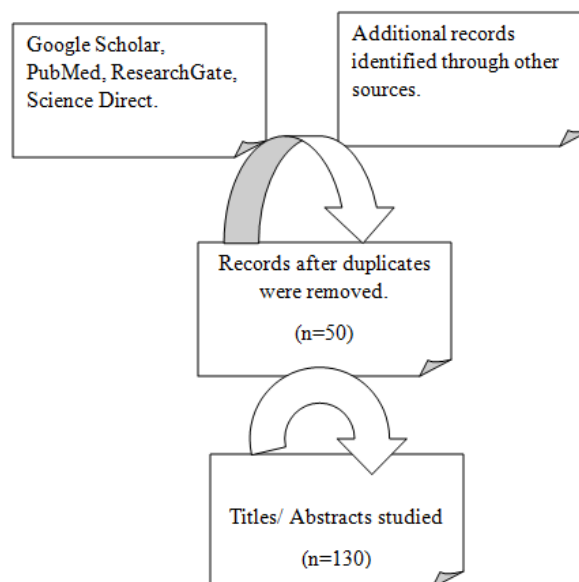


Figure 1: Flow chart of Data extraction

Proximate and mineral analysis

Royal Poinciana leaves and stems were analyzed for proximate and mineral content. *Delonix regia* leaves proximate examination shows that there are crude protein, crude fibre, ether extract, nitrogen-free extract, moisture, dry matter, ash, carbohydrates, and energy. Mineral analysis shows that *Delonix regia* leaves contain potassium, calcium, sodium, magnesium, phosphorus, copper, iron, zinc, selenium, and cobalt. *Delonix regia* leaves contain phosphorus, calcium, potassium, sodium, zinc, magnesium, copper, iron, cobalt, and selenium. Mineral structure in this study revealed that DSR had a higher focus than *Delonix regia* leaves.¹⁶

Pharmacological properties

Anti-inflammatory activity

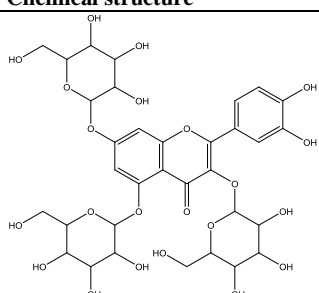
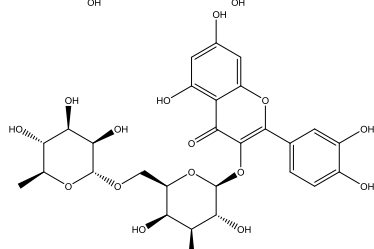
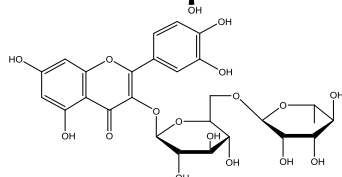
In order to cure local inflammation, blockage, diabetes, joint pain, pneumonia, jungle fever, joint agony, and viral infections, an extract from the leaves of the *Delonix regia* plant is utilized.⁵⁰ Methanol extract of *Delonix regia* leaves and ethyl acetate liquefiable and infusible root fractions additionally confirmed a momentous anti-inflammatory effect greater than that of *Delonix regia* bark extract.⁵¹ *Delonix regia* leaf powder is used to mitigate movement. The experiment used rat paw edema and cotton pellet granuloma to see anti-inflammatory activity. The ethanolic extract of *Delonix regia* leaves shown a stronger anti-inflammatory effect at doses of 400 mg/kg b.w. in both fractions as compared to a well-known group at doses of 10 mg/kg b.w. for the standard drug indomethacin.⁵² Rozina and her group assessed the mitigating, calming, and pain-relieving properties of 70% ethanolic concentrate of *Delonix regia* bark in carrageenan-actuated rear paw edema life-sized models utilizing the Randall-Sellito strategy. Ibuprofen was taken as the medication of choice, and it was recommended that the ethanolic concentrate of the

bark show essentially more calming action than the blossom extract. At long last, it was demonstrated that both bloom and bark separation showed critical pain-relieving action.⁵³ *Delonix regia* remove has quieting development in two cycles: carrageenan-activated back paw edema and cotton pellet-provoked granuloma in rodents. The paw edema response to this system was clearly reduced in rodents. Diclofenac-pretreated animals confirmed a more significant block of paw edema improvement. *Delonix regia* discrete (400 mg/kg) curbed carrageenan-incited sickness with 52% and 49% restriction with top activity at 24 and 300 min. Cotton strip-instigated granuloma results uncovered that the ethanol concentrate of *Delonix regia* oral cure significantly eases irritation (Table 2).⁵⁴

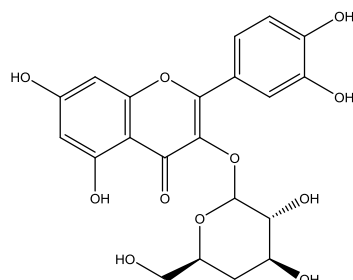
Antibacterial activity

Delonix regia leaf, stem, and root extracts have antibacterial effects. A scan with extracts obtained from *Delonix regia*, in which many efforts are made, suggests working with *Staphylococcus*, which is Gram-positive, and *E. coli*, which is Gram-negative. The use of the antibacterial enjoyment cup plate method was studied.¹⁵ Another test used to be carried out where, with the help of an agar-disc diffusion approach and a resistance to both gram-negative and gram-positive bacteria, the antimicrobial effect used to be recorded once (MIC). These extracts were evaluated for their overall performance in bacterial (MIC) assessment using the broth microdilution method. All the extracts tested were very sensitive to bacteria. It's advantageous for most *E. coli*, with a chosen MIC of 103.7 µg/mL.³⁸ The methanolic extracts of antibacterial activity was assessed. *Delonix regia* flower exhibit potent activity against *P. aeruginosa*, *S. aureus*, and *E. faecalis* *E. coli* (Table 2).⁸¹

Table 1: List of chemical constituents isolated from *Delonix regia*

Compound Name	Chemical structure	Type	Plant Parts	Reference
Quercetin trihexoside		Flavonols	Flowers	16, 7
Quercetin 3-O-robinobioside		Flavonols	Flowers	16, 7
Quercetin 3-O-rutinoside		Flavonols	Flowers	16, 7

Quercetin 3-O-galactoside

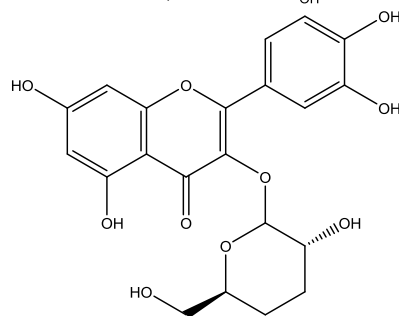


Flavonols

Flowers

16, 7

Quercetin 3-O-glucoside

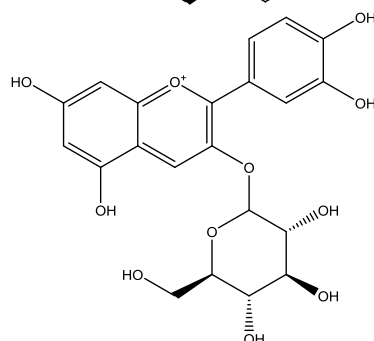


Flavonols

Flowers

16, 7

Cyanidin 3-O-glucoside

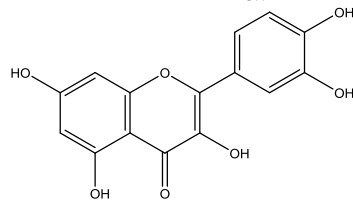


Flavonols

Flowers

16, 7

Quercetin

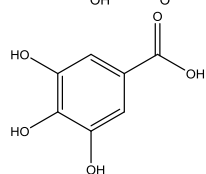


Flavonols

Flowers

16, 7

Gallic acid

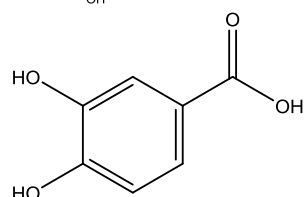


Phenolic acid

Flowers

16, 7

Protocatechuic acid

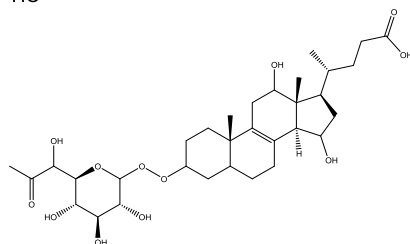


Phenolic acid

Flowers

16, 7

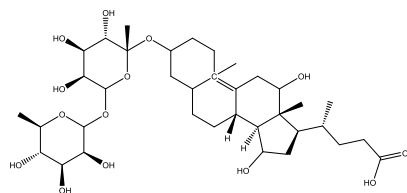
12, 15-Dihydroxy-chol-8-en-24-oic-acid-3-oxy-6'-acetyl-glucoside



Glucoside

Flowers

16, 7

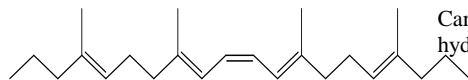
12, 15-Dihydroxy-5-*chol*-9-en-24-oic-acid-3-oxy-rhamnosyl-rhamnoside

Glucoside

Flowers

16, 7

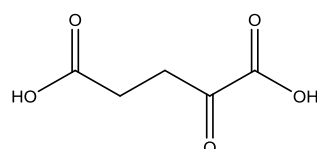
Phytoene



Carotene hydrocarbons

Flowers

16, 7

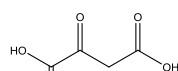
 α -ketoglutaric acid

Anthocyanins

Flowers

16, 7

oxaloacetic acid

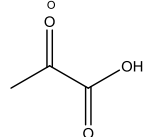


Anthocyanins

Flowers

16, 7

pyruvic acid

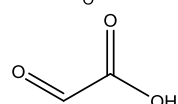


Anthocyanins

Flowers

16, 7

glyoxylic acid

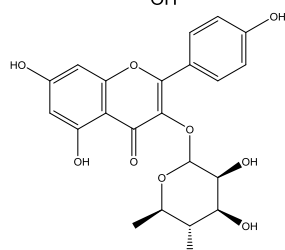


Anthocyanins

Flowers

16, 7

Kaempferol-3-rhamnoside

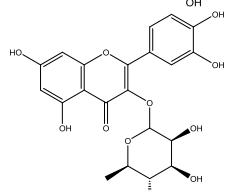


Flavonoids

Flowers

16, 7

Quercetin-3-rhamnoside

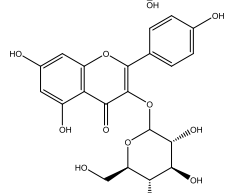


Flavonoids

Flowers

16, 7

Kaempferol-3-glucoside

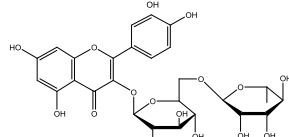


Flavonoids

Flowers

16, 7

Kaempferol-3-rutinoside

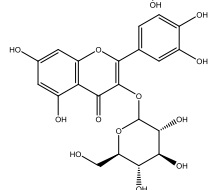


Flavonoids

Flowers

16, 7

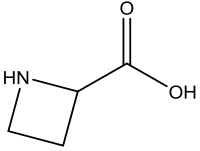
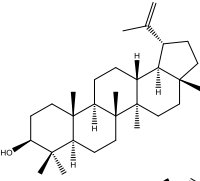
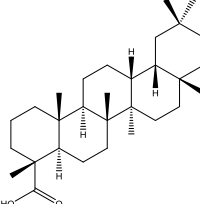
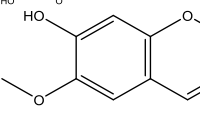
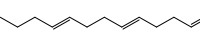
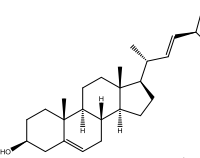
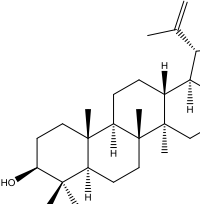
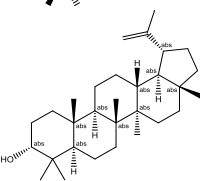
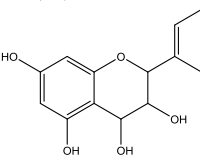
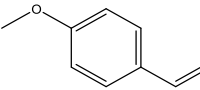
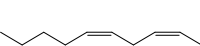
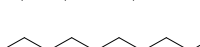


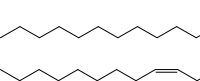
Quercetin 3-glucoside

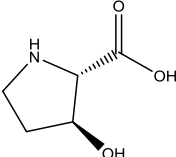
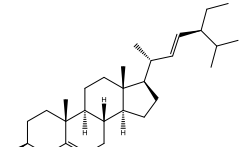
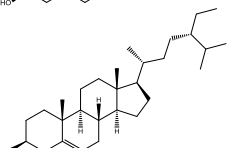
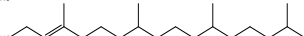


Flavonoids

Flowers

16, 7

L-Azetidine-2-carboxylic acid		Flavonoids	Leaves	14,15
Lupeol		Triterpenoidal Saponin	Leaves	14,15
Oleananoic acid		Sterols	Leaves	14,15
Scopoletin		Sterols	Leaves	14,15
Squalene		Sterols	Leaves	14,15
Stigmasterol		Sterols	Fruits	26, 27, 28
Lupeol		Triterpenoidal Saponin	Bark	17, 18, 19
Epilupeol		Triterpenoidal Saponin	Bark	17, 18, 19
Leucocyanidin		Flavonoids	Bark	17, 18, 19
p-methoxybenzaldehyde		Benzaldehydes	Bark	17, 18, 19
Linoleic acid		Fatty acids	Bark	17, 18, 19
myristic acid		Fatty acids	Fruits	26, 27, 28
palmitic acid		Fatty acids	Fruits	26, 27, 28
stearic acid		Fatty acids	Fruits	26, 27, 28
oleic acid		Fatty acids	Fruits	26, 27, 28

trans-3-hydroxy-L-proline		Amino acids	Fruits	26, 27, 28
Stigmasterol		Sterols	Fruits	26, 27, 28
Sitosterol		Sterols	Fruits	26, 27, 28
Phytol		Sterols	Fruits	26, 27, 28

Antimicrobial activity

Delonix regia leaves and flowers have antimicrobial activity. 80% methanol concentrate of *Delonix regia* blossoms and leaves was positioned as the best, showing the most reduced MIC (least inhibitory fixation) values against bacterial and contagious strains. Positive controls had strikingly decreased MIC values against the analyzed miniature creatures and growths. *Delonix regia* tremendous antimicrobial undertaking towards *P. aeruginosa* and *E. coli*. In general, its antimicrobial activity was once examined, and the leaf and flower extracts (80% methanol) were comparable to the conventional tablets flumiquine and amoxicillin. In the meantime, 80% methanol bark extract has been displayed to bring about genuine-looking exercise of *P. aeruginosa*, *E. coli*, and *A. niger* (Table 2).^{55, 71}

Antidiarrheal activity

Delonix regia plant has anti-diarrheal properties in all cases. *Delonix regia* of ethanolic extract (70%) displayed huge antidiarrhoeal diversion toward castor-oil-tested loose bowels in rodents. Castor oil, whose dynamic fixing is ricinoleic corrosive, prompts changes in mucosal liquid porousness and electrolyte transport, bringing about a hypersecretory reaction. Ricinoleic corrosive also creates the disease irritation of the gastrointestinal mucosa, vital to emit prostaglandins, which animate portability and discharge.⁵⁶ It has been suggested that the flavonoids and tannins found in roses may have an antagonistic effect on diarrhea by inhibiting or decreasing the release of gastrointestinal motility, protein precipitation, or electrolyte emission (Table 2).⁸²

Hepatoprotective activity

Delonix regia recommends hepatoprotective action. Tests affirmed that the methanol concentrate of aeronautical parts of *Delonix regia* in carbon tetrachloride achieved liver failure in rodents. At two dose levels (50 and 100 mg/kg), the ethanolic extract and its two fractions were examined for hepatoprotective efficacy against CCl₄-induced hepatic cell injury in rats. The flavonoid rich fraction demonstrated statistically significant hepatoprotection at the higher dose. This capacity to protect the liver might be explained by the presence of flavonoids, which are known to efficiently scavenge harmful free radicals.⁵⁸ Jameel and his research team aimed to assess the potential positive impact of a methanol extract derived from the aerial parts of *Delonix regia* on liver damage induced by CCl₄ in rats. Their findings indicate that the methanolic extract of the aerial parts of *Delonix regia* exhibits hepatoprotective properties against CCl₄-induced hepatotoxicity in rats (Table 2).⁵⁷

Antidiabetic activity

Delonix regia is notable on the planet for its restorative properties. *Delonix regia* leaves were separated orally from rodents by gavage and utilized in an alloxan-instigated diabetes life-size model.

Leaf extract was once fundamentally ($P < 0.001$) able to bring down blood glucose levels in alloxan-actuated diabetic rodents. According to the reports⁵⁹, the methanolic extract of the aerial parts of *Delonix regia* displayed hypoglycemic activity, as well as antioxidant and hypolipidemic activity. Its medicinal potential as a natural anti-diabetic therapy was suggested by the fact that the anti-diabetic impact was analogous to that of glibenclamide.⁶⁰ The study's findings show that the methanol extract of *Delonix regia* leaves significantly lowers blood sugar levels at all tested doses in a dose-dependent way. In mice with glucose-induced hyperglycemia, the maximum hypoglycemic action (42.46%) was found with a 400 mg kg⁻¹ dose of the methanol extract of *Delonix regia* leaves, whereas glibenclamide, the conventional medication, exhibited 47.65 % activity at a 10 mg kg⁻¹ dose.⁶¹ A results imply that the methanolic aerial component extract of *Delonix regia* shown antioxidant, hypolipidemic, and hypoglycemic properties. Given that its antidiabetic activity was similar to that of glibenclamide, it may find therapeutic application as a natural anti-diabetic agent (Table 2).⁶²

Antiulcer activity

Delonix regia generally has anti-ulcer effects. After treatment with *Delonix regia* ethanolic extract (100 and 200 mg/kg), doses confirmed intact epithelium of gastric mucosa⁶³. One more investigation was conducted to consider the counter-ulcer impact of the ethanolic concentrate of *Delonix regia* blossoms. Pale-skinned rodents of the two genders (200 gm and 250 gm) were utilized in the examination. The outcomes show that the ethanolic concentrate of *Cisalpinia pulcherrima* has anti-ulcer consequences for ethanol-initiated ulcers (Table 2).⁶⁴

Anticancer activity

Delonix regia flowers have been used as an anticancer agent. Current-day analysis has proven that *Delonix regia* flower extract has anti-cancer properties. In experiments using high-performance liquid chromatography (HPLC), *Delonix regia* exhibited the presence of high convergences of three distinguishable flavonoids.³¹ *Delonix regia* has anti-cancer activity due to its phytochemical compounds. *Delonix regia* extract with AgNps significantly decreased the number of cells treated. The morphological characteristics of cells were confirmed by the TUNEL assay that silver NPs induced cell death by apoptosis (Table 2).⁶⁵

Anthelmintic activity

Delonix regia has anti-helminthic activity. Methanolic and fluid extracts of *Delonix regia* flowers were investigated for anthelmintic activity using an earthworm (*Pheretima posthuma*). *Delonix regia* fluid and methanolic extracts of three flower concentrations were taken separately. The time of paralysis and death of worms are reported. Both aqueous and methanolic extracts confirmed substantial

anthelmintic activity, but the methanolic extract confirmed the best activity.⁶⁶ Three concentrations of *Delonix regia* leaves (25, 50, and 100 mg/ml) were examined in plant extract bioassays. Albendazole (10 mg/mL) is used as a standard reference drug, and distilled water is used as a control. Determination of paralysis, worst time, and time to loss of life have been recorded. Dose-dependent manner were found; however, methanolic extract was viewed as more effective than aqueous extract.⁶⁷ Saikat and his group tested earthworms with fresh leaf juice of *Delonix regia*, and it was observed that leaf juice had a lethal effect on earthworms. The earthworms were first paralyzed and then died. The times of paralysis and death were counted as (73±10 and 120±13 min), respectively. The worm tablets Alben DS and normal saline were used to complete the experiment (Table 2).⁶⁸

Cytotoxic activity

Delonix regia 70% ethanolic fixation treated uterine cell development, ovarian disease cells, colon malignant growth cells, and tamoxifen as a control. The cytotoxic action of the ethanolic concentrate of leaves was assessed using a deadly bioassay of *Delonix regia* brackish water shrimp. *Delonix regia* (70%) ethanolic concentrate of the bosom disease cell line, Cervilux cells was utilized. Most colon cells and growth cells are disease cells and are controlled with tamoxifen. The outcomes showed that the carbon tetrachloride division guaranteed a LC₅₀ worth of 0.83 µg·mL⁻¹, like that of ordinary vincristine sulphate (0.821 µg·mL⁻¹), though petrol ether and dichloromethane parts affirmed LC₅₀ upsides of 14.94 and 3.29 µg·mL⁻¹, respectively.⁶⁹ Also, a research group⁷⁰ evaluated the cytotoxic activity of a 70% ethanolic concentration of *Delonix regia* leaf using an MTT assay in breast disease cells (MCF-7), cervix cells (HeLa), brain growth cells, and colon disease cells, with tamoxifen as a confirmed control (Table 2).⁸³

Antioxidant Activity

Studies have shown that extracts made from leaves contain higher levels of antioxidant activity than extracts made from flowers and bark, and this is true regardless of the solvent that was used to make the extracts. In addition, the results of this study showed that methanol at a concentration of 80% had a superior efficacy as an extracting solvent for recovering powerful antioxidant components from Gulmohar in comparison to the efficacy of other solvents. This finding

indicates that related extracts have an admirable potential for the isolation of natural antioxidants and antimicrobial agents.^{9,71} Based on the radical scavenging impact on the DPPH [1,1-diphenyl-2-picrylhydrazyl] free radical,^{72,73} the radical scavenging activity of leaf and flower extracts was ascertained. In tubes with labels, 1 mL of various extract strengths was combined with 3 mL of DPPH solution (0.004% methanol). The tubes were kept at room temperature and in the dark for thirty minutes. A UV-visible spectrophotometer was used to measure the optical density at 517 nm (Table 2).⁸⁴

Gastroprotective activity

In general, studies have shown that *Delonix regia* leaves have gastroprotective action. *Delonix regia* leaves, as 70% ethanol, have an impact against headache medicine, liquor, and gastric ulceration. This is well known with pylorus ligation-induced lansoprazole use.⁷⁴ *Delonix regia* flower extract protein confirmed a large dose relying on protective effects with increased accelerated vasoconstriction or capillary resistance. All experiments have confirmed that the presence of antioxidant principles may have a protective effect on ulcers, such as tannins and flavonoids (Table 2).^{74,75}

Wound healing activity

Delonix regia ethanolic (70%) leaf extract was studied for wound healing in experimental animal models. *Delonix regia* fluid concentrate and ethanolic extract extraordinarily elevated recuperation contrasted with skin povidine iodine treatment (5%), as confirmed by wound compression coefficient, rigidity, and hydroxyproline content, while epithelization period diminished. The plant extract of the resulting part may also be an attempt to restore the wound responsible for the presence of excess flavonoids (Table 2).⁷⁶

Hypoglycaemic activity

Methanol concentrate of *Delonix regia* leaves had a fundamental glucose chopping down limit at all estimations endeavoured in a subordinate way. The outcomes displayed that *Delonix regia* showed a dumbfounding blood glucose chopping-down impact in glucose-activated hyperglycaemic rodents (Table 2).⁷⁷

Table 2: Reported pharmacological properties of *Delonix regia*

Pharmacological properties	Plant parts	Solvent	Authors
Anti-inflammatory	Leaves	Methanol, Ethanol	30, 51, 52, 53, 54
Antibacterial	Leaves, stem, root	Dimethylsulfoxide	15, 37, 81
Anti-microbial	Leaves, Flowers	Methanol	54, 55
Antidiarrheal	Plant	Ethanol	56, 82
Hepatoprotective	Leaves, Flowers	Methanol	57, 58, 59
	Aerial parts	Ethanol	
Antidiabetic	Leaves	Methanol	60, 61, 62
Antiulcer	Flowers	Ethanol	63, 64
Anticancer	Flowers	Ethanol	31, 65
Anthelmintic	Flowers, Leaves	Methanol, Normal saline	66, 67, 68
Cytotoxic	Leaves	Ethanol	7, 69, 70, 83
Antioxidant	Leaves, Flowers	Ethanol, Methanol	9, 69, 71, 72, 73, 84
Gastroprotective	Leaves, Flowers	Ethanol	74, 75
Wound healing	Leaves	Ethanol	76
Hypoglycemic	Leaves	Methanol	77
Antifeedent	Flowers	Methanol	78
Antihemolytic	Flowers	Methanol	79
Protective	Leaves	Ethanol	80

Antifeedent activity (Larvicidal activity)

Delonix regia flowers also act as antifeedants. A test that took out the *Delonix regia* flower showed that it had a strong effect on 1/3 and 4th instar hatchlings of the *Culex quinquefasciatus*. *Delonix regia* flower extract greatly reduced the hatching fee. It is more sensitive to larvae, and quite toxic pupae are released from third-instar larvae, closing instar larvae. The emergence of adults from treated pupae was definitely inhibited once at a concentration of 200 ppm. Evaluation of the larvicidal effect against 3rd instar larvae of *Hybleapuera* crême with a methanolic extract of *Delonix regia* in the experiment showed that the 4% methanolic extract caused 100% mortality (Table 2).⁷⁸

Antihemolytic activity

Traditionally, *Delonix regia* flower extract has antihemolytic activity. Antihemolytic endeavour was once evaluated in *Delonix regia* flower petals. An experiment showed that a methanolic extract of flowers (25, 50, 75, 100 µg·mL⁻¹) had activity towards isopropyl benzolhydro peroxide and hydrogen peroxide-instigated hemolysis and 90% antihemolytic action.⁷⁹

Protective activity

Delonix regia plant extract provides a rich donation of structurally diverse phytochemicals in addition to diverse herbal medicinal and biological activities induced by sodium arsenic in rat liver toxicity. A phytochemical evaluation of *Delonix regia* leaf extract verified the presence of flavonoids, alkaloids, tannins, terpenoids, glycosides and sugars. This ingredient contains a therapeutic delivery rate of *Delonix regia* leaf extract. Finally, studies have suggested local administration of some extracts of *Delonix regia* to have protective effects on the liver (Table 2).⁸⁰

Allergenicity

Allergic responses to *Delonix regia* dust are tried. The test estimates the commonness of dust sharpening among neighbourhood people. Aerobiological studies and immunoproteomic apparatuses were utilized in the surrounding air for a very long time to record *Delonix regia* dust focuses. Clinico-immunological tests were performed on a subject group. The result is that there is no negatively defenceless reaction to *Delonix regia* dust.⁸⁵

Thermogravimetric analysis (TGA)

Thermal degradation of biomass used to be analyzed with the use of a thermogravimetric analyzer (TG 209 F1 Libra, NETZSCH). Gulmohar seed cellulose is used in this test. In this experiment, thermalevaluation established that entire biomass decomposed in the first stage, whereas in the second stage, about 74.0% of PW and 64.0% of gulmohar seeds were decomposed and whole biomass was decomposed in the 0.33 stage.⁸⁶

Conclusion

Delonix regia is a valuable herb medicinal properties. The plant has already gained worldwide acceptance for medicinal activity. *Delonix regia* plants are not only medical but also fuel and it's flowers are widely used around the world for beautifying roadsides. In the present era, there are various laws, quality control, regulations and regulations for herbal medicines. Steps have been taken to develop the safety and clarity of herbal medicines. *Delonix regia* has a wide spectrum of medicinal properties and scientists demonstrate pharmacological activity in various ailments and it has active and inactive chemical compound values. *Delonix regia* components have been explored for various biological activities: anti-inflammatory, antibacterial, antimicrobial, antidiarrheal, hepatoprotective, antidiabetic, anti-ulcer, anticancer, anthelmintic, cytotoxic, antioxidant, gastroprotective, wound healing, hypoglycemic, antifeedant, protective activity. This review has indicated that *Delonix regia* is an important medicinal plant and in future, isolation of bioactive compounds from this plant can lead to newer drug discoveries.

Conflict of Interest

The authors declare no conflict of interest.

Authors' Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

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