Review on traditional medicinal plant: *Plumeria rubra*

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Abstract

*Plumeria rubra* is an ornamental tree of Apocynaceae family. *Plumeria rubra* is a flowering plant. Flowers are very fragrant, generally red pink or purple center rich with yellow. *Plumeria rubra* reported to have anti-fertility, anti-inflammatory, antioxidant, hepatoprotective and antimicrobial activities. It has been used in the folk medicine systems of civilizations for the treatment however as abortifacient, drastic, purgative, bleomorrhagia, used in toothache and for carious teeth. Flowers are aromatic, bechic and used as very popular pectoral syrup.

Keywords: *Plumeria rubra*, Hepatoprotective, purgative, Antimicrobeal

Introduction

In general, natural drug substances offer four vital and appreciable roles in the modern system of Medicine thereby adequately justifying their legitimate presence in the prevailing therapeutic Arsenal, namely:

(i) Serve as extremely useful natural drugs.

(ii) Provide basic compounds affording less toxic and more effective drug molecules.

(iii) Exploration of biologically active prototypes towards newer and better synthetic drugs.

(iv) Modification of inactive natural products by suitable biological/chemical means into Potent drugs [1, 7, 8].

Plumeria is genus of laticiferous trees and shrubs. Native of tropical America, some ornamental species are grown in warmer region of world. About eight species are reported from India, but owing to the overlapping character of some species, it become difficult to fix their identity.

In traditional system of medicine of India Plumeria species are widely used as purgative, remedy for diarrhea, cure of itch, bronchitis, cough, asthma, fever, piles, dysentery, blood disorder and tumors.

Plumeria is indigenous to tropical America and is found from southern Mexico to northern South America and also most abundant in India. However due to its ease of propagation through cutting, many species and hybrids of plumeria are now widely cultivated and distributed in the warmer region of world.

The trees were introduced to Malaysia and at least three main species are commonly found *plumeria obtusa, plumeria rubra* and *plumeria acuminate*. *Plumeria rubra* commonly grown for their ornamental purpose. The plant is propagated through cuttings. It sets seed rarely in India. The plants raised from the seed shown a wide variation in character evidently being different strains. *Plumeria rubra* is small tree 3.5-6.0 m in high, commonly grown in gardens, leaves lanceolate to obovate –oblong. Flowers very fragrant, generally red pink or purple center rich with yellow.

Flowers large in terminal 2-3 chotomous cymes, bracts many broad, deciduous, calyx small, glandular within, lobes broad, obtuse. corolla salver shaped, throat nacked lobes overlapping to the lefty, rarely to right. Stamen near base of tube. seeds oblong or lanceolate [2, 4, 5].

Its broad, usually round-headed canopy is often about as wide as the tree is tall. The species and hybrids vary somewhat in tree size, compactness, and branching character, leaf and flower size and colour, and deciduousness [9].
**Plant Profile**

**Plumeria rubra**

- **Common Name**: Frangipani
- **Vernacular Name**: Mar - Lal champa
- **English**: Frangipani
- **Kingdom**: Plantae
- **Subkingdom**: Tracheobionta
- **Order**: Gentiales
- **Family**: Apocynaceae
- **Subclass**: Asteridae
- **Class**: Dicotyledons
- **Division**: Magnoliophyta
- **Superdivision**: Spermatophyta
- **Subkingdom**: Tracheobionta
- **Kingdom**: Plantae
- **Vernacular Name**: Mar - Lal champa

Traditional uses:
- Fruit is reported to be eaten in West Indies. in India however it has been used as abortifacient.
- Root bark- Drastic, Purgative, Blenorrhagia.
- Latex – used in toothache and for carious teeth.
- Flowers- Aromatic, Bechic and used as very popular pectoral syrup [3, 6].

**Pharmacological Activity**

- **Anxiolytic effect**: Ethanol extract of flower of *Plumeria rubra* and its fraction was evaluated for anxiolytic effect using elevated plus model of anxiety. It was observed that the flower extract of *Plumeria rubra* and its insoluble butanolic fraction might possess significant anxiolytic potential [10].
- **Antibacterial activity**: *In vitro* antibacterial activity of ethanol, chloroform and ethyl acetate and aqueous extract of leaves of *Plumeria rubra* were performed using disc diffusion method against *S. epidermis* and *E. coli*. Of bacterial strains. It was observed that etanolic extract of leaves showed partial antibacterial activity against *S. epidermis* at 750 and 1000 µg/ml and at 1500 µg/ml in *E. coli*. Chloroform extract showed partial antibacterial activity against *S. epidermis* at 750and 1000 µg/ml and showed complete antibacterial activity against *E. coli* at 1500 µg/ml. Ethyl acetate extract showed partial antibacterial activity against *S. epidermis* at 1000 µg/ml and complete against *E. coli* at 1500 µg/ml aqueous extract shows partial antibacterial activity against *S. epidermis* at 750 and 1500 µg/ml and complete antibacterial activity at 1500 µg/ml for *E. coli* respectively. Standard ciprofloxacin showed complete antibacterial activity against *S. epidermidis* and *E. coli* at 500 µg/ml and 750 µg/ml respectively [11].
- **Antioxidant, cytotoxic and hypolipidemic activity**: Methanolic flower extract of *Plumeria rubra* were evaluated for antioxidant potential, cytotoxic and hypolipidemic activity. DPPH assay showed 72% inhibition and total phenolic content was found 167.3 µg/ml, also observed significant free radical scavenging activity at 1.67 mg/ml. ant cholesterol assay demonstrated that *Plumeria rubra* had highest hypolipidemic activity 60%. It was revealed that MTT assay using HCT cell lines 116 was failed to control proliferation of colon cancer cell by *Plumeria rubra* [12].
- **Hepatoprotective activity**: Alcoholic extract of pod *Plumeria rubra* was evaluated on CCL4 induced hepatic injury in male albino rats. It was found that alcoholic pod extract of *Plumeria rubra* at 200mg/kg and 100mg/kg possess significant hepatoprotective effect [13].
- **Anti-fertility activity**: Ethanolic extract of *Plumeria rubra* evaluated for abortifacient properties. it was observed that at dose of 50,100 and 200 mg/kg body wt produces dose dependent adverse effect on fertility index and number of implantation in the uterine horn of the female rats. by virtue of an increase in percentage of post implementation embryonic loss [14].
- **Antimicrobial activity**: *Plumeria rubra* extracts were evaluated for antimicrobial activity using cup plate method and minimum inhibitory concentration against Escheria Coli, Bacillus subtilis, Staphylococcus aureus and aspergillus niger. It was observed that a methanol extract exhibited significant activity against bacterial strains. As compared with Ciprofloxacin as a standard. Aqueous extract was active against fungal strains as compared with standard Fluconazole [15].
- **Antiviral activity**: *Plumeria rubra* containing fulvoplumerin act as inhibitors of human immunodeficiency virus type 1 (HIV) reversal transcriptase [16].
- **Anti-inflammatory and antioxidant activity**: Methanolic extract of flowers of *Plumeria rubra* showed significant antioxidant and anti-inflammatory activity and phytochemical analysis indicate that *Plumeria rubra* was rich in flavonoid and phenol contents [17].
- **Anthelmintic activity**: Saponin extract of leaves of *Plumeria rubra* exhibited significant anthelmintic effect in concentration of 25 mg/ml comparable with the standard piperazine citrate [18].
- **Antioxidative and proteolytic activities**: *Anti-oxidative* and proteolytic activities were performed on lattices of *Plumeria rubra*. results revealed that *plumeria rubra* possesses relevant enzymatic and proteolytic activities [19].
- **Anti-microbial activity and phytochemical constituents of methanol extract of *Plumeria rubra* (flower and leaf)** was investigated. Phytochemical screening of the crude extract revealed the presence of tannins, phlobatannins, saponins, flavonoids, steroids, terpenoids, cardiac glycosides and reducing sugar. Phlobatannins were found to be absent in the methanol extract of *Plumeria rubra* (flower). All the crude extract displayed higher inhibitory effects at the tested concentration (20 mg/ml) except on *Corynebacterium pyogenes* and *Bacillus anthracis of Plumeria rubra leaf* [20].
- **P. rubra flowers revealed the presence of tannins, alkaloids, flavonoids, saponins, gums and terpenoids.**
Phytochemical Activity

- Flowers contain resin, quercitin, and traces of kaemferol and cyanidin diglycosides. Fresh leaves and bark contain plumeride, resinic acid, bark also contain fulvoplumerin, a mixture of terpenoids and sterols plumeride. The latex coagulum from branches gave caoutchoue and resin matter.
- Chemical composition of essential oil obtained by hydrodistillation of the leaves were (Z)-β-farnesene α-patchoulene, limonene, (E)-β-farnesene, α-copaene and phytol. However, the quantitative significant compounds of the flowers oil were (E)-non-2-en-1-ol, limonene, phenyl acetaldehyde, n-tetradecanal, γ-eleme and (E,E)-α-farnesene.
- Compounds isolated from ethanol soluble fraction of methanol extract of Plumeria rubra are Rubranoside glucopyranosylnaringenin, a new flavanone glycoside, rubranin, a new sphenolipid rubradoid, a new iridoid glycoside, rubrajaleelol and rubrajaleelic acid.
- The latex coagulum from branches gave caoutchoue and resin matter.
- In the essential oil, 13 hydrocarbons, 17 alcohols, 13 esters, 9 aldehydes and 15 miscellaneous compounds were detected.
- Five compounds were isolated from the alcoholic extract of the leaves and were identified as lupeol nanaoate, lupeol heptanoate, rubrinol glucoside, β-sitosterol-β-D-glucoside, and plumeiride coumarate, on the basis of their physicochemical characters and spectral analyses.
- Plumeia rubra has resulted in identification of 41 compounds. Oil comprised 10 esters (43.3%), 11 hydrocarbons (8.1%), 10 alcohol (29.8%), 4 carboxylic acids (8.5%), 2 ethers (1.0%), 3 aldehyde (2.5%) benzyl salicylate (20.9%).
- Plumeria Rubra is a good source of ursolic acid, is a natural pentacyclic triterpenoid carboxylic acid.
- The gas chromatography of Plumeria rubra revealed that floral oil comprises 31 volatile component mainly of alkane acid, lauric acid, myristic acid and palmitic acid, were major component, rest of oil contains hydrocarbon, alcohol, ether, aldehyde etc.
- The compounds were isolated from the heartwood of Plumeria rubra, Plumericin and isoplumericin displayed molluscicidal, cytotoxic and antibacterial activity, hydroxyacetophenone was weakly cytotoxic.
- By bioactivity-directed fractionation of the P. rubra, cytotoxic constituents have been reported from the bark of Plumeria rubra collected in Indonesia. Three iridoids, fulvoplumerin, allamcin, and allamanin, as well as 2, 5-dimethoxy-p-benzoquinonewere found to be active constituents.
- The flower volatile constituents of Plumeria rubra L. grown in foothills of north India were analyzed by gas chromatography (GC) and GC-mass spectrometry (GC-MS). Altogether 31 constituents, representing 94.0% of flower essential oil and 89.2% of steam volatile extract were identified. Benzyl esters (49.0%, 41.4%), alicyclic alkanes (25.8%, 7.2%), oxygenated monoterpenes (0.1%, 27.1%), oxygenated sesquiterpenes (9.5%, 8.8%), and diterpene (9.4%, 0.2%), were the major class of constituents. Benzyl salicylate (26.7%, 33.5%), benzyl benzoate (22.3%, 7.9%), geraniol (trace, 17.2%), (E,E)-geranyl linalool (9.4%, 0.2%), tricosen (8.3%, 1.1%), linalool (0.1%, 8.0%), nonadecane (7.0%, 3.8%), (E)-nerolidol (7.0%, 5.5%), and pentacosane (4.4%, 0.3%) were the major constituents identified in flower oil and hydrodistilled volatile distillate. Results were compared with reported floral compositions of Plumeria rubra for medicinal purpose. The compounds isolated from plant parts species with the structures have been studied along with traditional uses and pharmacological activity. The evaluation needs to be carried out on Plumeria rubra in order to use the plant in formulation for their practical and clinical applications, used for the welfare of the mankind.

Conclusion

The present review describes the phytochemical and pharmacological screening of Plumeria rubra for medicinal purpose. The compounds isolated from plant parts species with the structures have been studied along with traditional uses and pharmacological activity. The evaluation needs to be carried out on Plumeria rubra in order to use the plant in formulation for their practical and clinical applications, used for the welfare of the mankind.

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References

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