



## International Journal of Pharmacy & Therapeutics

Journal homepage: [www.ijptjournal.com](http://www.ijptjournal.com)

# IJPT

### **PLUMERIA RUBRA LINN. : AN INDIAN MEDICINAL PLANT**

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#### **ABSTRACT**

Since ancient times, plants have been an exemplary source of medicine. Research conducted in last few decades on the plant mentioned in ancient literature or used traditionally. *Plumeria rubra* is one such plant that has been frequently used as medicine which belongs to *Plumeria* genus. The decoction of the bark and roots of *P.rubra* used to treat asthma, ease constipation, promote menstruation, venereal disease, reduces fever and latex used to soothe irritation. The plant contains various phytoconstituents like the cytotoxic iridoids, fulvoplumerin, oleanane type triterpene etc. This present review summarizes the physiochemical constituent and also pharmacological reports that have been shown promising results.

**Keywords:** *Plumeria rubra*, Chemical constituents, pharmacology, Apocynaceae.

#### **INTRODUCTION**

*Plumeria rubra* (Hindi name: Lal champa; English: True Frangipani) belonging to Family Apocynaceae. They have laticiferous trees and shrubs; native of tropical America. *Plumeria* plants are famous for their attractiveness and fragrant flowers. *Plumeria rubra* is a small beautiful, flowering tree, with a wide variety of flower colors. It is the most commonly seen in Florida. The waxy, long-lasting flowers are sweetly perfumed, making the species a natural for many warm-climate gardens around the world. Some ornamental species are grown in the warmer regions of the world. About eight species are reported from India, but owing to the overlapping of characters in some species; it become difficult to fix their identity. *Plumeria acuminata* and *Plumeria rubra* are commonly grown for their ornamental flowers.

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*Plumeria rubra* is native of tropical America and is cultivated in various parts of North America, West Indies, Malay Archipelago, Cochin China, Jamaica, Brazil and Guiana. It is an easily growing plant. *Plumeria* is a common ornamental in Yards and other planned landscapes. It is easily to growing in hot, dry areas and is found in Hawaii from sea level to 2000 ft elevation. It has moderate wind resistance and salt tolerance. For best growth and flowering in the landscape, irrigation is needed during dry periods. The trees reach maturity (full size) in about five year. The fruit is reported to be eaten in West Indies. In India; however, it has been used as an abortifacient (Kirtikar KR and Basu BD, 1935).

#### **Morphological Characteristics**

Frangipani is well- known for its intensely fragrant, lovely, spiral shaped, reddish brooms which appear at branch tips June to November. The plant is erect, branches are very thick. Leaves are scattered, lanceolate to obovate, nerves numerous, horizontal and 12.5 to 20 cm long. Flowers are very fragrant, generally red, pink or purple centered with rich yellow. They are

large in terminal, 2-3 cymose cymes, bracts many, broad, deciduous. Calyx small, 5-lobed, eglandular within; lobes broad, obtuse. Corolla salver shaped, throat necked, Stamens near the base of the tube, anthers obtuse, cell rounded at the base. Disk 0 or lining the calyx tube. Carpels 2, distinct; Style short; Stigma, 2 lobed; Ovules many seriate in each cell. Flowers of most cultivars are highly fragrant and bloom from March to October. The hybrids differ in their profusion of blooms; with some producing more than 200 flowers per cluster and other only 50-60 flowers. Follicles are linear oblong or ellipsoid. Seeds are oblong or lanceolate, plano convex, winged, albumen fleshy, thin; cotyledons oblong or ovate-cordate (Anonymous 1).

### General and Medicinal Uses

Various scientific evaluations have been conducted to verify the traditional uses of this plant in the folk medicine. The fruit is reported to be eaten in West Indies. In India, however, it has been used as an abortifacient. Medicinal properties of *P. rubra* are more or less similar to those of *P. acuminata* (Watt JM and Breyer-Brandwijk MG, 1962). According to some authorities, *P. acuminata* is considered as a variety or a form of *P. rubra* linn. The flowers are aromatic and bechic and widely used in pectoral syrups. The essential oils from the flowers used for perfumery and aromatherapy purposes. The flowers decoction of *P. rubra* was reported to use in Mexico for control of diabetes mellitus. The Leaves of *P. rubra* are used in ulcers, leprosy, inflammations and rubefacient (Bobbarala V et al., 2000).

A decoction of the bark has been used for the treatment of venereal disease and also used in the indigenous system of medicine for the treatment of rheumatism, diarrhoea, blennorrhoea and leprosy. The decoction of the bark and roots of *P. rubra* is traditionally used to treat asthma, ease constipation, promote menstruation and reduce fever. The root bark is a drastic purgative used mostly for blennorrhagia in Guiana. For instance, the extract obtained from the bark of *P. acuminata* was found having antimutagenic properties (Guevara AP et al., 1966). The leaves extract of *P. rubra* exhibited antibacterial activity (Hamburger MO et al., 1991). While the barks extract showed cytotoxic effects against a number of in vitro human cancer cell lines (breast, colon, lung, fibrosarcoma and melanoma) (Kardono LB et al., 1990). The flowers and the latex of *Plumeria rubra* can be used for stopping vaginal bloodshed, and tooth headache, and the latex of the plant is used against earache. Infusions are used as an eye-cleaning liquid (Ruiz F et al., 2008). The root bark is bitter, pungent, acrid, heating, carminative, laxative; useful in leprosy, itching, ulcers, pains, ascites -In general

the therapeutic properties are the same as those of *Michelia champaca* (Ayurveda). The root bark is purgative; useful in gleet, urinary discharges, venereal sores; cures tumours and rheumatic pains (Yunani).

### Toxicology

The barks extract of *P. rubra* showed cytotoxic effects against a number of in vitro human cancer cell lines (breast, colon, lung, fibrosarcoma and melanoma).

### Phytochemistry of *P. Rubra*

The flowers contain resin, quercetin, traces of kamempferol and a cyanidin diglycoside. It contains seven volatile constituents like 2-methylbutan-1-ol,  $\beta$ -phenylethyl alcohol, nanodecane, heneicosane, benzyl salicylate, tetradecanoic acid and phenylacetaldehyde. Amongst them 2-methylbutan-1-ol could be considered as the chemical marker in characterizing its essential oil. The occurrence of this constituent together with  $\beta$ -phenylethyl alcohol, phenylacetaldehyde, nanodecane and heneicosane in Malaysian varieties of *P. rubra* agree with the finding of on the essential oil of *Plumeria rubra* bryan cultivar of *P. rubra* from Hawaii (Omata A et al., 1992). The essential oil of *Plumeria rubra* form *acutifolia* (Poir.) Woodson cv. 'Common Yellow' growing in Hawaii was extracted by simultaneous distillation and extraction (SDE) and analysed with GC and GC-MS, and a total of 74 compounds were identified. Linalol, phenylacetaldehyde, *trans,trans*-farnesol,  $\beta$ -phenylethyl alcohol, geraniol,  $\alpha$ -terpineol, neral and geranial were found to make a major contribution to the floral scent of this flower. They investigated the Phytochemical Screening of Methanol extract of *P. rubra* flower and leaf and found Tannins, Flavonoids, Terpenoids, Reducing sugar and Alkaloids in flower and leaf and other Phlobatannins, Saponins, Steroids, Carbonyl in only leaf and extract displayed antimicrobial activity (20 mg/ml) using agar well technique (Omata A et al., 2007).

The fresh leaves and bark contain respectively: plumieride, 0.83, 0.53 and resinic acid, 1.26, 0.4%. A recent examination of the fulvoplumierin, a mixture of terpenoids and sterols and large quantities of plumieride. The latex coagulum from the young branches on analysis gave: caoutchouc, 25.5; resinous matter, 21.9; and moisture, 15.7%. The bark contains the cytotoxic iridoids, fulvoplumierin, allamcin, allamandin, 2, 5-dimethoxy-p-benzoquinone, plumericin and the lignin liriodeन्द्रin. Five additional iridoids, 15-demethylplumieride, plumieride,  $\alpha$ -allamcinidin,  $\beta$ -allamcinidin, and 13-O-*trans*-p-coumaroylplumieride were obtained as inactive constituents. A flavan-3-ol-glycoside, plumerubroside (C<sub>24</sub>H<sub>30</sub>O<sub>12</sub>, m p 210-11°C) and a bicyclic lupin alkaloid, plumerinine is also reported from the stem-bark of *P. rubra* (Akhtar et al., 1994). Recently, Comins

and Coworkers devised a stereocontrolled total synthesis of (+/-) plumerinine and showed that its NMR data differ from natural plumerinine. The plant contains the oleanane type triterpenes, 6 $\alpha$ -hydroxy-epi-oleanolic acid (C<sub>30</sub>H<sub>48</sub>O<sub>4</sub>, mp 235-37°C) and 3 $\alpha$ , 27-dihydroxy-olean-12-ene (C<sub>30</sub>H<sub>50</sub>O<sub>2</sub>, m p 183-84°C) (Akhtar N *et al.*, 1994). The two new iridoid Diastereoisomers were isolated from the flowers of *P. rubra* L. cv. *Acutifolia* and structure was elucidated using spectroscopic methods (Ye G *et al.*, 2008). The compound Plumericin, isoplumericin, 4-hydroxyacetophenone, plumeride, 13-O-coumaroylplumeride and protoplumericine A were isolated from the heartwood of *Plumeria rubra*. Significant amounts of immunoreactive cardiac glycoside were found to be present in the *Plumeria. rubra* (Radford DJ *et al.*, 1986).

The plant contains the triterpene, rubrinol (3 $\beta$ , 30-dihydroxy-12-ursene, C<sub>30</sub>H<sub>50</sub>O<sub>2</sub>, m p 244°C). It also contains taraxateryl acetate, lupeol, stigmasterol, oleanolic acid and cycloart-22-ene-3 $\alpha$ ,25-diol.

#### Pharmacological Properties of *Plumeria rubra*

The plant is reputed to possess purgative, diuretic, abortifacient and antituberculous properties and is also used as a remedy for rheumatism, diarrhoea, blennorrhoea,

gonorrhoea, syphilis, venereal sores and leprosy (Comins DL *et al.*, 2002). The leaves extract of *P. rubra* exhibited antibacterial activity (Hamburger *et al.* 1991). While the barks extract showed cytotoxic effects against a number of in vitro human cancer cell lines (breast, colon, lung, fibrosarcoma and melanoma). The antimicrobial properties of the essential oils (2  $\mu$ l per disk) were determined in vitro using agar diffusion method. Fulvoplumerin, an iridoid obtained as a constituent of *P. rubra* L., has been shown to inhibit HIV-1 [IC<sub>50</sub>=98  $\mu$ g/ml (400  $\mu$ M)] and HIV-2 [IC<sub>50</sub>=87  $\mu$ g/ml (357 $\mu$ M)] Reverse transcriptases to similar extents (Tan GT *et al.*, 1992). The medicinal plant *P. rubra* is Reported source of Cardiac glycoside which have positive inotropic effect and used in Congestive cardiac failure (Nick. H *et al.*, 1998).

Rubrinol showed antibacterial activity against two gram positive (*Bacillus anthracis*, *Corynebacterium pseudodiphthericum*) and two gram negative (*Pseudomonas aeruginosa* and *P. pseudomallei*) organisms. *P. aeruginosa* is a causative agent responsible for infecting burns, wounds, and urinary tract; it also causes infection in cystic fibrosis patients; *P. pseudomallei* causes melioidosis or pseudoglanders.



Figure 1. Flowers of *Plumeria rubra*

#### CONCLUSION

Pharmaceutical researches conducted over the past few decades show that the natural products are potential sources of novel molecules for drug development (Farnsworth NR *et al.*, 1990). As we concluded that the medicinal plant *Plumeria rubra* was used in treatment of venereal disease, rheumatism, diarrhoea, blennorrhoea, asthma, leprosy and reduce fever and have

phytoconstituents like cytotoxic iridoids, Tannins, Flavanoid, terpenoid, reducing sugar, phlobatannins, saponins, steroids and carbonyl.

#### ACKNOWLEDGEMENT

We would like to thank Mrs Fatma Rafiq Zakaria, Hona'ble Chairman of Maulana Azad Education Trust, Dr. Rafiq Zakaria Campus for providing us all the facilities to complete our work successfully.

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