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Review Article

AN REVIEW OF PHYTOCHEMICAL CONSTITUENTS & PHARMACOLOGICAL ACTIVITY OF *PLUMERIA* SPECIES

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ABSTRACT

In Indian system of medicine, a large number of drugs of either herbal or mineral origin have been advocated for various types of diseases, India has been one of the pioneers in the development and practice of well-documented indigenous systems of medicine, particularly Ayurveda, Siddha and Unani. For millennia, the Indian population has depended mainly upon plant based crude drugs for a variety of ailments. This alternative system of medicine is gaining increasing popularity worldwidePlumeria species are widely used as a purgative, remedy for diarrhea,cure of itch, bronchitis, cough,asthma, fever bleeding piles, dysentery, blood disorders and tumors etc. .This review on plumeria species focuses over the plant chemical compositions, its ethnomedicinal uses, linked from ancient times to the present with a scope of development in future.

Keywords: Plumeria, Antioxidants, Antitumor, Antinociceptive Activity.

INTRODUCTION

Ayurveda,the ancient Indian therapeutic measure is renowned as one of the major systems of alternative and complementary medicine. As other herbal systems, greater parts of its medicaments are based on indigenous herbals. And the thorough and fractionate knowledge about the medicinal plant is mandatory for all who is working in the field of Ayurveda, in order to identify and select the appropriate plant for a specific disease. In the recent years, the interest in medicinal plants has increased in a great deal. Apart from this; people from the west have also taken this matter seriously by conducting various researches on plant based medicines

In tradition system of medicine of plant of India Plumeria species are widely used as a purgative, yremedy for diarrhea, cure of itch, bronchitis, cough, asthma, fever, bleeding, piles, dysentery,blood disorders and tumours[1]

Plumeria L. (Family: Apocynaceae) is indigenous to tropical America and is found from southern Mexico to northern South America and also most abudent in India[2]. However, due to its ease of propagation through cuttings, many species and hybrids of Plumeria are now widely cultivated and distributed in the wanner regions of the world [3].

Plumeria, the most celebrated of all tropical flowers, in India commonly known as frangipani. While in Malaysia, it is most famously called 'kemboja,' but several other names such as 'pokok kubur' and 'bunga kubur' have been used to refer to different species and hybrids of Plumeria . The trees were introduced to Malaysia and at least three main species are commonly found: *Plumeria obtusa, P. rubra and P. acuminata* (designated as *P. acutifolia* Poir. by Burkill and revised as P. ruhra (arma acutifolia (Poir.) [5]

Taxonomical classification of Plumeria species

- **Domain:** *Eukaryota*
- **Kingdom:** *Plantae*
- **Subkingdom:** *Viridaeplantae*
- **Phylum:** *Magnoliophyta*
- **Subphylum:** *Euphyllophytina*
- **Infraphylum:** *Radiatopses*
- **Class:** *Magnoliopsida*
- **Subclass:** *Lamiidae*
- **Superorder:** *Gentiananae*
- **Order:** *Apocynales*
- **Family:** *Apocynaceae*
- **Genus:** *Plumeria*

Plumeria obusta has white flowers with small brilliant yellow centre.,up to 9 cm in diameter; the leaves are dark green, glossy, obovate and obuste at both ends. Tree can grow to about 6-9 m tall and partly deciduous at different times of the year.

While *plumeria acuminate* is an evergreen or Partly deciduous tree up to 6 cm high; leaves are light green in colour, elliptic in shape with acuminate tips and the colour of the flower can vary from white to yellow [6]

All species are small trees with very thick, fleshy, stout branches and produce a milky juice when the leaves or branches are cut. The leaves are spirally arranged near the ends of the swollen branches and fruits are as a pair of cylindrical, horn shaped with many flat seeds shortly winged at one end. In general, frangipani leaves are green and the flowers are large, waxy, very fragrant, in terminal or lateral stalked cluster [7].

Plumeria rubra in contrast, has flowers in various shades of red, pink, orange and yellow; the leaves also have many different sizes, shapes and colors [8]. This species is a deciduous tree which can exceed 10 m tall in the tropics but in the subtropics, it is unlikely to reach more than 4 m high [9].

Plumerias are believed to be brought to the Far East by the Spanish not just as ornamental trees but more of their medicinal properties. The indigenous medical traditions in Java and Madoera make use of decoction of the leaves as lotion for cracks and eruptions on the soles of the feet while decoction of the bark is given for gonorrhoea, dropsical and venereal affections. In the Philippine Islands and West Indies the milky latex and decoction of the bark are reputed to possess purgative, emmenagogic, febrifugic and diuretic properties. In India the plant also finds applications in treatment of skin diseases, fevers, dispersed dropsies and the flowers are even eaten with betel leaves to cure ague [2].

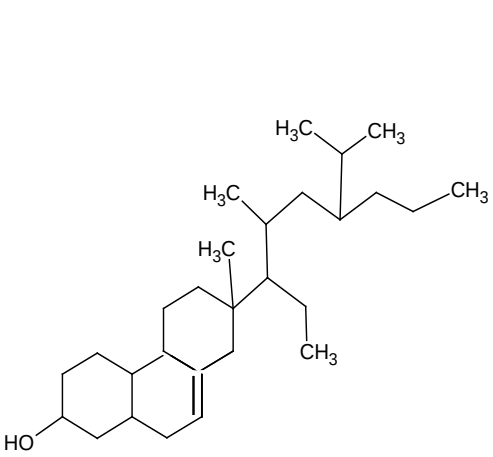
Phytochemistry

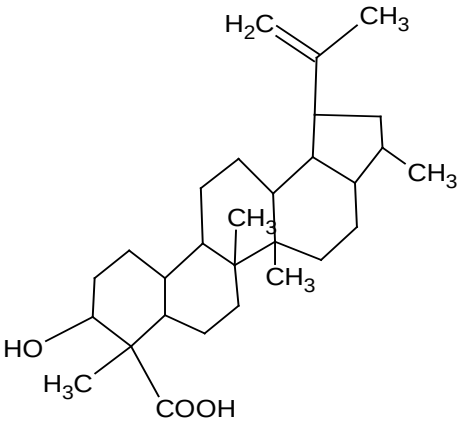
Preliminary phytochemical screening:-

The different extracts of plumeria species were analysed for the presence of alkaloids, glycosides, terpenoids reducing sugars, saponins, tannins, carbonyls, flavonoids phlobatannis and steroid.

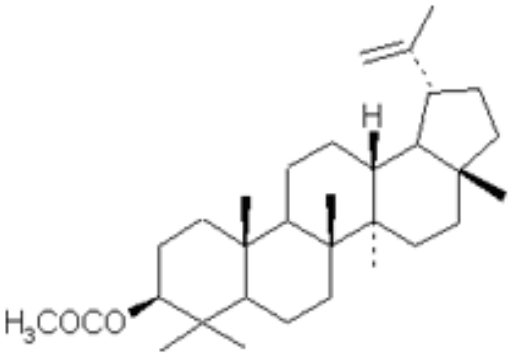
Phytochemical studies on genus *Plumeria* started as far back as 1870 when Peckolt and Boorsma reported the isolation ofthe main iridoid glucoside Plumieride from the stem bark of *P. rubra* and *P. lancifolia* respectively[10]

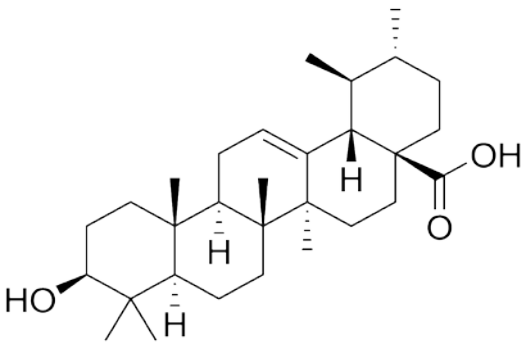
Phytochemical constituents from Plumeria acuminate 1)Stigmast-7-enol(1), Lupeol carboxylic acid(2), lupeol acetate(3), Urosolic acid(4) had isolated from ethanolic extract of leaves *of Plumeria acuminata* & also shows significant atimutagenic activity[11].





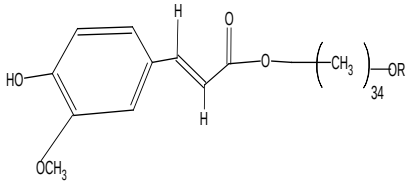
Stigmast-7-enol (1) Lupeol carboxylic acid(2)





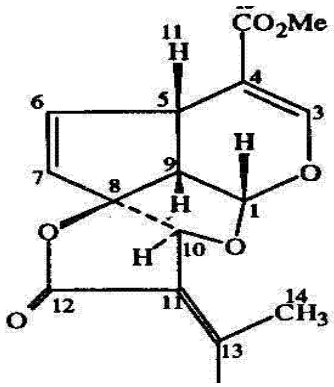
Lupeol Acetate(3) Ursolic Acid(4)

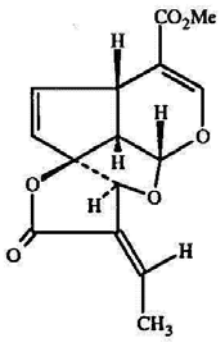
2)Ferulic acid derivatives 34-hydroxy tetratriacontanyl ferulate(5) and 34-O-acetyl tetratriacontanyl ferulate[6], were isolated, along with plumericin(7) and isoplumericin(8), from the stem bark of *Plumeria bicolor*[12].



R=H (34-Hydroxy tetratriacontanyl ferulic acid ester)(5)

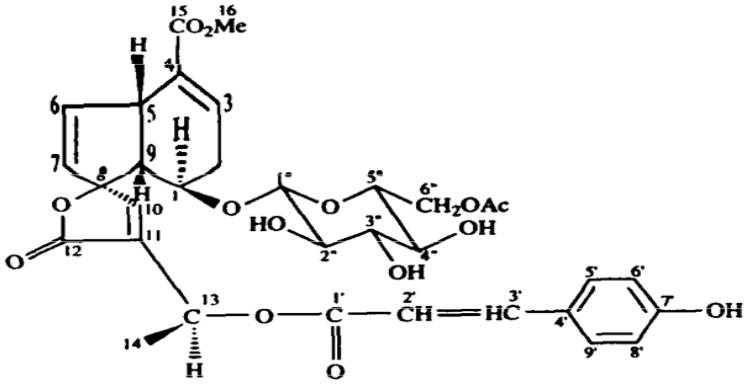
R=OCH_3 (34-O-Acetyl tetratriacontanyl ferulate)(6)





Plumericin(7) Isoplumericin(8)

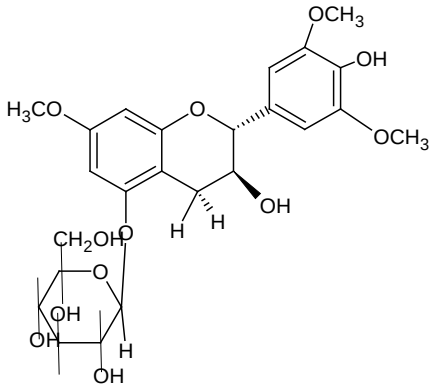
3) Two new and three known iridoids had isolated from the fresh, whole spring leaves of *Plumeria obtusa***.** The new iridoids have been characterized as 6''-O-acetylplumieride p-E-coumarate (9) and 6''-0-acetylplumieride -p-Z-coumarate(10), while the remaining compounds have been identified as plumieride, plumieride p-Z-coumarate and plumieride p-E-coumarate through spectral studies[13].



1]2',3'E(6”-O-acetylplumieride p-E-coumarate)(9)

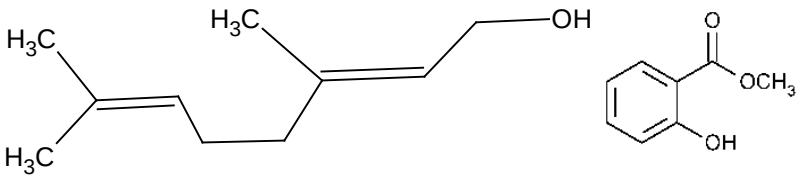
2]2',3'Z(6”-0-acetylplumierid p-Z-coumarate)(10)

4)(2R,3s)-3,4’dihdroxy-7,3’,5’-trimethoxyflavan-5-O-β-*D-glucopyranoside(*11)asFlavan3- Ol Glycoside had isolated From Bark Of *Plumeria Rubra*[14].

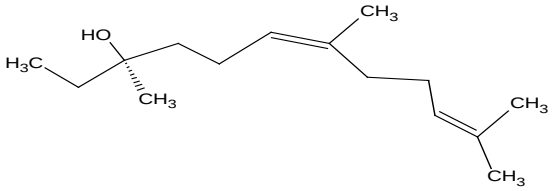


(2R,3s)-3,4’dihdroxy-7,3’,5’-trimethoxyflavan-5-O-β-*D-glucopyranoside.(11)*

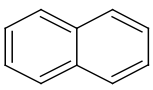
5)Theflowerof *Plumeriarubra* consist1, 1diethoxyethane, benzaldehyde, geraniol[12], citral, methylbenzoate(13), Nerolidols(14), Naphathalene(15), linalool(16), Banzylbenzoate, methyl salicylate[15, 16].



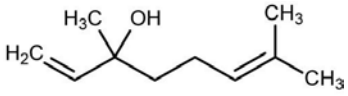
Geranial (12) Methyl benzoyate(13)



Nerolidols(14)

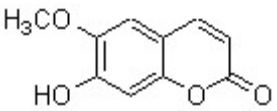


Naphthalene (15)

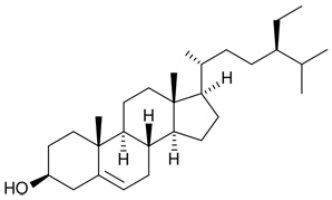


Linalool (16)

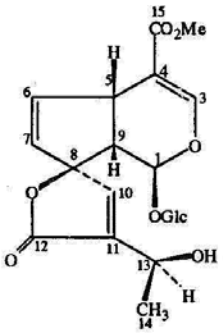
6)The bark of plumeria rubra Consists scopoletin[17], β-Sitosterol(18), Plumieride [19], fulvoplumerin(20), The root contains plumericine, , β-dihydroplumericin(21), isoplumericin(22), β-dihydroplumericinic acid, Fulvoplumerin and plumeride. Rubrinol; an antibacterial tritripenoid. together with teraxasteryl acetate, lupeol, stigmasterol, oleanolic acid[17].



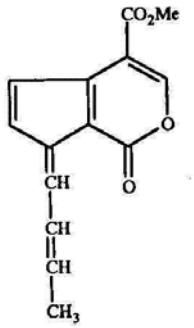
Scopoletin (17)



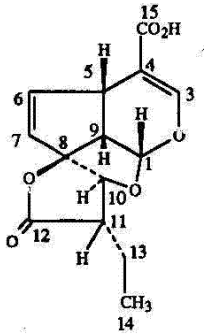
β-Sitosterol(18)



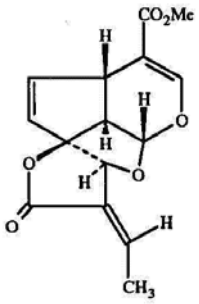
Plumieride(19)



Fulvoplumericin(20)



Dihydroplumericine[21]



Isoplumiricin[22]

7) The oil of P obtusa was found to be rich in benzyl salicylate (45.4%) and benzyl benzoate (17.2%), but also minute concentrations of alkanoic acids. oil obtained from *P.acuminata* was rich in palmitic acid (36.2%), linoleic acid (16.8%), lauric acid (10.4%) and myristic acid (10.3%). The pink flowered *P. rubra* oil was similar to *P. acuminata* oil in that it was also devoid of benzyl salicylate and benzyl benzoate and rich in alkanoic acids but linoleic acid was absent in the oil of the former. However, the orange flowered P. rubra oil contained both the non-terpene esters (benzyl salicylate, benzyl benzoate and 2-phenylethyl benzoate) and alkanoic acids in significant amounts. The orange flowered cultivar had the highest concentration of (E)-nerolidol (14.4%) and geraniol (4.1%) among the species studied [18].

Pharmacolgical activity

1) Antiinflammatory activity

Methanolic extract of leaves of *Plumeia acuminata* shows significant antiinflammatory activity carried on carrageenan, dextran, histamine and serotonin-induced inflammation in rat hind paw oedema models.

Result shows that methanolic extract shows significant anti-inflammatory activity on the tested experimental animal models. The extract (500 $mgkg^{-1}$ b.w) exhibited maximum antiinflammatory effect i.e., 30.51, 47.06, 34.48 and 32.50% ($P < 0.001$) at the end of 3 h with carrageenan, dextran, histamine and serotonin respectively. Administration of MEPA (500 $mgkg^{-1}$ b.w) and indomethacin (10 $mgkg^{-1}$ b.w) significantly reduced the formation of granuloma tissue induced by cotton pellet method at a rate of 45.06 and 51.57% respectively. The effect produced by the extract was comparable to that of indomethacin a prototype of a nonsteroidal antiinflammatory agent.[19]

2) Antioxidant, Free Radical Scavenging Activitiy and hypolipidemic activity

Methanolic extract of *Plumeria acuminata* shows significant antioxidant and Free Radical Scavenging Activities.result shows that the different concentration of Methanolic extract at 50, 100, 200, 300, 400 and500 µg mL-1 showed antioxidant activities in a dose dependent manner and had 46.01, 52.83, 57.43, 61.38, 68.27 and 73.14% inhibition, respectively on lipid peroxidation of linoleic acid system. At the same time α-tocopherol at the concentration 500 µg mL-1 showed 81.21% inhibition[20].

Flavone glycoside isolated from *Plumeria rubra* shows antioxidant and hypolipidemic activity.

Flavone glycoside on treatment to the hyperglycemic animals, there was no significant alteration in the blood glucose and serum total cholesterol, while a significant reduction in the level of serum triglycerides was observed when compared with the alloxan injected hyperglycemic control animals[21].

3) Antipyretic and Antinociceptive Activity

A single oral administration of Methanolic extract at different doses (100, 250 and 500 mg kg^{-1}) showed significant reduction in brewer`s yeast induced hyperthermia in rats. Methanolic extract extract *Plumeria acuminata* also elicited pronounced inhibitory effect on acetic acid-induced writhing response, hot plate, tail flick and tail immersion responses in mice in the antinociceptive test[22]

4) Antimicrobial activity

Methanolic extract of *Plumeria acuminata* were investigated for their invitro antimicrobial properties by agar disc diffusion method, . The crude methanolic extracts MEPA inhibited the growth of both gram positive bacteria *(Bacillus subtilis, Stephyltococcus aureus pers.and Micrococcus luteus*) and Gram negative bacteria (*Escherichia coli, Pseudomsonas aeruginosa and Salmonella typhimurium*). The Gram positive bacteria tested appeared to be more susceptible to the extracts than the Gram negative bacteria[23].

Methanolic extract of *Plumeria rubra*(leaf &flower) were able to shows antimicrobial action against different bacteria, Result shows extract Methanolic extract of leaf and flower of Plumeria rubra inhibits the growth of the 14 indicator bacteria with the zone inhlbiton between 12-28 mm. The extract *P.rubra* flowers found more active than the leaf part against Bacillus cereus with zone of inhibition of 28 [24].

Essential oils from flowers of *Plumeria alba* were tested against set of microorganisms in order to estimate their antimicrobial potentials.

Result shows that Gram negative bacteria appear to be least sensitive to the action of many other plants essential oils.18-23 The volatile oils of *P. alba* flower part were more active against *S. aureus* and *B. subtilis* , presenting an important growth inhibition at lower concentrations [25]

Ethanolic extract of *Plumeria acutifolia* stem, bark was tested for antimicrobial activity against Gram-positive bacteria (*Bacillus subtilis, Enterococcus faecalis, Staphylococcus aureus*), Gram-negative bacteria (*Escherichia coli, Klebsiella Pnumoniae, Psuedomonas aeruginosa, Salmonella typhimurium*) and fungi (*Aspergillus niger and candida albicans*) by disc diffusion method. Minimal inhibitory concentration (MIC) and acute toxicity were also assayed. The ethanol extract showed the strong in vitro antimicrobial activity against E. faecalis, B. subtilis, S. aureus, P. aeruginosa, S. typhimurium, A. niger and C. albicans. The extract did not show any toxic symptoms against the tested mice[26].

The anti-bacterial and anti-fungal activities of methanolic extract and the isolated fraction of the plant *Plumeria alba* was assessed by standard dilution test using Mueller Hinton agar (MH) medium. The zone of inhibition was compared with that of Standard antibiotic ciprofloxacin (5mg/disc) by disc diffusion method. The Anti fungal activity was assessed by standard dilution technique using Sabouraud (SDA) dextrose agar medium. The results are compared with standard Clotrimazole (125mcg/ml). An attempt was made to isolate the fraction responsible for the antimicrobial property of the extract. The methanol extract showed potential anti-bacterial and anti-fungal properties comparable with standard Ciprofloxacin and Clotrimazole respectively against the organism examined. The minimum inhibitory concentration (MIC) of the extract for antibacterial activity was 200mcg/ml. The isolated fraction was also found to possess antimicrobial properties similar to that of the crude extract. The MIC of the fraction was 133.33mcg/ml and the thin layer chromatographic study of the fraction showed it as triterpenes. The study suggests that the plant is promising for development of phytomedicine for antimicrobial properties[27].

5) Antitumour and antcancer activity

Methanolic extract of plumeria alba leaves possesses significant antitumour activity against dalton lymphoma ascites in mice result shows that methanolic extract of *Plumeria alba* can significantly prolong the life span, reduce tumour volume and improve the haemotological parameters of the host(mice)[28].

Anti cancer activity of ethanolic extract of Leaves of *Plumeria rubra* against Ehrlich Ascites Carcinoma (EAC) in Swiss albino mice. The extract at the dose of 200 mg/kg body and 400 mg/kg body weight were administered orally which increases the life span of EAC treated mice and restore the hematological parameters as compared with the EAC bearing mice[29].

6) Antiviral activity

Plumeria rubra containing fulvoplumierin act as inhibitors of human immunodeficiency virus type 1 (HIV) revarse trancriptase [30]

CONCLUSION

Our pharmaceutical industry continuously search new lead molecules having better therapeutic action and less side effect, In recent years lead molecules from natural origin had gaining more popularity due to less side effect and better therapeutic action. Particularly in antimicrobial field because of rapidly developing resistance to synthetic molecules, Present review indicats that different extracts shows good pharmacological action. That means plumeria species has wide scope to isolate various phytochemical constituent and evaluate their pharmacological screening to get better therapeutic value.

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