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COMPREHENSIVE OVERVIEW OF *PLUMERIA OBTUSA*

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ABSTRACT

The various species of *Plumeria* are known to have medicinal properties and have a long history of use by indigenous and tribal people in India. The medicinal value of this *Plumeria* species in the treatment of a large number of human ailments is mentioned in *Ayurveda, Charaka Samhita and Sushruta Samhita* mentions the medicinal value of Plumeria species in the treatment of a large number of human diseases. These plants are well known for their religious value, cosmetic importance and tremendous potential to be used as medicinal agents to cure infections, digestive diseases, anti-inflammatory and antipyretic action, anti-tumor potential, anti-oxidant properties, as a purgative, remedy for diarrhea, bronchitis, cough, asthma, fever bleeding piles, dysentery, blood disorders and tumors etc. Today it is a challenge for scientists to provide efficient, safe and cheap medications. In this case *Plumeria* can be an exclusive medicine which is widely distributed throughout our country. The present review gives an overview of *P.obtusa* with reference to to its botanical aspects, ethnobotanical uses, Phytochemistry and pharmacological activity.

KEYWORDS: *Plumeria* species, *Plumeria obtusa*, Singapore graveyard flower, Phytochemistry, Pharmacological activity.

Contents

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, remedy for diarrhoea, 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 warmer regions of the world.[3]

Plumeria obtusa, the Singapore graveyard flower,.[4] is a species of the genus Plumeria (Apocynaceae). Locally it called as Frangipani or Champa. Indigenous to Central America, Southern Mexico, Southeast Asia. The leaves are dark green in colour and glossy. Leaves are elliptical and obovate. Apex is rounded. Flowers are white in colour with yellow central portion and rounded obovate petals. The seeds produce the white, red, pink, yellow and multicoloured blooms. You can recognize Plumeria seed by locating a pod that splits open on the tree.[5] The plant is widely cultivated for its ornamental and fragrant flowers around the world, where suitably warm climate exists. It is reportedly naturalized in China.[6][7]

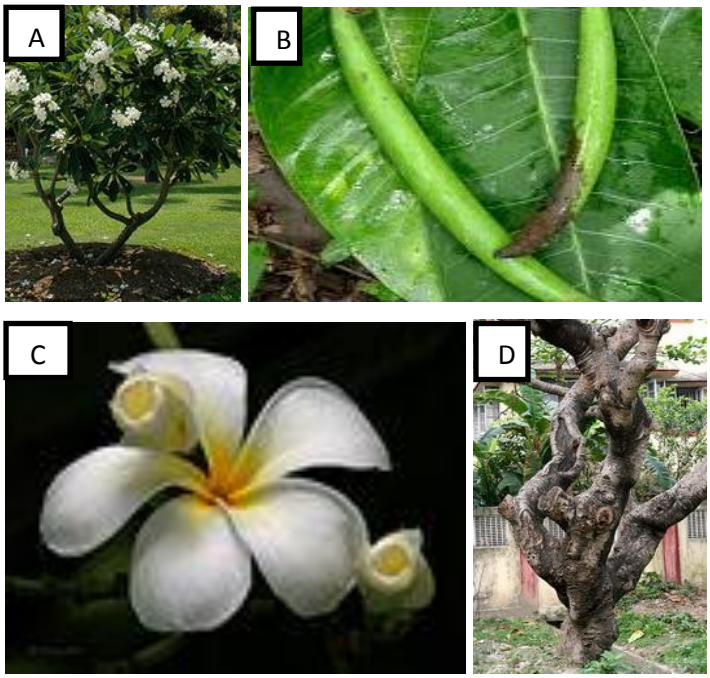


Fig 1. Photographs of *Plumeria obtusa* (A) tree (B) fruit (C) flower (D) bark

Taxonomical Classification

Kingdom	**Plantae- Plants**
Subkingdom	Tracheobionta- Vascular plants
Superdivision	Spermatophyta- Seed plants
Division	Magnoliophyta- Flowering plants
Class	Magnoliopsida- Dicotyledons
Subclass	Asteridae
Order	Gentianales
Family	Apocynaceae-Dogbane family
Genus	*Plumeria* L.- plumeria
Species	*Plumeria obtusa* L. Singapore graveyard flower

Synonyms[8]

Scientific names	**Common names**
Plumeria apiculata Urb.	Kalatsutsing-puti (Tag.)
Plumeria bahamensis Urb.	Singapore graveyard flower (Engl.)
Plumeria barahonensis Urb.	White calachuche (Engl.)
Plumeria beatensis Urb.	White frangipiani (Engl.)
Plumeria bicolor Seem.	
Plumeria cayensis Urb.	
Plumeria clusioides Griseb.	
Plumeria bahaconfusa Britton	
Plumeria cubensis Urb.	
Plumeria cuneifolia Helwig	
Plumeria dictyophylla Urb.	
Plumeria ekmanii Urb.	

Plumeria emarginata Griseb.	
Plumeria estrellensis Urb.	
Plumeria inaguensis Britton	
Plumeria krugii Urb.	
Plumeria marchii Urb.	
Plumeria montana Britton & P.Wilson	
Plumeria nipensis Britton	
Plumeria nivea Mill.	
Plumeria obtusa L.	
Plumeria ostenfeldii Urb.	
Plumeria parvifolia Donn	
Plumeria portoricensis Urb.	
Plumeria tenorei Gazparr.	

Botanical Description

Plumeria obtusa is a shrub or small tree growing up to 5-10m tall (c.12–25 ft).[5][10] Branches are thick, succulent, widely spaced and covered with knobby protuberances. Stems and leaves yield a milky sap. Leaves are dark green, leathery, obovate to oblong-obovate, up to 30 centimeter long, with conspicuous parallel secondary veins running from the mid-vein and clustered near the tips of the branches. Flowers are white, five-lobed, with a yellow center, borne in clusters at the end of the branches.

Fig 2. *Plumeria obtusa* tree, fruit, flower and leaves.

Geographical distribution[9]

Native

- **Northern America**
  - *Northern Mexico*: **Mexico -** Chihuahua, Durango, San Luis Potosi, Sinaloa, Sonora, Tamaulipas, Zacatecas, Baja Sur

- *Southern Mexico*: **Mexico -** Aguascalientes, Campeche, Chiapas, Colima, Guanajuato, Guerrero, Hidalgo, Jalisco, Mexico, Michoacan, Morelos, Nayarit, Oaxaca, Puebla, Queretaro, Quintana Roo, Tabasco, Veracruz, Yucatan

- **Southern America**

- *Central America*: **Belize**; **Costa Rica**; **El Salvador**; **Guatemala**; **Honduras**; **Nicaragua**; **Panama**

Naturalized

- **Southern America**

- *Caribbean*: **Bahamas**; **Cuba**; **Dominica**; **Dominican Republic**; **Grenada**; **Guadeloupe**; **Haiti**; **Martinique**; **Netherlands Antilles**; **St. Kitts and Nevis**; **St. Lucia**; **St. Vincent and Grenadines**

- *Northern South America*: **Venezuela**

Ethnobotanical uses

Plumeria obtusa is commonly used as an ornamental, grown for its flowers. In Cambodia the flowers are used to make necklaces and in offerings to the deities.[6] In traditional medicine used in that country, a decoction of the bark is given in varying doses as a purgative or as a remedy against oedemas. The Plant is also used as a remedy for blenorrhagia, boils, herpetic lesions, sores, syphilis and wounds. Used as cicatrizant, pectoral, purgative and hemostatic. In the Sekhukhune District of South Africa, decoction of leaves is taken three times daily for diabetes.[11] In Asia, the decoction of leaves is used for treating wounds and skin diseases. Bark and latex are used as diuretic and purgative.[12] The essential oil obtained from the flower is used as ingredient in cosmetics, candles, potpourri, massage oils and aromatherapy.

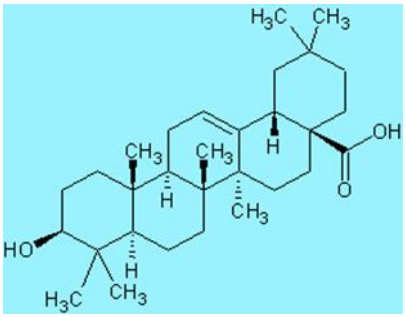
Phytochemistry

Preliminary phytochemical screening of *P.obtusa* revealed the presence of sterols, alkaloids, flavonoids, terpenoids and glycosides.

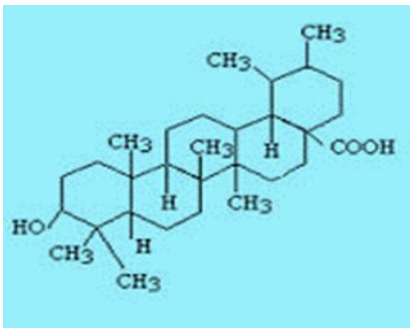
- Neutral N2 fraction of methanolic extract of fresh, undried and uncrushed leaves of *Plumeria obtusa* isolated a new lupane triterpenoids (1) along with five known compounds viz., obtusaline, betulinic acid, oleanolic acid, ursolic acid, kaneroside and oleandrin. N3 neutral fraction yielded 10 new compounds (11-13, 15-19, 22, 23) together with 8 known compounds (7-10, 14, 20, 21, 24) isolated for the first time from this

species, viz., a-amyrin (7) neriucoumaric acid (8), isonericoumaric acid (9), alphitolic acid (10), obtuscin (11), oytusinin (12), obtusilin (13), 3b.23-dihydroxyurs 12-en. 28 oic acid (14), obtusidin (15-19), 27.p-Z.coumaroytoxyursolic acid (20), 27.p--E.coumaroytoxyursolic acid (21), coumarobtusanoic acid (22) coumarobtusane (23) and oleanonic acid (24)[13], Fig. 3.

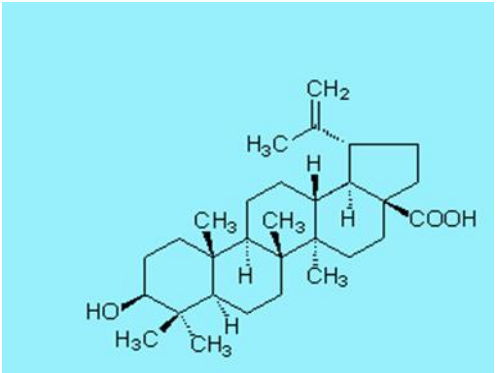
- Study of flowers for essential oil yielded 21 compounds viz., linalool, (Z)-geraniol, (Z)-citral, (E)-geraniol, (E)-citral, (Z)-beta-farnesene, (E)-beta-farnesene, 1-hexadecene, 2-methylpentadecane, alpha-farnesene, (Z)-farnesol, (E)-farnesol, (E)-farnesal, benzyl benzoate, 1-octadecanol, benzyl salicylate, eicosane, unknown1, unknown2, (E)-farnesyl acetate and heneicosane.[14] Fig.4.
- Phytochemical screening of various extracts of leaves yielded sterols, alkaloids, flavonoids, terpenoids, glycosides.[15]
- Study of fresh leaves yielded two new iridoids viz., 6″-O-acetylplumieride p-E-coumarate and 6″-O-acetylplumieride p-Z-coumarate and three known iridoids viz., plumieride, plumieride p-Z-coumarate and plumieride p-E-coumarate.[16]
- Oil of Plumeria obtusa was found rich in benzyl salicylate (45.4%) and benzyl benzoate (17.2%), with only minute concentrations of alkanoic acids.[17]



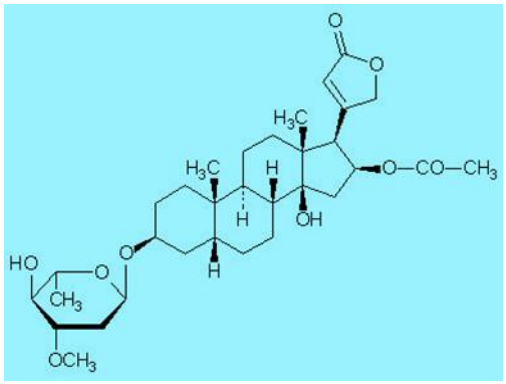
Oleanolic acid (1)



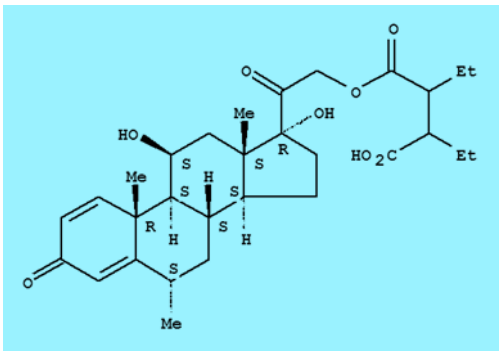
Ursolic acid (2)



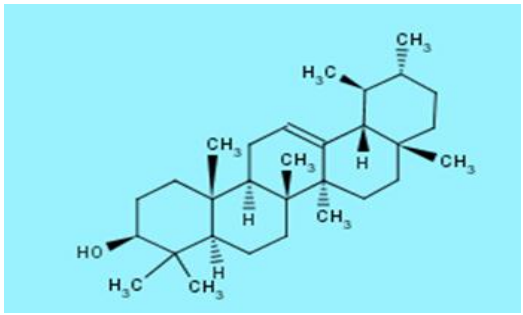
Betulinic acid (3)



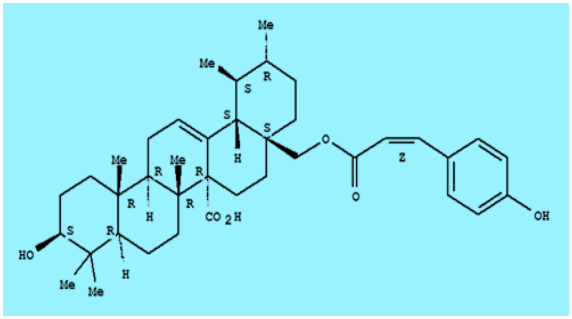
Oleandrin (4)



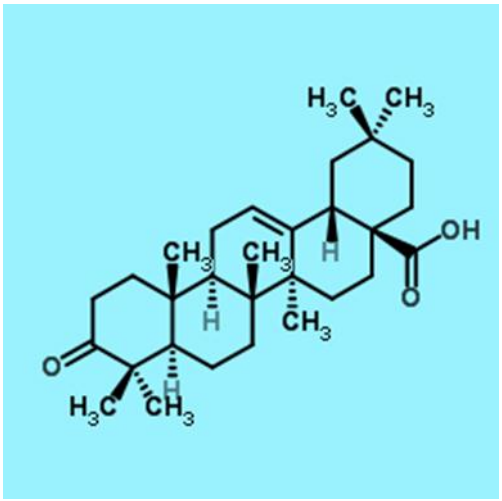
Kaneroside(5)



a-amyrin (6)

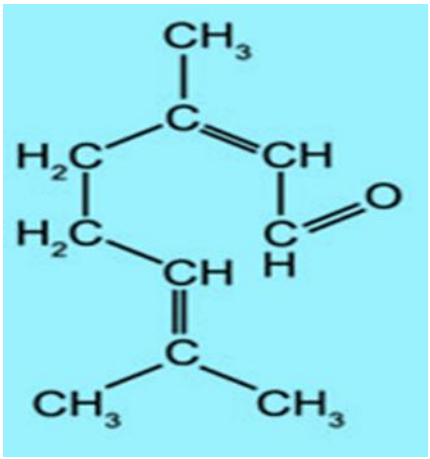


Neriucoumaric acid (7)

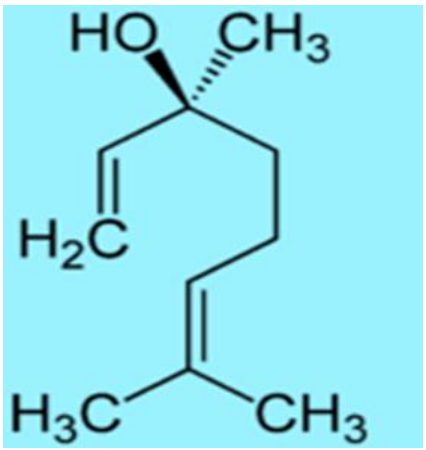


Oleanonic acid (8)

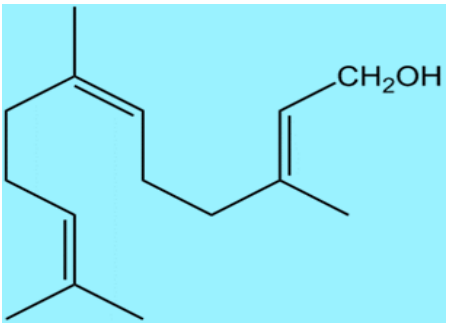
Fig. 3. Triterpenoids and Cardiac glycosides isolated from *P.obtusa* leaves



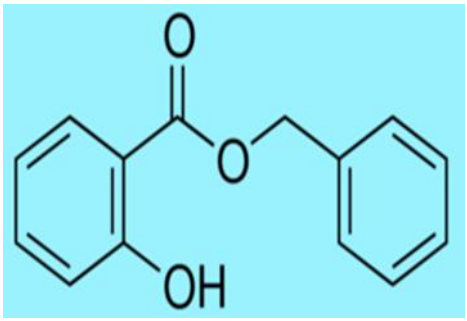
Citral (9)



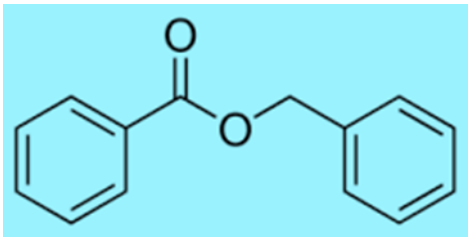
Linalool (10)



Farnesol (11)



Benzyl salicylate (12)



Benzyl benzoate (13)

Fig. 4. Essential oil components reported from *P.obtusa* flowers

Biological Activity

Various extracts obtained from flowers, leaves, stem and bark of *P. obtusa* has shown to possess anti-microbial, anti-oxidant, anti-proliferative, anti-ulcer and insecticidal activity.

(1) Antimicrobial activity

Various solvent extracts from flowers of *P. obtusa* have shown antimicrobial activity against a broad spectrum of human pathogenic organisms. The extracts showed variable degrees of inhibition of all microorganisms. Among gram positive bacteria, the most susceptible was B. subtilis, the most resistant S. aureus. Among gram negative bacteria, the most susceptible was Eriwina carotovora, the most resistant P.aeruginosa.[18] In another study the antibacterial activities of ethanol, petroleum ether, chloroform, ethyl acetate and isobutanol extracted

samples from leaves of Plumeria obtusa against P. aeuriginosa, Bacillus cereus, C.albicans, E. carotovora, E.coli, K. pneumoniae, S.typhi ans S. aureus using the disc diffusion susceptibility assay. The Results showed PE, iso-butanol and EA fractions showed inhibitory activities against all eight microbial species except K. pneumonia and P.aeruginosa.[19]

(2) Antioxidant activity

The antioxidant potential of a methanol extract and fractions of *P. obtusa* leaf extract and fractions has shown moderate dose-dependent antioxidant activity based on DPPH and lipid peroxidation inhibition assays.[20]

(3) Antiproliferative activity

Leaf extracts of 10 Apocynaceae species were evaluated against three human cancer cell lines (MCF-7, MDA-MB-231 and HeLa). *Plumeria obtusa* was one of six plants that showed positive growth inhibitory activity, with ≤50% cell growth. The n-hexane extract of *P. obtusa* inhibited MCF-7 and HeLa cells.[21]

(4) Insecticidal activity

The insecticidal efficacy of *P. obtusa* foliar extracts on mosquito and beans weevil populations. *P. obtusa* yielded mosquito mortality rate of 86.2% and weevil mortality of 90% respectively suggesting potential applications in public health pest and disease management, food preservation and crop protection.[22]

(5) Antiulcer activity

The methanolic extracts of *Plumeria obtusa* stem bark were shown to be effective in increasing the healing of gastric ulcers induced by pylorus ligation, indomethacin in wistar rats. The stem bark extracts in dose of MEPO 250mg/kg & 500 mg/kg diminished the ulcer index, total ulcer area and the percent protection of ulcer compared with control group. The results of the study indicate antiulcer effects of stem bark extracts are due to reduction in gastric acid secretion and gastric cytoprotection and proton pump inhibition mechanism.[23]

CONCLUSION

In the recent past the demand of herbal products have flourished greatly owing to their inherent quality of having negligible side effect profile. Literature review showed that *plumeria obtusa* is highly esteemed as a rich source of therapeutically important phytoconstituents such as kaneroside, ursolic acid, benzyl salicylate and benzyl benzoate.

Different extracts obtained from various parts of the plant have shown to possess numerous biological activities such as antimicrobial, anti-oxidant, anti-ulcer, anti-cancer and insecticidal activity in different in vitro and in vivo models. Since the worldwide situation is currently changing towards the utilization of nontoxic herbal drugs, development of modern drugs from *Plumeria* species should be accentuated. Clinical trials should be directed to support its pharmacological utilize. What's more, more studies are needed to investigate its biological activity and microscopy.

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