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"PHYTOCHEMICAL AND PHARMACOLOGICAL ASPECTS OF *Plumeria obtusa*: A REVIEW"

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Abstract: *Plumeria obtusa* an important member of the Apocynaceae family, is renowned for its therapeutic qualities, mild side effects, and reasonable price. It originated in tropical America but is now widely grown, particularly in India, where people value its beauty and cultural significance. The plant's therapeutic benefits are increased by the presence of antioxidants, which are essential for curing illnesses and reducing the adverse effects.

Objective: This review delves into providing information about *Plumeria obtusa's* pharmacological activity and therapeutic potential. Its morphology, phytochemical composition, and many pharmacological activities, including wound healing, anti-inflammatory, antimicrobial resistance, anti-bacterial, antimicrobial, anti-ulcerogenic, insecticidal, and antioxidant qualities, are important research fields. Furthermore, it evaluates *Plumeria obtusa's* toxicity using acute and sub-acute toxicity investigations in order to identify safe dosage ranges and general safety profiles.

Conclusion: This review emphasizes on the phytochemistry, morphology, pharmacological profile, toxicity of *Plumeria obtusa*. Further research and clinical trials are necessary to elucidate mechanisms of action and optimize its use in the treatment.

***Keywords – Plumeria obtusa*, Phytochemical, Pharmacological activities, Toxicity studies.**

I. INTRODUCTION

Herbal therapy addresses mental, emotional, spiritual, and physical health in order to promote holistic well-being. It highlights lifestyle choices and individual considerations as essential components of care. Herbs are generally thought to be safe, but if taken improperly, they may be dangerous. Most cases of medicinal plant poisoning are caused by misidentification or improper preparation by unskilled personnel. Certain herbal treatments, like *digitalis*, which is strictly restricted in nations like Britain because of its strong effects, can mimic the effects of prescription pharmaceuticals. Even if there aren't many instances of this kind, it's important to treat them carefully. [1].

Herbal medicines are valued for their effectiveness, low side effect rate, and affordability; *Plumeria obtusa*, an Apocynaceae member, is one such example. This plant, which is native to the New World, is now widely cultivated across tropical and subtropical regions of the world. Although *Plumeria obtusa* is native to tropical America, which includes southern Mexico and northern South America, it has thrived especially in India. Known for their breathtaking beauty, these plants are frequently seen in tropical environments, frequently gracing gardens and landscapes. Notably, they are highly valued for their ethereal beauty and scent and have a specific significance in cultural contexts where they are often associated with cemeteries.[1].

Antioxidant capabilities are found in many medicinal plants in fact the precise mechanism of action behind their activities are still unclear. These antioxidants are essential for the treatment of several illnesses, including diabetes, heart disease, cancer, and brain diseases. Herbal antioxidants can also lessen the harmful effects of dangerous drugs or chemicals. Medicinal plants contain antioxidants, which both enhance their therapeutic benefits and can lessen the harmful effects of other chemicals.[1].

Plumeria obtusa, a member of the Apocynaceae family, is often referred to as Champa (Hindi) and White Frangipani (Australia). *Plumeria* comprises laticiferous trees and shrubs, with approximately 8 species reported in India. These plants typically grow into large shrubs or small trees, reaching heights of up to 8 meters (26 feet). Their alluring and fragrant flowers are highly admired, with essential oils extracted from the blossoms used in perfumery and aromatherapy. In today's context, herbal medicines are experiencing a surge in demand due to their wide-ranging both biological and therapeutic qualities, enhanced safety profiles, and cost-effectiveness. [2,3].

II. MORPHOLOGY

The adaptable *Plumeria obtusa* grows to be between 0.9 and 6.1 meters tall, exhibiting growth as both a small shrub and a tree. Thick succulent branches with knobby protuberances that are frequently ornamented and clustered leaves that are mainly located around the tips of the branches give it a characteristic appearance. Large and rectangular in appearance, these leaves stand out for having rounded tips as opposed to the pointed ends found on other *Plumeria* species. The leaves have a glossy upper surface, are dark and leathery, and have noticeable parallel secondary veins that run from the mid vein to the margins. The species' inflorescences, which emerge at the tips of branches on sturdy stalks, are laden with many white flowers with yellow centers that give the tree vivid bursts of color. *Plumeria* blooms are distinguished by their five fused petals that come together to form a short tube that resembles a funnel before lobes are formed. This unusual and visually arresting plant completes its life cycle when its fruit, a dry follicle, breaks along one side to release winged seeds.[2].

III. PHYTOCHEMISTRY

Pentacyclic triterpenoids, including kaneroside, oleandrin, α-amyrin, neriucoumaric acid, isoneriucoumaric acid, alphitolic acid, oleanonic acid, methyl p-E-coumarate, and scopoletin, which are located and have not yet been detailed from this source in the aerial sections of *Plumeria obtusa*.

Plumeria obtusa's stem bark and leaves yielded 12 known compounds and four new triterpenoids, identified as champalin A, champalinol, champalinone, and champalin B, which are respectively characterized as dammara-12,20(22)Z-dien-3-one, dammara-12,20(22)Z-dien-3β-ol, olean-12-en-3β,27-diol, and 27-hydroxyolean-12-en-3-one. Eight triterpenoids, dammara-3β,20(S),25-triol, and 3β-hydroxy-27Z-feruloyloxy, were among the identified substances.-urs-12-en-28-oic acid, 3β-hydroxyolean-12-en-28-oic acid (oleanolic acid), 3β,27-dihydroxylupan-29-ene (betulin), 3β-hydroxylupan-29-en-28-oic acid (betulinic acid), 3β-hydroxyursan-12-en-28-oic acid (ursolic acid), 3β-hydroxy-27-p-coumaroyloxy-olea-12-en-28-oic acid (obtusilinin) and urs-12-en 3-one (α-amyrenone); an iridoid, 1α-plumieride; a fatty acid ester, methyl n-octadecanoate (methyl stearate); a cardenolide, 3α,14β-dihydroxy-17β-card-20(22)-enolide (3-epidigitoxigenin); and a steroid, 3β-hydroxy-5-stigmastane (β-sitosterol).

The remaining compounds have been identified as plumieride, plumieride p-Z-coumarate, and plumieride p-E-coumarate. The new iridoids have been characterized as 6"-Oacetylplumieride p-E-coumarate and 6"-0-acetylplumieride -p-Z-coumarate. [4,5].

IV. PHARMACOLOGICAL ACTIVITIES

Wound healing

Three spray formulations, each made from the ethanolic leaf extracts of *Plumeria obtusa*, were tested for their ability to promote wound healing in rats. The formulations were tested at three different concentrations: 2.5%, 5%, and 10%, with 60% ethanol serving as the solvent. The sprays were compared to a commercial wound spray known as Hansaplast; in one type of wound test, the 10% formulation demonstrated a tensile strength of 404 grams, which was comparable to the 435 grams of the commercial spray. Overall, the 10% spray (200 mg/kg BW) was the most effective. [6].

Anti-inflammatory

Aerial part

In mice, a bacterial toxin called lipopolysaccharide causes acute lung injury (ALI). This study investigated the potential protective effects of the plant *Plumeria obtusa* L. leaf parts on ALI. Dichloromethane fraction extract (DCM-F) of *Plumeria obtusa* was employed by the researchers to successfully lower levels of dangerous chemicals, oxidative stress, and lung inflammation. Mice's lung inflammation and tissue damage were considerably decreased when administered DCM-F of *Plumeria obtusa*. The extract demonstrated potential as an effective anti-inflammatory and antioxidant agent for lung health by lowering damaging cytokines and restoring antioxidant enzyme levels. [7].

Bark part

The ethanolic fraction of *Plumeria obtusa* stem-bark demonstrated strong anti-inflammatory effect when tested in vivo utilizing animal models such as rat paw edema induced by carrageenan and granuloma pouch model induced by cotton pellets. The presence of alkaloids, flavonoids, and glycosides is linked to these activities. In both *in vivo* animal model tests, *Plumeria obtusa* 400 mg/kg produced extremely significant results, suggesting that the extract's action was dose-dependent. The study used of only two experimental models is one of its limitations. [8].

Anti-microbial Resistance

A methanolic extract (M-F) from the aerial parts of the plant *Plumeria obtusa* L. was the subject of this study's investigation into its antibacterial capabilities. They discovered that this extract had the ability to combat two gram-negative, multidrug resistant (MDR) bacteria: *K. pneumoniae* and *E. coli* O157:H7, which produces Shiga toxin. Standard antibiotics are not always effective in treating these dangerous germs. Additionally, the study found that M-F was significantly more successful in lowering the resistance of these bacteria to therapy when paired with gentamicin (GEN), an antibiotic. The M-F extract included particular chemical components known as plumieride-type iridoids, according to further investigation. A couple of these substances, 13-O-caffeoylplumieride and plumieride, were discovered and demonstrated to possess mild antibacterial properties against MDR bacteria tested. [9].

Anti-bacterial

The test extract has strong inhibitory effect against each of these bacterial strains. Chloroform and Acetone extracts of leaves exhibit partial antibacterial activity against *S. aureus*, *P. aeruginosa*, and *S. typhi*, while Methanol and Aqueous extracts demonstrate complete good antibacterial activity against all three test microbes (*S. aureus*, *P. aeruginosa*, and *S. typhi*) at 50 µg/ml, 100 µg/ml, 200 µg/ml, and 400 µg/ml. Complete antibacterial action against *S. aureus*, *S. typhi*, and *P. aeruginosa* is demonstrated by standard ciprofloxacin. [10].

Anti-microbial

Plumeria obtusa leaves contained several extracts that shown antibacterial activity against various microorganisms. In contrast to other solvents, the majority of *Plumeria obtusa's* antimicrobial compounds were soluble in iso-butanol and ethyl acetate. Additionally, samples extracted with petroleum ether and chloroform had strong antibacterial and antifungal activity, pointing to a possible application for this plant. *Plumeria obtusa* contains antibacterial chemicals that could be a more modern and reasonably priced way to treat infectious disorders.[11].

Dexamethasone induced insulin resistance

Dexamethasone was utilized in this investigation to mimic circumstances such as elevated blood sugar and insulin resistance in rats by inducing insulin-resistant diabetes in them. They examined the effects of *Plumeria obtusa* leaf extracts on these diabetic rats. The extracts successfully lowered blood sugar, lipid, and glycosylated hemoglobin levels, particularly in their ethanol and aqueous forms. Additionally, they enhanced the structure of the brain, liver, kidneys, heart, and body weight. The extracts are appealing for the management of diabetes since they probably function through a variety of pathways, such as antioxidant activity, insulin-like actions, and increased insulin sensitivity. [12].

Antiulcerogenic activity

In rats treated with indomethacin and pylorus ligation-induced stomach ulcers, the plant's methanol stem bark extracts were found to be beneficial. When compared to the control group, the stem bark extract at doses of 250 and 500 mg/kg reduced the ulcer index, total ulcer area, and ulcer protection percentage. The reduction in gastric acid secretion, gastric cytoprotection, and proton pump inhibition mechanism were the authors' explanations for the antiulcerogenic effect of this result. [13].

Insecticidal activity

The insecticidal efficacy of *Plumeria obtusa* leaves hexane- and ethanol-based extracts was evaluated against *Aedes aegypti*. Both the extract discouraged mosquito from laying eggs. This implies that these extracts might be an effective all-natural method of managing mosquito populations. [14].

Anti-oxidant activity

The assay for lipid peroxidation inhibition and 1,1-diphenyl-2-picrylhydrozyl (DPPH) radical scavenging was used to assess the antioxidant capacity of methanol extract, hexane, ethyl acetate, n-butanol, and aqueous fractions of *Plumeria obtusa* leaves at doses of 200, 400, 600, 800, and 1000 µg/ml. For the DPPH and lipid peroxidation assays, the outcomes were compared to standard concentrations of ascorbic acid (100 µM) and tocopherol (100 µM), respectively. In all models, the n-butanol fraction exhibited the highest level of antioxidant activity, whereas the methanol extract and fraction demonstrated modest dose-dependent activity. [15].

V. ASSESSMENT OF TOXICITY STUDIES

Acute toxicity study

Acute toxicity of *Plumeria obtusa* was investigated in this study. The goal of the study was to identify safe dosage ranges and comprehend the hazardous effects of the plants. Rats were given doses of up to 2000 mg/kg body weight when the plant extracts were tested, and no substantial harmful effects were observed; instead, only minor weight changes were noted. Important conclusions consist of: Organ, biochemical, hematological, and renal parameters were normal.

Plant extracts are safe for rats at the tested dose, according to the study's findings, with a no-observed-adverse-effect level (NOAEL) of more than 2000 mg/kg. Confirming their safety and effectiveness will require more research on frequent use. [16].

Sub-acute toxicity study

Plant extract from *Plumeria obtusa* was used in a subacute toxicity investigation at concentrations of 200 mg and 400 mg/kg. They saw alterations in the rats' body weight, signs of disease, and effects on their nervous systems. Blood and organ samples were also analyzed to look for any detrimental effects. The findings demonstrated that, while there were some small variations from the control group, the extract had no significant negative effects on the rats. [17].

VI. CONCLUSION

Several pharmacologically and medicinally significant compounds, such as plumieride, champalinol, obtusilinin and iridoid glycoside, as well as other secondary metabolites, are found in *Plumeria obtusa*, according to the literature review. According to studies examining the pharmacological properties of diverse plant extracts using both *in vitro* and *in vivo* models, these substances are effective against a wide range of illnesses. Because of its wide range of therapeutic effects, *Plumeria* has received a lot of interest in pharmacological research and is highly regarded as a general treatment in Ayurvedic medicine. As the world moves toward using non-toxic plant products, there is an increasing focus on creating contemporary medications made from *Plumeria* species. Clinical trials must be carried out in order to completely validate its medicinal potential.

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