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A REVIEW ON PHYTOCHEMICAL AND PHARMACOLOGICAL ACTIVITIES OF AGLAIA ELAEAGNOIDEA (JUSS) BENTH

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ABSTRACT

Plants are known to be the primary source of many medicines, and they are crucial to human health. Scientists now, more than ever, depend on evidence-based medicine and contemporary scientific techniques to demonstrate the effectiveness of herbal remedies and to gain a deeper comprehension of the mechanisms underlying their effects. *Aglaia elaeagnoidea* is a morphologically diverse evergreen tree belonging to the Meliaceae family. This plant has been known for its traditional use over the decades and so far, a variety of compounds have been isolated from it. This article reviews the reported phytochemical and pharmacological activities of *Aglaia elaeagnoidea.*

Keywords: *Aglaia elaeagnoidea,* chokkala, priyangu, pharmacological activities, isolated compounds.

INTRODUCTION

India is known to have a large variety of herbs due to its diverse climatic conditions. It is reported that India has been relying on medicinal herbs to prevent and cure diseases for centuries. Over 100 species of Aglaia have been reported so far. *Aglaia elaeagnoidea* of the genus Aglaia belonging to the family Meliaceae is an evergreen tree that can reach a height of up to ten meters. The *Aglaia elaeagnoidea* tree, commonly referred to as "Chokkala," is found in Tamil Nadu, India's Western Ghats, particularly on red soil. Its roots are buried underground. Rural communities utilize the leaves and stem bark of this tree to treat various ailments, including skin conditions, fever, dysentery, cooling, astringent properties, abdominal pain, and hemorrhages[1].

Vernacular names[2]:

English	**droopy leaf, priyangu, coastal boodyarra**
Hindi	**priyangu (प्रियंगू)**
Tamil	**chokkala, chokla**
Malayalam	**nyalei, punniyava, cheeralam**
Telugu	**yerraadugu, erranduga, kondanduga**
Kannada	**gadagayya, kempunola, thottilu, priyangu**
Mandarin	**Shanluo**
Sinhala	**puwanga**

Taxonomical classification:

Kingdom	**Plantae**
Division	**Magnoliophytes**
Class	**Magnoliopsida**
Order	**Sapindales**
Family	**Meliaceae**
Genus	**Aglaia**
Species	**elaeagnoidea**

ORIGIN AND ITS DISTRIBUTION

They are found throughout the Pacific Islands and Indo-Malaysia. They are often found throughout many drier zones of India as well as the wet forests of the Western and Eastern Ghats, as well as states like Andhra Pradesh, Kerala, Karnataka, Bihar, and the Andaman and Nicobar Islands[3].

MORPHOLOGY

Leaves: The leaves are lepidote scaly. Compound or elliptic, imparipinnate, spiral leaves with a rachis measuring 1.5–3.5 cm and slight canaliculate above. Leaves are alternate to sub-opposite, with 3-7 leaflets[2][3].

Fruit: The fruits were sub globose, pear-shaped, trilocular berries with a base attached by a rim of calyx teeth, and apex centrally depressed, measuring 3 to 4 cm in length and 3 to 3.5 cm in diameter. Pedicel short attached

to base. Tan-colored pericarp of fruit that opens easily with light pressure, revealing a thin, papery partition separating three loculi[4].

Flower: Roundish yellow flowers[3].

Bark: Bark is lenticellate and greyish brown; the blaze is reddish brown.

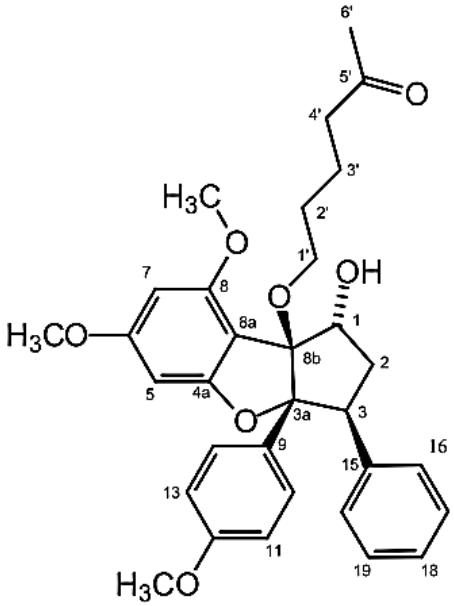
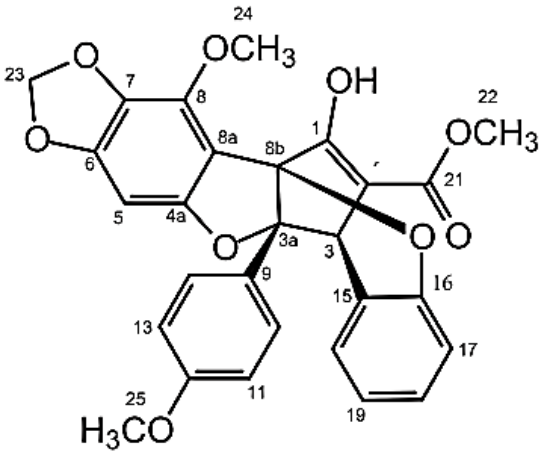
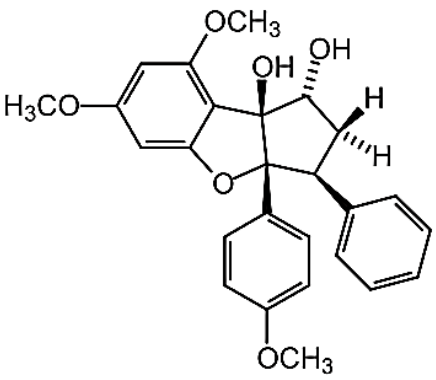
Fig.1 : Twig of *Aglaia elaeagnoidea*

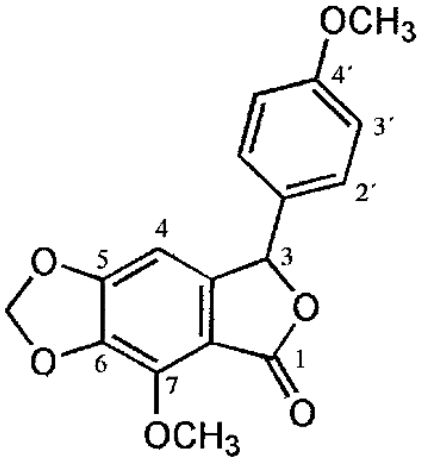
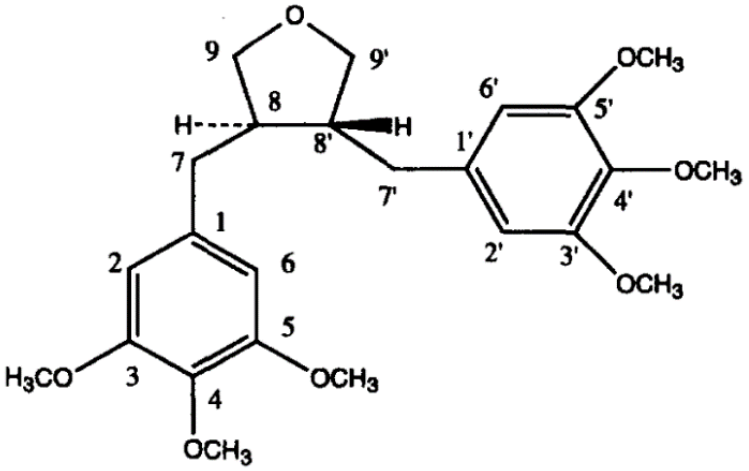
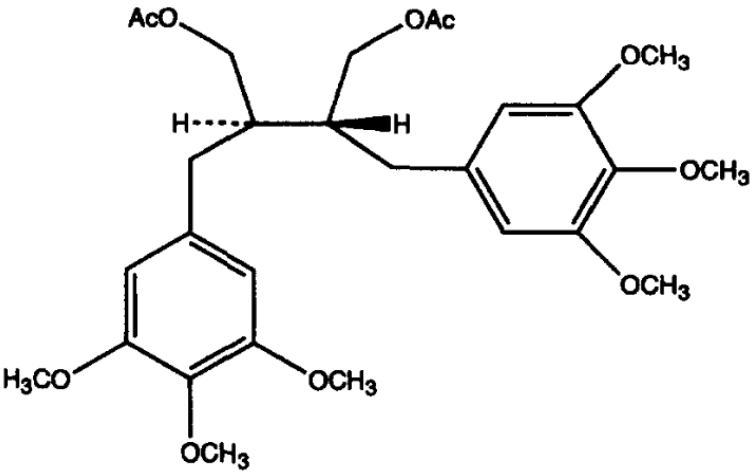
Fig.2: *Aglaia elaeagnoidea* tree

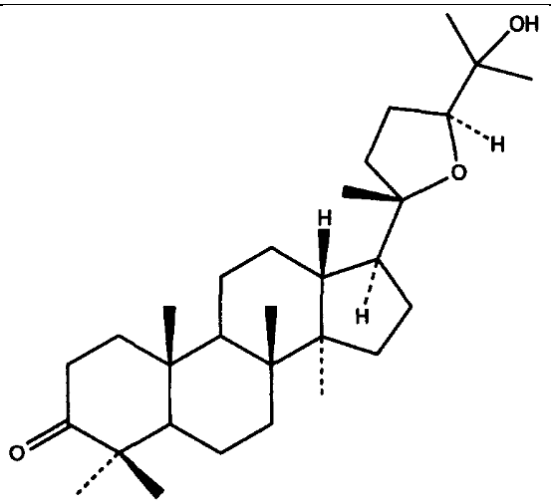
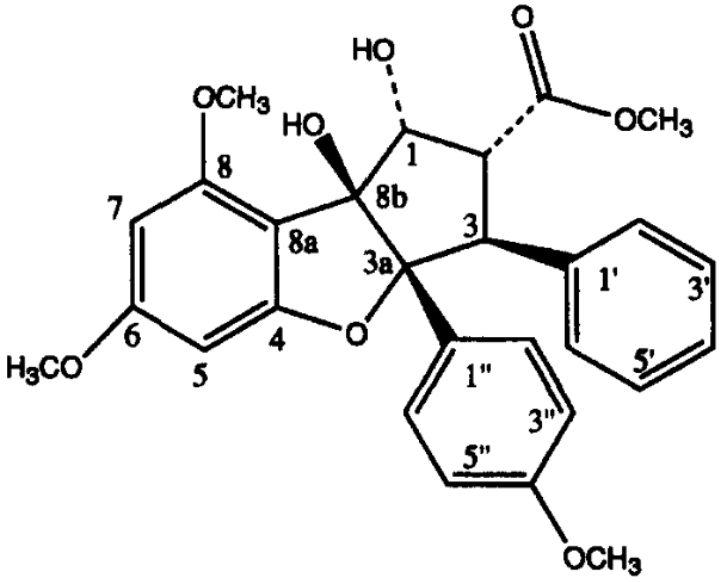
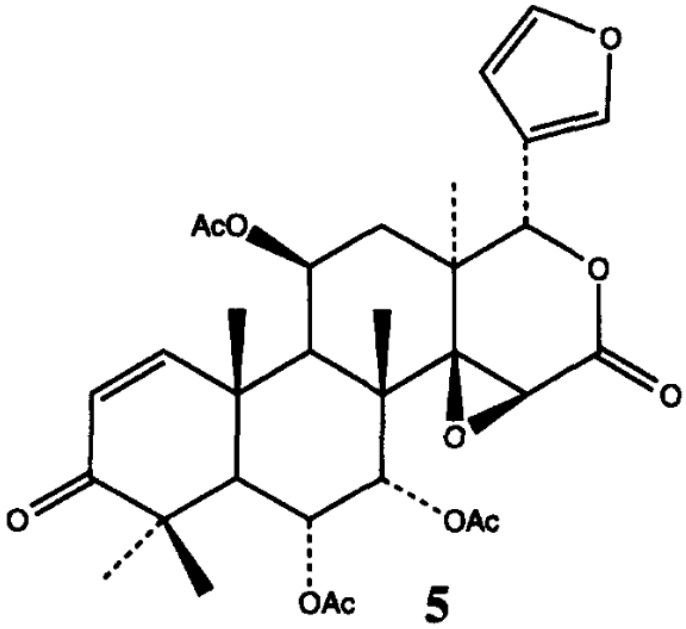
Cultivation Details: This tropical plant thrives in lowland regions that experience seasonal weather patterns and are situated away from the equator. It cannot survive frost. Optimal growth occurs under filtered sunlight. It favours a well-aerated, humus-laden soil that retains moisture. The blooms emit a potent fragrance. To produce both fruit and seeds, cultivation of both male and female plants is necessary[2].

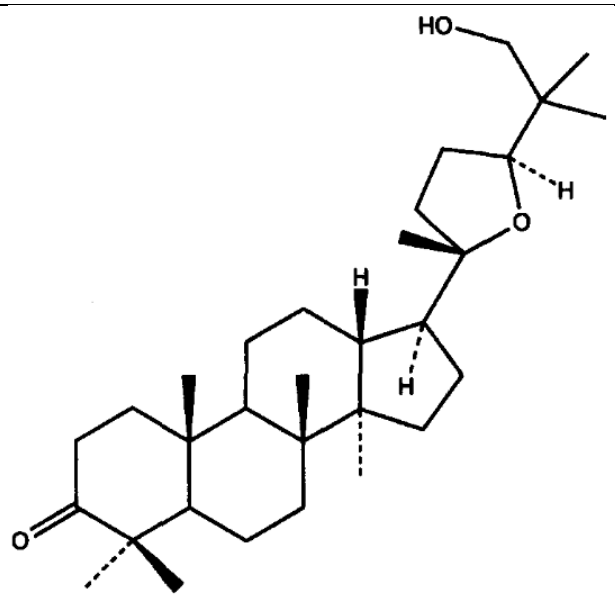
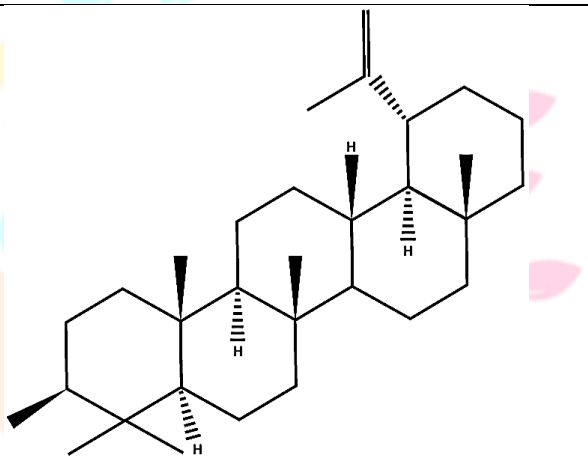
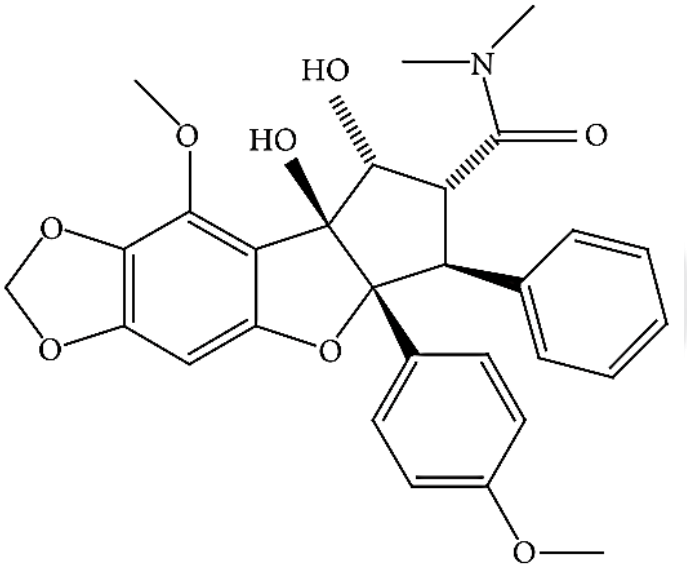
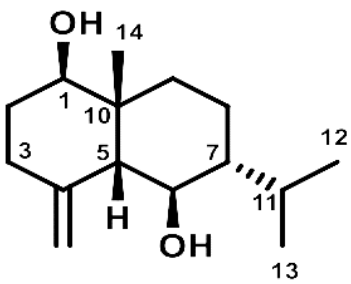
PHYTOCHEMICAL CONSTITUTION

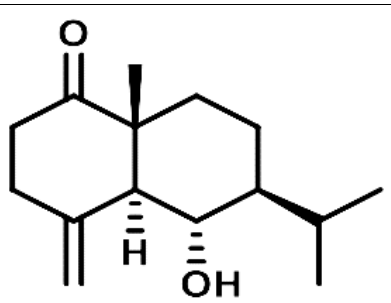
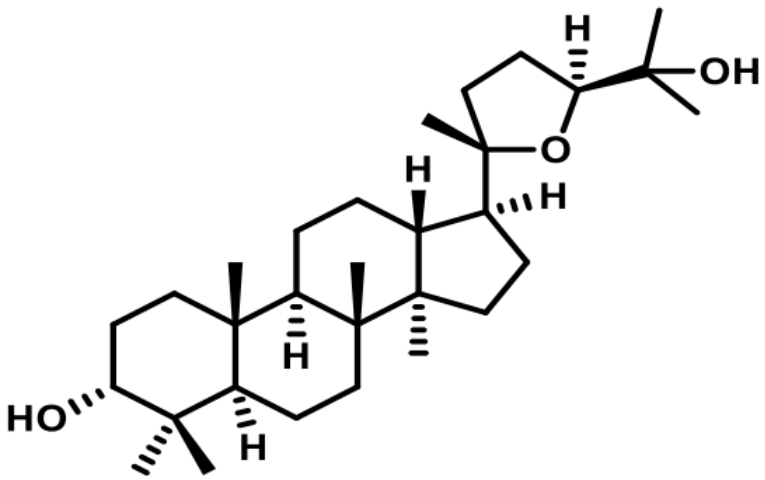
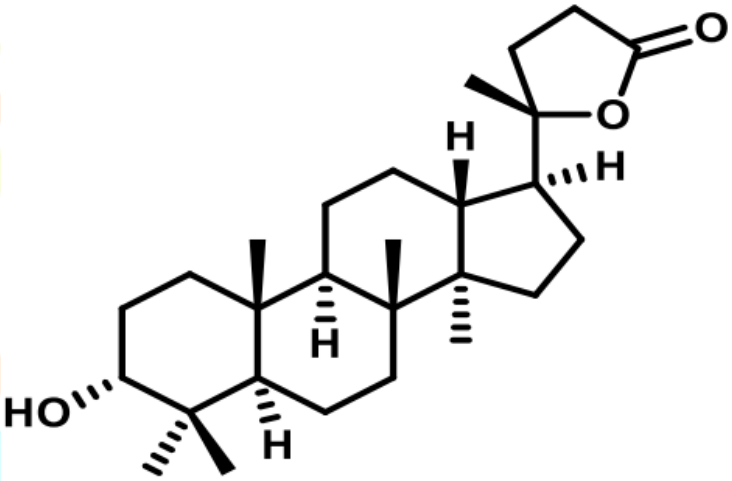
Phytochemical screening of *Aglaia elaeagnoidea* reveals the presence of alkaloids, flavonoids, terpenoids, sterols, phenols, tannins, coumarins, xanthoproteins, quinones, fatty acids, carbohydrates, saponins, leucoanthocyanins and emodins. So far, a variety of compounds like terpenoids, benzofuran, rocaglamides and lignans have been isolated from the plant. The following table shows some of the isolated compounds from various parts of the plant, *Aglaia elaeagnoidea.*

PART USED	CHEMICAL NAME	CHEMICAL STRUCTURE
Bark	8b-O-5-oxohexylrocaglaol[5]	
Bark	Elaeagnin[5]	
Bark	Rocaglaol[5]	

Leaf, stem, root	Aglalactone[6][7]	
Bark	Trans-3,4-bis(3,4,5-trimethoxybenzyl)-tetrahydrofuran[8]	
Bark	Trans-2,3-bis(3,4,5-trimethoxybenzyl)-l,4-butanediol diacetate[8]	

Bark	20S, 24S-epoxy-25-hydroxydammaran-3-one[8][9]	
Bark	Methyl rocaglate[8]	
Bark	6α,11β-diacetoxygedunin[8]	

Bark	20S,24S-epoxy-25-hydroxymethyldammaran-3-one[8]	
Fruit	Lupeol[10]	
Bark	Aglaroxin A[11]	
Stem Bark	5-epi-eudesm-4(15)-ene-1β,6β-diol[9]	

Stem Bark	6α-Hydroxy-eudesm-4(15)-en-1-one[9]	
Stem Bark	20S,24S-epoxydammarane-3α,25-diol[9]	
Stem Bark	3α-epi-cabraleahydroxy lactone[9]	

According to the GC-MS analysis of bioactive components of *Aglaia elaeagnoidea*, the major compounds in the leaf of the plant were found to be:

- **Caryophyllene** (13.04%)
- **1-Heptatriacotanol** (10.74%)
- **9,19-Cycloergost-24(28)-en-3-ol,4,14-dimethyl-, acetate, (3β,4α,5α)** (9.25%)
- **Cholestan-3-ol,2-methylene-, (3α,17α)** (9.07%)
- **Phytol** (8.42%)
- **12-Oxabicyclo[9.1.0.]dodeca-3,7-diene,1,5,5,8-tetramethyl-,[IR-(IR*,3E,7E,11R*]** (5.54%)

The major compounds in the bark was found to be:

- **Squalene** (16.56%)
- **Trans-Z-a-Bisabolene epoxide** (13.50%)
- **7- Hexadecenal,(Z)** (6.79%)
- **Imidazole,2-amino-5-[(2-carboxy)vinyl]** (6.56%)
- **8,11,14-Eicosatrienoic acid, (Z,Z,Z)** (5.83%)[12].

PHARMACOLOGICAL ACTIVITY

Antifungal Activity

Evaluation of the anti-fungal quality of methanol extract of leaf, stem and root bark was performed using germ tube inhibition tests in two-fold serial broth dilution. Flavaglines isolated from *A. elaeagnoidea* were tested for bioactivity against three plant pathogenic fungi, *Pyricularia grisea, Alternaria citri,* and *Fusarium avenaceum,* using the spore germination inhibition assay in microwells. The effectiveness of these natural compounds was compared to commercial fungicides, such as Benlate and Blasticidin S. Among the tested compounds, rocaglaol exhibited the highest antifungal activity, surpassing the commercial fungicides, with low EC50 and MIC values[13].

Antioxidant Activity

Antioxidant study of *A. elaeagnoidea* fruits was conducted by DPPH (2, 2-Diphenyl-1-picrylhydrazyl) method using Vitamin C as standard. Juice of *A. elaeagnoidea* fruit at 10µg /ml of concentration showed 67.19% of inhibition. The percentage inhibition of fresh juice of *A. elaeagnoidea* fruit (crude) showed gradual increase in percentage inhibition as the concentration increased. Overall *A. elaeagnoidea* fruit showed moderate percentage of inhibition, thus presence of good amount of antioxidant principle[4]. The total antioxidant capacity of the hydroalcoholic extract and fractions of *Aglaia elaeagnoidea* using FRAP assay. It was found that the hydroalcoholic extract of *Aglaia elaeagnoidea* showed a high FRAP value of 1.36, followed by the hexane fraction (0.95), the ethyl acetate fraction (0.78) and the methanol fraction (0.76). It was reported that the extract and fractions of *Aglaia elaeagnoidea* contained sterols, terpenoids, alkaloids, flavonoids, tannins and glycosides, which might be responsible for the observed antioxidant activity either singly or in synergy[14].

Anti-cancer activity

The cytotoxic activity of the isolated terpenoids from the stem bark of *Aglaia elaeagnoidea* against two human cancer cell lines: HeLa (cervical cancer) and DU145 (prostate cancer) was evaluated by extract dilution method. Cells were treated with samples containing the different isolated terpenoids, positive control (cisplatin), and negative control, followed by incubation. PrestoBlue reagent was added to the cells to measure cell viability based on color change, which is indicative of metabolic activity. IC_{50} values, which represent the concentration of the compound required to inhibit 50% of cell viability was measured. The findings indicated that compound 20S,24S-epoxydammarane-3α,25-diol showed stronger cytotoxic activity against HeLa cervical cancer and DU145 prostate cancer cell lines compared to other compounds tested[9].

Cytotoxic Activity

The cytotoxic activity of some compounds isolated from *Aglaia elaeagnoidea* was tested against HepG2 cells using the SRB (Sulforhodamine B) assay. The positive control that was employed was camptothecin. IC_{50} values were obtained following a 48-hour cell exposure. Cytotoxicity tests on HepG2 cells showed that rocaglaol, 8b-O-5-oxohexylrocaglaol, and dehydroaglaiastatin had notable effects. Based on the results obtained, it appears that rocaglamides exhibited exceptional cytotoxicity towards HepG2[5].

Larvicidal Activity

The larvicidal activity of an aqueous leaf extract of Aglaia elaeagnoidea was investigated by preparing Priyangu-synthesized Ag nanoparticles. Following WHO (2005) with minor modifications by Govindarajan and Benelli, the acute toxicity of Priyangu leaf extract and Priyangu-synthesized Ag nanoparticles on mosquito larvae was examined on the three species of mosquitoes. Priyangu extract and Priyangu synthesized Ag nanoparticles were evaluated at various doses. For every tested dose, five replicates were employed. After 24 hours of exposure, when the larvae were not fed, the extent of larval mortality was determined. Each test included two control groups (AgNO3 and distilled water). Probit analysis was used to evaluate the mortality data and determine the LC_{50} and LC_{90}. Synthesized silver nanoparticles have the potential to significantly reduce malaria and arbovirus mosquito vector larvae populations at relatively low doses, while leaving predaceous fish, backswimmers, and water bugs unaffected[15].

Anti-inflammatory activity

Leaves and stem bark of *Aglaia elaeagnoidea* was evaluated for its anti-inflammatory activity using the protein denaturation method. The ethanolic extracts and the standard drug diclofenac sodium were tested at various concentrations (50, 100, 200, 400, 800, and 1600 µg/ml) to inhibit protein denaturation. Both the leaf and stem bark extracts showed dose-dependent inhibition of protein denaturation with the leaf extract exhibiting a higher potential for reducing inflammation compared to the bark extract revealing its anti-inflammatory potential[16].

Wound Healing Activity

The wound healing activity of ethanol extract of *Aglaia elaeagnoidea* leaves was investigated using the dead space wound and burn wound models. The mechanical and physical alterations in the granuloma tissue are examined in the dead space wound model. The appropriate therapeutic treatment is administered orally or topically to the animals in the respective groups for ten days in succession. In the burn wound model, rats were divided into five groups, with SSD cream 1% as the reference standard, Eucerin as the control, and 5%, 10%, and 20% ointments of *Aglaia elaeagnoidea* extract as the treatment groups, beginning shortly after burn wound induction. The rate of wound contraction was determined. The findings demonstrated that, in comparison to the control group, the ethanolic extract ointment of *Aglaia elaeagnoidea* efficiently promotes wound contraction and improves the tensile strength of excision, incision, and burn wound[2].

Analgesic Activity

Analgesic activity of the ethanolic extract of leaves of *Aglaia elaeagnoidea* have been studied using three evaluation methods such as acetic acid induced writhing test, tail-immersion test and formalin induced paw

licking test. Ibuprofen 100 mg/kg was used as standard drug which was given orally. 150mg/kg and 300mg/kg of the extract were chosen as low dose and high dose respectively. The extract demonstrated dose-dependent analgesic activity, suggesting that the plant has analgesic properties[17].

Anti-asthmatic activity

The anti-asthmatic activity of *Aglaia elaeagnoidea* was assessed by evaluating the bronchodilating effect of a triterpene identified as Lupeol isolated from its fruit pulp. The study utilized an isolated goat trachea chain preparation to assess the bronchodilating effect of lupeol. The contractile response of the tracheal chain to histamine, which is known to cause bronchospasm, in the presence and absence of ethanolic extract containing lupeol was measured. Additionally, the dose-response curves for histamine with and without the ethanolic extract was created. It was observed that lupeol inhibited the contractile effect of histamine with a notable decrease in contraction at a concentration of 800 µg/ml in the goat tracheal chain preparation, indicating its potential as a bronchodilator[10].

Antibacterial Activity

The antibacterial activity of *Aglaia elaeagnoidea* was tested by extracting plant leaves and stem bark powder with five solvents such as chloroform, ethanol, methanol and petroleum ether. The antibacterial activity against Gram-positive bacteria (*Staphylococcus aureus* & *Bacillus subtilis*) and Gram-negative bacteria (*Vibrio vulnificus* & *E. coli*) were tested from the prepared stock solution (50 µg/ml) of all the extracts using the agar well diffusion method. 50 µl of the extracts was considered as an optimum concentration while DMSO served as negative control. The zone diameter (mm) was measured to determine the inhibition zone against tested bacteria and fungus. Both leaf and bark extracts of *A. elaeagnoidea* showed low to moderate inhibition zone against all the bacteria used for testing which indicates its anti-bacterial activity[18].

Hepatoprotective Activity

The hydro alcoholic extract of stem of *Aglaia elaeagnoidea* was proven to have hepatoprotective activity which was studied using experimental animals. The hydro alcoholic extract of *Aglaia elaeagnoidea* along with its hexane, ethyl acetate and methanol fractions, at the doses of 150,300 & 600 mg/kg and two isolated phytoconstituents (50mg/kg) was administered orally to the Wister albino rats with carbon tetra chloride(1ml/kg) induced hepatotoxicity. Silymarin (50mg/kg) was given as reference standard drug. It was evident from the results that after treatment with the plant extract, there was a significant reduction in the levels of serum biochemical parameters serum glutamic oxaloacetic transaminase (SGOT) and serum glutamic pyruvic transaminase (SGPT), alkaline phosphatase (ALKP) and total bilirubin (TBL) induced by carbon tetrachloride hepatotoxicity, indicating the potential hepatoprotective activity of *Aglaia elaeagnoidea*[3].

CONCLUSION

Many plants have been shown to exhibit a variety of pharmacological actions. Plants are being researched for possible therapeutic applications, based on traditional medical systems. The review on *Aglaia elaeagnoidea* gives an insight onto one such traditionally used medicinal herb. Its unique chemical constituents, ecological significance, and traditional uses underscore its importance in both scientific research and cultural heritage.

However, much remains to be discovered about this intriguing species. Future studies should aim to further elucidate the plant's phytochemical profile and explore potential applications in medicine. In the face of global issues such as climate change and widespread diseases, the existence of species like Aglaia elaeagnoidea serves as a powerful reminder of the vast, untapped potential within nature. Ensuring the preservation and research of these species is essential, as they may possess the keys to solving numerous critical issues.

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