A Review on Medicinal Value and Pharmacological Profile of *Hildegardia Populifolia(Roxb.) Schott and Endl. (Malvaceae)*

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Abstract

The study's objective was to investigate the therapeutic potential of the phytochemical-rich, endangered tree species *Hildegardia populifolia.* Due to its purported analgesic, anti-nociceptive, sunblock activity and anti-inflammatory properties as well as its capacity to fight bacteria and address the escalating problem of antibiotic resistance, this plant has traditionally been used more and more in healthcare. While *H. populifolia* exhibits minimal antifungal activity, alcoholic extracts from the stem, leaves, and bark of the plant exhibit antioxidant and antihemolytic properties. Additionally, the antidiabetic potential of the extract was assessed in these studies using the DNSA (3,5-dinitrosalicylic acid) technique. Moreover, this study supports conservation by examining clonal propagation techniques for this vulnerable species and demonstrating that mature stem cuttings can be utilized for effective vegetative multiplication.

Keywords: Antioxidant, Antimicrobial, Antidiabetic*, Hildegardia populifolia.*

Introduction

Less than twenty *H. populifolia* trees survive in the Kalrayan Hills. It is a member of the Malvaceae (previously Sterculiaceae) family and is native to Andhra Pradesh and Tamil Nadu.[1] Named for Saint Hildegard of Bingen, the genus Hildegardia has 13 pantropical species.[2] Dog bites and malaria are traditionally treated with infusions of stem bark. This study examines its pharmacological characteristics and conservation tactics in light of its endangered condition and medicinal potential.[3]

Plant profile: Leaves, Fruits, Flowers of *Hildegardia Populifolia* tree.

Scientific classification
Author name: Schott & Endl

Kingdom:		Plantae
Phylum	:	Streptophyta
Class		:
Equisetopsida		
Subclass	:	Magnoliidae
Clade	:	
Tracheophytes		
Clade	:	Angiosperms
Clade	:	Eudicots
Clade	:	Rosids
Order	:	Malvales
Family	:	Malvaceae
~~Genus~~	:	~~Hildegardia~~
Species		:

Populifolia.[4,5]

Fig no.1: *Hildegardia Populifolia* plant morphology

Plant profile

Distribution

- **Andhra Pradesh:** Kadapa, Chandrayani Kona, Ananthapuramu, Chittoor.
- **Maharashtra:** Pune cultivation.
- **Tamil Nadu:** Kalrayan Hills, Dharmapuri, Krishnagiri, Villipuram, Cuddalore.[6]

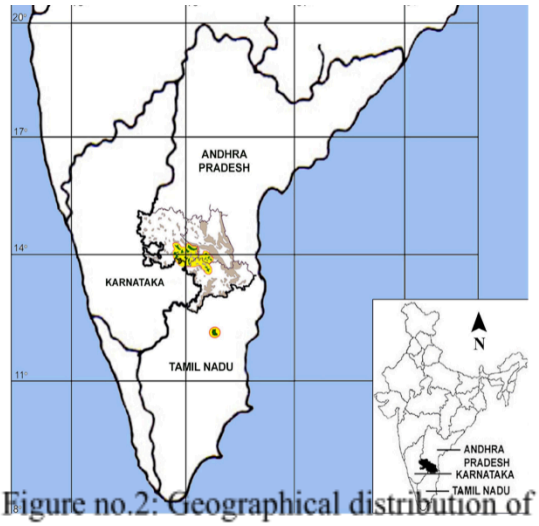

Figure no.2: Geographical distribution of *HP*

Taxonomy (Overview)

Botanical designation : *Hildegardia populifolia* (Roxb.) Schott & Endl., 1832[7]

Family : Malvaceae

Common names : Galibuda, Delibuda

Telugu: Galibuduga, Pichipoliki

Tamil : Malaipuvarasu[8]

Synonyms : Clompanus populifolia, Firmiana populifolia, H. candolleana[9], H. candollei, Sterculia populifolia, S. obtusifolia, S. candollei.[10]

Description

The *H. populifolia* tree has smooth bark and loses its leaves in the winter. The palmate, 6–11 × 9 cm leaves have long petioles and six veins. The tree yields up to 15-cm-long red flowers with fuzzy, spoon-shaped sepals. Each of the fruit's five enlarged follicles holds two seeds. The seeds are oval-oblong, light brown, and 15–20 mm long.[11] *Hildegardia populifolia* is endemic to specific regions in southern Andhra Pradesh and Tamil Nadu Eastern Ghats. [12]

Pharmacological Activities

Figure no.3: Therapeutic activities of *Hildegardia Populifolia*

1. Antihemolytic Activity

With an inhibitory impact ranging from 52.37% to 71.00%, the plant extract showed Antihemolytic efficacy. Erythrocytes from cow blood were isolated by centrifugation and subjected to the plant extract in order to assess this activity. This implies the possibility of having antioxidant qualities and the capacity to shield cellular membranes from oxidative damage.[13]

2. Antimicrobial Activity

The plant's leaflets were extracted using ethanol and tested against various microorganisms. The extract showed inhibitory zones against P. aeruginosa (2.5 mm), S. aureus (1.5 mm), and A. niger (1.6 mm), indicating potential antimicrobial properties. This activity is likely due to the presence of polyphenolics and phenols in the extract.[14]

3. Antifungal Activity

Using a variety of solvents, the plant's stem, bark, and leaves were removed and tested against fungus strains. With zones of inhibition against Trichoderma viride measuring 25 mm and 30 mm in diameter, the methanolic extracts demonstrated strong antifungal activity. Additionally, the extracts demonstrated action against Verticillium lecanii, suggesting that they may have antifungal qualities.[15]

4. Antioxidant Activity

The antioxidant activity in medicinal plants may be largely due to phenolic compounds, including flavonoids, which possess hydroxyl groups with redox capabilities by using DPPH Assay IC50 value of the extract was found to be 10.35 µg/mL and 14 µg/mL for the standard, ascorbic acid , it results in that *H. Populifolia* having significant antioxidant activity.[16]

5.Antidiabetic Activity

The DNSA (3,5-dinitrosalicylic acid) technique was used in this assay to measure the antidiabetic efficacy. In this IC_{50} values were computed by plotting the percentage of α-amylase inhibition against different extract concentrations. The aqueous extract has a lower IC_{50} of 9 µg/mL compared to 14 µg/mL for acarbose. Comparing the extract to the standard, there was a noticeable inhibitory effect.[16]

6.Anti-nociceptive

Antinociceptive impact in albino mice using acetic acid-induced writhing and hot plate methods. The test extract of *H. Populifolia* at a dose level of 200 mg/kg body weight, demonstrated considerably better antinociceptive efficacy than standard drugs Aspirin(100mg/kg) and Pentazocine(3mg/kg).[17]

7.Sunblock Activity

The sunblock activity was measured using the UV-visible spectrophotometry method. With an SPF of 5.6, the 5% extract [F3] cream has the maximum value**.**[18]

8.Anti-Inflammatory Activity

The plant extract demonstrated anti-inflammatory activity in rat models, reducing paw edema induced by carrageenan, formalin, and histamine. The extract's effect was most pronounced at a dose of 200 mg/kg, resulting in a significant decrease in paw size.[19]

9. Analgesic Activity

The plant extract showed analgesic activity in both hot plate and acetic acid-induced writhing tests. The extract increased the latency period in the hot plate test and reduced the number of writhes in the acetic acid-induced writhing test, indicating potential analgesic properties.[19]

Pharmacognostic activity

10. Effect of Growth Hormones on Rooting

The study revealed that auxins, specifically IBA and NAA, significantly influence rooting in *H. populifolia* stem cuttings, with their combination enhancing rooting in various plants. The physiological phases of rooting are closely linked to alterations in auxin concentrations.[20]

Table 1. Reported Pharmacological and Pharmacognosy studies of various parts of *Hildegardia Populifolia.*

SI NO	Extract type/Medium used	Parts used	Pharmacological Activity and Pharmacognosy studies	References
1	Methanol	Leaves, Stem Bark	Antihemolytic activity	13
2	Methanol	Leaves, Stem Bark	Antioxidant activity	13
3	Ethanol	Leaves	Antimicrobial activity	14
4	Methanol	Leaves, Stem Bark	In vitro Antifungal activity	15
5	Methanol	Leaves, Bark	Antioxidant properties	16
6	water	leaves	Antidiabetic activity	16
7	Methanol	Stem Bark	Anti-nociceptive	17
8	Cream	Stem Bark	Sunblock activity	18
9	Methanol	Leaves	Anti-inflammatory activity	19
10	Methanol	Leaves	Analgesic activity	19
11	Indole Butyric Acid (IBA) and Naphthalene Acetic Acid (NAA)	Stem	Effect of Growth hormone on Rooting	20
12	Methanol	Leaves	GC-MS Analysis	21
13	Ethanol	Leaves	The mineral assessment, Thin Layer Chromatography, the phytochemical and in vitro activity of Antioxidants.	22
14	Methanol	Leaves, Stem Bark	Invitro antioxidant activity and Polyphenol Estimation	23
15	Water	Explants	Plant tissue culture	24
16	Methanol	Stem Bark	Antinociceptive and Anti-inflammatory activities	25
17	Ethanol	Leaves	DNA purification and PCR standardization	26
18	Water	Follicles with seeds	In vitro and in vivo seed germination and phytosociology	27
19	Water	Explants	Indirect Organogenesis	28
20	Water	Tree species	Phyto Geographic Analysis	29
21	Water	Tree	Assessment of genetic homogeneity and in vitro development	30
22	Water	Whole Plant	Ecology of regeneration, anemophily monoecy, and anemochory	31

23	Water	Explants, Seeds	In vitro micropropagation	32
24	Methanol	Stem Bark	Treatment of malaria and dog bite	33

Phytochemical screening

GC-MS analysis of the methanolic leaf extract of *Hildegardia populifolia* revealed a range of phytochemicals. $C_{22}H_4.O$ (42.94 percent), Olean-12-ene (12.57 percent), palmitic acid (10.65 percent), and 4-aminopyridine, 2,6-dimethyl- (4.38 percent) were the main compounds found. Phytol was identified as one of the eighteen compounds found. Numerous bioactive substances, including steroids, flavonoids, alkaloids, phenolics, terpenoids, and tannins, are abundant in this plant extract. Polyphenols, tannins, glycosides, carbohydrates, steroids, and flavonoids were found in hexane, ethyl acetate, ethanolic, and aqueous extracts through phytochemical screening. The ethyl acetate and ethanolic extracts contained triterpenes, whereas the hexane and aqueous extracts contained saponins. None of the extracts contained triterpenoid saponins.

Triterpenoids, flavonoids, glycosides, phenols, steroids, polysaccharides, and saponins were found in the initial evaluation of the ethanolic extract from *Hildegardia populifolia*. According to the physicochemical assessment, the percentages of total ash, water-soluble ash, acid-insoluble ash, and sulfated ash were 3.09 percent, 9.21 percent, 10.17 percent, and 11.12 percent, respectively. The volatile extractives were determined to be 3.12 percent, 3.81 percent, 11.75 percent, 18.12 percent, and 10.14 percent w/w in petroleum ether, ethanol, acetone, chloroform, and ethyl acetate.[21]

Discussion

This study illustrates that *H. populifolia* exhibits considerable antihemolytic, antioxidant, antimicrobial, and antidiabetic properties, reinforcing its traditional medicinal applications. Phytochemical analysis indicated the presence of triterpenoids, flavonoids, glycosides, phenols, steroids, polysaccharides, and saponins, which are likely responsible for its pharmacological efficacy. The physicochemical assessment of the leaf powder established standard ash and extractive values that are beneficial for quality control. Additionally, GC–MS analysis identified 18 bioactive compounds within the methanolic extract. The extract demonstrated robust antioxidant activity, validated through both the DPPH scavenging method and the ABTS+ assay, alongside significant antihemolytic effects that suggest protection against oxidative stress. Its antimicrobial properties against S. aureus, P. aeruginosa, and A. niger further support its traditional use in infection treatment. The antidiabetic activity, assessed using the DNSA method, was also confirmed, underscoring its potential in glucose regulation. Effective micropropagation utilizing MS medium enriched with 2,4-D offers a viable strategy for the conservation of *H. populifolia*. Collectively, these results affirm its ethnomedicinal importance and present promising avenues for future pharmacological exploration.

Conclusion

Hildegardia populifolia is a promising source of natural antioxidants, antimicrobials, antihemolytic, antifungal, anti-nociceptive, anti-inflammatory, analgesic and antidiabetic agents with validated pharmacological activities. Its

conservation via clonal propagation is critical due to its endangered status.This data will aid in further research to separate and examine the bioactive components

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