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A Review on Pharmacognistic and Pharmacological Activities of Hygrophila Auriculata

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Abstract: ***Hygrophila auriculata is described in Ayurvedic literature as Ikshugandha, Ikshura and Kokilasha "having eyes like Kokila or Indian cuckoo". It is common in moist places on the banks of paddy fields and widely distributed throughout India from Himalayas to Ceylon, Burma, Srilanka, Malaysia and Nepal. The plant contain phytosterols, tannins, carbohydrates, flavonoids, terpenoids, sterols, palmitic, stearic, oleic, linoleic acid, alkaloids, steroids, tannins, proteins, carbohydrates, fats. Other nutrients like β- carotene, riboflavin, copper and calcium are present. It shows potential in treating liver diseases of the aerial parts, roots and whole plant was studied by various models viz. carbon tetrachloride induced hepatotoxicity, paracetamol and thioacetamide intoxication, and galactosamine induced liver dysfunction in rats. Seeds, leaves and roots showed antinociceptive activity which was studied using both chemical and thermal methods of nociception in mice. The plant also show hematopoietic, anti-inflammatory, antioxidant, hypotensive, diuretic, hypoglycemic activities.***
Keywords: Hygrophila, antioxidant, hematopoietic, flavonoids, Carbohydrates, Riboflavin, Calcium

I. INTRODUCTION

Hygrophila auriculata is an herbaceous plant native to South India and parts of Africa. Its seeds are a part of South Indian cuisine, commonly used as a seasoning. It is known as "Neermulli' in the vernacular. It belongs to the Acanthaceae family and is one of the most versatile Ayurveda medicines[1]. The family composes of a number of genus and species having medicinal value and they are usually perennial herbs or shrubs, rarely trees; some are lianes, xerophytes, aquatica, or mesophytes. It is a stout herb with numerous fasciculate usually unbranched subquadrangular erect stems, 0.6-1.5 m high, thickened at the nodes, more or less hispid with long hairs, especially below each node[2]. All the different parts of the plant are prescribed for one or the other condition and it is very commonly prescribed by Ayurveda doctors as an anti-diabetic, antioxidant, hematopoietic, diarrhea, hepatoprotective agent. This holds great promise for a country like India where there are a huge number of diseases.

Due to the recent lifestyle changes and shift towards excessive urbanisation, there has been an exponential increase in the occurrence of diseases. In countries with poor economies like India, it is useful to employ a number of indigenous plant medicines due to the relatively high cost of allopathic medicines. Ensure safety and efficacy of the crude drugs derived from plants must be subjected to extensive phytochemical analysis to develop sustainable, safe and marketable drugs from them.

This review aims at describing the traditional uses, phytochemical profiles and therapeutic potential of various parts of Hygrophila auriculata (K. Schum) Heine, which has been used in traditional practice for many years.

II. PLANT PROFILE



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III. TAXONOMIC CLASSIFICATION

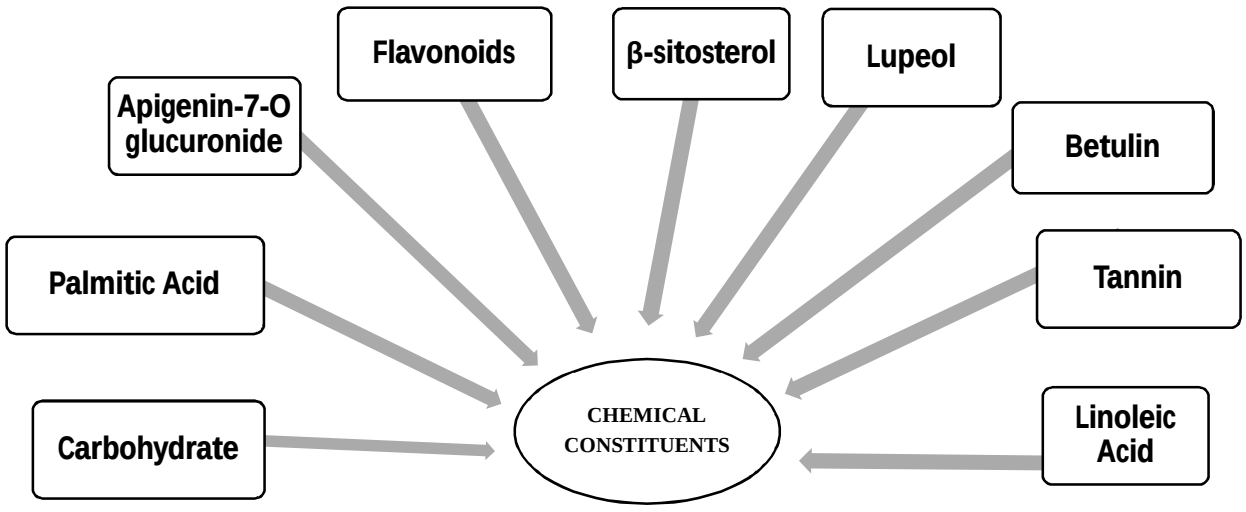
Kingdom	Plantae
Subkingdom	Viridiplantae
Infrakingdom	Streptophyta
Superdivison	Embryophyta
Divison	Tracheophyta
Subdivison	Spermatophyta

Class	Magnoliopsida
Superorder	Asteranae
Order	Lamiales
Family	Acanthaceae
Genus	Hygrophila R. Br.
Species	auriculata

IV. MORPHOLOGY

1) *Leaves:* Leaves sparsely hispid on both sides, tapering at the base, sessile, in verticels of 6 at a node, the 2 outer leaves of the whorl larger, reaching 18 by 1.3-3.2 cm, oblong-lanceolate or oblanceolate, the 4 inner leaves (two on each side) reaching about 3.8 cm long, each of the 6 leaves with nearly straight sharp yellow spine, 2.5-4.5 cm long, in its axis[4].
2) *Flowers:* Flowers in whorl of 8 (in 4 pairs) at each node; bracts about 2.5 cm long, like the leaves, lanceolate, hairy and ciliate; bracteoles 2 cm long, linear-lanceolate, with hyaline margin in the lower part, hairy and ciliate with long white hairs. [5,6].
3) *Roots:* The root has an intact, continuous rhizodermis (epidermis) followed by two layers of tangentially oblong compact outer cortex. The inner cortex is wide and parenchymatous. Thin, uniseriate partition filaments, made up of thin-walled parenchyma cells, form wide, radially elongated air chambers. Some of the partition cells have thick walls and are dilated and squarish rectangular. The vascular cylinder has a thin endodermal layer and a pericyclic layer. The xylem consists of five exarch strands and a few wide angular vessels in between the exarch strands and phloem is in five small groups alternating with the primary xylem strands. The central part of the flower is narrow and parenchymatous[7].

V. CHEMICAL CONSTITUENTS



VI. PHARMACOLOGICAL ACTIVITY

1) *Hypoglycemic Activity:* Hypoglycemic activity Fernando et al., (1991) carried out preliminary investigations of the hypoglycaemic activity of aqueous extracts of the whole plant of Asteracantha longifolia and found that the extract significantly lowers the fasting blood glucose level and markedly improves the glucose tolerance of rats at a therapeutic dose equivalent to 5 g/kg of the starting material [8].
2) *Antioxidant Activity:* The in vitro antioxidant activity was studied using ferric thiocyanate (FTC) and thiobarbituric acid methods[9]. Again Usha et al [10] have reported the hepatoprotective activity of the aqueous extract of the roots of H. spinosa at a dose of 200 mg/kg body weight, orally in CCl4 induced liver damage in rats. They here analyzed the levels of some known antioxidant (both enzymic and non enzymic) activities and histopathological studies to find out the hepatoprotective activity.
3) *Antimotility Activity:* The antimotility activity of Hygrophila auriculata was studied by the charcoal meal feeding method and atropine sulphate, at a dose of 0.1 mg/kg (i.p.), was used as the standard comparator drug. The alcoholic extract of the leaves of Hygrophila spinosa T. Anders, at a dose of 400 mg/kg body weight, significantly decreased the distance travelled by the charcoal meal through the gastrointestinal tract suggesting that the extract exhibited antimotility activity [11].
4) *Aphrodisiac Activity:* The ethanolic extact of Hygrophila indicates androgenic activity with improvement of sexual behavior in the rat by reliant on dose, improve the histo-architecture of the testis, increase the concentration of sperm count in the epididymis and increase testosterone level. The ethanolic extract of Hygrophila auriculata was directed as 100, 150 and 200 mg kg^{-1} doses to rats for a period of 28 days, and the action associated with control rats. The alterations are a weight of organ, sexual behavior, histo-architecture and fructose level of seminal vesicles were observed in a body. The erotic behavior was considered by determining of parameters in aphrodisiac. The plant extracts showed that ability to raise the development of mature spermatozoa and witnessed in transverse section[12].
5) *Haematopoietic Action:* Petroleum ether extraction from Hygrophila auriculata increases WBC count significantly. The mixture of Petroleum: ether: chloroform extracts of leaf showed significantly increases erythrocyte count, leukocyte count, and hemoglobin count[13].
6) *Neuroprotective Activity:* Due to the presence of active terpenoid element in Hygrophila auriculata shows improvements in cognitive testing and reductions in brain lipid peroxidation with potency comparable to 500mg/Kg Vitamin E by treated in orally for seven days in rats then subject to transient global cerebral ischemia[14].
7) *Anti Inflammatory Action:* Ethanol and distilled water extract of the plant exhibited significant anti-inflammatory activity, whereas potent analgesic activity was shown by petroleum ether and ethanol extract, when compared with respective controls and were comparable with those of standard drugs diclofenac sodium and analgin in albino rats and mice at a dose of 400 mg/kg body weight, orally[16].
8) *Anti Nociceptive Activity:* The aqueous extract of leaves, aerial parts and roots of H. auriculata was studied using both chemical and thermal methods of nociception in mice. The extracts at 100 and 200 mg/kg body weight doses inhibited the abdominal constrictions induced by acetic acid and also increased the pain threshold of mice towards the thermal source. The activity was comparable to standard drug aspirin and anti nociceptive activity was observed[17].
9) *Diuretic Activity:* The method described by Lipschitz et al was performed for the activity. Male Wistar albino rats (150–200 g) were used for the experiment. The animals were divided into different groups: the control group received normal saline (25 mL/kg body weight, p.o.); the second group received frusemide (10 mg/kg, p.o.), and other groups received doses of extracts/fractions (200 mg/kg each), in normal saline. The volume of urine collected was measured at the end of 5 h and the total urine volume and concentrations of Na+, K+, and Cl− in the urine were determined. The alcoholic extract of H. auriculata (Schum.) Hiene at doses of 200 mg/kg showed a significant increase in the total urine volume and concentrations of Na+, K+, and Cl− in the urine in the rats. Thus this conclude the diuretic activity of plant [18,19].

VII. CONCLUSION

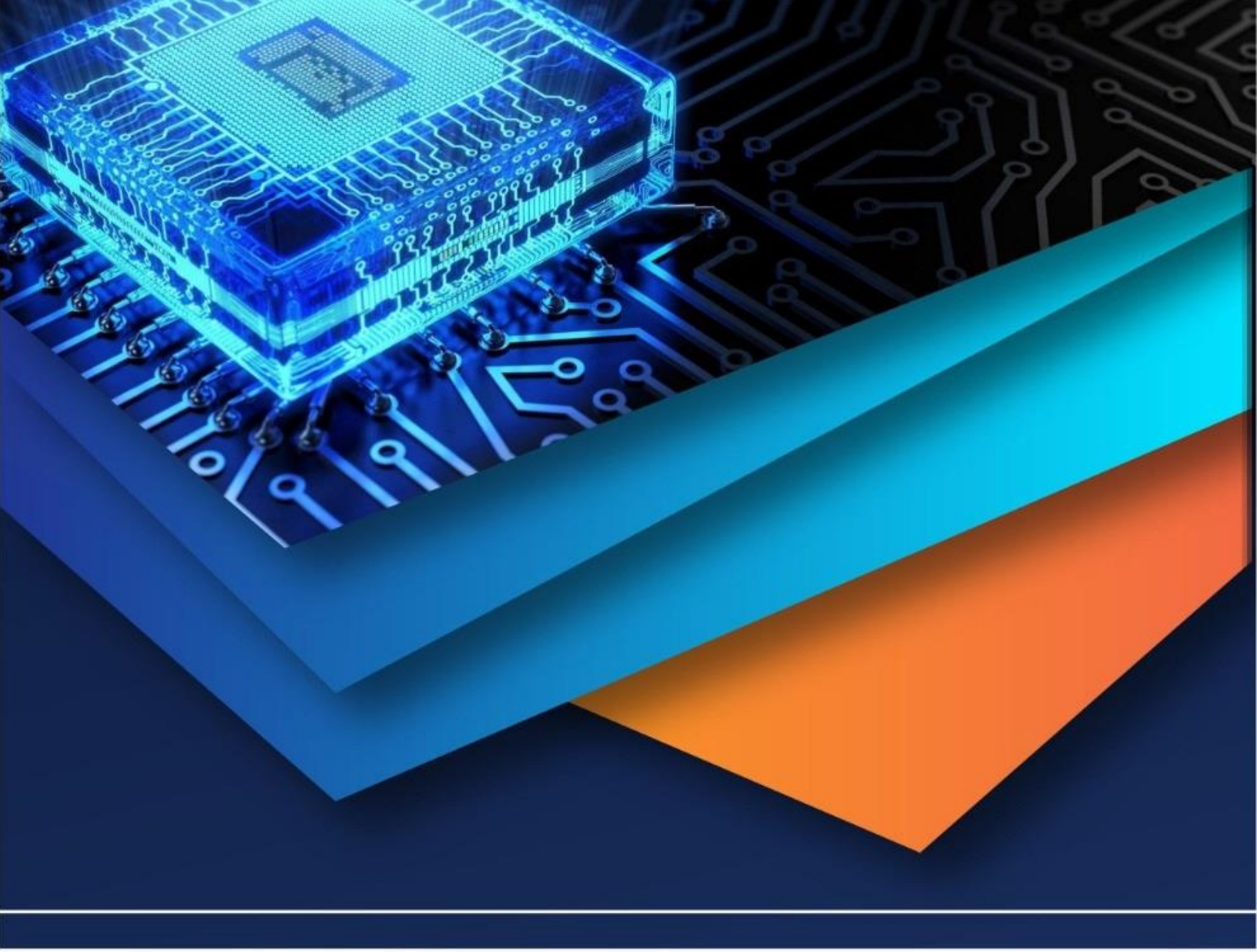
In this review, the pharmacologic studies conducted on H.Auriculata indicate the immense potential of this plant in the treatment of conditions, such as diarrhea; inflammation, diabetes, fever including liver and kidney disorders. It show potency in different activities like antioxidant, haematopoietic, diuretic, neuroprotective due to presence of active constituents like flavaniods, tannins, phytosterols, etc.The leaves show maximum potency and are rich source of vitamin –c, iron, sodium and potassium. In the global scenario medicinal plant value is increasing so, the information will help the scientists and researchers to screen the compounds responsible for different bioactivities, and to elucidate the molecular mechanism of action and drug development from natural sources.

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