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Phytochemical profile and pharmacological activities of *hemigraphis colorata*: a review

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Abstract

The use of herbal plants in the medical system plays an important role in the treatment of illnesses. Researchers all over the globe are exploiting the medicinal plants because of their least side effects, high efficacy and safety. Advancement in science technology has led to the development of a novel formulation from the medicinal plants. Exploitation of such medicinal plants has helped in treatment of ailments and its management. Even though researchers are discovering the hidden potentials of the medicinal plants still there are many underutilized medicinal plant with potent remedies. Among such plants *Hemigraphis colorata* is a plant that has significant part in the medicine system and has made a remarkable impact in traditional medicine treatment. The plant has been used in treatment of bloody dysentery, bacterial infection, fungal infection, haemorrhoids and as a wound healing agent. Along with these several pharmacological studies also suggest that the plant has potent antibacterial activity, anti-inflammatory activity, anticancer activity, antidiabetic activity, antidiarrheal activity etc. these activities can be a results of its vast phytochemical composition which includes alkaloids, tannins, glycosides, steroids, flavonoids etc. the present review is an effort made to collect all the available information regarding the phytochemistry, traditional usage and pharmacological activities.

Keywords: *Hemigraphis colorata*, Acanthaceae, , traditional uses, pharmacological activities, Phytochemistry, bioactive compounds

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Introduction

Since the advent of civilization, natural products, especially those produced from plants source, have been employed to assist mankind in maintaining its health. The therapeutic efficacy of medicinal plants is attributed to their bioactive components, which can be combined into contemporary medical systems to create novel drug formulations for medical conditions. Over the past few

decades plant derived phytochemicals and active components have played a major role in pharmaceutical drug discoveries and its development. Different parts of plants provide a variety of phytoconstituents, comprising primary and secondary metabolites like alkaloids, glycosides, tannins, saponins, resins, and gums, each of which has a specific relevance in terms of the potency [1]. The significance of the active biological constituents of traditional plants in the field of medicine and agriculture has promoted scientific curiosity in the biological importance of these active elements. Although researches have investigated the biological properties of many plants it is restricted only to a small number of plants species considering the vast flora. Therefore, in-

depth research on these plants' biological processes and their primary phytochemicals is required in order to achieve a meaningful sense of natural products [2]. As a result many traditional medicinal plants have undergone extensive testing in pharmacological models in the field of ethno pharmacology. The secondary metabolites and medicinal plants that can be extracted naturally have been used as substitutes for treatments of a variety of illnesses

Hemigraphis colorata a purple colored perennial herb, belonging to family Acanthaceae. Chiefly it is considered as an ornamental plant in spite its biological significance. [3].

Botanical description and geographical distribution

Hemigraphis colorata, commonly known as tincture plant or metal leaf belong to family Acanthaceae. *Hemigraphis colorata* is a creeping herb native to Indonesia and Malaysia, distributed in tropical and subtropical countries like Asia, America, the Caribbean and many islands of the Indian and Pacific Ocean. It has been widely commercialised as an ornamental plant due to its attractive and vivid foliage of green and purple colour. Often planted as the carpet plant. Once rooted, the species spreads out to produce vast dense carpets that completely cover the understory of natural forests, replacing native flora in the process [4].

Morphological characteristics

Hemigraphis colorata is a versatile and exotic perennial herb which grows to the height of 15-30cm. Its branches lie upon or just above the ground and spreads with rooting stems. Leaves (Figure-1) are greyish green in colour with a crimson purple stain on top and a darker purple underneath. These leaves are slender and lance shaped with toothed, scalloped or lobed margins with tiny white flowers its terminal spikes (Figure-2) [5]. The leaves are 4 to 8 cm long and shimmering silvery violet underneath red purple. This plant is adapted to India and is a native of Java [6].



Figure- 1 *H. colorata* leaves



Figure-2 *H. colorata* flower

Botanical classification [6]

Kingdom : Plantae
 Phylum : Spermatophyta
 Subphylum : Angiospermae
 Class : Dicotyledonae
 Order : Scrophulariales
 Family : Acanthaceae
 Genus : *Hemigraphis*
 Species : *colorata*

Synonyms: *Hemigraphis colorata.*, *Blechum cordatum*,
Ruellia alternate, *Ruellia blumeana*,

Vernacular names [7]

Kannada : Tincture ghida

English : Red flame ivy, Metal leaf, Cemetery plant,
 Aluminium plant, Tincture plant
 Sanskrit : Vranaropani
 Malayalam : Murikooti

Phytochemical constituents:

Phytochemicals of a long traditional history and have been utilised as ailments, dyes, and food additives. Phytochemicals are a group of secondary metabolites that have therapeutic properties. The plant is rich in both primary and secondary metabolites comprising of phenols, saponins, flavonoids, terpenoids, coumarins, carbohydrates, carboxylic acid, xanthoproteins, tannins, proteins, alkaloids, steroids, and sterol [7]. Several studies suggest that the main chemical constituent present in the *H. colorata* is β - Carotene.

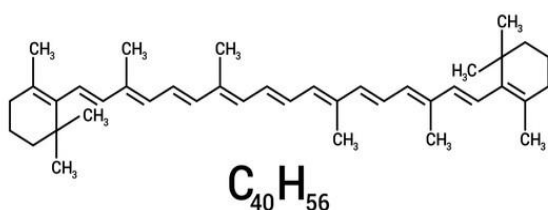


Figure 3 Structure of β - Carotene

Traditional uses

In Traditional system of medicine, plants play a major role in the treatment of several diseases due to its various phytochemicals present in it. Plants have been used in healthcare since time immemorial. Studies have been carried out globally to verify their efficacy and some of the findings have led to production of herbal medicines. In many parts of South-India the leaves of *H. colorata* are used in treating wounds because of its incredible potency to heal wounds. The plant is also known to be used a remedy in treatment of bloody dysentery, bacterial infection, fungal infection and haemorrhoids [3, 5, 8]. It has been claimed that in folklore medicine the plant leaves have been used in treating skin diseases. The paste of these plant leaves have been used in treating fresh cuts, the juice of the fresh leaves is used as a coagulants in order to prevent blood lose, sometimes it is used as a oral contraceptives to prevent pregnancy [6]. The plant *Hemigraphis colorata* is also known to be used for treating anaemia, gall stones, excessive menstruation and as a contraceptive [8].

Pharmacological activities**Antioxidant activity**

Akhil T T et al., reported that the extraction of dried leaves of *H. colorata* in different solvents such as n-hexane, acetone, chloroform, and ethanol showed a potent antioxidant activity [9]. *Nasrin et al.*, reported that the ethanolic extracts of the leaves showed concentration dependent antioxidant activity [10]. *Gangadharan et al.*, Reported that the crude extracts

indicated remarkable antioxidant activity in terms of DPPH free radical scavenging activity and Ferric reducing potential.it also showed presence of significant polyphenolic content such as phenolic compounds, flavonols and flavonoids [11].

Anti-inflammatory activity

Shahid et al., reported the presence of flavonoids in the leaves of *H. colorata* and also investigated its anti-inflammatory activity against carrageenan induced paw edema and concluded that the flavonoids in a test drug are responsible for its significant anti-inflammatory activity [14]. *Gangadharan et al.*, reported that the ethanolic leaf extracts of the *H. colorata* showed significant *In-vitro* anti-inflammatory activity using Human RBC Membrane Stabilization method compared to the standard diclofenac sodium [12]. *Rehman et al.*, reported that the methanol and ethyl acetate extracts of leaves of *H. colorata* showed significant anti-inflammatory activity in Xylene induced ear edema test and Cotton pellet induced granuloma formation [13].

Wound healing activity

Methanolic extract of *H. colorata* showed a wound healing property against the bacteria causing wound such as *Escherichia coli* and *Klebsiella pneumoniae* by well diffusion method at the concentration 25 μ g - 100 μ g. The activity may be due to the presence of antioxidants was reported by *Reetha k* [14]. *Subramoniam et al.*, reported that the paste prepared from the fresh leaves of the plant showed potential wound healing activity by showing faster rate of wound contraction and epithelialization [15]. *Prakashbabu et al.*, reported that the methanolic extract of the leaves in paraffin showed remarkable wound healing activity against excisional wound healing method and the they concluded that the extracts showed significant wound healing activity compared to the standard Boric acid [16]. *Arun et al.*, reported that the ethyl acetate extracts of *H colorata* leaves were rich in antioxidants and polyphenols and *Invitro* evaluation of wound healing activity against scratch wound test model of HaCaT cell showed that the extract is an effect pro-proliferative as an effect wound healing agent by inhibition of COX-1 and COX-2 which are responsible wound inflammation and are known to slow down the process of healing [17].

Anti-diarrhoeal activity

Rahman et al., reported that methanol and ethyl acetate extract of *H. colorata* showed anti-diarrhoeal property against castor oil induced anti-diarrhoeal test in mice. The treatment prolonged the time for induction as well

as decreased the frequency of defecation in a dose dependent manner [13].

Antibacterial activity

Anitha et al., reported that the benzene extracts of the *H. colorata* leaves showed potential antimicrobial activity against *Streptococcus aureus* and they also concluded that this is due to the presence of phenolic contents in the benzene plant extract [18].

Nasrin et al., reported that the various crude extracts of the leaves of *H. colorata* are effective antimicrobial agents and demonstrated its activity through agar diffusion method against *Escherichia coli* (-) and *Bacillus subtilis* (+) [19].

Antidiabetic activity

Gayathri V et al. reported that n-hexane and ethyl acetate extract of *H. colorata* showed a potential anti-diabetic activity against alloxan induced diabetic rats at the concentration of 100mg/kg body weight of rats. They further concluded that the effect may be because of the presence of steroids and coumarins in the extract was proved by [20]

Anthelmintic activity

Scariya S et al., reported that the different extracts of *H. colorata* showed anthelmintic activity against Indian earthworms (*Pheretima posthuma*) at the concentration of 20mg/ml, 40mg/ml and 80mg/ml. It is clear that the standard Albendazole (80mg/ml) showed the effect at 10 minutes and the 80mg/ml concentration of fresh juice extract showed the effect at 21 minutes whereas the higher concentrations of aqueous and ethanolic extracts showed the effect at 28 and 43 minutes respectively [21].

Anti-cancer activity

Sasidharan et al., reported that anti-cancer activity of the extracts of *H. colorata* against Skin cancer cell line-A431 and Normal cell HEK-293 indicated cytotoxicity in a dose dependent manner. It was concluded that the cell toxicity was mainly result of apoptosis and nuclear damage [22].

Antinociceptive activity

Rehman et al., reported that the methanol and ethyl acetate extracts of dried leaf of *H. colorata* showed a potent antinociceptive activity againsts formalin induced paw licking model in mice, the results indicated that the extract were effective against both acute and late phases by inhibiting inflammatory mediators. Acetic acid induced writhing test indicated that the treatment significant inhibited the incidence of writhing and also reported that this may be results of inhibition of endogenous mediators or blockage of prostaglandin pathways [13].

Miscellaneous activity

H. colorata having a plenty of pharmacological activities due to its phytoconstituents, apart from that the plant can also be applicable for other purpose. It inhibit the mild steel corrosion in 1M HCl was investigated using mass loss measurements, ultraviolet-visible(UV) spectroscopy, Fourier transform infrared spectroscopy and other techniques at the temperature ranges 303K – 323K[22]. Also nanoparticles of *H. colorata* having a significant role in the bioremediation of waste water [23, 24]. Sometimes the leaves extract can be used as a natural dye.

Conclusion

In the last few years, the usage of herbal drugs more in India and worldwide than allopathic medicine because of its less side effect and their potency. The development of science and technology in medicine system may led to the development of novel formulation of herbal drugs and also identification and isolation of different chemical compound present in a plant materials for treatment purpose. The pharmacological activity of herbal plant material is mainly due to its phytoconstituents or secondary metabolites. The current study reveals the various phytochemical constituents and pharmacological activities of *Hemigraphis colorata* like antibacterial activity, anti-inflammatory activity, antidiarrheal activity, antidiabetic activity, antinociceptive activity, haemostatic activity, anticancer activity, antioxidant activity, anthelmintic activity and some miscellaneous activity such as to prevent mild steel corrosion, as a natural dye and bioremediation of waste water etc. *H. colorata* is considered as a medicinally, ornamentally, economically valuable species for further research activities.

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