A review on the phytochemistry and pharmacology of *Hemigraphis colorata*


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Abstract

*Hemigraphis colorata* (Blume) H.G. Hallier (syn: *Hemigraphis alternata*, family: Acanthaceae), is an exotic plant adapted to India and commonly known as Red Ivy. The other names of the plant are Aluminium plant, Red flame Ivy, Waffle plant, Java Ivy cemetery plant, Metal leaf etc. The main traditional use of the plant is in wound healing, hence familiar in name "Murikotti" or Murianpacha. The phytoconstituents present in *Hemigraphis colorata* are saponins, flavonoids, terpenoids, coumarins carbohydrates, carboxylic acids, xanthoproteins, tannins, proteins, alkaloids, steroids and sterols. The main pharmacological activity of *Hemigraphis colorata* are in wound healing, ulcers, inflammation, diabetes mellitus and it is used to promote urination. This review was aimed to collect information about the phytochemical and pharmacological effects of *H. colorata* for future works.

Keywords: *Hemigraphis colorata*; Phytochemistry; Pharmacological effects; Wound healing

1. Introduction

Plants are source of natural products for various therapeutic processes and they play a major role in the treatment of human disease. The plant *Hemigraphis colorata* (Blume) is a versatile tropical low creeping perennial herb that reaches a height of 15 to 30 cm [1], which is the native of tropical Malaysia [2]. It is a prostrate growing plant with spreading, rooting stems. Its stainy leaves are slender and lance shaped with toothed, scalloped or lobed margins. They are grayish green stained with red purple above and darker purple beneath [3]. Literally *Hemigraphis* means 'half writing' because the filament of the outer stamen bear brushes [4]. *H. colorata* blooms irregularly throughout the year in the tropics. Flowers are small (1 to 1.5cm diameter), five lobed, bell shaped with imbricate bracts. These are white in colour with faint purple marks within and appear in terminal 2 to 10cm long spikes [5,6]. Seeds are small, flat and white in colour. The leaves are opposite, ovate of cordate, serrate crenate, about 2 to 8 cm long and 4 to 6 cm wide, bearing well defined veins. They are grayish green stained with red purple above and darker purple beneath [7,8].

2. Common uses

The plant has various medicinal properties, but of these only few are reported. The leaf juice is applied directly on open wound to stop bleeding [4]. In folk medicine, it is used internally to cure anemia. Traditionally, the leaves are consumed to mend gall stones, excessive menstruation and as a contraceptive [9,10]. In Java, leaves are used to treat bloody dysentery and haemorrhoids. It also used as a diuretic. The whole plant of *H. colorata* is used for diabetes mellitus [11].

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2.1. Plant profile

2.1.1. Scientific classification

- Kingdom: Plantae
- Order: Lamiales
- Family: Acanthaceae
- Genus: *Hemigraphis*
- Species: *Colorata*
- Synonym: *Hemigraphis alternate*

2.2. Phytochemistry

The phytoconstituents in plants can be used for various medicinal purposes. The phytoconstituents present in *H. colorata* are saponins, flavonoids, terpenoids, coumarins, carbohydrates, carboxylic acids, xanthoproteins, tannins, proteins, alkaloids, steroids and sterol [12]. The phytochemical characteristics of *Hemigraphis colorata* studied using different solvents based on their polarity. The whole plant of *H. colorata* were extracted using solvents such as hexane, chloroform, acetone and ethanol in the increasing order of their polarity. The ethanolic extract showed maximum average extractive yield [13].

2.3. Phytochemical analysis

**Table 1** Comparison of various solvent extracts of *Hemigraphis colorata*

<table>
<thead>
<tr>
<th>Solvents used (150ml)</th>
<th>Colour and consistency</th>
<th>Polarity</th>
<th>Boiling point of solvent</th>
<th>Average yield of extraction(%w/w)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hexane</td>
<td>Yellowish, sticky</td>
<td>1.88</td>
<td>69</td>
<td>1.3</td>
</tr>
<tr>
<td>Chloroform</td>
<td>Dark green</td>
<td>5.6</td>
<td>35</td>
<td>1.4</td>
</tr>
<tr>
<td>Acetone</td>
<td>Green</td>
<td>21</td>
<td>56</td>
<td>0.5</td>
</tr>
<tr>
<td>Ethanol</td>
<td>Yellowish green</td>
<td>24.3</td>
<td>79</td>
<td>2.4</td>
</tr>
</tbody>
</table>

The plant extracts revealed the presence of phytoconstituents which are known to exhibit medicinal as well as physiological activities [14,15].

**Table 2** Determination of presence of phytoconstituents in different extracts of *Hemigraphis colorata*

<table>
<thead>
<tr>
<th>Compounds</th>
<th>Hexane</th>
<th>Benzene</th>
<th>Petroleum ether</th>
<th>Chloroform</th>
<th>Ethanol</th>
<th>Methanol</th>
<th>Acetone</th>
<th>aqueous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkaloids</td>
<td>_</td>
<td>_</td>
<td>_</td>
<td>+</td>
<td>_</td>
<td>_</td>
<td>_</td>
<td>+</td>
</tr>
<tr>
<td>Phenol</td>
<td>_</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>_</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Flavonoids</td>
<td>_</td>
<td>_</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>_</td>
<td>_</td>
<td>+</td>
</tr>
<tr>
<td>Saponins</td>
<td>_</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>_</td>
<td>_</td>
<td>_</td>
</tr>
<tr>
<td>Steroids</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Tannins</td>
<td>_</td>
<td>+</td>
<td>+</td>
<td>_</td>
<td>+</td>
<td>+</td>
<td>_</td>
<td>_</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>+</td>
<td>+</td>
<td>_</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

(+) – indicates presence of phytoconstituents, (-) - indicates absence of phytoconstituents
3. Pharmacological activity

3.1. Anti-oxidant activity

*In vitro* antioxidant potential of leaf of *Hemigraphis colorata* studied by using reducing power and DPPH radical scavenging activity. The phenolic compounds are effective hydrogen donors, which makes them good antioxidants. The reducing power of aqueous and ethanolic extracts of *Hemigraphis colorata* were increased with quantity of samples. With the increase in the concentration of extracts, percentage of radical scavenging activity was found to be significantly increased [13,16].

3.2. Anti-Elastase activity

Elastase are a group of serine proteases that possess the ability to cleave the important connective tissue protein. Elastin is a key component in keeping parts of the body flexible, such as the elasticity in the skin and in the lungs. The aqueous and alcoholic extracts of *Hemigraphis colorata* showed a considerable inhibition towards porcine pancreatic elastase and the inhibitory effect increases significantly with increase in concentration of both extracts. Elastase inhibitors are also used as anti-ageing and anti-wrinkling agent [16].

3.3. Anti-inflammatory activity

*In vitro* anti-inflammatory assay was carried out by HRBC membrane stabilization method. The anti-inflammatory effects of *Hemigraphis colorata* extracts may be due to the presence of flavonoids, tannins, phenols [13].

3.4. Wound healing activity

The wound contraction and epithelialisation were faster in *H. colorata* leaf paste applied mice when compared to control. Wound contraction progressed faster when the leaf paste was applied on the wound compared to untreated wounds. In the *H. colorata* treated wounds, the drug adhered on the wound and prevented the discharges from the wound within a few hrs after the application. The efficacy of the leaf preparation was comparable to that of povidone-iodine ointment [17,18].

3.5. Anti-bacterial activity

*In vitro* antibacterial efficacy of the *Hemigraphis colorata* leaves and stem of crude aqueous, acetone, benzene, chloroform, ethanol and petroleum ether extracts were quantitatively assessed on the basis of zone of inhibition. Ethanolic extracts of *H. colorata* shows anti-bacterial effects against the *K. pneumonia*. Ethanolic extracts of leaves and stem extract of *H. colorata* show the inhibitory activity against the bacteria *S. typhi* due to the presence of active constituents present in the plant. *H. colorata* stem and ethanol extracts of *H. colorata* leaves displayed the inhibition zone against the bacteria *B. cereus*. Petroleum ether extracts of *H. colorata* provides moderate anti-bacterial activity against the pathogen *S. marcescens*. The antibacterial study of ethanolic leaf extract of *Hemigraphis colorata* was determined by agar diffusion method and it shows antibacterial activity against *Escherichia coli* (-) and *Bacillus subtilis* (+). The antibacterial potential increase with increase in concentration of plant extract [19,20].

3.6. Anti-diabetic activity

The hypoglycaemic and anti-diabetic properties of *H. colorata* was identified for the first time using Wistar rats and Swiss albino mice using glucose tolerance test. The n-hexane & ethanol extracts of the whole plant were found to lower the blood glucose levels in glucose fed rats. The presence of steroids & coumarins in the plant extract is responsible for the hypoglycaemic and anti-diabetic effects [11].

3.7. Miscellaneous activity

*Hemigraphis colorata* was recognized as one of the ornamentals which can remove harmful volatile organic compounds to maintain the quality of indoor air, because volatile indoor pollutants from paints, odorants, cleaning agents etc., can cause various ailments to people during exposed to them. Chloramphenicol and Ciprofloxin are antibiotics were used in antibacterial assays of methanolic extract of *Hemigraphis* to treat UTI patients [21,22].

4. Conclusion

Plants plays a major role in the treatment of human diseases. Medicinal action of the plants is due to the synergic action of several compounds targeting multiple sites associated with physiological processes. *Hemigraphis colorata* belongs to
Acanthaceae family, is one of the potential plants among the tribal healers of south India. The plant contains various phytoconstituents such as flavonoids, phenols, carbohydrates, coumarins, sterols etc. Due to the presence of various phytoconstituents it is used for various treatments such as in wound healing, anemia, gall stone, diuretic, haemorrhoids and diabetic mellitus.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest.

References


