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The Plant *Aerva sanguinolenta*: A Review on Traditional Uses, Phytoconstituents and Pharmacological Activities

Joy Sarker¹, Md. Rahmat Ali¹, Muhammad Ali Khan², Md. Mahbubur Rahman³, ASM Sakhawat Hossain³, AHM Khurshid Alam^{1,*}

ABSTRACT

Aerva sanguinolenta L., (*A. sanguinolenta* L.) Blume is a perennial herb that belongs to the Amaranthaceae family. The plant has widely been used as a traditional medicine for long time. It is rich in phytochemical constituents such as tannins, flavonoids, terpenoids, sphingolipids, polyphenolic compounds and betacyanins. Moreover, it has significant therapeutic effects, including antihyperglycaemic, hepatoprotective, antioxidant, antimicrobial, anti-inflammatory, diuretic and anti-leishmania activities. The scientific validation is essential for the acceptance of medicinal plants as therapeutic agents against several disorders. Hence, the traditional uses, phytochemical constituents, medicinal significance and pharmacological effects of the plant are discussed in this review.

Key words: *A. sanguinolenta*, Phytochemical Constituents, Traditional Uses, Medicinal Significance, Pharmacological Activities.

INTRODUCTION

Plant medicines are the most widely used medicines in the world today. Bangladesh is a well-known repository for medicinal plants. Plant and its extracts have been used in ayurvedic, siddha and unani for treating different types of diseases from ancient time. A few of the medicinal plants have been evaluated scientifically. Phytochemical constituents possess important pharmacological properties like chemopreventive and cytotoxic effects. A natural constituent from traditional medicinal plants boosts up the health and mitigates the ailments. In present days, scientific evaluation of various pharmacological effects of medicinal plants has increased throughout the world.^[1] More than 80% population from developing countries depends upon the traditional medicines mainly plant drugs used for their primary health care reported by World Health Organization (WHO). Medicinal plants exhibit lower side effects compare to synthetic drugs. Because of this, the use of medicinal plants is growing worldwide.^[2]

Plant Introduction

Botanical Name: *Aerva sanguinolenta* (L.) Blume

Synonyms: *Achyranthes sanguinolenta* L.

Local Name: Lal bish hori

Plant Family: Amaranthaceae

Plant Form: Herb

About *Aerva sanguinolenta* (*A. sanguinolenta*) Plant

Habit: An erect, perennial, often climbing, herbs, 30 - 150 cm tall, arising from the woody base.

Stem: Branches terete, densely appressed lomentose in younger parts.

Leaves: Sub - sessile, alternate or fascicled or with opposite and alternate mixed, ovate - elliptic or lanceolate or oblong, acute or mucronate at the apex, cuneate, subacute or tapering at base, entire along the margin, densely clothed with appressed white hairs on both sides; petioles 3 - 8 cm along.

Inflorescence: Spikes.

Flowers: Flowers small, white or with a pinkish or golden tinge, in spikes which are 0.5 - 3.0 cm long, globose or cylindric, white - woolly, shining and which may be solitary or fascicled in the axils of leaves or gathered into lax terminal racemes; often forming paniculate inflorescence due to suppression of upper leaves.

Fruits: Utricle 1 mm in diameter, reniform, broadly ovate, acute, thin.

Seeds: 1 mm in diameter, reniform, brownish - black, shining, smooth.

Flowering and Fruiting time: September - January.

Traditional Uses

Traditionally, the whole plant of *Aerva sanguinolenta* (*A. sanguinolenta*) (Figure 1) is used as a tonic, sedative and dermatitis.^[3] The decoction made from young branches of the plant used internally against haematuria and irregular or painful menstruation. The roots are used for dysentery and paste of the roots is applied externally for headache.^[4] Bhoxas tribals of Dehradun tie a twig of the plant on the neck

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Figure 1: *Aerva sanguinolenta*.

of sick cattle's with the belief that it may get relief.^[5] Leaves are made into paste and applied externally for the treatment of cuts and wounds.^[6] It has been reported that the ethanol extract of the whole plant possesses neuroleptic activity.^[7]

Medicinal Significance

In folk medication, the leaves and flowers of the plant were used as wound healing and anti-inflammatory for injuries from falls, rheumatic arthritis and pain in muscles.^[8] The whole plant was used as diuretic and demulcent.^[9] Tender shoot of the plant is used as decoction form for galactagogue to nursing mother^[10] and decoction of whole plant is taken twice a day to expel intestinal worms.^[11] Leaves and roots of the plant have been used for body pain and the paste of the leaves and roots is applied to the affected area.^[12] The plant extract showed significant wound healing property.^[13] Bark is used in the ailment of blood in urine. A list of bioactivity and secondary metabolites present in the plant has been shown in [Table 1].

Phytochemical Constituents Isolated from *A. sanguinolenta*

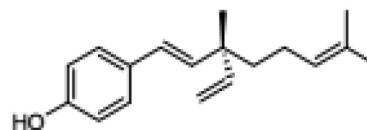
Investigation on the profile of biochemicals in the species of *Aerva* genus suggested that the species are to be a valuable source of different classes of biologically active compounds. The survey of previous phytochemical work on the species of the *Aerva* genus revealed that the alkaloids, flavonoids, coumarins, terpenoids, steroids and various phenolics have been

Table 1: Current bioactivity and secondary metabolites profile of *A. sanguinolenta*.

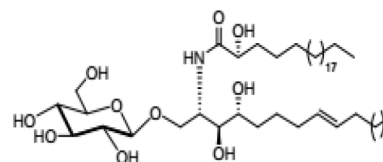
<i>A. sanguinolenta</i>				
Used part	Extract	Secondary metabolites	Bioactivity	References
Aerial part	Ethyl acetate and chloroform	Flavonoid, tannin	Antioxidant	18
	Ethyl acetate and chloroform	Flavonoid, tannin	Antidiabetic	18
Leaves	Methanolic extract	Bakuchiol	Antimicrobial activity	14
	Ethanol extract	Polyphenolic compound	He patoprotective activity	19
Whole plant	Aqueous extract	-	Anti-inflammatory	20
	Aqueous extract	-	Diuretic	20
	Ethanol extract	-	Neuroleptic activity	7

discovered in these plants. Very few phytochemical investigations have been done on *A. sanguinolenta*. Following phyto-constituents have been isolated and published from this plant so far.

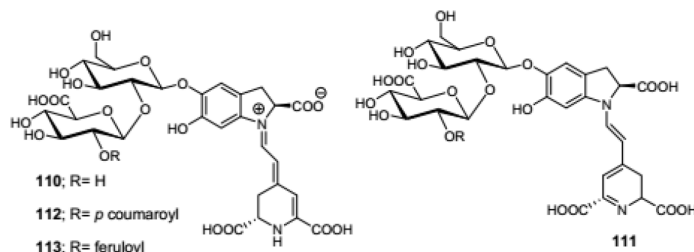
Terpenoids: Ameroterpene, bakuchiol, has been isolated from the methanol extract of the dried leaves of *A. sanguinolenta*, which inhibited the growth of *Streptococcus mutans* -MTCC 497, *Actinomyces viscosus* -ATCC 15987 and *Streptococcus sanguis* ATCC 10556 with an MIC value of 0.98 µg/mL for each strain.^[14]



Sphingolipids: An anti-inflammatory cerebroside, ASE-1, is discovered from the ethanolic extract of leaves of *A. sanguinolenta*.^[15]



Betacyanins: Acylated and simple betacyanins i.e., amaranthine (i), isoamaranthine (ii), celosianin I and celosianin II (iii) were identified and quantified in inflorescence of *A. sanguinolenta*.^[16]



It also contains flavonoids, tannins and polyphenolic compounds.

Pharmacological Effects

Antioxidant activity: Antioxidant substances are found in different natural sources like plants and micro-organisms.^[17] Different species of *Aerva* are reported to show antioxidant activities. Very little work has been done on *A. sanguinolenta* and in this regard only a few reports are available. According to a study, the antioxidant potential is associated with the ethyl acetate and chloroform extracts of aerial parts of *A. sanguinolenta*.^[18]

Antidiabetic activity: The ethyl acetate and chloroform extracts of aerial parts of *A. sanguinolenta* exhibited mild anti diabetic activity.^[18]

Antimicrobial activity: The methanolic extract of the leaves of *A. sanguinolenta* showed good anti-microbial activity. Bioactivity guided isolation of the methanolic extract with hexane: chloroform (1: 1/1:3) and chloroform: ethyl acetate (9:1) over silica gel to afford 4 fractions. Out of which, fraction-2 showed better activity against gram positive pathogens with MIC of 0.98 µg/ml and moderate activity against dandruff causing yeast with MIC of 250 µg/ml. The crude extract has been shown good antimicrobial activity. Based on the bioassay guided fractionation and isolation, one pure compound, bakuchiol was characterized and the compound showed potent antibacterial activity against oral pathogens and dandruff causing organisms. This compound was an alternative source to synthetic molecules.^[14]

Hepatoprotective activity: The hepatoprotective effects of ethanolic extract of *A. sanguinolenta* are investigated by oral route to adult male Wistar rats weighing about 160-180 gm. The protocol started with oral feeding of 200 and 400 mg/kg body weight of the extract. After treatment of sixteen consecutive days and after 24-hr of last dose and 18-hr fasting, all animals in each group were sacrificed by cervical dislocation. The blood and liver were collected for biochemical estimation and histopathological observation, respectively. From the reported result, it was found that the ethanolic extract of the plant has hepatoprotective activity, which was comparable to that of the standard. Here, hepatoprotective activity of ethanolic extract of *A. sanguinolenta* leaves may be due to the presence of polyphenolic compounds. Besides, *A. sanguinolenta* contains flavonoid and tannin, which are also known as natural antioxidants due to their electron donating property by either scavenging the principal propagating radicals or halting the radical chain.^[19]

Diuretic activity: The studies on diuretic activity revealed that the extract of *A. sanguinolenta* has considerably increased the urine volume with significant increase in the cationic concentration at each increased dose. The Na⁺/K⁺ ratio indicates a dose dependent response with comparable results at the doses of 100, 200 and 400 mg/kg with that of the reference standard drug administered.^[20]

Anti-inflammatory activity: The aqueous extract of *A. sanguinolenta* showed significant anti-inflammatory activity at all tested dose levels. The percentage inhibition of paw oedema was found to be dose-dependent. However, the percentage protection was found to be almost equal at the doses of 200 mg/kg and 400 mg/kg, which conclude that a dose of 200 mg/kg may be considered as optimum dose, which was comparable with the reference drug, indomethacin. Thus, the study justifies its use in the indigenous system of medicine and folkloric remedies as anti-inflammatory agent. Further study is needed to isolate the active principles responsible for these activities and study of their exact mechanism of actions.^[20]

Anti-leishmania activity: *A. sanguinolenta* extract promisingly showed anti-leishmania activity. IC₅₀ values were recorded between 0.1 µg/ml to 1 µg/ml. Phytochemical analysis of methanolic extract revealed the presence of active functional groups. Morphological and cellular analysis of parasite found gross changes. The infrared and mass spectrometric analysis found considerably modified functional changes in the parasite

metabolism. The treated cells appeared exhausted proportion of most metabolites, showing that losing the integrity of outer cell membrane and internal metabolites will be disappearing upon cell death. In the parasitic cells, the drug was attributed and established the changes in the strength of functional metabolites. This investigation supports a good response with *A. sanguinolenta* extract as herbal medicine and the development of new phytomedicine in the rationale behind the treatment of neglected tropical diseases of Leishmaniasis.^[21]

CONCLUSION

The *A. sanguinolenta* is one of the most important medicinal plants used for many diseases and disorders. The presence of phytochemical constituents such as terpenoids, sphingolipids, betacyanins etc. play a therapeutic role in pathologic conditions. It exhibits diuretic activity, anti-inflammatory, antihyperglycemic, anti-leishmania activity and so on. Hence, applying more scientific methods on this plant may lead to discover new entity and helpful for pharmaceutical industry for making new therapeutic drugs.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

ABBREVIATIONS

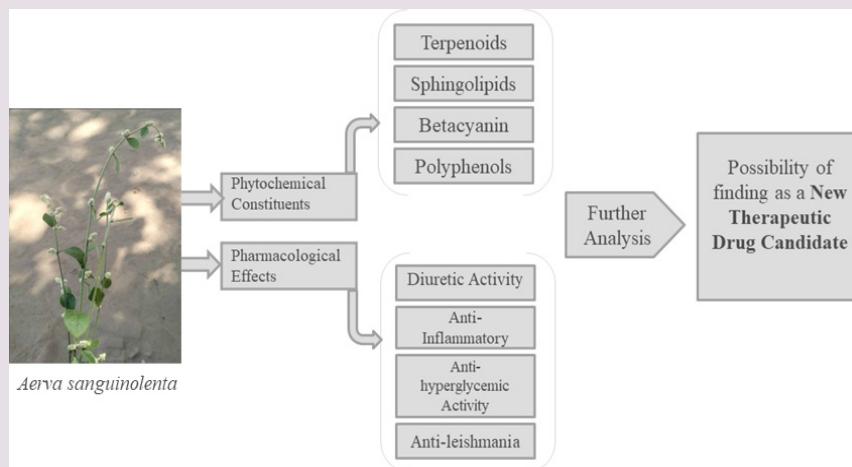
ATTC: American Type Culture Collection; **IC₅₀:** Inhibitory Concentration; **MIC:** Minimum Inhibitory Concentration; **MTCC:** Microbial Type Culture Collection; **WHO:** World Health Organization.

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GRAPHICAL ABSTRACT



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