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FLEMINGIA VESTITA- A REVIEW ON THE UNEXPLORED PLANT FROM THE NORTH EAST INDIA

Rahnam Berceroy Jyrwa, Asst. Prof. Sangita Boro* & Asst. Prof. Bhriganka Bharadwaj

Department of Microbiology, Assam down town University, Sankar Madhav Path, Gandhi Nagar, Panikhaiti, Guwahati 781026, Assam, India.

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***Corresponding Author**
Asst. Prof. Sangita Boro
Department of Microbiology, Assam down town University, Sankar Madhav Path, Gandhi Nagar, Panikhaiti, Guwahati 781026, Assam, India.

ABSTRACT

The genus Flemingia (family Leguminosae) comprises over fourty species in the world. In out of all the fourty species *Flemingia vestita* is the one that is found to be present as a wild herb in the mountain slope of Himalayas. It is distributed in Sichuan and Yunnan provinces of China and Nepal. In India this Flemingia species has been abundantly found to be preent in the Northeastern region i.e. the Khasi hills and Jaintia Hills of Meghalaya. It is also sparsely found in Laos, Philippines and Vietnam. It has been traditionally used as an anthelmintic, the basis of which has been scientifically validated. Previous studies showed that it is rich in bioactive isoflavones such as genistein, daidzein, formononetin and pseudobaptigenin. This review article includes the detailed exploration of the morphology, phytochemistry, and pharmacological aspects of *Flemingia vestita* in an attempt to provide a direction for further research.

KEYWORDS: *Flemingia vestita*, Phytochemistry, Isoflavone, Anthelminthic, North East India.

INTRODUCTION

The genus Flemingia Roxb. Ex comprises of erect or prostrate shrubs and herbs native to the tropics and subtropics. Different species of *Flemingia* has been found to be distributed almost throughout India in Andaman and Nicobar Islands, ascending to an altitude of 4,500 ft. Himalayas from Simla and Kumaon, ascending to 8000 ft. to Assam, Dehradun and Siwalik

range, Bundelkhand, Sind, Rajasthan and Bengal to South India.[7] About fifteen species of Flemingia occur in India.[7] *Flemingia vestita* other names are *Flemingia procumbens* Roxb.; *Moghania vestita* (Benth.) ex Baker Kuntze; *Moghania procumbens* (Roxb.) Mukerjee and it is famously known as Soh-phlang in Meghalaya. It has been found that it possesses anthelminthic properties in it and it is traditionally used to eliminate intestinal worms.[8, 15, 14] The juicy tuber is a highly priced vegetable among the Garo, Khasi and Jaintia tribes of Meghalaya, India.[13] In fact its demand as foodstuff has increased so much that it has been cultivated as a cash crop and is regularly available in the local markets. In terms of nutritional value, it is particularly rich in phosphorus and proteins.[6]

Image a: *Flemingia vestita* plant with its roots.

(Source: www.zizira.com)

Image b: *Flemingia vestita* roots being sold in market.

(Source: www.zizira.com)

Image c: *Flemingia vestita* cultivation.

Scientific Classification / taxonomy[4]

Domain : Eukaryota

Kingdom : Plantae

Division : Magnoliophyta

Class : Magnoliopsida

Order : Fabales

Family : Fabaceae alt. Leguminosae

Sub family: Faboideae

Tribe : Phaseoleae

Sub tribe :Cajaninae

Genus : *Flemingia*

Species : *vestita*

Morphology

F. vestita is a perennial herb, having a prostrate but weak stem, densely pubescent, measuring about 60 cm in average. It is highly branched with hairy rhizome and hirsute stems. The roots are tuberous (6 cm or longer). Leaves are pinnately compound with obovate-cuneate leaflets. Leaves are digitately 3-foliolate; stipules ovate, 4–8 mm, persistent; petiole 1–2 cm, wingless, and also pubescent like the stem. Lateral leaflets are obliquely elliptic, and slightly smaller. Raceme is axillary or terminal, about 2-10 cm, and densely pubescent; bracts lanceolate. Calyx is 5-lobed; lobes are linear-lanceolate, lower one is longest, longer than the tube.[15]

Corolla is slightly longer than calyx and elliptical. Fruits are hairy sub-cylindrical pods. Seed is globose, brown or black in colour. Flowers are bright-red.[4]

Cultivation

It is usually sown in the month of April-May. It flowers during August and September and in the month of October-November the tubers of the plant are dug out. The harvest is stored in a hole covered with earth. They are taken out a little at a time and sent to the market. They are scrubbed and cleaned multiple times before transporting to the market. Once planted in an area, that particular area is left fallow for about five years before another crop is harvested. The soil needs to become hard that is why farmers seek out land in the forest to plant *F. vestita*.[16]

Phytoconstituents

Isoflavanoids, genistein, formononetin, pseudobaptigenin and daidzein were found in the extracts of the root of *Flemingia vestita*.[4]

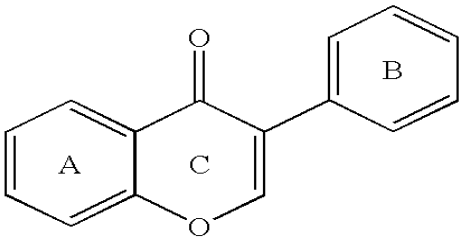

Image d: Isoflavonoid.

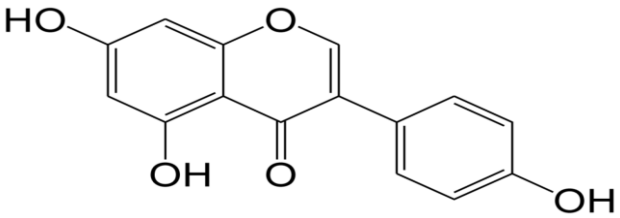

Image e: Genistein.

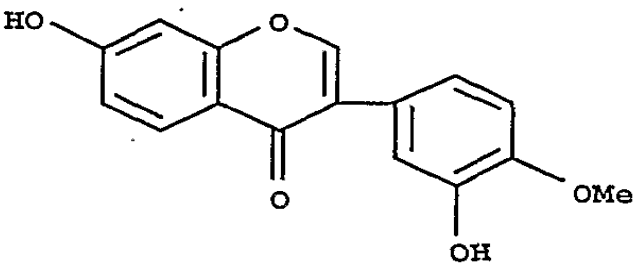

Image f: Formononetin.

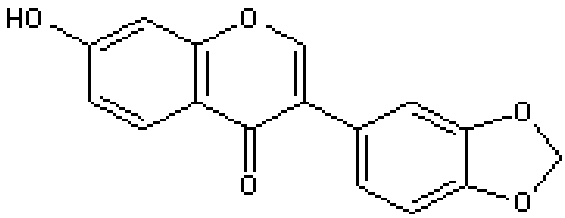

Image g: Pseudobaptigenin.

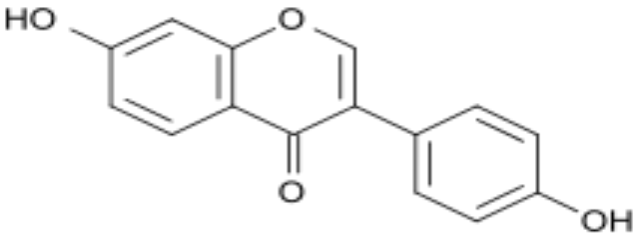

Image h: Daidzein.

Anthelmintic activity

Das et.al, 2005 reported anthelminthic activity of *F. vestita* by causing a flaccid paralysis accompanied by alterations in the structural architecture of the tegumental interface and metabolic activity in *Raillietina echinobothrida*, the cestode of domestic fowl. The crude root-peel extract and pure genistein were tested in vitro with respect to Ca2+ homeostasis and the occurrence of some metal ions was detected in the parasite. In the parasite's tissue, a significant amount of Ca2+ (¨400 Ag/g dry tissue wt) was found to be present besides magnesium, iron, zinc, lead and chromium whilst manganese, cadmium and nickel were below the level of detection. The Ca2+ concentration was decreased significantly by 39%–49%, in the parasite tissue exposed to the test materials in comparison to the respective controls. There was also an increase in Ca2+ efflux by 91%–160% into the culture medium under similar treatments. The changes in Ca2+ homeostasis may be related to the rapid muscular contraction and consequent paralysis in the parasite due to the anthelmintic stress caused by the phytochemicals of *F. vestita*.[1]

Das et al., 2006 reported a vermifugal / vermicidal effect in the fowl tapeworm *Raillietina echinobothrida* by treating the alcoholic crude root-peel extract of *Flemingia vestita* and its major compounds isoflavone and genistein (Das et al., 2006). Also, the root-tuber peel of *F. vestita* and its active component genistein, were tested in respect of glucose metabolism in the cestode, *Raillietina echinobothrida*. In the treated worms, there was a significant decrease

in the glycogen concentration accompanied with the decrease of glucose by 14-32%, whereas the malate concentration increased by 49-134% as compared to controls.[2]

Das et al., 2004 studied the role of phytochemicals from *F. vestita*, in particular genistein, which influence the key enzymes of gluconeogenesis- pyruvate carboxylase (PC), phosphoenolpyruvate carboxykinase (PEPCK) and fructose 1, 6-bisphosphatase (FBPase)-in *R. echinobothrida*, which is perhaps a function of high energy demand of the parasite under anthelmintic stress (Das et al., 2009).[3]

Tandon et al., 2003 reported the effect of the crude root-peel extract (5 mg/ml) and pure genistein (0.2 mg/ml) from *F. vestita* which were tested in respect of glycogen metabolism in the fowl tapeworm, *Raillietina echinobothrida*. The glycogen concentration was found to decrease by 15-44%, accompanied by an increase of activity of the active form of glycogen phosphorylase (G Pase a) by 29-39% and decrease of activity of the active form of glycogen synthase (G Sase a) by 36-59% in treated parasites as compared to untreated controls, but without affecting the total activity (a + b) of both the enzymes.[8]

Pal and Tandon, 1998 had studied the mode of action of genistein and its effect on the activity of tegumental enzymes of the parasite *Raillietina echinobothrida* using acid phosphatase (AcPase), alkaline phosphatase (AlkPase), adenosine triphosphatase (ATPase) and 5‟-nucleotidaes (5‟-Nu). The crude extract of *F. vestita* (50 mg/ml) and genistein (0.5 mg/ml) suppressed the activity of AcPase, AlkPase, ATPase and 5‟-Nu by 97, 95, 88 and 57% respectively.[13]

Tandon et al., 1997 reported the in-vitro activity of root-tuber-peel extract of *F. vestita*, which was tested against helminth parasites. Live parasites (nematode: *Ascaris* from pigs, *A. lumbricoides* from humans, *Ascaridia galli* and *Heterakis gallinarum* from domestic fowl; cestode: *Raillietina echinobothrida* from domestic fowl; trematode: *Paramphistomum sp*. from cattle) were collected in 0.9% physiological buffered saline (PBS) and maintained at 37 ± 1ºC. The treated parasites showed structural alteration in their tegumental architecture. This study suggests the vermifugal activity of the plant extract against trematodes and cestodes. [14]

Kar et al., 2002 studied the effect of the crude peel extract of *F. vestita* and genistein, for nitric oxide (NO) and the enzyme nitric oxide synthase (NOS) in *Fasciolopsis buski*, the large intestinal fluke of swine and human host. In biochemical analysis, the NOS activity showed a significant increase in the parasites treated with the test materials and reference drug,

compared to the untreated controls. The increase in NOS activity in the treated parasites can be attributed to an inducing effect of the plant-derived components.[5]

The treatment of parasite *Fasciolopsis buski* with 20 mg/ml of crude peel extract of *F. vestita*, 0.5 mg/ml of genistein showed a marked decrease in the levels of free amino acid; arginine, ornithine, tyrosine, leucine, isoleucine, valine, alanine, glycine, proline, serine, threonine, taurine and increase in the levels of glutamic acid, glutamine, phosphoserine, citrulline and GABA. The ammonia level increased by 40.7%, 66.4% and 18.16% in treatment with F. vestita, genistein. The changes in the levels of the amino acids and nitrogen components post treatment suggest that the amino acid metabolism in the parasite may have been altered under the influence of the test materials (Kar et al., 2004).[6]

Roy and Tandon, 1996 reported the effect of ethanol root-tuber extract of F. vestita on a leguminous plant on *Artyfechinostomum sufrartyfex* and *Fasciolopsis buski* by a scanning electron microscopy. A. sufrartyfex became paralyzed within 1.1-1.4, 0.8-1.0, and 0.3-0.5 h, respectively. Stereo scanning observations were noticed on the tegumental surface of treated {(20 mg extract/ml phosphate-buffered saline (PBS)}, A. sufrartyfex revealed the sloughing off of most of the spines or their deformation as well as wrinkles and rupture of the general tegument. Severe tegumental alterations and deformities were also displayed by *F. buski* when exposed to 20 mg extract/ml PBS.[11]

CONCLUSION

Since time immemorial medicinal plants have been used traditionally to treat various ailments and North East India is one such part of the country which has many incredible and unexplored plants that could be remedies for many dreaded diseases. Among the many different species of Flemingia, *Flemingia vestita* is found only in the Khasi Hill and Jaintia Hills of North Eastern India. It is an unexplored herb which is traditionally used only as an anti helminthic herb. Its many other medicinal aspect is yet to be identified. So this review was aimed to give an idea about the plant as it has the potential for in depth investigation for various biological activities. The extracts of *Flemingia vestita* may help in the development of many potent antibacterial, antioxidant and antibacterial drugs.

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