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A REVIEW ON *MYXOPYRUM SERRATULUM* A.W.HILL - A PROMISING MEDICINAL PLANT

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ABSTRACT

The plant kingdom is a rich source of chemicals with physiological activity that have a wide range of pharmacological effects. *Myxopyrum serratulum* A.W.Hill is a climbing shrub. This medicinal herb has been utilised for a variety of illness situations since ancient times. The leaves were traditionally used as an astringent, acrid, sweet, thermogenic, anodyne, febrifuge, and tonic in Ayurveda. Many ethnobotanical advantages of the complete plant include the treatment of wounds, otitis, rheumatism, fever, cough, asthma, and headaches. There are many different phytochemical compounds, including as glycosides, alkaloids, triterpenoids, and flavonoids. Anti-asthmatic, anti-microbial, wound-healing, and anti-oxidant qualities have all been proven up to this point. Phytochemical research indicate that this plant can significantly advance the medical sector. Many pharmacological traits are still under investigation. This specific plant was chosen for examination due to both its interesting morphological characteristics and pharmacological benefits. The primary subjects of this review article on *Myxopyrum serratulum* A.W.Hill are its fundamental characteristics and a number of research initiatives.

KEYWORDS: *Myxopyrum serratulum* A.W.Hill, flavonoids, anti-asthmatic, anti-oxidant, wound healing activity.

INTRODUCTION

A medicinal plant is any plant in one or more of its parts contain substances that can be used for therapeutic purposes, which are precursors for the synthesis of useful drugs.[1] Therapeutic potential of plant products can be traced back more than 5,000 years, since evidence suggests that Indian, Egyptian, Chinese, Greek, and Roman civilizations used them to treat illnesses and to revitalise bodily systems. India has about 4.5 million plant species and among them estimated only 250,000-500,000 plant species, have been investigated phytochemically for biological or pharmacological activity.[2] For decades, plants have been used as an important source of medicine in pharmaceutical biology. Medicinal and aromatic plants can contribute significantly to the improvement of rural people's subsistence livelihoods, particularly for women, in an environmentally friendly way while preserving the biodiversity of these natural resources.[3] As per WHO estimates, even today, up to 80 percent of population still rely on traditional medicines.[4] In addition, the active components of Taxol, vincristine, and morphine were isolated from, foxglove, periwinkle, yew, and opium poppy respectively. Thus, this medicinally potent plant can contribute a lot to the pharma industry.

Myxopyrum serratulum A.W. Hill, is a large woody climbing shrub belonging to the family Oleaceae, with small yellow flowers. Myxopyrum genus are native to South-East Asia and can be seen in Southern China and New Guinea, Chittagong and South Deccan Peninsula. In India, they are found throughout in Kerala, mainly in evergreen forest at an altitude of 600 to 900 m and also in Tamil Nadu, Western Ghats, Sikkim and Assam. In Kerala, it is commonly known as ‘Chathuramulla’, Chathuravalli and Chathurakodi. [5] Other species belonging to this genus are *Myxopyrum nervosum* Blume seen in Borneo, New Guinea, *Myxopyrum ovatum* seen in Philippines, Borneo, *Myxopyrum Smilacifolium* (Wall.) Blume seen in Bangladesh, Cambodia, Vietnam and *Myxopyrum pierrei* seen in Vietnam and Thailand.[6]

In Indian system of medicines such as Ayurveda, Siddha, Unani and homeopathy this particular plant is claimed to cure various ailments such as wounds, cough, nerve complaints, head ache, back ache and arthritis.[7] Different phytochemical constituents like flavonoids, terpenoids, alkaloids, steroids, glycosides are present in different parts and exibhits important pharmacological properties.[8] The anatomical and chemical investigations on *Myxopyrum*

genus are very limited. Future research into the pharmacology of this plant that is simple to grow at home will provide useful and marketable medicines.

Fig. 1: *Myxopyrum serratulum* A.W.Hill leaves.

Plant Profile

Taxonomical classification.[9]

Table 1: Taxonomical classification of *Myxopyrum serratulum* A.W.Hill.

Kingdom	Plantae
Division	Tracheophyta
Class	Magnoliopsida
Order	Lamiales
Family	Oleaceae
Genus	*Myxopyrum*
Species	*serratulum*

Synonyms: *Chondrospermum smilacifolium*

Common names

- **Malayalam** – Chathuramulla, Chathurakodi, Chathuravalli.
- **Tamil** – Sathuramullai.
- **Sanskrit** – Hemamalati
- **Assamese**- Gohora - lata

Morphology[10]

Habitat

Myxopyrum serratulum A.W.Hill, belonging to the family 'Oleaceae', are mostly seen in semi-evergreen, evergreen forests, and also in sacred groves. It is widely distributed in many parts of India and as well as in many other countries of South East Asia. This plant is clearly

an example of a climbing shrub. It is particularly twinning shrub and having 4 angular branches.

Leaves

Leaves are having many unique specifications for the identification of this particular plant. They are 7-13 cm in length and 3-5 cm in breadth. Mainly they are in elliptic or ovate shape. The base of the leaves are rounded to sub cordate. The margins have got special characteristics such as they are serrulate from the middle towards the acuminate apex. Basally they are 5 nerved. The petiole of the leaves are 1 to 2 cm long.

Stem

This plant has got Quadrangular shaped stem. This is one of the main unique characteristics of this plant. Common names are derived according to the shape of stem.

Flowers

They are little, four-membered axillary trichotomous panicles. They are also bisexual and merous. It has a four-lobed, yellowish corolla with tubes that are 1 to 2 mm long. It has a 4-lobed, 1 to 1.5 cm long calyx. The two induced stamens are present. Two ocular ovaries, one to two ovules per locule, and two lobed stigmas.

Fruit

This plant produces small, globose-shaped, black fruits that are 1-1.5 cm wide in size with 2 seeds. February to August is when it bears fruit.

Roots

It has branched and tap roots.

Fig. 2: Leaves. Stem and Flower of *Myxopyrum serratulum* A.W.Hill.[11]

Phytochemical Constituents

Pharmacognostical studies of leaves and stem revealed the presence of various phytochemical constituents whereas roots showed the presence of verbascoside, myxopyroside, and 5-hydroxyl methyl fural.

Ethnobotanical Uses[12,13,14]

Leaves

- Swelling: - Put the leaves in water and boil. Pour the water on the swollen part.
- Cuts caused by iron implements: - Char the leaves in an earthern pot and apply the powder on the wound.
- The paste of the leaves taken with clarified butter in cough, asthma, chest diseases.
- It is also used in nervous complaints and rheumatism.
- Oil extract of the leaves can be used for massage in fever, headache and backaches.
- They were also used as febrifuge, tonic, astringent, acrid, sweet and thermogenic.

Roots

✓ They were used in prurigo and scabies.

Whole plant

✓ All parts were used for headache, asthma, cough, fever, otitis, rheumatism and wounds.

Plant Studies

Phytochemical Analysis[15]

This study aimed to evaluate pharmacological importance of *Myxopyrum serratulum* A. W. Hill., through the screening of phytochemical constituents. Preliminary phytochemical screening for alkaloids, phenols, coumarins, flavonoids, quinones, tannins, steroids, glycosides, saponins and triterpenoids was carried.

Phytochemical constituents in different solvent extracts.

Table 2: Presence (+) or absence (-) of phytochemical constituents.

Phytochemical constituents	Petroleum ether		Benzene		Ethyl acetate		Methanol	Ethanol		
	Leaf	Stem	Leaf	Stem	Leaf	Stem	Leaf	Stem	Leaf	Stem
Alkaloids	+	+	+	+	+	+	+	+	+	+
Anthraquinones	-	-	-	-	-	-	-	-	-	-
Coumarins	+	+	+	+	+	+	+	+	+	+
Flavonoids	+	+	+	+	+	+	+	+	+	+
Phenols	+	+	+	+	+	+	+	+	+	+
Quinone	-	-	-	-	+	+	+	+	+	+
Saponins	+	+	+	+	+	+	+	+	+	+
Steroids	+	+	+	+	+	+	+	+	+	+
Tannins	-	-	-	-	-	+	+	+	+	+
Terpenoids	-	-	-	-	-	+	+	+	+	+
Glycosides	+	+	+	+	+	+	+	+	+	+
Xanthoproteins	+	+	+	+	+	+	+	+	+	+

GC-MS Analysis of Bioactive Components

This investigation was carried out to determine the possible bioactive components in leaves using GC-MS analysis. It was performed with GC clarus 500 Perkin Elmer system and Gas chromatograph interfaced to a Mass spectrometer equipped with an Elite – 1 fused silica capillary column. For GC-MS detection, and electron ionization system with ionizing energy of 70 eV was used. Ethanolic maceration was used for extraction of leaves and twenty four compounds were identified. The prevailing compounds were 2-Propenoic acid, 3-(4-methoxy phenyl),1-(2-Hydroxy-ethyl)-2-methyl-1H-benzoimidazole-5-carboxylic acid methyl ester, n-Hexadecanoic acid, Isoquinoline, 1,2,3,4-tetrahydro-1-ally1-6,7-dimethoxy-3,3-dimethyl, Phytol, 3,7,11,15-Tetramethyl-2-hexadecen-1-ol, Ethyl α-d-glucopyranoside, Pyrazolidine-3,5-dione,Hexadecanoic acid, ethyl ester , 1H-Indol-4- ol , 9,12-Octadecadienoic acid, 4-((1E)-3-Hydroxy-1-propenyl)-2-methoxyphenol , Oleic acid. These compounds were used in various applications as anti-microbial, anti-inflammatory, anti-cancer, anti-oxidant .anti-androgenic, anti-acne, anti-histaminic, anti-diabetic, anti-leukemic, anti-ulcerogenic, anti-arthritic, analgesic, diuretic, preservative, hypocholesterolaemic, pesticide, hepatoprotective, vasodilator etc.[16]

Heavy Metal and Trace Element Analysis

This study was designed to establish the presence of heavy metal and trace element analysis in the aerial parts of *Myxopyrum serratulum* A.W Hill which is commonly used in treatment of wounds, inflammation. The aerial parts were shade dried and coarsely powdered. Standard

solution was prepared to obtain calibration graph. Five different concentrations were prepared by diluting stock solution (1000 ppm) of each element. Sample solution was prepared by Wet digestion method. It was used for digesting the sample 2 gm of dried sample was transferred with 10 ml of nitric acid and heated at 95°C in a hot plate for fifteen minutes. After cooling, 5 ml of concentrated nitric acid was added and provided additional heat for 30 minutes at 95°C. Last step was repeated without oiling the solution until reduced to 5 ml.

Sample was concentrated again. Added 3 ml of 30% hydrogen peroxide and 2 ml of deionizer. The beaker was covered to start the peroxide reaction and the sample was heated gently. 5 ml of concentrated Hydrochloric acid and 10 ml of deionizer was added. Water is added at last without boiling. After cooling the sample was filtered through Whitman filter paper (no. 42) using deionizer water, the sample was diluted to 50 ml. This sample which was digested and analysed for Cadmium, Lead, Zinc, Magnesium, Copper using flame atomic absorption spectrometer and arsenic and mercury using hydride generation technique. By using cold vapour atomic absorption spectroscopy, mercury was analysed. It is concluded that the plant contained trace of heavy metals and they are found to be within prescribed limit. The concentration of trace elements like Copper, Zinc, iron is found to within prescribed limit as per WHO Guidelines.[17]

In Vitro Antioxidant Activity

The research study was undertaken to investigate and evaluate *in-vitro* antioxidant activity of *Myxopyrum serratulum* A.W HILL. Cold maceration with successive solvent extraction was performed. The methanolic extract of *Myxopyrum serratulum* was examined for *in-vitro* antioxidant activity using DPPH and Nitric oxide scavenging activity with reference to the standard drug, Ascorbic acid. It showed significant activity with maximum inhibition which is comparable with the standard drug.[18]

In- Vitro Anti-Inflammatory and Anti-Asthmatic Activity

In this study, the protective effects of *M. serratulum* on airway inflammation was investigated in ovalbumin induced murine model of allergic asthma and lipopolysaccharide stimulated inflammation in RAW 264.7 murine macrophages, and the possible mechanisms were elucidated. The chromatographic analysis identified the presence of Gallic acid, protocatechuic acid, catechin, ellagic acid, rutin, p-coumaric acid, quercetin, naringenin and apigenin. In vitro anti-inflammatory activity were evaluated by estimating the levels of nitric oxide, reactive oxygen species and cytokines in lipopolysaccharide stimulated RAW 264.7

macrophages. *In vivo* anti-asthmatic activity was studied using ovalbumin murine model. The study was carried out by measuring airway hyper responsiveness. In broncho alveolar lavage fluid, total and differential cell counts, eosinophil peroxidase, prostaglandin E2, nitric oxide, reactive oxygen species and cytokines like IL-4, IL-5 and IL-13 Serum total IgE level was measured and the histopathological changes of lung tissues were observed. The expressions of cyclooxygenase-2 and inducible nitric oxide synthase in lung tissue homogenates were detected by Western blot. It was concluded that the methanolic extract significantly reduced airway hyper responsiveness, number of inflammatory cells, eosinophil peroxidase, prostaglandin E2, nitric oxide, reactive oxygen species, and cytokines IL-4, IL-5 and IL-13 in broncho alveolar lavage fluid, serum total IgE and the histopathological changes associated with lung inflammation. Western blot studies showed that the methanolic extract substantially suppressed COX-2 and inducible nitric oxide synthase protein expressions in the lung tissues of OVA-sensitized/challenged mice.[19]

Antimicrobial Activity

The antibacterial and antifungal activities of petroleum ether (40-60^{o} C), benzene, and chloroform, ethanol and water extracts of the leaves of *Myxopyrum serratulum* were tested for their antimicrobial activity in Agar diffusion assay. Significant antimicrobial activities were found against three gram positive bacteria, Streptococcus faecalis, Baccillus subtilis and Baccillus cereus, four gram negative bacteria; Klebsiella aerogens, Escherichia coli, Pseudomonas aeruginosa, Proteas vulgaris and two fungi, Candida albicans, Aspergillus flavans strains by using zone of inhibition assay. The activities were confirmed by Activity Index. Activity Index values were found to be higher for ethanolic extract followed by the water extract. Among all the extracts tested; the ethanolic extract showed a good antimicrobial potential against microorganisms used in the study. The Minimum Inhibitory Concentration for the ethanolic extract was also determined. [20]

Wound Healing Activity

In the study, ethanol extract of the leaves *of Myxopyrum serratulum* has been investigated for its wound healing activity by excision and dead space wound models in rats. Wound healing activity has been assessed by the rate of wound contraction, tensile strength and weight of the granulation tissue formed. Significant increase in the wound contraction has been observed on the extract animals in excision wound model. The 100 mg/kg 200 mg/kg and 400 mg/kg doses of ethanolic extract of the leaves of *Myxopyrum serratulum* showed significant increase

in the weight of granulation tissue and increase in tensile strength in dead space wound model.[21]

Bronchodilatory Effect

This study was undertaken to evaluate the bronchodilatory effect of the methanolic extract of *M. serratulum* on histamine-induced bronchospasm by *in-vivo* and the inhibitory effect of the extract on histamine contracted tracheal chain and ileum by *in-vitro* guinea pig model. The dried leaves were coarsely powdered and then extracted with methanol by hot extraction method. Male Hartley strain guinea-pigs of 300-400 g weight and female Balb/c mice weighing 25–30 g.

Experimentally, bronchial asthma was induced by exposing the guinea pigs to 0.5% histamine aerosol using an ultrasound nebulizer in aerosol chamber made of perspex glass. The animals were removed from the perspex container and allowed to recover from the respiratory distress by exposing to fresh air for 24 hours. After 24 hours, the animals were grouped into five (n = 6), among which the animals of Group I received oral dosage of vehicle (0.95% NaCl solution); Group II received standard chlorpheniramine maleate at a dosage of 100 mg/kg, Group III, IV and V received 100, 200 and 400 mg/kg oral dose of the extract, respectively. After the administration of the vehicle, standard and test drugs, the pre-convulsion time was reassessed after 1st and 4th hours, and the percentage increase in pre-convulsion time was calculated. Additionally, the relaxant effect of four cumulative concentrations of the extract was assessed using pre-contracted tracheal chain under different conditions. The high dosed extract prolonged the preconvulsive time when compared to saline and standard chlorpheniramine maleate. *M. serratulum* possessed significant bronchodilatory effect through the underlying mechanisms such as histamine (H1) receptor antagonistic, adrenoceptor stimulatory, an inhibitory effect on calcium channels. This study served as a scientific evidence for the ethno medicinal uses of *M. serratulum* in airway diseases.[22]

Green Synthesis of Nanoparticles

This study introduced a facile, green, one-pot and eco-friendly method for the synthesis of silver and gold nanoparticles using microwave-assisted strategy. The aqueous leaf extract was used as both stabilizing and reducing agents for this preparation. The leaves were chopped into fine pieces and 20 g of it was mixed with 100 mL of double distilled water in a flask fitted with a condenser. Subsequently, it was boiled for 20 min at 60 °C. After cooling, the

clear leaf extract was filtered by means of Whatman No. 1 filter paper and stored in a refrigerator at 4°C. The synthesized nanoparticles were characterized by using UV-vis spectroscopy, Fourier transform infra-red spectroscopy X-ray powder diffraction, Transmission electron microscopy and Energy-dispersive X-ray spectroscopy analysis. The involvement of phytochemicals in the reduction and stabilization of nanoparticles was confirmed by FTIR spectroscopy. The crystalline structure of nanoparticles was assured from XRD analysis. The size and morphology of nanoparticles were obtained from the TEM images. The presences of silver and gold elements were confirmed from their respective EDAX spectrum.

The antimicrobial effects of leaf extract and synthesized silver and gold nanoparticles were tested against both bacterial and fungal strains by employing agar well diffusion method. The nanoparticles show high antimicrobial properties. The antioxidant properties were studied by simple DPPH assay. The nanoparticles exhibited better DPPH scavenging activities compared to leaf extract. In addition, it has been shown that the synthesized silver and gold nanoparticles functioned as an effective catalyst for the reduction dyes such as 4- nitrophenol, methylene blue and Congo red by sodium borohydride. The phytochemicals in the plant extract act as both capping and stabilizing agents. Synthesized nanoparticles show high antimicrobial, antioxidant and catalytic activities. Thus, it was concluded that the nanoparticles synthesized using *M. serratulum* A.W. Hill can be effectively used as both antimicrobial and antioxidant agents in various biomedical applications and the dye reduction capability of nanoparticles can be effectively used for the removal of hazardous dyes from wastewater.[23]

CONCLUSION

Biodiversity contributes significantly towards human livelihood and development and thus plays a predominant role in the wellbeing of the global population. According to WHO reports, around 80 % of the global population still relies on botanical drugs and today several medicines owe their origin to medicinal plants. Recent research have confirmed several of the biological benefits of *Myxopyrum serratulum* A.W.Hill including anti-inflammatory, anti-bacterial, wound healing, and bronchodilatory. This plant has been used medicinally for a very long time. Alkaloids, phenols, tannins, coumarins, terpenoids, and other compounds known for their pharmacological effects were confirmed by preliminary phytochemical

investigation. There are still a great deal of pharmacological activities that are unknown. As a result, this plant has the potential to become a useful medicinal tool in the future.

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