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PHYSICOCHEMICAL AND BIOLOGICAL PROPERTIES OF *ADIANTUM CAPILLUS-VENERIS* LINN: AN IMPORTANT DRUG OF UNANI SYSTEM OF MEDICINE

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ABSTRACT

The aim of the present paper is to provide information regarding the therapeutic uses and scientific studies carried out on *Adiantum capillus-veneris* Linn. The key words used for the literature search were *Adiantum capillus-veneris*, Parsioshan, physico chemical, phytochemical and pharmacological study. The search was carried out through Unani classical books, ethno botanical literature and Google scholar. The drug is popularly known as "Parsiaoshan" in Unani and used to treat a number of diseases. It is traditionally used as a diuretic, resolvent, antipyretic, demulcent, emmenagogue, expectorant and deobstruent. It is also useful in the treatment of hair fall and skin diseases. Chemical analysis of Parsioshan shows that it contains triterpenoids, flavonoids and various other constituents. Research studies have shown that it possesses anti fungal, anti inflammatory, anti bacterial, hypoglycemic and lithotriptic activities. An extensive review of ancient literature of Unani medicine revealed that the drug having numerous therapeutic actions, several of which have been established scientifically which may help the researchers to set their minds for approaching the utility, efficacy and potency of *Adiantum capillus-veneris.*

INTRODUCTION

As folk medicine, the pteridophytes which constitute ferns and fern allies have been known to man for more than 2000 years and also have been mentioned in ancient literature. It has been observed that pteridophytes are not infected by microbial pathogens, which may be one of the important factors for the evolutionary success of pteridophytes and the fact that they survived for more than 350 million years[1].

Fern and fern allies, also known as botanical snakes or plant reptiles, have always been in the center stage of attraction to botanist, horticulturists and nature lovers since ancient times. This fascinating group of pteridophytes is distributed in the Himalaya, Western Ghats, and Vindhya, hilly areas of Bihar, Orissa and Madhya Pradesh as well as in the Aravalli, particularly in Mount Abu in Rajasthan[2]. *Adiantum capillus-veneris* Linn is a graceful delicate fern of damp places, found chiefly in the western Himalayas, ascending to an altitude of 2,400 m, and extending into Manipur. It is common in Punjab, Bihar, Maharashtra, and south India. It grows among rocks and on walls[3, 4]. Theophrastus (327-287B.C.) and Dioscorides (100A.D.) have referred to medicinal attributes of certain ferns. *Adiantum capillus-veneris* Linn is one such fern whose medicinal values have long been mentioned by Sushrata and Charaka[5].

Taxonomical Classification[6]

Kingdom : Plantae

Division	:	Pteridophyta
Class	:	Pteridopsida
Order	:	Pteridales
Family	:	Adiantaceae
Genus	:	Adiantum
Species	:	cappilus- veneris

Vernaculars[7]

Arabic	:	Shairuljin, Shaar-ul-jibal, Shaar-ul-arz
Ayurvedic	:	Hansaaraja, hansapadi
English	:	Maiden hair fern, Maria's fern, Our Lady's hair
Gujarati	:	Hanspadi
Hindi	:	Hansraj, Mubaraka, Pursha
Kannada	:	Hansraj
Persian	:	Sirsiapeshane
Tamil	:	Seruppadai
Kashmir	:	Dumtuli
Urdu	:	Persia – ushan
Unani	:	Barsioshan, Kazbaratul Ber

History

As early as in 100 A.C. Dioscorides described *Adiantum capillus-veneris* by the name of *Adiavrov* for having leaves serrated at the top like coriander. The Western Arabs, however, appear to use *Adiantum capillus-veneris,* as they call the plant *Kuzburat-el bir* or "coriander of the wall", indicating a habitat where *A. venestum* is not found. Other Arabic names for the genus Adiantum are *shaar-el-jinn* i.e. "fairies hair", *shaar-el-jibal* i.e. "hair of the mountains"; *shaar-el-fual* i.e. "hair of omens"; *sak-el-aswad* i.e. "black stem" and *Nasif-el-aswad* i.e. "black veil," Ibn Sina and other medical writers describe the drug under the name of *Barsiawashan,* which is the Arabic form of its Persian name *Parsiawashan*. It is considered to be deobstruent and resolvent, useful for clearing the *primaviae* of bile, and phlegmatic humors; also, expectorant, diuretic, emmenagogue, and alexipharmic properties are also ascribed to it. Used as a plaster, it is considered to be discutient, and is applied to chronic tumours of various kinds. Theophrastus mentions two kinds of Adiantum, "white" and "black," used in making hair oil. Greek synonyms for the plant are polytrichon, calitrichon, trichomenis, and ebinotrichon[8].

Geographical Distribution

A native of tropical America *Adiantum capillus-veneris* Linn found throughout the world in moist and shady places. In India it is distributed in Tamil Nadu up to 1800 meter on the mountains, Himalaya and in north India[9].

Botanical Description

Adiantum capillus-veneris is a delicate graceful fern. Stipes is blackish, 10-23 cm long[10]. Fronds bipinnate with short terminal pinna and numerous erect patent lateral ones on each side, the lowest being slightly branched; segments cuneate, 1.5-2.5 cm broad; sori borne at the roundish sinuses of the crenations, obreniform or rounded [4,5].

Pharmacological Actions and Uses in Unani Literature

It has *Dafe humma* (antipyretic), *Mulattif (*demulcent), *Munaffise balgham* (expectorant), *Mudire baul* (diuretic), *Mudirre haiz* (emmenagogue), *Muhallil* (resolvent) and *Mujaffif* (siccative) properties[11, 12]. The whole herb is used as medicine in various forms like decoction, powder, paste, oil etc. in different aliments. The whole plant is used as a hair tonic. Decoction in wine is given in cases of hard tumors of spleen, liver and other viscera. The fronds are powdered and given with honey against bad cold. It is also useful in splenic pain and jaundice. It expels the stone from the kidneys and bladder. It is therapeutically used to promote diuresis. Due to its mucilaginous, pectoral and expectorant properties, its decoction is used in breathing difficulties, bronchitis, and cough. Along with vinegar and olive oil it is useful in alopecia and with the oil of Habbul Aas it is useful in maintenance of hair

colour and hair loss. It is also useful in insect and dog bite[9, 11, 12, 13, 14].

Ethnomedicinal Uses

It is used as demulcent, expectorant, astringent, antitussive, diuretic, and emmenagogue, febrifuge and also as a hair tonic[5, 15, 16, 17]. In Punjab, the fronds are given with pepper as a febrifuge; pounded with honey, they are administered in catarrhal affections. They are smoked to relive cold. The dried fronds are used as a substitute for tea. The herb is used as a pectoral, and also in catarrhal affections. It is reported to be used as a hair tonic. The fern is boiled in wine or mead, and drunk in case of hard tumors in the spleen, liver and other visceras[4]. Its decoction is also used to remove dandruff. Fresh leaves are boiled in water along with sugar; one cup of this decoction is taken orally twice a day for a week to treat jaundice and hepatitis[15]. The fronds are chewed for the treatment of mouth blisters. Frond extract mixed with honey is used as an eye ointment[18].

Physico Chemical Studies [9]

Study of the powdered drug

The powder is fine and a bit fluffy in texture. It is dark brownish green in colour and has no taste. The powder after being cleaned in charcoal hydrate, when observed under microscope, showed mostly fragments of leaves and petioles mostly with no distinguishing character. A very few isolated pieces of sporangial wall with characteristic transverse thickening were also visible. Occasional triangular spore tetrads were also present. Reaction of chemicals with crude powdered drug and fluorescence analysis (Table 1) are as follows:

Reaction of chemicals with crude powdered drug

Chemicals	Observations
Powder treated with water	An emulsion formed
Powder shaken in a test tube with water	No frothing, floats partially
Powder treated with 5% NaOH	Turns dark chocolate brown
Powder treated with 66% H_2SO_4	Turns dark blakish brown
Powder pressed between two filter papers	No oily stain appears

Identity, purity, strength and assay

Foreign organic matter	Nil
Purity	100%

Physico chemical constants (%)

Loss on drying at 105ºC	7.36
Solid contents	74.48

Ash values

Total ash	7.81
Acid insoluble ash	4.42
Water soluble ash	0.42

Successive extractive values (%)

Pet. Ether (60-80º)	4.49
Chloroform	3.03
Acetone	4.60
Ethanol	9.27
Distilled water	14.07

Phytochemical Studies [19]

Nine new compounds were identified in the twenty-two isolated triterpenoids, from the fresh fronds of *Adiantum capillus-veneris* Linn collected in Japan. The plant of Chinese and Egyptian origin were also identified with the two new triterpenoids each as 4a -hydroxyfilican- 3-one and fern-9 (11)-en-12b –o and oleanane triterpenoids; olean-12-en-3-one and olean-18-en-3-one[19].

Four triterpenoidal compounds belonging to adiantane and filicane groups, isoadiantone; isoadiantol-B; 3-methoxy-4-hydroxyfilicane and 3,4-dihydroxyfilicane, from the hexane fraction and three flavonoids from the ethyl acetate fraction as: quercetin , quercetin-3-*O*-glucoside and quercetin-3-*O*-rutinoside (rutin) were identified in Chromatographic fractionation of the alcoholic extract of the dried fronds of *Adiantum*

capillus-veneris Linn. The identification of the isolated compounds has been established through their physical, chemical and spectroscopic methods including IR, ^{1}H NMR, ^{13}C NMR, HSQC, HMBC, NOESY and MS [23].

Scientific Reports

Antifungal Activity

The water extracts and extracted phenols from gametophytes and different parts of sporophytes of, *Adiantum capillus-veneris* L. was investigated for its antifungal activity and found to be bioactive against *Aspergillus niger* and *Rhizopus stolonifer*. Antifungal activity was found to be higher in gametophytes. Among the different parts of sporophytes, immature pinnule possesses highest fungi static property[20].

Antioxidant activity

Antioxidant potential of leaf extract of *Adiantum capillus-veneris* Linn was studied in vitro by Anil Kumar, against H_2O_2 induced oxidative damage in peripheral blood lymphocytes. Pre treatment with plant leave extract for 18 hours could effectively inhibited lipid peroxidation and enhanced the activities of antioxidant enzymes and glutathione content significantly. The results indicate that it might be due to its direct action in scavenging free radicals and thereby modulating the antioxidant defence system[21].

Antibacterial activity

Pradeep investigated the *in vitro* antibacterial activity of twelve important pteridophytes plants by disc diffusion method. The aqueous and alcoholic leaves extract of *Adiantum capillus-veneris* Linn were found to be effective against *Agrobacterium tumefaciens*, *Escherichia coli*, *Salmonella arizonae*, *Salmonella typhi* and *Staphylococcus aureus* strains of Bacteria.

Anti inflammatory activity

Alcoholic extract of *A. capillus-veneris* and its hexane fraction showed a significant anti-inflammatory activity against formalin induced inflammation. The hexane fraction and compounds 3, 4 showed topical anti-inflammatory activity after 6 h and continued for 30 h in croton oil-induced inflammation[23].

The ethyl acetate fraction of the ethanolic extract of *A. capillus-veneris* showed significant inhibition of hind paw oedema induced by carrageenan when evaluated for its anti-inflammatory activity [24].

Analgesic activity

The analgesic activity of the ethanolic extract of *A. capillus-veneris* and its fraction has been carried out by tail flick method and writhing test result showed significant analgesic activity with insignificant ulceration as compared to the standard drug [24].

Hypoglycemic activity

The alcoholic extract of *A. capillus-veneris* showed a significant hypoglycaemic effect in OGTT using rabbit model. Started after 30 min and continued for 4 hours[23].

Lithotriptic activity

In vitro antilithiasic activity of hydro alcoholic extract of *Adiantum capillus-veneris* was evaluated by crystallization, aggregation and nucleation assays. The result showed significant inhibition of crystallization and aggregation which was further confirmed by *in vivo* study against Ethylene glycol (0.75%) and ammonium chloride (1%) induced Urolithiasis in male Sprague Dawley rats. Urine microscopy showed significant reduction in the number of crystals in test groups [25].

DISCUSSION

The present review reveals that *Adiantum capillus-veneris* Linn is used in treating various ailments. Recent ethno botanical, phytochemical and pharmacological studies have reported the medicinal values of *Adiantum capillus* and its active constituents. This review provides evidence based scientific validation to some of the therapeutic uses and actions described for Parsioshan in classical texts of Unani medicine. It is popularly used as diuretic and for the treatment

of kidney stone in Unani system of medicine since long. Its pharmacological activities like anti oxidant[21], anti bacterial[22], anti-inflammatory[24], lithotriptic activities[25] clearly justify its therapeutic efficacy in nephrolithiasis. It is further suggested that phytochemical and pharmacological studies on some of the less known or controversial Unani drugs may be taken up on priority basis not only to scientifically validate therapeutic uses , but revive the faith and confidence of Unani practitioners in its actions to serve the large strata of the rural society.

CONCLUSION

This article briefly reviews the traditional knowledge and ethno medicinal reports on therapeutic activities of the plant *Adiantum capillus-veneris* Linn. The physicochemical, phytochemical and pharmacological studies of this plant provide a scientific basis for its therapeutic use.

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Table 1: Fluorescence analysis of the powdered drug

Observation under		
Treatment	**Ordinary light**	**Ultra violet light**
Powder as such	Dark dull green	colourless
Powder treated with 1N NaOH in methanol	Dark brown	colourless
Powder treated with 1N NaOH in water	Dark brown	colourless
Powder treated with 1N Hcl	Brown	colourless
Powder treated with 50% HNO_3	Dark cherry brown	colourless
Powder treated with 50% H_2SO_4	Dark brownish green	colourless
Powder mounted in nitro cellulose in amyl acetate	Almost black	colourless
Powder treated with 1N NaOH in methanol, dried and then mounted in nitrocellulose in amyl acetate	Dark chocolate brown	colourless
Powder treated with 1N NaOH in water, dried and then mounted in nitrocellulose in amyl acetate	Dark brown	colourless