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REVIEW ARTICLE

An Ethno-Pharmaco-Botanical Review of Hamsapadi –*Adiantum lunulatum* Burm. F. (*A. Philippense* Linn.)

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ABSTRACT

Hamsapadi, Adiantum lunulatum Burm.f. (*A. Philippense Linn)* usually known as '*Walking Maiden hair fern'* is used as an ornamental plant and widely distributed in India. It is commonly found in wet, shaded areas and on moist mud walls during monsoon. It is a drug with a significant ethno- botanical & therapeutic importance. It was in use since time immemorial for medicinal and other uses. Several phyto-constituents have been isolated and identified from different parts of the plant such as Carotenoids, Flavonoids, Nortriterpene-adiantone etc. The dried whole plant has been used as a medicine for bronchitis and cough. It is used in bleeding diseases, burning sensation, erysipelas, epileptic fits, dysentery, strangury and elephantiasis. Few studies have been undertaken till date to substantiate its pharmacological activities such as antibacterial, antifungal, antioxidant, hypotensive etc. This article reviews the complete details of the drug such as Morphology, Distribution, Ethno botanical claims, and Pharmacological activities.

Key words: Ayurveda, Dravya Guna, Herbal Medicine, Dysentry, Erisipelas

INTRODUCTION

Pteridophytes are one of the oldest and primitive vascular plant groups on earth. These represent over 1200 taxa, belonging to 204 genera in the world. They make an important contribution to earth's plant diversity and form a significant dominant component of many plant communities especially in the tropical and temperate regions [1]. Pteridophytes have been poorly studied and considered economically less important group of plants in the plant kingdom. *Adiantum lunulatum* Burm. is a cosmopolitan fern belonging to the family Adiantaceae, and genus Adiantum. In India it is found very commonly in the South in plains and lower slopes of the hills and in the North along the foot of the Himalayas from East to West at an altitude of 1000-3000 feet [2]. As far as trade of medicinal plants is concerned only the species of *Adiantum are* exploited under the trade name *Hansraj, Hanspadi, Myurshikha*. As the name indicates, the plant is described as the one resembling the feet of swan [3]. The entire plant of this species is used as medicine in Ayurveda, Siddha and Unani [4].

Table 1:Taxonomical Classification [5]

Kingdom:	*Plantae*
Phylum:	*Pteridophyta*
Class:	*Pteropsida*
Order:	*Filicales*
Family:	*Pteridaceae (Adiantaceae)*
Genus:	*Adiantum*
Species:	*Adiantum lunulatum* Burm. f. (*A. philippense* Linn.)

Synonyms [6,7,8,9]

Brahmadani, Chitrapada, Dharttarashtrapadi, Ghritamandalika, Godhangri, Godhapadika, Hamsapadika, Hansaghri, Hansavati, Karnati, Kiramata, Kirapadika, Kitamari, Madhusrava, Padangi, Raktapadi, Sancharini, Shitangi, Sutapadika, Suvaka, Tamrapadi, Tridala, Tripadi, Tripadika, Tripornika, Vanda, Vikranta, Vishvagranthi, Vrikshabhaksha, Vriksharuha, Vishagranthi .

Table 2: Vernacular Names [10,11,12,13,6]

Language	Vernacular names
English	*Maiden hair fern, Walking maiden hair fern.*
Hindi	*Hansapadi, Banda, Hansaraja, Samalpatti, Hansapagi, Kalijhamp, Kalijhant, Paresiyavasan, Hanspadee.*
Bengali	*Goyalelata, Kalijhant.*

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Gujarati	*Hansapadi,Mubarkha, Mubarkhinipalo, Hansraja.*
Kannada	*Hamsapadi, Nayalad, Naralad.*
Marathi	*Ghodkhuri, Hansraj,Hansaraj, Mubarak, Kamsaraj Rajkombada, Rajhans.*
Kashmiri[14]	*Dumtuli.*
Punjabi	*Harsraj*
Telugu	*Nayalod,Hamsapadi*
Assami. [15]	*Sharul Arj, Sharujeena, Parsiyav*
Santhal [16]	*Dodhali.*
Porebunder [17]	*Hansraj, Kalohansraj.*
Philippines [18]	*Culantrillo*
Unani[19]	*Hansraj*
Persian	*Parsiaoshan*
Bangladesh [20] **(tribal)**	*Bandortala*
Classical Names	*Hamsapadi ,Hamshahvaya ,Triparni ,Tripadi ,Triparnika*

Botanical Description

A small , rhizomatous sub erect graceful fern, Stipes 6-15 cm, long, tufted, wiry upto 10x 0.1 cm glabrous, polished, dark chest nut brown scaly at the basal part; fronds are glabrous, 9-18 inches long, 3 inches wide, simply pinnate, with a dark brown, polished wiry stipe and often elongated and rooting at the apex. Apex acuminate, margin entire, pale brown. Lamina lanceolate , up to 20 x5 cm, simply pinnate .Pinne pale or deep green thinly leathery ,glabrous above and below ,up to 10 pairs, alternate, stalked, fan shaped, upto 6x 2cm, dimidiate, the lower edge nearly in line or oblique with the petiole, upper edge rounded, lobed, acroscopic base truncate, margin entire: veins distinct above and below, dichotomously, flabellately branched free reaching the margin distinctly petiolate, without scales; one or two inches long, half to one inch wide, obliquely oblong, the lower edge direct from the petiole , the point and upper edge rounded and somewhat crenate or lobed. Each lobe bears a transversely elongated sorus when fertile [3] . Sori are continuous line along the edge (marginal) and are crescent shaped.[21] ,[18] , [10] ,[22] , [23], [24] (**Fig1,2,3 &4**)

Fig 1: Full Plant- *Adiantum lunulatum Burm.f.* (*A. Philippense Linn)*

Fig 2: Full Plant- *Adiantum lunulatum Burm.f.* (*A. Philippense Linn)*

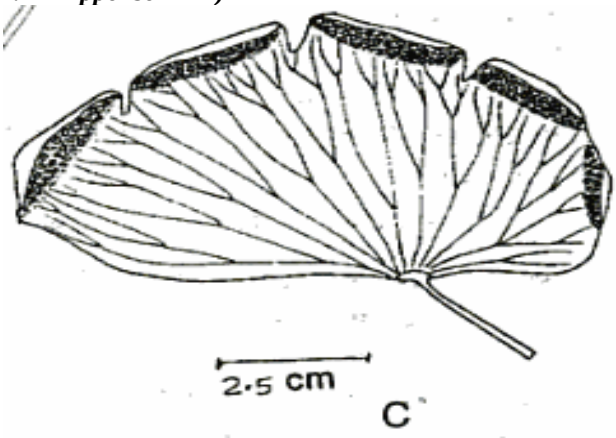


Fig 3: *Pinna showing Sori*

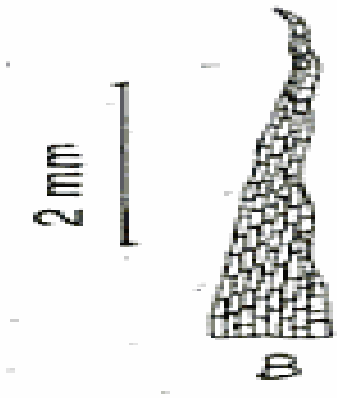


Fig 4: *Rhizome scale*

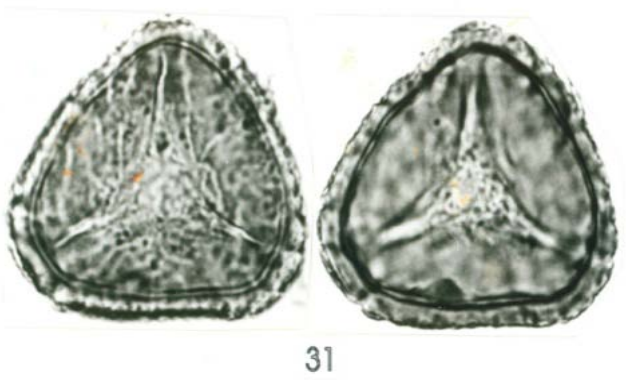


Fig5: Pollen & Spore

Habitat and Distribution

It is an erect or slightly decumbent fern, about 15 cm high confined to tropical moist deciduous forests and throughout greater part of India up to an altitude of 1200m .It prefers humus rich, wet; clay; sand; acidic; loam soils, found commonly in varied habitats and growing successfully in crevices of stony walls and hilly slopes [25]. *Adiantum* can be acclimatized to different types of habitats along with change in morphological appearance due to difference in soil parameters and different habitats. The growth of *Adiantum lunulatum* is affected and plant has variations in growth forms which can be correlated with its ecotypes showing correlation between its habitat and growth forms [25], [18]. The plant is native to tropics, commonly found at Mount Abu, Gwaparnath, Ajmer and Menal of Rajasthan, Ceylon [23] and Burma [10]

Types

The *Adiantum arcuatum* of Swartz, is considered to be a variety and as per Sir William Hooker the Brazilian fern(*Adiantum deflectens*, of Martens) may also prove to be another form of *Adiantum lunulatum*[26].

Part(S) Used

Whole plant, rhizome, leaf [6]

Ethno-botanical claims

The plant is said to possess a wide range of therapeutic utility**.** Following are the ethno-botanical claims reported till date.

Genaralised Symptoms

It acts as febrifuge [13] & reduces burning sensation [11]. The whole plant is boiled with water and the decoction is applied externally on the affected places to get relief from body pain .It is a good Tonic[19] and is beneficial in wasting diseases[27], atrophy[27] cachexy[28] inflammatory diseases. It is said to possess antiseptic activity and hence beneficial in septic conditions [27].

Respiratory System

The fronds are used against cough and cold, .It is a good expectorant [29], the decoction of the rhizome is given in throat affections and also used for febrile conditions in children [18], [28]. It is a well known remedy in bronchitis and asthma [18,30,31]. In Asthma the stem bark of *Bridelia retusa* along with that of *Terminalia bellrica* and the roots of *Adiantum lunulatum* Burm are crushed in equal proportions and taken in a size of red gram once daily for three months [31]. Leaf and root decoction is used for the treatment of chest ache [27] & other chest complaints [32]. A syrup is made in France from the herb's fronds and rhizomes, *Syrup De Capillaire* and given in pulmonary catarrh. The herb brings up phlegm. Provides relief in whooping cough[27] . Pills of Bengal gram size are made of the paste obtained by mixing 100 g *A. lunulatum* (whole plant), 50 g seeds of *Balanites aegyptiaca* (L.) Del. (Balanitaceae) and 50 g gum of *Diospyros melanoxylon* Roxb. (Ebenaceae) with old jaggery. Two tablets a day are given for 3–4 days to cure typhoid [28]. The nasal drops prepared by boiling the root in oil, are instilled in nose as a decongestant in hoarseness of voice .The decoction of Maidenhair being drunk helps those who are troubled with shortness of breath [28].

Digestive System

The whole plant is pungent and used as antidysenteric [22]. 2 g of fresh leaf paste is taken orally on empty stomach twice a day for 10 days for relief from indigestion [32]. Leaves, ground with cow's milk, are given to children for diarrhoea due to indigestion. It is a good carminative and is used in bilious complaints [32]. The fern is boiled in wine and drunk in cases of affections of spleen, liver and other viscera. It is also beneficial in yellow jaundice, diseases of spleen & stops fluxes in the stomach [27], it is also said to be a good demulcent [29].

Musculoskeletal System

It is used in muscle pain, sprain and rheumatic conditions .It is used to treat bone fractures [27]
Leaves and stems of *Lygodium flexuosum* (L.) Sw. and *Adiantum lunulatum* are macerated with black pepper (fruits of *Piper nigrum*) and fried in mustard oil. In Paralysis the mix is applied to the body thrice daily till cure [30].

Urinary System

Rhizome is prescribed for strangury [11], [28]. Roots are considered diuretic, and are used in dysurea, and help exceedingly to break the stone in the kidneys [27].

Lymphatic System

It is a good remedy for Elephantiasis [10] ,[28]. Rhizome is used to reduce glandular swellings [31]. The fronds made into plaster are applied to

chronic gouty and other swellings and also in chronic tumours [33]. It consumes and wastes away King's evil(swollen lymph glands caused by Tuberculosis) [28].

Reproducive system

Fresh leaf decoction is given to cure irregular menstrual cycle. Plant paste is given to women to help them to conceive [34]. It is found useful in cold inposhumes (purulent swellings or abscess) of the uterus [31]; It is employed as an emmenogogue under the names of polytrichi, polytrichion or kalliphylon, administered as a sweetened infusion of 1oz(30cc) to 1 pint (568 cc) of boiling water [27].

Skin

The whole plant is ground into a paste with turmeric and applied over the affected places to, treat burns, infected wounds[35] and sores. [27] Juice of the fresh plant is applied to abscess and wounds for quick healing[1]. Paste of the plant is applied over boils to burst. It is applied 2-3 times a day [20]. Fruits and leaves are beneficial in leprosy, and erysipelas [11], [13]. Leaf juice is given in ulcers and burning sensation [1]. It is a good emollient [27] and is also chewed for the treatment of mouth blisters [19]. The herb, bolied in oil of camomile, dissolves knots, allays swellings and dries up moisture from ulcers [27]. It is used in bleeding diseases [11]. It is a good Styptic and has a coolant activity [27].

Cosmetic

It is considerably a good remedy for pimples. It also makes the hair of the head or beard to grow that is fallen and pulled off and hence used in baldness and hairfall [27].

Eyes

Frond extract mixed with honey is used as an eye ointment [29].

Psychiatric illness

Along with other therapeutic applications, The Ayurvedic Pharmacopeia of India indicates the use of the dried whole plant in psychosis .It is one of the ingredients of the classical drug *Manasamitra vataka* prescribed for mental disorders [19]. It is also used in Convulsions [31], Epileptic fits [11].

Antidotes

It is used as an antidote in snake bites [29], [36], [37] and also as an antidote for rabid dog's bite[28]. The seeds are prescribed externally in suppurations due to poisonous bites [27].

Other Ailments

With Asparagus racemosus it is used in gonorrhea [28].

Other uses

It is also used in nose studs and ear studs [38].

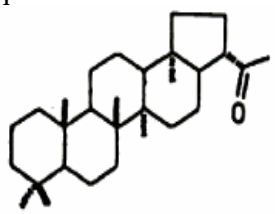
Caution

It is Emetic in large doses [39].

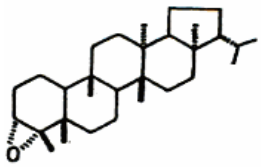
Chemical Constituents

Plant

Chlorophyll degradation products, carotenoids [40], 22,29ψ-epoxy-30-norhopane-13β-ol, fern-9 (11)-en-6α-ol, fern-9(11)-ene, fern-9(11)-en-25-oic acid, fern-9(11)-en-28-ol, filicenol-B, adiantone and oxidation product of fern-9(11)-en-6α-ol obtained as 6-oxofern-9(11)-ene, 3βacetoxy-6α-hydroxy-hop-15,17(21)-diene [41], flavonoids [42] . 6a-Acetoxy-16b,22-dihydroxy-3-ketoisohopane. Astragalin (kaempferol-3-glucoside), pruning ans isoquercetin is isolated from the plant. Mixture of esters, ketone, mp.222^{o}, a diol, mp.243 ^{o}; a nortriterpene-adiantone; a triterpene epoxide-adiantoxide, mp.229 ^{o}-isolated and characterized as 3α, 4α-epoxyfilicane; astragalin, isoquercitrin, nicooiflorin, kaempferol- 3- glucuronide, rutin and querciturone is also isolated.

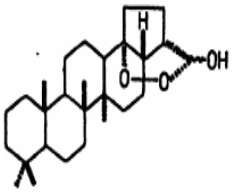


Adiantone

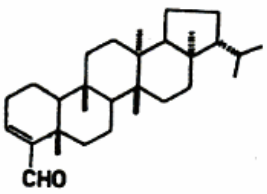


Adiantoxide

Isofernene(8-fernene), mp.191^{o}, fernene, mp.171^{o},7-fernene, mp. 211^{o}, 3-filicene, mp.224^{o}, adiantone, mp.220^{o}, a nortriterpenoid hemiketal-adipedatol, mp. 185^{o}- filicenal has been isolated from leaves.



Adipedatol



Filicenal

Adiantone, traces of 3-filicene and a new ketol-21-hydroxy-30-norhopan-22-0ne (I)-isolated; along with a triterpenoid keto-alcohol,α-carotene monoepoxide, leucopelargonidin,kaempferol and quercetin glucosides[3] ,Isohopane-type triterpenoid, 10.

Pharmacological Activities

Plant was reported for antidysentric, ulcer healing, antidiarrhoeal, antifungal [43], hypotensive[44] antibacterial [34], and abortificient[45]activities. Antifungal and antibacterial activities of plant phenolics are well established [31]. Plant was also reported for its contraceptive properties [46].

Ethanolic extract of *A.lunulatum* showed strong antioxidant activity by inhibiting DPPH, hydroxyl, hydrogen peroxide and nitric oxide radicals, and reducing power activities when compared with standard ascorbic acid. In addition, the Ethanolic extract of *A.lunulatum is* found to contain a noticeable amount of total phenols, which plays a major role in controlling antioxidant activity. The results of this study shows that the ethanolic extract of *A.lunulatum* can be used as easily accessible source of natural antioxidant. However, the components responsible for the antioxidant activity of *A.lunulatum* are currently unclear. Therefore, it is suggested that *in vivo* antioxidant activity should be performed [47]. Alcohol extracts of Adiantum lunulatum are found effective against *E. coli , S. typhi* [48] *; & S. aureus*[49]

Pharmacognosy

Macroscopic

Root

Very thin, fibrous, about 10-15 cm long, reddish black in colour, soft and branched.

Microscopic

Transverse section of mature root shows single layered epidermis consisting of thin walled, small and irregular cells, followed by 3-4 layers of large thick walled, polygonal, parenchymatous cells of cortex; endodermis single layered composed of square or somewhat rounded cells; pericycle single layered composed of square shaped sclerenchymatous thick and dark reddish-brown wall; pericycle encloses a diarch stele with a few elements of xylem and phloem [14].

Macroscopic

Rhizome

Long, up to 2 mm thick, glabrous, prostrate or erect, dark reddish-brown or black in colour.

Microscopic

Mature rhizome consists of thick-walled, rectangular, small cells of epidermis, followed by 3-4 layers of sclerenchymatous cells of hypodermis, composed of thick-walled cells; cortex wide, made up of thin – walled, rounded or oval shaped parenchymatous cells, enclosing an amphiphloic siphonostele; endodermis present; vascular bundle with xylem consisting protoxylem towards both ends and metaxylem in the centre; phloem surrounds the xylem externally and also internally; tracheids with scalariform to reticulate thickening; a central pith consists of thick walled cells, fibres and is sclerenchymatous.[22]

Frond

Rachis shiny black, simple pinnate, pinna roughly lunulate, subdimidiate, lower edge nearly in line and oblique with its black shiny petiole, upper edge bluntly rounded and more or less lobed, a few sori in a continuous line on the under surface along the edge, with a false indusium. Transverse section of petiole shows concave-convex outline; epidermis single layered; hypodermis consists of 2 or 3 layers, lignified, thick walled, sclerenchymatous cells; ground tissue composed of oval to polygonal, thin walled parenchymatous cells; stele single, slightly triangular in shape, located centrally and surrounded by pericycle and endodermis[22].

Pinnule

Shows single layered epidermis on either surface; mesophyll round to oval in shape and not differentiated into palisade and spongy parenchyma; a few stomata present only on lower surface and a few sori are also present [22].

Powder microscopy

Whole plant powder is dark reddish-brown in colour; shows dark reddish brown pieces of sclerenchymatous cells and light coloured crushed cells of cortex, a few tracheids having reticulate thickening, fibres and a few spores[22].

Physical constants

Total Ash - Not more than 16%; Acid insoluble Ash – Not more than 11%, Alcohol soluble extractive – Not less than 3 %; Water soluble extractive – Not less than 5% .[22]

Thin Layer Chromatography

TLC of the alcoholic extract on silica gel „G plate using n-Butanol: Acetic acid: water (4:1:5) shows under UV (366 nm) two fluorescent zones at Rf. 0.80 and 0.96 (both blue). On exposure to lodine vapour three spots appear at Rf. 0.19, 0.30 and 0.80 (all yellow). On spraying with 5% methanolic sulphuric acid reagent and heating the plate for about ten minutes at 110 ^{o} C three spots appear at Rf: 0.19, 0.30 and 0.80 (all yellowish – brown) .[22]

Toxicology

LD50 of ethanolic extract was found to be >500 mg/kg bw i.p. in rats

Trade and Commerce

Retail Market Price – in the year 2006 was Rs.160/kg [44].

Substitutes and Adulterants

Adiantum capillusveneris Linn., *A aethiopium* Linn., *A. pedatum* Linn. and *A venustum* G. Don. are used as substitutes [50], [51] .In kerala *Desmodium triflorum* is used as *Tripadi* and *Hamsapadi*. [19], [52]

Propagation and Cultivation

Grows wild in moist places and under shade near swamps.[53] *A. lunulatum* has been studied from varied habitats to find out relationship of habitats

and growth forms. Substrate analysis was done, along with changing habitats. It is cultivated as a hedge plant Variations in the soil parameters like soil pH, soil organic matter and soil moisture content were examined at different localities of varied habitats which are correlated with the ecotypes of the species [25].

Ayurvedic Properties **[54]**

Rasa – *Kashaya Tikta* **[8],[6],** *Madhura* **[55],[56],**

Guna – *Guru, Snigdha* [54]

Vipaka – *Madhura* [8]

Veerya – *Sheeta* **[3]**

Doshghanata – *Kaphapittashamaka* [57],[3],[6],[8]

Gana- It has been included in Vidarigandhadi gana by Acharya Vagbhata [32]. In Madhura Skandha by Achayra Charaka along with 19 other drugs.

Table 3: Karma [58]

S.No	Property(sanskrit)	Property (English translation)
1	*Kanthya*	Beneficial for throat, vocal cord(voice)
2	*Kasahara*	Alleviates cough
3	*Shwasahara*	Alleviates Dyspnoea
4	*Raktashodhaka*	Purifies Blood
5	*Raktapittashamaka*	Pacifies Rakta and Pitta
6	*Mootrala*	Diuretic
7	*Balya*	Gives Strength
8	*Stambhana*	Styptic
9	*Dahaprashamana*	Pacifies Burning sensation
10	*Vishaghna*	Antidote
11	*Vranaropana*	Accelerates Wound healing
12	*Krimighna*	Alleviates Worm Infestation
13	*Bhutabadhahara-Rakshoghna*	Protects from Bad omens
14	*Ashmaribhedana*	Lithotryptic
15	*Shothahara*	Alleviates Oedema

Table 4: Rogaghnata [8,9,59]

S.No	Disease	Equivalent English Term
1	*Kantha vikara-Swarabheda*	Throat ailments
2	*Kasa*	Cough
3	*Shwasa*	Dyspnoea
4	*Pratishyaya*	Running nose
5	*Mootrakrichchhra*	Dysurea
6	*Atisara*	Diarrhoea
7	*Galaganda*	Goitre
8	*Raktapitta*	Bleeding diseases
9	*Vatarakta*	Gout
10	*Apasmara*	Epilepsy
11	*Visarpa*	Herpes
12	*Shotha*	Oedema
13	*Gulma*	Tumours
14	*Daha jwara*	Fever
15	*Visha*	Poisoning
16	*Vrana*	Wounds
17	*Agni-rohini*	Plague
18	*Luta visha*	Spider Poison
19	*Dourbalya*	Generalised weakness

Dose: Juice-10-20 ml; Powder 1-3 gm.; Decoction 50 – 100ml [6,8]

Table 5: Formulations [60, 61]

S.No	Type of Dosage form	Name of formulation
1	***Taila***	*Madhuyastyadi taila*
2	***Vati and Gutika***	*Manasamitra vataka*
3	***Rasayoga***	*Muktapanchamritarasa, Svarnabhupati rasa, Kalakuta rasa*
4	***Ghritam***	*Vidaryadi ghrtam*
5	***Asava***	*Vidaryasava*

Discussion and Conclusion

Pteridophytes are one of the oldest land plant groups on earth and constitute a vast group of vascular cryptograms. The position of the Pteridophytes as intermediate between the lower cryptograms and higher vascular plants has made the group fascinating. The tribal communities, ethnic groups and folklore practitioners throughout the world are utilizing plant parts like rhizome, stem, fronds, pinnae and spores in different ways for the treatment of various aliments since ancient time. Various articles on

Pteridophytes have been published till date but enough attention has not been paid towards their medicinal aspects. *Hamsapadi, Adiantum lunulatum Burm.f.* (*A. Philippense Linn)* , though a Pteridophyte with a less economic importance but does wonders in the medical field & is not less than any Angiosperm .It has a very significant and wide range of therapeutic application such as leprosy, erysipelas, elephantiasis, dysurea ,strangury ,fever, asthma, hoarseness of voice and various other systemic illnesses. It has quite a few evaluated pharmacological activities such as antibacterial, antifungal, hypotensive, antioxidant etc.The Pharmacodynamics and Pharmacokinetics of the drug are still being analysed. Till date few researches have been carried out justifying some of the activities such as antioxidant, antifungal, antibacterial, hypotensive etc. But as per the Ayurvedic classics the range of utility is still wider and is yet to be justified and thus is a guideline for further research.

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