



Research Article

PHARMACOGNOSTICAL STUDY OF LEAF OF *HAMSAPADI* (*ADIANTUM LUNULATUM*)

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ABSTRACT

Pharmacognostical evaluation of leaves of *Adiantum lunulatum* is done for identification in field and for differentiation from other species of *Adiantum*. **Methods:** A detailed literary work of drug studied and its pharmacognostical, phytochemical and analytical study including powder microscopy and taste determination of leaves with suitable instruments. **Results:** Macroscopic evaluation reveals the pinnacles are half moon shaped, alternate, sub-opposite or opposite in apical portion of the frond, having lobes with minor incisions. In microscopic structure the two surfaces of pinna are covered by epidermis and epidermal cells are wavy in outline. The opening and closing of stomata will be regulated by guard cells, whereas there is absence of stomata on epidermis. The vascular cells are lined by an endodermal tissue. Transverse section of petiole showed that it is externally covered by an epidermis lined by cuticle on its outer wall which renders the petiole to be shining. Below the epidermis is a fairly thick hypodermis made up Sclerenchyma cells of 4-5 layers in thickness. They are dead cells compact in arrangement and look dark in colour. Powder microscopy of leaves reveals shows few Tracheids of the veins and the Parenchyma cells of the leaves. The Sori are very prominent structures occurring at the leaf margin, they are visible characteristically under the microscope. The Sori contain number of Sporangia each Sporangium is lined by cells with U shaped thickening having their outer wall thin in nature. **Conclusion:** This study will help in Authentication of *Hamsapadi* plant.

INTRODUCTION

There has been no direct mention or reference regarding *Hamsapadi* in vedic literature like *Rigveda*, *Yajurveda*, *Samaveda*, *Atharvaveda*. Screening *Aaranyaka* and *Upanishad* reveals the same fact. The references of *Hamsapadi* emerged during *Samhita* period.

Bruhatrayee

Charakacharya has mentioned the drug *Hamsapadi* in the *Kanthyadashemani*^[1] and *Madhuraskandha*^[2] by the name *Hamsapaadi*. He included *Triparni* in the *Shaka Varga*^[3]. Both Chakrapani and Gangadhara opine that *Triparni* is *Hamsapadi*. Another mention of the drug *Hamsapadi* in Charaka Samhita can be traced from the treatment of

'*Nakhadantavish*' in the form of *Lepa* (external application) with other drugs^[4]. In the context of *Vatarakta* the drug *Hamsapadi* is included as an ingredient in the preparation of '*Madhuparnyaadi taila*'^[5].

Acharya Sushruta has mentioned the drug *Hamsapadi* in '*Vidarigandhadi Gana*'^[6]. There is mention of the drug, '*Hamsaavhyaya*' in the context of '*Galagand*'. The drug is one of the ingredients in '*Amrutadi taila*' and the preparation is meant for internal administration^[7]. Dalhana claims '*Hamsaavhyaya*' as *Hamsapadi*.

Acharya Vrudha Vagbhata has mentioned the drug *Hamsapadi* in '*Kanthy Mahakashaya*'^[8] and in *Vidaryadi Gana*^[9].

Vagbhatacharya, mentioned *Hamsapadi* in '*Vidaryadi Gana*' by its synonym *Triparni*.^[10] He mentioned *Hamsapaadi* in the treatment of '*Vataj svarabheda*' in the form of *Taila* with other drugs for *Nasya* purpose^[11].

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Nighantu

The classical literature dealing with the study of herbs is Nighantu. In this regard the Nighantu are the most useful texts to study a drug in detail. The references of *Hamsapadi* can be traced from various *Nighantus* like Dhanvantari Nighantu (10th-11th century)^[12], Shodhala Nighantu (11th-13th century)^[13], Madanapala Nighantu (1347th AD)^[14], Kaiyadeva Nighantu (14th century)^[15], Bhavaprakasha Nighantu (16th century)^[16], Raj Nighantu (17th-18th century)^[17], Hrudayadeepaka Nighantu^[18], Shaaligraam Nighantu (1896 AD)^[19], Priyanighantu^[20].

Definition: (*Shabdakalpadruma*)

Hamsapadi, Hamsapaadi: 'Hamsasyeva paadaa moolaanyasyaa'

The root of the plant resembles the leg of the Swan.

According to Dalhana, '*Hamsapadaakaara patra*' means the leaves resembles to that of Swan leg i.e., pinnules are like the leg of the Swan.

Meaning and Interpretation of synonyms: (*Shabdakalpadruma*)

- *Raktapaadi: 'Raktaah paadaa asyaah/'*
The stem part of the plant is resembles the colour of blood (red in colour).
- *Tripadaa, Tripaadikaa: 'Trayah paadaah moolaani yasyaah/'*
The root has three *Paadaa* i.e., three stems arising from a root.
- *Keetamaataa: 'Keetaanaam maataa iva/'*
It provides shelter to the insects hence the name.
- *Keetamaarii: 'Keetam maarayati/'*
The synonym based on the Action, that it is effective against *Krimija* type of diseases.
- *Krimighni: 'Krimin hanti iti/'*
It destroys *Krimi*.
- *Madhusravaa: 'Madhunah sravo yasyaah/'*
That is, the secretions of the plant resemble the consistency of honey.

Botanical Explanation

The drug *Adiantum lunulatum* is considered as source for *Hamsapadi* and study regarding same is conducted.

Pteridophyta

Pteridophyta/Filicophyta has about 20,000 species of plants, one of its species ferns traditionally belong to group Filices. The modern classification settles them in Pteridophyta^[21].

Pteridaceae/Adiantaceae

Genus *Adiantum* of Maidenhair ferns contains about 200 species. Some researchers place it in *Adiantaceae* family but it is member of *Pteridaceae*.

The Genus name comes from the Greek, meaning "not wetting", referring to the frond's ability to shed water without becoming wet.

Pteridaceae belongs to order *Pteridales*. members of this family mostly are terrestrial or epipetric having erect rhizome or creeping. The reflexed margin of the leaf lack true indusium, forms a typically false indusium protection for linear sori on the margin of the compound leaves^[22].

Genus Adiantum

Sori marginal, varying in shape from globose to linear, usually numerous and distinct, sometimes confluent and continuous; indusium of the same shape as the sorus, formed of the reflexed margin of the fronds, bearing the capsules on its under side; veins free^[23].

Synonyms of the *Adiantum lunulatum*^[24]

1. *Adiantum philippense* Linn.
2. *Adiantum arcuatum* Sw.
3. *Adiantum lunatum* Cav.
4. *Adiantum lunulata* (Burm. f.) Retz

Habitat

A graceful fern found on rocks and slopes of the lower hills throughout the greater parts of India up to an altitude of 1,200 meters This fern grows frequently especially during the rainy season. It is also found on brown laterite soil or under shade near swamps

Morphology of the Plant

The plant possesses a small ascending rhizome 8 to 22mm in size. It is densely covered with fibrous roots, palae and leaf bases. Palae on the rhizome are long, multicellular and multiseriate ranging from 1550-2750µm in length. 3-5 green fronds come out from the rhizome. The stem of the plant is weak and upright. Scales on the stipes are comparatively shorter. The stipe is 6-15 cm long, smooth with glistening black hair at the base. The fronds vary from 16-42 cm in length with variable breadth and pinnate. The pinnules are alternate, sub-opposite or opposite in apical portion of the frond, half moon shaped, having lobes with minor incisions. The texture is soft. The veins are fine, indistinct and more conspicuous on the undersurface, branched or unbranched, running close to each other. The sori are marginal with a linear arrangement, discontinuous or more often confluent.

However, there are two biotypes, one with robust size and almost continuous sori, whereas, the other one is comparatively smaller and the sori are discontinuous. The former is probably a Tetraploid, whereas, the latter is a Triploid form of *Adiantum lunulatum*^[25].

Hamsapadi - *Adiantum lunulatum*



Habitat



Source Plant

Pharmacognocny^[26]

Microscopic

Mature Root: A single layer epidermis consisting of small and irregular cells forming a thin wall, followed by polygonal parenchymatous cells, forming 3-4 layers of large thick walled cortex. A single layered endodermis composed of somewhat rounded or square cells. A single layered pericycle composed of square shaped sclerenchymatous thick dark reddish brown wall which encloses a diarch stele with phloem and xylem.

Matured Rhizome: Epidermis consists of rectangular, thick walled small cells. Then the hypodermis made of sclerenchymatous thick walled cells about 3-4 layered. A cortex made up of parenchymatous cells oval in shape, covering an amphiphloic siphonostele; endodermis present; vascular bundle with metaxylem in centre and xylem consisting protoxylem towards both ends; phloem surrounds the xylem both internally and externally; with scalariform to reticulate thickening tracheid present; central pith is sclerenchymatous with thick walled cells and fibers.

Petiole: A epidermis single layered showing concave-convex outline; of 2 or 3 layers, lignified, thick walled, sclerenchymatous cells of hypodermis; oval to polygonal thin walled parenchymatous cells ground tissue; stele single located centrally, triangular in shape inside pericycle and endodermis.

Pinnule: A epidermis of single layer on either surface; mesophyll not differentiated into palisade and spongy parenchyma round to oval in shape; a few stomata and a few sori also seen on lower surface.

Powder Microscopy

Dark reddish brown in color; shows dark reddish brown pieces of sclerenchymatous cells and light colored crushed cells of cortex, a few tracheids having reticulate thickening, fibers and a few spores.

MATERIALS AND METHODS

For any scientific experiments, materials are resources available for relevant experiment are established scientific procedures for selected experiments.

Pharmacognostical Study

In the present study, an attempt was made to establish reference standards, which will be very essential from the 'Standardization of the raw drug' point of view. The drug was subjected to various analytical procedures as per the guidelines of 'Quality Control Methods for Medicinal Plant Materials' published by World Health Organization (WHO). The analytical values were compared with the standards mentioned in 'The Ayurvedic Pharmacopoeia of India, part1, Vol. III, Government of India, Ministry of Health and Family Welfare'.

Collection of the Samples

Authentic samples of *Hamsapadi (Adiantum lunulatum)* were collected from the region of Udyavara village, Taluka and District Udupi in Karnataka State.

Place of Study: S.D.M. College of Ayurveda, Kuthpady, Udupi, Karnataka.

Macroscopical Study

It includes the observations based on organoleptic characters like shape, size, taste, odor, color, touch, texture and fracture. It is similar to examination by sensory organs mentioned in Ayurvedic text.

Microscopic Study

Transverse sections of stem and leaves were carried out.

- Clearing agent - Chlorol hydrate.
- Stains used - Phloroglucinol: Hcl (1:1).
- Iodine.

Powder microscopy of dried leaves was carried out.

- Clearing agent - Chloral hydrate.
- Stains used- Phloroglucinol: Hcl (1:1).
- Iodine.

OBSERVATIONS/RESULTS

Macroscopical Study

The pinnules are alternate, sub-opposite or opposite in apical portion of the frond, half moon shaped, having lobes with minor incisions. Size- (2-4cm × 1/2-2cm). The texture is soft. The veins are fine, indistinct and more conspicuous on the undersurface, branched or unbranched, running close to each other.

Organoleptic observations of the extracts were as follows.

Organoleptic Observations of the Extracts

Character	<i>Hima</i>	<i>Kwatha</i>	Chloroform	Pet. ether	Methanol
1. Color	Light brown	Dark brown	Dark brown	Yellow	Dark green
2. Odor	Sweet, fishy	Sweet, fishy	Characteristic	Characteristic	Characteristic
3. Touch	Non sticky	Non sticky	Non-sticky	Non-sticky	Non-sticky
4. Taste	<i>Tikta, Kashay</i>	<i>Tikta, Madhur, Kashay</i>	-	-	-

Microscopical Study

Pinna

The pinna is very thin, grass green in color. The two surfaces are covered by epidermis. The epidermal cells are wavy in outline, frequently the upper epidermis shows number of stomata with biconvex lens shaped 'stoma'. On either side, there are two guard cells which regulate the opening and closing of the stomata. In between the two epidermis, there is mesophyll cells which are rounded parenchyma cells containing chloroplasts. Thus the mesophyll cells are photosynthetic which is not differentiated into spongy and palisade parenchyma. In the lamina region the veins are seen in parallel manner showing a small group of xylem surrounded by phloem. The vascular cells are lined by an endodermal tissue. On either sides of endodermis there are few thick walled cells stretching up to epidermis. They are called sclerotic cells.

Petiole

The petiole is dark brown in color arising from the rhizome, unbranched, rounded and shining. It bears 10-15 pairs of pinnae.

A transverse section of petiole shows the following structural characters-

It is covered externally by an epidermis lined by cuticle on its outer wall which renders the petiole to be shining. There are no stomata on the epidermis. Below the epidermis is a fairly thick hypodermis made up Sclerenchyma cells of 4-5 layers in thickness. They are

dead cells compact in arrangement and look dark in color. The hypodermis is protective in function.

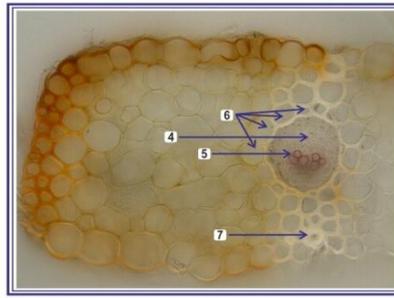
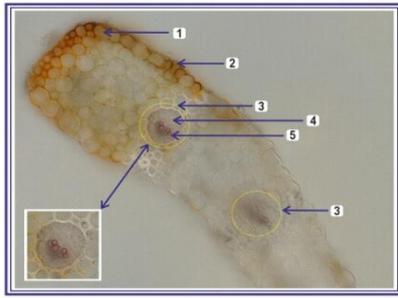
Below the hypodermis there is a cortex made of parenchyma cells of polygonal shape and are compact in arrangement. The cortex is delimited by a single layer of endodermis. Inside this is the stele. The stele consists of phloem. Outside the phloem, there is a single layer of pericycle.

Xylem: Xylem is 'E' shaped or bracket shaped with protoxylem occurring at the two ends and metaxylem situated in the centre. Xylem is consisting of tracheids and xylem parenchyma. The xylem is a water conducting tissue in plants.

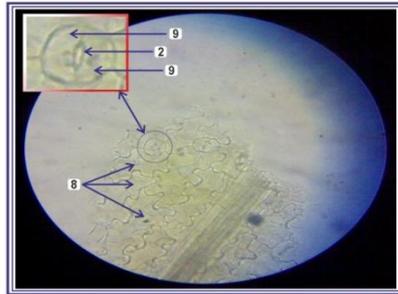
Phloem: Phloem is surrounding the xylem. It is composed of 'Sieve cells' and phloem parenchyma and conducts food. This type of vascular composition is called 'Protostele.'

Powder Microscopy of Leaves

It shows few tracheids of the veins and the parenchyma cells of the leaves. Since the Sori are very prominent structures occurring at the leaf margin, they are visible characteristically under the microscope. The Sori contain number of Sporangia which are oval in outline. Each Sporangium is lined by cells with U shaped thickening having their outer wall thin in nature. There is an annulus at which the sporangium breaks open at the time of spore liberation. Annulus open out into straight structure when it loses water content.

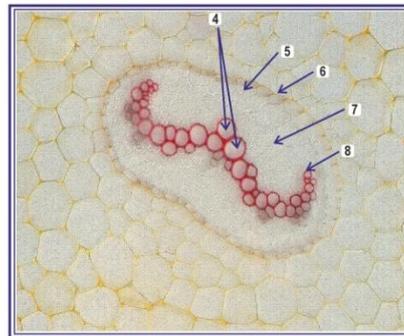
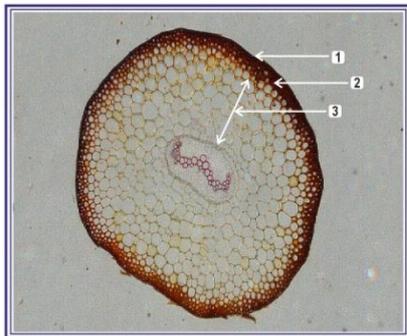


Transverse section of Pinna of *Adiantum lunulatum*



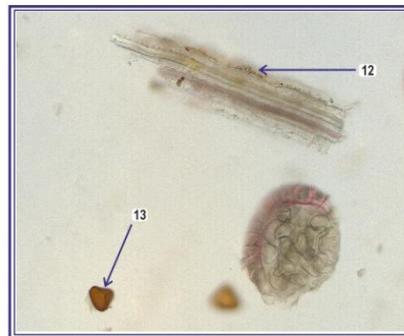
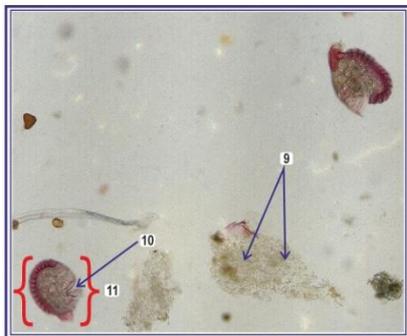
Epidermal Cells with stomata

- 01. Epidermis
- 02. Stoma
- 03. Structure of Vein
- 04. Phloem
- 05. Xylem
- 06. Endodermis
- 07. Sclerotic Cells
- 08. Epidermal Cells
- 09. Guard Cells



Transverse section of Petiole of *Adiantum lunulatum*

- 01. Epidermis
- 02. Hypodermis
(Sclerenchyma)
- 03. Cortex
- 04. Metaxylem
- 05. Pericycle
- 06. Endodermis
- 07. Phloem
- 08. Protoxylem
- 09. Parenchyma
- 10. Annulus
- 11. Sporangium
- 12. Trachids
- 13. Spore



Powder microscopy of Pinnae of *Adiantum lunulatum*

CONCLUSION

The references regarding drug *Hamsapadi* are available in the *Samhita Granthas* and its uses are also described in detail. The drug is used in various preparations. The description of the synonyms and its uses are dealt in the *Nighantu Granthas*. The source for the drug *Hamsapadi* is considered as *Adiantum lunulatum* in the study which is included in the *Adiantaceae* family.

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