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Research Article

Barleria lupulina Lindl.

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Pharmacognostical Study of Barleria lupulina Lindl. - A Lesser-known Medicinal Herb

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Barleria lupulina Lindl. is an ornamental shrub belonging to Acanthaceae family. Its ethnomedicinal uses are reported in Southeast Asian folk medicine, where it is being used for treating wounds, insect stings and snake bites. Also, its antibacterial anti-inflammatory properties have been researched. Since it is not explicitly mentioned in classical Ayurvedic texts, it falls under the category of Anukta Dravya (Extra phamacopoeial drug). Its pharmacognostical study is very much under-explored which is crucial for its authentication, purity assessment and medicinal efficacy. In present investigation its morphological and microscopic characteristics are studied, highlighting features of its leaves, stems, flowers etc. Microscopic analysis reveals essential cellular structures, including vascular bundles, trichomes and cystoliths, which aid in its authentication and identification. The powder behaviour of whole plant indicates the presence of pitted and spiral vessels, thin-walled fibres, Calcium oxalate crystals, cork cells, trichomes and stomata. Despite the modern techniques, identification of plant drugs by pharmacognostic studies is very basic and more reliable.

Keywords: Barleria lupulina Lindl., Hop-headed barleria, Anukta Dravya, Pharmacognostical identification, Anti-inflammatory, Antimicrobial

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Introduction

Barleria lupulina Lindl. is a potential medicinal plant belonging to the Acanthaceae family. This species introduced from Mauritius is now found throughout India for ornamental and aesthetic purposes.[1] Despite its traditional use in various folk medicine systems, it is not explicitly documented in classical Ayurvedic texts, making it an *Anukta Dravya* (Extra phamacopoeial drug) —a category of medicinal substances that are not mentioned in ancient Ayurvedic scriptures but are explored for their therapeutic potential using modern research and traditional knowledge.[2] The pharmacognostical identification of an unknown drug is the very basic step and essential for ensuring its authenticity, purity and therapeutic efficacy.

Although *B. lupulina* is a lesser-known medicinal plant and its pharmacognostical potential remains underexplored, necessitating further scientific investigation in this regard to validate its medicinal properties and expand its applications in traditional and modern medicine. By analyzing its macroscopic features, researchers can establish preliminary identification, which aids in distinguishing this drug from other similar drugs. However, the microscopic examination provides a detailed cellular structure which is crucial for detecting adulteration and ensuring standardization. This approach helps in quality control, classification and validation of medicinal substances, ensuring their safe and effective use in traditional and modern medicine.

B. lupulina is small shrub, commonly known as 'Hop-headed *Barleria'*. Its ethnomedicinal uses are reported from Southeast Asia including Thailand & Vietnam. Also found in tropical Asian countries like India, Pakistan, Myanmar, China, Philippines & Srilanka. In India it is commonly found in Madhya Pradesh, Rajasthan, Tamil Nadu, Maharashtra, Orissa, Assam, Andaman Nicobar, Gujarat states, where it thrives even in open woodlands and disturbed habitats with seasonal dry conditions. [3] This species is recognized for its distinctive bright yellow, tubular flowers that grow in compact spike-like inflorescences, accompanied by narrow lanceolate leaves with red midrib and spiny stem. These make it distinct from *Justicia gendarussa* of same family (*Krisna vasa)* which is also a similar shrub of dark appearance with white purpulish flowers but leaves are devoid of red midrib & spinal stem.

Another close member *Barleria prionitis* linn. is easily distinguished from its morphological features of leaf size, shape and flower pattern. Pharmacologically, this plant is having anti-inflammatory, antimicrobial and wound-healing properties, making it a popular choice in ethnomedicine for treating snake bites, insect stings and skin ailments.[4] Vital bioactive compounds such as flavonoids, alkaloids, and tannins, have been isolated from its leaves, roots and stem, which contribute to its therapeutic effects.

Material and methods

- **Collection and Authentication of the plant material**

The fresh parts of whole plant of *Barleria lupulina* Lindl., of Family Acanthaceae were procured from Herbal Garden of Govt. Ayurvedic College, Patiala which were identified and authenticated by the subject expert basing upon e-Flora of India, e-Flora of Gandhinagar, Gujarat, India.[5]

Pharmacognostical study including macroscopy and microscopy of different parts was done. Microscopy was done to study cellular characteristics of different parts such as leaves, root, stem & powdered drug. Transverse section of leaf, stem & root was done, then mounted in glycerin on glass slide and were observed under microscope at 10X, 45X for their anatomical details. Microscopy of surface epidermis of leaf was also done. Collected plant material was washed & dried under shade, which was ground into fine powder using an electric grinder. This powder was further sub. to microscopy study, powder behaviour, preliminary phytochemical study of plant. Physicochemical parameters such as colour, odour, LOD, total ash, extractive value of crude drug were done by using methods as recommended by Indian Pharmacopoeia.

Results

Morphological Analysis of fresh parts of plant of *Barleria lupulina* Lindl. (Fig. 1)[6]

A) Description - It is a glabrous, erect and branched shrub up to 1.5 m tall, with axillary spines.

B) Leaf - Branches are usually short with clustered leaves. Leaf blades 4.5-13 x 0.7-2.2 cm, narrowly elliptic or linear, chartaceous, glabrous except for a few hairs on veins.

Adaxial midrib is red. Lower surface is light green than the upper. Apex is acute and mucronate. Base is acute. Margins are entire and revolute.

C) Root - Thickness is about 1 cm, cylindrical and tapering, bearing lateral roots and brownish in color.

D) Stem - The stem is typically reddish-brown or purplish in color, hairless, highly branched, and 4-sided (quadrangular). It features spines that occur in pairs, often found in the leaf axils.

E) Flower - The zygomorphic flowers arranged in terminal spikes with overlapping bracts that is up to 9 cm long. Four unequal lanceolate sepals make up the calyx, while a yellow, 3-5 cm long corolla with 5 sepals extends beyond the bracts.

F) Fruit - 2 seeded Capsule. Capsule is flattened, ovate-lanceolate, glabrous & up to 1.5 cm long.

G) Seed - 5-5.5 mm long, ovate to lenticular, apiculate, with fibrous, golden covering.

A – Flower

B -Adaxial surface of leaf

C - Abaxial Surface of leaf

D - Stem

E - Root

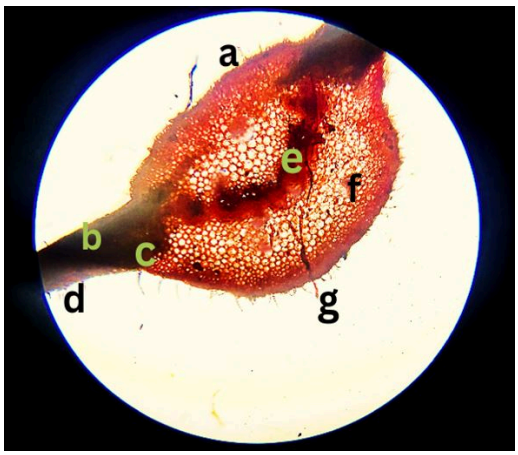
Figure 1 (A, B, C, D, E): Showing fresh parts of *Barleria lupulina* Lindl.

Microscopic features of T.S of fresh parts of *Barleria lupulina*[7]

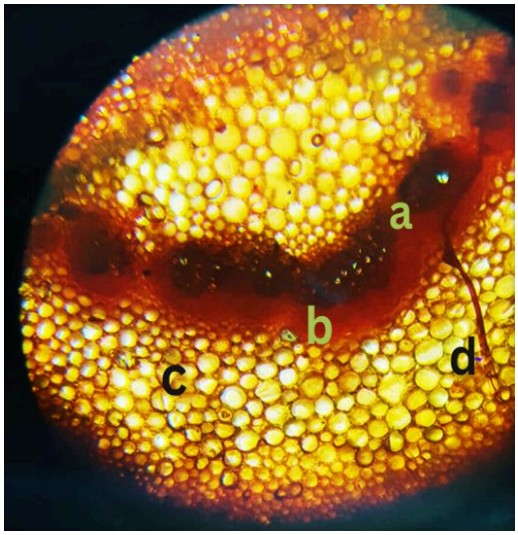
A. Leaf - (Fig 2)

The transverse section (TS) of *Barleria lupulina* leaf reveals several distinct anatomical features.

Midrib consists of spongy parenchymatous cells arranged in layers, with loosely packed circular or angular cells that have intracellular spaces. Vascular bundle is hemispherical, containing thick vertical band of xylem & wide band of phloem. Xylem elements are spherical & thick-walled, systematically arranged alongside upper & lower collenchymatous cells. Lamina is flat & even-surfaced, with mesophyll tissue different. into single layer of palisade cells & spongy parenchymatous cells. Trichomes are absent & stomata are present, including diacytic stomata. Cystoliths are also observed in TS, contributing to structural & physiol. adaptations of leaf. Lower Surface epidermis shows numerous diacytic stomata observed.

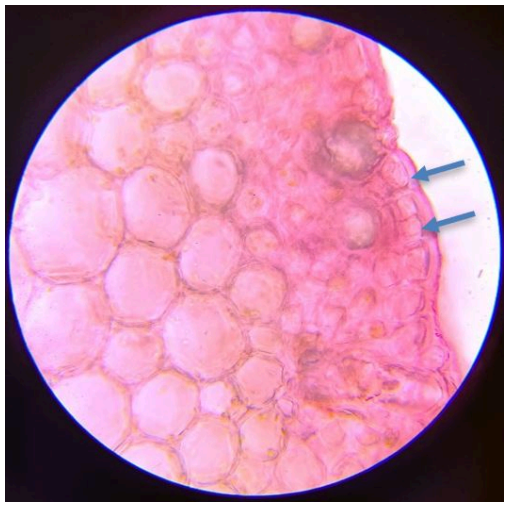


A (10X) - a. Upper epidermis, b. Palisade parenchyma, c. Spongy parenchyma, d. Lower epidermis, e. Vascular bundles, f. Collenchyma, g. Trichomes

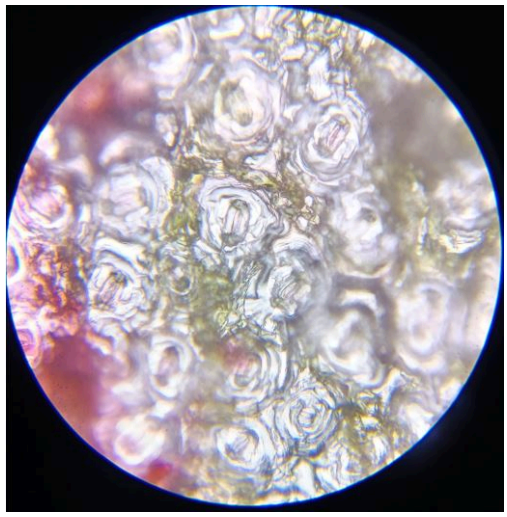


B (45X) - a. Xylem, b. Phloem, c. Collenchyma, d. Glandular trichomes

Figure 2 (A, B): T. S of *Barleria lupulina* Leaf



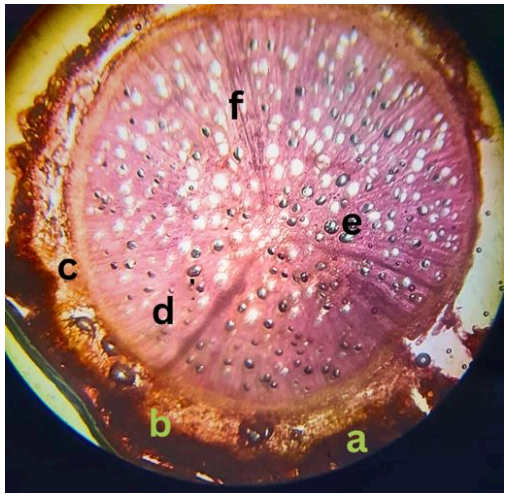
C – Cystolith in T.S (45X)



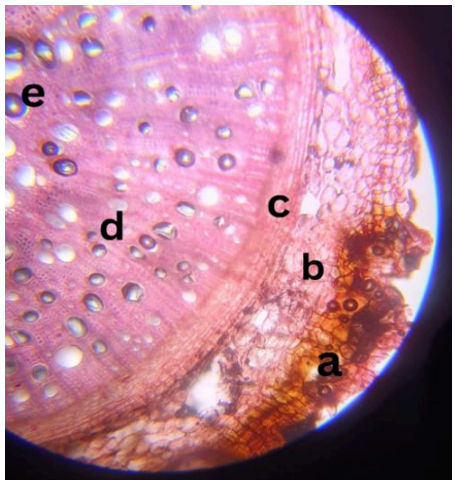
D - Stomata in lower Surface epi (45X)

Figure 2 (C, D): Showing Cystolith and stomata of *Barleria lupulina* Leaf

B. Root - (Fig. 3)



A (10X) - a. Cork b. Phelloder, c. Phloem, d. Xylem, e. Xylem vessels,f. Medullary Rays



B (45X) - a. Cork b. Phelloderm, c. Phloem, d. Xylem, e. Xylem vessels, f. Medullary Rays

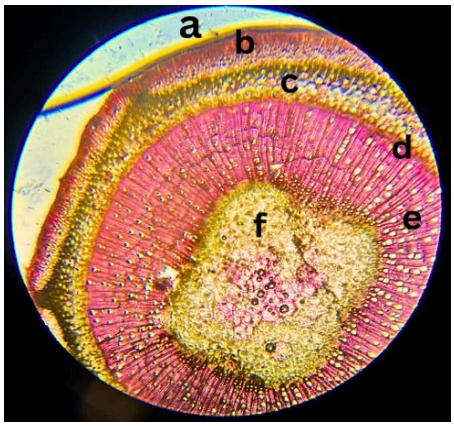
Figure 3 (A, B): T. S of *Barleria lupulina* Root

TS of Root shows outermost layer of cork cells (phellem) which are tightly packed. Beneath the cork cells phelloderm is present composed of few layers of parenchymatous cells. Vascular tissues are arranged radially, with alternating strands of Xylem and Phloem. The Xylem, composed of thick-walled vessels and parenchymatous cells, forms the central part of vascular bundle, while the phloem parenchyma surrounds the xylem. Broad medullary rays are running radially across the root.

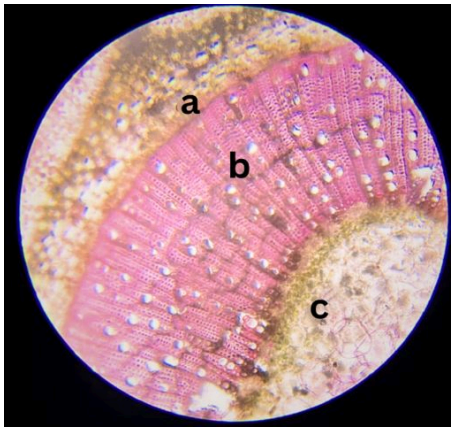
C. Stem - (Fig. 4)

TS of Stem shows single layered epidermis covered with thin cuticle & contains trichomes. Beneath epidermis, Cortex is located, composed of parenchymatous cells with varying shapes & sizes.

Vascular bundles are arranged in a ring-like pattern containing Xylem and phloem. Pith is present in the central region which is composed of parenchymatous cells.



A (10X) - a. Epidermis, b. Cortex, c. Phloem, d. Vascular Cambium, e. Xylem, f. Pith



B (45X) – a. Phloem, b. Xylem, c. Pith

Figure 4 (A, B): T. S of *Barleria lupulina* Stem

D. Powder - (Fig. 5)

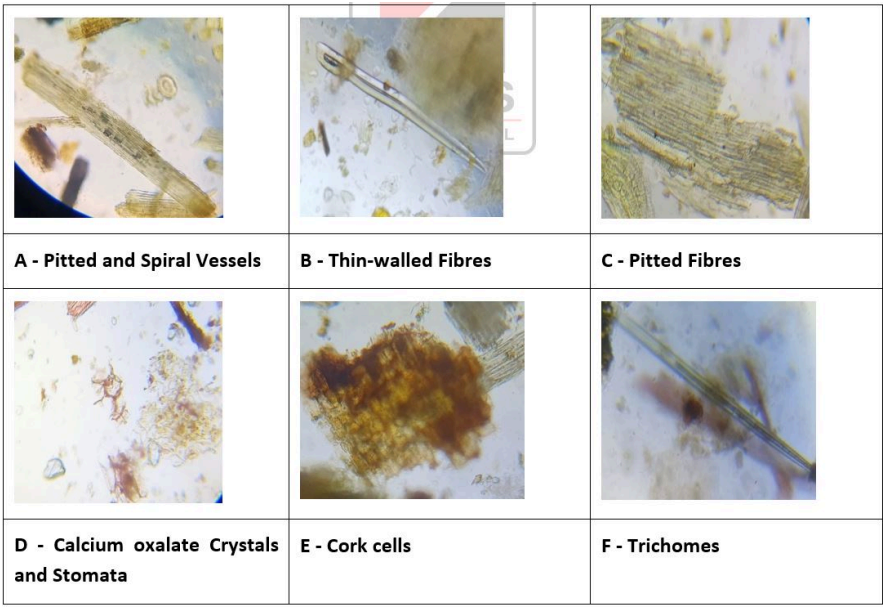


Figure 5 (A, B, C, D, E, F): Microscopy of *Barleria lupulina* Powder

The powder typically shows fragments of epidermal cells with stomata, pitted and thin-walled fibres, cork cells, trichomes, and vascular elements like xylem vessels. Calcium oxalate crystals are also observed.

Physico-chemical analysis

The physico-chemical analysis of the plant was done at DTL, Patiala.

Table 1: Physico-chemical Analysis of *Barleria lupulina* Powder

SN	Tests/Analysis Parameters	Results	Limits/Method
1.	Foreign Matter	Nil	----------
2.	Loss on Drying	4.7%	----------
3.	Total Ash Value	11.37%	----------
4.	Acid Insoluble Ash	1.5%	----------
5.	Water Soluble Extract	8.08%	----------
6.	Alcohol Soluble Extract	23.52%	----------
7.	pH Value	4.98	----------

No Standard parameters are available in API and other standardization books.

Preliminary Phytochemical Screening

Table 2: Phytochemical Screening of Whole powder of *Barleria lupulina* Lindl. shows-

SN	Phytochemical Screening	Tests	Reagents Used	Observations	Results
1.	Alkaloids	Dragendroff's test	Dragendorff's reagent	Orange-brown precipitate	+ve
2.	Tannin	Ferric chloride test	Ferric chloride.	Blue colour	+ve
3.	Flavanoids	Alkaline reagent test	NH3	Yellow colour	+ve
4.	Saponin	Foam test	No foam developed.	Absent	-ve
5.	Glycosides	Baljet test	Picric acid	Absent	-ve

Ethnomedicinal Uses

Barleria lupulina Lindl. is widely recognized in traditional medicine for its diverse ethnomedicinal applications. It thrives in tropical and subtropical zones. In India, it is commonly grown as an ornamental plant in gardens and parks, but its medicinal significance extends beyond aesthetics. Ethnomedicinal uses are reported from Southeast Asia including Thailand and Vietnam.**[8]** The leaves and roots are traditionally chewed to alleviate toothache, while leaf poultices are applied to insect bites, snake bites and dog bites for their anti-inflammatory properties.

In Thai folk medicine, *B. lupulina* is externally used to treat herpes simplex, herpes zoster, varicella zoster virus lesions and is also noted for its diuretic and anti-amoebic activities.**[9]** Its leaf juice is used to stop bleeding and leaf paste serves as a poultice to relieve pain, making it valuable in wound care. Moreover, *B. lupulina* has demonstrated a strong inhibitory effect against acne-inducing bacteria, highlighting its dermatological applications. Despite its traditional prominence, further scientific investigation is necessary to fully understand and to tap its therapeutic potential.

Discussion

Present pharmacognostical study of *Barleria lupulina* Lindl. reveals significant morphological and microscopic characteristics that aid in its identification and authentication. The macroscopic analysis highlights its distinctive features, such as lanceolate leaves with red midrib, spiny stems and bright yellow flowers, which are crucial in distinguishing this species from other members of the *Barleria* genus and Acanthaceae family. The microscopic examination provides insight into its cellular structures, including the arrangement of vascular bundles, trichome distribution, and the presence of calcium oxalate crystals, which are important markers for quality control.

The presence of flavonoids, alkaloids, and tannins in it supports its traditional usage in herbal medicine for anti-inflammatory, antimicrobial, and wound-healing properties. The pharmacognostical identification, phytochemical tests and preliminary phytoconstituents ensures the purity and therapeutic efficacy of the plant, preventing adulteration and ensuring safe medicinal applications. Despite its potential, *B. lupulina* remains an underexplored species in Ayurvedic literature, highlighting the need for further quantitative phytochemical and pharmacological investigations to validate its *Rasapanchaka* and medicinal benefits scientifically.

Conclusion

Present study helps to identify *Barleria lupulina* Lindl. with distinctive morphological and microscopic characteristics that facilitate its authentication and classification as a medicinal herb. Its traditional use in treating wounds, insect stings, snake bites, anti-inflammatory,

Anti-microbial aligns with the bioactive compounds identified in its leaves, stems and roots. However, due to its status as an *Anukta Dravya* (Extra phamacopoeial drug), further research is required to establish its therapeutic applications and integrate it into Ayurvedic and modern medicine.

Further toxicological and standardization techniques will help to enrich Ayurvedic pharmacopeia and will ensure its safe and effective use.

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