

Macroscopic, microscopic, and micrometric evaluation of *Madhaviyata* (*Hiptage benghalensis* Linn. (Kurz.) flower

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Abstract

Background: *Hiptage benghalensis* Linn. (Kurz). is belonging to Malpighiaceae family and one of the important Ayurvedic drugs. Almost all parts of the plant are in the traditional medicine systems of Asian countries to treat various diseases over many centuries. Flowers are used in earache, *Shirahshool* (headache) dried flower in *Agnimandya* (digestive impairment), *Krimi roga* (worm infestation), *Kandu* (itching), *Pama* (eczema), *Raktapitta* (bleeding disorder), *Sthaulya* (obesity), and *Twak roga* (skin diseases); kernel of seeds is prescribed for reducing abdominal girth (obesity); leaves are used in chronic rheumatism, asthma, and skin disease; bark in bronchial asthma. **Aim and Objective:** Till date, no data have been found on micromorphology and micrometric evaluation on *Madhaviyata* flower. The present study has been focused on micromorphological and detailed micrometric evaluation of individual parts of flower including its powder microscopy. **Materials and Methods:** Fresh flowers were collected; free-hand sections of various parts of flower and the micrometric analysis were done as per the standard pharmacognostical procedures. **Result and Conclusion:** Pharmacognostical evaluation of floral parts plays an important role in identification point of view as pollen grains are the characteristic feature. Other than that, fibers with different sizes and shapes were also found to be present.

Key words: *Hiptage benghalensis*, flower, *Madhaviyata*, pharmacognosy, micrometry

INTRODUCTION

Madhaviyata (*Hiptage benghalensis* Linn. [Kurz]) commonly known as helicopter flower belongs to Malpighiaceae family. The plant is widely distributed all over India, North of South America and is widely cultivated in the tropics for its attractive and fragrant flowers. It is also occasionally cultivated for medicinal purposes. It can be trimmed to form a small tree or shrub or can be trained as a vine.

The genus *Hiptage* (syn: *Banisteriopsis*) and *Diplopterys* include some species with hallucinogenic compounds.^[1] The bark, leaf, and flower of the aromatic plant are useful in conditions of burning sensation, wounds, ulcers, inflammations, leprosy, scabies, cough, and rheumatism.^[2] In view of its important in traditional and modern system of medicine, it was though worthwhile to develop quality standard for the same. As far as botany and chemistry of this plant is concerned, a large

number of scientific data are available, but a systematic standardization study is still lacking. Hence, in the present investigation, an attempt has been made to standardize the *H. benghalensis* by microscopic investigation.^[3]

Plant is stout, high-climbing liana, or large shrub and with scandent branches reaches up to 16 feet with white or yellowish hairs on the stem; leaves are lanceolate to ovate-lanceolate and approximately 20 cm long, and 9 cm broad with petiole up to 1 cm long; flowers, fragrant, borne in compact ten-to-thirty together in axillary racemes, pink to white, with yellow marks; fruits, samaras with three spreading, papery oblanceolate to

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elliptic wings, 2-5 cm long flowering in February to March and fruiting in April to May^[1,2,4,5] [Figure 1].

In *Ayurveda*, *Chandrakala rasa* referred *Madhavilata* flower in problems such as *Agnimandya* (Digestive impairment), *Krimi roga* (worm infection), *Kandu* (Itching), *Pama* (Eczema), *Raktapitta* (Bleeding disorder), *Sthaulya* (obesity), and *Twak roga* (skin diseases).^[6]

MATERIALS AND METHODS

Materials

Collection

Fresh flowers of *H. benghalensis* were collected by the scholar in the month of January 2016, from the Botanical Garden, Gujarat Ayurved University, Jamnagar, India.

Processing and preservation

Genuine and good quality materials, required for the present study, free from any filth and worm infection, were cut and washed and preserved to study macro and microscopy; coarse powder of sufficient quantity was prepared and stored in airtight container for powder microscopy.^[5]

Methods

Pharmacognostical analysis

Morphological study

Under this section, flower was studied in detail and observations were noted properly and then matched with the data available in taxonomic book and with the flora.^[1,7]

Macroscopic study

The collected sample was identified and authenticated by studying their characters systematically as per the methods



Figure 1: Morphology of *Madhavilata - Hiptage benghalensis* Kurz. (Linn.), (a) natural habitat, (b) a flowering twig, (c) flower in receme

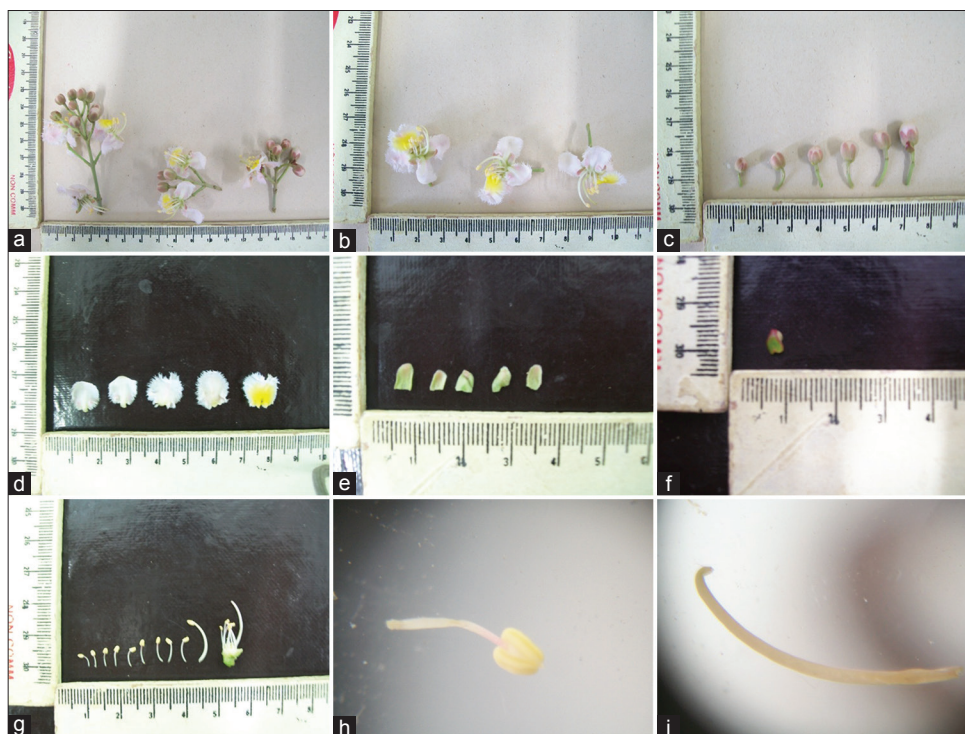


Figure 2: Flower macroscopy, (a) a flowering twig, (b) flowers, (c) flowering buds, (d) sepals, (e) petals, (f) nectary gland, (g) accessory whorls, (h) androecium, (i) gynoecium

described in the textbooks of botany, floras, and pharmacognosy. The specimen was observed as such with necked eyes. The samples were cleaned properly and macroscopic studies of the different parts of the flower were carried out. Individual characters of the flower such as petiole, sepal, petal, androecium, ovary, and their macroscopic characters such as size, shape, and color were noted in detail.^[8,9]

Organoleptic characters

Evaluation of the raw sample was done by their various characters such as color, texture, odor, and taste.^[7]

Microscopic evaluation

Free-hand sections of various parts of flower, i.e., androecium, petals, and ovary, were taken. It was first observed in distilled water and then stained with phloroglucinol and concentrated. Microphotographs were taken using microscope, attached with camera. Shade-dried flowers were powdered and analyzed for powder microscopy.^[9,10]

Micrometric Evaluation

Systematic evaluation of petals, stamens, gynoecium, and ovary was followed by micrometry, microscope with preloaded micrometric analysis. Measurement of length, breadth of the sepals, petals, pollen grains, etc and their mean value was taken into consideration.^[7-9]

RESULT AND DISCUSSION

Micromorphology

- Inflorescence: In terminal racemes, sometimes axillary.
- Flowers: With 4 white, one yellow colored petal, fragrant.
- Bracts: Small, 4-5 mm long, at the base of peduncle.
- Bracteoles: At the base of pedicel, 2 mm long.
- Pedicel: 5.5 mm long.
- Calyx: 5-partite, 6 mm long, with one large gland partly on the pedicel.

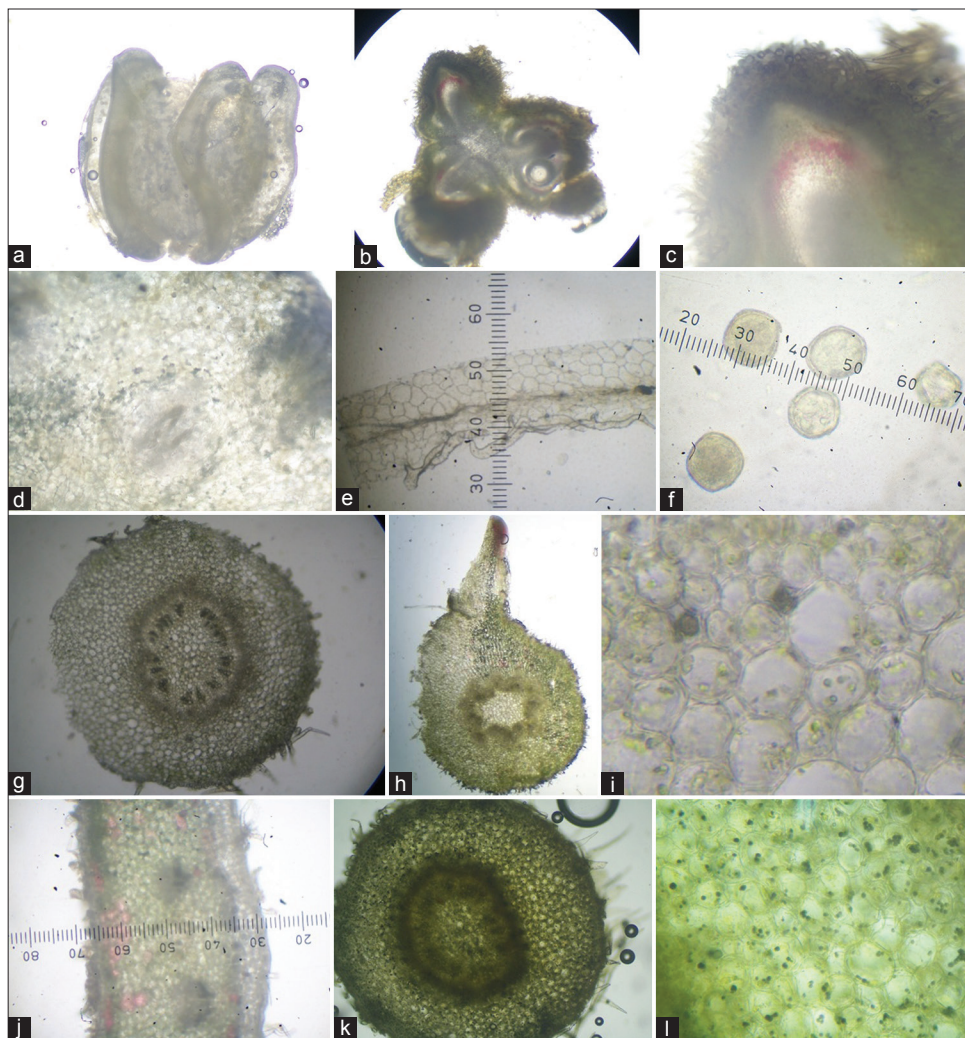


Figure 3: Flower microscopy (a) anther microscopy (×10), (b) ovary microscopy (×10), (c) coloring matter in ovary (×10), (d) T. S. of ovary (×10), (e) T. S. of petal (×10), (f) pollen grains (×40), (g) T.S. of petiole without nectary gland (×10), (h) T.S. of petiole with nectary gland (×10), (i) ground tissue of petiole embedded with crystal and starch grains (×40), (j) T.S. of nectary gland (×10), (k) iodine stained section of petiole (×10), (l) stained starch grains of petiole (×40)

- Corolla: Clawed, unequal, silky, fringed, four white measuring 1.4-1.5 cm and one yellow measuring 1.6-1.5 cm.
- Androecium: Stamens 10 free, declinate, one much long than the others; smaller 1.5 mm and larger 6 mm, filament connate at the base.
- Gynoecium: Ovary 3-lobed, styles 1-2, 1.4-1.5 cm long, flattened at the base [Figure 2 and Table 1].

MICROSCOPY AND MICROMETRY

Petiole

T.S. of petiole measuring 3.6 mm showed outer epidermis, cortex, vascular bundle, and central large pith.

Epidermis is made up of simple tabular-shaped epidermal cells which are interrupted by number of trichomes and covered with cuticle. Epidermis followed by cortex is made up of parenchyma cells without any intercellular space and consists of some prismatic crystals and brown content. Vascular bundle circularly arranged outer phloem with sieve elements and fibers and inner xylem consists of xylem parenchyma and its fibers. Centrally located pith consists of parenchyma cells loaded by prismatic crystals, isolated oil globules, starch grains, and brown content [Figure 3g].

Petiole with Nectary Gland

Morphology of petiole with nectary gland is same as compared to normal petiole, but where the extended portion

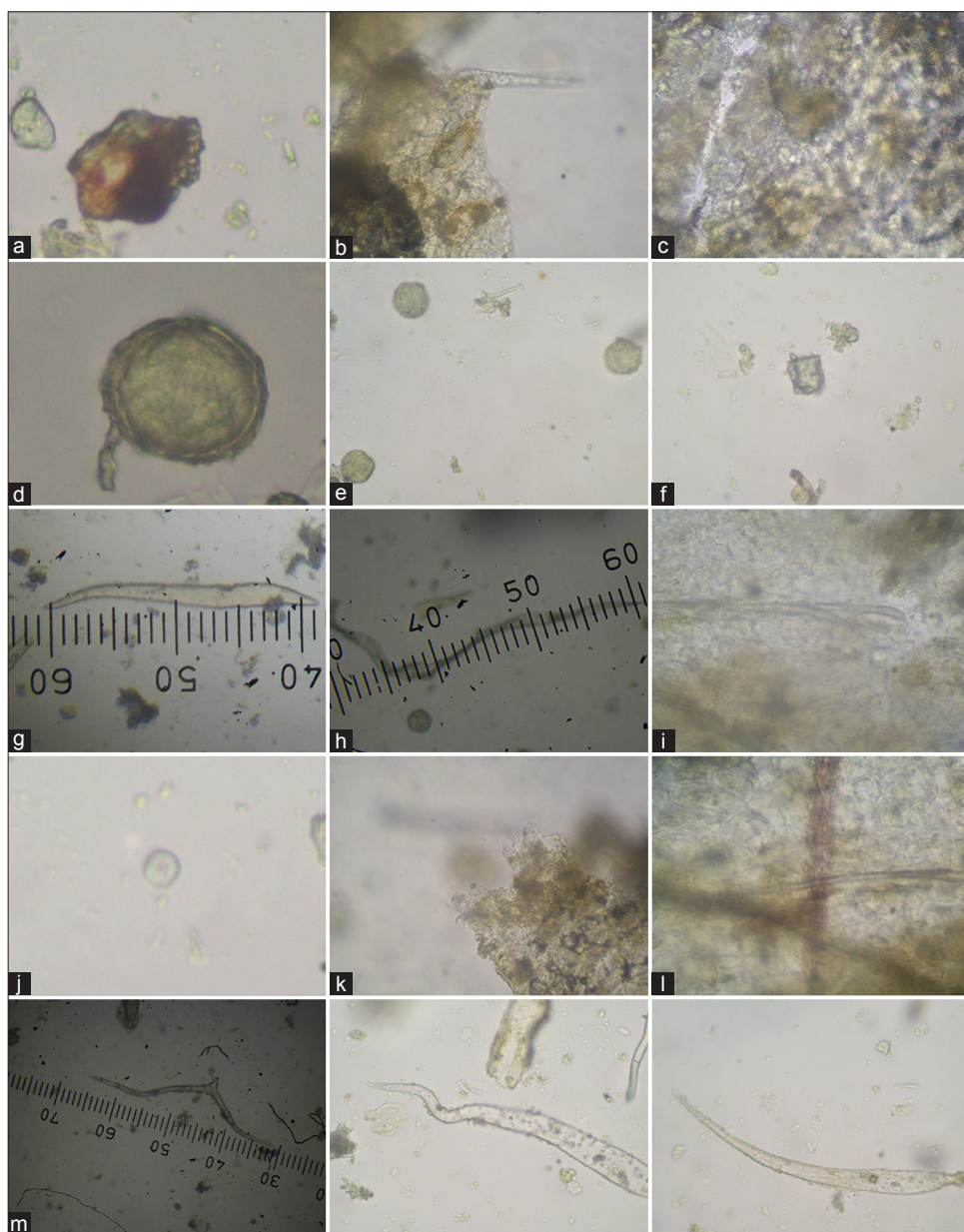


Figure 4: Powder characters of flower, (a) coloring matter ($\times 40$), (b) cut fragment of sepal with attached trichome ($\times 40$), (c) sepal in surface view ($\times 40$), (d) pollen grain ($\times 40$), (e) pollen grains ($\times 40$), (f) prismatic crystal ($\times 40$), (g) fiber ($\times 40$), (h) fiber ($\times 40$), (i) spiral vessel ($\times 40$), (j) starch grain ($\times 40$), (k) striated cuticle ($\times 40$), (l) stained spiral vessel ($\times 40$), (m) different types of trichome ($\times 40$)

Table 1: Micrometric values of individual character

Character	Measurement
Radius of T.S. of pedicel (×4)	5.5 mm ²
Pedicel	2.2-2.5 cm
Sepal	0.6 cm
Petal	White – 1.4-1.5 cm Yellow – 1.6-1.5 cm
Trichome (10×X10x)	3.5 mm
Single stamen	Smaller - 0.6 cm Larger - 1.5 cm
Pollen grain (10×X10x)	0.5 mm ²
Prismatic crystal (10×X10x)	0.6×0.5 mm
Gynoecium	14-15 mm

of the gland shows coloring matter and large number of calcium oxalate crystals, remaining cellular structure is same as petiole [Figure 3h].

T.S. of Nectary Gland

Diagrammatic transverse section of the nectary gland shows adaxial epidermis comprising single layered of tubular-shaped parenchyma cell filled with pink color cell sap. Abaxial epidermis consists of four layer of parenchyma cell containing pink color cell sap. Both are surface covered with thin cuticle and numerous trichomes. Ground tissue is consisting with the homogenous mesophyll of spongy parenchyma. Open collateral vascular bundle situated in the central position of the section [Figure 3j]. Centrally located pith consist parenchyma cells loaded by prismatic crystals, isolated oil globules, starch grains and brown content. [Figure 3g, i, k, l]

Corolla

T. S. of petal measuring 1.2 mm consists of single layered outer epidermis with thick striated cuticle as compared to inner epidermis two to three layered; both the epidermis are interrupted by both simple and appressed trichomes. Hypodermis beneath the outer epidermis, rest of the ground tissues consists of oil globule, coloring matter, cluster crystal, and no vascular bundle is present in all over the ground tissue [Figure 3a, f].

Androecium

Crushed part of the anther shows four anther lobes, and pollen chamber contains the oval shaped, yellow color oil globules containing pollen grain, connective tissue. Crushed part of the filament portion shows epidermis and parenchymatous ground tissue [Figure 3a].

Ovary

Ovary tricarpellary with ovule in each chamber [Figure 3b-d].

POWDER MICROSCOPY

Organoleptic Characters

Color: Brownish, Odor: Aromatic, Taste: Sweet, Astringent touch: Coarse powder.

Powder microscopy: Diagnostic characters of flower show diacytic stomata from pedicel and calyx, parenchyma cells of sepal, wavy parenchyma cells and epidermal cells of petal in surface view, pollen grains from anther, fiber, multicellular trichomes, pollen grains, fibers, oil globules, pleuricellular hair, and prismatic crystal from petal [Figure 4].

CONCLUSION

Microscopic study of the flower gives relevant source of information that standardizes to dispose of the quality and identity of this plant in future exploration.

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