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ANATOMICAL STUDY OF *EUPHORBIA HIRTA* L.

Darshika Acharya and Meenakshi Vaidya*

SVKM'S Mithibai College, Department of Botany, Vile-Parle West Mumbai 400 056, India.

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***Corresponding Author**
Dr. Meenakshi Vaidya
SVKM'S Mithibai College, Department of Botany, Vile-Parle West Mumbai 400 056, India.

ABSTRACT

Euphorbia is a genus of flowering plants, commonly called **spurge**; it is also called spurge family (Euphorbiaceae). Leaves of *Euphorbia hirta* L. contain secondary metabolites such as alkaloids, diterpenoids, stigmasterone, beta- siteosterol, carboaromatic compounds polyols. Alkaloids and phenolic acids, are major chemical compounds present in stem of *Euphorbia hirta*. The plant is medicinally important. The roots, stem, leaves, fruits and seeds are all useful as medicine. The present study deals with anatomical study of the plant like venation, stomata, sections of root & stem. This study will be helpful in correct identification and standardization of the plant material which is of medicinal importance.

KEYWORDS: *Euphorbia hirta*, anatomical, venation, stomata, medicine, standardization.

INTRODUCTION

Euphorbia hirta L. Belongs to family Euphorbiaceae (Hooker, 1883). Family Euphorbiaceae is also called spurge family consisting of about 322 genera and 8910 species. Species are predominantly cosmopolitan with strongest representation in the humid tropical and sub-tropical regions of both hemispheres. It is the sixth largest family in the world. *E. hirta* is an evergreen medium sized shrub attaining a height of 4-5 feet, found throughout India, plentifully in the plains of Maharastra. Leaves are glabrous, simple, alternate and hairy, obovate to oblong, denticulate or crenate margin, petiolate, unicostate reticulate venation, dark green rough upper surface, faint green lower surface. It consists of cyathium inflorescence, up to 4 cm long and 1.5 cm across, scarlet red –brown flowers. Seed is non-endospermic.

Vernacular names-English: pill-bearing spurge, asthma plant, hairy spurge, garden spurge, Bengali: boro-kerui. Gujarati: dudeli, Hawaiian: Koko kahiki, Hindi: baridhudi, dudh ghas, dudhi, Sanskrit: chara, amampatchairasi (Joshi, 2000).

CHEMICAL CONSTITUENTS

Phytochemicals are secondary metabolites in one or more parts of the medicinal plants. These have the ability to produce a definite physiological action on the human body. In the present study. Leaves of *Euphorbia hirta* contain secondary metabolites such as alkaloids, diterpenoids, stigmasterone, beta- siteosterol, carboaromatic compounds polyols. Alkaloids and phenolic acids, are major chemical compound present in stem of *Euphorbia hirta*. Roots contain a triterpenoid dicarboxilic acid, barringtonic acid and other tirterpenoids, barringenic acid, euphane triterpenoids, phytosterolin gallic acids, and linoleic acids.

USES

Leaves used in the treatment of snake bite, applying crushed leaves to a wound can also stop bleeding and it contains anti-inflammatory agents. The decoction of the roots of *E. hirta* is used to heal various female disorders. It increases lactation in nursing mothers who are not producing enough milk, but it should never be administered to pregnant women, as this may induce miscarriage. **Roots** are cooling and expectorant, stimulating and emetic. The **fruits** are bitter, coolant, acrid, astringent to the bowels, vulnerary, anthelminthic, cough, intermittent fever etc. **Seeds** are very warm and dry and are used as an aromatic, carminative and emetic, applied to the abdomen to relieve pain. Seeds are also reported to relieve seminal weakness and gonorrhea. (Kapoor, 1990).

MATERIALS AND METHODS

The plant material i.e. leaves and stem of *Euphorbia hirta* for the present work was collected from Borivali and Waghoba forest (Palghar) & authenticated.

For the study of leaf architecture, the method used is as described by Payne, 1969 & Mohan Ram and Nayyar, 1978. For the study of stomata the method is as described by Gupta, 1961. The terminology used in anatomical studies is in accordance with Hickey and Wolfe (1975), Melville (1976), Hickey (1973, 1979) and Dilcher (1974).

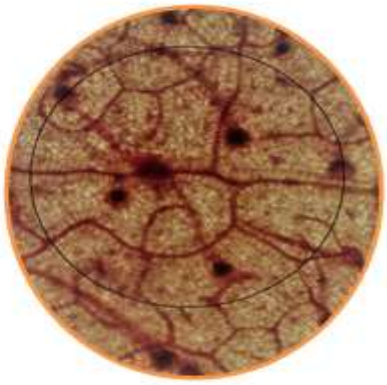
The microphotographs showing different anatomical features were taken by using Cosina Camera at various magnifications as mentioned in the plates.

OBSERVATIONS

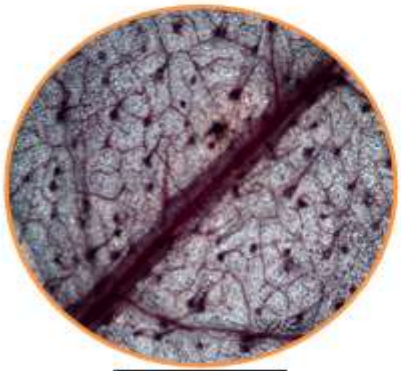
LEAF VENATION

Leaf organization is simple. The lamina is symmetrical; base is symmetrical; form is elliptic; apex is attenuate and base is acute. The margin is entire. The leaf texture is coriaceous. There are no glands and the petiole is normal. The type of venation is Pinnate Camptodromous eucamptodromous. The variation in the angle of divergence is nearly uniform. The relative thickness of secondary veins is moderate; its course is curved abruptly and unbranched. Intersecondary veins composite. Intramarginal vein is absent. Tertiary veins (3^0) are present; angle of origin exmedial to admedial side is RR/AR/OA/AA/RA; the pattern is reticulate orthogonal. The higher order venation forming a reticulum in which vein orders are distinct. The highest vein order of leaf is 5^0. The marginal ultimate venation is looped. Areoles are well developed; arrangement is random and shapes quadrangular, pentagonal and polygonal. Veinlet's are few and linear with brachytracheoids throughout the lamina; terminal in position; superimposed or juxtaposed in orientation.

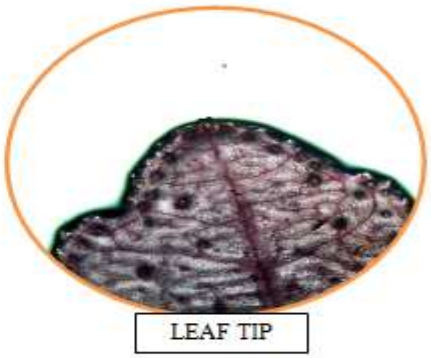
ENTIRE LEAF



(AREOLE)

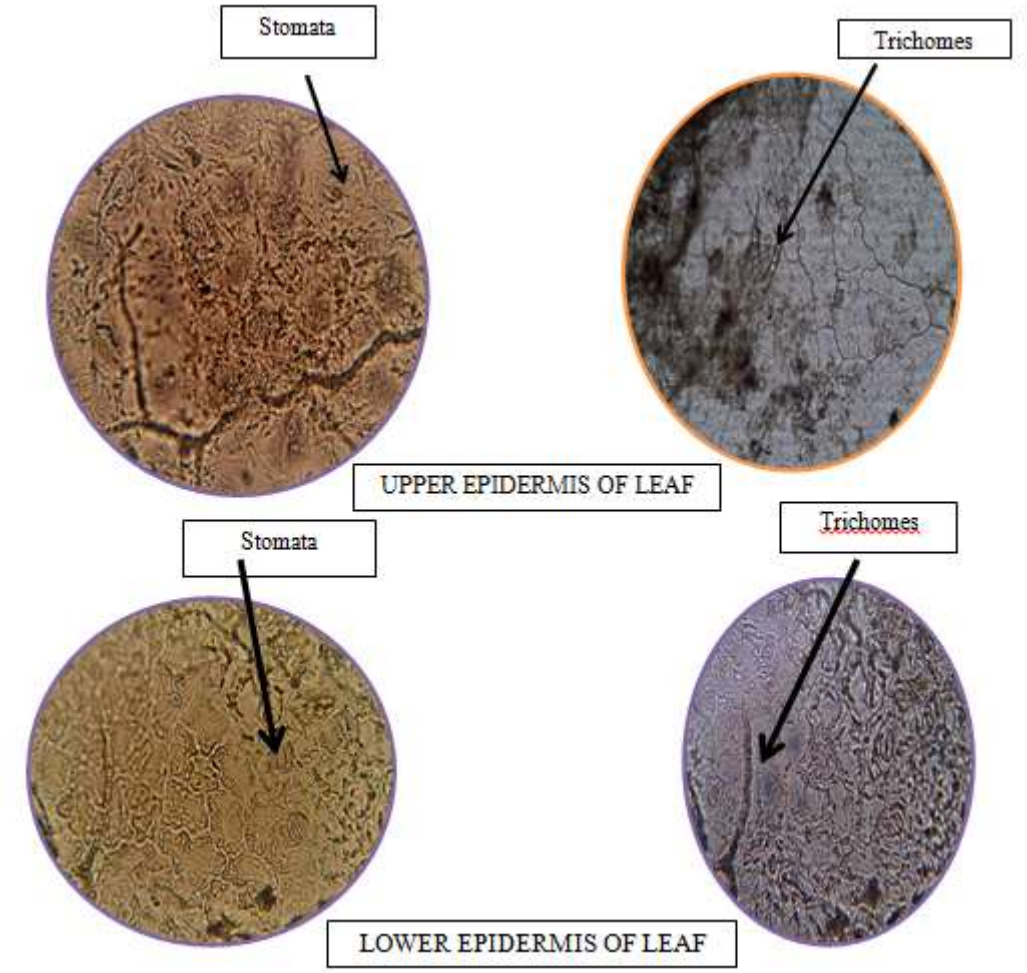


MIDRIB



LEAF TIP

STOMATA



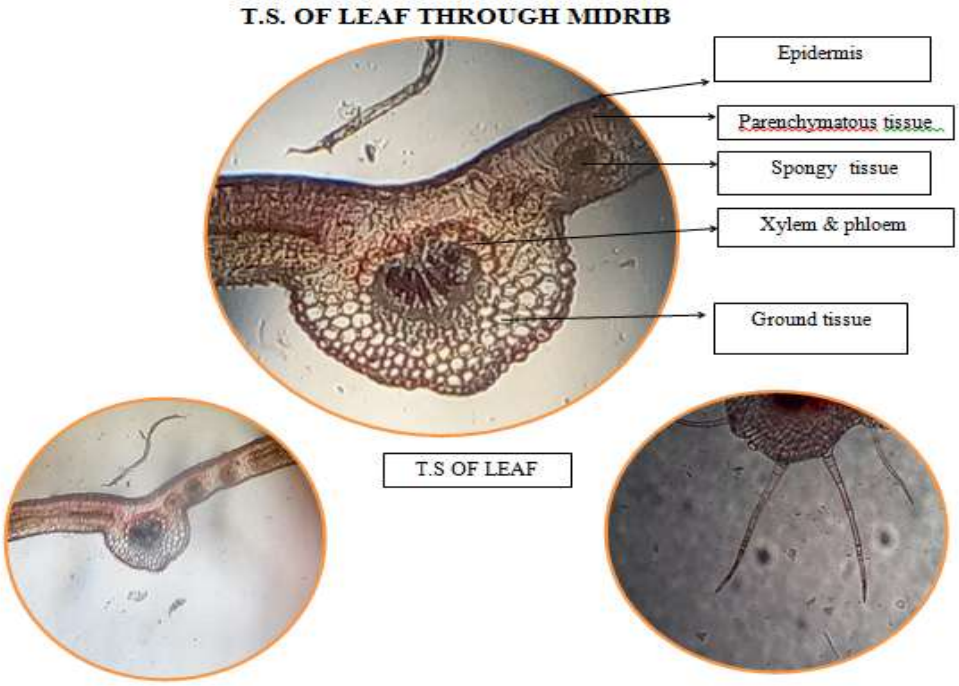
STOMATA

Upper epidermis (Text Fig. 1): The stomata are Paracytic type on upper epidermis. The epidermal cells are polygonal and irregular in shape.

Lower epidermis (Text Fig. 2): Stomata are Paracytic type. The guard cells are elongated and kidney shaped and epidermal cells are polygonal and irregular in shape.

T.S. OF LEAF

The transverse section of the leaf of *E. hirta* shows a dorsiventral nature. The section is broadly divided into lamina and midrib region.



T.S. OF LEAF

T.S of leaf shows three distinct regions viz., upper epidermis, lower epidermis and mesophyll. The upper epidermis of leaf in *E. hirta* was uniseriate, regular, thin walled and covered with thin cuticle layer. Trichomes (multicellular uniseriate or multicellular gland like) that present on both surfaces of leaves, were surrounded by stellated arranged epidermal cells ranged between 12-14 cells around the base of each hair. Mesophyll was differentiated into palisade and spongy layers, which was composed of parenchyma cells which were variable in size. The palisade layer was on the adaxial side of the leaf and composed of 2-rows of cells. The spongy layer was present in the cells which are spherical and sub spherical with big and small intercellular spaces. The spongy layer thickness was different around the midrib region, compared with other parts, so it has 2-6 rows of cells. The xylem elements initiated perfectly and composed of many straight rows of mainly vessels. The xylem elements were surrounded internally by variable parenchyma cells. These parenchyma cells were different in size, so that vascular bundle may be enclosed completely by parenchyma cells. Vascular bundle phloem elements were abundant and occupied a good part of the vascular bundle as a semicircle shape. The lower epidermis is also single layered with rectangular cells having prominent trichomes like outgrowths.

T.S. OF STEM

Cross section of the stem was generally circular in shape and covering with thick cuticle and trichomes.

The epidermis was uniseriate and isodiametric where epidermal cells were elongated, compactly arranged, bearing unicellular and multicellular trichomes.

T.

Treachery elements of wood were resembled by vessels and tracheids, which were in radial rows. Xylem parenchyma was distinct within the stem. The xylem projected clearly toward the pith that will be single, double or triples. The phloem was in external position and usually surrounded by thick fibrous tissue which resemble the bundle caps. The phloem was differentiated by 4-6 narrow parenchymatous layers. The sieve elements and other cells of phloem distributed regularly between the bundle cells and xylem and there were few fibers, or these cell elements present as an islands between the bundle cap fibers. The pith of this species studied has a distinct gap or central cavity at maturation stage., the pith cells were big, with thin walls and distinct intercellular spaces.

T.S. OF ROOT

The section of root was generally circular in shape and it is covering with thick layered and trichomes.

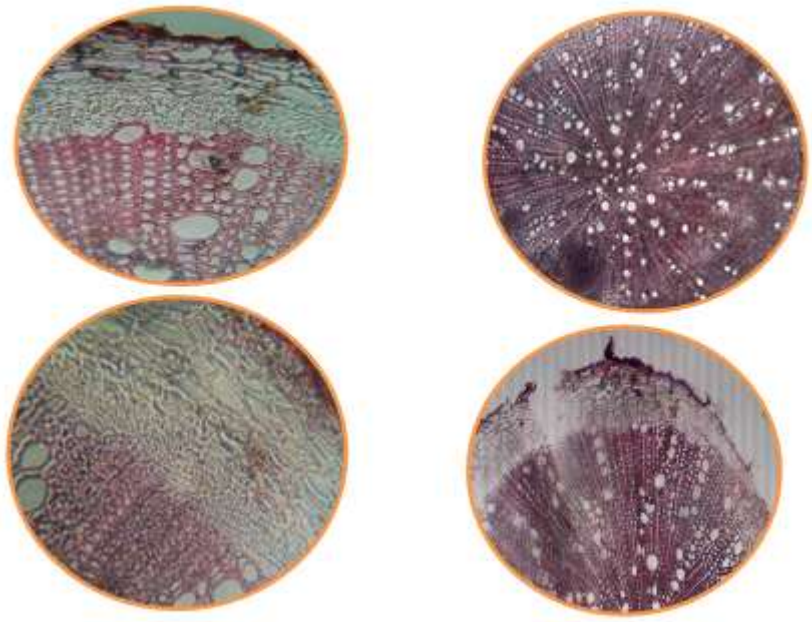
T.S of root shows three distinct region viz Epidermis, cortex and pericycle.

The epidermis of root *of E. hirta* is known as epiblema. It is typically uniseriate outer most layer which consisting of tubular living cells.

Cortex is parenchymatous with intercellular cell spaces the last layer is endodermis with distinct casparian thickening.

Pericycle is present next to endodermis which is single layered and parenchymatous. Small parenchymatous Conjunctive tissues occur between xylem and phloem group. Small pith is noticed at early stage which is obliterated later.

T.S .OF ROOT



RESULTS AND DISCUSSION

The microscopic characters, leaf constants, quantitative analysis and physico-chemical constants studied here can be used for judging the adulteration and purity of this drug. Since these parameters studied are constant and any change in these values are indicative of substitution and adulteration with the plant, *E. hirta*.

The present work was taken up with a view to lay down standards which could be useful to detect the authenticity of this medicinally useful plant.

Macro and micro morphological standards discussed here can be considered as identifying parameters to substantiate and authenticate the drug.

Euphorbia hirta is simple belongs to the family Euphorbiaceae.

Leaf organization is simple. The type venation is Pinnate Camptodromous eucamptodromous. Stomata are Paracytic type on both the surfaces. The T.S. of leaf shows prominent midrib consisting of trichomes and lamina consisting of spongy and parenchyma cells. The vascular system of the midrib is complex.; main bundle shows -xylem elements which are thick walled, circular and it occurs in parallel radial rows with small sclerenchyma cells in between the rows and phloem occurs in thin sheath around the xylem. T.S. of the stem is circular with slightly curved from the upper side. T.S. of root is circular which shows three regions epidermis, cortex and pericycle. Trichomes are present in the outer side of the section.

Leaf architectural study is found to be useful for taxonomic purpose. Vein islets area as criteria for classification was first applied by Levin (1929). Hall and Melville (1951, 1954) proposed veinlet termination number as a technique for testing the purity of fragments of a particular leaf type for pharmacognostical properties. Rao (1957); De Roon (1967); Rao and Das (1979b) presented a resume on the morphological features of tracheoids. This may serve as a diagnostic feature in certain species. According to Metcalfe and Chalk (1950) and Kasapligil (1951) the stomata are paracytic in Lauraceae. Ferguson (1974) reported anomocytic type of stomata in the fossil leaves of the genus *Laurus*. Role of anatomy in the study of stomata in ten members of the family Arecaceae has been studied by Vaidya (2016) along with study of trichomes in some species of *Litsaea* (2016a). Anatomical studies of the medicinally important plant *Ruta graveolens* has been studied by Vaidya & Shingadia (2015).

CONCLUSION

Standardization is essential measure for quality, purity and sample identification. Macro morphology and Cytomorphology along with the Quantitative analytical microscopy is one of the simplest and cheapest methods to start with for establishing the correct identity of the source materials. Here the information collected was useful for further pharmacological and therapeutical evaluation along with the standardization of plant material. Leaf architectural study is found to be useful for taxonomic purpose. Ayurveda is not being accepted worldwide due to lack of standardization although it is being used in India. To meet this objective, efforts are now being made in various laboratories for standardization of plant drug material. The Government of India has taken a lead in this direction and recently published an Ayurveda Pharmacopoeia, which describes in detail approximately 150 plants. Indian Drug Manufacturers Association has also undertaken a similar project and till date have published three volumes which enlist about 65 to 70 plants. Taking into consideration the fact that

since more than 7500 species are being used in healthcare, standardization of drugs thus becomes a stupendous task. The present work is a small contribution in this direction.

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