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Research Article

EPIDERMAL HAIRS OF *DIPTERACANTHUS PROSTRATUS* (POIR.) NEES. (ACANTHACEAE)

Ramani K*

Plant Biology and Plant Biotechnology Department, Srimathi Devkunvar Nanalal Bhatt Vaishnav College (Autonomous), Chennai - 600044, India

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ABSTRACT

Plant hairs are epidermal appendages of diverse form, structure, functions like protective, supporting and absorbing. Epidermal hairs occur on all parts of a plant, either they persist throughout the life of an organ or they are ephemeral. They classified into different morphological categories. Structurally, they may be subdivided into unicellular or multicellular. They distinguished on the basis of their emergence on the epidermal and sub-epidermal tissues. They have been used in the classification of genera, species in certain families and interspecific hybrids. They may show wide variations within families, within a plant groups and even in the same plant. They act as biomarker and taxonomic significance and also useful to identify the plants even in the powder form. They play a pivotal role in the herbal preparation and enrich the literature on the systematic anatomy of plant. This study reveals the microscopic characteristics of trichomes of Dipteracanthus prostratus (Poir.) Nees.

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INTRODUCTION

Epidermal hairs occur in all aerial parts of the plant. They derived from the epidermis or sub-epidermal layers. They integrate with non-trichomatous epidermal cells having protrusions in the form of papillae and with cells differentiated as water vesicles. They develop early in relation to the growth of the organ and stomata crypts. Their density is more on the leaf vein and apex seen in angiosperms (Oppenheimer, 1959). They vary in morphological features, location and mode of secretion (Werker, 2000). They classify genera, species in certain families and interspecific hybrids (Metcalfe and Chalk, 1950). They may fall off early or persist through the life of a plant; others die and become dry. The root hairs are short lived and rarely branched. The hairs act as biomarker to identify the plants even in the powder form (Gohil *et al.*, 2007) and play a pivotal role in the stability of herbal preparation. They function are various, they reduce transpiration, insulate the mesophyll from excessive heat, remove salts from the leaf tissue, prevent an accumulation of toxic salts, associate with the production of chemicals, defence against herbivores, pathogens and insects (Levin, 1973). They covered with cuticle, cell wall is of cellulose. The wall thickness and its chemical nature vary greatly. Their walls may be lignified, rarely impregnated with silica or calcium carbonate crystals (Beyrich, 1943). The protoplast contains little cytoplasm. The chloroplasts may be small and not persisting and highly vacuolated. The young root hairs have mucilaginous pectin covering. They exhibit great diverse in structure, form, type, size, location, density, function and their distribution are important diagnostic characters in plant identification. They classified into different morphological categories (Foster, 1949). Structurally, they are subdivided into unicellular or multicellular. The unicellular hairs are branched or not.

The multicellular hairs consist of a single row of cells or several layers, branched in dendroid manner; others have the branches oriented largely in one plant or not. Each hair divided into foot and body. The foot imbedded in the epidermis, the surrounding cells are morphologically distinct from other epidermal cells and body projecting above the epidermal surface.

The glandular hairs found on the surface of the plant body. Their structures vary in the degree of complexity. Each hair consists of stalk with unicellular or multicellular head. The head constitutes the secretory part secrete essential oils or oleo-resins. They are indicative on the concentration of secondary metabolites. Many of them are acts as excretory organs, which discharge terpenes. Their glands secrete mucilage and resins (Brick, 1914). They reduce the activity or cease to function after the leaves expand. The oil is released to the surface when the cutinized beak like extension at the upper end is broken.

LITERATURE SURVEY

The different types of epidermal hairs are observed in Acanthaceae members such as sessile glandular hairs in

*Corresponding author: **Ramani K***
Plant Biology and Plant Biotechnology Department, Srimathi Devkunvar Nanalal Bhatt Vaishnav College (Autonomous), Chennai - 600044, India

Ecbolium linneanumb Kurz.; disc-shaped in *Asteracantha longifolia* Nees.; single cell stalk with four cells head in *Adhatoda vasica* Nees.; long hairs in *Lepidagathis cuspidate* Nees., short hairs in *Hygrophila serpyllum* Anders, which used as an aid for identification (Parveen *et al.,* 2007). Epidermal hair cells contain a number of cell inclusions observedin *Ruelliapatula* Jacq and they are not observed in *Rungia repens* Nees (Dipa and Daniel, 2011).

METHODOLOGY

Plant collection

Fig. 1 *Dipteracanthus prostratus* - Plant twig

Dipteracanthusprostratus (Poir.) Nees. (Acanthaceae) is a perennial herb grown in the wild. The fresh and healthy plant was collected from Nenmangalam area, Chennai (Fig.1).

Microtome technique

After collection, the plant parts were separated, cleaned with water and fixed in FAA for 24 hours. After fixation, the specimens dehydrated with graded series of TBA as per schedule (Sass, 1940). Infiltration of the specimens carried out by gradual addition of paraffin wax melting point 56-58^{o}C until TBA solution attained super saturation and casted into paraffin blocks. The section adjusted to 10-12 µm thickness with the help of Rotary Microtome. De-waxing carried out by customary procedure (Johansen, 1940), stained with Toluidine blue (O'Brien *et al.,* 1964) and mounted with DPX. They are photographs using Nikon Microscope. The figure magnifications indicated by the scale-bars.

Hand-Peeling technique

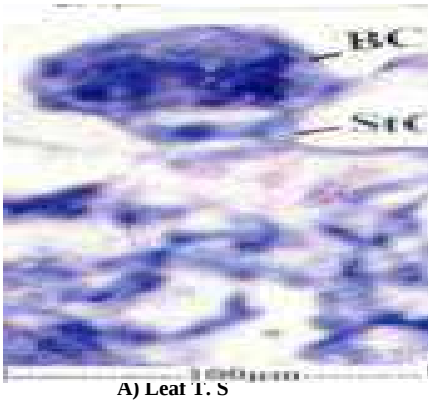
The leaf epidermis peeled, washed, stained in saffranin and glycerine mounted on a clean slide.

Powder Microscopy

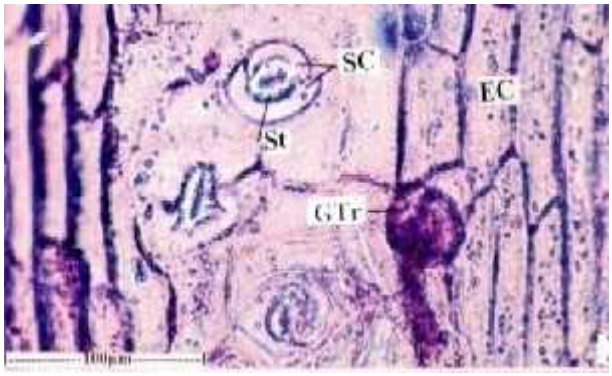
The powder of different parts are cleared with sodium hydroxide, stained and mounted in glycerine.

RESULTS AND DISCUSSION

The microscopic observation of *Dipteracanthus prostratus* reveal that the narrow epidermis with small cylindrical cells. The glandular hairs are multicellular capitated type, which are erect in the leaf surface (Fig.2a). It consists of one basal cell, a short stalk cell and a two cellular head. The body consists of five compactly united cells forming a sub-spherical body. The gland is short, rectangular and hemispherical shape. They exhibit central circular stalk and 6 - 7 radiating rectangular cells forming a circular outline. The non-glandular hairs are unicellular or multicellular. The unicellular hairs are observed on the aerial surface on the surface of sepal (Fig.3a).

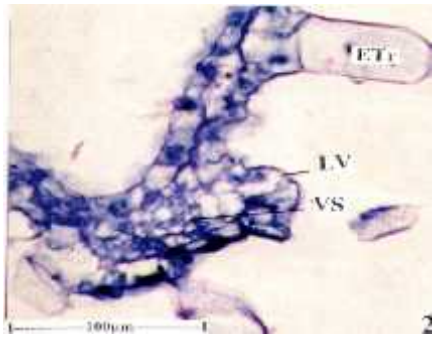


A) Leaf T. S



B) Stem surface

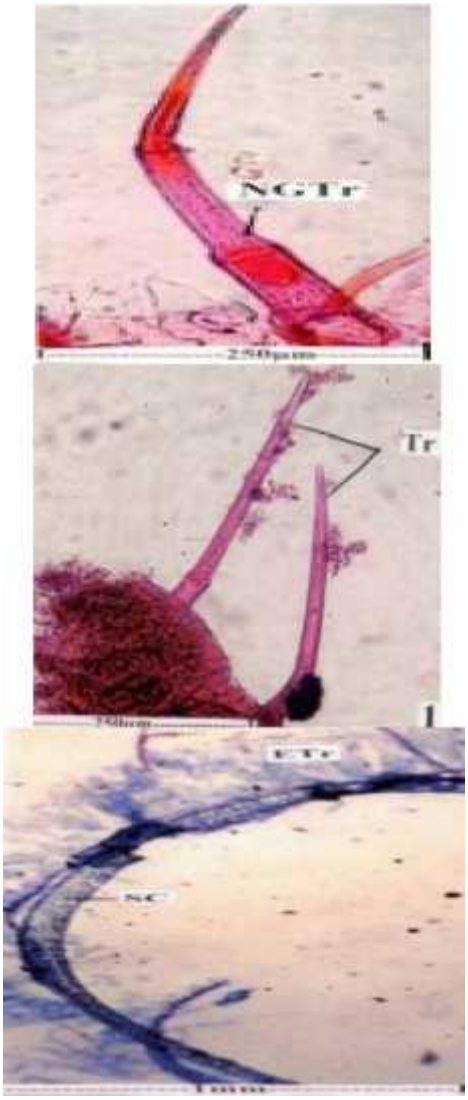
Fig. 2 Glandular trichome



A) SepalT.S.

Fig.3 Non-glandular unicellular trichome

The multicellular hairs evenly spread on surface of leaf, flower and seed parts. It consists of four or more vertically elongated cylindrical cells. They are gradually narrow and taper at the tip. Their surface has minute spiny cuticular outgrowths. The seeds are covered with fringed hygroscopic mucilaginous hairs round the edge with outer sclerotic layers. The seed hairs are not branched, short or long. Their cells are narrow, rectangular with spiral and annular thickened walls. The long candelabra hairs are unique for *Dipteracanthus* genus, which are abundant on the surface of the leaves veins and apex regions (Oppenheimer 1959). Their stalk densely covered cuticular warts, which helps to protect against direct sun exposure, UV light, insulate the plant from wind (Graham *et al.,* 2006), reduce the rate of transpiration (Nosonovsky and Bhushan, 2007) and associate with the production of chemicals, provide defence against herbivores and pathogens. The hand-peeling showed the glandular surface on the stem. The gland appears in circular with central stalk. Their cells contains dark inclusions are observed on the stem surface (Fig.2b).



a). Leaf surfaceb).Flower surfacec). Seed surface

Fig.4. Non-glandular multicellular trichomes

(BC-Body Cell; EC-Epidermal cell; ETr-Epidermal Trichome;GTr-Glandular Trichome; LV- ; NGTr-Non-Glandular Trichome; SC-Stomata Cell; StC-Stalk Cell;Tr-Trichome; VS-Vascular Strand)

The powder microscopic study revealed that both glandular and non-glandular hairs. The non-glandular hairs are multicellular and not branched on the abaxial surface of the flowers and leaves. They are resembled that on the stem.

They consists of four vertically elongated cylindrical cells are gradually narrow and tapering at the tip. Their surface has minute spiny cuticular outgrowths observed in leaf (Fig. 4a), flower (Fig. 4b) and seed surfaces (Fig. 4c).The *D. prostratus* seeds are covered by hygroscopic hairs. Microscopic characteristics of epidermal hairs are to resolve the taxonomic conflicts (Fang and Fan, 1993).

CONCLUSION

Dipteracanthu sprostratus used as tribal medicine administered both internally as well as applied externally in the form of dried powder, paste, drops, infusion and honey syrup. The microscopic characteristics of epidermal hairs play a pivotal role in the identification, which stability of herbal preparation.

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