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# Micromorphological Observations of *Canscora alata* (Roth) Wall - A Potent Medicinal Plant

***S. Kavuthami[1] and G. Jayanthi[2*]***
*[1]Ph.D. Research Scholar, PG and Research Department of Botany,*
*Vellalar College for women (Autonomous), Erode-12, Tamil Nadu, India.*
*[2]Associate Professor, PG and Research Department of Botany,*
*Vellalar College for women (Autonomous), Erode-12, Tamil Nadu, India.*

*(Corresponding author: G. Jayanthi*)*
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**ABSTRACT: The research work aims to study the micromorphological standards of *Canscora alata* belonging to the family Gentianaceae. Diagnostic anatomical characters include glandular trichome, epidermal fragments with anisocytic stomata, oil globules, spiral vessel, pitted paranchyma and sclereids with brown content are stable characteristic features of the study plant which help in the identification of plant at microscopic levels and have been considered as important in the classification of angiosperms. These features impart theoretical value and contribute to the enrichment of the already available information on the data of the genus *Canscora* and family Gentianaceae.**

**Keywords:** *Canscora alata*, Gentianaceae, Pharmacognosy, anatomy, anisocytic stomata.

## INTRODUCTION

Herbal plants have been used in traditional systems of medicine for thousands of years, Smetanina (2011); Slobodianiuk *et al*. (2020). In recent days the pharmaceutical industries mostly use plant based raw materials for production of medicines pertaining to the scientific fact that most of the important drugs for the treatment of life-threatening diseases are cured by modern pharmacopeia are plant derived Darzuli *et al.* (2021); Budniak *et al*. (2020). In addition, the plant possesses a wide range of secondary metabolites which have lot of pharmacological properties. There is a growing need for plant raw materials to manufacture drugs. In the pharma industry it is of prime importance in pharmaceutical sciences to expand existing and searching for new sources (Huzio *et al*., 2020; Marchyshyn *et al*., 2021; Slobodianiuk *et al*., 2021). However, a key obstacle in both, traditional plants and their acceptance in modern medicine is the lack of scientific documentation and stringent quality control. Hence it becomes extremely important to make judicious efforts towards standardization of desired plant material Sethiya *et al*. (2010).

A promising source of biologically active substances from plant *Canscora alata* under the family Gentianaceae, which has been used in folklore medicines with less scientific valediction. The present work has been initiated to study the micromorphological standards of the plant *Canscora alata* to recognize the tissues and cells, and thereby giving speciation differentiation. The genus *Canscora* is represented by 7 species, habited in moist deciduous forests of hills and plains. It is distributed in tropical African and South Asia. In India it is distributed throughout sub-tropical regions. The synonym of this species are *Canscora decussata* (Roxb) Roem. & Schult.; *Pladera decussata* Roxb.; *Exacum alatum* Roth.

## MATERIALS AND METHODS

**Plant collection.** The plant *Canscora alata* (Roth) Wall, whole plants were collected from Vellode, Erode District, Tamil Nadu. During September 2021.

**Plant Identification.** The plant material was identified taxonomically with the help of the local floras (Gamble and Fischer 1956; Matthew, 1983) and Botanical Survey of India, Southern region center, Coimbatore, Tamil Nadu. The herbarium number provided by Botanical survey of India is BSI/SRC/5/23/2021/Tech/295

**Taxonomy.** Taxonomical studies on the plant were carried out and its systematic position has been assigned as per the angiosperm taxonomic classification (Bentham and Hooker, 1862-1883).

**Macroscopical characters (Trease and Evans (1983); Wallis (1985).** The macroscopic features of collected plant were examined using magnifying lens. Morphological parameters such as plant height, branching type, leaf margin, apex, base, flowering type, pedicle size, nature of calyx, corolla, ovary size, style size, stigma type, fruit size, colour of the fruit, seed type size of the seed, colour of the seed and rooting type were recorded.

**Microscopical studies:** O'Brien *et al*. (1964)
The whole plant of *Canscora alata* (Roth) Wall was fixed in FAA (Formalin 5ml: Acetic acid 5 ml: 70% Ethyl alcohol – 90ml). The plant materials were left in FAA for few days and then they were dehydrated employing Tertiary Butyl Alcohol (TBA) series (Sass, 1940). Paraffin infiltration and embedding wax blocks were done in the usual method (Johansen, 1940). Serial paraffin sections of 10-12 mm thickness were prepared with the help of Spencer Rotary Microtome. These sections were stained with Toluidine blue as per the schedule suggested by O' Brien *et al*. (1964). Sections were stained with fast green. Microscopic observations were made both under normal and polarized lights. Photomicrographs were also taken with NIKON ALPHA PHOTO – 2 microscopic units. The polarized light was very much useful to detect the lignified elements, crystals and starch grains.

**Quantitative microscopy.** The fresh leaf samples were boiled with saturated chloral hydrate solution. The isolated tissues were mounted on to slides. Vein islets, vein termination, epidermal number, stomatal number, stomatal index and palisade ratio were noted and recorded.

**Powder microscopy.** A pinch of the powder was mounted on a microscopic slide with a drop of 50% glycerol after treating with saturated chloral hydrate for clearing and potassium iodide solution for testing starch grains. Characters were observed using Nikon ECLIPSE E200 trinocular microscope attached with Zeiss ERc5s digital camera under bright field light. Photomicrographs of diagnostic characters were captured and documented.

## RESULTS

**Macroscopical observations.** The morphology of the study plant *Canscora alata* is given in Plate 1. The plants grow up to 20cm; stems basally and apically branched, with prominent wings up to 1.6 mm wide. Leaves are Cauline and sessile, lamina with three main veins, elliptic to lanceolate shape, often falcate. The base is wedge-shaped to shortly attenuate with acute apex. Inflorescences are axillary, cymes; bracts linear to lanceolate, pedicels 2–26 mm long. Calyx persistent, with eight prominent, 1–1.3 mm wide wings; tube 8–9 mm long; lobes anisomorphic which are acute, two larger lobes are long and two lobes are shorter. Corolla tube 8–9 mm long, white, two lobes broadly elliptic and the other two lobes are elliptic. Filaments of upper stamens are 1.8–2.2 mm long, broadened below anther. Ovary 6–8, style up to 4 mm long; stigmatic lobes 0.7. Capsule 8, Seeds irregular in shape, cubical to rectangular and with shallowly sunken sides, outer testa reticulates, with shallow cells; Testa cells irregularly polygonal, and are oriented irregularly and the anticlinal walls are curved (Plate 1a&b).

(a) Habit

(b) Closure view

**Plate 1.**

**Microscopical studies**

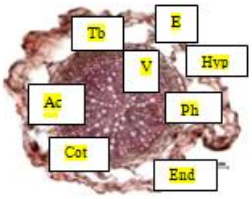
**T.S. of Root.** The T.S of root is nearly circular in shape, which is single layered and wavy in nature and followed by hypodermis. The cortical region shows many air cavity and trabeculae. The single layer endodermis is present, which surrounds the centrally situated vascular region. The xylem elements occupy the centre and are surrounded by phloem tissue (Plate 2-A).

**T.S. of Stem.** The T.S of stem showing single layered epidermis with striated cuticle and 4-winged projections at each corner. A group of sclerenchymatous cells are present below the 4 projections; 2 to 6 layered of cortex are present. The outer 3 layers made up of compactly arranged chlorenchymatous cells followed by loosely arranged cells forming large vacuoles. The vascular bundles are arranged in the centre which is covered by single layered endodermis. The phloem is seen surrounding the xylem elements with centrally placed parenchymatous pith (Plate 2- B-a-e).

**T.S. of Leaf.** The T.S of leaf through midrib shows single layered epidermis covered by distinct cuticle followed by 3 to 4 layers of parenchymatous tissues. A collateral open vascular bundle is present which is centrally placed (Plate 3 a-c).

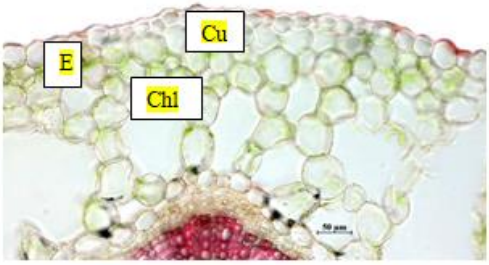
**Lamina:** The T.S of lamina is isobilateral and shows single layered epidermis covered by thick cuticle. The mesophyll tissue is made up of 3 to 4 layers of cells which are not differentiated into spongy and palisade parenchyma. The oil globules are seen randomly distributed throughout the mesophyll cells (Plate 3-d).

A) T. S of Root

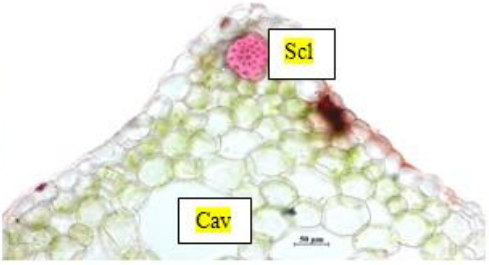



B) a) T. S of Stem

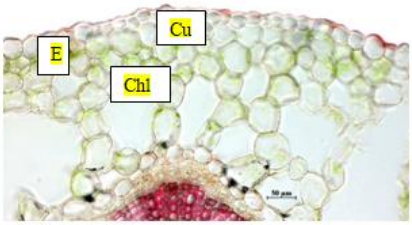

b) Upper region enlarged



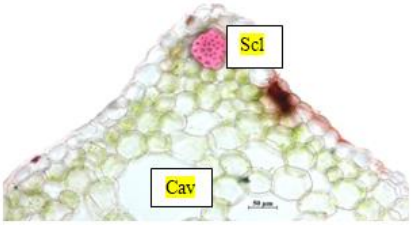

c) Mucilage cavity



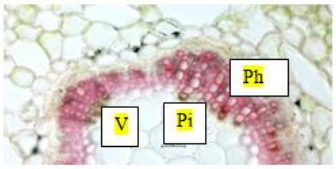

b) Upper region enlarged

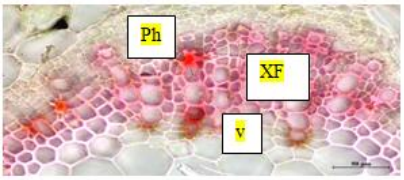



c) Mucilage cavity



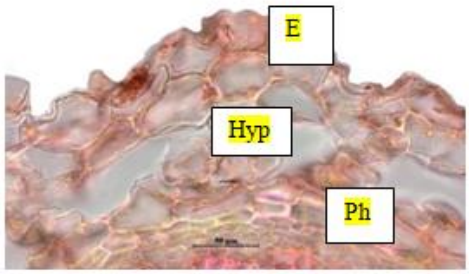

(d & e) Vascular region enlarged



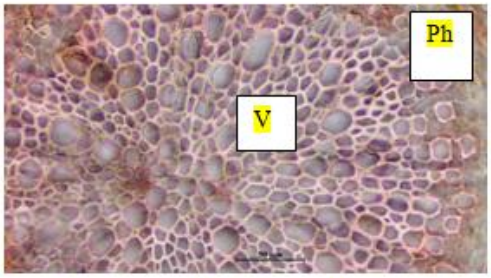




**TB**-trabeculae; **HYP**-hypodermis; **Cav** - cavity; **Chl** - chlorenchyma; **Cu** - cuticle; **E** - epidermis; **End** - endodermis; **P** - parenchyma; **Ph** - phloem; **Pi** - pith; **Scl** - sclerenchyma; **V** - vessel; **XF** - xylem fibre

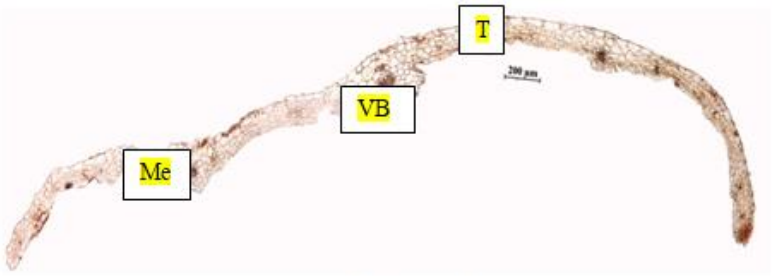
**Plate 2.**



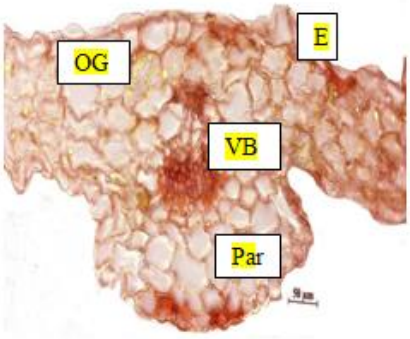

a) T.S of leaf base



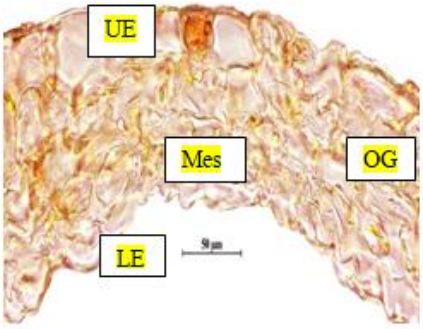

b) T.S of Petiole




c) T.S of leaf




d) T.S of midrib



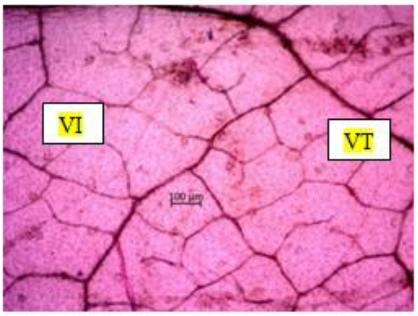

e) T.S of Lamina

**Cu**- cuticle; **OG** - oil globule; **LE**-lower epidermis; **Mes** - mesophyll; **Par** - parenchyma; **UE** - upper epidermis; **VB** - vascular bundle

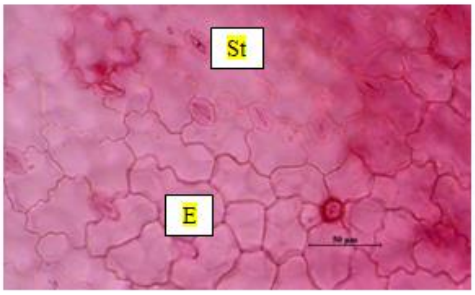
**Plate 3.**

**Quantitative microscopy.** The quantitative parameters obtained from microscopic observations of epidermal peelings of leaves were recorded and given in Table 1. The leaf is amphistomatic with anisocytic stomata on both upper and lower epidermis; both upper and lower epidermis is wavy in nature (Plate 4a-c).

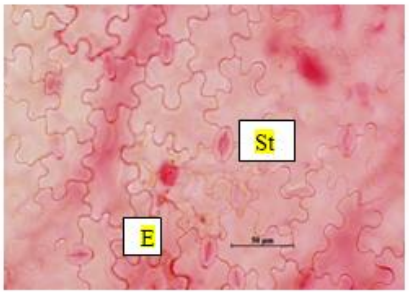
**Powder microscopy.** Powder is greyish green in colour with no characteristic odour and taste. The powder possesses glandular trichome, epidermal fragments with anisocytic stomata, petiole epidermis, cells with oil globules, spiral vessel, pitted parenchyma, sclereids and cells with brown content (Plate 5-a-i).




a) Veins




b) Upper epidermis




c) Lower epidermis

**E** - epidermis; **St** - stomata; **VI** - vein islet; **VT** - vein termination

**Plate 4.** Quantitative microscopy of leaf.

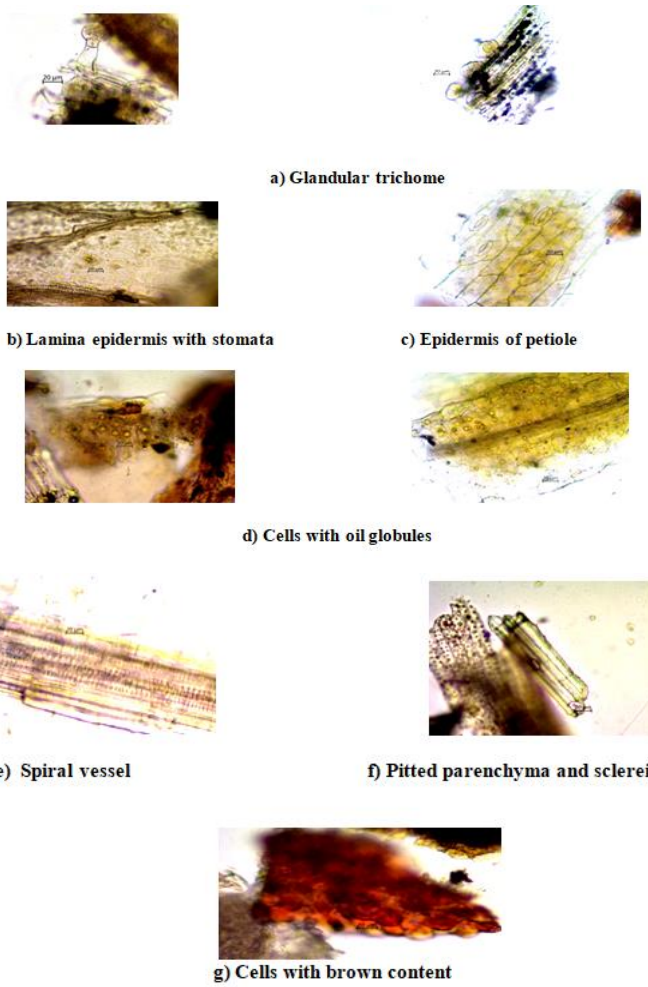



**Plate 5. Powder microscopy.**

**Table 1: Qualititative microscopy of leaf.**

| Parameters | Upper epidermis (/mm$^2$) | Lower epidermis (/mm$^2$) |
|---|---|---|
| Epidermal number | 80 – 90 | 85 – 110 |
| Stomatal number | 40 – 50 | 60 – 65 |
| Stomatal index | 64 – 66 | 63 – 68 |
| Palisade ratio | sss 10 -12 | |
| Vein islet | 6 – 8 | |
| Vein termination | 10 – 12 | |

## DISCUSSION

In the present micromorphological observations provide macroscopy, microscopy, quantitative and powder microscopy of *C. alata*. The presence of papillose epidermis is a characteristic of the family Gentianaceae, mentioned in the classical works of Solereder (1908); Metcalfe and Chalk (1950), recorded the presence of simple unbranched short, long and thickened (Shaggy) hairs and trichomes. In our result the presence of glandular trichome and oil globules are seen randomly distributed throughout the mesophyll cells, providing the pharmacognostical standards of the *C.alata* which are useful to the scientific standardization of the study plant. In root the cortical region shows many large sized air cavity and trabeculae, single layer endodermis surrounding the centrally situated vascular region (Plate 2).

The presence of exoderm with tangentially elongated cells in which there are anticlinal division wall is less mentioned Shanawany *et al.* (2004). In *Gentianopsis ciliate*, alongside anticlinal divisions, endoderm cells with transversal or oblique divisions observed by Lux and Luxova (2001). The root cortical region showed large sized air cavity and trabeculae. The stem showed 4 – winged projection at each corner; a group of sclerenchymatous cells are present below the 4 projections were observed. Vascular bundles are arranged in the centre covered by single layered endodermis. Presence of narrow conspicuous endodermis is a characteristic feature of Gentianaceae (Metcalf and Chalk 1950). These features can be reliably used to distinguish species of this genus.

Earlier anatomical studies consider the anamocytic type as characteristic for Gentianaceae (Metcalf and Chalk 1950). But Patel *et al.* (1981) showed varied type of

stomata including anomocytic, actinocytic, anisocytic, paracytic, diacytic types and stomata with a single guard cell. In our present study the stomata are anisocytic (Plate 4). Similar studies were reported by Bhavadharaniparkavi and Abirami (2023) on the phytochemical analysis and bioactive components of a medicinal plant *Acalypha paniculata* miq showing correlation.

Anatomical data on plants are secure features for species identification and quality control of plant drug and reveal their relationship with the environment. Powder microscopical studies showed glandular trichomes, epidermal fragments with anisocytic stomata, petiole epidermis filled with oil globules and cells with brown content are consider as characteristic features of *C.alata* . So, the identification of structural diagnostic features and classes of chemical constituents with known biological activity in plants will increase the reliability of preparation of pharmaceutical products. The morphoanatomical features of *C. alata* is being reported for the first time *and* it is necessary to document the morphoanatomical characters to avoid adulteration of the plant-based drug.

## CONCLUSIONS

The research work will provide pharmacognostical standards for the identification of the study plant *Canscora alata.* This will be tremendously useful in determining the purity and quality of the genuine raw drugs, probing in to standard herbal drug preparations.

## FUTURE SCOPE

The anatomical studies provide intrinsic scope in the field of pharmacognosy and expressed a basic tool for identification of genuine and adulterants drug.

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**Conflict of Interest.** None.

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