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ABSTRACT

The present paper reports observations on anatomy of petioles hitherto uninvestigated 09 species belonging to 06 genera of the family Acanthaceae. The petioles (in T. S.) are usually circular or broadly circular in outline and adaxially channeled. The degree of development of endomorphic features and their distribution, inclusive of cell inclusions, are described. The vasculature is generally resolved into a central prominent arc along with few or none vascular bundles. The characteristics of epidermis, wings, pattern of vascular supply and sclerenchyma surrounding it, cell inclusions, etc. are systematically important. A key helping identification of taxa investigated is provided based on these features.

Key Words: Petiolar Anatomy, Taxonomy, Acanthaceae.

1. Introduction:

A very large amount of element of uncertainty exists in a presentation of the morphology of Angiosperms. This is so due to the inequality in the accuracy and definiteness of the work done (*cf.* Coulter and Chamberlain, 1965). This situation still remains the same. It is quite clear that leaf in Angiosperms is the most varied organ exo-morphologically. Fair diversity in its anatomy is also documented in the classic works (*cf.* Metcalfe and Chalk, 1950; Solereder, 1908). There are certain angiospermic families wherein, leaf although offers a great diversity in anatomical

structures, have been overlooked. The present authors, therefore, extended observations on foliar anatomy of leaves in the family Acanthaceae. This communication is a part of it. It aims at focusing systematic importance of leaf anatomical features in view of its role in taxonomic considerations.

2. Materials and Methods:

The plants were collected from different places like Tropical Botanic Garden and Research Institute, Palode, Thiruvanthapuram District (Kerala); Malbar Botanical Garden, Kozhikode (Kerala); Munnar, Idukki District (Kerala); Forest Research Institute, Peechi, Trichur (Kerala); Calicut University, Botanical Garden, Kozhikode (Kerala); Lal Bag Garden, Bangalore (Karnataka); Government Botanic Garden, Ootacamund (Tamilnadu) and Charanmal, District Dhule (Maharashtra). They were preserved in F.A.A. solution. For free hand transections middle part of petiol was selected. They were stained in safranin (1%) and fast green (1%) and mounted in D. P. X. after the customary method of dehydration. The unusual paraffin embedding method of Johansen (1940) has been followed especially for transections of petioles. They were mounted in glycerine and made semi-permanent slides by ringing with nail paints. The cellular sketches were drawn using prism type of camera lucida. They were inked by using Camligraph or Rotring isographs technical pens with 0.1, 0.2, 0.3 points.

3. Table – I : ANATOMICAL OBSERVATIONS

Sr No	Plant species studied	Shape of epidermal cells	No. of hypodermal layers	Wings present/absent	Shape of central vascular arc	No. of additional vascular bundlers	Shape of cells of conjunctive tissue	Sphaerathides present/absent	Cystolithes present/absent	Vascular tissue capped by sclerenchyma	Figure No.
1.	<i>Pachystachys lutea</i> Nees.	Squarish	04	Present	Lunar	02	Polygonal	Present	Present	--	01
2.	<i>Peristrophe montana</i> Nees	Rounded	04-05	Absent	Lunar	02	Rounded	Present	Present	2-Layers	02
3.	<i>Pseuderanthemum malabaricum</i> (C. B. Clarke) Gamble	Squarish	04	Present	Lunar	02	Rounded	Absent	Absent	--	03
4.	<i>Pseuderanthemum reticulatum</i> Radlkf.	Squarish	07	Present	Lunar	02	Polygonal	Absent	Present	--	04
5.	<i>Rungia parviflora</i> (Retz.) Nees	Squarish	03	Absent	Lunar	Absent	Polygonal	Absent	Absent	--	05
6.	<i>Staurogyne zeylanica</i> (Nees) O.Ktze	Squarish	02	Absent	Horse shoe	02	Polygonal	Absent	Absent	--	06
7.	<i>Stenosiphonium cordifolium</i> (Vahl) Alston.	Squarish	03	Present	Horse shoe	02	Rounded	Present	Present	--	07
8.	<i>Stenosiphonium parviflorum</i> T. Anders.	Squarish	02	Present	Horse shoe	04	Rounded	Absent	Present	--	08
9.	<i>Stenosiphonium russellianum</i> Nees	Squarish	06	Absent	Horse shoe	02	Polygonal	Present	Present	--	09

4. DISCUSSION:

(i) Epidermal Features:

The petioles in all the species investigated are adaxially channeled. The channels are generally shallow. In T.S., the petioles are usually circular or broadly circular in outline.

The outermost epidermal is generally single layered containing small cells. The outer cell walls of epidermal cells are generally thicker than the inner ones. Moderately thick to thick cuticle is overlaid on the outside. The shape of epidermal cells differs from species to species. In majority of taxa, they are squarish in outline. They are rounded in certain species e.g. *Peristrophe montana*. The epidermal layer is interrupted at some places due to the presence of cystoliths.

(ii) Hypodermal Features:

Generally, the hypodermis follows the epidermis. The hypodermal cells are collenchymatous in all the species. They are generally rounded in shape and have obviously thick walls. The hypodermal layers are 2 to 7 forming continuous layer throughout. Out of 09 species studied, only 04 species exhibit two to three layered hypodermis. They are four to seven layered in 05 species. Occurrence of collenchymatous hypodermal layers in the petiolar region can be conceivable from the standpoint of mechanical function.

(iii) Vasculature and conjunctive Tissue:

Generally the petiole in Acanthaceae obtains a solitary vascular strand from the nodal vasculature as in most of the sympetalous taxa (*cf.* Metcalfe and Chalk, 1950). This vascular strand during its further course through the petiolar region is resolved differently. In all species, the petiolar vasculature is mostly resolved into a conspicuous or medium-sized central arc and a few to many vascular bundles. Out of 09 species studied, in 07 species the vascular tissue is comprised of a prominent central vascular arc and pair of adaxial vascular bundles. In certain species, the petiolar vasculature is resolved into four vascular bundles, besides the central arc e.g. *Stenosiphonium parviflorum*. In case of *Rungia parviflora*, the vasculature consists of a central prominent arc and pair of adaxial vascular bundles is absent. The vascular bundles in all species are collateral. The central vascular arc assume generally two types of shapes *viz.*, lunar-shaped and horse shoe-shaped. In about 05 taxa, the former condition prevails, whereas in rest others it is horse shoe –shaped. In case of 02 species, the central vascular arc is capped abaxially by 2-layered sclerenchyma e.g. *Peristrophe montana* and in patches in *Pseuderanthemum malabaricum*. The vascular and other tissues are

generally surrounded by conjunctive tissue. The cells of conjunctive tissue are parenchymatous and thin walled. They are rounded or oval and polygonal in shape. The larger parenchymatous cells are generally located in the central region of the petiole. They decrease in size gradually towards the outside. Thickness of their cells walls generally diminishes towards the centre of the petiole. The cells are polygonal throughout in case of *Pachstachys lutea*, *Pseuderanthemum reticulatum*, *Rungia parviflora*, *Staurogyne zeylanica* and *Stenosiphonium russellianum*.

(iv) Cell inclusions:

The occurrence of cystoliths is noteworthy in the family Acanthaceae. However, they lack in petiolar region of some taxa of the present account e.g. *Pseuderanthemum malabaricum*, *Rungia parviflora* and *Staurogyne zeylanica*. When present, they are distributed usually in the epidermal and hypodermal layers. Another notable occurrence of cell inclusions is the sphaeraphides. They are usually found in the cells of conjunctive tissue and hypodermis. They are present in 04 species e.g. *Pachstachys lutea*, *Peristrophe montana*, *Stenosiphonium cordifolium* and *S. russellianum*. The present investigators also noted tannin cells in the conjunctive tissue of *Pseuderanthemum malabaricum*.

(v) Earlier work:

Petiole in the acanthaceous taxa appeared ignored by the anatomists. Metcalfe and Chalk's work (1950) is probably only report on its anatomy. They gave an account of petiole anatomy with particular emphasis on vascular system. They also illustrated nodal anatomy although topographically. They noted petioles in the various genera of the Acanthaceae containing a central vascular arc with few or none vascular bundles. They also pointed out occurrence of a continuous vascular cylinder in the petiole.

(vi) Taxonomic significance:

The leaves although provide many anatomical characters of taxonomic importance, they are derived from the blade (lamina). The petioles are usually ignored in anatomical studies. Petiole anatomical data, as with most all other types of data, can also be used. This was indicated well by Metcalfe and Chalk (1950). They pointed out importance of vascular pattern in the petiole of some genera of Acanthaceae. However, there are also anatomical data of the petioles which can be successfully used in systematic thinking. This aspect of anatomy of petiole has been largely overlooked. Schofield (1968) conveniently employed petiolar anatomy of the Guttiferae and related families as their diagnostic features. The present

investigators investigated petiolar anatomy of 20 species in the family. The features such as shape of epidermal cells, number of hypodermal layers, occurrence of petiole wings, pattern of vascular supply, cell wall contours of conjunctive tissue, presence or absence sclerenchyma associated with vascular tissue and cell inclusions (sphaeraphides, cystoliths, etc.) appeared of taxonomic significance specially at specific levels. Their diagnostic utility is already explained earlier. Tayade and Patil (2008) and Shisode and Patil (2008) also found these features useful to distinguish the taxa of family Convolvulaceae and the order Celastrales respectively. Thakur and Patil (2009) also employed them similarly in the euphorbiaceous taxa. Patil and Patil (2013) used petiole anatomy identifying various species of the genus *Strobilanthes* Blume. The literature survey indicated no petiolar anatomical study in the Acanthaceae. The present authors devised a following key based on endomorphic features of petioles of the taxa studied. This justifies the role of anatomy in taxonomy. It appears that such study should be taken up which will bring round the role of petiole anatomy and taxonomy of even disputed taxa in the Acanthaceae and its related families.

5. ANATOMICAL KEY TO THE TAXA STUDIED:

1. Vascular arc capped adaxially by sclerenchyma..... *P.montana*
1. Vascular arc not as above 2.
2. Cystoliths absent 3.
2. Systoliths present 5.
3. A pair of vascular bundles absent,
besides central arc *R.parviflora*
3. Not as above 4.
4. Petiole winged and hypodermis 4-layered *P.malabaricum*
4. Petiole not winged and hypodermis 2-layered *S.zeylanica*
5. Sphaeraphides present 6.
5. Sphaeraphides absent 8.
6. Central vascular arc lunar shaped *P.lutea*
6. Central vascular arc horse-shoe shaped 7.
7. Petiole winged *S.cordifolium*

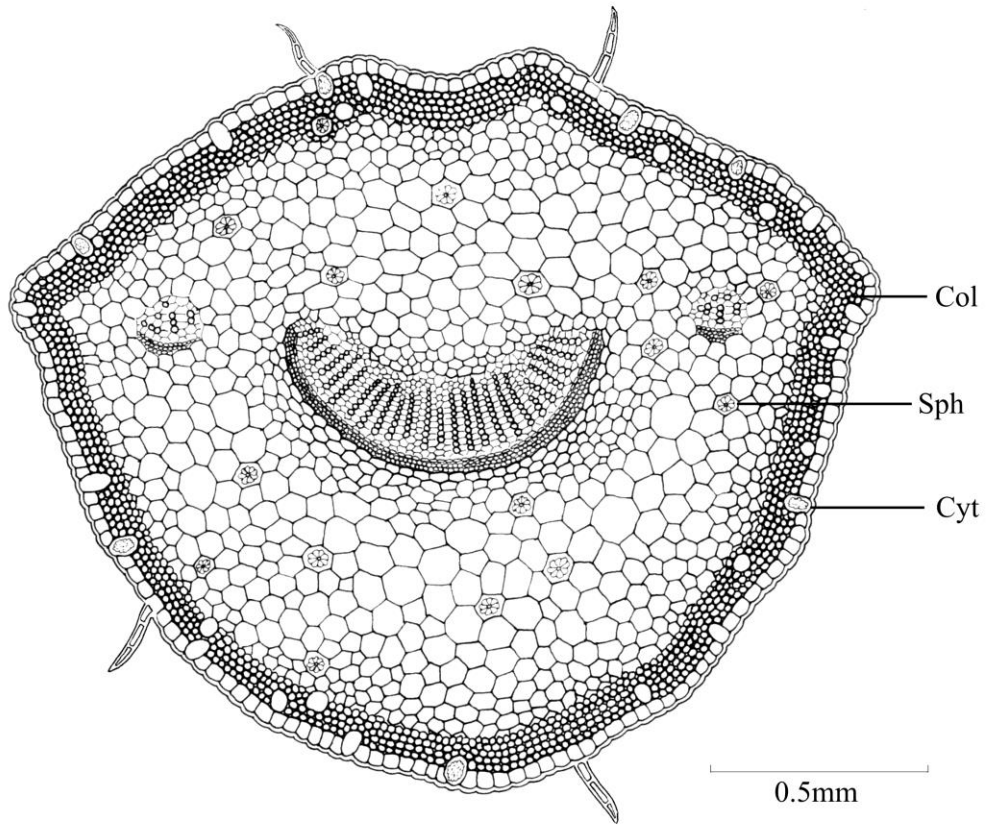
- 7. Petiole not winged *S.russelianum*
- 8. Hypodermis 2-layered and central arc
horse-shoe shaped *S.parviflorum*
- 8. Hypedermis 7-layered and central arc
lunar shaped *P.reticulatum*

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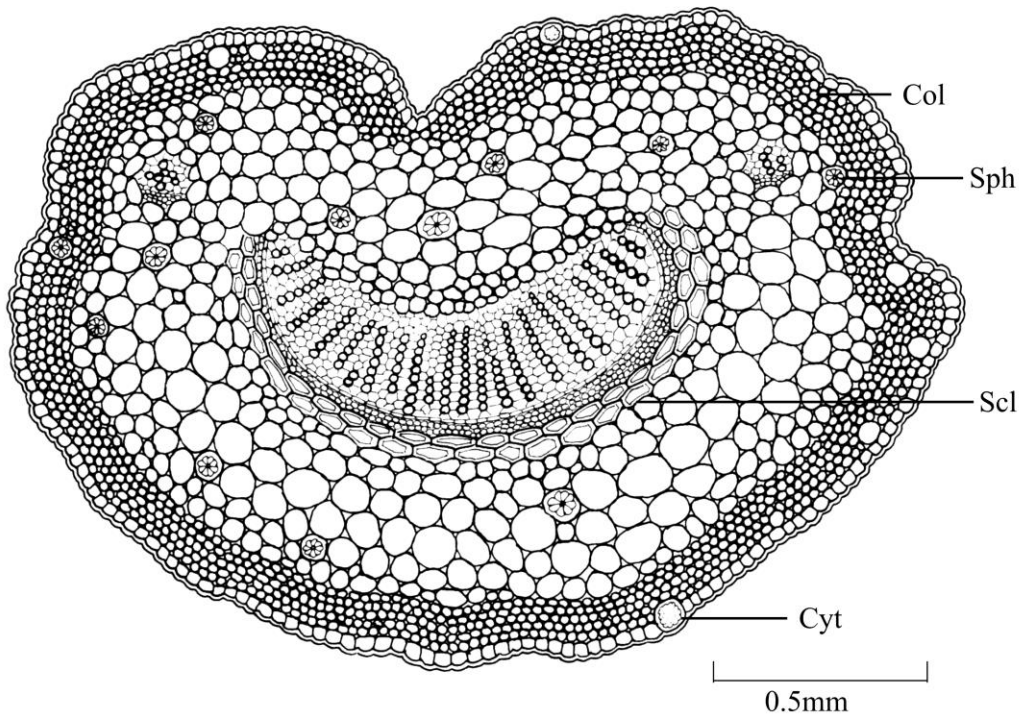
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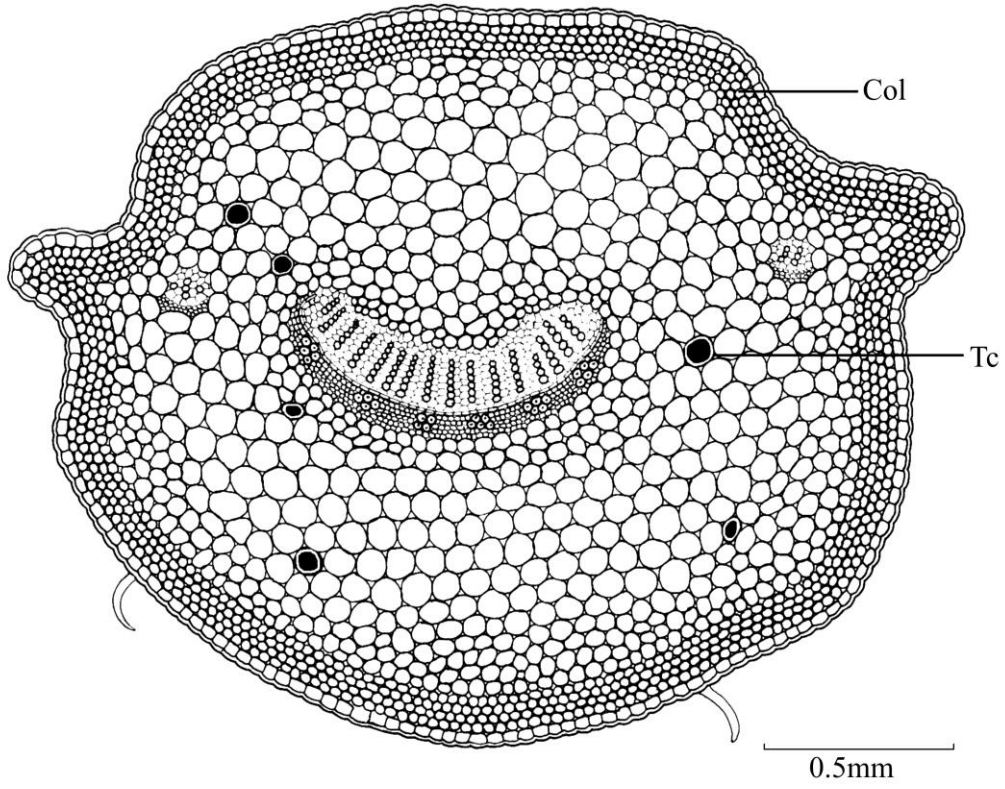
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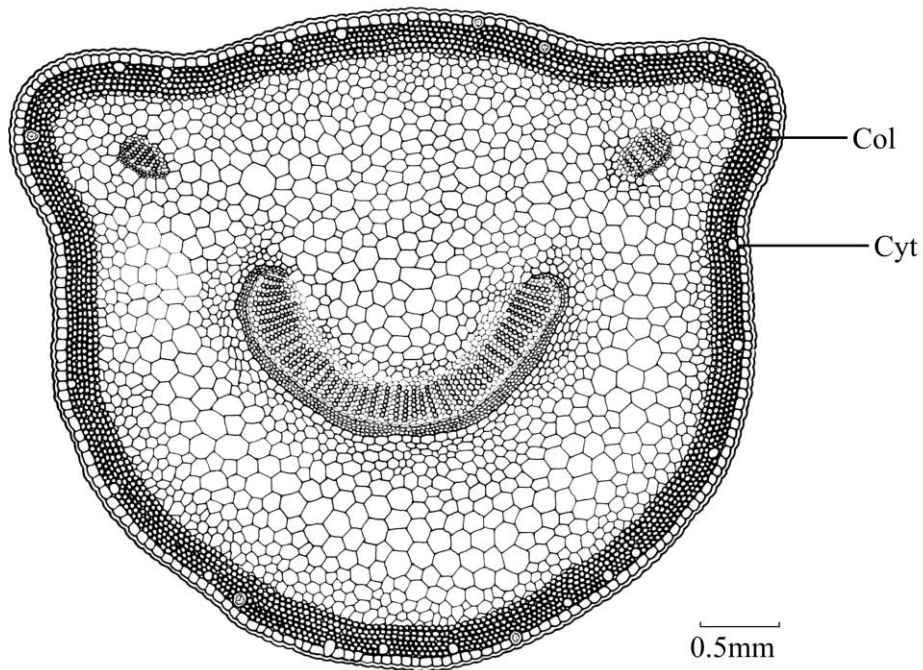
1. *Pachystachys lutea*



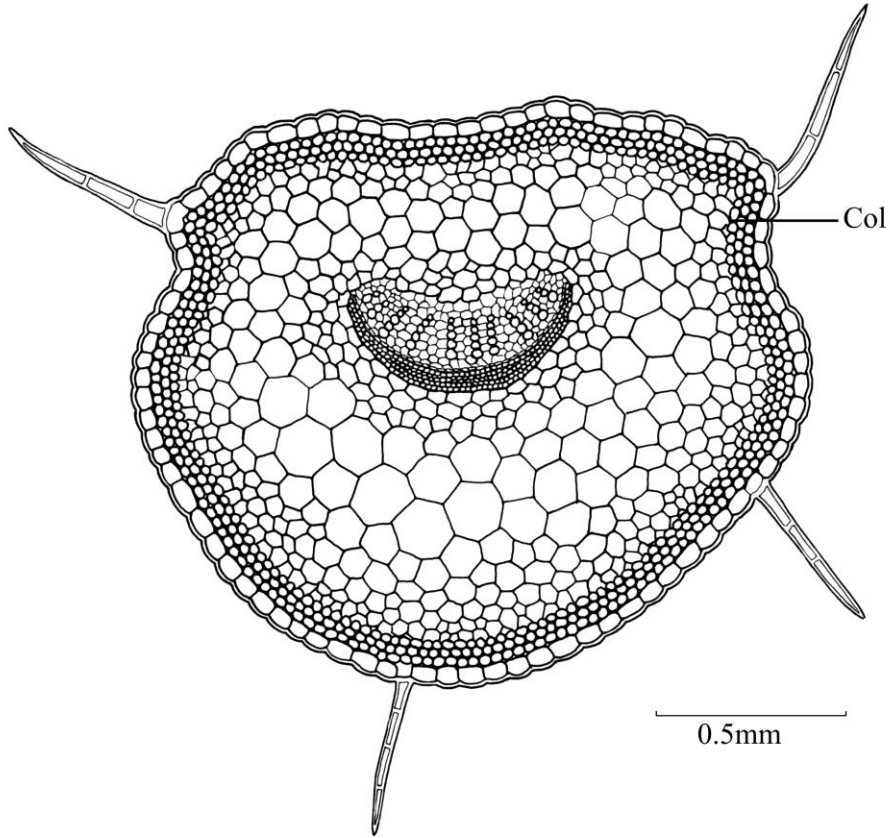
2. *Peristrophe montana*



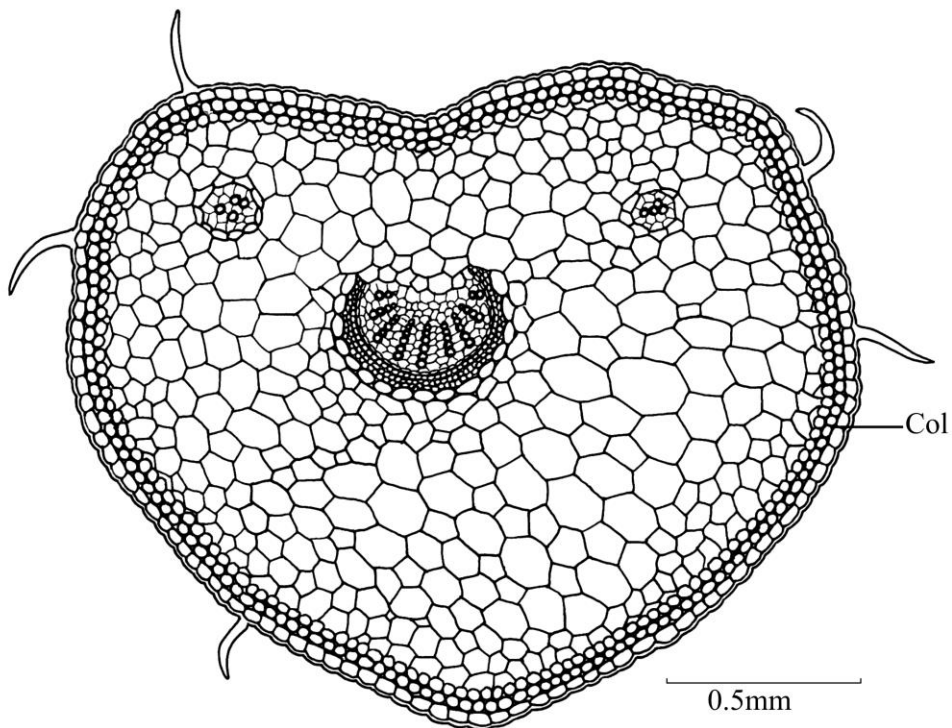
3. *Psepuberanthemum malabaricum*



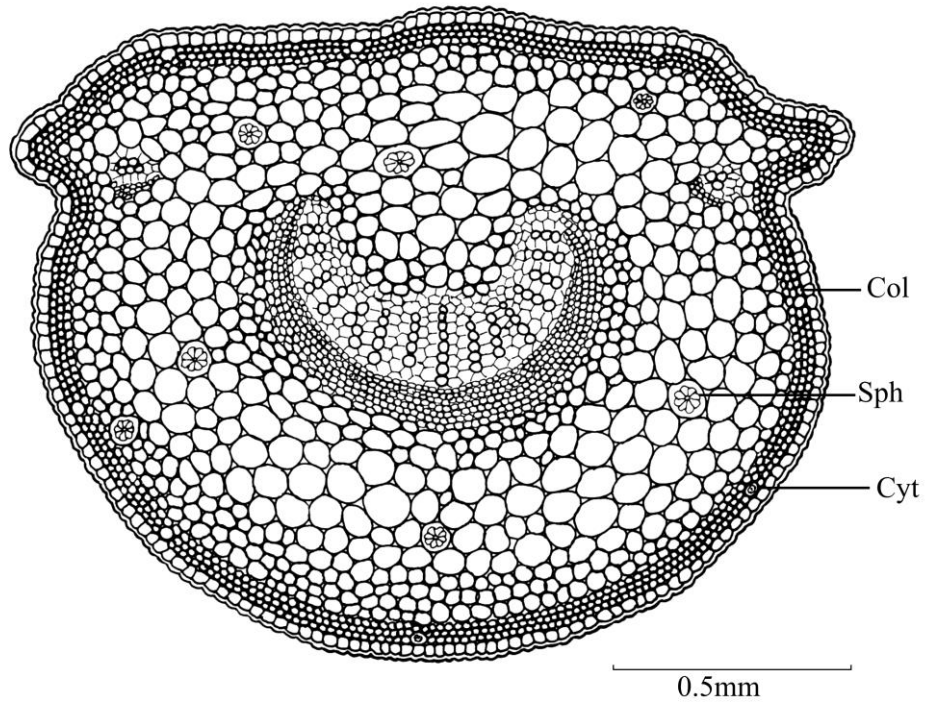
4. *Pseuderranthemum reticulatum*



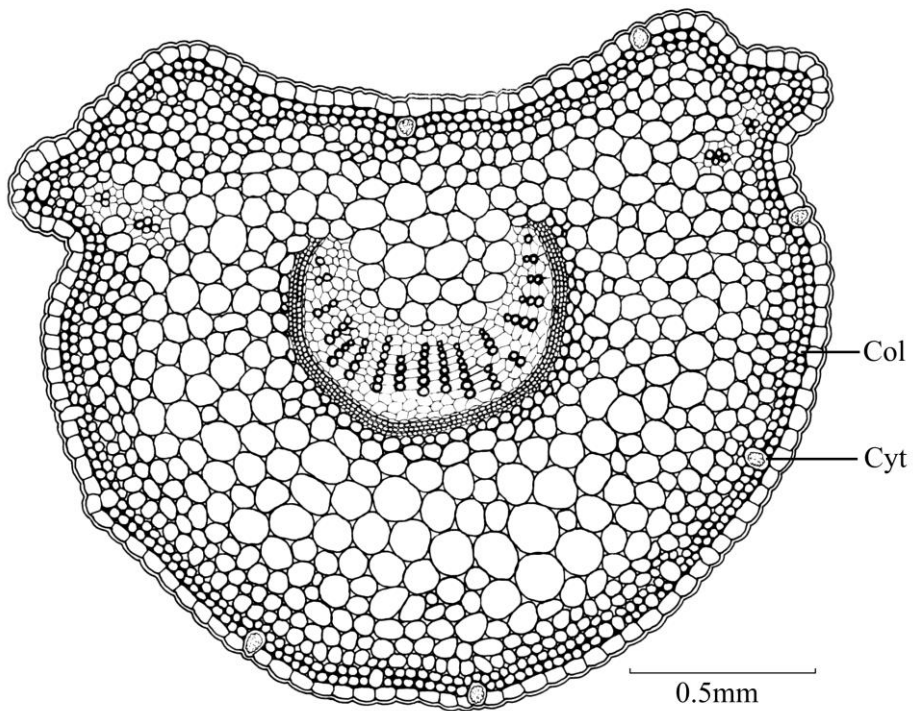
5. *Rungia parviflora*



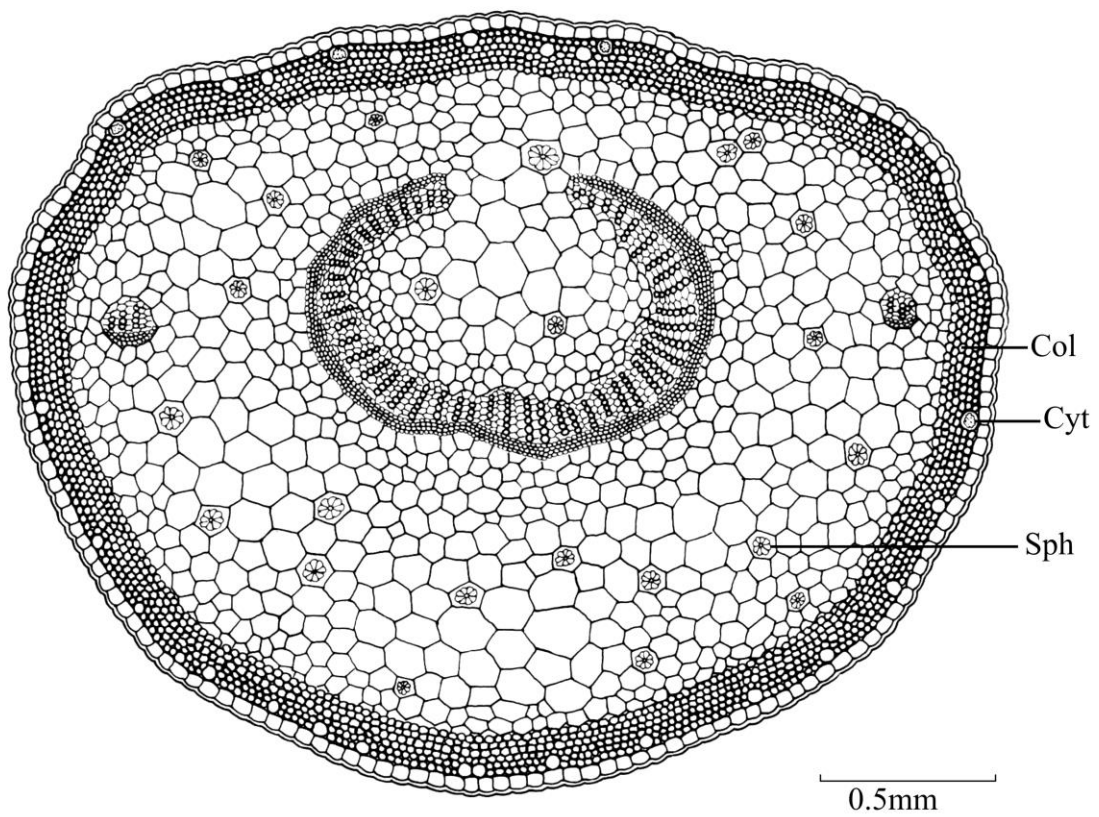
6. *Staurogyne zeylanica*



7. *Stenosiphonium cordifolium*



8. *Stenosiphonium parviflorum*



9. *Stenosiphonium russellianum*

Abbreviations Used:

Col : Collenchyma

Cyt : Cystolith

Scl : Sclerenchyma

Sph : Sphaeraphide

Tc : Tannin Cell