



Endomorphological studies in *Rauvolfia tetraphylla* L. (Apocynaceae)

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Abstract

In present work, an attempt was made to investigate *Rauvolfia tetraphylla* L. endomorphologically. The stem and petiole are characterized by the presence of epidermis, cortex, vascular region and central pith. The leaf shows the upper and lower epidermis; leaf lamina has mesophyll which is differentiated into palisade tissue and spongy parenchyma and midrib region have collenchyma which is followed by bicollateral vascular region. The stem shows the presence of collateral vascular bundles. The presence of multicellular trichomes were observed with average length of 0.29 mm on stem, petiole and leaf. The leaves are hypostomatic and characterized by the presence of paracytic stomata. Stomatal index - 22.81%; stomatal frequency- 24.6 per sq. mm and stomatal length- 31.19 μ m X 20.41 μ m was observed.

Keywords: *Rauvolfia tetraphylla*, Apocynaceae, Endomorphology, Bicollateral, Multicellular Trichomes, Paracytic

Introduction

The family Apocynaceae is represented by 180 Genera and 1500 Species worldwide whereas, in India it shows 29 Genera and 60 Species. The members of this family are mostly found in the warmer parts of the world but few are also found to be present in temperate region. In India, the members of Apocynaceae are chiefly found in the Eastern Himalaya and Southern Peninsular region. The members of this family are mainly used as Ornamentals, Medicines, Food and Fodder (Singh, Pande and Jain, 2013) ^[10].

Rauvolfia tetraphylla L. commonly known as a Devil Pepper, is a small, tree or shrub. The leaves are found to be whorled occurring in groups of four at each node and are light to dark green in colour (Iqbal, Khan and Khan, 2013) ^[3]. The flowers are creamy white originating in Umbellate Cyme. The fruits are of Drupe type, small, ovoid, deep red to purple in colour (Indian Biodiversity Portal, 2022) ^[2]. *Rauvolfia tetraphylla* is used prevalently in Ayurvedic and Unani system of medicines as well as a part of folk remedies of most Asian countries. *Rauvolfia* L. have small vessels, uniseriate rays, numerous bordered pits, and large radial latex canals (Metcalfe and Chalk, 1957) ^[6]. The present work is conducted to study the endomorphological features of stem, petiole and leaf epidermal features and foliar trichomes of *Rauvolfia tetraphylla* L.

Material and Methods

The endomorphological studies were carried out by using fresh samples such as stem, leaf, and petiole of *Rauvolfia tetraphylla* L. plant collected from the Botanical Garden of Poojya Sane Guruji Vidya Prasarak Mandal's S. I. Patil Arts, G. B. Patel Science and S. T. K. V. S. Commerce College, Shahada, District Nandurbar (M.S.). The species was identified using Flora of Dhule and Nandurbar Districts (Maharashtra), (Patil, 2003; Dwivedi and Singh, 1990) ^[1].

The free hand section of stem, petiole and leaf were taken using 7° Clock Platinum Razor blades (Dwivedi and Singh, 1990) ^[1]. The sections were stained with polychromatic stain

Toluidine Blue (Parker, Haskins and Deyrup-Olsen, 1982) ^[7]. The sections were mounted in 30% Glycerin and observed under Esaw-classic-40c 2000 X digital trinocular microscope.

For epidermal studies, the abaxial side of leaf was peeled carefully using a fine forceps and stained with Safranin. For the epidermal impressions of adaxial side, the leaf surface was stained with safranin for 4-5 minutes followed by removal of excess stain by tissue paper. A thin layer of transparent nail polish was applied to the stained surface and allowed it to dry completely. The nail polish peels were carefully obtained with the help of a fine forceps. The peels were mounted in aqueous glycerine (30%) and observed under compound microscope. The photographs were taken with Optscopes IS-500, 5.1 MP CMOS Microscope Camera (Jagtap and Tayade, 2021) ^[4].

Observations

1. Endomorphology of Stem (Fig. 1)

The outermost layer of stem, epidermis is covered with barrel shaped cells with covered with thick cuticle. Hypodermis is followed by epidermis with few layers of chlorenchyma tissue and an innermost layer of cortex known as endodermis is formed with single layer of parenchymatous tissue / cells. Pericycle is a discontinuous layer present in the form of patches consisting of many widely spaced strands of thick-walled fibers. Vascular bundles are conjoint, collateral, open and endarch. Vascular system composed of primary phloem, secondary phloem, cambium, secondary xylem, primary xylem. Many medullary rays traverse the secondary xylem. Pith is well developed, thin-walled, parenchymatous and present in the center.

2. Endomorphology of Petiole (Fig. 2)

A single layered, small celled epidermis is observed in the cross section of the petiole with the multicellular trichomes. The successively after the epidermis, 5-6

layers of collenchyma cells were present in the region of outer cortex and below that parenchyma cells covered with 6-8 layers. A single layer of endodermis is also present at the end of inner cortex. Pericycle cells were observed not as continuous layer but 8-10 cells form a bunch of pericycle. The entire petiole is covered with a small gap in-between of each pericycle bunch. Bi-collateral vascular bundles were present in the petiole region. The clear and large pith region of parenchyma cells was observed in the centre of the petiole.

3. Endomorphology of Leaf (Fig. 3)

Transverse section of the midrib of leaves exemplified a single layer of upper and lower epidermis with a very thin cuticle. In epidermis, abundant multicellular trichomes were observed. In the midrib region of leaf just below the upper epidermis 5-7 layer of collenchyma cells, which were polygonal in shape and lesser than parenchymatous cells. Above the lower epidermis the collenchyma cells were observed. The vascular bundles were bicollateral type, composed of xylem at the center with phloem on both the sides. Other area of the midrib covered with thin-walled parenchymatous cells. In the leaf blade region, mesophyll tissue composed of palisade cells below the upper epidermis and lower side spongy parenchyma cells. In the leaf blade area single layer of upper epidermis and lower epidermis is present, with the epidermal cells collenchyma and parenchyma cells

were not present, as observed in the midrib region. A single layer longitudinally arranged palisade cells were present below the upper epidermis, from the end of the palisade cells a loosely arranged spongy photosynthetic cells were arranged with a large space in between the spaces of spongy tissues.

4. Foliar Epidermal Features (Fig. 4)

The leaves of *Rauvolfia tetraphylla* L. having hypostomatic structure.

Leaf Adaxial surface:

Microscopic observation of the upper epidermis shows that it is devoid of any type of stomata. Epidermal cells are chlorophyllous and numerous foot cells were observed.

Leaf Abaxial surface:

On the lower epidermis, paracytic and anisocytic stomata were present. Stomatal index was 22.8%; Stomatal frequency was 24.6 per sq. mm and Stomatal size- length was 31.19 μm and breadth was 20.41 μm . Chlorophyllous guard cells and epidermal cells were present.

5. Foliar Trichomes (Fig. 5)

The multicellular filiform trichomes were observed on both adaxial and abaxial surface of leaf. The foot of trichome was single celled while body was multicellular, Apex cell is pointed. The average length of trichome observed was 0.29 mm.

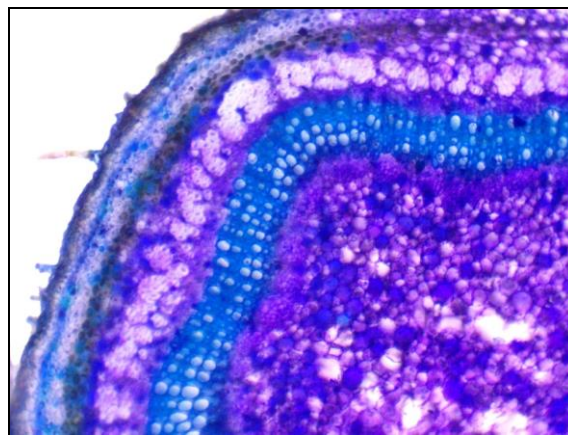


Fig 1: Endomorphology of Stem

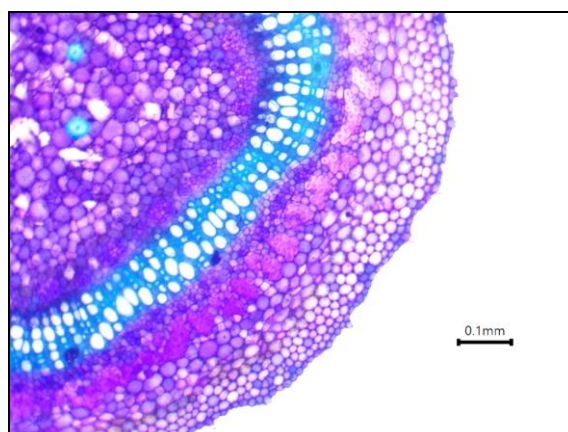


Fig 2: Endomorphology of Petiole

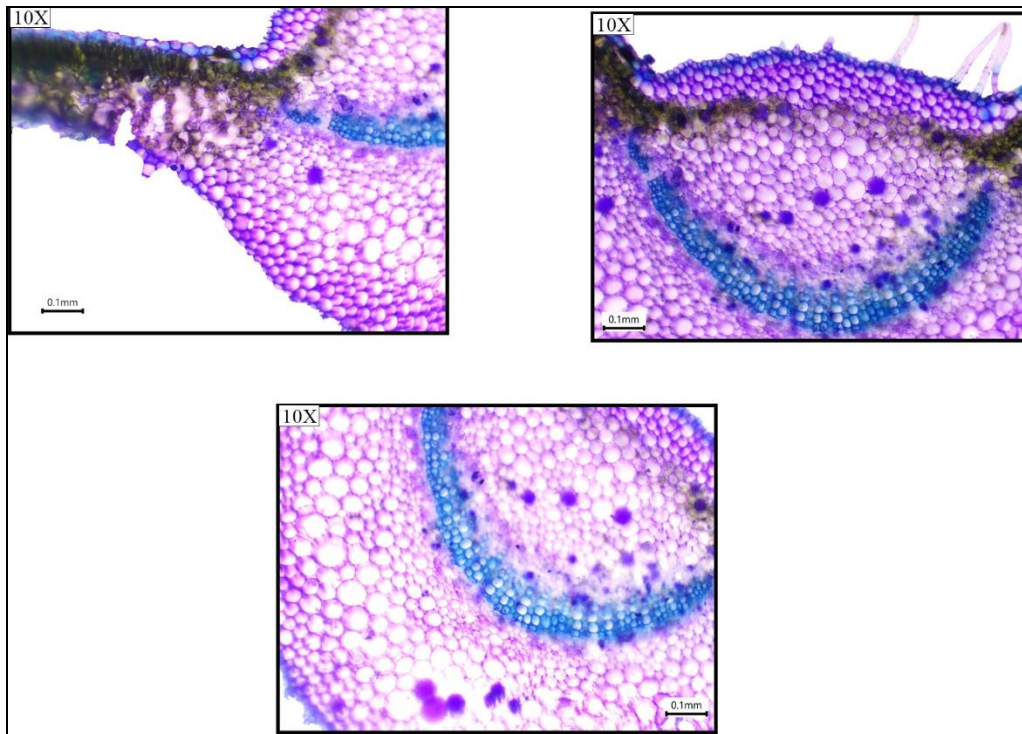
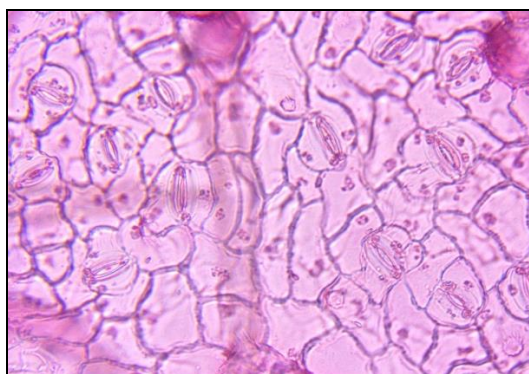


Fig 3: Endomorphology of Leaf



Abaxial



Adaxial

Fig 4: Foliar Epidermal Features (Stomata)

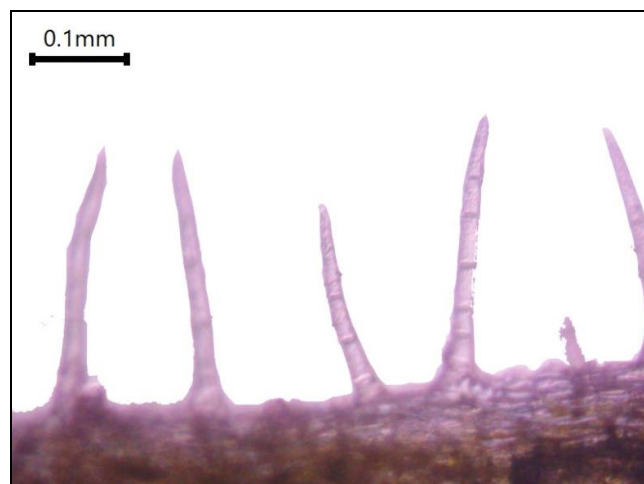


Fig 5: Foliar Trichomes

Results and Discussion

The stem of *Rauvolfia tetraphylla* is circular in outline. Epidermis is made of barrel shaped parenchyma cells, covered with trichomes. The cortex is having

parenchymatous hypodermis, few chlorenchyma layers and innermost endodermis. The vascular bundles are conjoint, collateral, open and endarch. Vascular system composed of primary phloem, secondary phloem, cambium, secondary

xylem, primary xylem. Numerous medullary rays traverse the secondary xylem. A massive, well developed and parenchymatous pith is present at the center.

The leaves are petiolate having a small and circular petiole. Epidermis is single layered and small celled with the unicellular and multicellular trichomes. The epidermis is followed by 5-6 layers of collenchyma cells which is further followed by 6-8 layers of parenchyma cells. The vascular bundles are bi-collateral present in the petiole region. The clear and large pith region of parenchyma cells was observed in the center of the petiole.

Endomorphological studies revealed the presence of dorsiventral nature of leaves. The upper and lower epidermis is single layered with a very thin cuticle. In epidermis, abundant multicellular trichomes were seen. There is a presence of 5-7 layered collenchyma below upper epidermis and few layers below lower epidermis in midrib region. The vascular bundles were bicollateral type, composed of xylem at the center with phloem on both the sides. There is a presence of thin-walled parenchyma cells around vascular region. The mesophyll tissue composed of single layered palisade cells below the upper epidermis and lower side loosely arranged spongy parenchyma cells.

According to Patel (2005)^[8] *Rauvolfia tetraphylla* leaves are hypostomatic in nature. The adaxial side is devoid of stomata while the abaxial side is having paracytic stomata. Metcalfe and Chalke (1957)^[6] also reported hypostomatic leaves and presence of paracytic stomata in *R. tetraphylla*. Kadiri and Ayodele (2003) have also reported hypostomatic leaves and paracytic stomata in some species of *Rauvolfia*. Kannabiran and Ramassamy (1988)^[5], have reported the presence of hypostomatic leaves with anomocytic and paracytic stomata and uniseriate trichomes in *R. tetraphylla*. The stomatal index is 22.8%; stomatal frequency is 24.6 per sq. mm and length of stomata is 31.19 μm while breadth is 20.41 μm . The multicellular and filiform trichomes are observed on both sides of leaves. The length of trichome reported is 0.29 mm.

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