



Anatomical studies (Stem & Ovary) of Genus *Datura* L. (Solanaceae) in Karnataka, India

Rashmi Gulaguli,^{id} Shreyas Betageri*,^{id} Vanaja G. Patgar,^{id} K. Kotresha^{id}

Taxonomy and Floristic Laboratory, Department of UG, PG and Research in Botany, Karnatak University's, Karnatak Science College, Dharwad-580001, India

Abstract

Anatomical studies in genus *Datura* in Karnataka recorded various different variations in stem anatomy showing different arrangement of epidermis, cortex, vascular bundles and pith. Ovary anatomy of genus *Datura* L. very much variations showing presence of locules, septum formation.

Keywords: *Datura discolor*, *D. ferox*, *D. innoxia*, *D. metel*, *D. stramonium*

INTRODUCTION

Diversity of *Datura* L. across South West and Central U.S.A. to Mexico is 14 species [7]. Latin Solanum "the nightshade plant" derived the family name as 'Solanaceae'. The genus *Datura* belonging to the Solanaceae family comprises several species including some medicinal properties [10]. Cytological and tissue culture studies [13] have reported arrangement and variations among four distinct taxa in *Datura* and two distinct taxa in *Withania*. Anatomy and Morphology of stem in some species of Solanaceae [6] family has reported the variations in *Solanum tuberosum* L., *Capsicum annum* L. and *Datura stramonium* L. [12]. The growth of *Datura innoxia* was huge in normal water, but the average roots were long under wastewater. *Datura innoxia* demonstrated have strong adaptive potential under wastewater. Stem and leaf anatomy of nine *Solanum* species of Egypt to find useful taxonomic characters and indicate close interrelationships among the collected species include: the diversity of epidermis, cortex, vascular bundle and pith thickness of stem is varied for epidermis, mesophyll for leaves lamina and midrib. Ultimate motto of work is to solve taxonomic dispute among *Solanum* genus [11]. Microscopical investigation of three *Datura* species have recorded the variations among the stem sections between 3 taxa in *Datura* [5]. Morphological studies of flowering plants (Solanaceae) have reported variations in morphological aspects among 20 species belonging to Family Solanaceae which is toxic (Potent-alkaloids) in some conditions used as staple food. The present observation shows that majority of Solanaceae species have same morphological features of family [4].

MATERIAL METHODS

Study area: The research was conducted across various districts. The plants from different localities of Karnataka were collected in different seasons from districts like Gadag, Dharwad, Belagavi, Hassan and Chikkamagaluru covering different agro-climatic zones to capture the diversity of *Datura* species.

Collection & identification: Collection of species was carried out in different seasons (Summer, winter, and rainy), collected in triplet form for dissection, identification and anatomical studies. Identification using different district floras [(2); (3); (9); (1); (8)].

Anatomical studies: Collected stem samples were stored in water for one day, washed in 100 % alcohol, and sectioned and stained with safranin stain and observed under binocular microscope, recorded the characters with photographs. Ovary anatomy was selected small ovary which is slightly maturing, sectioned and observed under microscope with safranin stain.

RESULTS

During the survey five *Datura* species with two varieties from different districts of Karnataka (**Figure 1**). The variations observed and studied among all the *Datura* species are described individually below.

STEM ANATOMY OF GENUS *DATURA* L. IN KARNATAKA:

I) *Datura discolor* Bernh. (Figure 2)

The stem is circular. The transverse section of *Datura discolor* shows the presence of cuticle layer above the epidermis. The epidermis is 4-5 layered, cells varying from rectangular to cylindrical; these are tightly packed which bears trichomes arising from the epidermal layer. Cambium is about 4 layered having hexagonal cells. Endodermis and pericycle is single layered. It also bears Vascular bundles i.e., phloem and xylem. The Meta xylem, xylem and Proto xylem are arranged linearly towards the pith. Pith is hollow, where Parenchyma having thin cell walls and few chlorenchyma cells containing chloroplast are present.

II) *Datura ferox* L. (Figure 2)

The stem is circular. Shows multilayered cuticle layered above the epidermis which is about 7-8 layers from which trichomes arose. Hypodermis made up cuboidal shaped cells and are larger than epidermis and is one layered.

08 February 2025: Received | 10 March 2025: Revised | 12 April 2025: Accepted | 03 May 2025: Available Online

Citation: Rashmi Gulaguli, Shreyas Betageri, Vanaja G. Patgar, K. Kotresha (2025). Anatomical studies (Stem & Ovary) of Genus *Datura* L. (Solanaceae) in Karnataka, India. *Journal of Plant Biota*. 77 to 81. DOI: <https://doi.org/10.51470/JPB.2025.4.1.77>

Shreyas Betageri | shreyasbetgari@gmail.com

Copyright: © 2025 by the authors. The license of Journal of Plant Biota. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

Cortex is with irregular shaped (circular, ovate, elongate) cells and are collenchymatous. Endodermis 1 or 2 layered with rectangular or barrel shaped thin wall. Pericycle 1-2 layered. Phloem is with two or many layered cells, Xylem are 5 and more layers which are continuous. Large pith is present at the center, which is composed of large parenchymatous and chlorenchymatous cells between them having oval structure.

III) *Datura innoxia* Mill. (Figure 3)

The stem is circular. Shows epidermis which is the outermost single layer, above which 2 layered cuticle coverings is present. Epidermis bears many trichomes having glandular and multicellular trichomes. Outer cortex is made up of collenchymatous cells, 2-3 layered cells similar to endodermis cells. Cortex is thin walled bearing 4-6 layers, and cells are circular oblong. Phloem are rectangular cells, 4- 6 layered. Xylem strands grows up to 15-20 layers. Below the xylem 4-5 layers of thin walled parenchymatous cells are present, it is compactly arranged, tangentially elongated or polygonal. Pith is large at the center; it is made of large parenchymatous cells along with chlorenchymatous cells and bearing hollow structure at the centre.

IV) *Datura metel* L. (single white corolla) (Figure 3)

The stem is circular. Shows two layered epidermis, above which a thin cuticle layer is observed. Cortex is made up of 4-5 layers having collenchymatous cells that are cuboidal in shape. Pericycle is about 2-3 layers. Phloem is about 3-4 layers that are rectangular in shape. Xylem cells are arranged radially beneath the phloem. Pith is large having parenchymatous and chlorenchymatous cells, ranging from hexagonal to circular in shape.

V) *Datura metel* L. (single purple corolla) (Figure 4)

The stem is circular. Epidermis is one layered made up of cuboidal shaped cells. Above which thick cuticle layer covering is observed. Hypodermal layer is larger, rectangular shape than the epidermal cells. Cortex, is made up of 8-10 layers having collenchymatous cells that are rectangular, oval, circular or irregular in shape. Endodermis is not prominent. Pericycle is 3-4 layered. Phloem is composed of 4-7 layers of rectangular, tangentially elongated cells. Radially arranged xylem cells are found below the phloem. Xylem patches penetrating into the pith region. Pith is large and composed of thin walled parenchymatous cells, circular with presence of chlorenchymatous cells in between.

VI) *Datura metel* L. (Tri-petal purple) (Figure 4)

The stem is circular. Thick cuticle covering, below which about 8-9 layers of epidermis is observed. Hypodermis comprises of Parenchyma and collenchymatous cells ranging from circular to hexagonal shapes of various size. Cortex comprises of 10-12 layers. Pericycle is about 4-5 layers. Phloem is composed of 5-6 layers. Xylem cells found penetrating into the pith region. Pith is large, found slightly arranged towards the epidermis region, i.e., not exactly at the central region, having thin walled parenchymatous cells and chlorenchymatous cells in between.

VII) *Datura stramonium* L. (Figure 5)

The stem is circular. Thin cuticle covering, below which about 5-6 layers of epidermis is observed. Hypodermis comprises of collenchymatous cells ranging from circular to hexagonal shape of various size. Cortex comprises of 10-12 layers.

Endodermis is about 2-3 layers. Phloem is composed of 5-6 layers. Xylem cells found penetrating into the pith region. Proto xylem and Meta xylem are present. Pith is large with hollow at the center.

OVARY ANATOMY OF *DATURA* L. IN KARNATAKA

Seven species ovary were collected at maturing stage and sectioned to get the T.S. of the ovaries to get the photographs.

Datura discolor Bernh. (Figure 6)

Ovary superior, bicarpellary, fused carpels, biloculate, placentation-axile, numerous ovules, inner side of ovary wall is smooth, Fruit 5-6cm, globose, irregular dehiscence, spinescent capsule, stout spines, 90-100 in number, 1.3-1.5cm.

Datura ferox L. (Figure 6)

Hypogynous, carpellary, syncarpous, bilocular, axile placentation, due to false septum locules often appears to be tetralocular; ovules numerous, extremely spiny fruit capsule. Fruit ovoid to ellipsoid, 8-10cm, dehiscence irregularly, spinescent capsule, extremely robust spines, upto 60 spines, spines vary from small to large about 0.3mm to 4cm long.

Datura innoxia Mill. (Figure 6)

Superior ovary, two carpels, syncarpous ovary, bilobed, axile placentation. A false septum often divides each locule, giving a slightly tetralocular appearance, Ovules numerous, distinctly pubescent ovary. Fruit globose or ovoid, loculicidal spinose capsule, 4-5 cm in diameter, deflexed, spines straight, numerous, softer, slender, equal in length; 1-1.3cm long, the capsule splits irregularly when ripe.

Datura metel L. (white corolla) (Figure 6)

Features a hypogynous ovary, bicarpellary, syncarpous, 2-chambered or spuriously 4-celled, axile placentation, numerous ovules, ovary is smooth and glabrous. Fruit a spinescent globose capsule, pendulous, dehiscing irregularly, spines depectoid, shorter, 0.5-0.7cm in length; ovules numerous.

Datura metel L. (purple corolla) (Figure 6)

Possesses a superior, bicarpellary, syncarpous ovary, bilocular, axile placentation. A false septum often creates a tetralocular appearance during cross section, Ovules are numerous, The ovary is smooth and glabrous pubescence, matures into a spiny capsule. Fruit globose capsule, dehiscing regularly, pendulous, diploid spines, shorter than other species, 0.3-0.5 cm long.

Datura metel L. (Tripetal) (Figure 6)

Superior, bicarpellary, syncarpous ovary, bilocular, axile placentation. A false septum often creates a tetralocular appearance same as that of observed in other variety of *D. metel*, Ovules are numerous, matures into a typical spiny capsule. Fruit globose capsule, dehiscing regularly, pendulous, diploid spines, 0.2-2.4 cm long.

Datura stramonium L. (Figure 6)

Hypogynous or superior ovary, bicarpellary, syncarpous or fused carpels, tetralocular with axile placentation. Ovules are numerous, anatropous, and bitegmic. The ovary wall is smooth to slightly pubescent, matures into a large, spiny capsule, 3.5-7 cm long, Fruit an upright or erect, almost globose to ovoid capsule up to 5 cm × 4.5 cm, spines few to many, slender, stiff, stout, up to 0.1-0.3mm long, many-seeded, dehiscence into 4-valves prominently.

Acknowledgment

Authors are thankful to Yukti Y., Spoorthi D., Rakshitha B. K., and Supriya P. helped us during the field visit and collection.

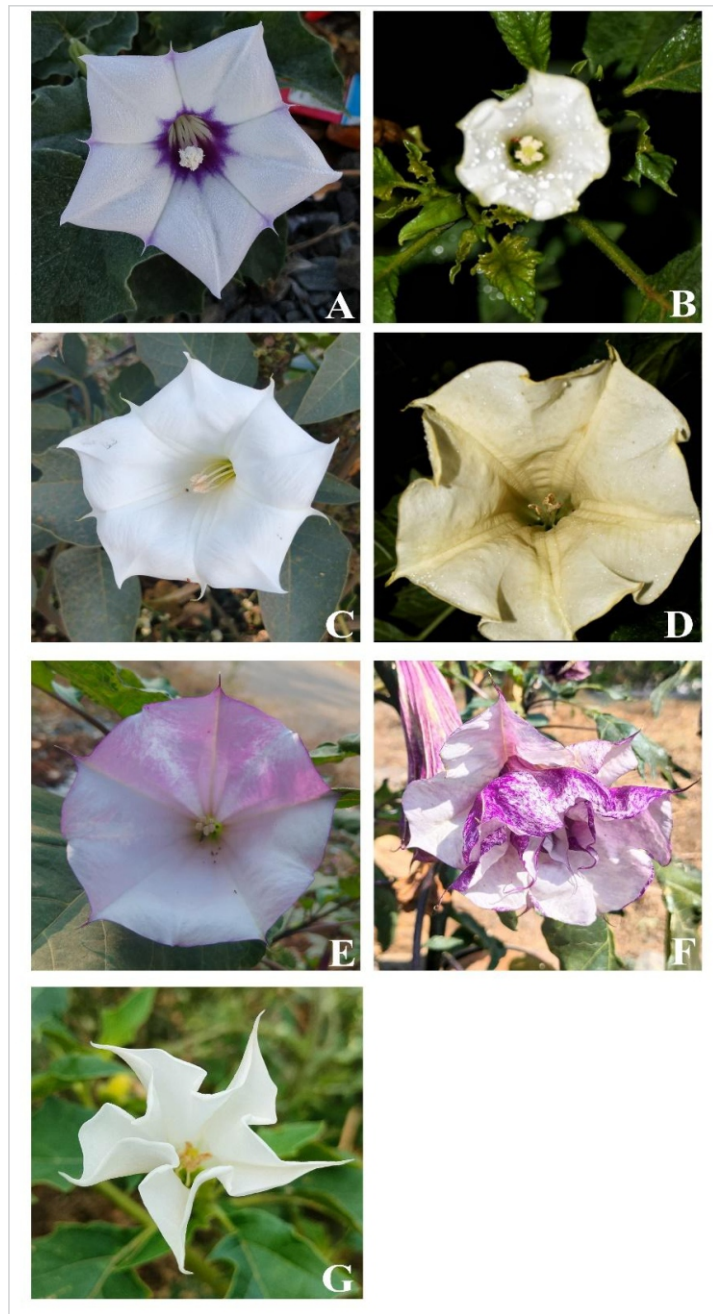


Figure 1: A. *Datura discolor* Bernh.; B. *Datura ferox* L.; C. *Datura innoxia* Mill.; D. *Datura metel* L. (white corolla); E. *Datura metel* L. (purple corolla); F. *Datura metel* L. (tri-petal); G. *Datura stramonium* L.

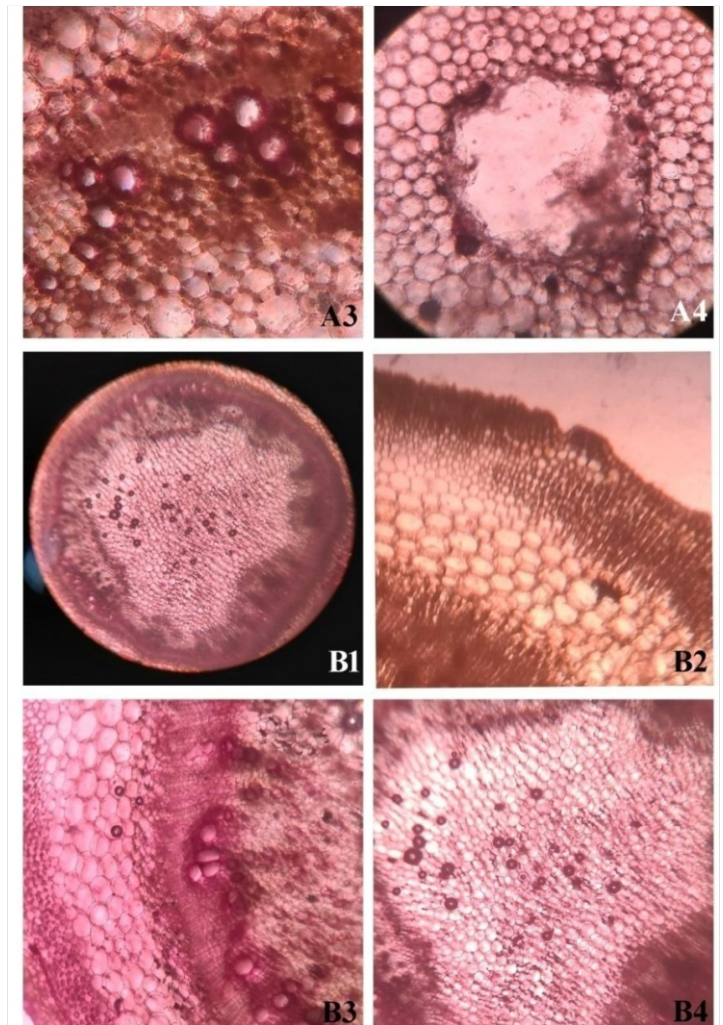
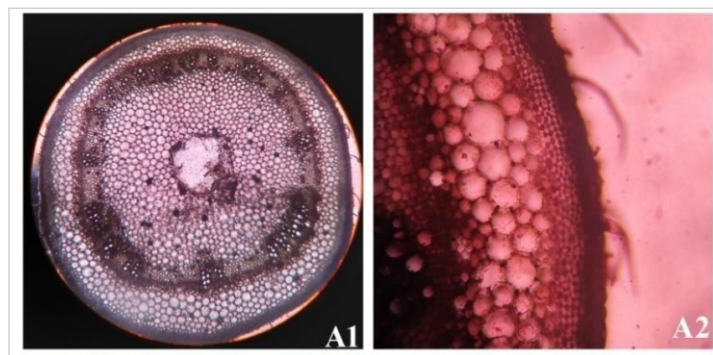
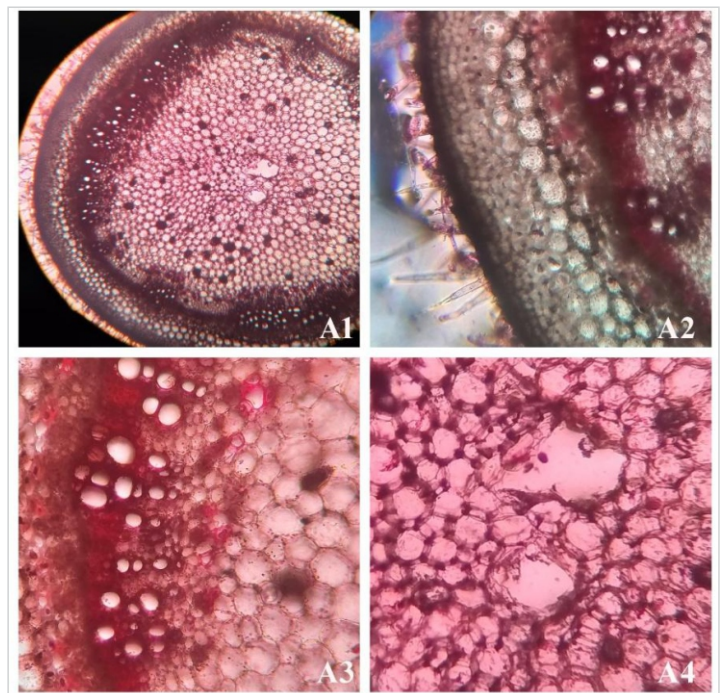


Figure 2: T.S. of Stem: *Datura discolor* Bernh. - A1. Whole stem; A2. Epidermis with trichomes; A3. Vascular bundle; A4. Pith; *Datura ferox* L. - B1. Whole stem; B2. Epidermis with trichomes; B3. Vascular bundle; B4. Pith.



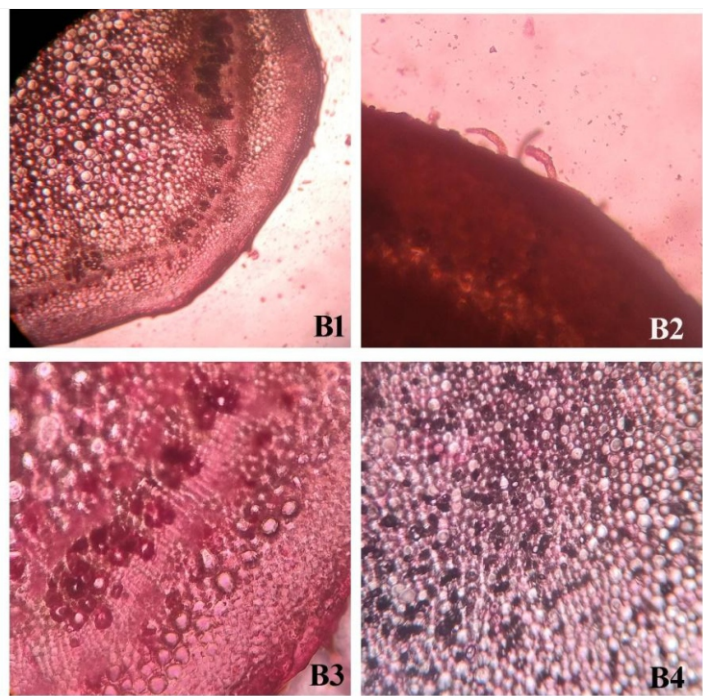


Figure 3: T.S. of Stem: *Datura innoxia* Mill. - A1. Whole stem; A2. Epidermis with trichomes; A3. Vascular bundle; A4. Pith; *Datura metel* L. (single white corolla) - B1. Whole stem; B2. Epidermis with trichomes; B3. Vascular bundle; B4. Pith

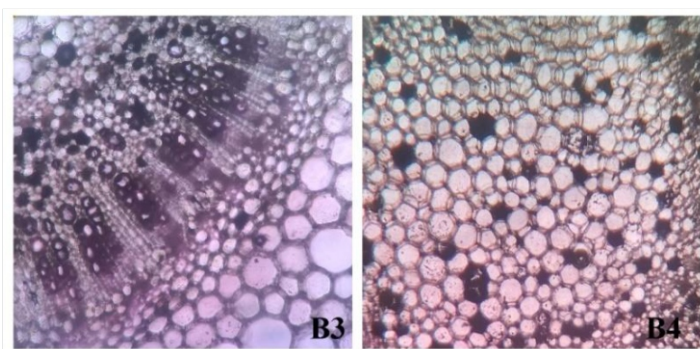
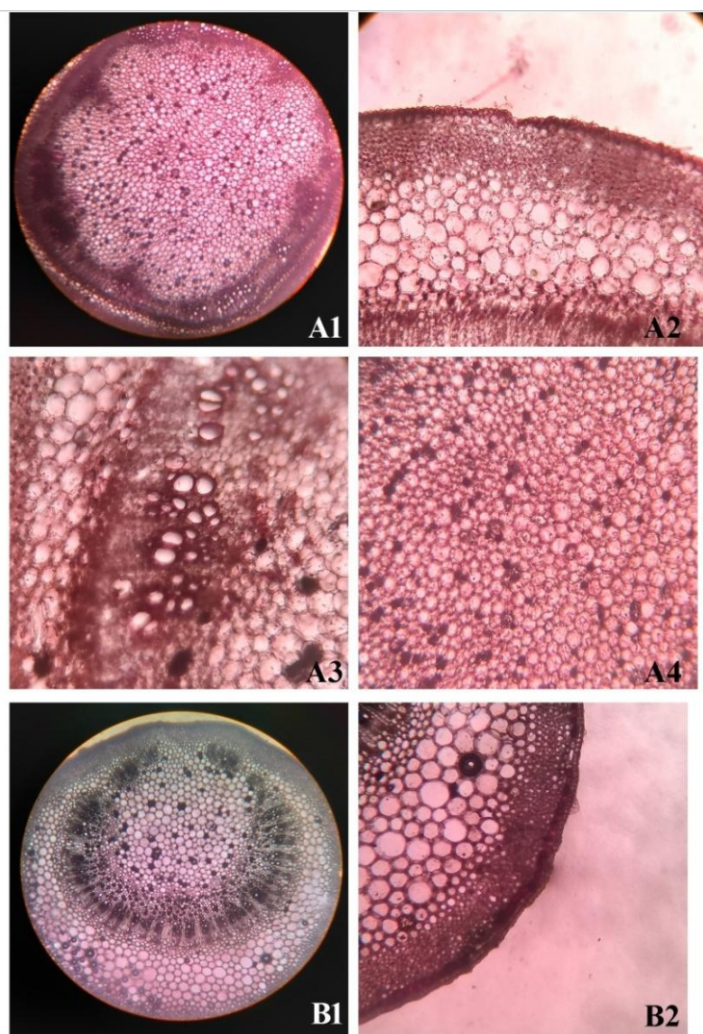


Figure 4: T. S. of Stem: *Datura metel* L. (single purple corolla) - A1. Whole stem; A2. Epidermis; A3. Vascular bundle; A4. Pith; *Datura metel* L. (Tri-petal purple) - B1. Whole stem; B2. Epidermis; B3. Vascular bundle; B4. Pith.

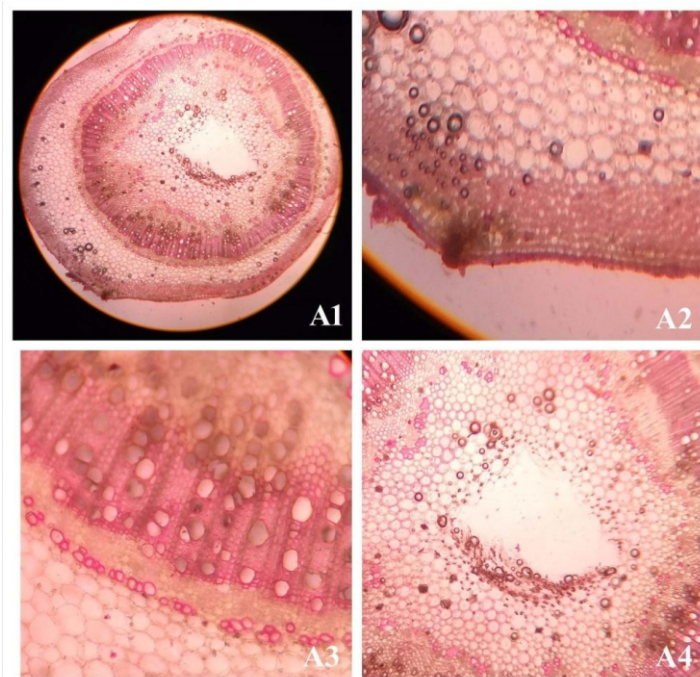
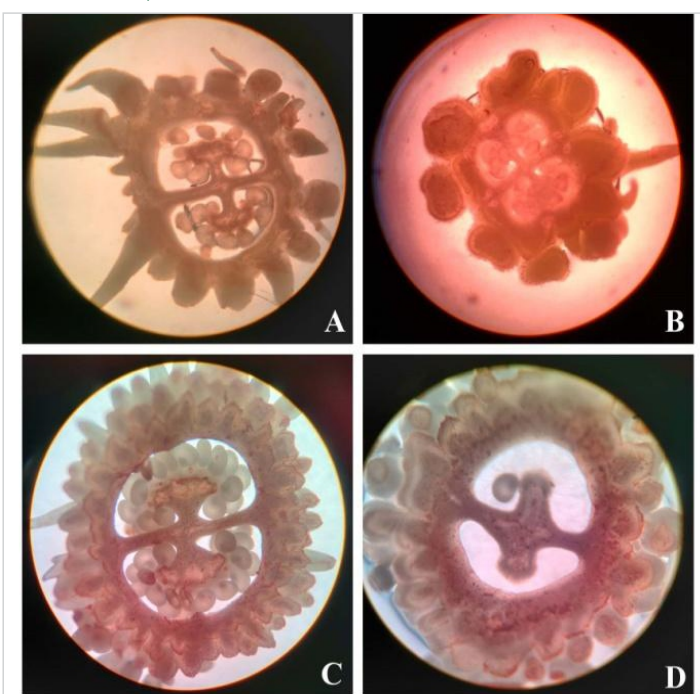


Figure 5: T. S. of stem: *D. stramonium* L. - A1. Whole stem; A2. Epidermis; A3. Vascular bundle; A4. Pith.



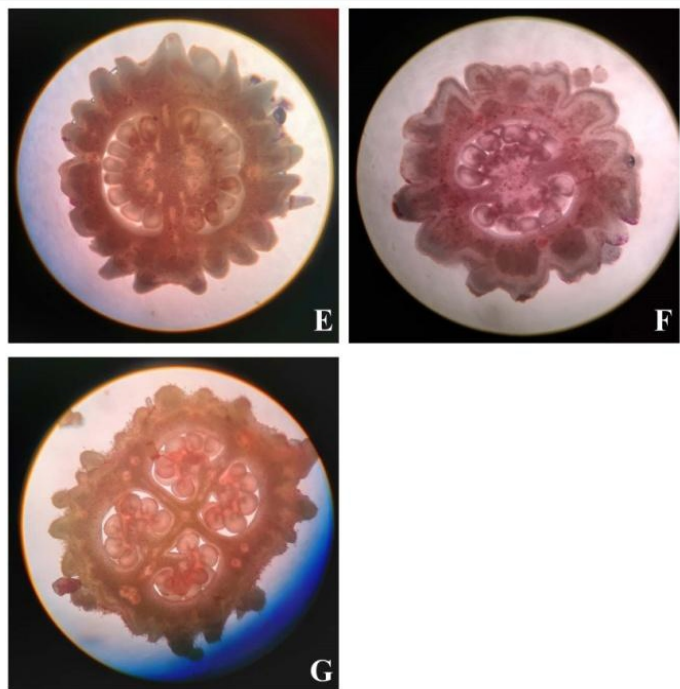


Figure 06. T.S. of Ovary of *Datura* L. genus in Karnataka: A. *Datura discolor* Bernh. ; B. *Datura ferox* L.; C. *Datura innoxia* Mill.; D. *Datura metel* L. (white corolla); E. *Datura metel* L. (purple corolla); F. *Datura metel* L. (tripetal); G. *Datura stramonium* L. . Whole stem; A2. Epidermis; A3. Vascular bundle; A4. Pith.

References

1. Bhat, K. G. (2014). Flora of South Kanara: Dakshina Kannada and Udupi Districts of Karnataka. Udupi: Taxonomy Research Centre. Chitpady, Udupi.
2. Cooke, T. (1906). Flora of the presidency of Bombay. Vol. I. II. III. Botanical Survey of India.
3. Gamble, J. S. and Fischer C. E. C. (1928). Flora of Presidency of Madras. Vol. I. II. III. Secretary of State for India in Council.
4. Jagatheeswari, D. (2014). Morphological studies of flowering plants (Solanaceae) *International Letters of Natural Sciences*. 15:36-43.
5. Krishnan, V. and Gopi, M. (2018). Microscopical investigation of three *Datura* species *Indian Journal of Economics and Development*. 6(5): 3-6.
6. Nagdy, G. A., Yossef, F. A., Abou-bakr, M. H. A. and Ahmed, A. M. (2005). Morphological and Anatomical studies on the stem of some Solanaceae genera. *Agricultural Science Mansoura University*, 30 (11): 6669-6686.
7. POWO, 2025 "Plants of the World Online". Facilitated by the Royal botanical Gardens, Kew. Published on the internet: <https://powo.science.kew.org/taxon/> [accessed: 27 April 2025].
8. Saldanha, C. J. and Nicolson, D. H. (1976). Flora of Hassan District Karnataka. Amerind Publishing Co. Pvt. Ltd., New Delhi.
9. Singh, N. P. (1988). Flora of Eastern Karnataka. Vol. 1 & 2. Mittal publications. New Delhi.
10. Shah, N. D. and Shah V. V. (2012) Solanaceae: Historical Aspects. *International Journal of Pharmaceutical Research and Bio-science*, 1(3): 90-95.
11. Soliman, M. S. A., Nasser, A. M. and Fatma, A. Z. (2018). Stem and Leaf Anatomical Analysis of Some Medicinal Plants in two Solanaceae Tribes in Egypt. *International Journal of Trend in Research and Development*, 5(5): 297-309.
12. Taimoor, H. F., Jabeen, S., Shakoar, A., Mahummad, S. A., Siddique, N., Shahzad, K., Mahummad, U. R. and Li, Y. (2024). Morpho-anatomical adaptations of dominantly grown wild *Datura innoxia* to wastewater resource: Productivity and ecological issues. *Geoscience Frontier*, 15 (3): 1-11. <https://doi.org/10.1016/j.gsf.2023.101717>
13. Thirupurasundari, G. and Ganapathi, A. (2000). Cytological and tissue culture studies on *Withania* and *datura* of South Indian flora. Bharathidasan University.