WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
Coden USA: WJPRAP Impact Factor 8.63
Volume 15, Issue 11, 1817-1824. Research Article ISSN 2277–7105

FROM MORPHOLOGY TO MOLECULES: PHARMACOGNOSTIC AND PHYTOCHEMICAL EVALUATION OF DATURA METEL LINN. LEAF

[1]*S. Khathija, [2]Renu Dixit, [3]K.V.V. Bhaskar Reddy

[1]PG Scholar, Department of Dravyaguna, Sri Venkateswara Ayurvedic College.

[2]Principal and Professor, Department of Dravyaguna, Sri Venkateswara Ayurvedic College.

[3]HOD and Professor, Department of Shalya Tantra, Sri Venkateswara Ayurvedic College.

Article Received on 05 May 2026,
Article Revised on 25 May 2026,
Article Published on 01 June 2026

https://doi.org/10.5281/zenodo.20526562

***Corresponding Author**

S. Khathija

PG Scholar, Department of Dravyaguna, Sri Venkateswara Ayurvedic College.

How to cite this Article: [1]*S. Khathija, [2]Renu Dixit, [3]K.V.V. Bhaskar Reddy (2026). From Morphology To Molecules: Pharmacognostic And Phytochemical Evaluation Of Datura Metel Linn. Leaf. World Journal of Pharmaceutical Research, 15(11), 1817–1824.

ABSTRACT

Datura metel Linn., a plant belonging to the Solanaceae family is widely distributed across the World. Traditionally *Datura metel* Linn., is used many diseases, including Neurological and heart diseases, fever, catarrh, pain, diarrhea, skin diseases, chronic bronchitis, asthma, digestive disorders and so on. It possesses many important phytochemicals that can be used to treat various diseases. The present study is aimed to establish Pharmacognostic standards and evaluate the Phytochemical profile of its leaves. Detailed Macroscopic and Microscopic examinations were carried out for proper identification and authentication of the plant material. The Powdered drug was further subjected to Qualitative Phytochemical screening using standard procedures. The findings revealed distinct Morphological and Anatomical characteristics along with the presence of important Phytoconstituents such as Alkaloids, Reducing sugars, Proteins, Steroids, Glycosides, Flavonoids, Tannins, Phenolic compounds, Quinones, Anthraquinones and Coumarins. These results support the Traditional medicinal use of the plant and provides a scientific basis for its Standardization and further Pharmacological investigations.

KEYWORDS: *Datura metel*, Pharmacognosy, Phytochemical screening.

1. INTRODUCTION

Pharmacognostic evaluation is essential for the Identification, Authentication and Quality control of crude drugs. In addition, Phytochemical investigations help in detecting the presence of bioactive compounds responsible for therapeutic activity. Therefore, the present study was undertaken to perform a detailed Pharmacognostic evaluation and Qualitative Phytochemical analysis of the leaves of *Datura metel* Linn.

2. MATERIALS AND METHODS

2.1 Collection and Authentication

The leaves of *Datura metel* Linn. were collected from the outskirts of Tirupati region and the fresh drug was sent for Macroscopic evaluation to the Department of Pharmacognosy, Siddha Central Research Institute (CCRS), Chennai. After that, the drug was dried and made into powder form and used for Phytochemical analysis.

2.2 Pharmacognostic Study

Macroscopic Evaluation

The leaves were examined for Organoleptic and Morphological characters such as Size, Shape, Color, Margin, Apex, and Venation. The External feature of test sample was documented using Nikon D-5600 Digital camera.

Microscopic Evaluation

The Sample was preserved in fixative FAA for more than 48 h. The preserved specimens were cut into thin transverse section using a sharp blade and the sections were stained with 0.8% Safranin and 0.5% Astra blue to observe anatomical features including epidermis, stomata, trichomes, mesophyll, and vascular bundles. Transverse sections were photographed using Axiolab5 trinocular microsope attatched with Zeiss Axiocam208 color digital camera under bright field light. Magnifictions were indicated by scale bar.

2.3 Phytochemical Screening

The Powdered drug was subjected to Qualitative chemical tests to detect Alkaloids, Reducing sugars, Proteins, Amino acids, Steroids, Glycosides, Saponins, Flavonoids, Tannins, Phenols, Anthraquinones, Quinones and Coumarins using standard protocols.

For the detection of Alkaloids, **Dragondroff's Test** was done in which to 1 ml of the extract, 1 ml of Dragondroff's reagent was added.

For the detection of Reducing sugars, **Benedict's test** was done in which equal volume of Benedict's reagent and test solution was mixed in a test tube. This was heated in boiling water bath for 5 min.

For the detection of Proteins, **Million's test** was done in which to 5 ml of Million's reagent 3 ml of test sample was added.

For the detection of Amino acids, **Ninhydrin test** was done in which 3ml of test solution was heated with 3 drops of 5% Ninhydrin solution in boiling water bath for 10 min.

For the detection of Steroids, **Salkowski test** was done in which the extract was dissolved in chloroform and equal volume of concentrated Sulphuric acid and was shaken well.

For the detection of Glycosides, **Keller Killiani Test** was done in which 1 ml extract was dissolved in acetic acid containing traces of ferric chloride and it was then transferred to a test tube containing sulphuric acid.

For the detection of Saponins, **Foam test** was done in which 1 ml of extract was diluted with distilled water to 20 ml and shaken in a graduated cylinder for 15 minutes.

For the detection of Flavonoids, **Sulphuric acid test** was done in which Sulphuric acid was added to the test solution.

For the detection of Tannins, **Ferric chloride test** was done in which to 1ml of extract, ferric chloride was added.

For the detection of Phenols, **Fecl3 test** was done in which a few drops of 10% ferric chloride solution was added to 1ml of sample.

For the detection of Anthraquinones, **Borntrager test** was done in which 5ml of chloroform was added to 0.5g of the sample and shaked for atleast 5 minutes and filtered. Then the filtrate was shaked with an equal volume of 10% ammonia solution.

For the detection of Quinones, **HCL Test** was done in which a few drops of concentrated Hydrochloric Acid was mixed with 2ML of the sample.

For the detection of Coumarins, **NaOH Test** was done in which 3ml of 10% NaOH was added to the sample in a test tube the colour of the solution was observed.

3. RESULTS

3.1 Pharmacognostic Findings

Macroscopy

Fresh leaves are green on upper surface and pale green on lower surface;

Type of Leaf: Simple, broadly ovate, petiolate

Apex: Acute

Base: Unequal

Margin: Undulate and dentate,

Venation: Reticulate

Length: 10 to 18 cm

Width: 8 to 15 cm

Organoleptic Characters

Appearance: Fresh leaves green on upper surface and pale green on lower surface

Texture: Glabrous to minutely pubescent

Odor: Unpleasant when crushed

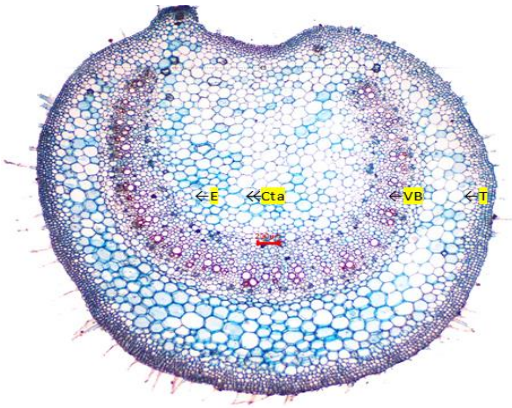
Taste: Bitter

Microscopy

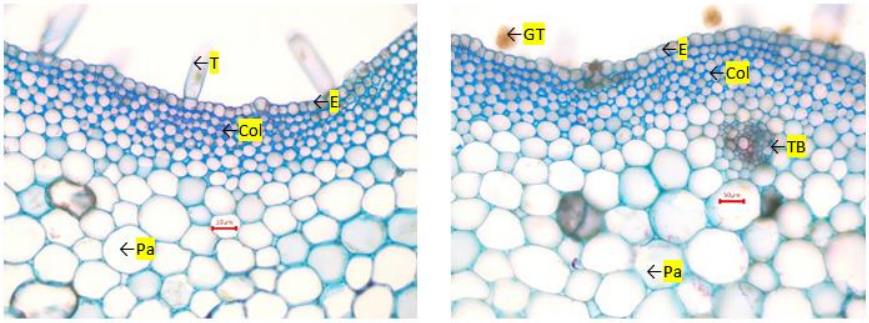
A Dorsiventral Leaf structure was observed with well-defined epidermis, multicellular trichomes, stomata, palisade and spongy parenchyma, and distinct vascular bundles. The TS of petiole shows a narrow cortex with 5 to 6 layers of collenchymatous cells followed by 6 to 7 layers of parenchymatous ground tissue. The vascular bundles are bicollateral in which the xylem is located in the centre and sandwiched between two patches of phloem tissue. The TS of Leaf shows broadly convex shaped lower midbrib surface and slightly elevated upper

midrib surface. The TS of midrib shows single layered upper and lower epidermii covered by cuticle and numerous multicellular trichomes. 5 to 6 layers of collenchymatous hypodermis is present below the upper epidermis while 2 to 3 layers found below the lower epidermis. Vascular bundles are bicollateral. The TS of lamina is dorsiventral and shows single layered upper and lower epidermii covered by cuticle and bears numerous multicellular trichomes. Mesophyll tissue is differentiated into upper layer of palisade cells. Lower 3 to 4 layers of loosely arranged spongy parenchymatous cells with intercellular spaces. Several veins were seen transversing through the mesophyll tissues

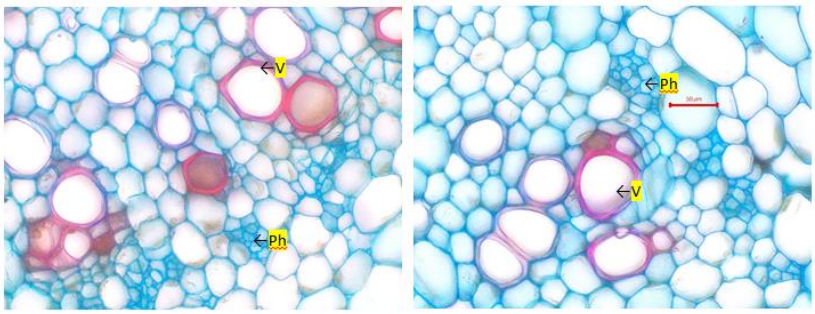
TS of petiole



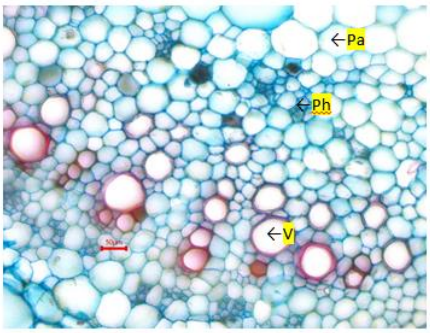
TS of petiole.

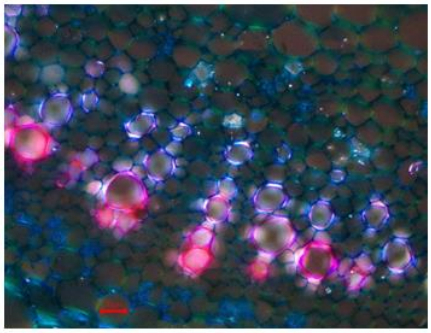


Upper portion enlarged view.

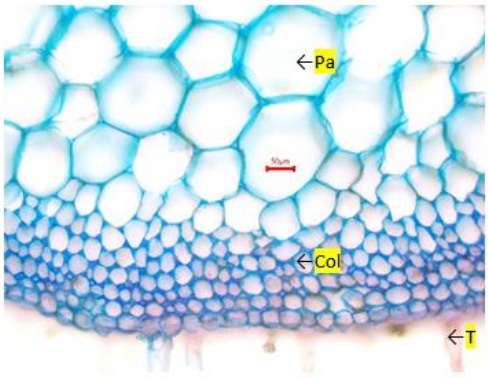


Enlarged view of xylem and phloem.





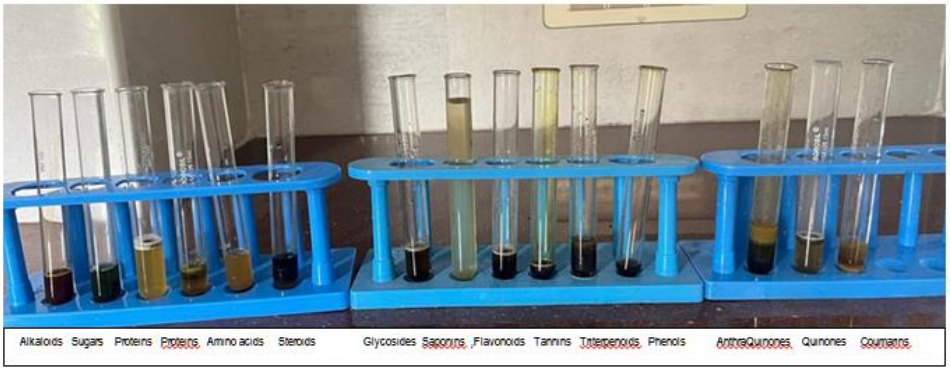
Vascular bundles **TS under polarizer field**



Lower portion enlarged view.

Col - collenchyma; **Ct** - cortex; **E** - epidermis; **GT** - glandular trichome; **Pa** - parenchyma; **Ph** - phloem; **T** - trichome; **TB** - trace bundle; **V** - vessel; **VB** - vascular bundle

3.2 Phytochemical Findings



Qualitative analysis confirmed the presence of

- ✓ **Alkaloids:** Formation of **orange red precipitate** indicated the presence of alkaloids.
- ✓ **Reducing sugars:** Change in the color of test solution to **green color** indicated the presence of reducing sugars.
- ✓ **Proteins:** There was white color precipitate formation which turned **brick red color**

- ✓ **Amino acids:** There was no change in the color to the required **purple or bluish color**. This indicated absence of Amino acids.
- ✓ **Steroids:** Chloroform layer appeared **red** and acid layer appeared **greenish yellow** represented the steroid components in the tested extract.
- ✓ **Glycosides**: At the junction there was a formation of a **reddish-brown colour**, which gradually became **blue** confirmed the presence of glycosides.
- ✓ **Saponins:** There was no stable foam seen and the foam appeared was minimal. This indicated the absence of Saponins.
- ✓ **Flavonoids:** There was an appearance of intense yellow color which became **colourless** on the addition of a few drops of dil. Hcl acid. This indicated the presence of Flavanoids.
- ✓ **Tannins:** Formation of a **dark blue or greenish black colour** showed the presence of tannins.
- ✓ **Terpenoids:** A **reddish-brown** colouration of the interface is formed to show a positive result of the presence of Triterpenoids
- ✓ **Phenols:** The **dark blue color** change in the solution indicated the presence of Phenols.
- ✓ **Anthraquinones:** The **red colour** change in the solution indicated the presence of Anthraquninones
- ✓ **Quinones:** Formation of **yellow precipitate** indicates the presence of Quinones.
- ✓ **Coumarins**: The formation of **Yellow colour** solution indicates the presence of Coumarins.

4. DISCUSSION

- ➢ The Pharmacognostic features observed in this study serve as reliable parameters for identification and authentication of *Datura metel* Linn. Microscopic characteristics such as **Bi collateral vascular bundles** (xylem centrally placed with inner and outer phloem) in the **midrib, lamina veins** and **petiole** facilitate **efficient transport of secondary metabolites including tropane alkaloids like scopolamine, hyoscyamine and atropine. Glandular trichomes** on the **epidermis of the leaf, lamina and petiole** are the main sites where **tropane alkaloids** are **synthesized and secreted. Parenchymatous ground tissue** around vascular bundles acts a **storage site** for these **alkaloids** and helps in their **solubility and bio availability.** The presence of multicellular trichomes and stomatal arrangement further strengthen its standardization profile.

- ➢ The Phytochemical screening was carried out using standard procedures as a specific test

involving the use of a particular Chemical (acid or base) was done which revealed the presence of particular phytochemical constituents. Thus, the test drug *Datura metel* Linn. Leaf revealed the presence of diverse bioactive compounds like Alkaloids, Reducing sugars, Proteins, Steroids, Glycosides, Flavonoids, Tannins, Terpenoids, Phenols, Anthraquinones, Quinones and Coumarins. These play an important role in Standardization criteria of the drug.

5. ACKNOWLEDGEMENT

The authors would like to sincerely acknowledge the Department of Pharmacognosy, Siddha Central Research Institute (CCRS), Chennai for providing the necessary research facilities for the successful completion of this study. The authors would like to extend their thanks to Dr. Monika Sharma PhD Scholar for her thesis insights which were helpful in the study.

6. CONCLUSION

The Present Investigation establishes important Pharmacognostic and Phytochemical standards for *Datura metel* Linn. The drug Datura metel Linn. was thus concluded to be authentic as the drug matched with the API standard protocols. These findings can serve as a reference for Quality control and Future research.

7. REFERENCES

1. Wallis TE. Analytical Microscopy - Its aims and methods in relation to foods, water, spices and drugs. Third Edition. Boston: Little, Brown and Company; 1965.
2. Fahn A. Plant anatomy. Third Edition Pergamon Press, Oxford; 1980.
3. R Mattummal, DK Gopi, SKK Narayana. Comparison of the leaf drug Ruta graveolens and its substitute Ruta chalepensis. Int. J Res. Ayurveda Pharm., 9(6): 2018.
4. Lian W, Wang Y, Zhang J, Yan Y, Xia C, Gan H, et al. The genus Datura L. (Solanaceae): A review of botany, traditional use, phytochemistry, pharmacology, and toxicology. J Ethnopharmacol., 2022; 290: 115005.
5. Bruneton J. Pharmacognosy, phytochemistry, medicinal plants. 2nd ed. Paris: Lavoisier Publishing; 1999.
6. Trease GE, Evans WC. Pharmacognosy. 16th ed. London: Saunders Elsevier; 2009.
7. Wagner H, Bladt S. Plant drug analysis: A thin layer chromatography atlas. 2nd ed. Berlin: Springer; 1996.
8. Harborne JB. Phytochemical methods: A guide to modern techniques of plant analysis. 3rd ed. London: Chapman & Hall; 1998.