WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
Coden USA: WJPRAP Impact Factor 8.63
Volume 15, Issue 11, 1825-1840. Research Article ISSN 2277–7105

PHARMACOGNOSTICAL AND PHYSICOCHEMICAL EVALUATION OF ŚIGRU MŪLA (*MORINGA OLEIFERA* LAM.) FOR STANDARDIZATION

Dr. Renu Dixit[1]*, Dr. Bhanu Pratap Singh[2], Dr. K. V. Vijaya Bhaskara Reddy[3]

*[1]Professor & H.O.D., Department of Dravyaguna Vigyana (Materia Medica of Ayurveda).

[2]PG Scholar, Department of Dravyaguna Vigyana (Materia Medica of Ayurveda).

[3]Professor & H.O.D., Department of Shalya Tantra, TTD's Sri Venkateshwara Ayurvedic Medical College, Tirupati, Dr NTR University of Health Sciences, Andhra Pradesh, India.

Article Received on 05 May 2026,
Article Revised on 25 May 2026,
Article Published on 03 June 2026,

https://doi.org/10.5281/zenodo.20526630

***Corresponding Author**

Dr. Renu Dixit

Professor & H.O.D., Department of Dravyaguna Vigyana (Materia Medica of Ayurveda).

How to cite this Article: Dr. Renu Dixit[1]*, Dr. Bhanu Pratap Singh[2], Dr. K. V. Vijaya Bhaskara Reddy[3]. (2026). Pharmacognostical and physicochemical evaluation of śigru mūla (moringa oleifera lam.) For standardization. World Journal of Pharmaceutical Research, 15(11), 1825–1840.

ABSTRACT

Śigru (*Moringa oleifera* Lam.) is a well-known medicinal plant with immense therapeutic potential and wide application in traditional systems of medicine. It has been extensively described in classical Ayurvedic texts including Vedas, Saṃhitās and Nighaṇṭus, with specific reference to its use in various disease conditions. In Āyurveda, Śigru Mūla (*Moringa oleifera* Lam.) is recognized for its potent medicinal properties and is indicated in several disorders owing to its dīpana, pācana and śothahara actions. The plant is known to possess diverse pharmacological activities such as anti-inflammatory, antimicrobial, antioxidant and analgesic properties, making it a highly valuable drug in herbal therapeutics. The present Pharmacognostical study of Śigru Mūla (*Moringa oleifera* Lam. root) was carried out at the Siddha Central Research Institute to establish its identity and standardization parameters. The study included evaluation of macroscopic, microscopic, and powder characteristics, which revealed distinct diagnostic features useful for identification of the drug. Physicochemical parameters were also assessed as per standard procedures. In the absence of specific standards for the root in the Āyurvedic Pharmacopoeia (API), root bark values were considered for comparative reference. The overall findings provide a reliable basis for authentication, quality control, and standardization of Śigru Mūla.

KEYWORDS: Śigru Mūla, *Moringa oleifera* Lam., Pharmacognostical study, Standardization, Powder microscopy, Physicochemical analysis, Quality control.

INTRODUCTION

Śigru (*Moringa oleifera* Lam.) is a multipurpose "Miracle Tree" of the family Moringaceae, indigenous to the sub-Himalayan tracts and globally valued for its exceptional nutrient density. In the Ayurvedic tradition, it is classified under the *Śirovirecanopaga* and *Kaṭuka Skandha* (pungent) groups, characterized by its *Kaṭu-Tikta* (pungent-bitter) *Rasa* and *Uṣṇa* (hot) *Vīrya*. While the **leaves, seeds and root bark** are the primary **parts used** in therapeutic formulations, the plant is clinically **indicated** for the management of *Śotha* (inflammation), *Kṛmi* (worms), *Vidradhi* (abscesses) and *Vātavyādhi* (neuromuscular disorders). This study aims to establish rigorous **pharmacognostical standards** and **physicochemical parameters** to validate the bioactive markers and safety profile of Śigru for modern clinical use. The Present study was mainly focussed on evaluation of Pharmacognosy which includes the determination of Microscopy, Macroscopy, Identification of the drug, Powder Microscopy and Physico-chemical studies of Śigru Mūla (*Moringa oleifera* Lam.).

Aim: To standardize Pharmacognostic study of Śigru Mūla (*Moringa oleifera* Lam.) for the identification features of the roots and development of quality control parameters for Śigru Mūla.

MATERIALS AND METHODS

Collection and Identification of the plant: The fresh Śigru Mūla were collected from the natural sources of Tirupati surroundings and thoroughly washed under water to remove the impurities. Genuine, good quality material which are free from any worm infestations were collected. The fresh Śigru Mūla were collected during September, it was sent to renowned institution SIDDHA CENTRAL RESEARCH INSTITUTE, Arumbakkam, Chennai, Department of Pharmacognosy and Phytochemistry for thorough examination of the specimen. The powder of Śigru Mūla (*Moringa oleifera* Lam.) was also sent for Pharmacognostic, Powder microscopy and Physico-chemical studies. The plant specimen was authenticated by Dr. Renu Dixit, Principal and Professor, S.V. Ayurvedic College, Department of Dravyaguna, Tirupati and research officer Dr. R. Shakila; Research Officer (Chemistry) & Head, Department of Chemistry Department of Pharmacognosy and Phyto-chemistry Siddha Central Research Institute, Arumbakkam, Chennai.

DETAILS OF PHARMACOGNOSTICAL SAMPLE OF ROOT

Name of the Sample : Śigru Mūla

Scientific Name : *Moringa oleifera* Lam. Family : Moringaceae

Parts used : Root

METHODOLOGY

1. **Macroscopy** (PCOG-004-SOP): The external feature of the test sample was documented using Nikon D-5600 Digital camera.
2. **Microscopy** (PCOG-005-SOP): 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. Transverse sections were photographed using Axiolab5 trinocular microscope attached with Zeiss Axiocam208 color digital camera under bright field light. Magnifications were indicated by scale bar.
3. **Powder microscopy** (PCOG-006-SOP): A pinch of the powdered sample was mounted on a microscopic slide with a drop of 50% glycerol after clearing with saturated solution of chloral hydrate. Sample was treated with iodine solution to confirm the presence of 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.

OBSERVATION AND RESULTS

1. a) Macroscopic description

The root is conical to fusiform, tapering gradually towards the distal end; varying in size; roots are generally 10 to 25 cm long and 1 to 4 cm thick at the crown; thin lateral roots are seen emerge from the main root; outer surface is yellowish-brown to pale buff, rough, longitudinally wrinkled, and marked with fine fissures and rootlet scars; fracture is short to fibrous, exposing a whitish to cream-colored internal surface (Fig. 1); with a characteristic pungent odour and a strong acrid taste.

b) Table no. 1: Organoleptic properties of *Moringa oleifera* Lam. Root

Sr. No.	Test parameters	Root
1.	Sparśa (Touch)	rough, longitudinally wrinkled and marked with fine fissures and rootlet scars
2.	Rūpa (Colour and size)	Colour - outer surface is yellowish-brown to pale buff, exposing a whitish to cream-colored internal surface Size- generally 10 to 25 cm long and 1 to 4 cm thick at the crown;

		thin lateral roots are seen emerge from the main root
3.	Rasa (Taste)	a strong acrid taste
4.	Gandha (Odour)	pungent odour
5.	Śabda (Fracture)	short to fibrous

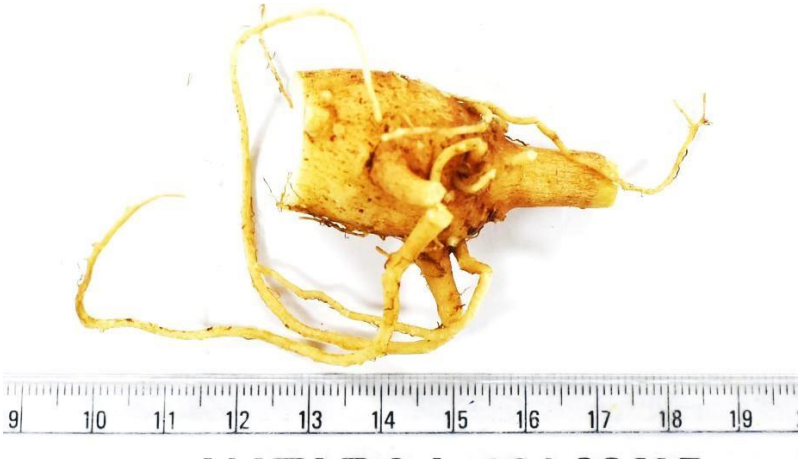


Figure 1: Macroscopy of the root.

2. Microscopy

Root (Outline and Cork): TS of root is nearly circular in outline with outermost cork consisting of 5 to 10 rows of rectangular to tangentially elongated cells which are brownish in colour due to the deposition of suberin.

Cortex: Cortex is broad and parenchymatous with large polygonal cells; numerous starch grains are seen scattered, few rosette and prismatic crystals of calcium oxalate are also present; few secretory cells like mucilage cells are also observed.

Pericycle: The pericycle occurs as a very narrow zone made up of sclerenchymatous and parenchymatous cells.

Vascular Region (Secondary growth): Well-developed secondary growth is seen with a radial and extensive vascular region.

Secondary Phloem: Secondary phloem is seen as patches outer to the xylem and is composed of sieve tubes, companion cells, phloem parenchyma and occasional phloem fibres; starch grains are seen in the phloem parenchyma.

Vascular Cambium: A continuous ring of vascular cambium separating phloem and xylem is observed.

Secondary Xylem: Secondary xylem is well developed and occupies a major portion of the section; vessels are large, circular to oval, mostly solitary or in radial multiples; fibres are thick-walled, elongated and provide mechanical strength; abundant starch is seen in xylem parenchyma.

Medullary Rays: Medullary rays are broad seen extending from the centre to the cortical region.

Pith: Pith is absent as the xylem occupies the central region (Fig. 2).

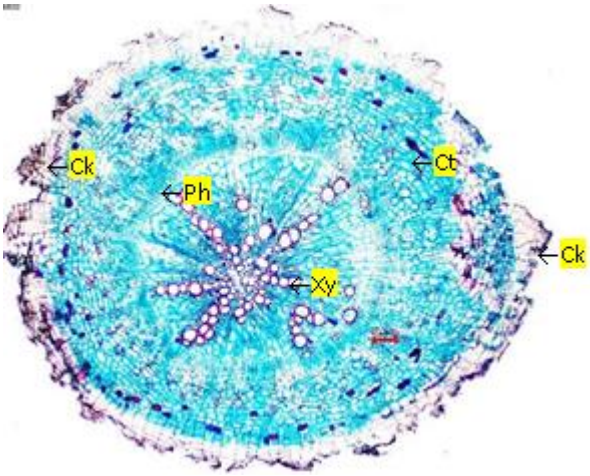


Figure 2: Microscopy of TS of root.

Ck – cork; **Ct** – cortex; **Ph** – Phloem; **Xy** - xylem

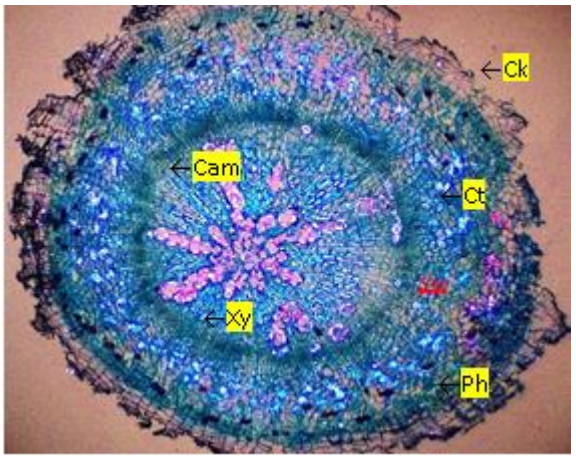


Figure 3: TS of root under polarizer.

Ck – cork; **Ct** – cortex; **Ph** – Phloem; **Xy** – xylem; **Cam** – cambium

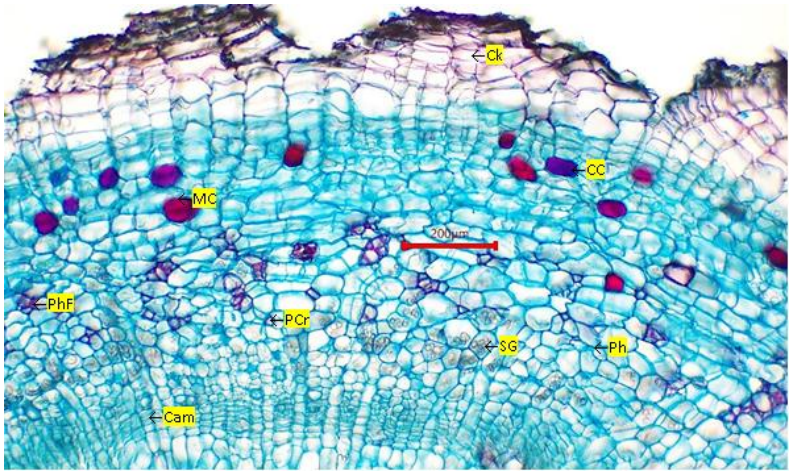


Figure 4: Enlarged outer portion.

Ck – cork; **Ph** – Phloem; **Cc** – cell content; **PCr** – prismatic crystal; **MC** – mucilage cell; **PhF** – phloem fibre; **SG** – starch grain; **Cam** - cambium

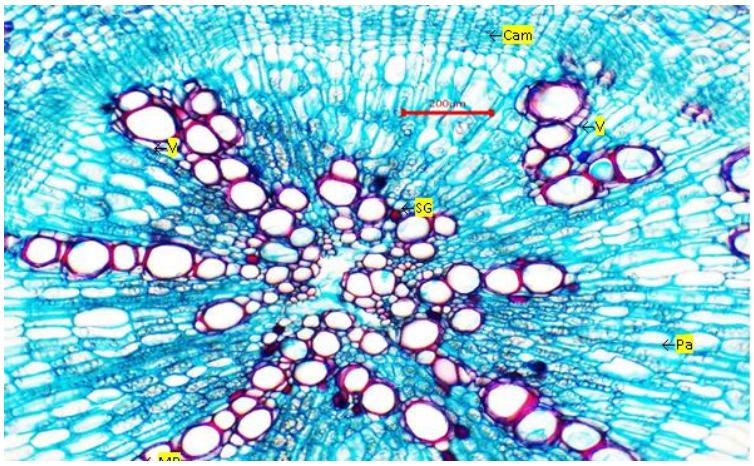
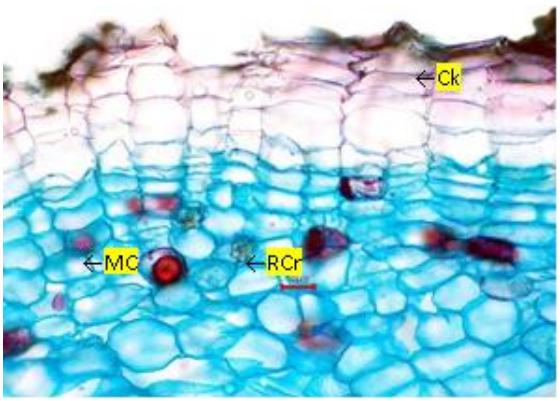


Figure 6: Enlarged vascular portion.

Cam – cambium; **V** – vessel; **Pa** – parenchyma; **MR** – medullary ray



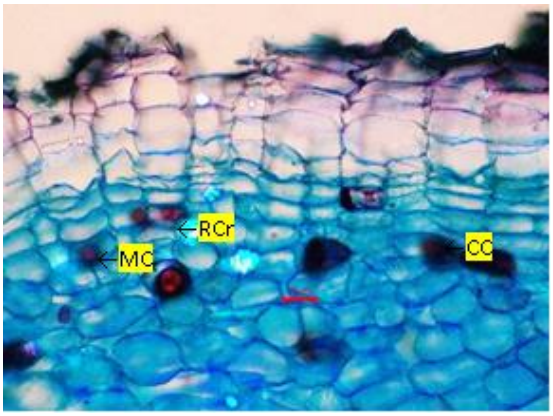


Figure 7: Enlarged cork portion. **Figure 8: Enlarged portion under polarizer.**

Ck – cork; **MC** – mucilage cell; **RCr** – rosette crystals

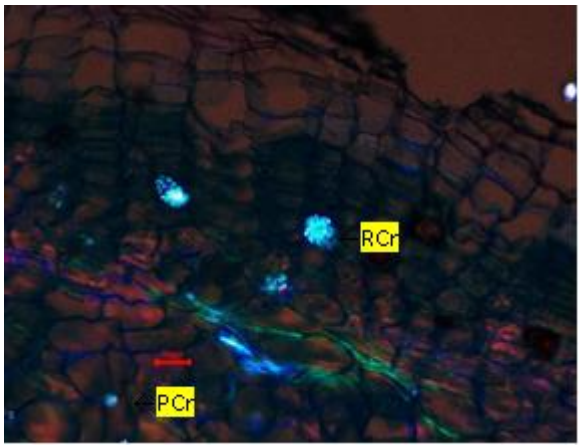


Figure 9: Crystals under polarizer.

Cc – cell content; **MC** – mucilage cell; **RCr** – rosette crystals

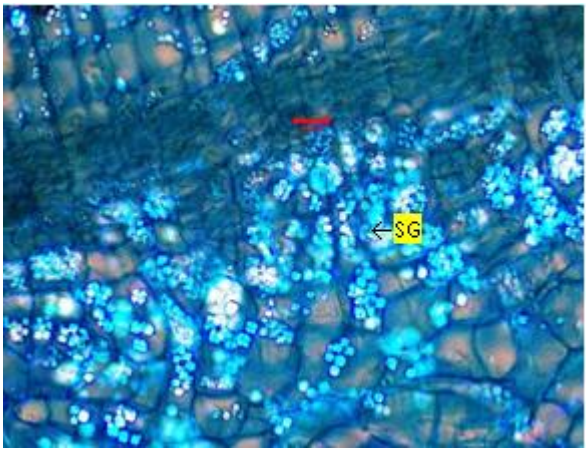


Figure 10: Starch grains under polarizer.

PCr – prismatic crystal; **RCr** – rosette crystals **SG** – starch grain

3. Powder Microscopy

The powder is dull yellowish brown in colour, with no characteristic odour and acrid taste and shows fragments of cork, parenchyma cells from the cortex, fibres, fibrosclereids, bordered pitted and reticulate vessels, stone cells, prismatic and rosette crystals, starch grains, cells with content and mucilage (Fig. 3).

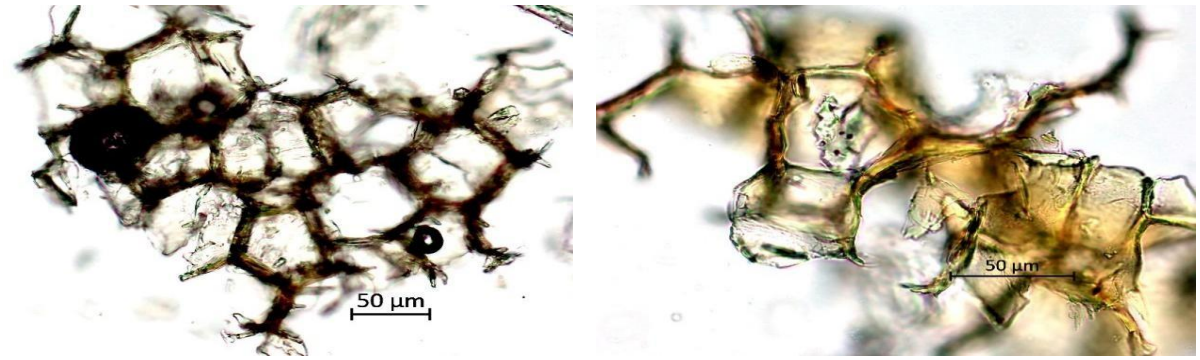


Figure 11: Cork.

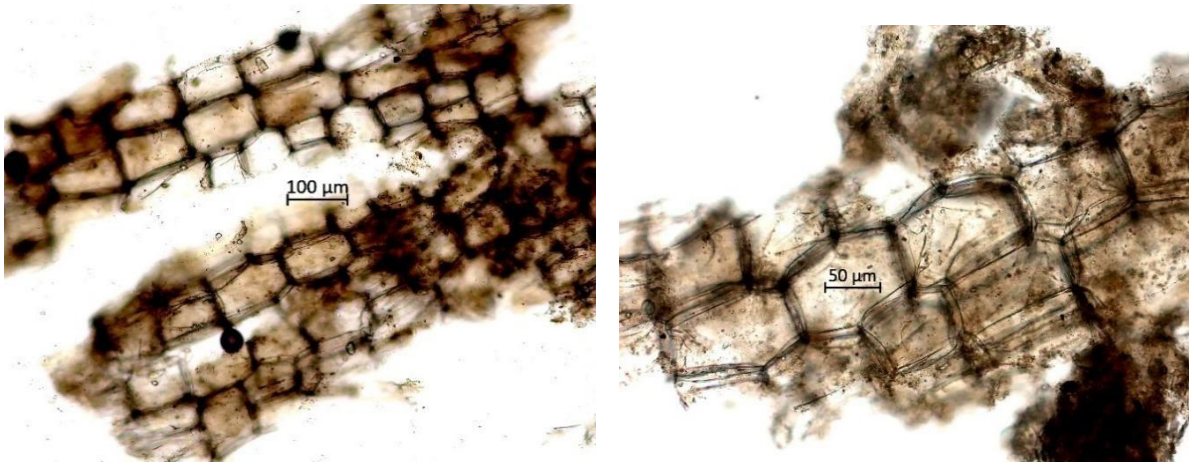


Figure 12: Parenchyma.

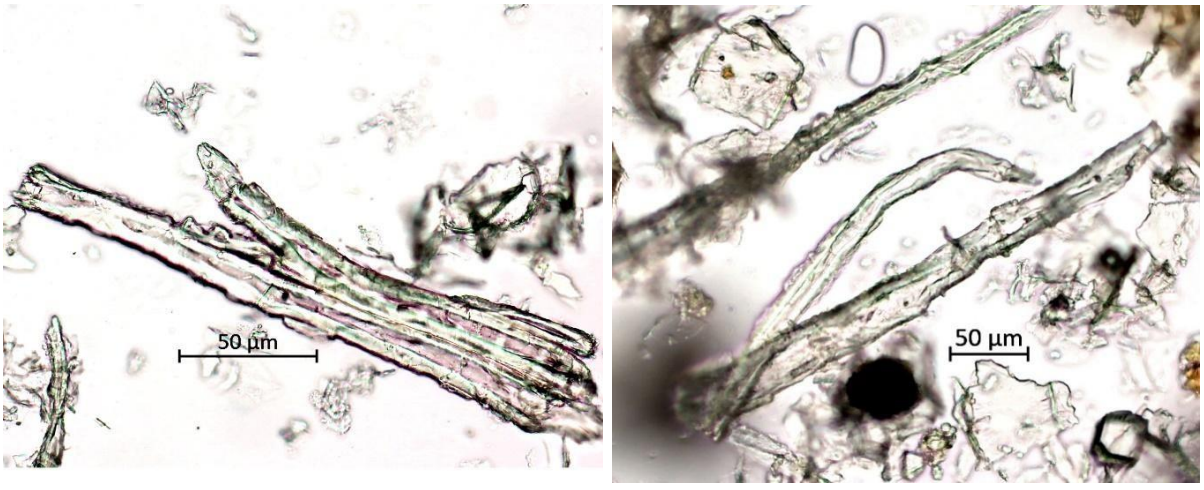


Figure 13: Fibre.

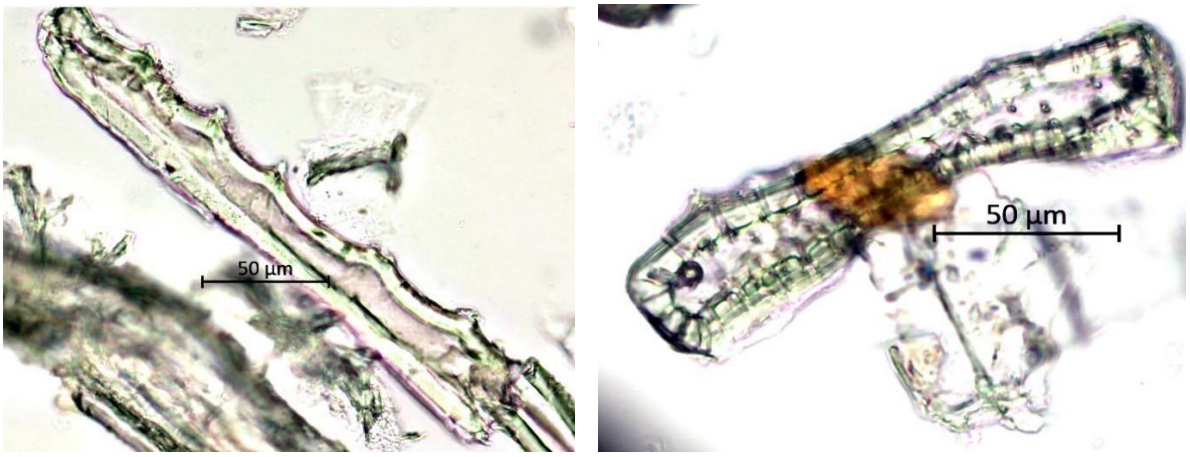
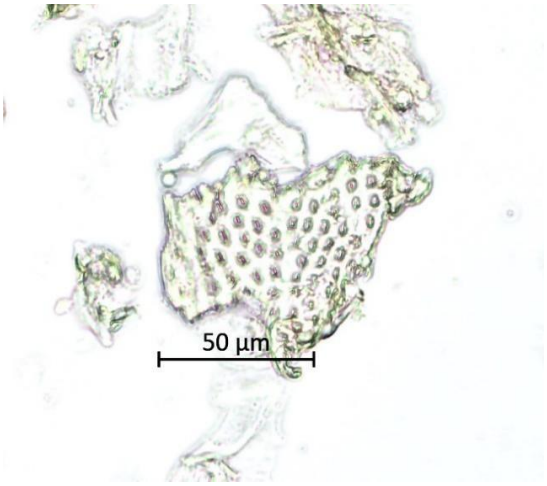


Figure 14: Fibrosclereid.



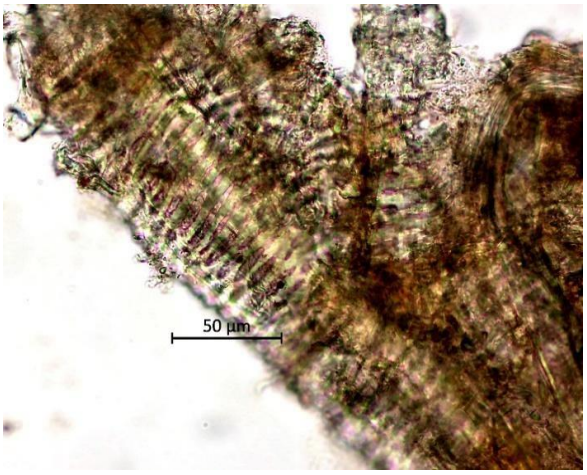


Figure 15: Bordered pitted vessel **Figure 16: Reticulate vessel.**

Figure 17: Stone cells.

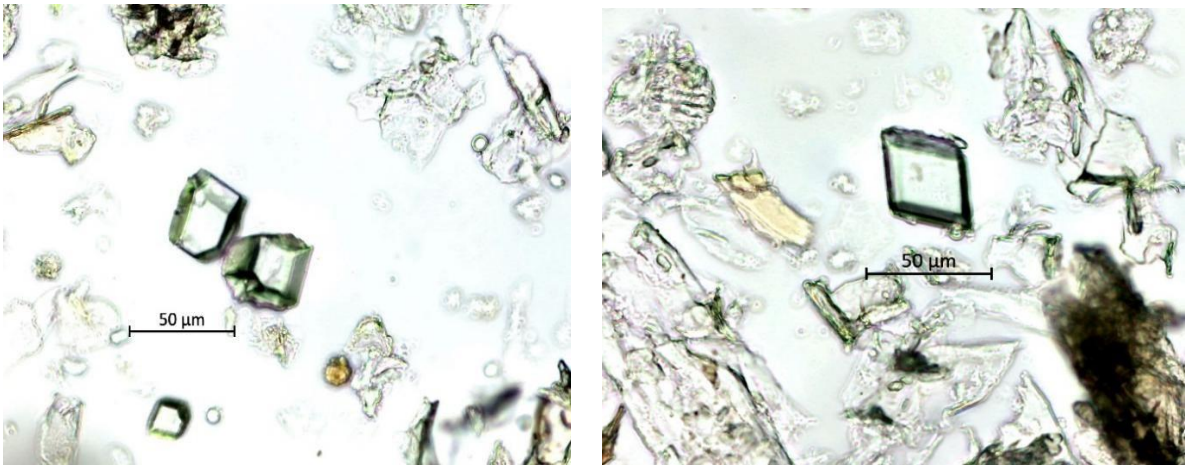


Figure 18: Prismatic crystal.

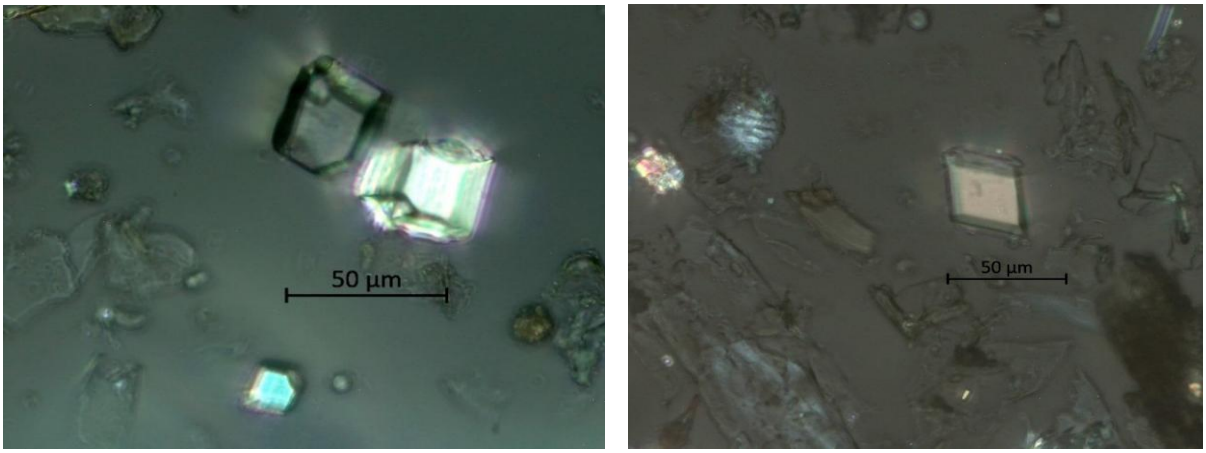


Figure 19: Prismatic crystal under polarizer

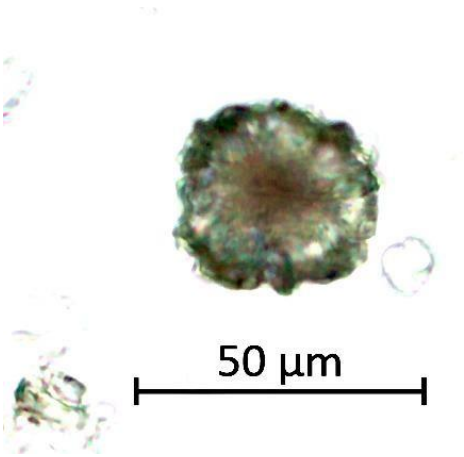


Figure 20: Rosette crystal.

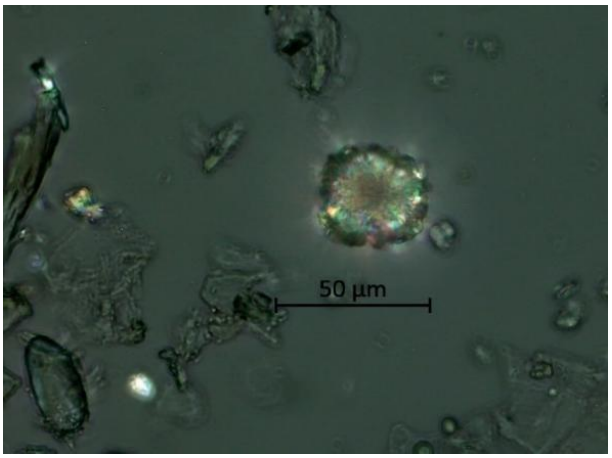


Figure 21: Rosette crystal under polarizer.

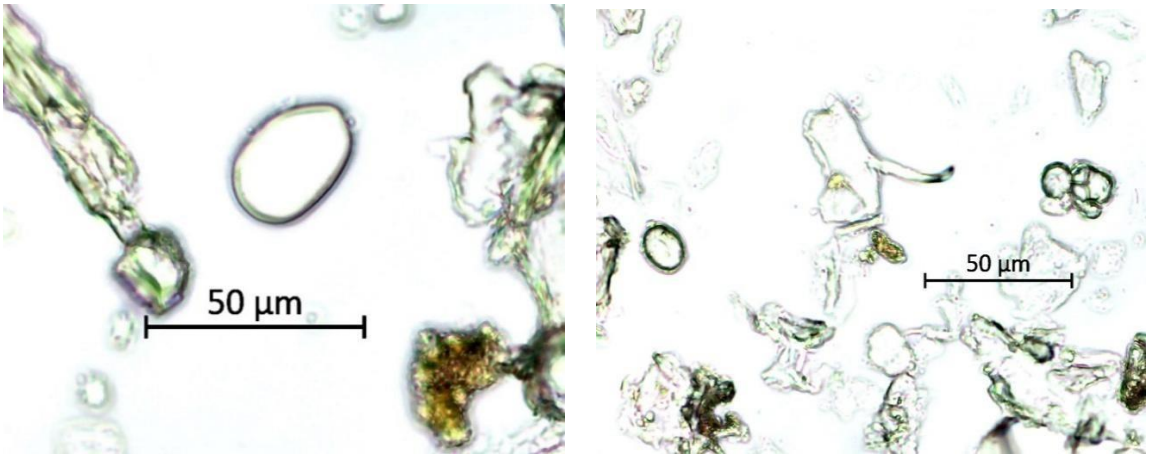


Figure 22: Starch grains.

Figure 23: Cell content.

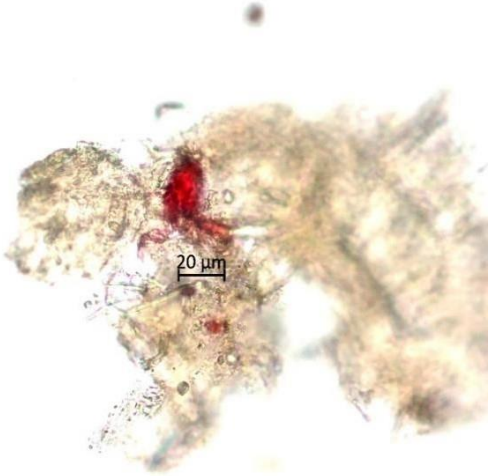


Figure 24: Mucilage.

D. PHYSICO-CHEMICAL STUDY IDENTIFY, PURITY AND STRENGTH METHODOLOGY

1) **Loss on drying at 105º C:** 10 g of sample was placed in tared evaporating dish. It was dried at 105˚C for 5 hours in hot air oven and weighed. The drying was continued until difference between two successive weights was not more than 0.01 after cooling in desiccator. The weight of the sample was used to compute the percentage of moisture.
2) **Total Ash:** 2 g of sample was incinerated in a tared platinum crucible at temperature not exceeding 450˚C until carbon free ash is obtained. The weight of the sample was used to compute the percentage of ash.
3) **Acid insoluble Ash:** To the crucible containing total ash was added with 25ml of dilute Hcl and boil. Collected the insoluble matter on ash less filter paper (Whatmann 41) and washed with hot water until the filtrate was neutral. Placed the filter paper holding the insoluble material back into the original crucible, let it to dry on a hot plate, and then lit it

under constant weight. Allowed the residue to cool in suitable desiccator for 30 mins and weighed without delay. Determined the acid insoluble ash content with the drug that had been air dried.

4) **Water soluble ash:** Boiled the ash for 5 min with 25 ml of water; collected insoluble matter on an ash less filter paper, washed with hot water, and lit for fifteen minutes at a temperature not to get above 450˚C. Subtract the weight of the insoluble matter from the weight of the ash; the difference in weight represents the water soluble ash with reference to the air-dried sample.

Table No. 2: Results of standardization parameters of Śigru Mūla (*Moringa oleifera* Lam.) Cūrṇa.

Sl. No	Name of the Experiments	Results n = (% w/w) (*Moringa oleifera* Lam. Root)	API (Appendix) (*Moringa oleifera* Lam. Rootbark)
1	Loss on Drying (105□C)	0.93%	-
2	Total Ash (600□C)	9.8%	Not more than 18%
3	Water soluble Ash	3.2%	-
4	Acid insoluble Ash	11%	Not more than 10%
5	Water soluble Extractive	20.66%	Not less than 11%

DISCUSSION

The present study comprehensively establishes the macroscopic, microscopic and powder characteristics of the root of *Moringa oleifera* Lam. providing a robust and reliable basis for its accurate identification and pharmacognostical standardization.

The macroscopic and organoleptic features—namely the conical to fusiform shape, rough and longitudinally wrinkled yellowish-brown surface, short to fibrous fracture, pungent odour and acrid taste—serve as fundamental diagnostic markers for crude drug recognition. These classical sensory parameters (Sparśa, Rūpa, Rasa, Gandha and Śabda) not only facilitate preliminary identification but also indicate the presence of active phytoconstituents responsible for its therapeutic efficacy.

Microscopic evaluation reveals a well-organized internal structure with a nearly circular outline and a protective cork composed of suberized cells. The broad parenchymatous cortex, enriched with abundant starch grains, calcium oxalate crystals, and mucilage cells, reflects significant storage and secretory activity. The narrow pericycle and continuous vascular cambium indicate active secondary growth, while the extensively developed secondary xylem

and phloem demonstrate efficient conduction and mechanical support. Features such as large vessels, thick-walled fibres and prominent medullary rays further enhance its structural integrity, whereas the absence of pith due to central xylem occupation serves as a key diagnostic hallmark.

Powder microscopy further substantiates these findings, with the drug exhibiting a dull yellowish-brown colour, acrid taste and characteristic cellular fragments including cork cells, cortical parenchyma, fibres, fibrosclereids, bordered pitted and reticulate vessels, stone cells, calcium oxalate crystals (prismatic and rosette), starch grains, and mucilage-containing cells. These micro-diagnostic elements provide an additional confirmatory tool, especially in powdered form where macroscopic identification is not feasible.

Collectively, the correlation of Macroscopic, Microscopic and Powder Microscopy characteristics offers a comprehensive and dependable standard for authentication, quality control, and detection of adulteration. This integrative pharmacognostical profile strongly reinforces the medicinal significance of *Moringa oleifera* Lam. root and supports its safe and effective utilization in herbal formulations, while also laying a solid foundation for further phytochemical and pharmacological investigations.

The physicochemical parameters provide crucial insights into the quality and purity of the drug.

a) The low Loss on drying (0.93%) indicates minimal moisture content, thereby enhancing stability and reducing the likelihood of microbial deterioration.
b) The total ash value (9.8%) falls within the prescribed limits, reflecting acceptable levels of total inorganic matter and indicating overall purity of the drug.
c) The water-soluble ash value (3.2%) denotes the presence of water-soluble inorganic constituents, suggesting a satisfactory level of physiologically important mineral content with minimal contamination.
d) The slightly elevated acid-insoluble ash value (11%) may indicate the presence of siliceous matter or extraneous earthy impurities, emphasizing the need for careful handling and processing.
e) The high water-soluble extractive value (20.66%) suggests a substantial presence of water- soluble bioactive constituents, supporting its potential therapeutic efficacy.

It is noteworthy that the official standards provided in the Ayurvedic Pharmacopoeia (API) do

not specify physicochemical parameters for the root of *Moringa oleifera* Lam. Therefore, for reference and comparative evaluation, the values of *Moringa oleifera* Lam. root bark have been considered. This comparative approach serves as a practical and scientifically justified baseline for preliminary standardization until specific standards for the root are established.

Collectively, the integration of Macroscopic, Microscopic, Powder and Physicochemical studies characteristics offer a comprehensive and dependable standard for authentication and quality control. These findings significantly enhance the Pharmacognostical profile of Śigru Mūla (*Moringa oleifera* Lam. root) and support its safe and effective use in herbal formulations, while emphasizing the need for the establishment of exclusive official standards for this plant part.

CONCLUSION

The present study establishes the macroscopic, microscopic, powder, and physicochemical standards of Śigru Mūla (*Moringa oleifera* Lam. root), providing a reliable basis for its identification and quality control. Distinct Macroscopic and Microscopic features, along with characteristic Powder microscopy, serve as key diagnostic markers for authentication.

The Physicochemical studies indicate good quality of the drug and in the absence of official standards for the root, comparison with root bark values offers a practical reference for preliminary standardization.

Overall, this study provides essential baseline data for the characterization, standardization, and detection of adulterants of Śigru Mūla (*Moringa oleifera* Lam. root), supporting its safe use in herbal formulations.

ACKNOWLEDGEMENT

The Authors express heartfelt gratitude for the timely help and providing facilities required during this Pharmacognostic study to research officer Dr. R. Shakila; Research Officer (Chemistry) & Head, Department of Chemistry Department of Pharmacognosy and Phyto-chemistry at SIDDHA CENTRAL RESEARCH INSTITUTE, Arumbakkam, Chennai.

REFERENCES

1. Kirtikar and Basu, Indian Medicinal Plants Volume I, 2nd revised edition. Dehradun: International book disributors, 2012; 676 – 683.
2. Wealth of India Vol. VI by National Institute of Science Communication and Information

Resources, CSIR New Delhi, India, reprint 2009; 425-429.

3. Indian Materia Medica (Vol.1) (Dr. K.M. Nadkarni's) by Popular Prakashan Pvt. Ltd., 1976, Reprint, 2010; 811-816.
4. Chunekar KC. Bhavaprakasa of Bhavamisra, Guduchyadivarga, Sobhanjan. Reprint ed. Varanasi: Chaukhambha Orientalia, 2015; 255-6.
5. Acharya Sushruta, Sushruta Samhita. With Nibandhsangraha Commentary of Sri Dalhanacharya, Vaidya Jadavji Trikamji Acharya, Ed. Varanasi: Choukhambha Orientalia, 8th ed., 2005; 142-66.
6. Anonymous. The Ayurvedic Pharmacopoeia of India, ebook. Part 1. New Delhi: Govt. of India: Ministry of Health and Family Welfare, Department of Indian Systems of Medicine and Homoepathy, 2003.
7. Anonymous. The Ayurvedic Formulary of India, ebook. Part 1. New Delhi: Govt. of India: Ministry of Health and Family Welfare, Department of Indian Systems of Medicine and Homoepathy, 2003.
8. API Text book of Medicine 7th edition by Siddharth N. Shah published by the association of Physicians of India, 2006; 1137.
9. API Text book of Medicine 7th edition by Siddharth N. Shah published by the association of Physicians of India, 2006; 1138-1141.
10. Harisson's principle of Internal Medicine 18th edition Chapter no 321 published by McGraw Hill-Global Education.
11. API Text book of Medicine 7th edition by Siddharth N. Shah published by the association of Physicians of India, 2006; 1161.
12. API Text book of Medicine 7th edition by Siddharth N. Shah published by the association of Physicians of India, 2006; 1161-1163.
13. API Text book of Medicine 7th edition by Siddharth N. Shah published by the association of Physicians of India, 2006; 1160-1163.
14. Gilani AH, Aftab K, Suria A, Siddiqui S, Salem R, Siddiqui BS, et al. Pharmacological studies on hypotensive and spasmolytic activities of pure compounds from Moringa oleifera. Phytother Res., 1994; 8: 87-91.
15. Shukla S, Mathur R, Prakash AO. Antifertility profile of the aqueous extract of Moringa oleifera roots. J Ethnopharmacol., 1988; 22: 51-62.
16. Fahad J, Vijayalakshmi, Satish Kumar MC, Sanjeeva, Kodancha GP, Adarsh B, et al. Antiurolithiatic activity of aqueous extract of bark of Moringa oleifera (Lam.) in rats. Health, 2010; 2: 352-5.

17. Mishra G, Singh P, Verma R, Kumar S, Srivastav S, Jha KK, et al. Traditional uses, phytochemistry and pharmacological properties of Moringa oleifera plant: An overview. Sch Res Libr, 2011; 3: 141-64.
18. Nadkarni KM. Indian Materia Medica. Mumbai: Popular Prakashan, 1994; 1319.