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EXPERIMENTAL STUDY

Microscopic Identification and Quality Assurance of *Zandu Nityam Churna*

C. S. Rana*, A. S. Kathait, M. C. Joshi, R. K. Rai

[1]Senior Manager, Pharmacognosy Lab, Department of Bio-resource Development, Zandu Advanced Ayurvedic Research Centre (ZAARC), Emami Limited, Kolkata, West Bengal, India
[2]Deputy Manager, Department of Bio-resource Development, Zandu Advanced Ayurvedic Research Centre (ZAARC), Emami Limited, Kolkata, West Bengal, India
[3]Assistant General Manager, Zandu Advanced Ayurvedic Research Centre (ZAARC), Emami Limited, Kolkata, West Bengal, India
[4]Head, Health Care Division, Zandu Advanced Ayurvedic Research Centre (ZAARC), Emami Limited, Kolkata, West Bengal, India

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ABSTRACT

Introduction: Constipation is a common digestive disorder with multiple underlying causes. Zandu Nityam Churna is a classical Ayurvedic formulation known for its laxative properties and pleasant taste, which relief in general constipation. This formulation contains key herbal ingredients such as *Svarnapatri*, *Erand*, *Haritaki*, *Baheda*, *Amla*, *Yashtimadhu,* and *Saunf*. These ingredients have been examined through powder microscopy for authentication and validation of the finished product. Despite the availability of advanced analytical tools, microscopic evaluation remains one of the simplest and most effective techniques for the identification of crude herbal drugs. Various published literature have also supported microscopic authentication and quality control of herbal churna formulations.

Materials and Methods: The powdered sample was soaked in water to soften the materials and then centrifuged for 5 min for the sedimentation. The suspended portion of the sample was carefully transferred to clean Petri dish and mounted with glycerin and then analyzed under a Labomed Microscope to identify the specific cellular structures, starch grains, and crystals at different magnifications.

Results and Discussion: Zandu Nityam Churna microscopy revealed the presence of stomata and trichomes in the leaf fragments of Svarnapatri (*Cassia angustifolia* Vahl.), oil globules of Erand (*Ricinus communis* L.), epicarp cells and brachysclereids types stone cells of Amla (*Phyllanthus emblica* L.), osteosclereids types stone cells and parenchymatous tissue of Haritaki (*Terminalia chebula* Reitz.), spiral vessels and stone cells of Baheda (*Terminalia bellerica* Gaertn. Roxb.), xylary vessels and stone cells of Yastimadhu (*Glycyrrhiza glabra* L.), and aleurone grains and mericarp cells of the fruits of Saunf (*Foeniculum vulgare* Mill.).

Conclusion: Powder microscopy serves as a vital tool in the authentication of powdered formulations. This technique is mainly important in the context of herbal medicines, where accurate identification of plant materials is essential. Employing such investigative methods can enhance consumer confidence in the authenticity and reliability of Churna formulations.

1. INTRODUCTION

Nityam Churna is formulated with the herbal ingredients such as Svarnapatri, Erand (castor), Triphala (Amla, Haritaki, and Baheda), Yastimadhu, and Saunf, which gently clean, lubricate, and moisturize the intestinal wall and help in regular bowel movements. Svarnapatri helps ease bowel movement, Erand taila helps improve intestinal movement, Triphala aids in maintaining gut health, Yashtimadhu assists in soothing the intestine, and Saunf provides relief from intestinal cramps.[1-8] Zandu Nityam Churna is an Ayurvedic laxative, and it has a pleasant taste which provides relief in general constipation. Constipation is a common digestive problem where a person has infrequent, difficult, or painful bowel movements. The most common causes of constipation include not eating enough fiber, vegetables, and

Corresponding Author:
C. S. Rana, Pharmacognosy Lab,
Department of Bio-resource Development, Zandu Advance Ayurvedic Research Centre, Emami Limited, Kolkata, West Bengal, India.
Email: drcsir@gmail.com

cereals as well as not drinking enough fluids. Foods that can cause constipation include processed foods, red meat, fried foods, and excessive dairy, which are low in fiber and high in fat (Anonymous).

Powder microscopy is a technique used primarily in pharmaceutical sciences, materials science, and forensic science to examine the microscopic properties of powdered (churna) substances. It involves analyzing particles using a microscope to determine their physical characteristics such as size, shape, and surface texture.[9-11] Powder microscopy is a valuable technique used to identify and authenticate plant-based materials in finished goods.[11-13] This method involves analyzing microscopic features of usable plant parts–such as cellular structures, tissue types, vascular elements, presence of specific crystals, and starch grains–to determine their botanical origin. Microscopy is an effective tool in detecting adulteration and ensuring the authenticity of herbal drugs and their genuine plant parts as per texts.[12,13] In the herbal drug industry, genuine raw materials from certain plants are often reported to be used interchangeably with others due to substitution and adulteration.[14] Microscopy can serve as a vital tool in identifying the presence of unwanted foreign matter, maintaining consistent quality, and ensuring the efficacy of the finished products.

Considering all the aforementioned facts, the present study was undertaken to examine the cellular and tissue-level characteristics of the herbal ingredients present in the churna formulation. This effort aims to reinforce public trust in Ayurveda and the authenticity, safety, and efficacy of Ayurvedic products/herbal medicines.

2. MATERIALS AND METHODS

Zandu Nityam Churna (powders) sample was dipped in chloral hydrate/water solution to soften and centrifuged 5 min for sedimentation. Supernatant was discarded to obtain a cleaned pellet. Suspended material of the sample was transferred to a clean glass microslide and mounted with a drop of glycerine. For the microscopic study, glycerine-mounted slides were viewed under a light microscope to study various tissues, cells, and crystals. Slides were observed under a Labomed microscope and captured images ×10 and ×40 magnifications using a vision camera. Genuine raw drug samples were crushed into a powdery mass and passed through a sieve to obtain a fine powder to identify individual ingredients as in-house standards/references. The sample appearances were matched with in-house standard images of the concerned species/usable plant parts.

3. RESULTS AND DISCUSSION

Zandu Nityam Churna would reveal the cells and tissues of its constituent herbs/herbal raw drugs. Key ingredients such as *Svarnapatri* (Senna) leaves, *Erand* (Castor) oil, *Triphala* (*Amla*, *Haritaki*, *and Baheda*) fruits, *Yashtimadhu* (Licorice) roots, and *Saunf* (Fennel) fruits have been identified based on their microscopic feature such as cell and tissue types, vascular elements, and presence of specific crystals, simple and compound starch grains [Figure 1].

Powder microscopy revealed characteristic microscopic features of the individual ingredients present in the *Churna* formulation. These microscopic observations align with the known diagnostic features of each raw drug component. Svarnapatri (*Cassia angustifolia* Vahl.) leaves showed surface view of the epidermis, anomocytic stomata, and unicellular, thick-walled, warty, straight, and bent trichomes. Erand (*Ricinus communis* L.) seeds displayed the presence of distinct oil globules. *Amla* (*Phyllanthus emblica* L.) fruits exhibit brachysclereid-type stone cells, fragments of sclereid fibers, spiral xylem vessels, scleroid stone cells, and the epicarp surface. *Haritaki* (*Terminalia chebula* Reitz.) fruits exhibited osteosclereids-type stone cells, elongated-lumen stone cells, parenchyma, silica crystals, crisscross fibers, and epidermal cells. *Baheda* (*Terminalia bellerica* Gaertn. Roxb.) Fruit powder showed macrosclereid-type stone cells, broad-lumen stone cells, spiral vessels, and unicellular bent trichomes. *Yastimadhu* (*Glycyrrhiza glabra* L.) presented fragments of pitted vessels with reticulate thickening, round to oval simple and compound starch grains, brachysclereid-type stone cells, and hexagonal calcium oxalate crystals. Saunf (*Foeniculum vulgare* Mill.) showed fragments of the mericarp cells, aleurone grains, secretory canal, and parenchyma cells [Figure 2].

According to the literature, the following diagnostic microscopic features are characteristic of the individual plant materials commonly used in herbal formulations: *Svarnapatri* (*C. angustifolia*) - Senna: Powder microscopy shows fragments of the leaf with typical anomocytic stomata, both covering and glandular trichomes, calcium oxalate crystals, palisade cells, and spongy mesophyll tissue.[15] Erand (*R. communis*) - Castor: Microscopy demonstrates fragments of the seed coat, endosperm cells, and prominent oil globules.[16] Amla (*P. emblica*) - *Amalaki*: Microscopy typically reveals fragments of the pericarp containing parenchyma cells, vascular bundles, and stone cells.[17,18] *Haritaki* (*T. chebula*) - Myrobalan: Characteristic features include fragments of the endocarp with stone cells and sclereid fibers.[19] Baheda (*T. bellerica*) - Bibhitaki: Powder microscopy reveals fragments of the pericarp with sclereids and fibrous tissue.[20] *Yashtimadhu* (*G. glabra*) - Licorice: Diagnostic features include fragments of root parenchyma, xylem vessels, and fibers.[21] Saunf (*F. vulgare*) - Fennel: Microscopic examination reveals fragments of the fruit containing oil globules, mericarp, parenchyma, and schizogenous oil ducts.[22]

Svarnapatri (*C. angustifolia*), commonly known as Senna, is a small shrub native to North Africa, with its wild habitats found in arid regions such as Somalia, Ethiopia, Sudan, and parts of Arabia. It has been naturalized and widely cultivated in India, particularly in the semi-arid regions of Rajasthan, Gujarat, Tamil Nadu, and Karnataka. The leaves are rich in anthraquinone glycosides, especially sennosides A and B, which are extensively used for laxatives. Beyond their purgative action, the chemical composition, solubility, bioavailability, and quantity of these phytoconstituents influence the plant's antibacterial, anti-inflammatory, and antioxidant properties.[1,2]

Erand (*R. communis*), commonly known as castor, is a fast-growing shrub or small tree that thrives in disturbed habitats and warm climates. It is commonly found in wastelands, along roadsides, and near water bodies. All parts of the plant are used medicinally; the seeds are especially valued for their oil, which possesses strong laxative properties. Phytochemical investigations have revealed the presence of alkaloids, flavonoids, glycosides, saponins, steroids, and fatty acids–most notably ricinoleic acid, the major component of castor oil. These constituents contribute to the plant's pharmacological activities, including digestive support, pain relief, antioxidant, anti-inflammatory, anti-diabetic, antimicrobial, and anti-fertility effects.[3,10]

Amla (*P. emblica*), commonly known as Indian gooseberry or Amlaki, is a small to medium-sized deciduous tree native to tropical and subtropical regions of Asia. The fruit is an exceptionally rich source of Vitamin C and various antioxidants, contributing to improved immunity, cardiovascular health, and skin and hair care. Both fresh and dried fruits contain significant levels of phytochemicals such as tannins and flavonoids, which account for their broad pharmacological spectrum.

Amla is used to manage conditions such as common cold, fever, cough, asthma, bronchitis, diabetes, headache, ophthalmic disorders, dyspepsia, colic, flatulence, hyperacidity, peptic ulcer, skin diseases, anemia, inflammation, jaundice, diarrhea, dysentery, hemorrhages, leukorrhea, menorrhagia, and various cardiac ailments.[23,24]

Haritaki (*T. chebula*), commonly known as Harad or black Myrobalan, is a deciduous tree that thrives in tropical, subtropical climates and dry and mixed deciduous forests across India, Sri Lanka, and Myanmar. Harad fruits are highly esteemed in traditional systems of medicine, particularly Ayurveda, for their broad spectrum of therapeutic properties. The fruits are rich in bioactive compounds, including tannins, phenolic acids, triterpenoids, and flavonoids, which contribute to their antioxidant, anti-inflammatory, and antibacterial activities.[25-29]

Baheda (*T bellerica*), also known as *Bibhitaki*, is a large deciduous tree native to India and Southeast Asia. It typically grows in tropical and subtropical zones, adapting to diverse ecosystems such as plains, lower hills, scattered forests, mountain slopes, and upper stream valleys in seasonal rainforests. The fruit is an important component in classical Ayurvedic formulations and is valued for its extensive therapeutic properties. *Baheda* is rich in phytochemicals, including glycosides, flavonoids, tannins, and phenolic compounds, which confer anti-inflammatory, anti-diabetic, antimicrobial, hepatoprotective, antipyretic, antidiarrheal, and antihypertensive effects.[30-33]

Yastimadhu (*G. glabra*), commonly known as licorice, is a perennial herb native to parts of Asia and Europe and is cultivated in the northwestern regions of India. It flourishes in warm, temperate to subtropical climates, preferring deep, well-drained, and fertile soils with ample sunlight. The roots of Mulethi hold great significance in Ayurveda and other traditional medicine systems due to their diverse pharmacological activities. Key phytoconstituents include glycyrrhizin, flavonoids, alkaloids, glycosides, saponins, and phenolic compounds. Pharmacological studies have confirmed its antibacterial, antioxidant, anti-inflammatory, antiulcer, antidiabetic, and antiviral properties.[34]

Saunf (*F. vulgare*), commonly known as fennel, is a hardy perennial herb native to the Mediterranean region and extensively naturalized and cultivated throughout the world. It thrives in dry, well-drained soils and is adaptable to a wide range of dry climatic conditions. Fennel seeds are traditionally used to support digestion, relieve bloating, gas, and constipation due to their high dietary fiber content. Phytochemical analyses reveal the presence of essential oils, flavonoids, phenolic compounds, and other volatile constituents, which contribute to fennel's antimicrobial, antioxidant, antiseptic, anti-inflammatory, anti-aging, and antispasmodic activities.[7,8]

4. CONCLUSION

Powder microscopy plays a vital role in the authentication of powdered (churna) formulation. This approach is crucial for maintaining the purity, safety, and efficacy of Ayurvedic medicines. Zandu Nityam Churna serves as a representative example of how microscopic analysis supports quality assurance in traditional/classical formulation. The present study emphasizes the distinctive microscopic features of key plant parts used in Nityam Churna. Misidentification and adulteration are critical challenges in the herbal industry, underscoring the urgent need for accurate identification and stringent quality control of herbal raw drugs/raw materials. The presence of all usable plant parts may strengthen public confidence in the authenticity and efficacy of Zandu Nityam Churna.

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6. AUTHORS CONTRIBUTIONS

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7. FUNDING

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8. ETHICAL APPROVALS

This study does not require ethical permission as it is an experimental study.

9. CONFLICTS OF INTEREST

Nil.

10. DATA AVAILABILITY

This is an original manuscript and all data are available for only review purposes from principal investigators.

11. PUBLISHERS NOTE

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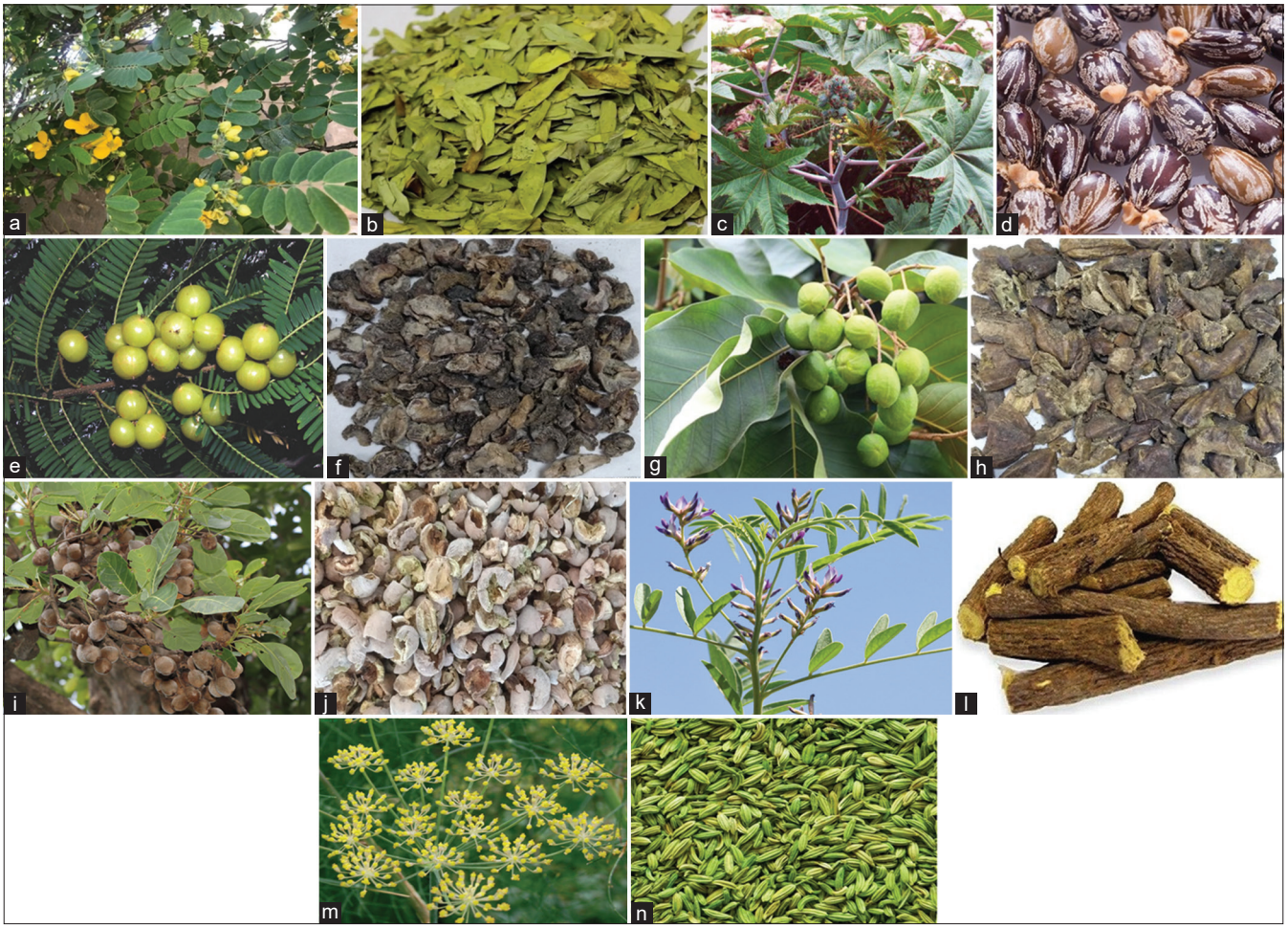

Figure 1: Key Herbal Raw Ingredients of Zandu Nityam Churna. (a) Svarnapatri (*Cassia angustifolia*) fresh leaves, (b) Svarnapatri dry leaves, (c) Erand (*Ricinus communis*) fresh fruits, (d) Erand dry seeds, (e) Amla (*Phyllanthus emblica*) fresh fruits, (f) Dry and deseeded fruits of Amla, (g) Haritaki (*Terminalia chebula*) fresh fruits, (h) Dry and Deseeded Fruits of Haritaki, (i) Baheda (*Terminalia bellirica*) fresh fruits, (j) Dry and deseeded fruits of Baheda, (k) Yastimadhu (G*lycyrrhiza glabra*) Habit, (l) Yastimadhu dry roots, (m) Saunf (*Foeniculum vulgare*) fresh fruits, (n) Saunf dry fruits/seeds

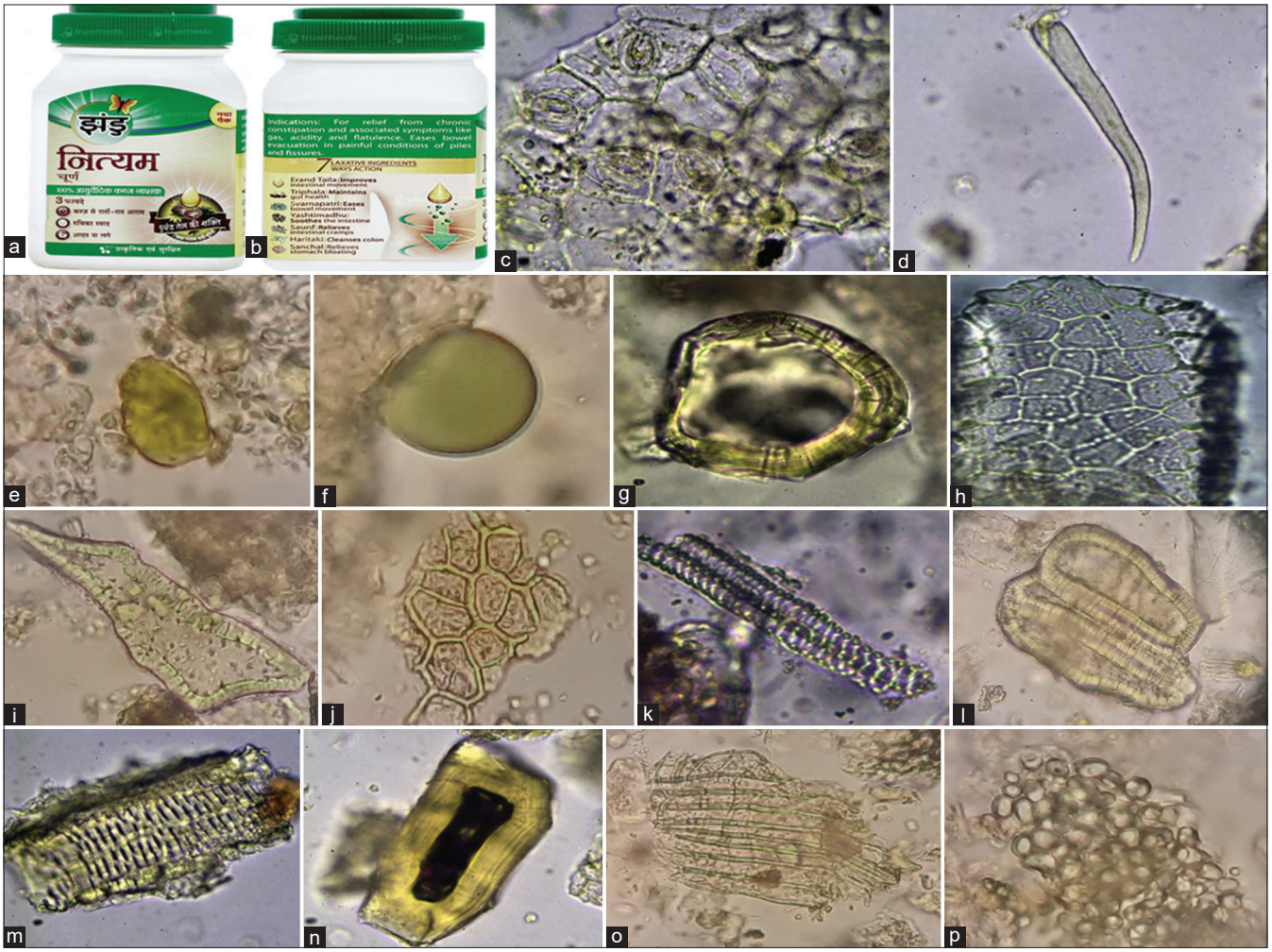

Figure 2: Microscopic Images of the Ingredients of Zandu Nityam Churna. (a) Front View of Zandu Nityam Churna, (b) Side View of Zandu Nityam Churna, (c) Stomata of Svarnpatri leaf, (d) Trichome of Svanpatri leaf, (e) Oil globule of castor seeds, (f) Oil globule of castor seeds, (g) Brachyscleried type stone cell of Amla, (h) Epicarp cells of Amla Fruits, (i) Osteoscleried type stone cell of Haritaki, (j) Parenchyma of Haritaki Fruits, (k) Spiral vessels of Baheda Fruits, (l) Stone cells of Baheda Fruits, (m) Xylary Vessels of Mulethi Roots, (n) Stone cell of Mulethi Roots, (o) Mericarp cells of saunf fruits, (p) Aleurone grains of Saunf Seeds