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Original article

# Triphala churna, myth and microscopic characterization

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**Abstract**

Anatomically/histologically, there are two types of sclerenchyma; elongated fibre and variously shaped sclereid. Collectively sclerenchyma cells make sclerenchyma tissue. These cells do not possess living proplasts at their maturity. Sclerenchyma is a supporting tissue, having thick wall lignified cells, whose main function is mechanical support. Fibres are elongate and sclereids are isodiametric. Fibres are often organised into bundles; there are some surface, xylary and extraxylary fibres. Sclereids are packed together very densely; they are recognized as stone cells. Astrosclereids, brachysclereids, macrosclereids, osteosclereids, trichosclereids and filiform sclereids are quite common. Interestingly, in triphala churna, most of the cells are recorded with sclerenchyma. Brachysclereid, osteosclereid and macrosclereid types stone cells are recorded in Amla (*Emblica officinalis* Garten), Harad (*Terminalia chebula* Retz.) and Baheda (*Terminalia bellerica* (Gaertn.) Roxb.) fruits, respectively. Thick walled lignified fibres and sclereids at micro level are most commonly same in all ingredients of the triphala churna. They are separately similar and dissimilar in their shape, size and texture. These fine particles can help to motion of the molecules as Quantum Physics (nature and behaviour of the matters) has suggested. Definitely, the prime formulators were aware of these things during composing this formulation. In the present study, this can validate the most ancient and traditional claims to wider acceptability and activity of triphala churna. Some interesting points are also evaluated at micro level.

**Key words:** Triphala, anatomy, histology, powder microscopy, formulation, validation

## 1. Introduction

Ayurveda, Unani and Siddha using mainly plant based drugs, are the traditional medical systems, which have survived through more than 3000 years (Ravishankar and Shukla, 2007). The Materia Medica contains a rich heritage of indigenous herbal practices that have helped to sustain the health of most rural people of India. Triphala Churna is one of them which is a staple of Ayurvedic medicine in India. It is also considered the most consumed formulations in India. It is also used as ingredients of different formulation and in manufacturing process of different formulation to support different intermediate processes. Triphala is a herbal rasayana (rejuvenation) formula which constituent equal parts of three myrobalans fruits, taken without seeds. Amla (*E. officinalis*), Baheda (*T. bellirica*), and Harad (*T. chebula*) are the main ingredients (Bhavprakash Nighantu, 2010). Chebulic Myrobalan (Haritaki), Belleric Myrobalan (Bibhitaki) and Indian Gooseberry (Amalaki) drupe fruits are part of the popular Ayurvedic medicine (Dravyagun Vigyan, 2011). Triphala churna (TC) is basically the powdered form of Triphala (three drupes). The word 'phala' adopted from Sanskrit literature, meaning fruits. Fruit is the essence of the tree itself and triphala churna with these fruits has all healing properties. TC benefits in various health disorders, especially the ones related to the digestive system (Bhavprakash Nighantu, 2010). TC is also known as the caretaker of all internal organs of our body. Many people consume this Ayurvedic medicine for weight loss, as it is an efficient metabolic stimulator (Dravyagun Vigyan, 2011). TC is a formulation that is majorly famous as an effective mild laxative (Mukherjee *et al.*, 2006). It helps in improving assimilation of the foods. Triphala has also known as one of the best natural colon cleansers. TC benefits in lots of health problems like indigestion and constipation. It increases the immunity level of a body and, thus helps in fighting with various types of infections. Triphala churna benefits in skin related problems as well. It removes dead cells and rejuvenates the skin cells to bring natural glow (Chamundeeswari *et al.*, 2007; Kaushika *et al.*, 2007). It also helps in correcting numerous ailments like scars, sunburns or skin rashes. TC has an amazing antioxidant property and it diminishes the oxidative pressure on the body. The regular use of Triphala powder certainly detoxifies body and retains efficacy of the whole digestive tract. Its anti-inflammatory property even helps a lot in various orthopedic health conditions like arthritis (Sen *et al.*, 2016). In addition, TC is beneficial in all types of eye diseases like cataract, progressive myopia, conjunctivitis. TC strengthens the brain cells and attentiveness by cutting off anxiety and nervousness which enhances memory power (Anonymous). Galic acid has anti mutagenic activity (Kaur *et al.*, 2002).

There are exceptionally few herbs in Ayurveda which comprises all five different tastes (rasas) (sweet, sour, salty, bitter and pungent). Triphala is one of them (instead Baheda fruit) have concentrated taste, effective and broad spectrum formula for balancing all three doshas (Bhavprakash Nighantu, 2010). Vata, pitta and kapha are three Ayurvedic doshas which are mainly responsible for the

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fundamental principles of Ayurvedic physiology (Dravyagun Vigyan, 2011). Haritaki is good for vata dosha, Bibhitaki is good for kapha dosha and Amalaki is good for pitta dosha. We experience good health, when these doshas are in balanced and we experience disease and ailments when they are out of balance. Churna is defined as a fine powder of drugs in Ayurvedic system of medicine (Chamundeeswari *et al.*, 2007). It is similar to powder formulations in Allopathic system of medicine. Triphala churna, trikatu churna, nyagrodhadi churna and sudarshana churna are some of example (Simbha and Laxminarayana, 2007; Kaushika *et al.*, 2006). In recent days, churna is formulated into tablets in order to fix the dose, make it more effective, palatable and convenient to carry. Smaller particle size increases absorption from gastro intestinal tract (G.I.T) and, hence the greater is bioavailability (Chamundeeswari *et al.*, 2007).

Every healthcare system will get paralyzed without having safe/ potent drugs (Unnikrishanan *et al.*, 2015). So, for a quality assurance of herbal products, standardization of a formulation is required (Ekka *et al.*, 2008; Rahman, 2017). Standardization might be based on microscopical, physical and phytochemical parameters (Rahman, 2017). Powder microscopy could be useful to authenticate the drugs and it might be easy, reliable and cost effective tools for disclosure of adulteration and substitutions. In herbal drug, parts of plants (leaves, seeds, fruits, barks and roots) are determined by the text or formulator. We assume that definitely there was some similarity of the plant parts in its ingredients, was considered at micro level, during prime development of this formulation/classified as a group of herbs which are collectively indicated for diseases and are taken as ingredients in the formulations. Keeping the facts in mind, present study has been carried out to revamp the gap for validation.

## 2. Material and Methods

### 2.1 Collection and identification

Wild collection of the plant species developed into herbarium specimens and identified from Botanical Survey of India (BSD), Dehradun (No. 116630). The usable fruit parts of the plants have kept in the museum as reference sample or as a standard for future references.

### 2.2 Sample preparation

Triphala churna powders was dipped in water and centrifuged for five minutes to soften and sedimentation. Supernatant was discarded to obtain cleaned pellet.

### 2.3 Mounting

Suspended material of the sample was transferred to a clean glass micro slide and mounted with a drop of glycerin (Khandelwal, 2012).

### 2.4 Observations

Slides were observed under axiostar plus microscope and captured images 10X and 40X magnifications using the camera AxioCam ICc5.

### 2.5 Microscopical evaluation

It was done for different sample images at different appearances. The sample appearances were matched with in-house standards of the concern species.

## 3. Results

Powder microscopy/histology of market and in-house triphala churna shown the presence of brachysclereid type of stone cells; epicarp surface; fragments of sclereid fibres; spiral xylem vessels and scleroid stone cells; osteosclereid type of stone cells; elongated lumen stone cells; parenchymatous silica crystals; criss cross fibres; epidermal cells; macrosclereid type of stone cells; broad lumen stone cells; spiral vessels and trichomes of the fruits of Amla (*E. officinalis*), Harad (*T. chebula*) and Baheda (*T. belerica*), respectively (Figures 1-14). Meanwhile, (Ashokkumar, 2007; Kaushika *et al.*, 2007; Shivakumar *et al*,. 2016) have already been observed acicular and druce calcium oxalate, simple and compound starch grains, isolated or grouped spherical, elongated to horizonatal stone cells, spiral, pitted vessels, unicellular and multicellular covering trichomes and lignified epidermal cells in the ingredients of triphala churna.

Anatomy and powder microscopy of Amla (*E. officinalis*) fruits shown presence of the epicarp in surface and in transverse cut view; longitudinal cut thick-walled parenchyma; thick-walled fibres and sclereidal fragments; bundle of xylem elements formed by spiral and scalariform vessels; mesocarp cells with pitted lignified parenchyma having starch grains and tannin cells; highly pitted sclereids fibres of endocarp; fragments of thin walled phloem parenchyma and thick walled sclereids (Ekka *et al.*, 2011; Kavita *et al.*, 2016; Meghashree *et al.*, 2017). Mean while in the present study microscopical characteristics of *E. officinalis* fruits are observed as brachysclereid types of stone cell (Figure 1); epicarp surface (Figure 2); fragments of sclereid fibres (Figure 3); spiral xylem vessels (Figure 4) and scleroid stone cells (Figure 5).

**Figure 1:** Brachysclereid types stone cell of Amla fruit.

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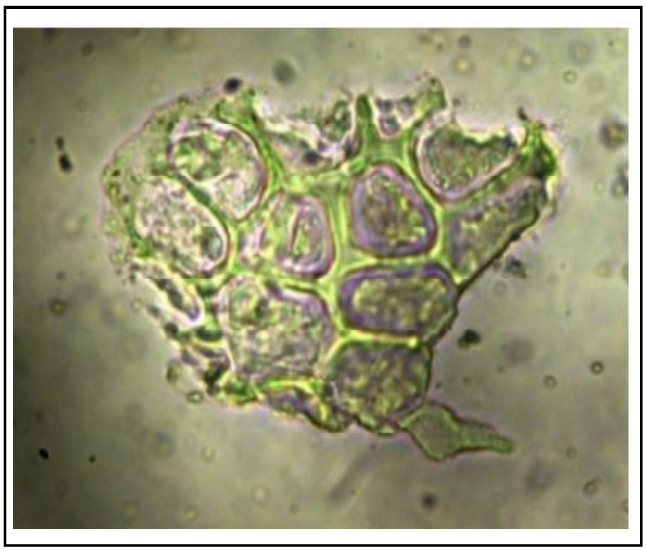

**Figure 2:** Epicarp surface of Amla fruit.

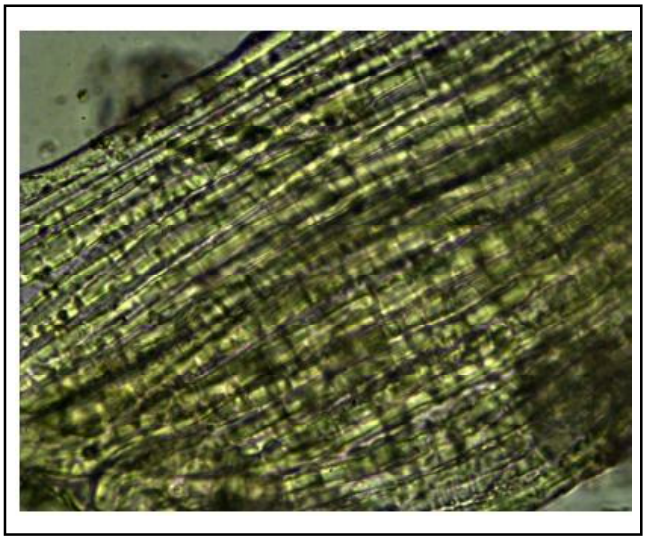

**Figure 3:** Fragments of sclereids fibres of Amla fruit.

**Figure 4:** Spiral xylem vessels of Amla fruit.

**Figure 5:** Scleroid stone cells of Amla fruits.

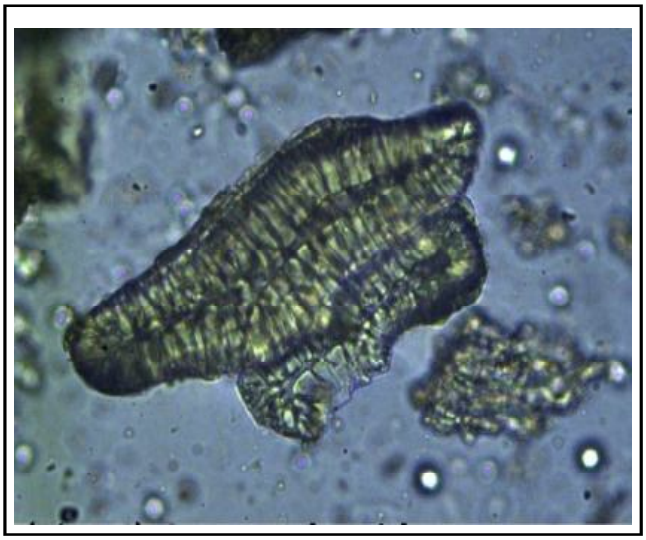

**Figure 6:** Osteosclereid types stone cell of Harad fruits.

**Figure 6:** Osteosclereid stone cells of Harad fruit.

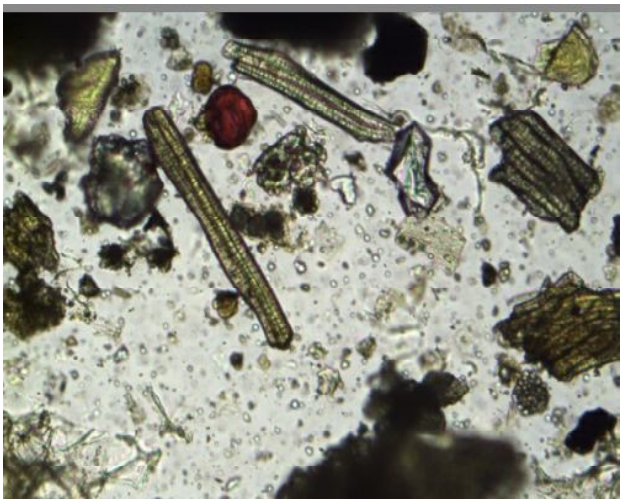

**Figure 7:** Elongated stone cells of Harad fruit.

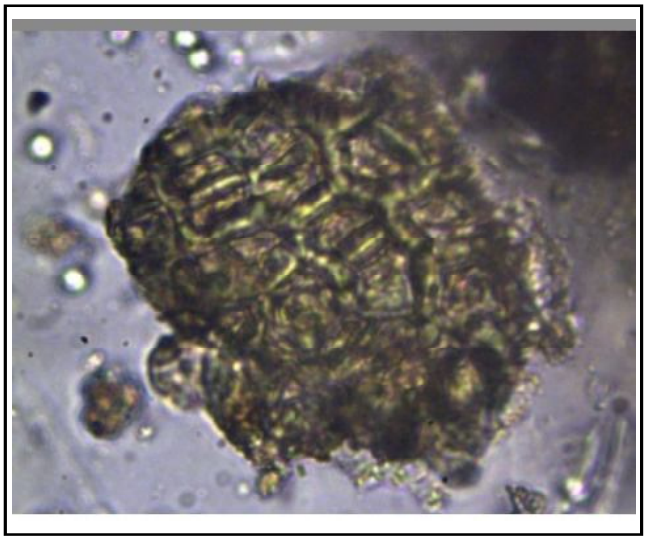

**Figure 8:** Parenchyma of Harad fruits.

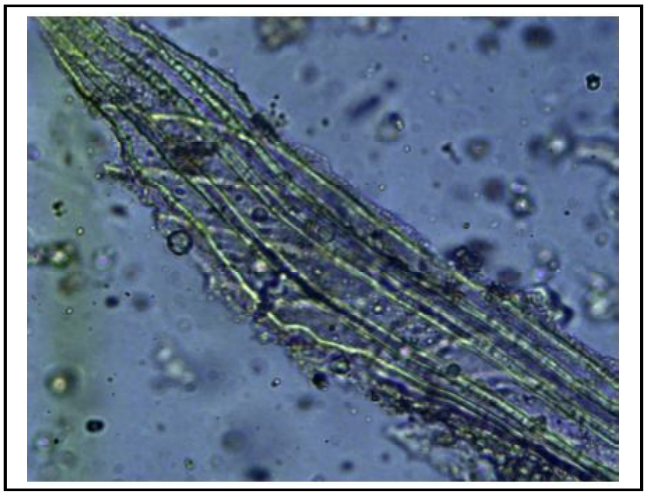

**Figure 9:** Criss cross fibres of Harad fruit.

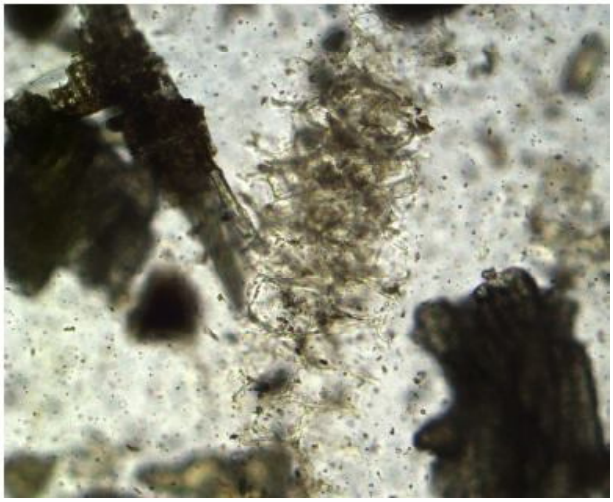

**Figure 10:** Epidermal cells of Harad fruit.

**Figure 11:** Macrosclereid stone cells of Baheda fruits.

**Figure 11:** Macrosclereid stone cells of Baheda fruits.

**Figure 12:** Scleroid stone cell of Baheda fruits.

**Figure 13:** Spiral vessels of Baheda fruit.

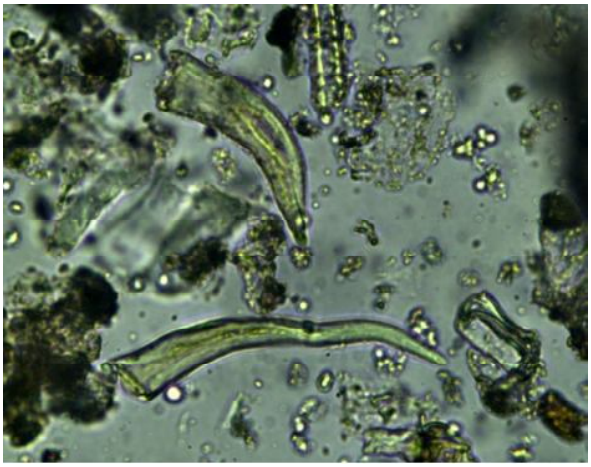

**Figure 14:** Trichomes of Baheda fruit.

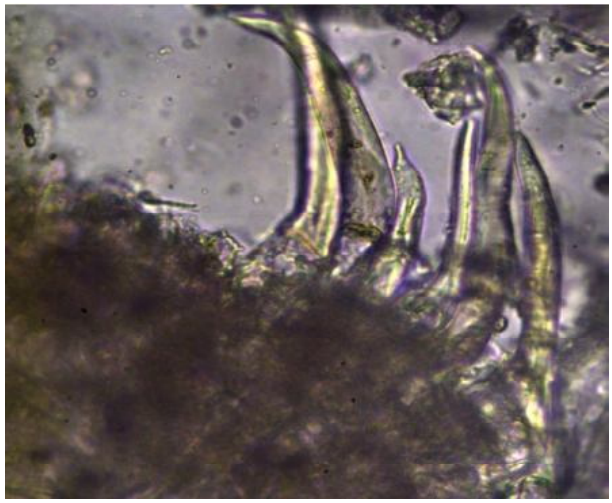

**Figure 14:** Epicarp trichome hairs of Baheda fruit.

Various workers (Singh and Sharma, 2010; Kumar and Krishana, 2012) have revealed presence of vessels with simple pits and groups of fibres with peg like outgrowth, elongated stone cells with narrow and broad lumen, parenchyma cells containing silica crystals, criss cross fibres, spherical pitted stone cells in *T. chebula* fruits in their microscopic studies. In the present study, we have recorded osteosclereid types of stone cells (Figure 6); elongated lumen stone cells (Figure 7); parenchymatous silica crystals (Figure 8); criss cross fibres (Figure 9) and epidermal cells (Figure 10).

Abraham *et al.* (2014) have confirmed the presence of starch grains, rosette like crystals of calcium oxalate and stone cells within fruits of *T. bellerica*. The single layered epidermis had a swollen base and hair like prolongation of trichomes and the central region occupied by round or oval stone cells in groups, having broad lumen cell cavity; parenchymatous cortex cells without intercellular spaces (Meena *et al.,* 2010; Saraswati *et al.,* 2012). In the present investigation, we have recorded macrosclereid types of stone cells (Figure 11); broad lumen scleroid stone cell (Figure 12); spiral vessels (Figure 13) and epicarp trichomes (Figure 14).

## 4. Discussion

Pharmacognostical standardization is carried out to determine its microscopical characteristics. In the present study, some interesting features of stone cells/sclerenchyma are noted and hypothesized for prime formulation. Triphala churna (TC) is an ancient/traditional polyherbal Ayurvedic formulation; it has great therapeutic acts against many acute and chronic ailments (Shivakumar *et al.,* 2016). Few formulators, make TC with 1:2:4 (Harad, Baheda and Amla) based on making their own interpretation of traditional reference. The difference is the amount of amalaki is more in the 1:2:4 combinations and it is an ideal for those who have diarrhea and who do not wish to have the laxative effect and it is ideal for those having high pitta. The excess of amla, being sheet virya (cool in action), nullifies the (ushna virya) hotness of haritaki and vibhitaki (Bhavprakash Nighantu, 2010). TC as such is slightly hot but 1:2:4 is quite heat neutral. TC contains gallic acid, ellagic acid and chebulinic acid, flavonoids and polyphenols, which have antibacterial, anti-inflammatory and antimutagenic, antidiarrheal

abilities (Kaur *et al.*, 2002; Mukherjee *et al.*, 2006; Sen *et al.*, 2016; Shivakumar *et al.*, 2016).

Amalaki (*E. officinalis*) is among the fruits which consumed on daily basis. It can be consumed any time before, during or after the meals. It is considered the best antiageing fruit/drug for all (Bhavprakash Nighantu, 2010). It has an efficient antidyslipidemic/ antihyperlipidemic and antioxidant properties. The chemical constituents are ascorbic acid, gallic acid, chebulinic acid, ellagic acid, 3-ethyl gallic acid, corilagin, emblicanin A and B, punigluconin, quercetin (Takako *et al.*, 2007). The fruits are rich in tannins and also contain phyllemblin (Meghashree *et al.*, 2017). *E. officinalis* (Amalaki) fruits are well known for its antiageing, antioxidant, anti-inflammatory, rejuvenating, hypolipidemic and immuno-modulatory activities (Ekta *et al.*, 2011; Kavita *et al.*, 2012).

The Sanskrit name "haritaki" or 'abhaya' means fearless; it dispels the fear of dying and diseases. *T. chebula* fruits have been extensively used in Ayurveda, Unani and Homoeopathy and have become cynosure for scientist of modern medicine (Bag *et al.*, 2013). It is well appraised for cleansing property and detoxification and rejuvenation (Miglani *et al.*, 1971; Sato *et al.*, 1997; Gandhi and Nayar, 2005). Haritaki possesses a wide variety of activities like antimicrobial, antioxidant, antiviral, anticarcinogenic, hypocholesterolemic, antispasmodic and hepatoprotective (Hushum *et al.*, 2002; Cheng *et al.*, 2003; Singh and Sharma, 2010; Rooplata and Vijay, 2013; Kushwah *et al.*, 2017).

Bibhitaki (*T. bellerica* ) fruit is an important ingredient of Ayurvedic formulation. Bibhitaki is good for all kapha related problems like cough, mucous, congestion, weight gain, heaviness, sticky, slimy ama, mucus feeling (Dravyagun Vigyan, 2011). The fruit extract stimulates the secretion of insulin and enhance its action (Kasabri *et al.*, 2010). Phenolic, phytosterols, triterpenoids, glycosides and tannins are active compounds in the fruits, which are having analgesic, anti-inflammatory, antimicrobial, antioxidant and antitumor activity (Abraham *et al.*, 2014). It has hepatoprotective, antidiabetic, weight loss, scraping action on fat, anticancer and antimicrobial properties (Vinoth *et al.*, 2012; Saraswati *et al.*, 2012; Kushwah *et al.*, 2017).

## 5. Conclusion

Hypothetically, for the first time, we have observed that in the ancient literature (Ayurveda) obviously they (primary formulators) were aware of these similar characteristics, even the structure and function of sclerenchyma tissues. Interestingly, sclerenchyma does not possess living proplasts at their maturity. This might support prevention of the microbial infestation and contamination during longer storage of the raw materials (Triphala). Thick walled lignified sclereids (fibres and stone cells) at micro level are most commonly equivalent in all ingredients (Figures 1-14). The respective sclerenchyma is more or less similar to each other in triphala churna. Sclerenchymatous stone cells and fibres are similar to each other. Definitely, their potential should be similar and to amplify the medical influence or strengthen to each others. There are some significant microscopical similarities and dissimilarities of the cell structure and composition. Some of them might be key characteristics features for the identification at mini-micro level. Suppose presence of epicarp trichome hairs and macrosclereids within Baheda (*T. bellerica*); epicarp surface and brachysclereids of Amla (*P. emblica*) and parenchymatous silica crystals and osteosclereid types stone cells within the fruits of Harad (*T. chebula*) differ to each others. These findings might be useful to additional information with respect to its true identification and formulation. Thus, it is concluded that the fruits powder of the triphala can be validated or authenticated on the basis of their microscopical characteristics.

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### Conflict of interest

We declare that we have no conflict of interest.

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