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Research Article

# Importance of Calcium Oxalate Crystals in Panchavalkala

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**ABSTRACT**
Among the various cell contents, calcium oxalate crystals of different types are found in different organs of the plant. They may be present in almost all parts of the plant. They give protection to the plant against birds and animals. They have great diagnostic value. Presence and absence of crystals, and dimensions are useful in correct identification of crude drugs. Help in detection of adulterants. Panchvalkala is the combination of five different plants of two families viz. Vata -Ficusbenghalensis (Moraceae), Udumbar - Ficusglomerata (Moraceae), Ashwattha - Ficusreligiosa (Moraceae), Parisha - Thespesiapopulnea (Malvaceae) and Plaksha - Ficuslecor (Moraceae). Members of moraceae and malvaceae family are extensively used in many of the medicinal preparation in Ayurveda. Panchavalkala is one of the ideal combinations for a vast range of therapeutics focused in Ayurveda like vranaprakshalana&ropana, shothahara, upadanshahara, visarpahara, etc. The author Pharmacognostically studied the powder characteristics, presence of rosette & prismatic crystals of calcium oxalate are very common in the above mentioned plants.

**Keywords** – Panchavalkala, Calcium Oxalate Crystals, Pharmacognosy

## INTRODUCTION

Family moraceae have 73 genara and 1000 species and confined in the tropical warm countries of the world. And family malvaceae have 82 genara and 1500 species distributed in tropical and temperate regions. Both extensively used in medicinal preparations in Ayurveda. The herbs of the family extensively used in vranaprakshalana&ropana , shothahara , upadanshahara , visarpahara , etc.

Among the various cell contents, calcium oxalate crystals of different types are found in different organs of the plant. They may be present in almost all parts of the plant. They give protection to the plant against birds and animals. They have great diagnostic value. Presence and absence of crystals, and dimensions are useful in correct identification of crude drugs. Help in detection of adulterants. Protein metabolism and other metabolism give oxalic acid which is harmful to the plant. To remove the harmful effect of oxalic acid, the plant forms harmless calcium oxalate with calcium (obtained from soil). They get deposited in different tissues, in different forms. They are harmless to plant and don't take part in metabolism, hence called excretory product.

Crystal's systems , : The calcium oxalate crystals occur in two different crystals system, they are tetragonal/quadratic system and monoclinic system. Crystals contain three molecules of water of crystallization. Crystals have 3 axes, which are at right angle to each other. Two axes (lateral axes) are equal and third axis may be smaller or larger than lateral axes, called vertical or principal axes. They are less common in plants. The crystals contain one molecule of water of crystallization. The crystals have 3axes, one vertical/principal axes and two lateral axes which are right angles to each other but only one axis is at right angle to the principal axes. They are more common in plants.

Forms of calcium oxalate crystals: Due to irregular development of axes, adhesion or twinning of crystals or belonging to different crystal systems, calcium oxalate occurs in different types. They are as follows:

1.Prisms/single crystals: they are large, single or small groups and well developed.

2.Cluster crystals/ spheraphides: they are group of numerous prisms/pyramids. The crystal are projecting, pointed, acute angled, and more or less spherical.

3.Rosette crystals: they are large number of crystals in spherical mass (in the centre of which is an organic substance). Components of crystals radiate from the centre to the periphery and form a toothed circumference.

4.Acicular crystals/ raphids: they re needle like, slender, long pointed at the ends. They may be single or in bundles.

5.Microcrystal/ crystal sand / micro sphenoid: occur like an amorphous mass in cell. They are very minute and are present in large number in a single cell which is usually enlarged than other cells and is called idioblast.

Anatomical characters of family moraceae – Members of the family mostly of trees and shrubs but few members is somewhat woody herbs. The hairs include glandular and non-glandular types. The epidermis of the leaf consists of one to several layers of cells. Occasional, thin, vertical partitions to the epidermal cells are recorded. An epidermis of several layers of cells is not to be confussed with true hypoderm, which also occurs in some genera. Cystoliths are also fairly common. Stomata are rather

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Table No. 1 Organoleptic characters of Powders

| Sr. No. | Plants | Colour | Touch | Odour | Taste |
|---|---|---|---|---|---|
| 1. | *Vata* | Black brown | Rough | Characteristic | Astringent |
| 2. | *Udumbara* | Dark brown | Rough | Characteristic | Astringent |
| 3. | *Ashwattha* | Brown | Slightly smooth | Characteristic | Astringent |
| 4. | *Parisha* | Yellowish brown | Slightly smooth | Characteristic | Astringent |
| 5. | *Plaksha* | Pale brown | Rough | Characteristic | Astringent |

Table No. 2 Histochemical Tests

| Reagents | Test for | Observation | Results | | | | |
|---|---|---|---|---|---|---|---|
| | | | A | B | C | D | E |
| Phloroglucinol + Conc. Hcl | Ca.oxalate crystals | Effervescence | + | + | + | + | + |
| Iodine | Starch | Blue | + | + | + | + | + |
| Iodine | Laticiferous vessels | Yellowish granular form | + | + | + | - | - |
| Phloroglucinol + Conc. Hcl | Lignin | Red | + | + | + | + | + |
| $Fecl_3$ | Tannin | Dark Blue | + | + | + | + | + |

A – *Vata*, B – *Udumbara*, C – *Ashwattha*, D – *Parisha*, E - *Plaksha*

Phtographs of Barks

Fig 2 *Udumbara*

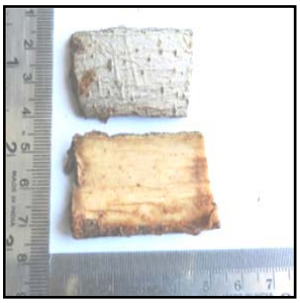

Fig 3 *Ashwattha*

Fig 1 *Vata*

Fig 4 *Parisha*

Fig 5 *Plaksha*

variable in the distribution, in the extent to which raised above or depressed below the leaf surface, and in the nature of the surrounding epidermal cells.

Secretory canals, which may be laticiferous or filled with gum-resin or mucilage, are widely distributed both in leaf and axis. The young stem contains a varying abundance of fibers in the phloem. The outer part of the wall of the phloem fibers is of different consistency from, and serves to envelop, the inner portion. The pericycle is usually marked by separated strands of fibres which are frequently unlignified. The cork arises superficially, whilst the primary cortex is often extensively sclerosed or contains stone cells. Crystals are secreted mostly in the form of clusters, solitary types being less frequent. They are sometime situated in idioblasts.

Anatomical characters of family malvaceae – Members

of the family are mostly herbs and shrubs, widely distributed throughout the world. Cork in the axis arises in the epidermis itself, or in the outermost part of the cortex. Stone cells are rarely present in the cortex. The pericycle of the young stem usually contains strands of fibres opposite the phloem groups, although in a few instances there is a tendency for the fibres to form a closed cylinder. The phloem, in most instances, is especially characteristic, consisting of triangular strands as seen in transverse sections with the bases towards the xylem, and stratified tangentially into alternating fibrous and non-fibrous bands. The primary medullary rays, where passing through the phloem, are also triangular but with the apices towards the xylem. The triangular shape of the phloem group is not very well defined in a few species. The xylem of the young stem usually forms a practically continuous ring, except where broken by the rather broad primary rays. The pith generally consists of thin-walled parenchyma, but in a few genara there are fibres in the perimedullary region.

**MATERIAL AND METHOD**

Collection: Fresh plants barks were collected from the Jamnagar region of Gujarat. The collected samples were identified, authenticated by subject experts of Pharmacognosy Department, I.P.G.T. & R.A, GujaratAyurved University.

**PHARMACOGNOSTIC EVALUATION**

Macroscopy : The macroscopic characters of the barks like morphology of barks, colour, fractrure were noted down as per standard procedures.

Organoleptic evaluation : The colour, odour, touch and taste of the barks were recorded separately.

Powder microscopy : Shade dried bark cut pieces were separately powder under mesh 60 no. Individual powder studied under the microscope with distilled water. Microphotographs were taken by using Carl Zeiss binocular microscope.

Histochemicaltests :Histochemical tests for few constituents like Calcium oxalate, tannin, lignine, laticeferous vessels etc. were also carried out.

**RESULTS**

The organoleptic characters of all the five plants are tabulated in Table No. 1 and the histochemical tests were conducted for various chemical constituents and are tabulated in Table No. 2

1. Vata: Macroscopic characters of stem bark: Mature stern bark grey with thin, closely adhered ashy white, light bluish green or grey patches, bark fiat or slightly curve, thickness varies with age of tree externally rough due to presence of horizontal furrows and lenticels, mostly circular and prominent, fracture short in outer two thirds of bark while inner portion shows a fibrous fracture taste, astringent. (Fig 1)

Powder Microscopy: Diagnostic Characters under the microscope are, Thin walled Parenchymatous cells, somewhat cubical to oval, few, occur in between the groups of stone cells and contains prismatic crystals of calcium oxalate, starch grains and tannin (brown pigment). It also shows some phloem fibres contain prismatic crystals forming crystal fibres. Stone cells vary in shape and in large amount circular to oval, contains plenty of starch grains and sometime have pitted walls and few stone cells in between it. (Fig 6-8)

2. Udumbara: Macroscopic characters of stem bark: Bark grayish-green, surface soft and uneven, 0.5-1.8 cm thick, on rubbing white papery flakes come out from outer surface, inner surface light brown, fracture fibrous, taste, mucilaginous without any characteristic odor. (Fig 2)

Powder Microscopy:Diagnostic Characters under the microscope are, Abundant prismatic crystals either free or in detached parenchymatous cells. Fibres, broken, unlignified with narrow lumen, associated with sclereids or with cells containing crystals. Sclereids separated or in groups. Occasionally parenchymatous cells with brownish contents are also seen. (Fig 9-11)

3.Ashwattha: Macroscopic characters of stem bark: Bark occurs in flat or slightly curved pieces, varying from 1.0-2.5 cm or more in thickness, outer surface brown or ash colored, surface uneven due to exfoliation of cork, inner surface smooth and somewhat brownish, fracture, fibrous, taste, astringent. (Fig 3)

Powder Microscopy: Diagnostic Characters under the microscope are, Parenchymatous cells contain numerous starch grains and prismatic crystals of calcium oxalate. Stone cells scattered in large groups, rarely isolated. It also shows numerous crystal fibers of secondary phloem. A number of ray cells and phloem parenchyma filled with brown pigments. (Fig 12-14)

4. Parisha: Macroscopic characters of stem bark: Bark occurs in flat to slightly curved pieces, varying in thickness according to age and parts of tree from where it is taken; external surface rough due to numerous irregularly scattered lenticels, fissured, exfoliating in irregular scales, grayish-brown; inner surface, laminated, foliaceous, reddish-brown; fracture, fibrous; no characteristic odor; taste, astringent. (Fig 4)

Powder Microscopy: Diagnostic Characters under the microscope are, Phloem parenchyma cells with large single rosette calcium oxalate crystal and occasionally seen with brown colored granular mass. It also shows numerous fibres in groups with narrow lumen and bluntly pointed ends. Starch grains, simple to 2 or 3 compound; hilum, distinct. (Fig 15-17)

5. Plaksha: Macroscopic characters of stem bark: Bark rough, occurring in flat to curved, quilled pieces, measuring 0.4-0.7 cm in thickness; external surface ash or whitish-grey; numerous transversely arranged lenticels; ranging from 0.1 cm - 1.3 cm in length, lip-shaped and exfoliating; internal surface rough, fibrous, longitudinally striated, reddish-brown; fracture, fibrous. (Fig 5)

Powder Microscopy: Diagnostic Characters under the microscope are, Parenarchymatous cells thick walled with simple pits and with starch grains, sometimes seen with brown pigments. It also shows prismatic crystals of calcium oxalate, elongated phloem fibres with wide lumen and pointed and tips, fibres with stone cells and

Microphotographs of Calcium oxalate crystals

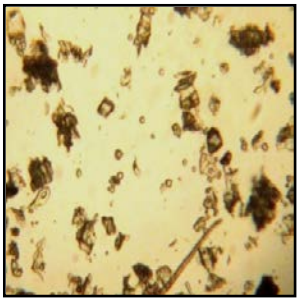
Fig 6 *Vata*-prismatic crystal

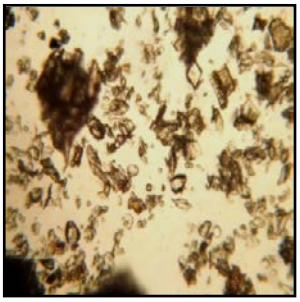
Fig 7 *Vata*-rhomboidal crystal

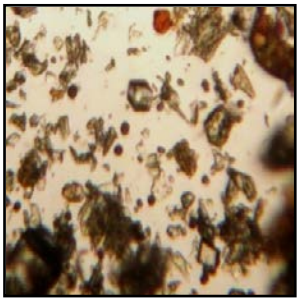
Fig 8 *Vata*-prismatic crystal

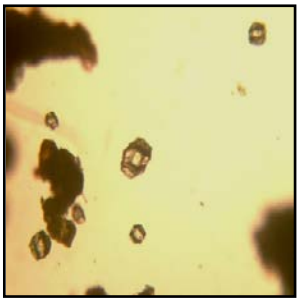
Fig 9 *Udumbara*-rhomboidal crystal

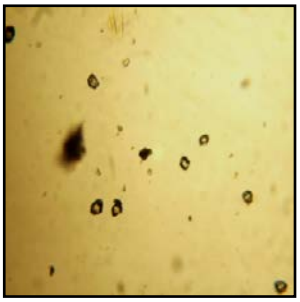
Fig 10 *Udumbara*-prismatic crystal

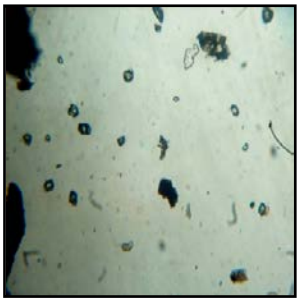
Fig 11 *Udumbara*-prismatic crystal


Fig 12 *Ashwattha*-crystal fibre


Fig 13 *Ashwattha*-rhomboidal crystal

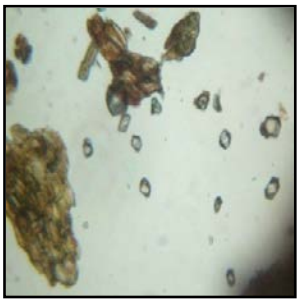
Fig 14 *Ashwattha*-prismatic crystal

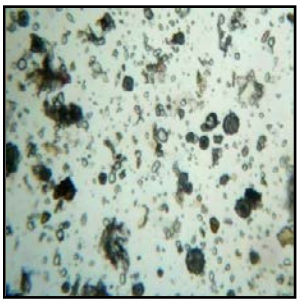
Fig 15 *Parisha*-rosette crystal

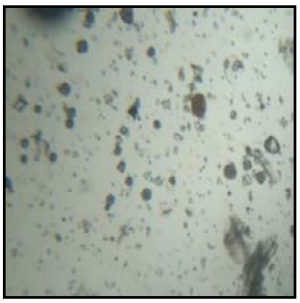
Fig 16 *Parisha*-prismatic crystal

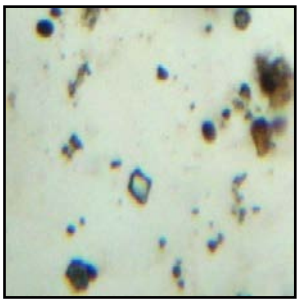
Fig 17 *Parisha*-rosette & prismatic crystal

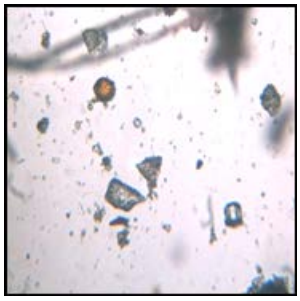
Fig 18 *Plaksha* –prismatic crystal

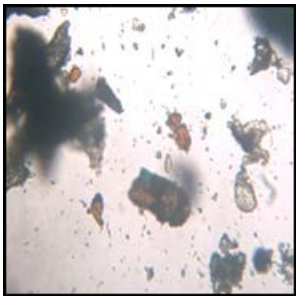
Fig 19 *Plaksha* –prismatic crystal


Fig 20 *Plaksha*–prismatic crystal

laticiferous cells. Stone cells in groups and singles, sometimes with simple pits. (Fig 18-20)

## DISCUSSION AND CONCLUSION

Calcium oxalate crystals play very important role in the plant itself and also in Ayurvedic formulations, for example formulations of Asthishrinkhala which is the rich source of Calcium oxalate. Panchavalkala is a composition which is having very good wound healing property and also used in other disorders which are as mentioned in introduction. From Ayurveda point of view its kashaya rasa is the main responsible factor for these kinds of activities because it enhances vaso constriction. All the five plants of this composition are highly kashaya in taste. Another reason for this composition is, distribution of the plants is very wide and also available in every season. Organoleptic characters showed that highly astringent ends in light itching in throat indicates the calcium oxalate crystals. All the five samples microscopicaly exhibit prismatic crystals and rosette crystals from Parisha.Even the Histochemical tests reveals that the presence of calcium oxalate crystals. Thus the calcium oxalate crystals are very important microscopic characters in indentifyingPanchavalkala drugs. For further future take as an reference and also needs its estimation.

## REFERENCES


1. Mitra J.N., Mitra D. and Chowdhuri S.K., Studies in botany, Volume I, 8th Edition, maulik library, Kolkata, 2012, 1224.
2. Mitra J.N., Mitra D. and Chowdhuri S.K., Studies in botany, Volume I, 8th Edition, maulik library, Kolkata, 2012, 1274.
3. CharakaSamhita, Chikitsasthana, 25/84 with Ayurveda Dipika, English commentary Ram Karan Sharma, Vd. Bhagwan Das, II Edition, Chaukhambha Sanskrit Series, Varanasi, 2001.
4. CharakaSamhita, Chikitsasthana, 25/87 with Ayurveda Dipika, English commentary Ram Karan Sharma, Vd. Bhagwan Das, II Edition, Chaukhambha Sanskrit Series, Varanasi, 2001.
5. SharangadharaSamhita, Madhyamakhanda, 2/151, Hindi translation Dr. ShailajaSrivastava, IV Edition, ChaukhambhaOrientalia, Varanasi, 2005.
6. BhavaPrakashaNighantu, Bhava Mishra, VataadiVarga 16 & 17, Edited by Dr. K.C. Chunekar, X Edition ChaukhambhaBharati Academy, Varansi 2006.
7. SharangadharaSamhita, Madhyamakhanda, 2/1, Hindi translation Dr. ShailajaSrivastava, IV Edition, ChaukhambhaOrientalia, Varanasi, 2005.
8. Khandelwal, K.R.,2008.PracticalPharmacognosy. Nirali Prakashan,Pune,139-141.
9. A.C. Dutta, A Class-Book of Botany, Oxford University Press, 1994, 172.
10. Anatomy of the dicotyledons leaves, stem, and wood in relation to taxonomy with notes on economic uses, oxford, clarendon press, 1950, volume II, 1259.
11. Metcalfe C. R. and Chalk L., Anatomy of the dicotyledons leaves, stem, and wood in relation to taxonomy with notes on economic uses, volume I, oxford, clarendon press, 1950, 223.
12. Trease, G.E. and Evans, W.C., Pharmacognosy, 12th Edition, 1983.,BailliereTindall, Eastbourne. U.K. 95-99, 512-547.
13. Kokate C.K., Practical Pharmacognosy, VallabhPrakashan Delhi, 2009; 1-13
14. Wallis T.E., J & A Churchill Ltd., London 104 Gloucester Place, W1. 1967; 567-568
15. Krishnamurty, K.V., Methods in the plant histochemistry, VishwanandanPvt, Limited, 1988. Madras, 1-7.