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## QUALITY ANALYSIS OF MARKET SAMPLES OF *ĀRILA* COLLECTED FROM DIFFERENT MARKETS OF KERALA USING PHARMACOGNOSTIC TOOLS

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### Keywords:

Prśniparṇī, Market sample study, *Pleurolobus gangeticus*, *Desmodium gangeticum*, Śālaparṇī, Pharmacognosy

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**ABSTRACT:** *Ārila* is a well-known drug used in many Ayurvedic recipes in Kerala. In most texts *Ārila* is seen paired with *Mūvila* and together they fare as components of the *Dāsamula*. From very old Kerala commentaries of ancient Ayurvedic texts, *Ārila* and *Mūvila* are seen as Malayalam translations of *Prśniparṇī* and *Śālaparṇī* respectively. In Kerala *Prśniparṇī* is often identified as *Ārila* and its source here is *Pleurolobus gangeticus* (L) J. St.-Hil. However, in North India and in API, source plant of *Prśniparṇī* is *Uraria picta* (Jacq.) Desv. ex DC. Both belongs to the family Fabaceae where former is a stout herb or under shrub and the other is a small branched, perpetual herb. In the current globalized world where market have expanded, there are unconfirmed reports that other drug sources like *Uraria picta* etc have begun appearing in Kerala herbal drug market in the name of *Ārila*. So, decided to investigate the status of samples of *Ārila* available in the Kerala herbal drug market and to check the quality and authenticity of the samples using pharmacognostic tools. As per microscopic studies, samples from Trivandrum, Kozhikode and Wayanad contains *P. gangeticus* roots and stems along with other similar looking plants. Idukki, Palakkad and Kasargod samples were mixtures of some similar looking species of *Desmodium*. Malappuram contains roots and stems of *Mūvila* (*Pseudarthria viscida*). On HPTLC analysis similar bands matching with *P. gangeticus* roots and stems were observed in Trivandrum, Kozhikode and Wayanad samples.

**INTRODUCTION:** Ayurveda, the science of life, is one of the oldest traditional systems of medicine. The knowledge is gained from Vedas, mainly based on Atharvaveda. Later Samhitas, Sangraha granthas, Nighantus, commentaries with translations came and modern era texts compilation came into being. Ayurvedic literature is vast as said above & it got translated to different languages, so we can see the name of a single drug source in Sanskrit and other local or vernacular names.

Language became a problem and it is evident when it came to commentaries. As India is a country having vast area and diversity due to its geoclimatic condition, a single drug can have multiples sources in different regions. Therefore, there is a chance of mixing up of drugs.

In last 2- 3 decades, due to the decreased availability, enlarged market, faster raw-drug logistics and establishment of new pharmaceutical companies demand for a particular raw drug can be met from different regions and the essential nature of local raw-drug market is being transformed. Therefore, in this scenario, there is a high relevance for a study on the market availability of drugs. In such a background, this study focuses on the drug *Ārila*, a well-known drug used in many Ayurvedic

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recipes and often seen paired with *Mūvila* and together they fare as components of the famous drug group *Daśamūla*. Very old Kerala commentaries of ancient Ayurvedic texts such as *Aṣṭāṅgahr̥daya* both *Ōrila* and *Mūvila* are seen as Malayalam translations of *Śālaparṇī* and *Pr̥śniparṇī*. In Kerala *Pr̥śniparṇī* is often identified as *Ōrila* and its source here is *Pleurolobus gangeticus* (L) J. St.-Hil<sup>1</sup>. However, in North India and in Ayurveda Pharmacopoeia of India, the source plant of *Pr̥śniparṇīs* *Uraria picta* (Jacq.) Desv. ex DC<sup>2</sup> botanically very different from *Pleurolobus gangeticus* (L) J. St.-Hil. The larger question about the exact identity of *Śālaparṇī* and *Pr̥śniparṇī* is there due to the above said problems which is not settled yet. However, this study is not taking these problems into consideration. As far as this study concerned, the single problem is *Ōrila* and its natural source in south India which is *Pleurolobus gangeticus* (L) J. St.-Hil. And whether the market reflects this identified source and if it does not, then attempt to identify what more is being sourced as *Ōrila*. This study is important when *Ōrilais* alone in a formulation i.e., not paired with *Mūvila*. In Malayalam texts like *sahasrayoga* and Malayalam commentaries of classical texts such as *Aṣṭāṅgahr̥daya*, commentators translate the term *Sthirā* as *Ōrila* in *yogas* such as that of *Rasonadi kaṣāyam*. That may cause problem due to the change in the formulation and effect, by the usage of *Uraria picta* (Jacq.) Desv. ex DC instead of *Pleurolobus gangeticus* (L) J. St.-Hil.

**In the Study Substitutes of *Śālaparṇī* (*Desmodium gangeticum*):** A Conceptual Review concluded that in the absence of *Desmodium gangeticum*, other five species (*D. podocarpum*, *D. repandum*, *D. trifolium*, *D. diffusum*, and *D. lexiciflorum*) of Genus *Desmodium* can be considered as substitutes on the base of Karma, Pharmacognostical morphology and some of the common chemical constituents of them<sup>3</sup>. And also there present study on an ethnobotanical survey on adulterants of medicinal plants used by traditional practitioners of Palakkad district, Kerala, India showed that adulteration had become a popular practice in the herbal industry & *Desmodium gangeticum* DC is one of the commonly adulterated drugs<sup>4</sup>. Therefore, to address a relevant problem, i.e., the possibility of adulteration of *Ōrila*, the drug which fares in many formulations can cause huge

impact in the health of society, this study is being taken up. The main issues facing by the drug sector is substitution, adulteration<sup>5</sup> etc can bring down the genuineness of *Ayurveda* drug field. Due to the informal activity of complex levels of suppliers, from the primary level of collectors to the specific dealers with the big manufacturing companies, the market is not controlled by any specific regulatory body in the state. In the current globalized world where market have expanded, herbals drug sources are no longer geographically limited. As a result, there are unconfirmed reports that other drug sources such as *Uraria picta* (Jacq.) Desv. ex DC etc. have begun appearing in the Kerala herbal drug market in the name of *Ōrila* and today there is condition where manufacturers or doctors are forced to buy whatever present in the market even without knowing original or not as they are not collecting it directly from authorized collectors. *Sandigdha dravya* as is a term used for medicinal plants having controversial botanicals as sources. So, we decided to check whether the drug present in the different markets is the same or whether any problem of raw material supply and quality currently exists by doing the comparison of its Pharmacognostic properties and HPTLC study of the market samples with the both source plants of *Pr̥śniparṇī* and *Śālaparṇī* as per API.

**MATERIALS AND METHODS:** Crude market samples were collected from 7 various markets and standard samples were collected from their natural sources.

The samples were named as: -

**Sample No. 1:** *Pleurolobus gangeticus* (L) J. St.-Hil Root (P.g- Rt) and Stem (P.g- St) from herbal garden of CMPR Kottakkal.

**Sample No. 2:** Collected from Thiruvananthapuram Market Sample (T).

**Sample No. 3:** Collected from Idukki Market Sample (I).

**Sample No. 4:** Collected Palakkad Market Sample (P).

**Sample No. 5:** Collected from Malappuram Market Sample (M).

**Sample No. 6:** Collected from Kozhikode Market Sample (KZ).

**Sample No. 7:** Collected from Wayanad Market Sample (W).

**Sample No. 8:** Collected from Kasaragod Market Sample (KS).

**Sample No. 9:** Aerial parts of *Uraria picta* (Jacq.) Desv. ex DC. (*U. picta*) from the garden of J. S Ayurveda Mahavidyalaya, Nadiyad Genuine samples were collected, authenticated and Herbarium specimens were deposited in 'CMPR Herbaria' (*Pleurolobus gangeticus* (L) J.St.-Hil. - CMPR HERBERIA 12373, *Uraria picta* (Jacq.) Desv. ex DC- CMPR HERBARIA 12868). Samples were washed under running tap water, air dried under shade, coarsely powdered and were kept in airtight containers for further use. Macroscopic and microscopic characters of the market samples along with HPTLC we reassessed as a part of this study. It was conducted at Pharmacognosy and Phytochemical lab, Dept of Dravyaguna Vijnana, V.P.S.V. Ayurveda College, Kottakkal and Center for Medicinal Plants Research, Arya Vaidya Sala, Kottakkal during the period of April, May and June 2022.

**Macroscopic Study:** Morphological characters of the genuine samples of *Ōrila* and its 7 market samples were studied and documented as per API. Characters such as shape, size, colour, surface, odour, and taste were noted and compared with the genuine samples.

**Microscopic Study:** Thin transverse sections of the root and stem of each sample were taken by hand and using microtome. The microscopical evaluation of sections were carried out to confirm the structural details of the materials. For effective results various reagents or stains were used to distinguish cellular structures. Histochemical tests were also done by applying the stains in required quantities. The compound microscope used for microscopic study was Trilocular Leica DM 1000 LED attached with 'Leica DFC 295' digital camera application software 'LAS version V3' were used for viewing and transferring microscopic images.

**Powder Microscopy:** The cell structure and inclusions in the powder were examined by powdering the material with mortar and pestle. Then it was stained by using appropriate stains and mounted in 40% glycerine. It was then observed

under microscope with attached camera for transferring microphotographs to the computer connected to it.

**Maceration Method:** The Maceration of samples were done by standard maceration techniques (Jeffrey's method). Maceration was done by treating small pieces of plant material in a test tube with maceration fluid (10% nitric acid and 10% chromic acid) for 1-2 hrs at 30-40° C. when the material became softened and cells got separated all the maceration fluid was drained out and the material was washed for several times. Then it was stained it with aqueous safranin, mounted in glycerine and observed under the microscope with attached camera for transferring microphotographs to the computer connected to it. Characteristics of lignified cells, xylem elements such as fibres and vessels were noted.

**Phytochemical Study:** Phytochemical comparison of the two source plants and seven market sample of *Ōrila* by thin layer chromatography (TLC). For the purpose, parts of selected plants were collected, and dried in the shade. The dried materials were powdered and subjected to extraction. For the extraction, 5 gm each of the plant materials were taken in round bottomed flask and refluxed with 50 ml of distilled water at continuously for 2 hours. The extracts were filtered, concentrated, and made up to 10 ml in a standard flask. Samples were applied on the plate using CAMAG automatic TLC sampler 4 attached to CAMAG HPTLC system. Applied 5 µl of test solution and (1 to 3 µl) of standard solution separately on a pre-coated silica gel 60 F25 TLC plate (E. Merck) of uniform thickness of 0.2 mm plate in the form of bands with width 8 mm using Hamilton syringe (100µl). The plate being developed in the solvent system in a twin trough chamber to 9 cm. The Stationary phase was Aluminium backed pre-coated Merck silica gel plate 60 F plate (10x10 cm). and the Solvent system used was Toluene: Ethyl acetate: formic acid (7:3: 0.1). The Visualization done by observing the plate under UV light at 254, 366 nm and after derivatisation with ANS reagent, recorded the R-value and colour of the resolved bands and the Densitometric scanning of the plates was done by using CAMAG TLC scanner 3 at 254, 366 and 550 nm.

**RESULT AND DISCUSSION:** The genuine samples of *Ōrila* and its seven market samples are compared by its pharmacognostic analysis using macroscopic, microscopic, histochemical, powder microscopic characters along with HPTLC parameters.

### Macroscopic and Microscopic Analysis:

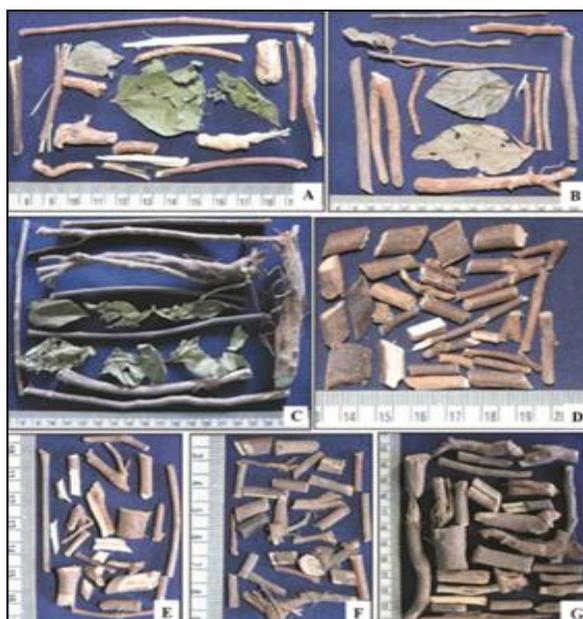
#### Macroscopic Comparison (Fig. 1 & Fig. 2, Table 1):

#### Macroscopic Characteristics of *Pleurolobus gangeticus* (L) J.St.-Hil. (Fig. 1):

**Root:** Drug consists of dried, cylindrical, branching tortuous, lateral pieces of root, pieces of 5 to 10 cm in length and 5 to 7 mm in diameter; pieces of tap root being thicker, few and poorly developed, surface is somewhat smooth, light yellowish, shows at places thin wiry rootlets or the scars left by them, transversely running lenticels and bacterial nodules of various sizes, bark is thin easily peel able from the central solid core of wood; fracture, outer short, inner fibrous. Taste is sweet and mucilaginous; odour not characteristic.



**FIG. 1: HABIT AND MARCOSCOPY OF THE SOURCE PLANTS OF ŌRILA.** A.-F. *Pleurolobus gangeticus* LG.-J. *Uraria picta* Jacq



**FIG. 2: SAMPLES OF ŌRILA COLLECTED FROM DIFFERENT MARKETS OF KERALA.** A. Thiruvananthapuram Market Sample; B. Idukki Market Sample; C. Palakkad Market Sample, D. Malappuram Market Sample, E. Kozhikode Market Sample; F Wayyanad Market Sample; G. Kasargod Market Sample

**TABLE 1: MACROSCOPIC COMPARISON OF SOURCE PLANTS AND SEVEN MARKET SAMPLES OF *ORILA***

S. no.	Sample	Shape	Size (in cm)	Colour	Surface	Odour	Taste
1	<i>P. g.</i> - root	cylindrical, branching tortuous	5 to 10 cm in length and 5 to 7 mm in diameter;	light yellowish	smooth; thin easily peelable bark	Not charact eristic.	sweet and mucilaginous
	<i>P. g.</i> - stem	Slender, somewhat angular	up to 1.0 cm in diameter	brown, pale yellow inside	appressed greyish hairs	Not charact eristic	slightly bitter
2	T	Cylindrical, Roots and stem with leaves	Root - 3-5 cmlength about 3mm india.Stem length about 2- 12 cm, 2mm- 1cm in dia.	Root light yellowish, Stem - slender brown colour with smooth fractures	Root pieces - easily peelable bark	Not charact eristic	No characteristic
3	I	Cylindrical Roots and stem with leaves	Diameter up to 1 cm. length up to 10 cm up to length 10- 12 cm	light brown in colour with thin bark	Stem hairy surface	not charact eristic	No characteristic
4	P	Cylindrical pieces of roots and stem	Roots - 20 cm length - stem pieces up to 13 - 17 cm - 0.4 - 1cm in diameter internode length about 1 - 5cm	Stem dark brown colour externally and light-yellow colour inside	stem part which is hairy	not charact eristic	No characteristic
5	M	Cylindrical pieces of roots and stem	Root 0.5-1.5 cm length and of 2-4 mm in dia. Stem length about .5- 2cm and 5-1cm in dia.	Stem- brown surface and inner pale white Root pale brown externally and pale white internally.	Root with peelable bark- some Stem surface have longitudinal lines	not charact eristic	No characteristic
6	KZ	Cylindrical pieces of roots and stem Mixture	Root - length 4-1cm and diameter about 3-5 mm. Stem pieces of length .5 – 4 cm and diameter .2-.8cm	Stem pieces present of light brown colour surface	Stems were glossy surface	odour not charact eristic	No characteristic
7	W	Cylindrical pieces of roots and stem Mixture	Roots are of length .5 -1.5 cm and diameter about .1-.5 mm. Stem- length .5 – 4 cm and diameter .1- .5cm	Stem pieces some were light brown, some dark brown surface inner creamy white colour	Some were smooth some were longitudinally wrinkled	odour not charact eristic	No characteristic
8	K	Cylindrical pieces of roots and stem	Root length .5- 1.5cm and diameter about 2-5 mm Stem - length 1cm – 8 cm and diameter of.5 – 1cm.	Root with light brown surface, Stem pieces of brown surface or with white colour surface	Some stems were smooth and some were rough	odour not charact eristic	No characteristic taste
9	<i>U. picta</i>	Cylindrical, branched, pubescent, transversely cut and, fracture fibrous. Leaves -Imparipinnate leaves linear- oblong, acute,	Stem 10 - 15 cm long, 0.2- 0.6 cm in diameter, Leaves 10 cm or more long, up to 2 cm wide	light yellow to brown external surface- leaf scar present at nodes, leaves blotched with white colour	smoothened surface longitudinal wrinkles in mature stem leaves g glabrous above, finely reticulately veined,	odour not charact eristic	No characteristic taste

\*P.g – *Pleurolobus gangeticus*, T- Thiruvananthapuram, I- Idukki, P- Palakkad, M- Malappuram, KZ-Kozhikode, W- Wayanad, K- Kasaragod, *U. picta* – *Uraria picta*.

**Stem:** Slender, up to 1.0 cm in diameter, branched, somewhat angular, clothed with appressed greyish hairs, external surface brown, internal pale yellow; fracture, short; taste, slightly bitter <sup>6</sup>.

**Macroscopic Characteristics of *Uraria picta* (Jacq.) Desv.ex DC. (Fig.1):**

**Root:** Occur in pieces of varying size, thickness of 1 to 2 cm, gradually tapering, tough, woody, cylindrical; externally light yellow to buff, internally pale yellow; surface bearing fine longitudinal striations; fracture, splintery or fibrous; taste, slightly acrid.

**Stem:** About 10-15 cm long, 0.2 - 0.6cm in diameter, in cut pieces; cylindrical, branched, pubescent, light yellow to brown external surface, transversely cut and smoothed surface, longitudinal wrinkles in mature stem, leaf scar present at nodes, fracture fibrous.

**Leaves:** Imparipinnate, up to 10 cm or more long, up to 2 cm wide, linear- oblong, acute, glabrous above, finely reticulately veined, leaf in upper part 5-7 and in lower part 3-5 leaf blotched with white colour.

**Macroscopic Comparison with Market Samples (Fig. 2):** Mostly mixture of dried sample of *Orila*

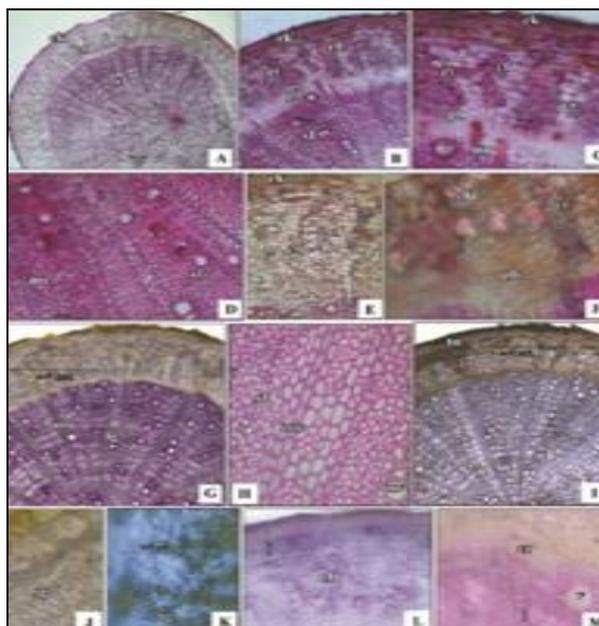
are available in the market. In the 4 market samples, *i.e.*, from Malappuram, Kozhikode, Wayanad, Kasaragod we collected very small pieces were found.

Macroscopic features are not sufficient for confirming the identity of samples. During our study we got mixtures of samples from almost all the markets except Idukki, Palakkad. Out of which some are finely chopped so that macroscopic features are not clearly distinguishable.

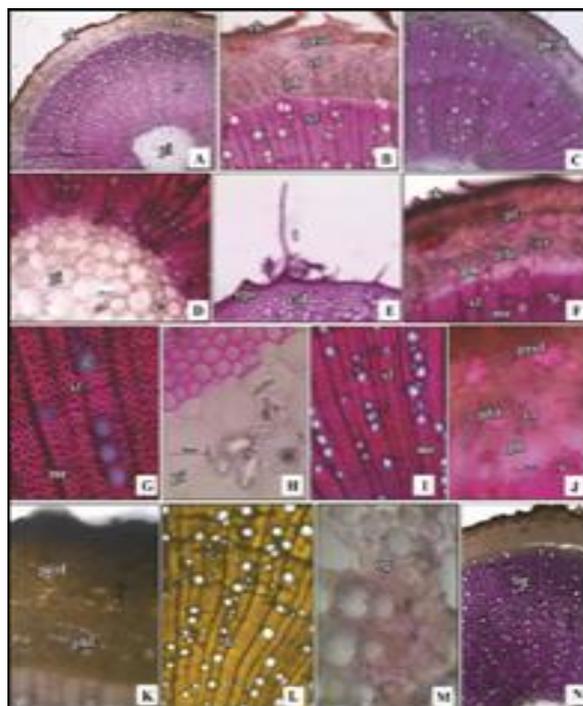
All the samples were mixtures of both roots and stems. In Trivandrum, Idukki, Palakkad samples leaves also were present. The details of the macroscopic comparison are given in the **Table 1**.

**Microscopic Comparison (Fig. 3 – Fig. 11, Table No. 2): Microscopic Characteristics of *Pleurolobus gangeticus* (L) J.St.-Hil. (Fig. 3 & Fig. 4):**

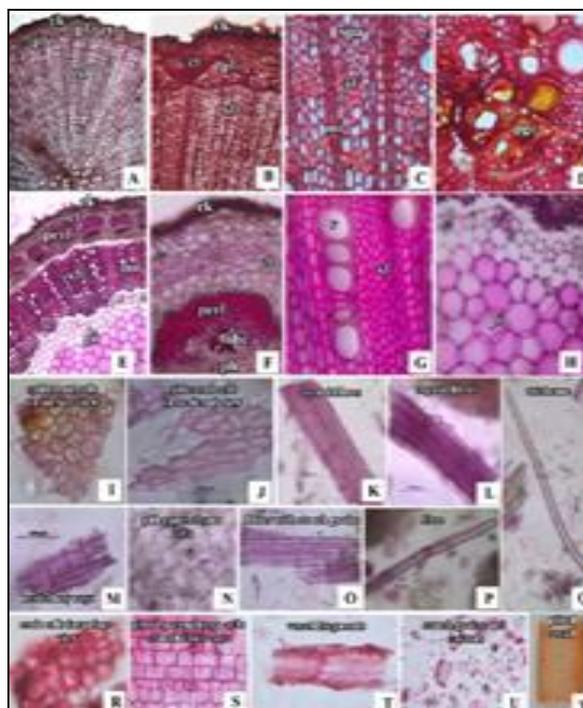
**Root:** Diagrammatic TS of the root circular to oval in outline with outer layer ruptured at many places, shows cork, cortex, phloem, and xylem. Major portion of the section occupied by wood region and medullary ray cells very prominent.



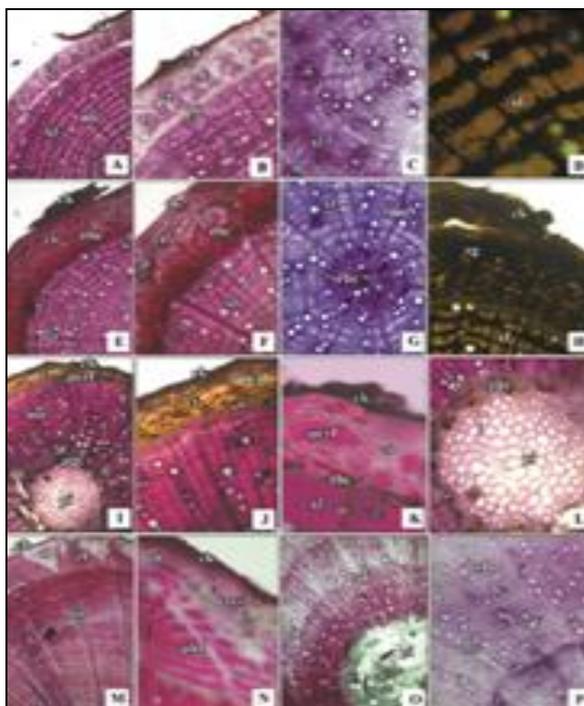
**FIG. 3: MICROSCOPY OF *PLEUROLOBUS GANGETICUS* L. ROOT. A. TS OF ROOT SHOWING ENTIRE VIEW, B. TS PORTION ENLARGED; C & E. TS OUTER REGION ENLARGED, D. XYLEM REGION ENLARGED. F. TS CORTICAL PORTION ENLARGED; H. ENLARGED VIEW OF XYLEM VESSELS AND FIBRES; G. & L. TEST FOR LIGNIFIED CELLS; I. TEST FOR TANNIN DEPOSITION; J. & K. TEST FOR STARCH GRAINS; M. PRESENCE OF CRYSTALS CF, CORTICAL FIBRES, CK, CORK, CR, CRYSTALS OF CALCIUM OXALATE; ET, CORTEX, LG, LIGNIN; MR, MEDULLARY RAYS; OG, OIL GLOBULE, PH, PHLOEM, SG. STARCH GRAIN; IN, TANNIN CELL, V, VESSEL, X, XYLEM, XF, XYLEM FIBRES**



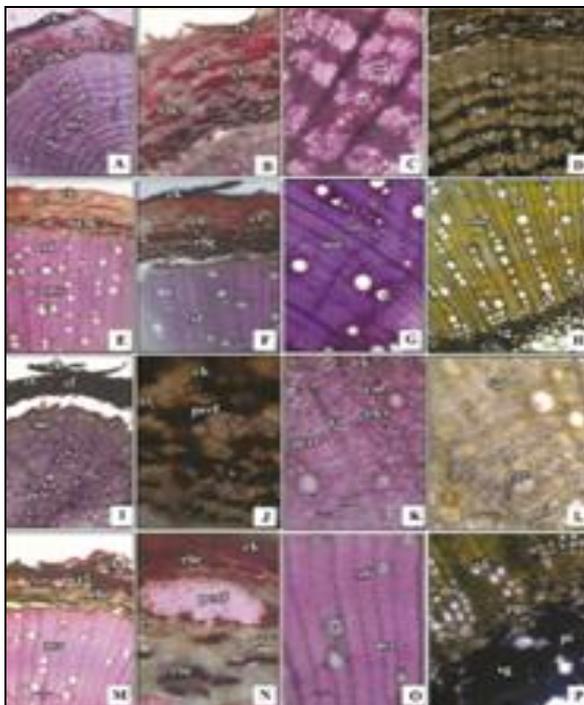
**FIG. 4: MICROSCOPY OF *PLEUROLOBUS GANGETICUS* L. STEM. A. TS OF SHOWING ENTIRE VIEW, B. TS PORTION ENLARGED; C. TS OUTER REGION ENLARGED, D. PITH REGION ENLARGED, E. TS OUTER SHOWING TRICHOME; F. TS CORTICAL PORTION ENLARGED; G. & I. ENLARGED VIEW OF XYLEM VESSELS AND FIBRES; H. PRESENCE OF CRYSTALS, J. TS PHLOEM PORTION ENLARGED, K. TEST FOR TANNIN DEPOSITION; L.. TEST FOR STARCH GRAINS, M. TEST FOR OIL, N. TEST FOR LIGNIFIED CELLS, CK, CORK: COL, COLLENCHYMA, CR, CRYSTALS OF CALCIUM OXALATE; ET, CORTEX, EPI, EPIDERMIS, F, FIBRES, LIG, LIGNIN, MR, MEDULLARY RAYS, OG, OIL GLOBULE; PERF, PERICYCLIC FIBRE, PH, PHLOEM, PHF, PHLOEM FIBRE, SG STARCH GRAIN, TN, TANNIN CELL, X, XYLEM, XF, XYLEM FIBRES, V. VESSEL**



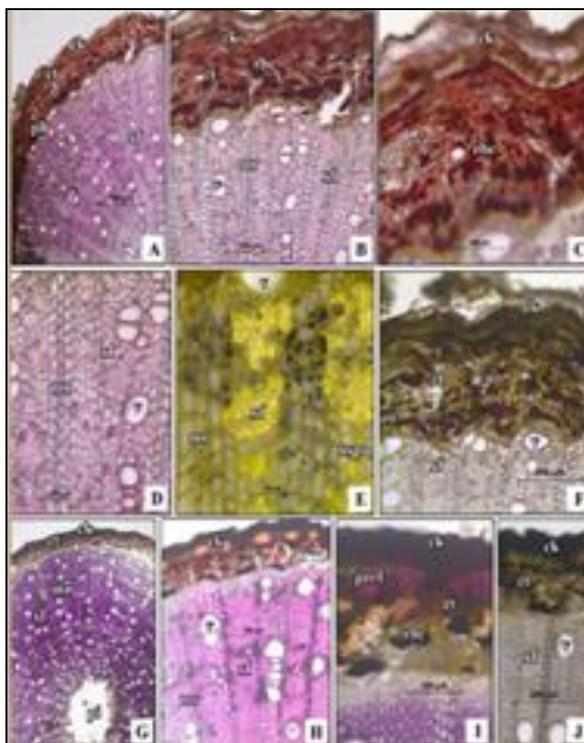
**FIG. 5: MICROSCOPY OF ORILA MARKET SAMPLE COLLECTED FROM TRIVANDRAM. A.-D. TS OF ROOT SAMPLE 1; E.-H. TS OF ROOT SAMPLE 2, 1.-1. TS OF STEM SAMPLE 1: M.-P TS OF STEM SAMPLE 2. CK, CORK: COL, COLLENCHYMA, CR, CRYSTALS OF CALCIUM OXALATE; ET, CORTEX, EPI, EPIDERMIS, F, FIBRES, LIG, LIGNIN, MR, MEDULLARY RAYS, OG, OIL GLOBULE; PERF, PERICYCLIC FIBRE, PH, PHLOEM, PHF, PHLOEM FIBRE, SG STARCH GRAIN, TN, TANNIN CELL, X, XYLEM, XF, XYLEM FIBRES, V. VESSEL**



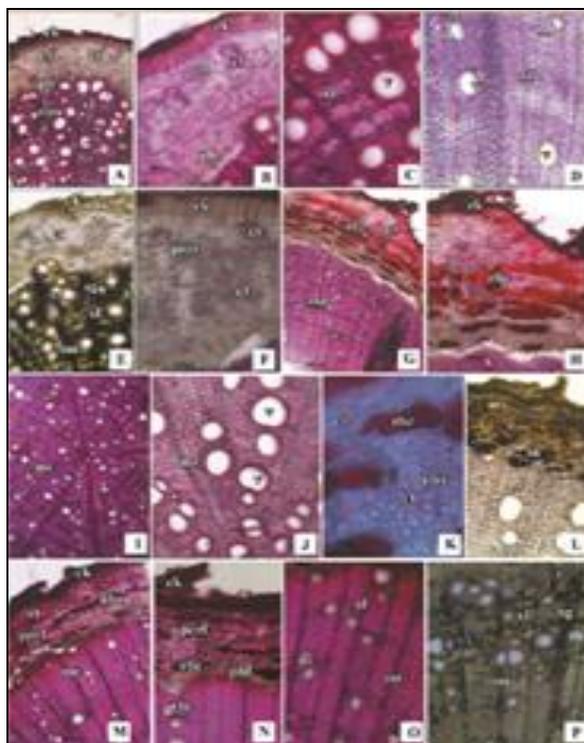
**FIG. 6: MICROSCOPY OF ŌRILA MARKET SAMPLE COLLECTED FROM IDUKKI AND PALAKKAD. A.-D. TS OF IDUKKI ROOT SAMPLE, E.-11. TS OF IDUKKI STEM SAMPLE, 1-1. TS OF PALAKKAD ROOT SAMPLE, M.-PTS OF PALAKKAD STEM SAMPLE. CK, CORK: COL, COLLENCHYMA, CR, CRYSTALS OF CALCIUM OXALATE; ET, CORTEX, EPI, EPIDERMIS, F, FIBRES, LIG, LIGNIN, MR, MEDULLARY RAYS, OG, OIL GLOBULE; PERF, PERICYCLIC FIBRE, PH, PHLOEM, PHF, PHLOEM FIBRE, SG STARCH GRAIN, TN, TANNIN CELL, X, XYLEM, XF, XYLEM FIBRES, V. VESSEL**



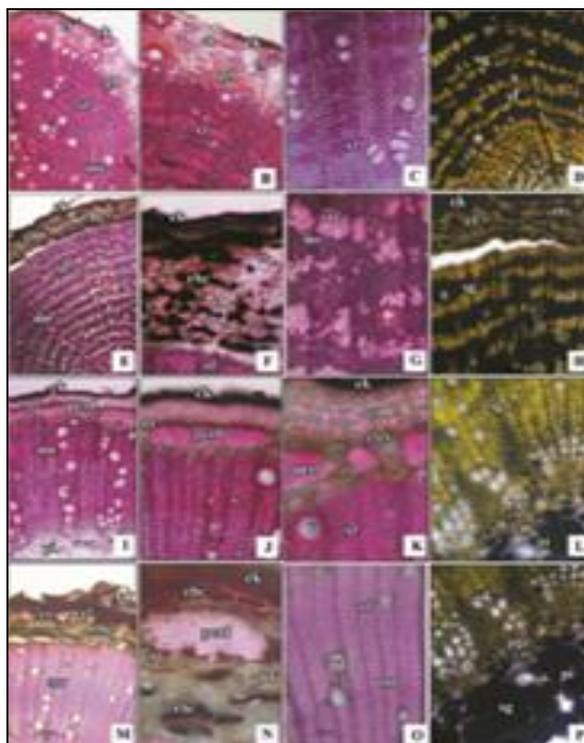
**FIG. 7: MICROSCOPY OF ŌRILAMARKET SAMPLE COLLECTED FROM MALAPPURAM. A.-F. TS OF ROOT SAMPLE; G.-JTS OF STEM SAMPLE 1; L.-O. TS OF STEM SAMPLE. CK, CORK: COL, COLLENCHYMA, CR, CRYSTALS OF CALCIUM OXALATE; ET, CORTEX, EPI, EPIDERMIS, F, FIBRES, LIG, LIGNIN, MR, MEDULLARY RAYS, OG, OIL GLOBULE; PERF, PERICYCLIC FIBRE, PH, PHLOEM, PHF, PHLOEM FIBRE, SG STARCH GRAIN, TN, TANNIN CELL, X, XYLEM, XF, XYLEM FIBRES, V. VESSEL**



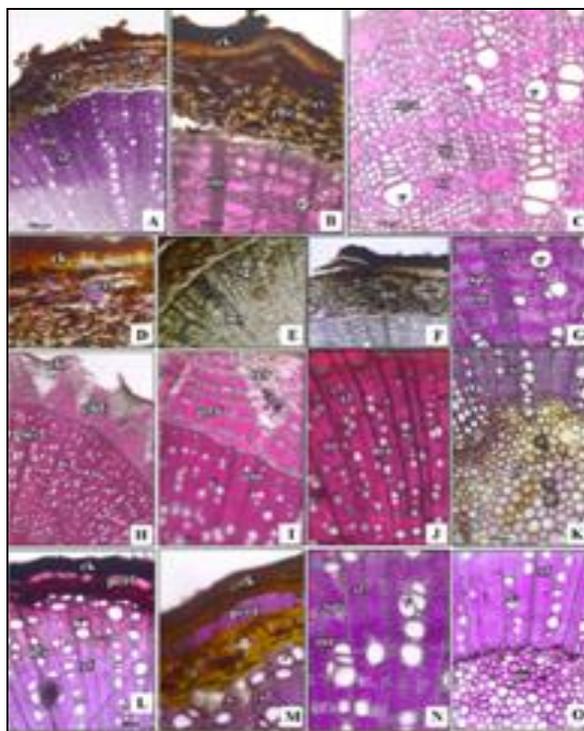
**FIG. 8: MICROSCOPY OF ÓRILA MARKET SAMPLE COLLECTED FROM KASARGODE. A.-G. TS OF ROOT SAMPLE, H.-K. TS OF STEM SAMPLE 1; L.-O. TS OF STEM SAMPLE 2. CK, CORK; COL, COLLENCHYMA, CR, CRYSTALS OF CALCIUM OXALATE; ET, CORTEX, EPI, EPIDERMIS, F, FIBRES, LIG, LIGNIN, MR, MEDULLARY RAYS, OG, OIL GLOBULE; PERF, PERICYCLIC FIBRE, PH, PHLOEM, PHF, PHLOEM FIBRE, SG STARCH GRAIN, TN, TANNIN CELL, X, XYLEM, XF, XYLEM FIBRES, V. VESSEL**



**FIG. 9: MICROSCOPY OF ÓRILAMARKET SAMPLE COLLECTED FROM WAYANAD. A. D. TS OF ROOT SAMPLE 1; E.-H. TS OF ROOT SAMPLE 2, I.-L. TS OF STEM SAMPLE 1; M.-P. TS OF STEM SAMPLE. CK, CORK; COL, COLLENCHYMA, CR, CRYSTALS OF CALCIUM OXALATE; ET, CORTEX, EPI, EPIDERMIS, F, FIBRES, LIG, LIGNIN, MR, MEDULLARY RAYS, OG, OIL GLOBULE; PERF, PERICYCLIC FIBRE, PH, PHLOEM, PHF, PHLOEM FIBRE, SG STARCH GRAIN, TN, TANNIN CELL, X, XYLEM, XF, XYLEM FIBRES, V. VESSEL**



**FIG. 10: MICROSCOPY OF ÓRILA MARKET SAMPLE COLLECTED FROM WAYANAD. A. D. TS OF ROOT SAMPLE 1; E.-H. TS OF ROOT SAMPLE 2, I.-L. TS OF STEM SAMPLE 1; M.-P. TS OF STEM SAMPLE. CK, CORK: COL, COLLENCHYMA, CR, CRYSTALS OF CALCIUM OXALATE; ET, CORTEX, EPI, EPIDERMIS, F, FIBRES, LIG, LIGNIN, MR, MEDULLARY RAYS, OG, OIL GLOBULE; PERF, PERICYCLIC FIBRE, PH, PHLOEM, PHF, PHLOEM FIBRE, SG STARCH GRAIN, TN, TANNIN CELL, X, XYLEM, XF, XYLEM FIBRES, V. VESSEL**



**FIG. 11: MICROSCOPY OF ÓRILA MARKET SAMPLE COLLECTED FROM KASARGODE. A.-G. TS OF ROOT SAMPLE, H.-K. TS OF STEM SAMPLE 1; L.-O. TS OF STEM SAMPLE 2. CK, CORK: COL, COLLENCHYMA, CR, CRYSTALS OF CALCIUM OXALATE; ET, CORTEX, EPI, EPIDERMIS, F, FIBRES, LIG, LIGNIN, MR, MEDULLARY RAYS, OG, OIL GLOBULE; PERF, PERICYCLIC FIBRE, PH, PHLOEM, PHF, PHLOEM FIBRE, SG STARCH GRAIN, TN, TANNIN CELL, X, XYLEM, XF, XYLEM FIBRES, V. VESSEL**

**TABLE 2: MICROSCOPIC COMPARISON OF THE SOURCE PLANTS AND MARKET SAMPLES OF –ŌRILA**

Sl. no.	Sample	Cork	Cortex	Phloem	Xylem	Ray Cells	Depositions
1.	<i>P. gangeticus L.</i> - Root	Up to 15 layers; Cells with reddish brown deposition	Up to 15 layers: Starch grains, prismatic crystals; solitary and groups of fibres scattered.	In patches above xylem alternating with ray cells; prismatic and rod-shaped crystals; fibres	Fibres in radial patches alternating with parenchyma; vessels with diameter 20 – 60 $\mu$ m.	Uni – multi seriate; prismatic crystals and starch grains	Starch grains in parenchyma cells of cortex, ray cells and xylem; Tannin in cork cells; Reddish brown content in some cork and cortical cells; Prismatic crystals in cortex, phloem and ray cells
		Up to 10 layers; tangentially elongated	Up to 10 layers; oval to elongated parenchyma; Pericyclic fibre patches in dis continuous ring; starch grains and prismatic crystals	Phloem fibres; prismatic crystals	Solitary/groups of vessels with diameter 10 – 50 $\mu$ m. Polygonal shaped parenchymatous pith with rod shaped crystals.	Uniseriate, rarely bi seriate; starch grains;	Starch grains in parenchyma cells of cortex, ray cells and xylem; Tannin in cork cells; Oil globules in xylem; Prismatic crystals in cortex; rod shaped crystals in pith
2. 3.	<i>P. gangeticus L.</i> - Stem	Up to 10 layers; tangentially elongated	Up to 15 layers of oval – elongated parenchyma; Starch grains, prismatic crystals; solitary and groups of fibres	Starch grains	Fibres in radial patches alternating with parenchyma; vessels with diameter 10 - 20 $\mu$ m. Plenty of starch grains	Uni – multi seriate; prismatic crystals and starch grains	Starch grains in parenchyma cells of cortex, ray cells and xylem; Tannin in cork cells; Reddish brown content in some cortical cells
		Up to 10 layers; tangentially elongated; reddish brown depositions	Plenty of starch grains; Reddish brown depositions	Plenty of starch grains; Reddish brown depositions	Fibres in radial patches alternating with parenchyma; vessels with diameter 10 - 50 $\mu$ m	Uni – multi seriate; prismatic crystals and starch grains	Starch grains in parenchyma cells of cortex; Reddish brown content in some cortical cells
	<i>Trivandrum Sample – Root</i>	Up to 5 layers; oval to elongated parenchyma; starch grains and rosette crystals of calcium oxalate	Phloem fibres in conical arrangement	Solitary vessels with diameter 10 – 40 $\mu$ m. Polygonal shaped parenchymatous pith with plenty of big sized rounded starch grains	Uniseriate, rarely bi seriate; starch grains;	Big sized starch grains in cortical cells, pith and xylem; rosette crystals in cortex	Up to 5 layers; oval to elongated parenchyma; starch grains and rosette crystals of calcium oxalate
	<i>Trivandrum Sample – Stem</i>	Up to 5 layers; oval to elongated parenchyma; Pericyclic fibre patches in dis continuous ring; starch grains	Phloem fibres	Solitary vessels with diameter 20 – 70 $\mu$ m. Polygonal shaped parenchymatous pith	Uniseriate, rarely bi seriate; starch grains;	Starch grains in parenchyma cells of cortex, ray cells and xylem; Tannin in cork cells;	Up to 5 layers; oval to elongated parenchyma; Pericyclic fibre patches in dis continuous ring; starch grains
4.	<i>Idukki - Root</i>	Up to 10 layers; oval to elongated parenchyma; majority of cells filled with reddish deposition and starch grains; fibres	Phloem fibres; Reddish brown depositions	Solitary vessels; rounded; less in number; diameter 15 – 50 $\mu$ m. parenchyma with starch grains and prismatic crystals; Fibres in patches alternating with parenchyma	Uni to bi seriate; filled with starch grains	Starch grains in parenchyma cells; Plenty of Reddish-brown deposition in cortex and phloem	Up to 10 layers; oval to elongated parenchyma; majority of cells filled with reddish deposition and starch grains; fibres scattered.

	<i>Idukki – Stem</i>	scattered. Up to 5 layers; tangentially elongated	Up to 10 layers; oval to elongated parenchyma; Pericyclic fibre patches in discontinuous ring; Reddish brown depositions	Phloem fibres; Reddish brown depositions	Solitary vessels with diameter 25 – 70 µm; reddish brown depositions; Polygonal shaped parenchymatous pith; Rod shaped crystals; Starch grains	Uni/bi seriate; starch grains	Starch grains in parenchyma cells; Plenty of Reddish-brown deposition in cortex, phloem and xylem
5.	<i>Palakkad – Root</i>	Up to 5 layers; tangentially elongated	Up to 10 layers; oval to elongated parenchyma; majority of cells filled with reddish deposition and starch grains; fibres scattered.	Phloem fibres; Reddish brown depositions	Fibres in radial patches alternating with parenchyma; vessels with diameter 15 - 60 µm. Plenty of starch grains and prismatic crystals of calcium oxalate	Uni seriate; starch grains	Starch grains in parenchyma cells of cortex, ray cells and xylem; Prismatic crystals in parenchyma cells; Reddish brown depositions in cortex and phloem
	<i>Palakkad – Stem</i>	Up to 10 layers; tangentially elongated	Up to 10 layers; oval to elongated parenchyma; Reddish brown depositions; Pericyclic fibre patches in discontinuous ring;	Phloem fibres; Reddish brown depositions	Solitary vessels with diameter 20 – 50 µm; reddish brown depositions; Polygonal shaped parenchymatous pith;	Uni seriate	Reddish brown depositions in cortex and phloem
6.	<i>Malappuram – Root</i>	Up to 10 layers; tangentially elongated	Up to 15 layers; oval to elongated parenchyma; solitary and groups of fibres; plenty of reddish-brown depositions	Phloem fibres; Reddish brown depositions	Solitary and groups of vessels with diameter 40 – 80 µm; prismatic crystals. Fibres similar to phloem fibres in patches	Uni - Multiseriate	Reddish brown depositions in cortex and phloem; prismatic crystals in cortex and xylem
	<i>Malappuram – Stem</i>	Up to 5 layers; tangentially elongated	Up to 10 layers; oval to elongated parenchyma; Pericyclic fibre patches in discontinuous ring; Reddish brown depositions	Phloem fibres; Reddish brown depositions	Solitary and groups vessels with diameter 20 – 90 µm; fibres in patches alternating with parenchyma cells; Pith cells large sized	Uni - Multiseriate	Reddish brown depositions in cortex and phloem
7.	<i>Kozhikode – Root</i>	Up to 10 layers; tangentially elongated	Up to 15 layers of oval – elongated parenchyma; Starch grains, prismatic crystals; solitary and groups of fibres	Phloem fibres	Fibres in radial patches alternating with parenchyma; vessels with diameter up to 90 µm; plenty of starch grains	Uni – Multiseriate; plenty of starch grains	Starch grains in parenchyma cells; prismatic crystals
	<i>Kozhikode – Root</i>	Up to 5 layers; tangentially elongated	Up to 10 layers; oval to elongated parenchyma; solitary and groups of fibres; plenty of reddish-brown depositions	Plenty of starch grains	Fibres in radial patches alternating with parenchyma; vessels less in number with diameter up to 50 µm	Uni – Multiseriate; plenty of starch grains	Starch grains in parenchyma cells; reddish brown depositions

8.	<i>Kozhikode – Stem</i>	Up to 5 layers; tangentially elongated	Up to 10 layers; oval to elongated parenchyma; Pericyclic fibre patches in discontinuous ring; reddish brown depositions	Phloem fibres; reddish brown depositions	Fibres in radial patches alternating with parenchyma; vessels with diameter up to 40 µm	Uni – bi seriate; starch grains	reddish brown depositions; starch grains
	<i>Wayanad –Root</i>	Up to 5 layers; tangentially elongated	Up to 10 layers; oval to elongated parenchyma; solitary and groups of fibres; Plenty of starch grains; reddish brown depositions	Plenty of starch grains	Fibres in radial patches alternating with parenchyma; vessels with diameter up to 20 - 50 µm; plenty of starch grains	Uni – Multiseriate; plenty of starch grains	Starch grains
	<i>Wayanad –Stem</i>	Up to 5 layers; tangentially elongated	Up to 10 layers; oval to elongated parenchyma; solitary and groups of fibres; Plenty of starch grains; Up to 10 layers; oval to elongated parenchyma; Pericyclic fibre patches in discontinuous ring; starch grains and prismatic crystals	Phloem fibres; prismatic crystals	Fibres in radial patches alternating with parenchyma; vessels with diameter up to 20 - 50 µm; plenty of starch grains Solitary vessels with diameter 10 – 50 µm. Polygonal shaped parenchymatous pith with rod shaped crystals.	Uni – Multiseriate; plenty of starch grains Uniseriate, rarely bi seriate; starch grains;	Starch grains Starch grains in parenchyma cells of cortex, ray cells and xylem; Tannin in cork cells; Oil globules in xylem; Prismatic crystals in cortex; rod shaped crystals in pith
	<i>Wayanad –Root</i>	Up to 5 layers; tangentially elongated	Up to 10 layers; oval to elongated parenchyma; Pericyclic fibre patches in discontinuous ring; Reddish brown depositions	Phloem fibres; Reddish brown depositions	Solitary vessels with diameter 25 – 70 µm; reddish brown depositions; Polygonal shaped parenchymatous pith; Rod shaped crystals; Starch grains	Uni seriate; starch grains	Starch grains in parenchyma cells; Plenty of Reddish-brown deposition in cortex, phloem and xylem
9.	<i>Kasaragod – Root</i>	Up to 10 layers; tangentially elongated	Up to 10 layers; oval to elongated parenchyma; solitary and groups of fibres; Plenty of starch grains	Plenty of starch grains; Phloem fibres; oil globules; prismatic crystals of calcium oxalate; reddish brown depositions	Fibres in radial patches alternating with parenchyma; vessels with diameter up to 20 - 70 µm; plenty of starch grains; prismatic crystals of calcium oxalate	Uni – Multiseriate; plenty of starch grains	Starch grains; Prismatic crystals, oil globules; reddish brown depositions
	<i>Kasaragod – Stem</i>	Up to 5 layers; tangentially elongated	Up to 5 layers; oval to elongated parenchyma; starch grains and rosette crystals of calcium oxalate	Phloem fibres in conical arrangement	Solitary vessels with diameter 25 – 85 µm. Polygonal shaped parenchymatous pith with plenty of big sized rounded starch grains	Uni – Multiseriate; plenty of starch grains	Starch grains; Rosette crystals
	<i>Kasaragod – Stem</i>	Up to 5 layers;	Up to 5 layers; oval to	Phloem fibres; reddish brown	Solitary vessels with diameter 20	Uniseriate, rarely bi seriate; starch	Starch grains in parenchyma cells of

	tangentially elongated; reddish depositions	elongated parenchyma; starch grains and prismatic crystals of calcium oxalate; pericyclic fibre patch in discontinuous ring	deposition	– 70 µm. Polygonal shaped parenchymatous pith; starch grains	grains;	cortex, ray cells and xylem; reddish brown depositions; Prismatic crystals
10.						
<i>U. picta</i> -Root	5 or 6 layers of thin walled, tabular, regularly arranged cork cells	4 to 6 layers; oval, tangentially arranged, thin-walled, parenchymatous cells, a few fibres present solitary or in groups	Phloem fibres, thick walled lignified with narrow lumen and tapering phloem rays	vessel very few, mostly confined to inner and outer part of xylem	Uniseriate; simple pits; starch grains	Starch grains in the xylem ray. Prismatic crystals in parenchyma cells of cortex, ray cells, xylem, and phloem
<i>U. picta</i> -Stem	2-3 layers of tangentially elongated cells	up to that 3-4 layers of oval to elongated thickened parenchyma; followed by thin walled loosely arranged parenchyma cells; as pericyclic fibre. Patches of discontinuous ring of prismatic crystals	Lignified phloem fibres scattered reddish-brown deposition	solitary or in groups, wide pith - large pitted parenchymatous polygonal cells, - rods shaped crystals present.	mostly uniseriate and multiseriate	starch grains in xylem region. Plenty of small oil globules in inner xylem region, phloem region and in cortex; rods shaped crystals in pith

<sup>8\*</sup> *P. gangeticus* – *Pleurolobus gangeticus*, *U. picta* – *Uraria picta*.

Detailed TS shows outer cork region composed of up to 15 layers of tangentially elongated, rectangular cells arranged in radial rows; outer layers ruptured at some places. Some of the cells of outer layer show reddish brown deposition. Cork is followed by a cortical region made up of up to 15 layers of oval to elongated, parenchymatous cells.

Plenty of fibres in solitary and in groups, few small sized starch grains and prismatic crystals of calcium oxalate are scattered throughout the cortical region. Some of the cells are filled with reddish brown depositions. Phloem is seen as small patches above the xylem composed of closely packed parenchymatous cells often alternating with radially elongated ray cells. Plenty of prismatic and rod-shaped crystals are scattered throughout the parenchymatous cells of the section. Lignified fibres in single and in groups scattered in the phloem region. Xylem is a wide zone composed of tracheids, fibres, vessels, xylem parenchyma and medullary ray cells. Major portion of the xylem

occupied by fibres and lignified parenchyma cells. Xylem fibres found as radial patches alternating with parenchyma cells. Xylem vessels round to oval, having diameter 20 - 60 µm, solitary or in groups, arranged radially at many places throughout the xylem. Tyloses and reddish-brown deposition found in some vessels especially at the centre. Medullary ray uni to multiseriate composed of radially elongated pitted parenchymatous cells. Ray cells are extended towards the cortical region at many places and shows the presence of prismatic crystals of calcium oxalate and small sized starch grains

**Stem:** Diagrammatic TS of the stem circular in outline with outer layer ruptured at many places, shows cork, cortex, phloem and xylem. Major portion of the section occupied by wood region. Detailed TS shows outer cork region composed of up to 7 layers of tangentially elongated cells; outer layers ruptured at some places. In young stem single layered epidermis of small, oval parenchyma

cells covered with thick brownish cuticle and interrupted at places by multicellular trichomes, a hypodermis consisting of 3 or 4 layers of oval collenchyma cells; Cork is followed by a cortical region made up of up to 11 layers of oval to elongated parenchymatous cells. Pericycle region represented by discontinuous ring of fibre patches. Few small sized starch grains and prismatic crystals of calcium oxalate are scattered throughout the cortical region especially in ray cells. Phloem region composed of up to 10 layers of closely packed parenchymatous cells alternating with radially elongated ray cells. Lignified phloem fibres and plenty of prismatic crystals are scattered throughout this region. Xylem is a wide region composed of tracheids, fibres, vessels, xylem parenchyma and medullary ray cells. Major portion of the xylem occupied by fibres and vessels. Xylem vessels round to oval, having diameter 10 - 50  $\mu\text{m}$  occurring more as solitary or in groups, scattered throughout the region. Medullary ray mostly uniseriate, rarely biseriate composed of radially elongated pitted parenchymatous cells extend towards the phloem region filled with starch grains. Pith is made up of thin-walled large polygonal shaped parenchymatous cells. Rod shaped crystals present in pith cells

#### **Microscopic Characteristics of *Uraria picta* (Jacq.) Desv. ex DC (Fig. 5):**

**Root:** Diagrammatic TS of the stem circular in outline with outer layer ruptured at many places, shows cork, cortex, phloem and xylem. Shows 5 or 6 layers of thin-walled, tabular, regularly arranged cork cells; cortex composed of 4 to 6 layers of oval, tangentially arranged, thin-walled, parenchymatous cells, a few fibres present singly or in groups. Phloem parenchyma composed of rounded to somewhat oval cells, larger towards periphery: fibres thick walled, lignified with narrow lumen and tapering phloem rays 1 to 5 cells wide. Xylem composed of vessels, tracheids, fibres, crystal fibres and parenchyma traversed by xylem rays; vessel very few, mostly confined to inner and outer part of xylem, xylem parenchyma mostly rectangular with simple pits; xylem ray cells is diametric showing simple pits, starch grains simple, round to oval, measuring 6 to 17  $\mu\text{m}$  in diameter, distributed throughout parenchymatous cells of secondary cortex, phloem and xylem; prismatic crystals of calcium oxalate present in crystal fibres,

as well as in many parenchymatous cells of secondary cortex, phloem and ray cells.

**Stem:** Diagrammatic TS of the stem circular in outline with outer layer ruptured at many places, shows cork, cortex, phloem and xylem. Major portion of the section occupied by pith region.

Detailed TS shows outer cork region composed of 2-3 layers of tangentially elongated cells ruptured at places, a hypodermis consisting of 2 or 3 layers of collenchyma cells. Below Cork is followed by a cortical region made up of up to that <sup>3</sup> -4 layers of oval to elongated thickened parenchyma cells followed by thin walled loosely arranged parenchyma cells with intercellular spaces. Patches of pericyclic fibre and few prismatic crystals present in that region. Wood area is seen as bundle. Wide phloem region composed of 12 - 14 closely packed parenchymatous cells alternating with radially elongated ray cells. Lignified phloem fibres scattered and reddish-brown deposition found. Xylem is a wide region composed of tracheids, fibres, vessels, xylem parenchyma and medullary ray cells. Major portion of the xylem occupied by fibres and parenchyma cells. Xylem vessels round to oval in shape, having diameter  $\mu\text{m}$  occurring more as solitary or in groups, arranged radially throughout the xylem. Medullary ray mostly uniseriate and multiseriate composed of radially elongated pitted parenchymatous cells extend towards the cortex region. Wide pith is made up of layer large pitted parenchymatous cells, thick-walled inner layer and thin-walled outer layer with rod shaped crystals present.

#### **Microscopic Comparison with market Samples (Fig. 6 to Fig. 11):**

Majority of the root samples showed the presence of reddish-brown deposition in cortical cells. In Malappuram sample very thick deposits were observed. Almost all the stem samples except some of the samples of Trivandrum and Kozhikode and Wayanad showed the presence of reddish-brown deposition. In Malappuram sample there were plenty of content cells in large clusters like that of *Pseudarthria viscid* and so, Malappuram sample may be the roots and stems of *Pseudarthria viscida*. Almost all samples showed presence of reddish-brown contents, plenty of vessels and phloem fibres which are not matching with the characters of *U. picta* mentioned in API.

So, can conclude that Kerala market samples do not have the presence of north Indian sample *U. picta*. Some of the roots selected from Trivandrum samples, root sample of Kozhikode and selected root samples of Wayanad showed the presence of scattered cortical fibre, starch grains and prismatic crystals. Some of the stem sample of Trivandrum and Kasargod showed the presence of rosette crystals of calcium oxalate in cortical cells.

Root of *P. gangeticus* was with xylem fibres resembling that of phloem which are arranged in radial patches alternating with xylem parenchyma. Xylem area of *U. picta* were found with round to oval vessels with uni to multiseriate medullary rays containing starch grains. Also, wide pith with large pitted parenchymatous cells containing rod-shaped crystals were present in it. Same arrangement was observed in some of the roots from Trivandrum, Kozhikode and Wayanad. The details of the microscopic comparison are given in the **Table 2**.

#### **Histo-chemical Comparison:**

##### **Histochemical Characteristics of *Pleurolobus gangeticus* (L) J.St.-Hil:**

**Root:** Small sized round starch grains were present in the parenchyma cells of cortex, medullary ray and in the xylem region. Pericyclic fibres, phloem fibres, xylem elements and medullary rays lignified. Tannin deposition present in the cork and phloem ray region. Presence of oil globules not observed.

**Stem:** Small sized round starch grains were present in the parenchyma cells of cortex and medium sized ones in the xylem region. Pericyclic fibres, phloem fibres, xylem elements and medullary rays lignified. Tannin deposition present in the cork and phloem ray region. Also, small oil globules present in the xylem region.

##### **Histochemical Characteristics of *Uraria picta* (Jacq.) Desv.ex DC**

**Root:** Starch grains in the xylem ray. Prismatic crystals in parenchyma cells of cortex, ray cells, xylem, and phloem. Lignin content present in the xylem elements, pericyclic fibres and in the phloem fibre region.

**Stem:** Medium sized round starch grains were present in the xylem region. Lignin content present

in the xylem elements, pericyclic fibres and in the phloem fibre region. Tannin present in the cork to phloem region. Plenty of small oil globules present in the inner xylem region, phloem region and in the cortex region.

#### **Histochemical Comparison with Market**

**Samples:** Histochemical tests of *Pleurolobus* root and showed small sized round starch grains in parenchyma cells of cortex, medullary ray and in the xylem region where in *Uraria picta* starch grains were present in xylem region only. Pericyclic fibres, phloem fibres, xylem elements and medullary rays lignified. Tannin deposition present in the cork and phloem ray region. Small oil globules in xylem of *Pleurolobus* where plenty of them were found in inner xylem region, phloem region and in cortex of *Uraria picta*.

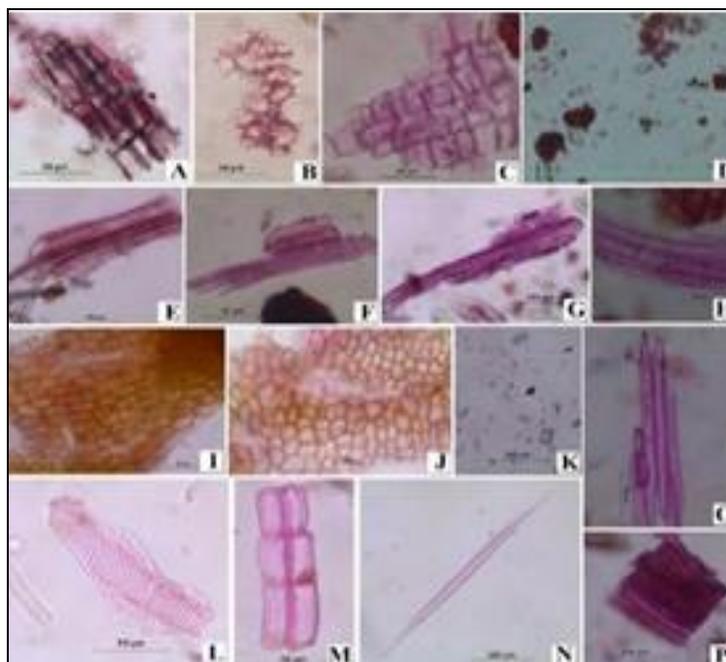
In all market samples, histochemical tests for tannin showed deposition in cortex and cork region. Lignification was present in a xylem and cortical fibre region, pericycle fibre, phloem fibre region of all samples. In all samples, starch grains were present in roots and stems with varying areas, sizes, and numbers in the xylem and in cortex region except in the Malappuram. The details of the histochemical comparison are given in the **Table 2**.

#### **Powder Microscopy (Fig. 12 & Fig. 13):**

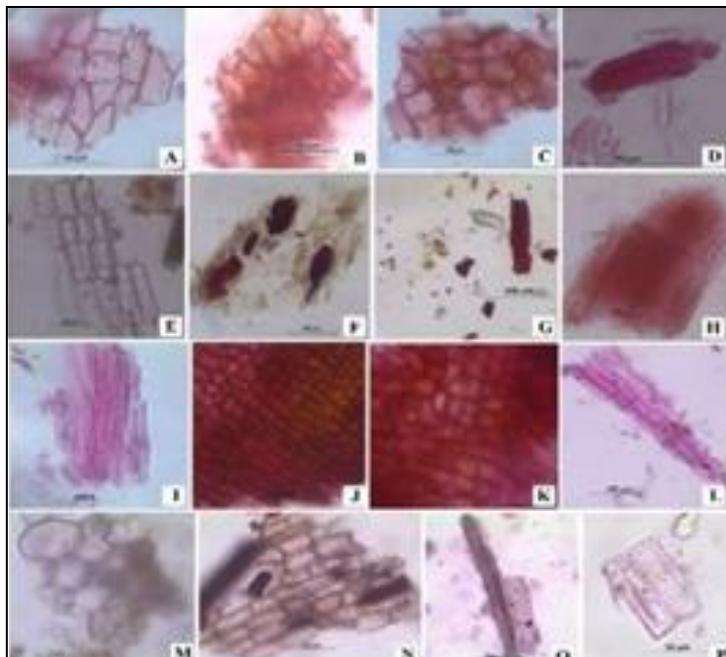
##### **Powder microscopic Characteristics *Pleurolobus gangeticus* (L) J.St.-Hil. (Fig. 12):**

**Root:** Surface view of cork cells; fragments of cortical parenchyma cells with and without reddish brown content; prismatic crystals of calcium oxalate; bundle of vessels and fibres; groups of vessels and fibres; pitted parenchyma cells with starch grains measuring 7-25 $\mu$  in diameter<sup>3</sup>; red coloured pigmented particle; pitted vessels etc observed in powder.

**Stem:** Shows surface view of cork cells; prismatic crystals and rod shaped of calcium oxalate; parenchyma cells; fragments of fibres; trichomes; xylem vessels; cut group of xylem vessels and tracheids; fragments of longitudinally cut crystal fibres; parenchyma cells and fibres filled with starch grains; bordered pitted vessel.; pitted parenchyma cells.



**FIG. 12: POWDER MICROSCOPY OF PLEUROLOBUS GANGETICUS L. A.- H. CHARACTERS OF ROOT; I - P. CHARACTERS OF STEM. A. CORK CELLS IN SECTIONAL VIEW; B. CORK CELLS IN SURFACE VIEW; C. PITTED PARENCHYMA CELLS OF MEDULLARY RAY; D. PRISMATIC AND ROD-SHAPED CRYSTALS OF CALCIUM OX STARCH GRAINS. E. FRAGMENTS AND FIBRES AND VESSELS; F. & G. FRAGMENTS OF FIBRES; H. FRAGMENTS OF VESSELS AND FIBRES; I. CORK CELLS IN SECTIONAL VIEW; J. CORK CELLS IN SURFACE VIEW; K. PRISMA ROD SHAPED CRYSTALS OF CALCIUM OXALATE; L. FRAGMENTS OF VESSELS; M. PITTED PARENCHYMA CELLS OF MEDULLARY RAYS; N. FIBRES WITH POINTED ENDS; O. FIBRES WITH STARCH GRAINS; P. FRAGMENTS OF FIBRES AND VESSELS.**



**FIG. 13: POWDER MICROSCOPIC CHARACTERISTIC OF MARKET SAMPLES; A. - I. CHARACTERS OF ROOT; J.- P. CHARACTERS OF STEM. A. CORK CELLS IN SECTIONAL VIEW; B. CORK CELLS IN SURFACE VIEW AND UNDERLYING CORTICAL CELLS WITH RED CONTENT; C. CORTICAL CELLS IN SECTIONAL VIEW WITH CONTENTS; D. REDDISH BRWON CONTENT; E. PITTED PARENCHYMA CELLS; F. PARENCHYMA CELLS WITH CONTENTS; G. CALCIUM OXALATE CRYSTALS AND PIGMENT CELLS; H. FRAGMENTS OF FIBRES AND VESSELS; I. FRAGMENTS OF FIBRES; J. CORK CELLS IN SURFACE VIEW; K. CORK CELLS IN SECTIONAL VIEW; L. PITTED PARENCHYMA CELLS; M. PARENCHYMA CELLS FROM PITH; N. CORK CELLS IN SECTIONAL VIEW; O. FIBRES AND PITTED VESSELS; P. PITTED PARENCHYMA CELLS.**

### Powder Microscopic Characteristics of *Uraria picta* (Jacq.) Desv.ex DC:

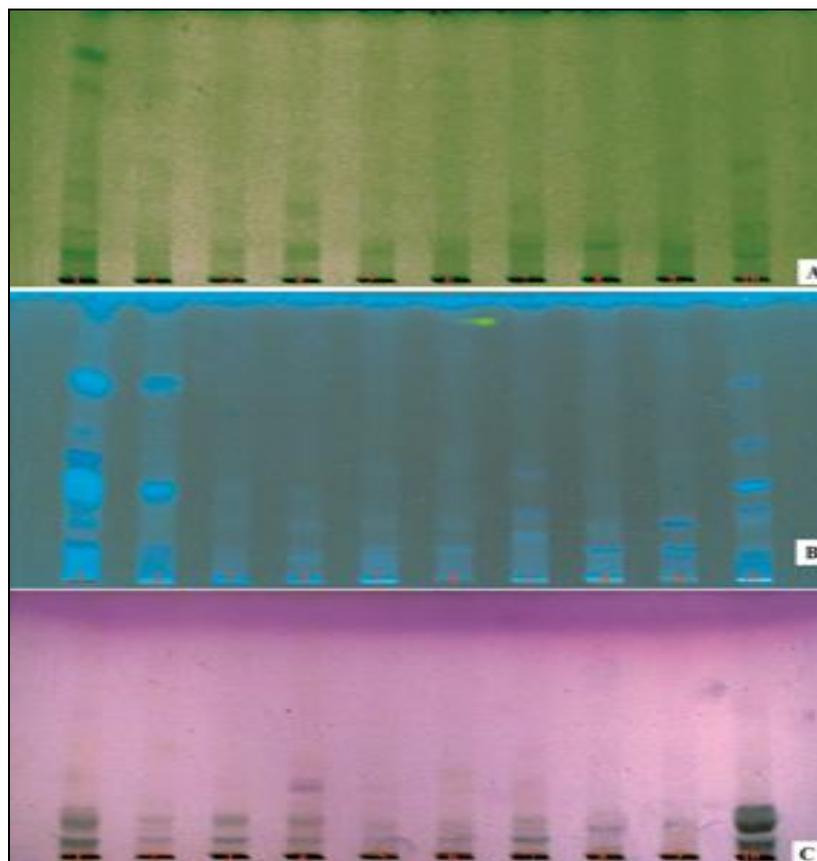
**Root:** Greenish-yellow; shows simple pitted vessels; fragments of fibres, tracheids, parenchyma cells; pieces of hairs; palisade cells; a few prismatic crystals of calciumoxalate; epidermal cells wavy walled in surface view showing paracytic stomata and starch grains simple, round to oval, measuring 6 to 17  $\mu$  in dia.

**Stem:** Shows fragments of surface view of cork cells; prismatic crystals and rod shaped of calcium oxalate; parenchyma cells; xylem fibres and phloem fibres; trichomes; pitted xylem vessels; cut group of xylem vessels and tracheids; fragments of longitudinally cutcrystal fibres; parenchyma cells and fibres filled with starch grains; bordered pitted vessel.; pitted parenchyma cells in pith; spiral vessel.

**Powder Microscopic Comparison with Market Samples (Fig. 13):** Powder microscopy of market

sample showed the presence of Rod-shaped crystals of calcium oxalate were found only in Pleurolobus and Trivandrum sample only. Simple and compound starch grains in clusters and solitary, Prismatic crystals, bundle of vessels and fibres, parenchyma cells with starch grains pitted vessel, fragments of surface view of cork cells, parenchyma cells, xylemfibres, trichomes, fragments of xylem vessels fibres, fragments of longitudinally cutcrystal fibres with or without reddish content, pitted parenchyma cells and fibres, pitted vessel, bordered pitted vessel where in the market sample reddish brown deposition were more.

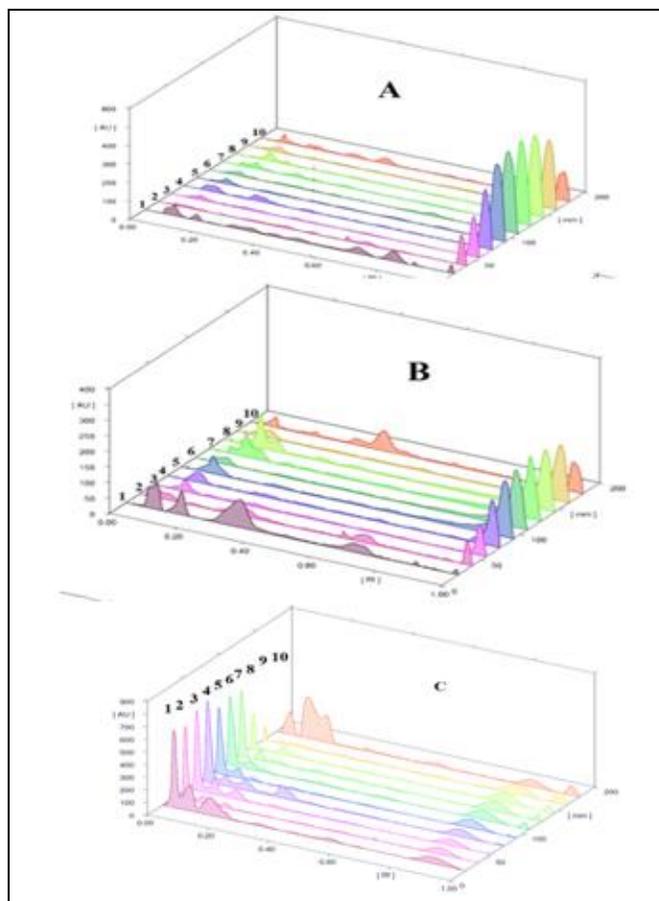
**HPTLC Comparison (Fig. 14 & Fig. 15, Table 3):** The Rf value of the genuine source plants and the market samples of *Orila* were calculated and colour of the bands were also noted. The Rf values at 254nm, 366nm & Rf value visualized after derivatisation are shown in the **Table 3**.



**FIG. 14: HPTLC COMPARISON OF THE HOT WATER EXTRACTS OF SOURCE PLANTS OF *ORILA* ALONG WITH ITS MARKET SAMPLES. A. TLC PROFILE OF AT UV 254 NM. B. TLC PROFILE OF AT UV 366 NM. C. TLC PROFILE AFTER DERIVATISATION. 1. PLEUROLOBUS GANGETICUS ROOT, 2. PICUROLOBUS GANGETICUS STEM, 3. THIRUVANANTHAPURAM MARKET SAMPLE, 4. IDUKKI MARKET SAMPLE; 5. PALAKKAD MARKET SAMPLE; 6. MALAPPURAM MARKET SAMPLE; 7. KOZHIKODE MARKET SAMPLE; 8. WAYANAD MARKET SAMPLE, 9. KASARGOD MARKET SAMPLE; 10. URARIA PICTA STEM**

The HPTLC profile of *P. gangeticus* root water extract at UV 254nm showed 8 bands and 4 bands in stem. 4 bands in Idukki sample. 2 bands in Trivandrum, Malappuram, Wayanad, one band each in Palakkad and Kasargod samples, 3 bands in Kozhikode sample, 2 bands each in Trivandrum and Idukki samples. Among these samples, 2 bands in Trivandrum and Idukki, Kozhikode, Wayanad and one band each in remaining all samples were found similar to *P. gangeticus* root. When R<sub>f</sub> values at UV 366nm is compared 2 bands in

Malappuram sample and one each in all the other samples were found similar to *P. gangeticus* root and at 550 nm 3 bands in Trivandrum and Wayanad samples, 2 bands in Idukki sample, 1 band each in kozhikode, Wayanad and Malappuram samples were found similar to *P. gangeticus* root. 3 bands in Trivandrum sample, 2 each in Idukki and Palakkad samples and 1 band in all other sample were found similar to *P. gangeticus* stem. The details of the HPTLC profile are given in the **Table 3**.



**FIG. 15: HPTLC DENSITOMETRIC COMPARISON OF THE HOT WATER EXTRACTS OF SOURCE PLANTS OF *ORILA* ALONG WITH ITS MARKET SAMPLES. A. PROFILE OF AT UV 254 NM. B. PROFILE OF AT UV 366 AM C. PROFILE AFTER DERIVATISATION. 1. *PLEUROLOBUS GANGETICUS* ROOT; 2. *PLEUROLOBUS GANGETICUS* STEM; 3. THIRUVANANTHAPURAM MARKET SAMPLE; 4. IDUKKI MARKET SAMPLE, 5. PALAKKAD MARKET SAMPLE; 6. MALAPPURAM MARKET SAMPLE; 7. KOZHIKODE MARKET SAMPLE; 8. WAYANAD MARKET SAMPLE, 9. KASARGOD MARKET SAMPLE; 10. *URURIA PICTA* STEM**

The R<sub>f</sub> value of the genuine source plants and the market samples of *Orila* were calculated and colour of the bands were also noted. The R<sub>f</sub> values at

254nm, 366nm & R<sub>f</sub> value visualized after derivatisation are shown in the tables.

**TABLE 3: HPTLC PROFILE- THIN LAYER CHROMATOGRAPHY**

		R <sub>f</sub> values of samples at UV 254 nm										R <sub>f</sub> values of samples at UV 366 nm										R <sub>f</sub> values of samples at UV 550 nm														
<i>P.g-Rt</i>	<i>P.g-St</i>	T	I	P	M	K	W	K			<i>U. picta</i>	<i>P.g-Rt</i>	<i>P.g-St</i>	T	I	P	M	K	W	K			<i>U.p icta</i>	<i>P.g-Rt</i>	<i>P.g-St</i>	T	I	P	M	K	W	K			<i>U.p icta</i>	
0.0	0.06	0	0.0	0	0	0	0	0	0.0	0.0	<i>U. picta</i>	0.0	0.0	0	0.0	0	0	0	0	0	0.0	0.0	<i>U.p icta</i>	0.0	0.0	0.03	0	0.0	0	0	0	0	0	0	0.0	
7			8						8	7	8	6	6		9								8	4	4			2							5	
		0		1	1	0	1	1				1	1	0		1	0	0	0	0						0	0	0	0	0	0	0	0	0	0	
		7		0	0	7	1	0				0	0		0	6	7	2	5								2	1	1	1	1	1				

0.1 0	0.61 1 0	0 0	0.1 0	0 7 2	0 1 1 7	0 1 1 1	0.1 6	0.0 9	0.0 8	0 1 1 1 0	0 1 1 1 1 0	0.3 2	0.0 9	0.0 9	0.09 0	0 8	0 0 0 0 0 0	0 0 0 0 0 0	0 0 0 0 0 0	0.1 1
0.1 7	0.68 3	0.2 3	0 2 4	0 1 1 7	0.1 9	0.1 7	0.3 2	0 0 0 0 0	0.4 7	0.1 6	0.1 4	0.16 0	0 3	0.1 0	0.1 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0.1 7
0.2 9	0.2 6	0.2 6	0 2 4	0 1 1 7	0.3 0	0.3 5	0.6 1	0 0 0 0 0	0.2 1	0.1 7	0.28 0	0 6	0.2 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0.3 0
0.3 4			0 2 4	0 1 1 7	0.4 1	0.6 9	0.6 7	0 0 0 0 0	0.3 2	0.5 5	0.43 0	0 5	0.8 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0.5 4
0.4 9			0 2 4	0 1 1 7	0.7 2	0.6 9		0 0 0 0 0	0.5 5	0.6 6	0.86 0	0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0.8 4
0.5 0			0 2 4	0 1 1 7	0.8 7			0 0 0 0 0	0.8 9	0.8 7	0 0	0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	
0.7 0			0 2 4	0 1 1 7				0 0 0 0 0					0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	
0.8 1			0 2 4	0 1 1 7				0 0 0 0 0					0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	
0.8 7			0 2 4	0 1 1 7				0 0 0 0 0					0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	

\*P.g – *Pleurolobus gangeticus*, T- Thiruvananthapuram, I- Idukki, P- Palakkad, M- Malappuram, KZ-Kozhikode, W- Wayanad, K- Kasaragod, *U. picta* – *Uraria picta*, Rt- Root, St- Stem.

**CONCLUSION:** After subjecting all the samples to pharmacognostic investigation like macroscopic, microscopic, histochemical, powder microscopic and HPTLC characteristics as per the standards and comparing those in all parameters we could not find that even one pure sample of *Orila* in market. Macroscopic features are not sufficient for confirming the identity of samples as we got mixtures of samples from almost all the markets out of which some are finely chopped so that macroscopic features are not clearly distinguishable. As per microscopic studies Samples from Trivandrum, Kozhikode and Wayanad contains *P. gangeticus* roots and stems along with other similar looking plants. Samples from Idukki, Palakkad and Kasargod were mixtures of some similar looking species of *Desmodium*. Malappuram sample contains roots and stems of *Mūvila i.e., Pseudarthria viscida*. As per HPTLC analysis also similar bands most matching with *Pleurolobus gangeticus* roots and stems were observed in Trivandrum, Kozhikode and Wayanad sample but showed some extra bands and differences as the samples were mixture of other plants also. All other sample extracts showed dissimilar bands in UV 254, 366 and Visible lights. And, the price has been rising 10 times during the last 13 years.

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