

MOMORDICA CHARANTIA

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Botanical name *Momordica charantia*
Linn.

Homoeopathy *Momordica charantia*

Family Cucurbitaceae

Trade name Karela.

Classical names as adopted in various traditional systems of medicine viz., Ayurveda, Siddha, Unani, Homoeopathy etc.

Vernacular names

Hindi : *Karela, Kareli*; Bengali: *Karala, Kerula, Uchche*; Gujarati: *Karela*; Telugu: *Kakara*; Bombay: *Kurela-jangro*; Marathi: *Karle*; Tamil : *Pakal, Pavakkachedi, Pavakkayi*; Kannada: *Hagala kayi*; Konkan: *Karathay*; Malayalam: *Kaippa, Kaippavalli, Paval*; Sanskrit: *Karavella, Sushavi*; English: *Bitter gourd, Carilla fruit*.

Ayurveda Kaaravella,
Peetapuahpa,
Chirachchaaa, Kathilla

Siddha Kompu, Pakal

Unani Karela

Botanical description

A monoecious annual climber with long, much branched, angled and grooved, more or less

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pubescent or hairy stem. Tendrils simple, slender, elongate, pubescent. Leaves almost orbicular in outline, 5-12.5 cm in diameter, pubescent or subglabrous on both the sides, cordate at the base, deeply divided into 5-7 lobes, the lobes acute or subacute, apiculate, coarsely spinous-dentate, constricted at the base, the sinus between them narrow, rounded; petiole 2.5-5 cm long, channeled, pubescent. Flowers monoecious. Male flowers: solitary, peduncles 5-10 cm long, glabrous or pubescent, furnished with a large reniform or orbicular bract at the middle; calyx 8-10 mm long, pubescent, lobes 5-6 mm long, elliptic, subacute; corolla somewhat irregular, lemon-yellow, segments obtuse or emarginate, 1.6-2 cm long, veined; stamens 3 or rarely 2, filaments short. Female flowers: peduncles 5-10 cm long, slender, bracteate, usually at or near the base; staminodes 3, glanduliform; ovary fusiform, muricate; stigmas 3, bifid. Fruits 5-25 cm long, light green to green in colour but bright orange when matured, pendulous, fusiform, beaked, ribbed with numerous tubercles; seeds brownish 13-16 mm long, compressed embedded in red pulp.

Distribution

The plant is cultivated throughout India and is distributed to Malaya, China, and Tropical Africa. There are many cultivated varieties which can be differentiated on the basis of the shape and size of the fruit.

Availability (abundant/rare/threatened/ endangered etc.) Abundant

Part used Ripe fruit (in Homoeopathy)
Whole plant, fruit, root & leaves
(in Ayurveda & Unani).

Action and uses

Traditional system

M. charantia is specially used as a folk medicine for diabetes. The fruits are stomachic and are also used in gout, rheumatism, in spleen and liver diseases. Fruit juice with chalk/sugar is used in stomatitis, and as an emmenagogue in dysmenorrhoea. The fruit juice given for 3 days once in the morning is said to exert a contraceptive effect. The fruit and leaves are used in piles, jaundice and as a vermifuge. The juice of the leaves is used as an emetic, purgative in bilious affections and also in relieving burning of the

feet. Leaves act as a galactagogue. In Konkan the leaf juice is applied externally for burning of the soles of the feet, and with black pepper it is rubbed round the orbit as a cure for night blindness. The pounded leaves mixed with some fatty materials are made into an ointment which is useful for scabies and other skin diseases. The roots are used as astringent and in haemorrhoids.

Ayurvedic system

कारवेल्लं हिमं भेदि लघुतिक्तमवातलम्।
ज्वरपित्तकफास्त्राघ्नं पाण्डूमेहक्रिमीन् हरेत्॥
तद्गुणा कारवेल्ली स्यात् विशेषात् दीपनीलघुः ॥
(भावप्रकाश)

Karavellam himam bhedi laghu tiktamavatalam
jvarapittakaphasraghnam pandumehakrimin haret
Tadguna karavelli syat visesat dipani laghu
(Bhavaprakasa)

(Sitala, Malabhedaka, Agnidipaka, Kaphaghna, Pramehaghna, Krimighna, Jvarghna, Pandu and Rakta Vikra and Madhumeha hara.)

The fruit is bitter, cooling, digestible, laxative, antipyretic, anthelmintic, appetiser; cures biliousness, 'Kapha', blood diseases, anaemia, urinary discharges, asthma, ulcers, and bronchitis; the juice is useful in cholera. The root possesses astringent properties and is effective in haemorrhoids and also used in ophthalmia and in prolapsus vaginae. The whole plant is abortifacient, antidiabetic (also fruits, leaves and root).

Unani system

Bitter gourd is generally used in inflammations and is best suited to the people of phlegmatic temperament. Thus, it is effective against diseases e.g. arthritis, gout, ascites, splenitis, intestinal worms, cough and bronchitis etc. which are caused by phlegm. The juice of its leaves is beneficial for pneumonia in children and causes diarrhoea. A paste made from grinding bitter gourd in vinegar reduces the swelling in mumps.

Homoeopathic system

Therapeutic effects of *M. charantia* are very similar to that of *M. balsamina* as mentioned in Boericke's Homoeopathic Mat. Med. and have been used for control of cramps, thirst, prostration and in accumulation of yellow watery fluid in the intestine.

Modern system

Extract of the fruit is taken orally in jaundice, piles, leprosy, as an emmenagogue in dysmenorrhoea, as a tonic in rheumatism and gout, and as laxative. Unripe fresh fruit juice is taken orally for malarial fever. Hot water extract of dried seeds is taken orally for diabetes, hepatic disorders, pain relief in gout, in rheumatism and as an anthelmintic. Hot water extract of flowers and leaves is taken orally each month to avoid child-birth through early abortion. Juice of the entire plant is taken orally as an abortifacient and as an emmenagogue. Leaves are eaten by children as a purgative and anthelmintic.

Pharmacognostic

Macroscopic

Fruit

Fruit, green but bright orange coloured at maturity, 5-15 cm long, pendulous, fusiform, usually pointed or beaked and bears numerous tubercles, 3-valved at apex when mature. Seed 8-15 mm long, creamy brownish, compressed, corrugate on the margins, sculptured on both faces. Transverse section of a fruit shows pericarp comprising of exocarp, mesocarp and endocarp; seed 0.5 mm thick, enveloped by false aril derived from the placental tissue and compact inner layer of loosely aerenchymatous endocarp of the fruit as a loose bag around the seed and funicle, eventually becoming slimy with orange carotenoid granules and abundant starch grains in the cells.

Leaf

The leaves are thin, reniform or suborbicular in outline, 4 to 12 cm broad, palmately to pedately 5-7 lobed, glabrate or pubescent, the lobes dentate, acute or obtuse; petioles slender 3 to 6 cm long. Odour not characteristic, taste slightly bitter.

Microscopic

Fruit

Fruit in transection shows circular outline with elevated tubercles and consists of exocarp of wavy outline exhibiting single layer of epidermis of thin walled rectangular cells interrupted by stomata, and trichomes of two types, (a) multicellular, uniseriate, warty, trichomes and (b) glandular trichomes with 3-4 celled stalk and multicellular head, followed by several layers of sub-epi-

dermal tissue of thin walled parenchyma cells containing chloroplast in mature fruit and spindle and thread like chromoplast in fully ripe fruit. Mesocarp consists of outer layers of small, compactly arranged parenchymatous cells containing large scattered bicollateral vascular bundles and inner layers of large, thin walled parenchymatous cells possessing small vascular bundles. Endocarp of the compact membranous inner layer of parenchymatous cells covering the seed.

Seed

Transverse section is bitegmic consisting of outer testa and inner tegmen. The testa shows outer epidermis of elongated, of varying height, palisade-like columnar cells with mucilaginous walls covered by thick cuticle, and contains starch grains; hypodermis differentiated into outer zone of 3-4 layers of small, contiguous cells and inner zone of 5-11 layers of aerenchymatous tissue of compact, lignified, thick-walled cells with pits; the inner epidermis consists of small ill defined cells. Tegmen consists of thin-walled parenchymatous cells embedding the vascular bundles and inner epidermis of small, thick-walled cells. The cotyledons are crescent shaped having single layer of epidermis, parenchymatous ground tissue and vascular bundles in a row.

Leaf

Lamina in transverse section shows epidermis single layered with sinuous anticlinal walls; stomata on both surfaces, anomocytic; cystoliths in single, double, triple or quadruple, present in lower epidermis; trichomes of two types, glandular and non-glandular on both the surfaces. Non-glandular trichomes multicellular, uniseriate with longitudinal cuticular striations and glandular trichomes with uniseriate, 3-5 celled stalk and multicellular head. However, explosive trichomes with 5-6 celled stalk and two celled head on the leaves and petioles and multicellular, uniseriate, elongated water containing trichomes at the margin of the leaves have also been reported in the literature. Mesophyll is differentiated into single layer of palisade and 3-5 layers of spongy parenchyma cells. Midrib is prominently projected from the lower surface, exhibits a small ventral bulge and possesses a small conjoint, collateral vascular bundle in the centre embedded in parenchymatous ground tissues and hypodermal collenchyma. Petiole shows ridged outline with strands of bicollateral vascular bundles arranged in the form of a ring in parenchymatous ground tissue and collenchymatous hypo

dermis. Thickness of the leaf as measured from transverse section 100-150 μ m; cells of upper epidermis T.16-25-35 μ m, R.12-14 μ m, L. 23-35-46 μ m; cells of the lower epidermis T.12-15-18 μ m, R.9-11-14 μ m, L.18-24-28 μ m; palisade cells 35-38-42 μ m x 9-11-14 μ m; stomata in surface view 12-18 μ m x 9-12 μ m; hair of the upper surface 120-350 μ m; hair on the margin of the leaf 200-450 μ m; hairs on the lower surface 200-450-600-700 μ m. In the petiole the epidermal cells are T.7-13-23 μ m, R.12-18 μ m, L.23-57 μ m; collenchyma cells. T.18-28 μ m, R 12-23 μ m, L 58-180 μ m; cells of ground tissue, T 92-155 μ m, R. 92-138 μ m, L 138-184 μ m; cortical cells T.46-76-105 μ m, R,46-60-75 μ m, L.150-206-230 μ m; fibres 23 μ m x 800-900 μ m, 1 mm or more; vessels 23-28 μ m x 900 μ m-1 mm or more; hair 200-550 μ m.

Stem

Transection is circular in outline and has five projecting ridges. The diagnostic characteristics are: epidermis single layered bearing stomata slightly raised above the level of epidermis; trichomes non-glandular and glandular similar to leaf; hypodermis collenchymatous containing chloroplasts at ridges, and 2-3 layers or none at furrows; cortex, a narrow zone of 2-3 layers of chlorenchyma at furrows; endodermis indistinct; pericycle in the form of continuous ring of 4-5 layers of thick-walled lignified sclerenchyma cells, and ground tissue of thin-walled parenchyma cells extending from below the sclerenchyma to the centre of the stem. Vascular bundles bicollateral, arranged in two rings, the outer row consists of five small bundles at ridges. Each bundle consists of xylem, two strips of cambium and two patches of phloem. Xylem occupies the centre of the bundle and consists of very wide vessels (metaxylem) on the outer side and narrower vessels (protoxylem) on the inner side, tracheids, fibres and xylem parenchyma. Cambium occurs in two strips, the outer, and inner forming narrow strips between wood and phloem. Phloem occurs in two patches, the inner and outer and consists of sieve tubes, companion cells and phloem parenchyma.

Powder

The powder of leaf is characterised by greenish to olive brown colour; under the microscope it shows the presence of fragments of epidermal tissue with often double, triple or quadruple cystoliths, different types of hair viz. glandular and non-glandular; collenchyma; vascular tissues specially xylem vessels with scalariform and spiral thickening.

Chemical constituents

Seed of *Momordica charantia* is reported to contain β -sitosterol-D-glucoside, stearic acid; two lectins (I, II) differing in amino acids composition and amino terminal sequences; five new triterpene-glycosides: momordicosides A, B, C, D, and E; two cytokinins: zeatin and zeatin riboside, and vicine. In addition momordicosides K and L have also been isolated from fruits. Immature fruits are reported to possess four momordicosides, G, F1, F2 and I. Bitter gourd is a good source of ascorbic acid and values upto 188mg/100g have been reported in fresh tender fruit, while, ripe yellow fruit contains approximately half the quantity of ascorbic acid as compared to tender fruit. An alkaloid momordicine (charantin) and saponin have also been reported from fruits and leaves. Analysis of the fruit of *Momordica charantia* gave the following values: moisture: 83.2; protein:2.90; fat:1.0; carbohydrate: 9.8; fibre:1.7, and mineral matter 1.4%; calcium 50, phosphorus 140, and iron 9.4 mg/100gm. The amino acids present in the fruit are aspartic acid, serine, glutamic, threonine, α -alanine, β -alanine, aminobutyric acid, pipercolic acid, phenylalanine, and proline. The green fruit also contains luteolin. Following vitamins and minerals are also reported viz. carotene (as vitamin A), thiamine, nicotinic acid, riboflavin, ascorbic acid, copper (traces) and potassium.

Pharmacology

Water extract of the dried seeds has been reported to possess abortifacient activity in rats and mice. The juice of fruit, administered orally in different doses produced hypoglycaemia in normal and alloxan induced diabetic rabbits. A dose of 6 ml/kg appeared to be optimal dose to produce the maximum fall in the blood sugar levels. Similar effects have also been reported in normal and alloxan diabetic dogs. The hypoglycaemic activity of *M. charantia* juice has been attributed to p-insulin, a polypeptide present in bitter gourd. It contains 17 amino acids, out of which 16 are similar to bovine insulin. Chronic administration (for 60 days) of *M. charantia* fruit extract (1.75g/day) to dogs led to testicular lesions with mass atrophy of the spermatogenic elements. The extract reduced the testicular contents of RNA, protein and sialic acid and also the acid-phosphatase activity. The aqueous extract causes sustained contraction of isolated rat uterus. Small doses cause relaxation of guinea pig ileum whereas higher doses cause contraction. Charantin exerts a non-specific antispasmodic and

summer crop is sown during April to July, while two crops are generally taken in the plains. The hot season or early crop is sown between March and April and is often grown without support : the rainy season crop is sown in June-July and is trained on supports. The seeds are sown in lines 60 cm apart in well-prepared and manured beds or in small pit. Two or three seeds are planted in each pit but only one plant is retained after germination . The plants are watered once or twice a week during the dry weather. They begin to flower within 30-35 days after sowing and fruits become ready for gathering 15-20 days later.

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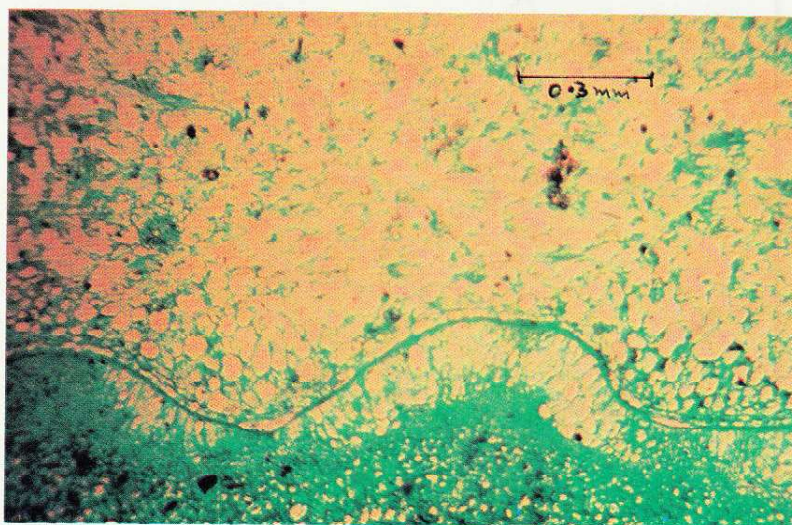
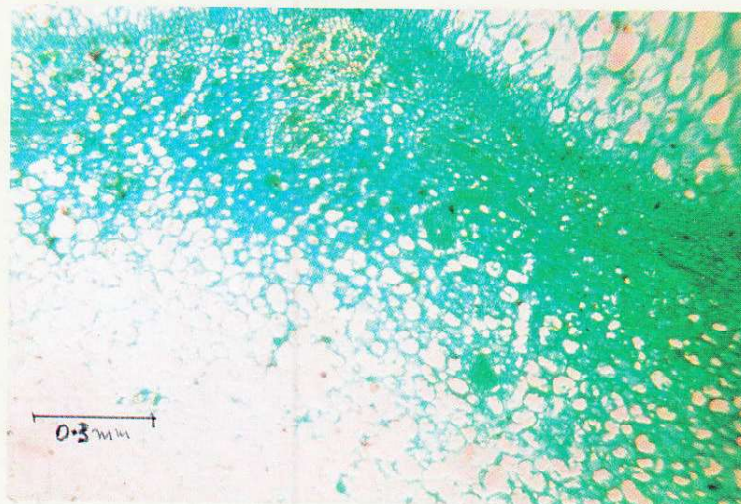
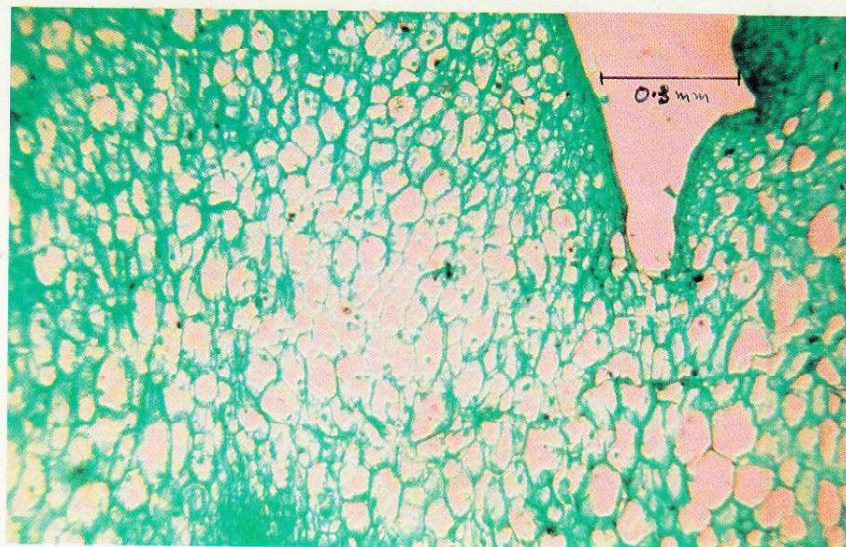


Fig. 1. Transection of fruit showing a portion of (1) exocarp (2) mesocarp and (3) endocarp and a small portion of testa of the seed.



Fig. 2. Transverse section of seed showing seed coat and a part of cotyledons.

Fig. 3. Transection of seed, a portion enlarged showing testa, tegmen and a small portion of cotyledon.

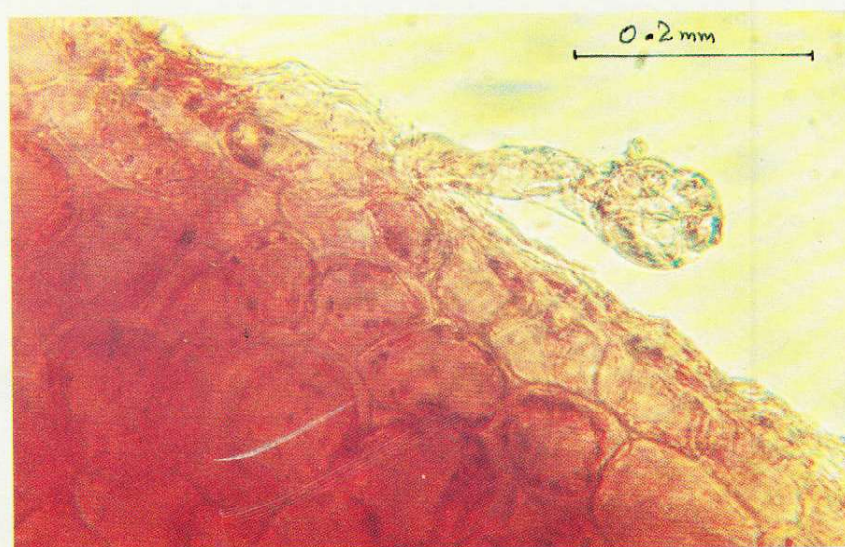
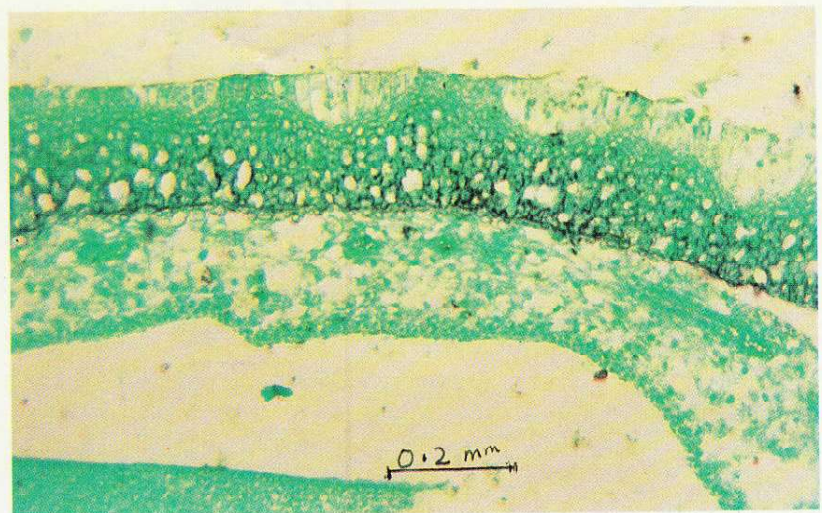


Fig. 4. A glandular trichome from the exocarp of fruit.

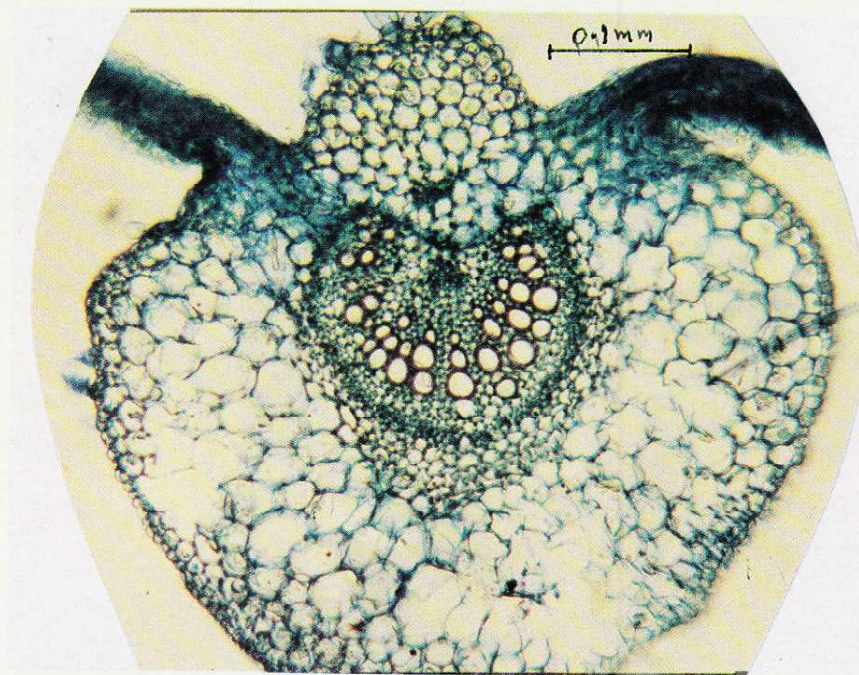


Fig. 5. Transection of leaf through midrib region showing conjoint, collateral vascular bundle.

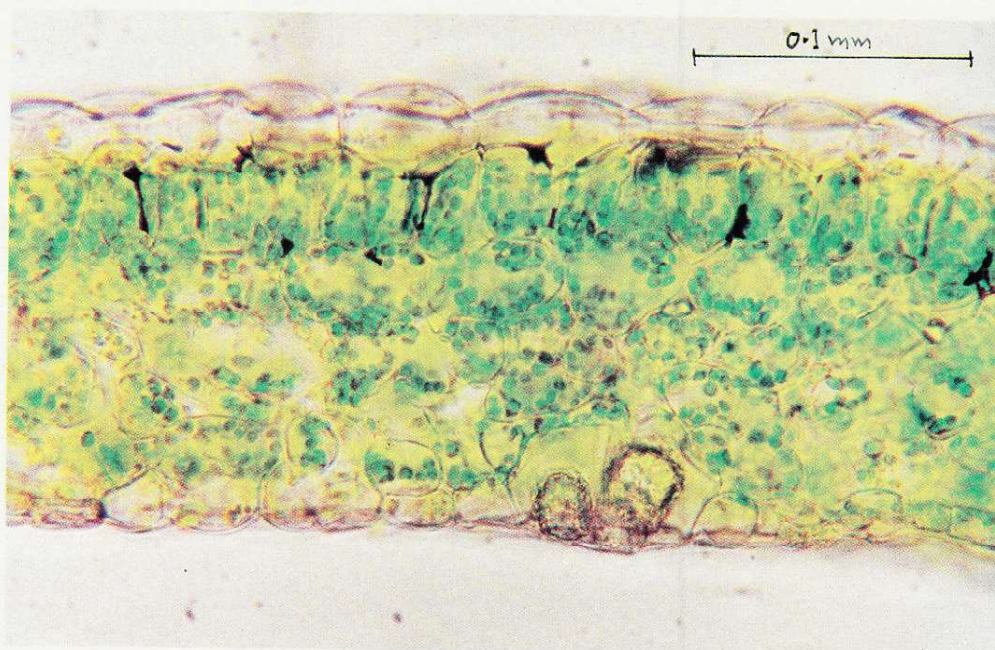


Fig. 6. Transection of leaf through lamina region showing dorsiventral nature and cystoliths in lower epidermis.



Fig. 7. Surface view of epidermis showing anomocytic stomata.

Fig. 8. Leaf margin showing multicellular, uniseriate trichomes.

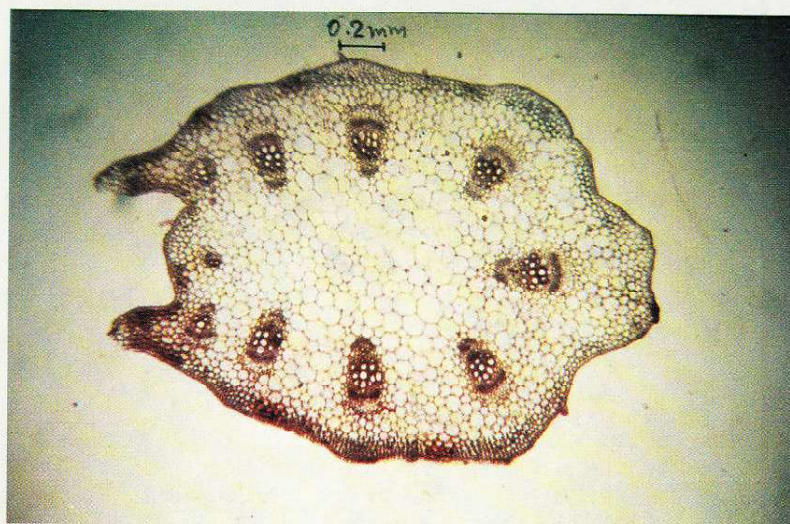
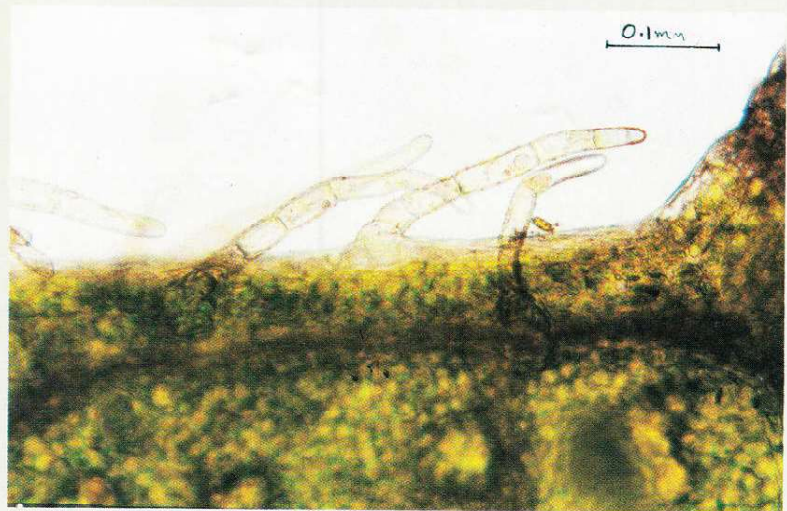


Fig. 9. Transverse section of petiole showing vascular arrangement.

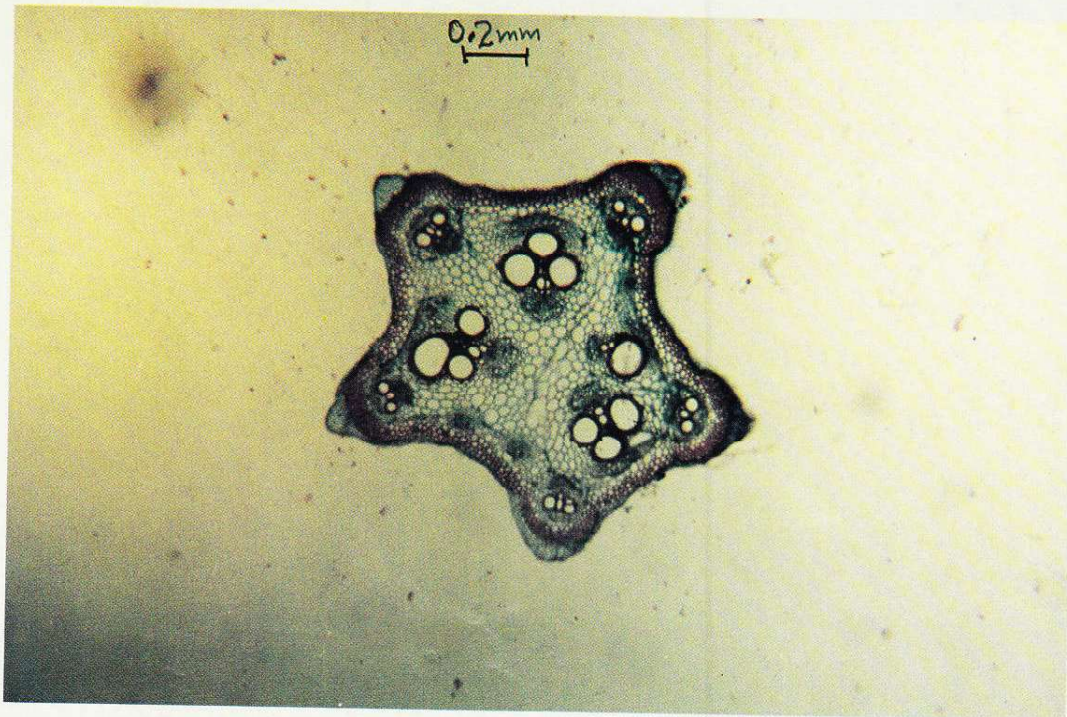


Fig. 10. Transection of stem showing five projecting ridges, sclerenchymatous pericycle and vascular bundles in two rings.

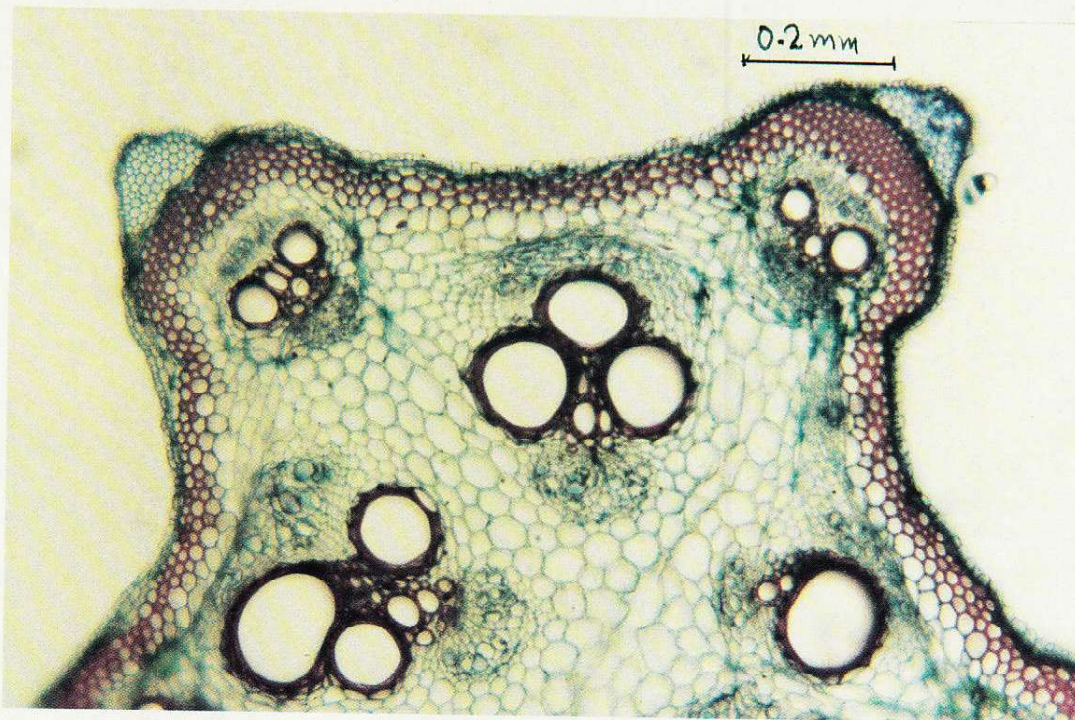


Fig. 11. Transection of stem, a portion showing collenchymatous hypodermis, pericycle of continuous ring of sclerenchyma and bicollateral vascular bundles.