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CAESALPINIA BONDUCELLA

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Botanical name *Caesalpinia bonduc* (Linn.) Roxb. emend. Dandy & Exell.

Synonyms *Caesalpinia bonducella* (Linn.) Flem.; *C. jayabo* b *cyanosperma* Maza; *Bonduc minus* Medic.; *Guilandina bonducella* Linn.; *G. bonduc* b *minus* DC.

Family Caesalpiniaceae

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

Ayurveda Kuberaaksha, pooteekaranja, prakeerna (prakeerya), kantakikarnja, vitapakaranja, pootika, lataakaranja

Siddha Kalarcik koluntu, kalarcip paruppa, kalarci ver

Unani Karanjwa, Akitmakit, Hajrul-Uqab, Hajrul-Wiladat, Khaya-Iblees, Khyrma-e-Abu Jahl.

Homoeopathy Caesalpinia bonducella

Trade name Karanju

Vernacular names

Bengali: *Nata*; Hindi: *Kanja, Karanju*; Kannada: *Gajagakayi*; Konkan: *Gajago*;

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Malayalam: *Kazhanchikkuru*; Marathi: *Gajaga, Sagargoto;* Tamil: *Avil, Gujju, Kazachchikaai*; Telugu: *Gachcha kaya*; Assam: *Lataguti*; Himachal Pradesh: *Karanj, Katkaranj*; Jammu & Kashmir: *Karanj*; Madhya Pradesh: *Gattar*; Mysore: *Sanna gejjuga*; Rajasthan: *Khar konda*; Sanskrit: *Kuberakshi;* English: *Malacca bean, Fever nut, Bonduc nut, Physic nut.*

Botanical description

An armed liana, upto 15 m in height. Branchlets glossy, black, armed with recurved, hard, yellow, prickles at the base of pinnae and elsewhere. Leaves pinnately compound 30-60 cm long, petiolate; petioles prickly; stipules in the form of a pair of reduced pinnae at the base of the leaf, each furnished with a long mucronate point; pinnae 6-11 pairs , 5-7.5 cm long; leaflets stalked, 2-3.8 by 1.3-2.2 cm, coriaceous, elliptic - oblong , obtuse, apex mucronate, upper surface glabrous, shining, lower surface, puberulous, dull, margin curved. Flowers in long peduncled terminal and supra-axillary racemes, dense at the top, lax downwards, 30-60 cm long, pedicels 5-8 mm, brown, downy; bracts squarrose, linear, acute, 1 cm long, fulvous- hairy. Calyx 5, 6-8 mm long, fulvous- hairy. Corolla 5, oblanceolate, yellow. Stamens 10, filaments declinate. Fruit: a pod, somewhat swollen, dark brown to black, beaked, shortly stalked, oblong, 5-7.5 cm x 4.5 cm, densely armed on the faces with wiry prickles. Seed 1 to 2, oblong, orbicular or ovoid to reniform, black, polished and hard.

Distribution

Throughout India and upto an altitude of 1,000 m in the Himalayas. It is also found in the deltaic regions of western, eastern and southern India, Myanmar and Sri Lanka.

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

Abundant

Part used

Seeds (in Homoeopathy and Unani), Bark,fruit, seeds and leaves (in Ayurveda).

Actions and uses

Traditional system

Lodhas used root powder in constitutional disorders; paste of twig with lime water in intestinal worms; leaf powder with decoction of long pepper as tonic; and powder of seeds in dyspepsia and in colic pain. *Mundas* used seed oil in facial paralysis and *Santals* used it for hydrocele and seed powder for malarial fever. In Katra valley (Jammu & Kashmir), the plant juice is taken for two weeks after meals to cure intermittent fever. In Kangra (Himachal Pradesh), the roots are used in intermittent fever and diabetes. In Sri Lanka, the plant is used for treatment of fractures. In Mauritius, crushed seeds mixed with honey or castor oil are given as an anthelmintic. In the West Indies, the roasted seeds are made into a kind of coffee for diabetics. In Jamaica, the bark is used as a rubefacient and as a local application for sores.

Ayurvedic system

करञ्जः कटुकस्तीक्ष्णो वीर्योष्णो योनिदोषहृत्।
कुष्ठोदावर्त्तगुल्मार्शोव्रणक्रिमिकफापहः।।
तत् पत्रां कफवातार्शः क्रिमिशोथहरं परम्।
भेदनं कटुकं पाके वीर्योष्णं पित्तलं लघु।।
तत्फलं कफवातघ्नं मेहार्शः क्रिमिकुष्ठजित्।।

(द्रव्यगुण)

karanja: katukastiksno viryosno yonidosahrt.
kusthodavarttagulmarsovranakrimikaphapaha: ..
Tat patram kaphavatarsa:krimisothaharam param .
bhedanam katukam pake viryosnam pittalam laghu..
tatphalam kaphavataghnam meharsa: krimikusthajit ..

(Dravyaguna)

It is *katu, teekshna, ushnaveerya*; beneficial in gynaecological disorders, skin diseases, constipation, abdominal lump, piles, ulcer, worms and deranged *kapha.* Leaves are beneficial in deranged *kapha, vata*, piles, worms and oedema ,laxative; *katuvipaka, ushnaveerya*, aggravates *pitta, laghu.* Fruits cure deranged *kapha* and *vata*, polyuria, piles, worms and skin diseases. The seeds of *Caesalpinia bonduc* are used as antiperiodic, antipyretic, tonic and febrifuge. It is also used in asthma and snake-bite. Tender leaves are used in disorders of the liver. Leaves and bark are used as febrifuge and anthelmintic. According to Chakradutta the water extract of root-bark of *C. bonduc* is often given orally in the early stage of small-pox. The leaves and seeds are often used as poultice in inflammation; leaf and bark possesses emmenagogue properties. Seeds of *C. bonduc* along with bark of *Alstonia scholaris* are given as a remedy in fever. The kernel powder of *C. bonduc* is often used as antimalarial drug. It is also given in piles. The seed-kernel paste in mustard or sesamum oil is externally applied in skin diseases and in earache. Relative efficacy of

'Ayush-64' and 'Saptaparnaghana Vati' of which it is one of the constituents, on microfilarial patients has been reported to be 65.2% and 86.6% respectively.

Unani system

Fever Nut is used in the form of powder or paste in ascites and hydrocele. In the case of numbness of testicles, leaves of castor are wrapped around the testicles after sprinkling fever-nut powder on them. Besides, the powder is also effective in itching . To control shivering associated with fever and blood impurities, the leaves of this drug are ground in water alongwith some seeds of black pepper . For the treatment of paroxysmal fever especially quadrant fever, pills are made from the powder of Fever Nut, Palas Papra (Bengal kino tree) and Aqaqia (Acacia) buds in equal weight. It has been reported that if two or three seeds of Karan-jawa (Fever Nut) are thrown into fire until its outer shell is completely burnt and then use of its kernel provides immediate relief in bronchial spasm. An oil prepared from burning Fever Nut in sesame oil and filtered, is good for septic wounds and itching. Half a kernel of Fever Nut finely ground with seven cloves relieves colic.

Homoeopathic system

This drug was proved by Dr. K.K. Bhattacharya and finds mention in Drugs of Hindoosthan by S.C. Ghose. Used for the treatment of different ailments of head, eyes, nose, mouth,tongue, abdomen, liver, spleen and for the control of mind. Its use is also recommended in the treatment of intermittent fever.

Modern system

Seeds are antiperiodic, antipyretic, tonic,febrifuge, given in asthma and snake- bite. Tender leaves are used in disorders of the liver. Leaves and seeds are used externally for dispersing inflammatory swellings. Leaves and bark are emmenagogue, febrifuge and anthelmintic. Oil from seeds is an emollient and is used as a liniment to remove freckles from the face and to stop discharge from the ear. Leaves and seeds are reported to be used in skin diseases and rheumatism.

Veterinary system

Santals gave 50 ml of root decoction with paste of 21 black peppers to cows for quick expulsion of placenta after delivery.

Pharmacognostic

Macroscopic

Seed

The seeds are globular or oval 1.2-2 cm in diameter, shining, grey, hard, with a smooth shiny surface. Testa thick, occupying 3/5th to 3/4th part of the entire diameter of the seeds. The embryo contains two thick, white cotyledons, radicle and plumule. On drying, the cotyledons shrink and get detached from the testa. The seed is exalbuminous. The powdered seeds have bitter taste and foul smell.

Root bark

Surface is hard, brown and shows lenticels. It is curved inwardly lengthwise and is differentiated into cork and secondary phloem. Dead cork is in the form of brown transverse blocks arranged in a regular order which shed easily leaving pale brown impression on the surface of the secondary phloem. Inner surface of the bark is fibrous and with streaks of orange brown colour.

Microscopic

Seed

Transverse section shows testa occupying a broad zone and an embryo of two cotyledons. The testa exhibits the outermost single layer of epidermis of palisade layer composed of columnar, unevenly thick-walled, non-lignified cells with narrow lumen and covered by thin cuticle; a wide zone of 40-50 layers of thick walled, irregularly arranged lacunate parenchyma cells with smaller cells in the sub-epidermal layers followed by larger lacunate,, branched cells , few cells of these layers contain brown contents; in deeper layers the cells tend to become oval and flattened and exhibit strip of vascular strands; the innermost layers of parenchymatous tissue show very small, thin walled, hyaline, polygonal and compactly arranged cells. Embryo consists of two cotyledons each of which is made up of single layer of epidermis followed by mesophlyll of polygonal parenchyma cells containing oil globules and starch grains.

Root bark

Transverse section shows externally several layers of thick-walled, loosely arranged spherical cork cells arranged in rows with the opening of lenticels and filled with brown coloured gum resin;

several layers of thick walled rectangular cork cells; a zone of several layers of thick walled tangentially elongated, oval parenchyma cells, filled with starch grains, gum resin, solitary and clustered crystals of calcium oxalate; layers of thick-walled, pitted sclereids outlined and embedded with a crystal layer of solitary, polygonal crystal of calcium oxalate and bundle of fibres respectively; alternate rows of multiseriate ray parenchyma cells filled with starch grains and bundles of thick-walled pitted phloem fibres alongwith the phloem parenchyma cells filled with starch grains, calcium oxalate crystals and gum resin content.

Powder

Seed

The characteristic features are : columnar, unevenly thickened, narrow lumened palisade cells measuring 200-214x17-21m; spheroidal, polygonal, oval or irregular shaped thick-walled parenchyma cells; spheroidal and polygonal thick-walled parenchyma cells with brown contents; thick-walled compressed parenchyma cells; thin-walled, roundish to polygonal cells with starch grain and aleurone grains; vessels with spiral thickenings.

Root bark

Thick-walled loosely arranged cells measuring 29-43 m in diameter; thin-walled, transparent storied cork cells measuring 43-96 x17-43 m; thick-walled, polygonal and oval parenchyma cells measuring 29-86 x 17-39 m; thin-walled, oval, ray parenchyma cells measuring 30-39 x 24-36 m; thin-walled, polygonal and oval gum resin cells measuring 80-200 x 43.50 m; heavily thickened and pitted sclereids with small lumen measuring 29- 71 x 14-16 m; thick-walled, pitted fibres measuring 129-214 x 14-29 m; very few pitted vessels attached to the fibres measuring 28-30 m in diameter; spheroidal clustered crystals measuring 21-29 m in diameter; polygonal solitary crystals measuring 14-36 x 10-29 m and spheroidal starch grain measuring 3-11m in diameter.

Behaviour of the powdered drug with different reagents

Root bark

Colour and appearance : Light brown and fine grain fibrous powder.

Water : Most of the powder settles at the bottom and some floats on the surface producing straw coloured turbid solution.

5%KOH solution: Powder settles at the bottom giving a dark brown coloured solution.

5% H_2SO_4 solution: Half of the powder settles at the bottom, other half floats on the surface and a very few fine particles remain suspended producing a colourless solution.

$FeCl_3$ solution : Equal quantity of powder settles at the bottom and floats on the surface giving a clear brown coloured solution.

Dragendorff's solution: Some powder settles and some floats giving a clear orange brown solution.

KI + I_2 solution: Half of the powder settles and other half floats giving a clear snuff brown coloured solution.

Seed

Colour and appearance: Powder is brown coloured somewhat sticky and grainy.

Water: Powder produces a faint straw coloured turbid solution.

5% KOH solution : Brown coloured turbid solution.

5% H_2SO_4 solution : Faint straw coloured turbid solution.

Petroleum ether and NH_3 : No significant results with the powder.

$FeCl_3$ solution: Powder settles at the bottom and a few particles remain suspended giving a dark brown solution.

Dragendorff's solution : Powder settles at the bottom and turns black giving a clear orange brown solution.

KI + I_2 solution: Powder settles at the bottom and turns black giving a clear brown solution.

Chemical constituents

Seeds contain bonducin, saponin, a bitter substance- phytosterinin, a thick- yellow fatty oil (20-24%) having a disagreeable odour of the following fatty acid composition: palmitic, 4.5; stearic, 7.5; oleic, 29.0; linoleic, 59.0%, and lignoceric in traces. The defatted kernels contain a, b-, g-, d- and e-

caesalpins, caesalpin F, homoisoflavone (bonducillin), and an amorphous glycoside, bonducin. In addition, seeds also contain starch, sucrose, 2-phytosterols and proteins (25.3%). The amino acid composition of the seed proteins is as follows: arginine, 0.2; cystine, 0.9; histidine, 3.4; leucine and isoleucine, 15.4; lysine, 6.8; methionine, 0.9; phenylalanine, 5.2; threonine, 8.2; tryptophan, 0.4; and valine, 8.5g/16g N.

Pharmacology

The powdered seeds of *C. bonduc* were found to have anti-estrogenic activity in mice and rabbits. Antifertility action of the seeds was noted in mice and in rats. Pharmacological trials have revealed diuretic and anti-pyretic activity of the nuts, and have also proved efficacious in diarrhoea. The alcoholic extract of the root and stem of *C. bonduc* were found to have antiviral activity against *Vaccinia* virus. An Ayurvedic preparation "Ayush-64" containing *C. bonduc* has been reported to be effective in microfilaria infection.

Toxicology

Caesalpinia bonduc is an ingredient of 'Ayush-64' .Sub-acute toxicity studies revealed that 'Ayush-64' administered orally at a dose level of 500 mg/kg for 30 days did not produce any toxicity in human studies.

Information related to therapeutic evaluation

Dose

Homoeopathy - 2x and higher.
Ayurveda - Root powder - 8 gm
Root decoction - 50 ml for cows
Unani - 250 mg-1gm

Formulations and preparations

A. Homoeopathic Mother Tincture preparation

Drug strength	1/10
C. bonduc in coarse powder	100g
Purified Water	400 ml
Strong Alcohol	635 ml

To make one thousand milliliters of the Mother Tincture.

Potencies

2x with Dilute Alcohol; 3x and higher with Dispensing Alcohol.

Identification

(i) Powder of the seeds does not show any fluorescence when exposed to ultra-violet light. However, its extract in 1% NaOH, ethyl alcohol and solvent ether emit a light green fluorescence under ultra violet light.

(ii) Powder gives positive tests for tannins with basic lead acetate and for alkaloids with Dragendorff's reagent.

(iii) On mixing with water, the powder produces mild frothing (indicates presence of saponins). If the above mixture is allowed to stand, a cream coloured gelatinous upper layer is separated which on heating attains a buff coloured resinous mass without emitting any smell.

(iv) Evaporate 20 ml of the homoeopathic mother tincture on water bath to remove alcohol. Extract the residue with 3 x 20 ml petroleum ether and concentrate the extract to 2 ml. Carry out the TLC of petroleum ether concentrate using petroleum ether :diethyl ether (9:1 v/v) as solvent system. In UV light one spot appeared at Rf. 0.13 (blue). After spraying with antimony trichloride reagent, following spots appeared at Rf. 0.09 (violet) and 0.15 (violet).

B. Ayurvedic preparations

Ayush 64, Saptaparnaghana vati.

C. Unani preparations

Karanjwa, Habb-e-Mubarish, Jawarish-Gajga.

Trade and commerce

Retail market price of seed: Rs.60/- per Kg (1999).

Substitutes and adulterants

Kantakaranja (*Caesalpinia bonduc* (L.)Roxb.) is often mistaken with *Karanja* (*Pongamia pinnata* (Linn.) Pierre). Sensarma (1989) included this plant alongwith *Basella rubra* L.under the classical name *Putika* in his ethnobo

tanical investigation on the plants in the 'Indian Puranas'. *C. crista* plant is much confused with *C. bonduc* with which it closely resembles, and is known by the same names in various regions in India .

Agrotechniques

An evergreen plant which grows in dry and semiarid regions, usually in open hedges. The fruits and seeds are found to float in sea water up to a period of one year and drift to coastal areas. The seeds exhibit dormancy which can be overcome by acid scarification, light and temperature treatment, or treatment with conc. sulphuric acid for 30-90 minutes. The seeds, acid treated for 90 minutes, if exposed to blue spectrum of light for 72 hours at 30^{o}C, exhibit 100% germination. The mature pods are collected in June-July. They are further dried in shade and then thrashed gently so that the seeds come out. Seeds being quite large are easily separated, kept in cool and dry place and protected from humidity. Medicinally the seeds once collected remain effective for several years.

Bibliography

1. Annual Report, DSU(CCRH), Ghaziabad; p-7-23, 1986-87.
2. Anonymous, The Wealth of India A Dictionary of Indian Raw Materials and Industrial Products, CSIR, New Delhi, Vol. III (revised); p- 6-8, 1992.
3. Chatterjee, A. and Pakrashi, S. C., The Treatise on Indian Medicinal Plants, PID, New Delhi, Vol. 2; p-27-29, 1992.
4. Ghose, S.C., Drugs of Hindoosthan, 8th edition, Hahnemann Pub. Co. Pvt. Ltd., Calcutta; p. 102-110, 1980.
5. Homoeopathic Pharmacopoeia of India, Govt. of India, Ministry of Health and Family Welfare, New Delhi, Vol. VI; p-24, 1990.
6. Kabiruddin, Makhzan-al-mufredat, Shaukat Book Depot, Shahdaula, Gujarat,IInd edition; p- 345-346, 1937.
7. Kirtikar, K.R. and Basu, B. D., Indian Medicinal Plants, B. Singh and M. P. Singh New Delhi, Vol. 2; p- 842-845, 1975.
8. Mukerji, B., Indian Pharmaceutical Codex; CSIR, New Delhi;. p- 43, 1953.
9. Nadkarni, A. K., Indian Materia Medica, Popular Prakashan, Bombay,Vol. 1; p-226-229, 1976.
10. Pal, D. C., Guha Bakshi, D. N., Sen Sharma, P., - A Lexicon of Medicinal Plants in India, Naya Prokash, Calcutta; p- 333-334, 1999.
11. Raghunathan, K and Mitra, R. Pharmacognosy of Indigenoous Drugs (CCRAS) New Delhi; p. 484-497, 1982.
12. Rastogi, R. P. and Mehrotra, B.N., Compendium of Indian Medicinal Plants, CDRI Lucknow and PID, New Delhi, Vol. IV; p-129, 1980-84.
13. Satyavati, G.V., Raina, M.K. and Sharma, M., Medicinal Plants of India, ICMR, New Delhi, New Delhi, Vol.1; p-159-161. 1976.
14. Sensarma, P., Plants in the Puranas, Naya Prokash, Calcutta; p-177, 1989.
15. Sharma, B. M. and Singh, P., Jour. Res. Ind. Med., 7(1); 8-17, 1972.
16. Standardisation of Single Drug of Unani Medicine, CCRUM, Govt. Of India, Ministry of Health and Family Welfare, New Delhi, Part 1;P-145-150, 1987.
17. Varma, P. N. and Vaid, Indu, Encyclopaedia of HomoeopathicPharmacopoeia, B. Jain Publishers, Delhi. Vol.1; p- 253-254, 1995.

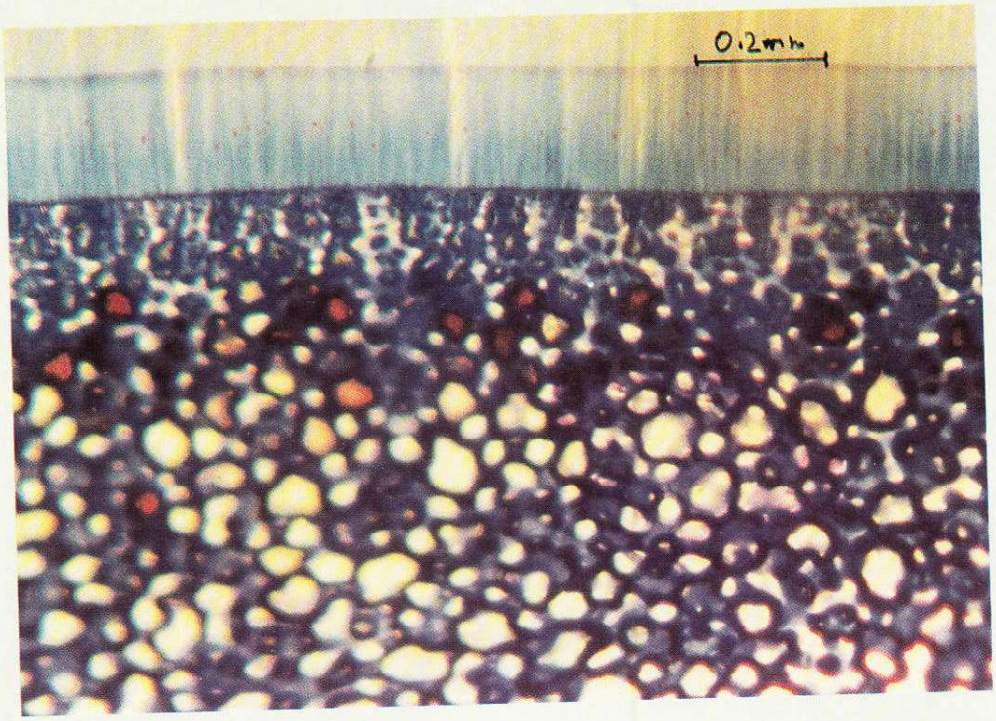

Fig. 1. Transection of seed showing an outer portion of testa.

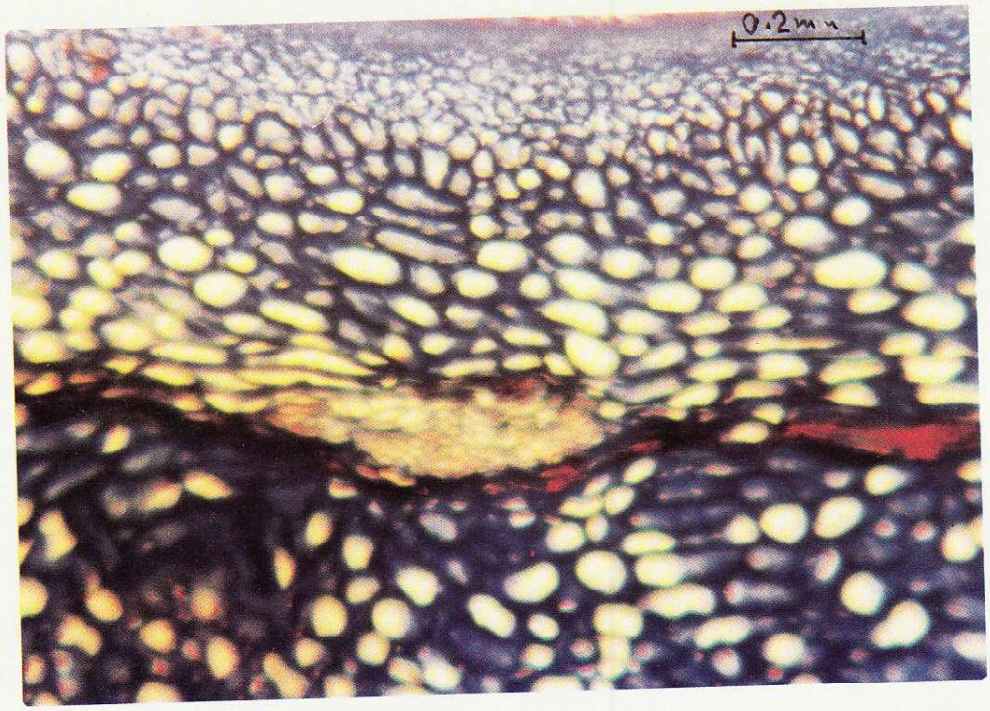

Fig. 2. Transection of seed showing inner portion of testa.