

Chapter 13

**Medicinal plants of the Lythraceae: *Ammania* (1),
Lagerstroemia (1), *Lawsonia* (1) and *Woodfordia* (1)****7. *Ammania baccifera* Linn.****Synonym:** - *A. salicifolia* Hiern**English name:** - Blistering Ammania**Hindi - Dadmari; Guj. - Jala. agio; Mal. - Kalluravanchi****Distribution:** - Found throughout India.

Ammania baccifera is a glabrous, erect, branching herb which is found as a weed in rice fields and marshy localities. Stems are erect, tetragonous which are often with numerous horizontal or ascending branches which become shorter towards the summit. Leaves are opposite or alternate, sessile, oblong or narrow elliptic and narrowed at the base. Flowers are in dense clusters or in short axillary cymes forming whorls in the axils. Capsule is depressed, globose, and red and irregularly circumscises above the middle. They are not fully covered by the calyx.

Part Used in medicine: - Leaves or the whole plant.

Medicinal Uses: - Leaves are acrid, used in treatment of rheumatic pains and fever. It is prescribed as stomachic and laxative. Fresh bruised leaves are used as rubifacient and external remedy for ringworm and other skin affections. Leaves or ashes of the plant are mixed with oil and applied to cure herpetic eruptions. Herb is rich in Vitamin C. It is reported to possess anti-typhoid and antitubercular properties. It is used as an adulterant of *Bergenia ciliata* (Haw.) Leaves are used in treatment of rheumatism and fever. (Anon., 1985). Ethanolic extract of the whole plant was found to be effective in reducing urinary calculi: (Anon., 2000)

Previous chemical reports: - Plant is reported to possess Vitamin C. No other data on the chemistry are available.

Previous pharmacognostic studies: - The pharmacognostic data on leaf/ stem are not available.

In the present work, the plant has been analysed for its chemical constituents like flavonoids, phenolic acid, quinones, etc. Pharmacognosy of leaves and stem also has been studied.

Materials and Methods:-

The plant was collected from Baroda. The voucher specimen has been deposited in the Herbarium, Department of Botany, The Maharaja Sayajirao University of Baroda (BARO), Vadodara. Standard methods, presented in chapter 2 were followed for the extraction, isolation and identification of the phytochemicals. Pharmacognostic studies were also has been performed by standard methods mentioned in Chapter 2.

Results:-

Phytochemistry: -

Leaves were found to contain quercetin and 3'-OMe quercetin as flavonoids. Phenolic acids identified were vanillic, syringic, gallic and melilotic acids. Quinones were present while steroids and glycoflavones were absent. Stem contained the same flavonoids as of the leaves. Phenolic acids present were vanillic, syringic, gallic, ferulic and melilotic acids. Quinones and steroid were present whereas glycoflavones were absent. Alkaloids were present in both parts of the plant.

Phytochemical biomarkers of leaves: Quercetin and alkaloids

stem: Quercetin, ferulic acid and alkaloids

Pharmacognosy of leaf and stem: -

Leaf micromorphology

Stomatal index of upper epidermis was 13-14 while that of lower epidermis was 14-15.

Leaf- T.S. (Fig. 28)

Leaf was dorsiventral. Midrib was concave on the upper side. In the midrib region, upper epidermal cells (17-27 x 10-47 μ m) were barrel to rectangular shape covered by cuticle which showed a pattern of ridges and furrows. Some of the epidermal cells showed brown contents also. Three to four layers of chlorenchyma (10-27 μ m) were there on upper side of vascular bundle. Ground tissues were absent at the upper side of the vascular bundle. Intraxylary phloem (7-17 μ m) on the upper side was smaller in size than the outer phloem. Tracheids (7-17 μ m) were square to spherical shape separated by one or two rows of xylem rays (7-14 μ m). Ground tissue below the bundle was composed of parenchyma (17-34 μ m) cells in which some of the cells contained sphaeraphides (10-20 μ m). Angular collenchyma (14-24 μ m) of one to two layers constituted the lower hypodermis. Lower epidermal cells (10-24 x 10-17 μ m) were smaller in size than the upper epidermal cells.

In lamina portion, mesophyll was differentiated into single layer of palisade (48-85 x 10-17 μ m) with many chloroplast and five to six layers of closely packed spongy cells (10-17 μ m). There was no indumentum on both sides of the leaf.

Powder study (Fig. 30a)

Powdered drug of the leaf consisted of fragments of anomocytic stomata with lower epidermal cells, palisade cells (48-85 x 10-17 μ m), upper epidermal cells, sphaeraphides (10-20 μ m), tracheids (16-20 μ m) with double spiral thickening, cuticle with ridges and furrows, phloem fibres (17-22 μ m) and crystals.

Pharmacognostic markers: Absence of indumentum

- : Epidermis with tannins
- : Cuticle with ridges and furrows

Stem- T.S. (Fig. 29)

Upper epidermal cells (17-31 x 14-34 μ m) were square to barrel shaped covered on the upper side by a cuticle with ridges and furrows. Cortex consisted of five to six layers of parenchyma cells where the first two to three layers were chlorenchyma (14-27 μ m). The inner layers (14-27 x 31-37 μ m) contained many air spaces alongwith sphaeraphides (17-

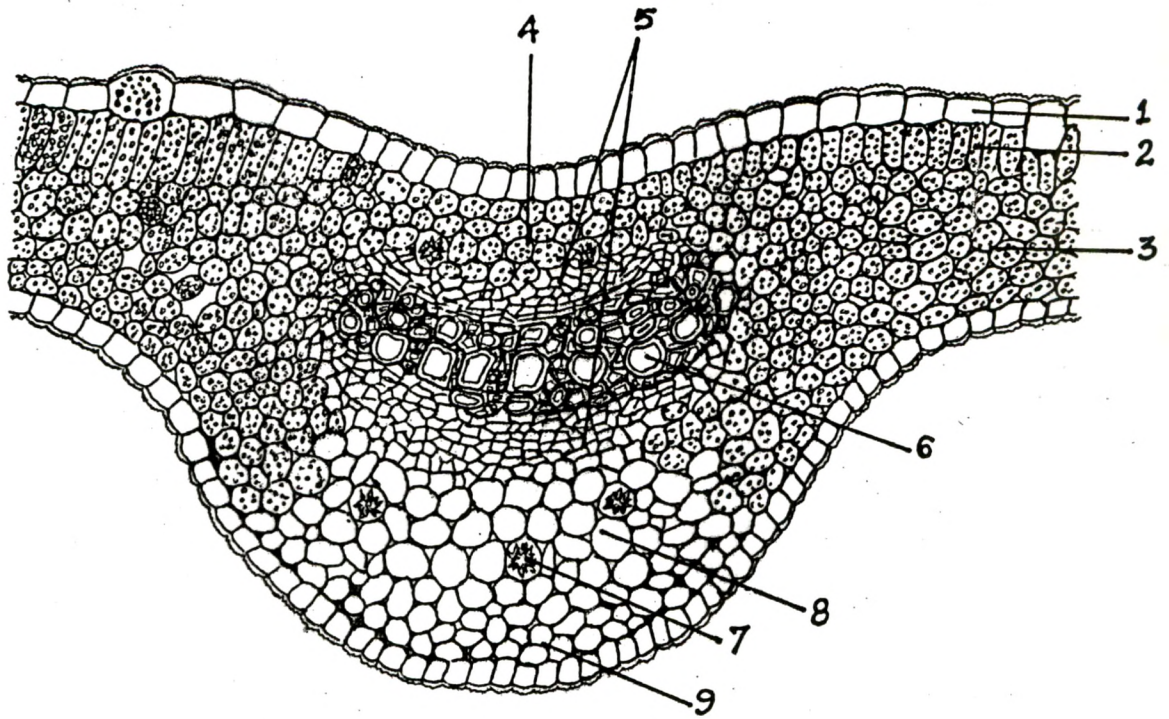


Fig. 28 *Ammania baccifera* Leaf, T.S.: 1. Epidermis, 2. Palisade tissue, 3. Spongy tissue, 4. Chlorenchyma, 5. Phloem, 6. Xylem, 7. Sphaeraphides, 8. Parenchyma, 9. Collenchyma

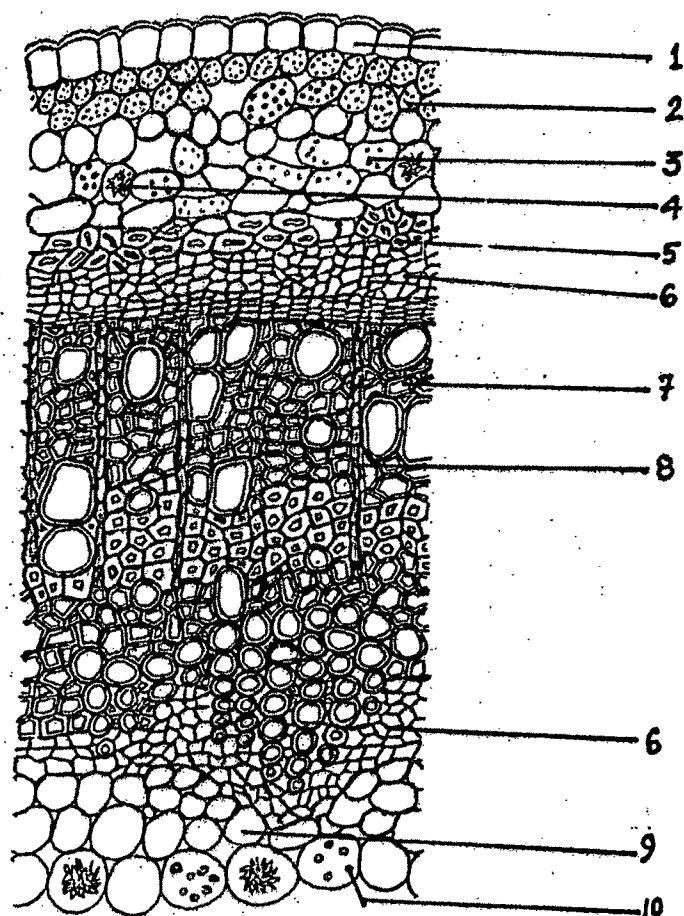


Fig. 29 *Ammania baccifera* Stem, T.S.: 1. Epidermis, 2. Chlorenchyma, 3. Parenchyma, 4. Sphaeraphides, 5. Scleried, 6. Phloem, 7. Xylem, 8. Medullary rays, 9. Pith, 10. Starch grains

20µm). Endodermis was not differentiated. Pericycle consisted of patches of sclerieds (10-13 x 13-24µm). Below the pericycle was a broad band of phloem (7-10µm). Xylem was diffuse porous. Vessels (17-27µm) were circular to slightly irregular in shape occurring singly or in pairs. The fibre tracheids (7-14µm) of outer and inner regions were with the large lumen while libriform fibres with thick wall and narrow lumen occupied the middle region. This gave an appearance of annual rings in stem. Intraxylary phloem was smaller than outer phloem. Pith consisted of parenchymatous cells (34-61µm) containing starch grains (3-6 µ) and sphaeraphides (14-20µm).

Powder study (Fig. 30b)

Sclerieds (10-13 x 13-24µm), vessels (25-48µm) with bordered pits alongwith medullary rays (10-24 x 120-250µm) and tracheids (17-27µm), pieces of phloem cells (7-10 x 31-37µm), tracheids with spiral and helical thickening, cells containing chloroplasts, sphaeraphides (14-20µm) and cork cells (6-10 x 17-25µm) were present in the powder.

Pharmacognostic markers: Fibre tracheids of two types - with thin walls and broad

lumen and another with thick walls and narrow lumen.

: Cuticle with ridges and furrows

: Stone cells

8. *Lawsonia inermis* Linn.

Synonym: - *L. alba* Lam.

English name: Henna, Egyptian privet

Sans. - *Mendika, Raktagarbha, Ragangi*; **Arab.** - *Henna, Al khanna*; **Hindi** - *Mehndi*;

Beng. - *Mehedi, Mendi*; **Mar.** - *Mendhi*; **Guj.** - *Medi, Mendi*; **Tel.** - *Goranti*;

Tam. - *Marithondi, Maruthani*; **Kan.** - *Mayilanchi, Gorante*; **Mal.** - *Mailanchi*,

Pontlasi, Oriya - *Benjati*; **Kashmir** - *Mohuz*; **Punjab** - *Mehndi*; **Mundari** - *Mindi*,

Bind.

It is a glabrous, much branched shrub or small tree with greyish brown bark where lateral branches are tetragonous often ending in a spinous point. Leaves are opposite, sub

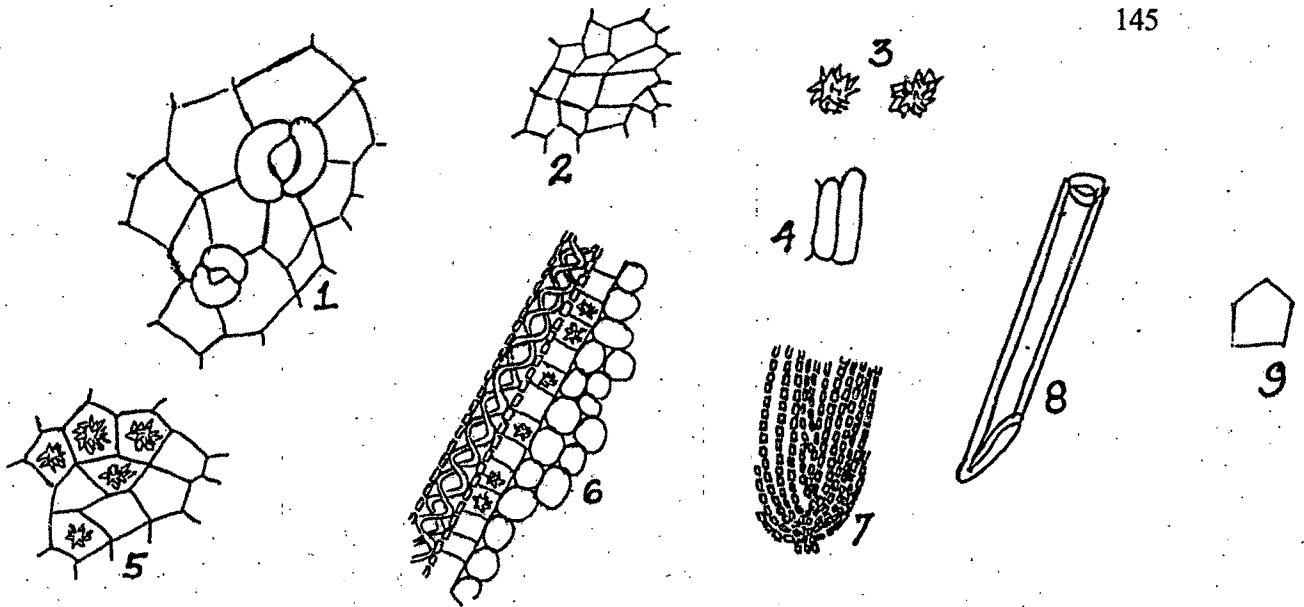


Fig. 30(a) *Ammania baccifera* Leaf, Powder study: 1. Anomocytic stomata, 2. Epidermal cells, 3. Sphaeraphides, 4. Palisade tissue, 5. Cells containing sphaeraphides, 6. Protoxylem with double spiral thickening, 7. Cuticle with ridges and furrows, 8. Phloem fibre, 9. crystal

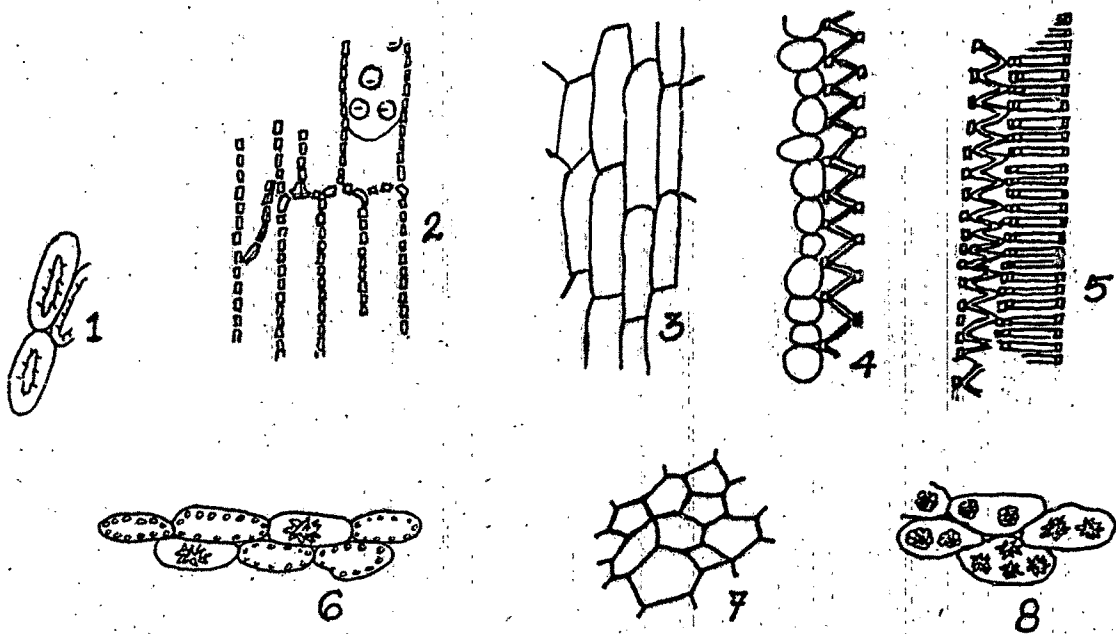


Fig. 30(b) *Ammania baccifera* Stem, Powder study: 1. Sclereids, 2. Vessel with bordered pits along with medullary rays and tracheids, 3. Phloem, 4. Tracheids with spiral thickening, 5. Protoxylem with spiral and annular thickenings, 6. Cells containing chloroplasts and sphaeraphides, 7. Cork cells, 8. Cells with sphaeraphides

sessile, elliptic or broadly lanceolate, entire, acute or obtuse, often mucronulate. Flowers are numerous, small, white or rose colored, fragrant, in large terminal pyramidal paniced cymes. Capsule is globose about the size of a pea with numerous, pyramidal, smooth seeds.

Parts used in medicine: - Leaves and stem.

History: - This plant had been described in *Charak Samhitaa* for the treatment of epilepsy and jaundice. It was also used for dyeing grey hair. In *Sushruta Samhita*, it had been recommended as a remedy for malignant ulcers. It was recommended as a curative of burning sensation (*daaha*). It is emetic, mitigates deranged kapha and cured obstinate skin diseases. Its seeds were used to cure constipation and fevers. (Sukh Dev, 2006)

Detailed medicinal properties.

Henna leaves are used as a prophylactic against skin diseases. It has astringent properties. It is used externally in the form of a paste or decoction against boils, burns, bruises and skin inflammations. Decoction is used as gargle for relaxed throat. Alcoholic extracts of henna leaves show mild antibacterial activity against *Micrococcus pyogenes* var. *aureus* and *E. coli*. Mehndi oil is used in perfumery. Leaves are also used to treat chest and lung diseases. Stem is used for jaundice, growth of hair, headache, leprosy, leucoderma, ulcers, lumbago, ophthalmia, skin diseases, stomachic, etc. (Anon., 1998)

Previous phytochemical reports.

Leaves contained 1, 4 – dihydroxynaphthalene; 1, 4-naphthaquinone; 1, 2-dihydroxy-4-glucosyloxynaphthalene and 2-hydroxy-1, 4-di glucosyloxynaphthalene. It also contained flavonoids like luteolin and apigenin; coumarins like esculetin, fraxetin and scopletin as well as steroids like β -sitosterol. Triterpenoids like hennadiol, 3-methylnonacosan-1-ol and mannitol had been isolated from stem bark (Anon., 1998) as also a naphthaquinone, isoplumbagin. Lawsaritol and lawsaritol-A were found in roots. (Sukh Dev, 2006). 24 β -Ethylcholest-4-en-3 β -ol has also been reported from the roots (Gupta, 1992).

Previous pharmacognostic studies

Pharmacognosy of leaves only had been studied.

In the **present work**, leaves and stem of this plant of have been screened for their secondary metabolites such as flavonoids, alkaloids, quinones, saponins; etc. Pharmacognostic studies of leaf and stem also have been conducted.

Materials and Methods:-

The plant material was obtained from Baroda. Voucher specimen of this plant has been deposited in the Herbarium, Department of Botany, The Maharaja Sayajirao University of Baroda (BARO), Vadodara. Standard procedures described in chapter 2 were followed for the extraction, isolation and identification of the phytochemicals as well as for pharmacognosy.

Results:-

Phytochemistry:-

Leaves were found to contain luteolin and 3'-OMe luteolin as flavones. Vanillic, *p*-hydroxy benzoic and gallic acids were the phenolic acids present. Quinones and steroids also were present. Alkaloids and glycoflavones were absent. **Stem** contained only 3', 4'-diOMe luteolin. It contained phenolic acids like vanillic, syringic, *p*-coumaric, gallic and ferulic acids Presence of quinones and steroids were observed. Alkaloids and glycoflavones were absent.

Phytochemical markers of leaves : Lawsone, luteolin, 3'-OMe luteolin, *p*-hydroxy benzoic acid

stem : 3'4- diOMe luteolin, *p*-coumaric acid, ferulic acid.

Pharmacognosy of leaf and stem:

Leaf micromorphology

Stomatal index of upper epidermis was 14-16 while that of lower epidermis was 21-23.

Leaf- T.S. (Fig. 31)

Leaf was dorsiventral. Upper epidermal cells (10-37 x 10-30 μ m) consisted of barrel shaped cells covered by a thin cuticle. Midrib region was flat on the upper side and V-shaped on the lower side. Hypodermis in midrib consisted of a patch of six to seven angular collenchyma cells (10-24 μ m) surrounded by four to five layers of angular chlorenchyma cells (10-17 μ m). Intraxylary phloem (7-13 μ m) was larger in size than the normal phloem and also contained sphaeraphides (6-12 μ m) in rays. Xylem tracheids (30-37 μ m) were irregular in shape separated by one to two rows of xylem rays (6-13 μ m). Below the vascular bundle were patches of stone cells (6-10 μ m). Ground tissue was composed of four to five layers of parenchyma (14-24 μ m) containing sphaeraphides followed by a single layered angular collenchymatous lower hypodermal region. Lower epidermal cells (7-17 x 7-14 μ m) were smaller in size than the upper epidermal cells

In the lamina portion, mesophyll was differentiated into single layer palisade (31-51 x 6-14 μ m) and closely packed spongy (10-17 μ m) cells containing sphaeraphides. Palisade and spongy cells were filled with chloroplasts.

Powder study (Fig. 34a)

Powder of the leaf consisted of fragments of chlorenchyma (10-17 μ m), anomocytic stomata, palisade (31-51 x 6-14 μ m), upper epidermal cells and sphaeraphides.

Pharmacognostic markers: Palisade and spongy with very little air spaces and completely filled with chloroplasts.

Stem -T.S. (Fig. 32)

The outer most layer was cork (6-12 x 18-25 μ m) of tangentially elongated cells. Remnants of epidermis and cuticle were seen outside. Rectangular patches of gelatinous fibres (10-20 x 7-10 μ m) surrounded by tannin cells. Below this layer was a region of five to six layers of square to polygonal shaped cells (13-20 x 7-20 μ m). One of the central layers was of sclereids (10-13 x 17-25 μ m). The next layer was cambium. Secondary cortex was composed of chlorenchyma cells (31-38 x 7-14 μ m) having thick gelatinous walls. Secondary phloem (6-13 μ m) consisted of elements, some of which contained sphaeraphides (6-10 μ m). Xylem vessels (17-37 μ m) were in groups of two or three and

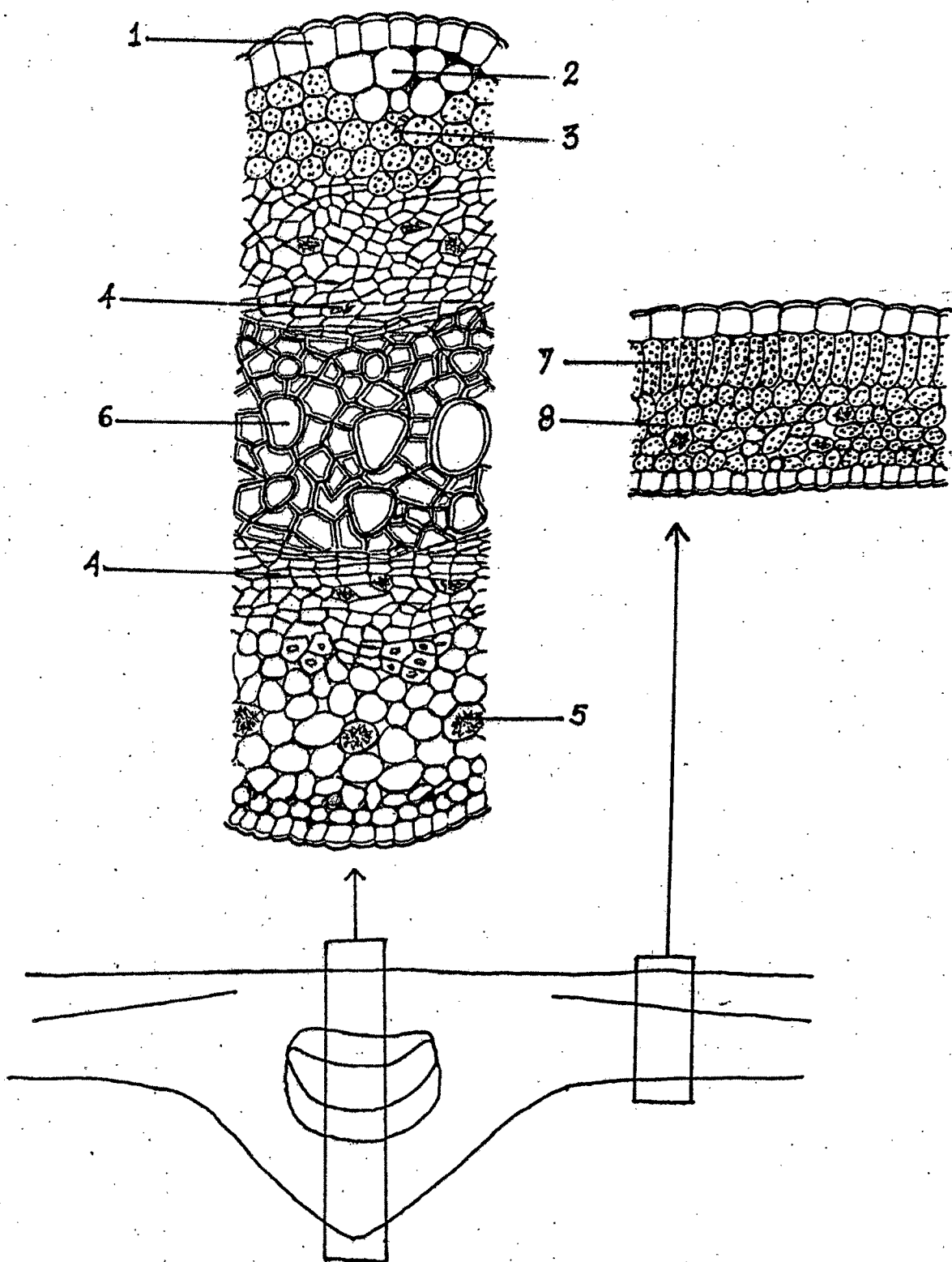


Fig. 31 *Lawsonia inermis* Leaf, T.S.: 1. Epidermis, 2. Collenchyma, 3. Chlorenchyma, 4. Phloem, 5. Sphaeraphides, 6. Xylem, 7. Palisade tissue, 8. Spongy tissue

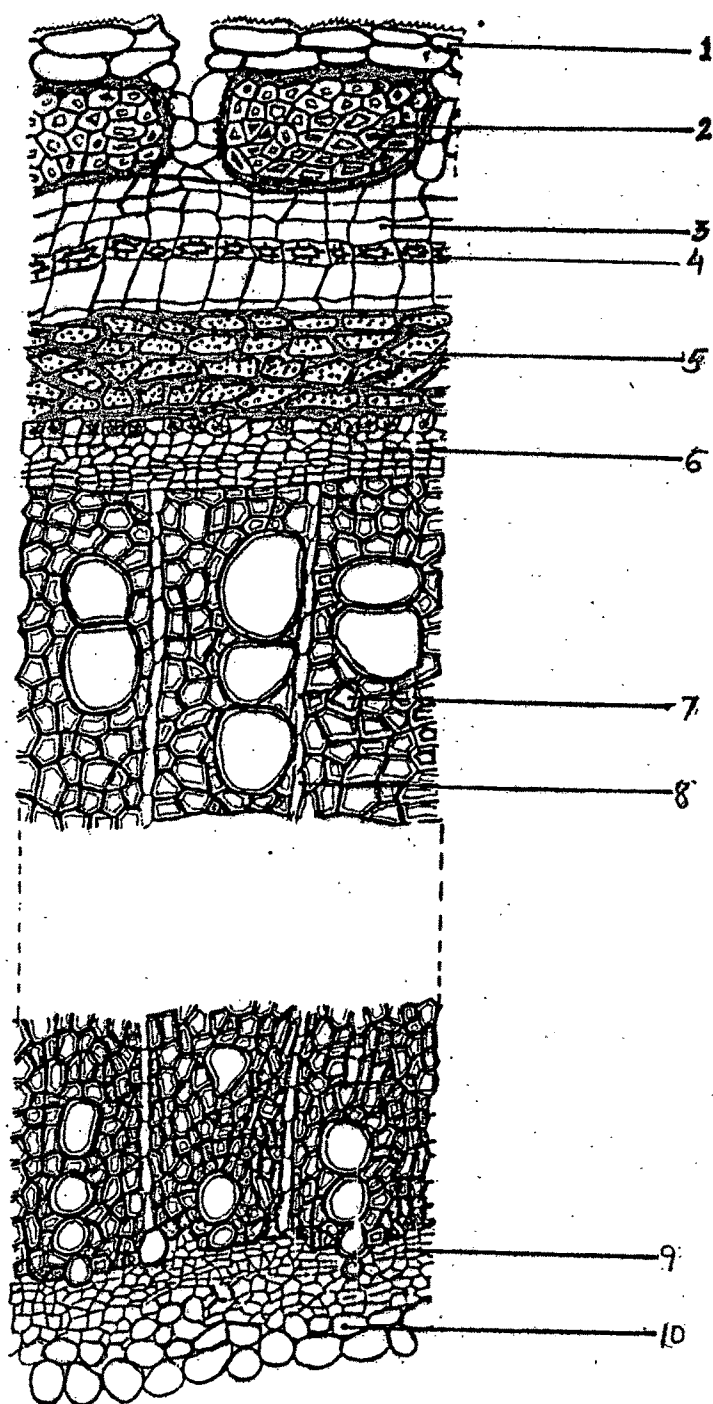


Fig. 32 *Lawsonia inermis* Stem, T.S.: 1. Epidermis, 2. Gelatinous Fibres, 3. Cortex, 4. Sclereid, 5. Thick walled chlorenchyma, 6. Phloem, 7. Xylem, 8. Medullary rays, 9. Intraxylary phloem, 10. Pith.

were oval in shape. Tracheids (7-14 μ m) were present in radial rows. Medullary rays (10-17 x 3-7 μ m) were uniseriate. Intraxylary phloem was of six to eight layers. Pith consisted of isodiametric parenchyma cells (24-48 μ m).

Stem -T.L.S. (Fig. 33a)

In T.L.S., cork cells (6-12 x 18-25 μ m) were rectangular. Gelatinous fibres (lumen-6 μ m) were elongated with thick walls and very narrow lumen. The next layers consisted of rectangular shaped parenchyma cells (6-12 x 17-29 μ m) in vertical rows. One row of sclereids (15-22 x 42-80 μ m) was also there. Secondary cortex consisted of rectangular chlorenchyma cells (6-14 x 18-23 μ m). Phloem cells (6-10 x 32-39 μ m) were elongated and phloem rays (18-23 x 146-321 μ m) were uni- or biseriate seen with sphaeraphides. Vessels (24-50 μ m) were found with horizontally placed closely packed bordered pits. Simple perforation plate was seen in the vessels. Tracheids (18-28 μ m) were found with simple pits. Xylem rays (10-24 x 123-410 μ m) were uni- to biseriate. Some of the xylem rays contained cells, the walls of which were thickened with a colorless material whereas other xylem rays had cells with lignified walls and pits.

Stem -R.L.S. (Fig. 33b)

In R.L.S., cork cells and cortex were similar to T.L.S. Phloem rays (17-24 μ m) contained upright cells of square or rectangular shape. Xylem rays (23-48 x 52-80 μ m) were also heterogeneous in having cells of two sizes containing starch grains. Protoxylem elements were with annular and spiral thickening.

Powder study (Fig. 34b)

Powder of stem consisted of cork cells (6-12 x 18-25 μ m), phloem cells (17-24 μ m) with sphaeraphides, chlorenchyma cells (6-14 x 18-23 μ m), phloem fibres (17-22 μ m), sclereids (10-13 x 17-25 μ m), and vessels (24-50 μ m) with bordered pits alongwith medullary rays (10-24 x 123-410 μ m) and tracheids (18-28 μ m).

Pharmacognostic markers: Patches of gelatinous fibres

- : Sclerieds
- : Thick walled chlorenchyma cells
- : Rays of square and rectangular cells

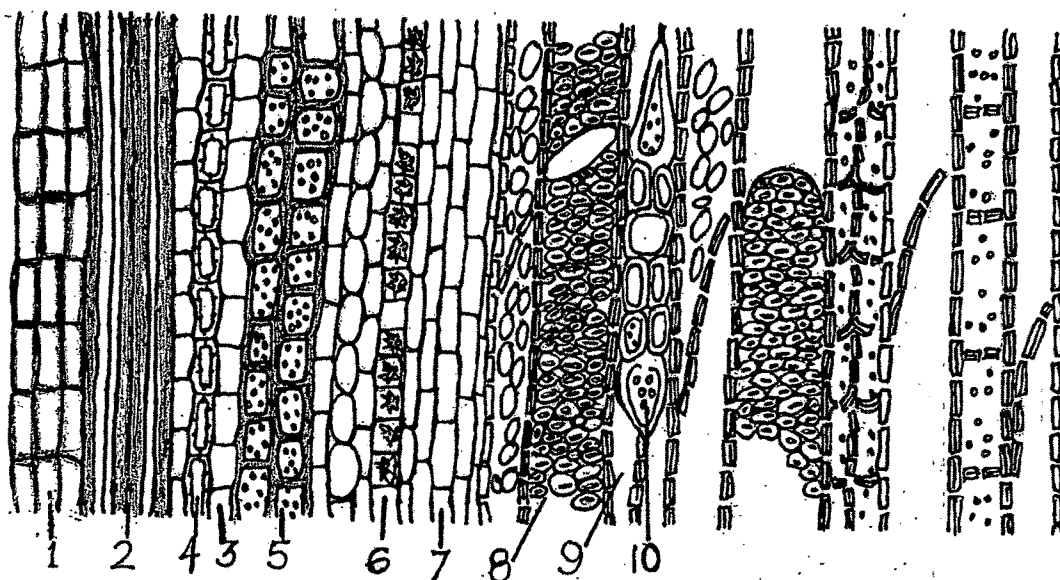


Fig. 33(a) *Lawsonia inermis* Stem, T.L.S.: 1. Cork, 2. Gelatinous fibres, 3. Parenchyma, 4. Sclereids, 5. Thick walled chlorenchyma, 6. Phloem rays, 7. Phloem, 8. Vessels with bordered pits, 9. Tracheid, 10. Xylem rays

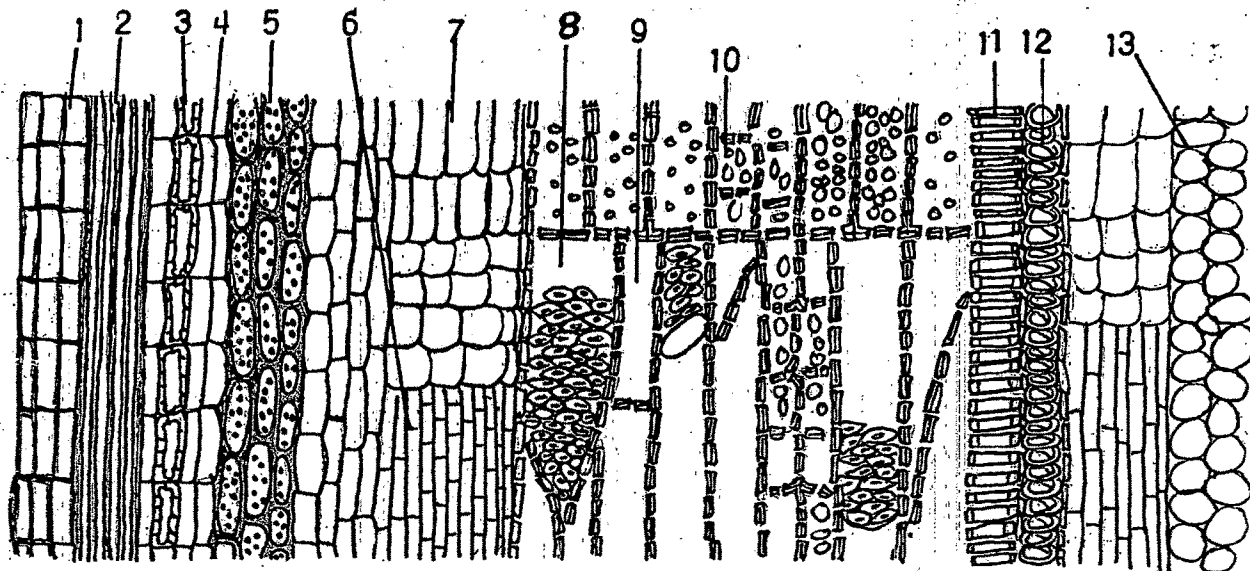


Fig. 33(b) *Lawsonia inermis* Stem R.L.S.: 1. Cork, 2. Gelatinous fibres, 3. Sclereids, 4. Parenchyma, 5. Chlorenchyma, 6. Phloem, 7. Phloem rays, 8. Vessel with bordered pits, 9. Tracheids, 10. Xylem rays, 11. Protoxylem with annular thickenings, 12. Tracheids with spiral thickenings, 13. Pith

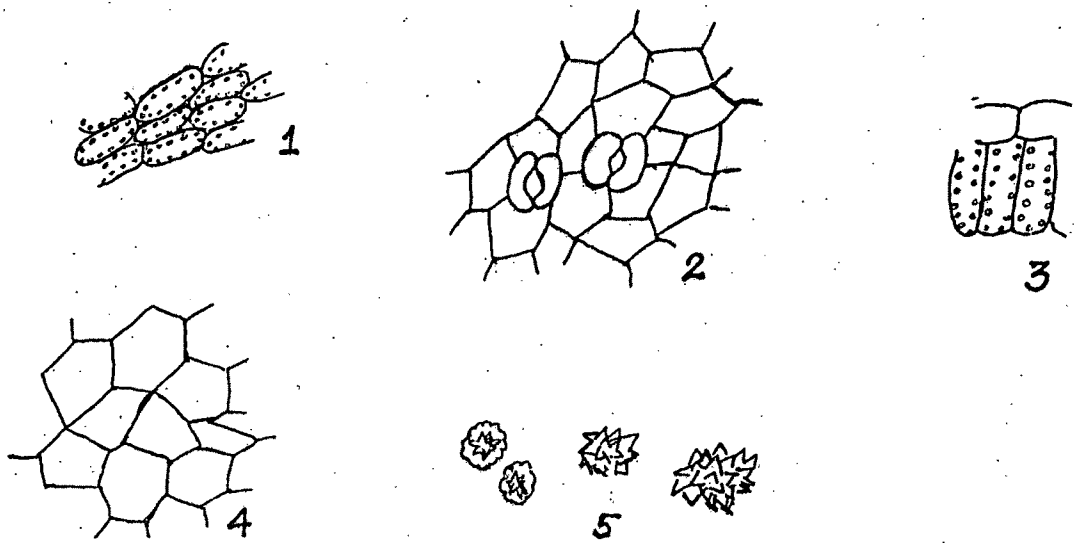


Fig. 34(a) *Lawsonia inermis* Leaf, Powder study: 1. Chlorenchyma, 2. Anomocytic stomata, 3. Palisade tissue, 4. Epidermal cells, 5. Sphaeraphides

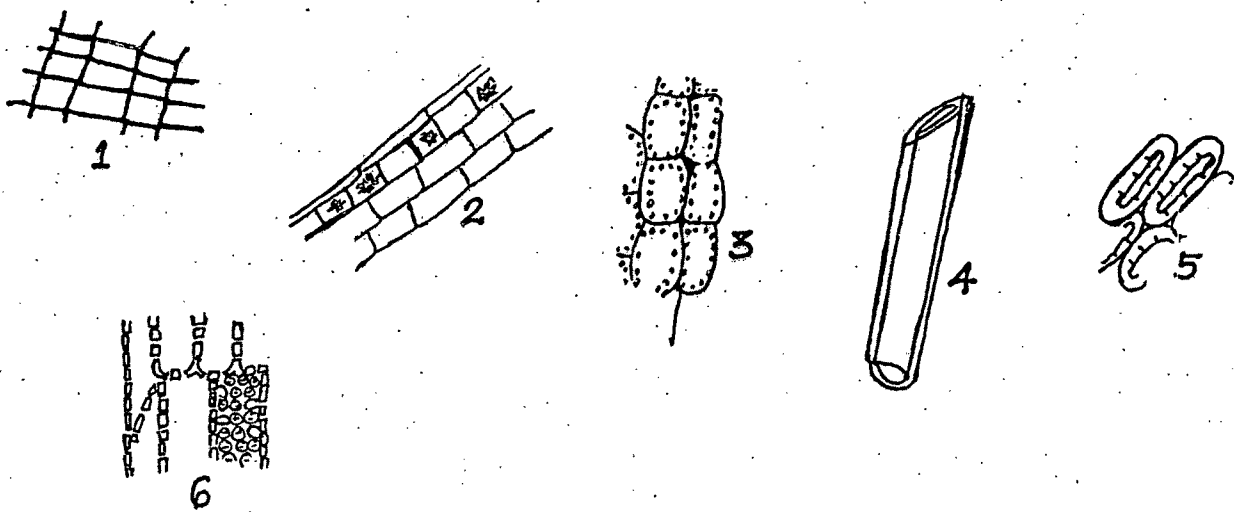


Fig. 34(b) *Lawsonia inermis* Stem, Powder study: 1. Cork cells, 2. Phloem cells with sphaeraphides, 3. Chlorenchyma, 4. Phloem fibre, 5. Sclereid, 6. Vessel with bordered pits alongwith medullary rays and tracheids

9. *Woodfordia floribunda* Salisb.

Synonym: - *W. fruticosa* Kurz.

English name: - Fire-flame bush, Shiranjitea

Sans. - Dhataki, Agnijwala; **Hindi** - Dawi, Thawi, Santha, Dhaula, Dhaura, Dhai;

Beng. - Dhai, Dawai; **Mar.** - Phulsatti, Dhaipal; **Guj.** - Dhavdi; **Tel.** - Jargi, Serinji, Gaddaisinka; **Kan.** - Tamrapushpi; **Oriya** - Jatiko, Harwari, **Jammu & Kashmir** - Thawi, Thai; **Punjab** - Tawi, Thai, Dahai, Dhawi, Gul dhawi, Gul bahar; **Bihar** - Icha, Dhenti, Phuldawai, Dhai-phul

Distribution: - Throughout India

This is a much branched beautiful shrub with fluted stems and long, spreading branches. Bark is reddish brown which peels off in thin, fibrous strips. Leaves are lanceolate, oblong - lanceolate or ovate to lanceolate. Flowers are numerous, brilliant red in dense axillary paniculate-cymose clusters. Capsules are ellipsoid and membranous. Seeds are brown, minute, smooth and obovate.

Parts used in medicine: - Flowers, Leaves

History: - According to Sivarajan and Balachandran (1994), the dried flowers of *Dhataki* were used in the preparation of aristas and asavas as it helped in fermentation. A yeast, *Saccharomyces cerevisiae*, was isolated from the flowers which were found capable of producing alcoholic fermentation. It was acrid, bitter, astringent, cold, light and intoxicant. It killed germs, purified blood, allayed thirst, healed ulcers, averted abortion and cured haematemesis. It also cured erysipelas, dysentery, diarrhoea and uterine diseases, esp. menorrhagia and leucorrhoea. *Abhayaristam*, *Kutajaristam*, *Khadiragulika*, *Ceriya Arimedastailam*, etc. are some of the preparations using the drug.

According to the texts, the plant had attractive flowers in bunches (*dhataki dhatrupushpika*, *gucchapuspa*, *sanghapuspa*) which were red as the flames or fire (*agnijwala*, *tamrapuspi*, *vahnipuspi*, *vahnisikha*). Other synonyms like *madyasakhi*, *madyavasini*, *madaniya*, *kunjarika*, etc. indicate intoxicating properties of the flowers.

Detailed medicinal properties:

Dried flowers are used extensively in Ayurvedic arishtas, for tonic, in disorders of mucous membrane, hemorrhoids and derangements of liver. It is used in bowel complaints and is also given in seminal weakness. The dried flowers are powdered and sprinkled on ulcers and wounds to diminish discharge and promote granulation. In Madhya Pradesh, a paste of flowers is used for the treatment of coughs. It is an ingredient of an ointment used on the pustules of smallpox. Extract of the plant is used for tooth ache and gum trouble and it also stimulates contraction of intestinal loops. (Anon., 1999). Fresh leaves are used as an excellent remedy for snake bite and among Santals it is used as a remedy in excessive bleeding during pregnancy, cholera, fever, muscular pain, sores and spleen complaints (Jain & Tarafda, 1970). Leaves show antibiotic activity *in vitro* against *Micrococcus pyogenes* var. *aureus* (Anon., 1999). It is also useful as an inhibitor of topoisomerase and as neoplasm inhibitors. It also serves as an antitumour agent.

Previous phytochemical reports:

Leaves contained 12-20% tannin and lawsone, the naphthaquinone of henna. 'Woodforticosin' was isolated from leaves. Stem contained β -sitosterol. (Anon., 1999).

Previous pharmacognostic studies:

Pharmacognosy of only flowers had been carried out by Dey & Das (1987).

In the present work, leaves and stem were analysed for their flavonoids, phenolic acids, quinones, etc in. Pharmacognostic studies of leaves and stem were also carried.

Materials and Methods:

Plant materials for the present study were collected from in and around Baroda. The voucher specimen of the plant has been deposited in the Herbarium, Department of Botany, The Maharaja Sayajirao University of Baroda (BARO), Vadodara. Standard methods, presented in chapter 2 were followed for the extraction, isolation and identification of the phytochemicals. Pharmacognosy has been conducted by standard methods mentioned in chapter 2.

Results: -**Phytochemistry:-**

Leaves contained quercetin and 3'-OMe quercetin. Phenolic acids identified were vanillic, syringic, *p*-hydroxy benzoic and gallic acids. The quinone, lawsone and steroids were present. Alkaloids and glycoflavones were absent. In stem, flavonoids were absent. Phenolic acids present were similar to the leaves except for gallic acid. Lawsone and steroids also were present. Alkaloids and glycoflavones were absent.

Phytochemical biomarkers of leaves: Lawsone, quercetin, 3'-OMe quercetin, *p*-hydroxy benzoic and gallic acid.

stem: Devoid of flavonoids, *p*-hydroxy benzoic acid

Pharmacognosy of leaf and stem:**Leaf micromorphology**

Stomata were anomocytic found only on lower epidermis. Stomatal index was 18-19. Trichome index for unicellular trichomes were 10-12 and 48-50 in the upper and lower epidermis respectively. Trichome index for multicellular trichomes were 14-16.

Leaf -T.S. (Fig. 35)

Leaf was dorsiventral. Midrib was more or less concave and slightly ridged on upper side and wavy on the lower side. Upper epidermal cells (17-20 x 17-23 μ m) were barrel shaped covered by a thin cuticle. Hypodermis consisted of five to six layered lacunar collenchyma (17-34 μ m). Ground tissue was composed of three to four layers of parenchyma (21-31 μ m) on the upper side. Vascular bundle was crescent shaped. Pericycle composed of sclerenchyma (14-21 x 14-17 μ m) was seen encircling the entire vascular bundle. Tracheids (34-37 μ m) were found in rows separated by xylem rays (13-20 μ m). Phloem (10-17 μ m) of one or two layers was seen above and below xylem. The parenchymatous ground tissue below the bundle contained sclereids (34-44 μ m) and sphaeraphides (17-34 μ m). Lower hypodermis was composed of lacunar collenchyma. Lower epidermal cells (17-24 x 17-27 μ m) were larger in size than that of the cells of upper epidermis. Unicellular (105-220 x 7-24 μ m) or multicellular uniseriate (125-238 x 10-28 μ m) trichomes were seen on both the epidermal layers.

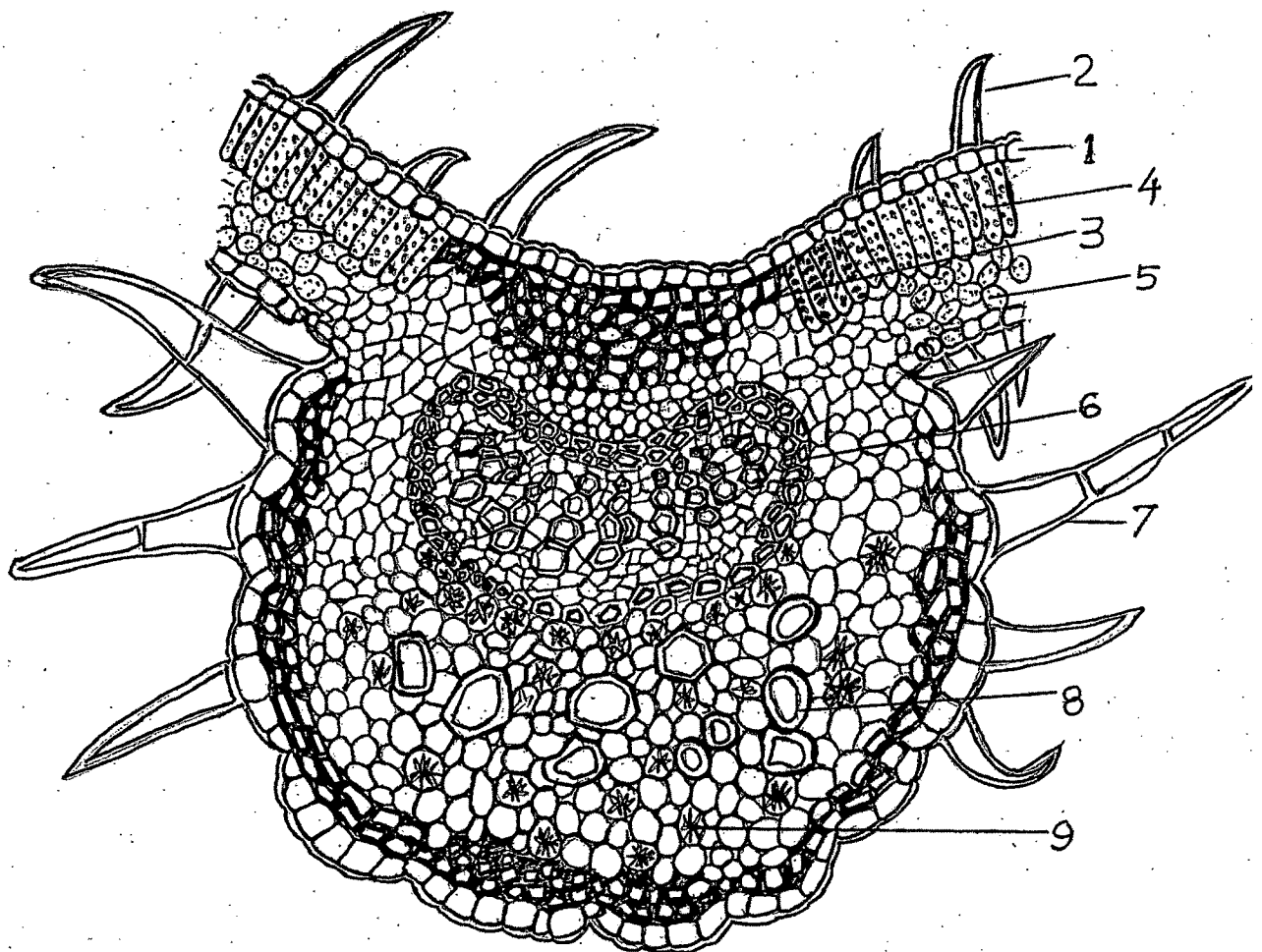


Fig. 35 *Woodfordia floribunda* Leaf, T.S.: 1. Epidermis, 2. unicellular trichome, 3. Collenchyma, 4. Palisade tissue, 5. Spongy tissue, 6. Sclerenchyma, 7. multicellular trichome, 8. Sclereids, 9. Sphaeraphides

In lamina portion, mesophyll was differentiated into single layered palisade (34-44 x 10-17 μ m) and three to four layered spongy cells. Palisade cells contained many closely packed small chloroplasts and spongy cells were with few chloroplasts.

Powder study (Fig. 38a)

Anomocytic stomata, multicellular (125-238 x 10-28 μ m) as well as unicellular (105-220 x 7-24 μ m) trichomes, upper epidermal cells, sphaeraphides, veins with sphaeraphides, parenchyma cells (21-31 μ m) containing sphaeraphides, lacunar collenchyma cells (17-34 μ m), sclereids (34-44 μ m) and sclerenchymatous fibres (lumen:10-20 μ m) were present in the powder of the leaf.

Pharmacognostic markers: Multicellular uniseriate and unicellular trichomes

: Sclereids

Stem - T.S. (Fig. 36)

Cork cells (7-10 x 17-24 μ m) were of thick walled rhomboidal cells or four to five layers. Below the cork was the cortex composed of polygonal parenchyma cells (14-38 x 14-44 μ m) intermingled with islands of stone cells (7-10 x 10-17 μ m). Phloem (7-10 μ m x 10-14 μ m) was composed of many layers in which some of the ray cells contained sphaeraphides. Phloem rays (10-14 x 10-17 μ m) were with some brown contents. Wood was diffuse porous. Xylem was very broad with vessels (20-34 μ m) occurring singly and were round to oval in shape. Medullary rays (20-34 x 6-10 μ m) were uniseriate with brown contents. Intraxylary phloem was of five to seven layers. Pith was composed of parenchyma cells (14-31 μ m) containing sphaeraphides.

Stem- T.L.S. (Fig. 37a)

In T.L.S., cork cells (6-10 x 17-23 μ m) appeared thick walled and oval with some intercellular spaces. Parenchyma cells (6-10 x 17-27 μ m) were rectangular shape. Sclereids (17-23 x 40-78 μ m) were mostly rectangular. Phloem cells (30-37 x 6-10 μ m) were elongated while phloem rays were of spindle shaped (17-24 x 170-289 μ m) uniseriate and five to six cells in height. Most of them contained sphaeraphides. Fibre tracheids (17-27 x 145-309 μ m) were simple. Medullary rays (10-23 x 130-425 μ m) were found to be uniseriate and three to four cells in height. Vessels (975-1120 μ m) were filled with very closely packed bordered pits of five to six rows.

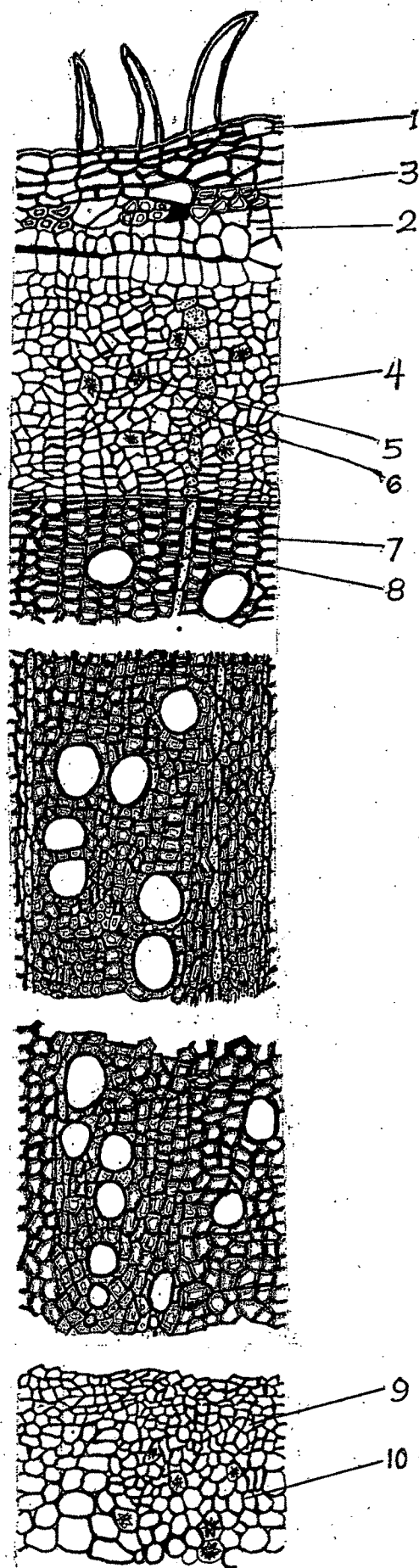


Fig. 36 *Woodfordia floribunda* Stem, T.S.: 1. Cork, 2. Parenchyma, 3. Stone cells, 4. Phloem, 5. Sphaeraphide, 6. Phloem rays, 7. Xylem, 8. Medullary rays, 9. Intraxylary phloem, 10. Pith.

Stem- R.L.S. (Fig. 37b)

In R.L.S., phloem rays were heterogeneous containing both elongate rectangular (17-23 x 44-70 μ m) and square cells (17-23 μ m). The square cells contained a single sphaeraphide each. Vessels (25-49 μ m) were found to contain closely packed bordered pits. Protoxylem (20-35 μ m) was found with spiral thickening followed by elongated phloem cells. Pith was composed of thin walled isodiametric parenchyma cells (13-30 μ m) without pits or any content.

Powder study (Fig. 38b)

Powder study of stem consisted of fragments of thick walled cork (6-10 x 17-23 μ m), sclereids (17-23 x 40-78 μ m), medullary rays (10-23 x 130-425 μ m), vessels (25-49 μ m) with bordered pits alongwith tracheids (20-35 μ m), phloem rays (17-24 x 170-289 μ m) alongwith phloem cells and tracheids with spiral thickening.

Pharmacognostic markers: Islands of stone cells

- : Phloem rays with some contents.
- : Phloem rays of spindle shape with five to six cells in height.
- : Vessels of closely packed bordered pits of five to six rows

10. *Lagerstroemia flos-reginae* Retz.

Synonym: - *L. speciosa* Pers.

English name: - Queen crape myrtle

Hindi – Jarul; **Beng.** – Jarool, Ajar; **Mar.** – Taman, Mota-bondara; **Tel.** – Varagogu;

Tam. – Kadali, Pumaruthu; **Kan.** – Hole-dasavala, Challa; **Mal.** – Manimaruthu;

Oriya – Patoli; **Punjab** – Jarul; **Assam** – Ajar, Thing-dou thlado

Trade name: - Jarul, Pyinma

Distribution: - Throughout India esp. Assam, Bengal and Deccan Peninsula

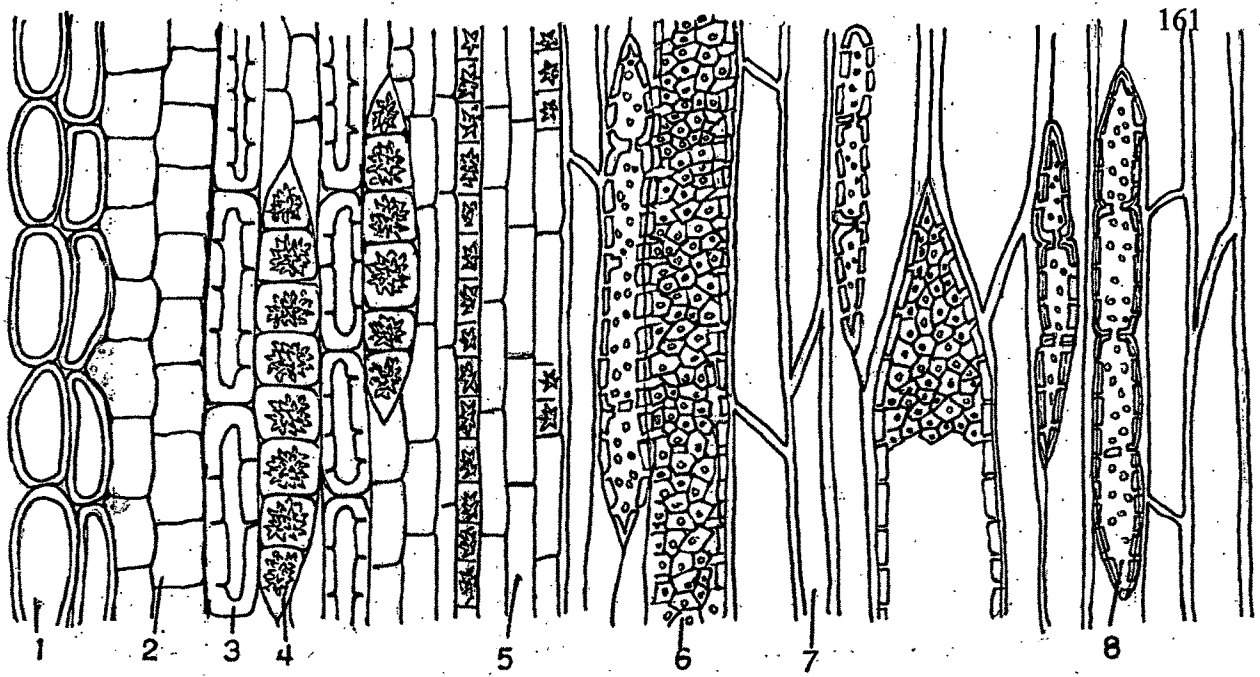


Fig. 37(a) *Woodfordia floribunda* Stem, T.L.S.: 1.Thick walled Cork, 2. Parenchyma, 3. Sclereid, 4. Phloem rays, 5. Phloem, 6. Vessels with bordered pits, 7, Tracheids, 8. Medullary rays

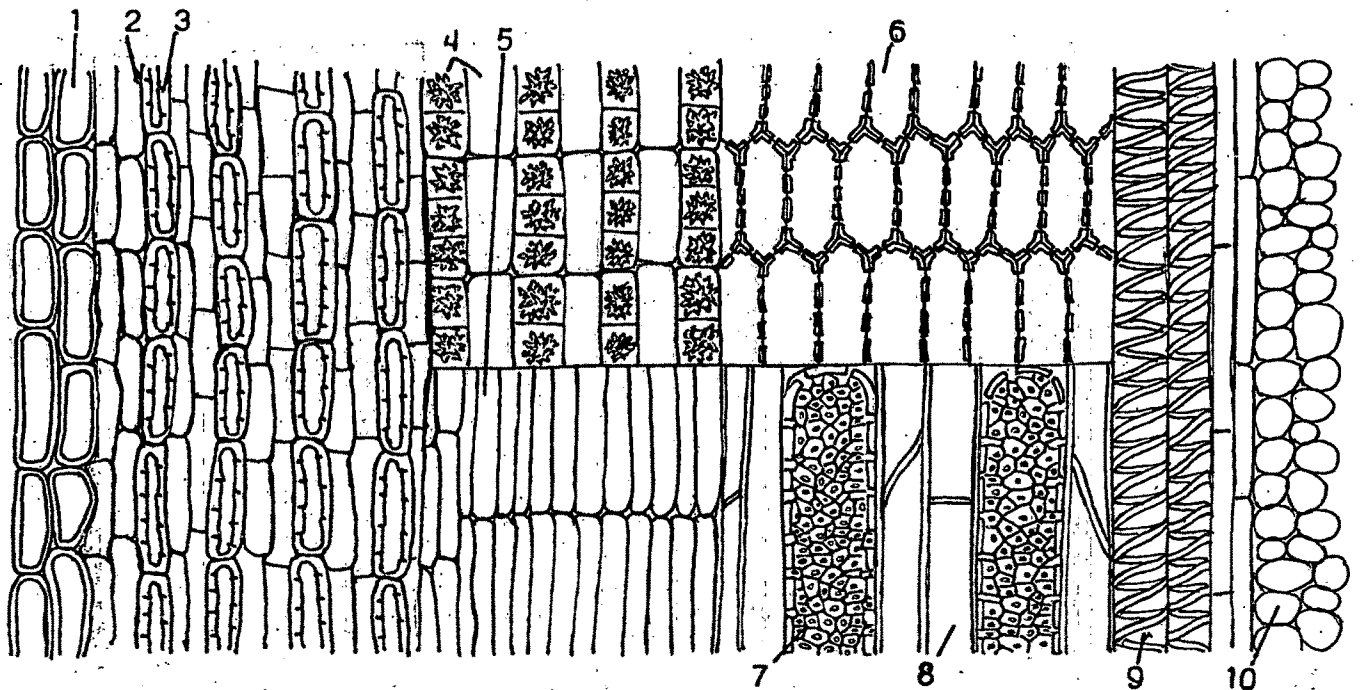


Fig. 37(b) *Woodfordia floribunda* Stem, R.L.S.: 1.Thick walled cork, 2. Parenchyma, 3. Sclereid, 4. Phloem rays of elongate rectangular and square cells, 5. Phloem, 6. Medullary rays, 7. Vessels with bordered pits, 8. Tracheids, 9. Protoxylem with spiral thickenings, 10. Pith

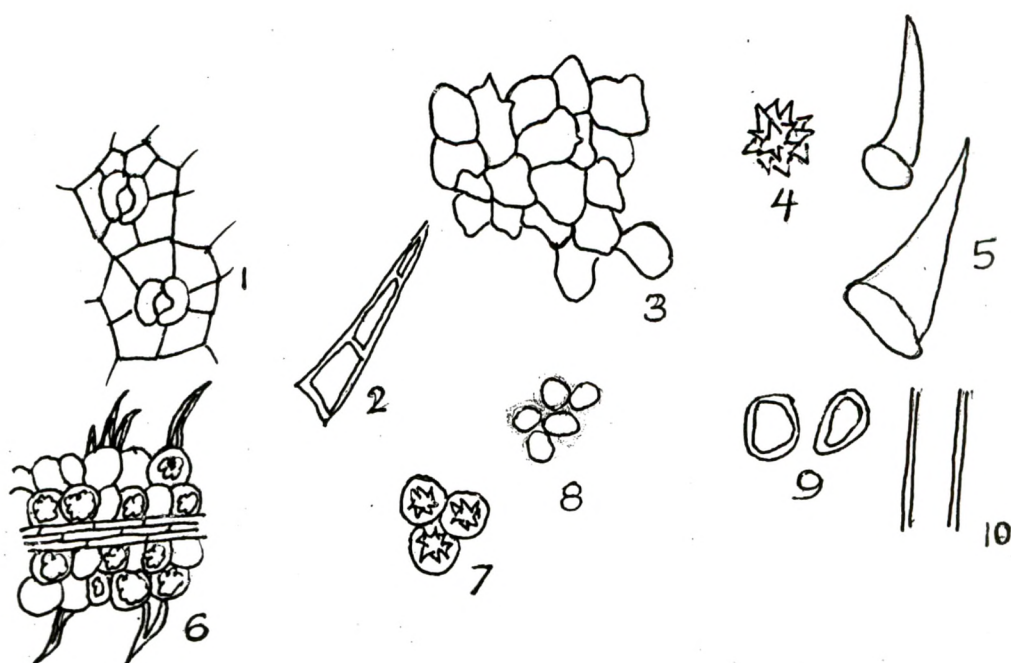


Fig. 38(a) *Woodfordia floribunda* Leaf, Powder study: 1. Anomocytic stomata, 2. Multicellular trichome, 3. Epidermal cells, 4. Sphaeraphide, 5. Unicellular trichome, 6. Veins with Sphaeraphides, 7. Parenchyma containing Sphaeraphides, 8. Lacunar collenchyma, 9. Sclereid, 10. Sclerenchyma

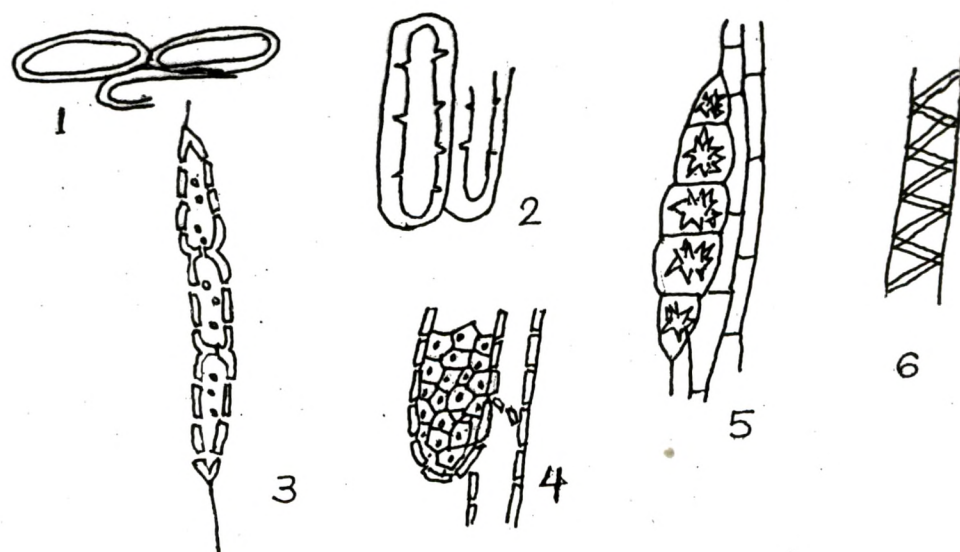


Fig. 38(b) *Woodfordia floribunda* Stem, Powder study: 1. Thick walled cork, 2. Sclereid, 3. Medullary rays, 4. Vessels with bordered pits along with Vessels, 5. Phloem rays along with Phloem, 6. Protoxylem with spiral thickening

This is a medium sized to large deciduous tree with a rounded crown. Bark is smooth and greyish. Leaves are oblong to lanceolate or elliptic. Flowers are in large panicles, mauve to purple. Capsule is ellipsoid or sub-globose. Seeds are pale brown.

Parts used in medicine: - leaves, bark, roots

Medicinal Uses:

Leaves are purgative, deobstruent and diuretic. Decoction of leaves and also of dried fruit, prepared like tea, is used for diabetes mellitus in Philippines. Bark is a stimulant and febrifuge. The decoction or infusion is given in abdominal pain and diarrhoea. Roots are considered astringent, stimulant and febrifuge. (Anon., 1998)

Previous phytochemical reports:

Roots, stem and leaves are found to contain hydrocyanic acid. Ellagitannins isolated from the plant parts are activators of glucose transport in fat cells.

Previous pharmacognostic studies:

Only pharmacognosy of flowers has been studied.

In the present work, leaves and stem were analysed for their flavonoids, phenolic acids, quinones, etc in. Pharmacognostic studies of leaves and stems also were also carried.

Materials and Methods:

Plant materials for the present study were collected from around Baroda. The voucher specimen of the plant has been deposited in the Herbarium, Department of Botany, The Maharaja Sayajirao University of Baroda (BARO), Vadodara. Standard methods, presented in chapter 2 were followed for the extraction, isolation and identification of the phytochemicals. Pharmacognosy has been conducted by standard methods mentioned in chapter 2.

Results: -

Phytochemistry:

In leaves, flavonoids present were quercetin and 3'-OMe quercetin. Vanillic, syringic, *p*-hydroxy benzoic, gallic and *p*-coumaric acids were the phenolic acids present.

Quinones, steroids and alkaloid were present. Glycoflavones were absent. In stem, flavonoids and phenolic acids were the same as the leaves. Quinones and steroids were present. Alkaloid and glycoflavones were absent.

Phytochemical biomarkers of leaves: Alkaloids, quercetin, gallic acid

Stem : Alkaloid absent, quercetin and gallic acid.

Pharmacognosy of leaf and stem: -

Leaf micromorphology

Stomata were anomocytic found only on lower epidermis. Stomatal index was 18-20. Trichomes were absent in both upper and lower epidermis.

Leaf - T.S. (Fig. 39)

Leaf was dorsiventral. In the midrib region, upper portion was ridged to form a hemispherical structure filled with parenchyma. Upper epidermal cells (17-23 x 17-20 μ m) were barrel to rectangular in shape covered by a thin cuticle. There were two large crescentiform collateral vascular bundles placed opposite to each other. Endodermis was not clearly differentiated. Pericycle was composed of sclerenchyma (13-20 x 14-17 μ m) which formed a discontinuous ring on the upper region and continuous ring on the lower region of the vascular bundle. Xylem tracheids (34-37 μ m) were hexagonal to spherical in shape separated by rays (13-17 x 13-20 μ m). Intraxylary phloem (10-20 μ m) was observed in both the vascular bundles. Between the two vascular bundles were pitted parenchyma cells (31-58 μ m) below the bundle the ground tissue contained sphaeraphides. Lower epidermal cells (14-17 x 17-24 μ m) were rectangular in shape.

In lamina portion, mesophyll was differentiated into an upper two layered elongated palisade (38-48 x 10-14 μ m) cells and lower spongy tissue (17-31 x 14-31 μ m) composed of rounded or elongated cells with large intercellular spaces. Both layers of palisade cells were of the same height. Sunken stomata were seen in the lower epidermis.

Powder study (Fig. 42a)

Leaf powder consisted of anomocytic stomata, upper epidermal cells, veins containing sphaeraphides, parenchyma cells (31-58 μ m), spongy cells (17-31 x 14-31 μ m),

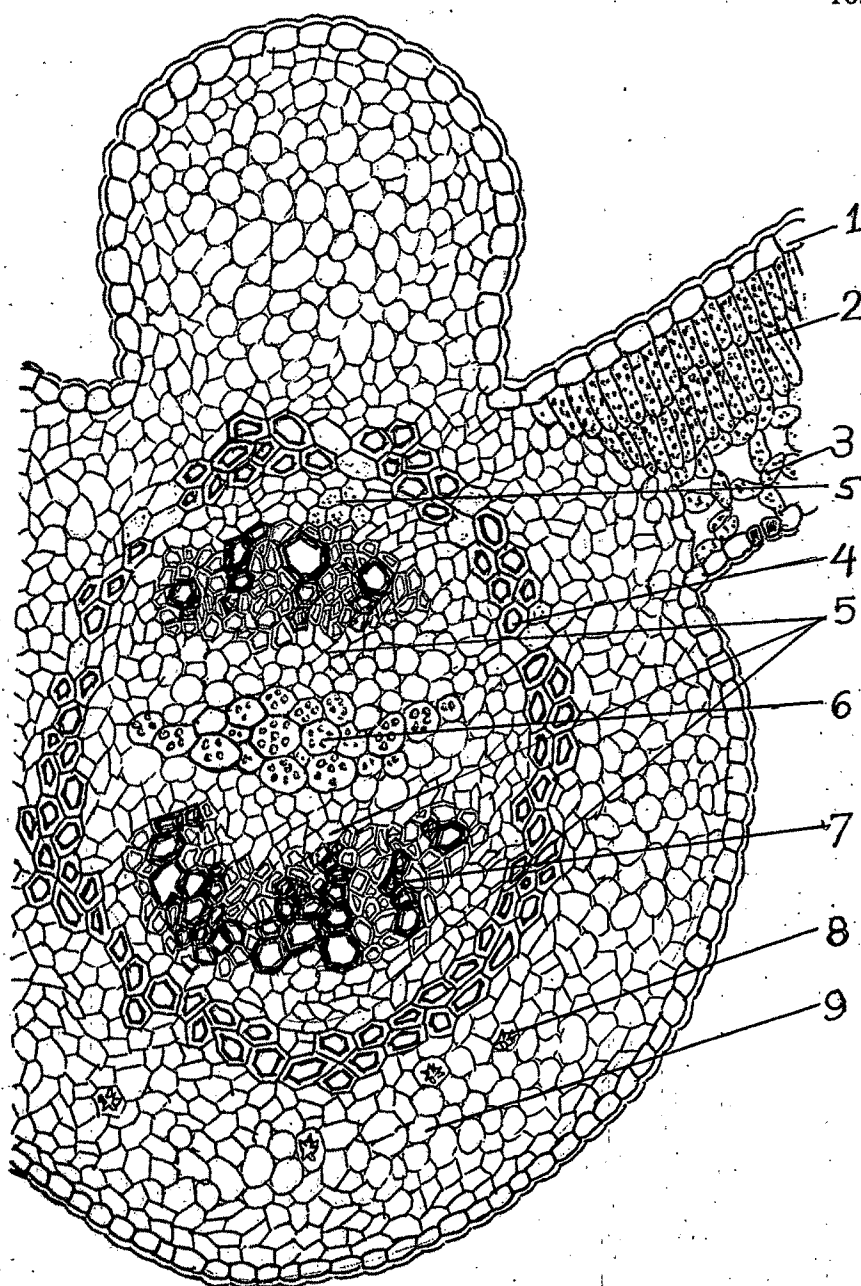


Fig. 39 *Lagerstroemia flos-reginae* Leaf, T.S.: 1. Epidermis, 2. Palisade tissue, 3. Spongy tissue, 4. Sclerenchyma, 5. Phloem, 6. Pitted cells, 7. Xylem, 8. Sphaeraphide, 9. Parenchyma

sphaeraphides, sclerenchymatous fibres (lumen: 15-26 μ m) and palisade tissues (38-48 x 10-14 μ m).

Pharmacognostic markers: Two layered palisade

: Sunken stomata

: Pitted parenchyma cells

: Two layered palisade of same height

Stem - T.S. (Fig. 40)

Transverse section of stem was circular in outline. Cork was the outermost layer which often peeled off. Cortex was made up of eight to ten layers of parenchyma cells (31-58 μ m) in which patches of stone cells (6-17 x 6-13 μ m) were observed. Pericycle was composed of patches of sclereids (7-17 x 10-14 μ m). Phloem (7-10 x 14-17 μ m) was of four to five layers of polygonal shaped cells. Wood was diffuse porous. Vessels (20-27 μ m) were oval to spherical in shape found solitary or in pairs. Tracheids (7-13 μ m) were in radial rows with some tannin deposits in them. Intraxylary phloem was found in isolated patches. Sclereids (10- 20 x 17-30 μ m) were found in between phloem patches and in outer layers of pith. Inner pith region contained polygonal to spherical shaped parenchyma (31-62 μ m) in which some of the cells contained starch grains.

Stem -T.L.S. (Fig. 41a)

Cork cells (6-10 x 15-30 μ m) were thin walled and rectangular in shape. Cortex was composed of irregular shaped parenchyma in which thick walled fibres were seen. V shaped crystals were observed in the phloem ray cells. Sclereids (7-13 x 10-20 μ m) were rectangle in shape. Phloem cells (7-11 x 35-40 μ m) consisted of elongated cells while phloem rays (15-22 x 189-300 μ m) were uniseriate spindle shaped with six to seven cells in height. Tracheids (17-27 μ m) were observed with simple pits. Vessels (25-52 μ m) were found with closely packed bordered pits. Xylem rays (22-40 x 330-520 μ m) were also uniseriate spindle shaped and of six to fifteen cells in height.

Stem- R.L.S. (Fig. 41b)

Most of the cells looked same as that of T.L.S. Phloem rays (18-24 μ m) were of square shaped with V shaped crystals. Xylem rays (15-22 μ m) were upright (15-22 μ m) as

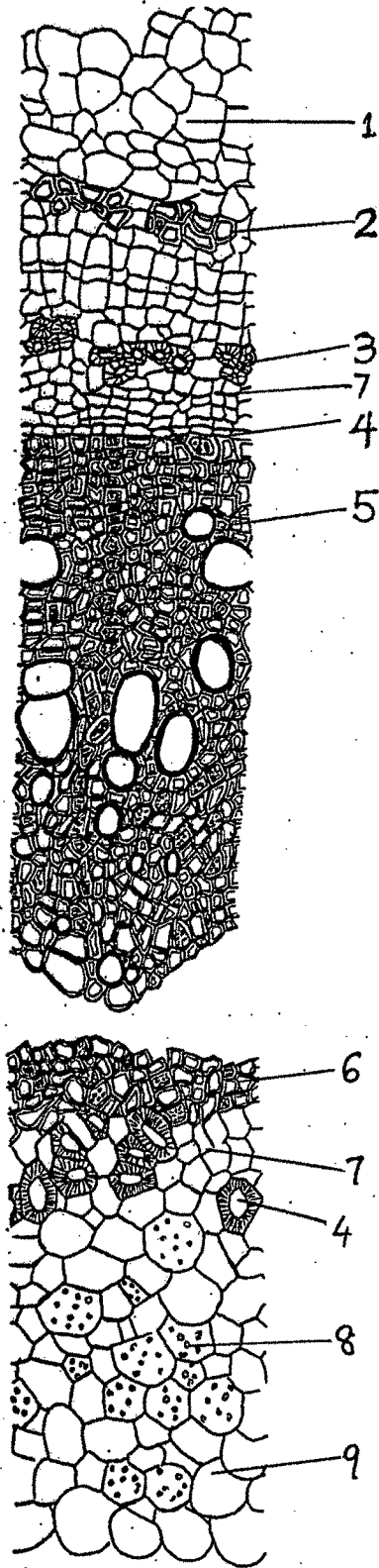


Fig. 40 *Lagerstroemia flos-reginae* Stem, T.S.: 1. Cortex. 2. Stone cell, 3. Sclereid, 4. Cambium, 5. Secondary xylem, 6. Primary xylem, 7. Phloem, 8. Starch grains, 9. Pith

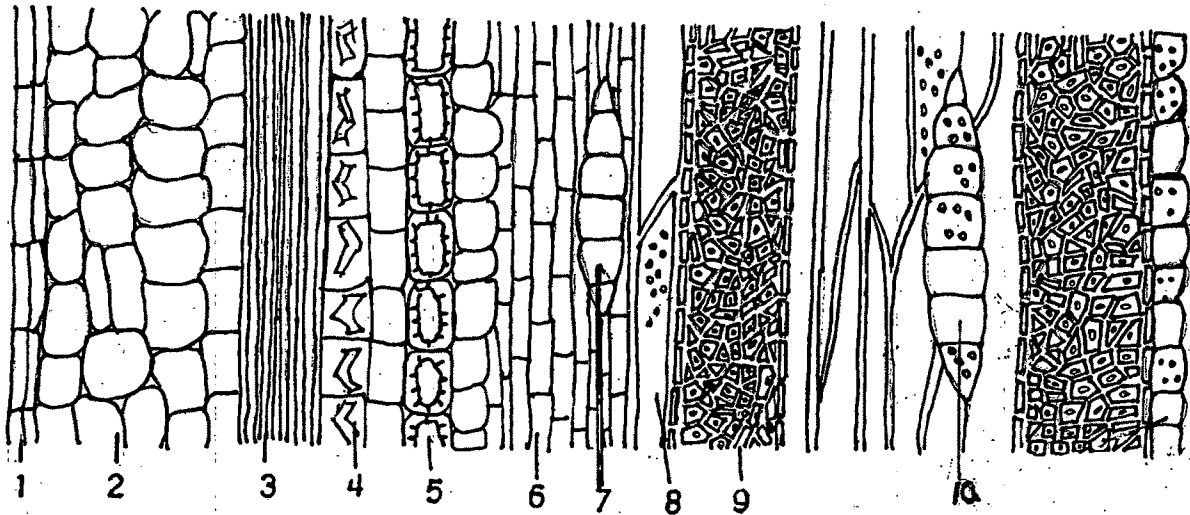


Fig. 41(a) *Lagerstroemia flos-reginae* Stem T.L.S.: 1. Cork, 2. Parenchyma, 3. Fibres, 4. Crystals 5. Sclereid, 6. Phloem, 7. Phloem ray, 8. Tracheid, 9. Vessel with bordered pits, 10. Xylem ray.

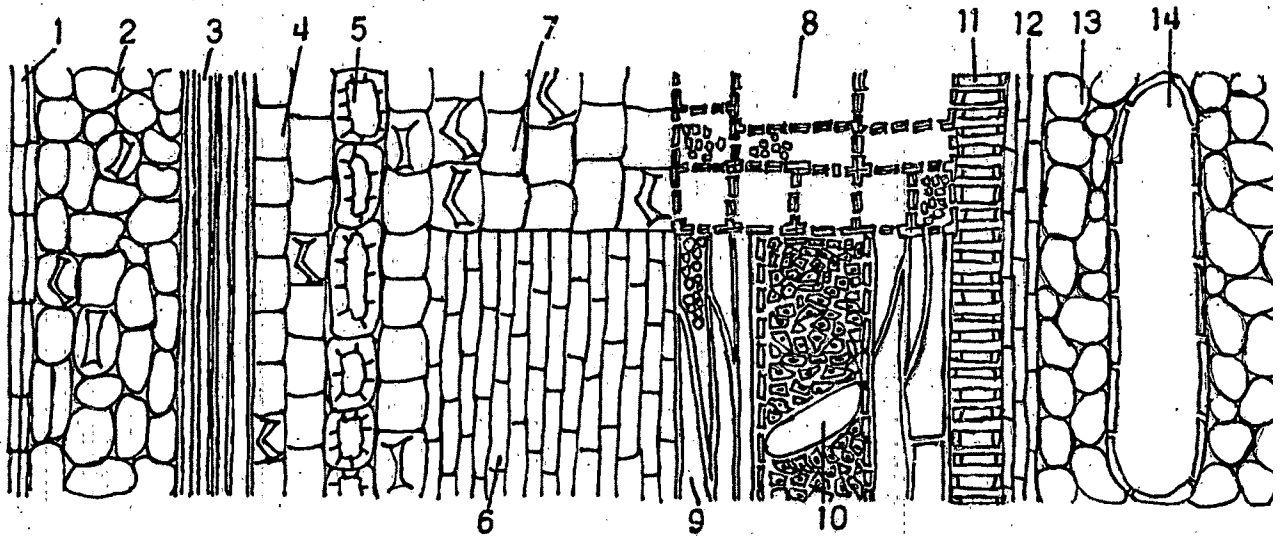


Fig. 41(b) *Lagerstroemia flos-reginae* Stem R.L.S.: 1. Cork, 2. Parenchyma with crystals, 3. Fibres, 4. Parenchyma, 5. Sclereids, 6. Phloem, 7. Phloem rays, 8. Xylem rays, 9. Tracheids, 10. Vessels with bordered pits, 11. Protoxylem with annular thickenings, 12. Intraxylary Phloem, 13. Pith, 14. Resin canal.

well as transversely (30-50 x 11-20 μ m) placed. Protoxylem was found with annular thickening followed by elongated phloem cells. Pith was composed of spherical to oval parenchyma cells in which large sclereids (1112-2100 μ m) were observed.

Powder study (Fig. 42b)

Powder of stem consisted of sclereids, parenchyma cells (31-58 μ m), phloem cells (7-11 x 35-40 μ m), vessels (25-52 μ m) with bordered pits alongwith tracheids (17-27 μ m), parenchyma cells with starch grains (31-62 μ m), cork cells, tracheids with annular thickening and crystals.

Pharmacognostic markers : Oval sclereids

: Broad bent flat (V shaped) prismatic crystals

: Tracheids with tannin deposits.

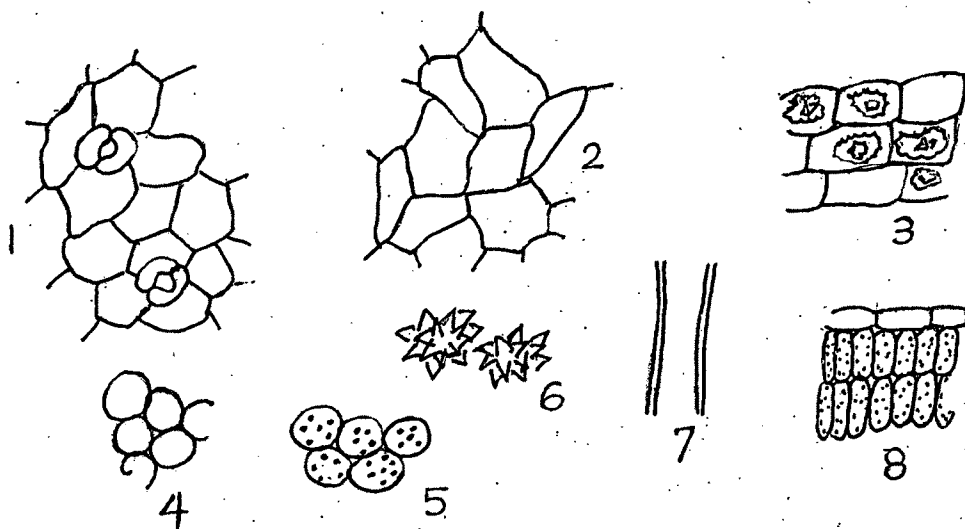


Fig. 42(a) *Lagerstroemia flos-reginae* Leaf Powder study: 1. Anomocytic stomata, 2. Epidermal cell, 3. Veins containing sphaeraphides, 4. Parenchyma, 5. Spongy cells, 6. Sphaeraphide, 7. Sclerenchyma, 8. Palisade tissue

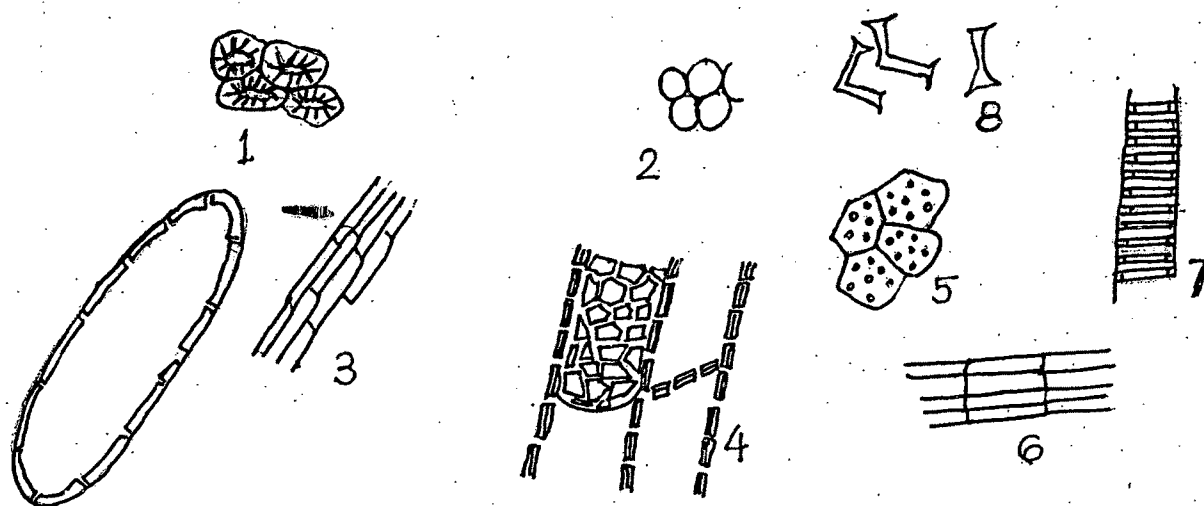


Fig. 42(b) *Lagerstroemia flos-reginae* Stem Powder study: 1. Sclereid, 2. Parenchyma, 3. Phloem, 4. Vessel with bordered pits along with Tracheid, 5. Parenchyma with Starch grains, 6. Cork, 7. Protoxylem with annular thickening, 8. crystals