Chapter 7

7.a. *Saraca indica* Linn. (Caesalpiniaceae)

Synonyms: ***Saraca asoca*** (Roxb.) De Wilde , *Jonesia asoca* Roxb.

Sanskrit : Anganapriya, Apashoka, Ashoka, Vitashoka

Vernacular names:.

Assamese : Ashoka.

Bengali : Ashoka.

English : Asok Tree.

Gujrati : Ashoka.

Hindi : Ashoka.

Kannada : Ashokadamara, Ashokamara, Kankalimara.

Kashmiri : Ashok.

Malayalam : Asokam.

Marathi : Ashok.

Oriya : Ashoka.

Punjabi : Asok.

Tamil : Asogam, Asogu, Asokam.

Telugu : Asogam, Asokamu, Vanjulamu ,Ashokapatta.

Distribution and habitat

The plant is a small to medium sized, evergreen tree distributed throughout India, particularly in Central and Eastern Himalayas, ascending to 2000 ft.

Morphological features

The plant has numerous spreading somewhat drooping branches bearing nearly sessile large a bruptly pinnate leaves, one to two feet long, having two to three pairs of large oblong lanceolate leaflets, large dense corymbs of brilliant orange-red fragrant flowers, and rigidly coriaceous or almost woody smooth turgid pods about six inches long containing four to eight seeds.

Medicinal uses:

The bark is bitter, astringent, sweet, refrigent, anthelmintic, styptic, stomachic, constipating, demulcent. It has stimu sating effect on endometrium and the ovarian tissue. It is useful in dyspepsia, fever, biliousness, burning sensation, abnormal enlargement of visceral organs, colic, dysentery, internal bleeding, haemorrhoids,

ulcers, uterine affections, menorrhagia especially due to uterine fibroids, meno-metrorrhagia, leucorrhoea and pimples. Leaves possess blood purifying properties and its juice mixed with cumin seed is used to cure gastralgia. Flowers are considered as excellent uyerine tonic and are used in cervical adenitis, biliousness, syphilis, hyperdipsia, burning sensation, haemorrhagic dysentery, piles, scabies in children and inflammation. Dried flowers are used in diabetes. Seeds are used in treating bone fracturyes, strangury and vesical calculi(Anon. 2005).

Previous Phytochemical reports

The bark of plant presence of (-) epicatechin, procyanidin, β- 2,11'-deoxyprocyanidin B, (+) catechin, (24, £)- 24- methyl-cholesta-5-en-3p-ol, (22 E, 21£)-24-ethycholesta-5,22 dien-33-ol, (24 £)-24- ethylcholesta-5-en-3-β-ol,leucopelargonidin-3-O-β-Dglucoside,leucopelargonidin and leucocyanidin. The flower part of plant contains oleic, linoleic, palmitic and stearic acids, β-sitosterol, quercetin, kaempferol- 3-0-β-D- glucoside, quercetin- 3-0-β-D-glucoside, apigenin- 7-0-β-D-glucoside, pelargonidin- 3, 5- diglucoside, cyanidin-3, 5-diglucoside, palmitic, stearic, linolenic, linoleic, β and γ sitosterols, leucocyanidin and gallic acid. Seed and Pod contains oleic, linoleic, palmitic and stearic acids, catechol,(-)epicatechol and leucocyanidin . Five lignan glycosides, lyoniside, nudiposide, 5-methoxy-9-β-xylopyranosyl-(−)-isolariciresinol, icariside E3, and schizandriside, and three flavonoids, (−)-epicatechin, epiafzelechin-(4β→8)-epicatechin and procyanidin B2, together with β-sitosterol glucoside, were isolated from dried bark (Pradhan, 2009).

Previous pharmacognostic reports

Little data is available on pharmacognosy of the stem bark of this plant. (Anon.1990 and Malati G and Pillai 2005).

Materials and methods

The plant material has been collected from Vadodara, Gujarat. Phytochemical analysis of roots of the plant for their secondary metabolites such as alkaloids, flavonoids, phenolics, steroids, quinones, mucilages and other compounds were done by standard methods of chromatography and spectrophotometry described in Chapter 2. Pharmacognostic, HPTLC finger printing and physico-chemical studies were done by using standard methods described in Chapter 2.

Results

Phytochemistry

The stem bark is found to contain cyanidin. The phenolic acids were vanillic and syringic acids. Mucilage amounted to 3.2% consisting of rhamnose, glucose and xylose. The plant also showed the presence of unidentified flavonoids and steroids.

Pharmacognosy

Macroscopic characters (Fig.134.)

Stem bark was channelled , externally rough, grayish brown and showed warty protuberances and numerous prominent circular to transversely elongated lenticels with transverse and longitudinal cracks. The fracture was short and slightly fibrous.

Fig.134. *Saraca indica* bark.

Microscopic characters

Bark : T.S (Fig. 135)

The T.S. of stem bark showed the periderm composed of 6 to 16 rows of slightly tangentially elongatedcork cells. The cells had brown thick walls. The outer few rows of cork cells were much compressed and their cell walls were wavy with outer one or two rows ruptured due to the formation of rhytidoma. Some of these cells contain reddish brown contents. The Phellogen was single row of narrow tangentially elongated thin walled cells. The phelloderm, innermost two to three rows of the cork made up of polygonal to isodiametric shaped cells and the walls were thin and yellow, interspersed in which were few thick walled, narrow lumened stone cells, which mostly isodiametric in shape with few cubical to linear shaped. The middle bark which was mainly secondary cortex was composed of thin walled

parenchymatous cells. The cells were fairly large polygonal and compactly arranged with few stone cells. Small spherical starch grains were also occurred in most of the parenchyma cells, while others contain rhomboidal crystals of calcium oxalate of various sizes and yellow masses. Inner to the secondary cortex was one or two nearly continuous tangential bands of stone cells. The stone cells were thick walled, with simple pits, striations and narrow lumened. The inner bark which constitutes nearly half the thickness of the entire bark consisted of phloem tissue, bast fibres and medullary rays. The phloem parenchyma cells were small thin walled, many of them contained yellow amorphous contents, spherical starch grains and rhomboidal crystals. Alternating with the parenohymatous elements were also found small groups of fibres (each group consisting of 4 to 6 cells). The fibers were of both septate and aseptate and many of these fibers were found associated with rhomboidal crystals. There were few compressed and nearly obliterated thin walled phloem elements with a light yellow colour occured in between the regular tissues. The medullary rays were mostly uni-or bi-seriate and most of them contained rhomboidal crystals. The cells were radially elongate at outer and appeared tangentially elongated in the inner.

Bark : Powder study (Fig. 136)

The components present in the powder were thick walled brown colour cork cells, parenchyma containing spherical starch grains, stone cells with thick walled, sclerides, rhomboidal crystals, crystal fibres.

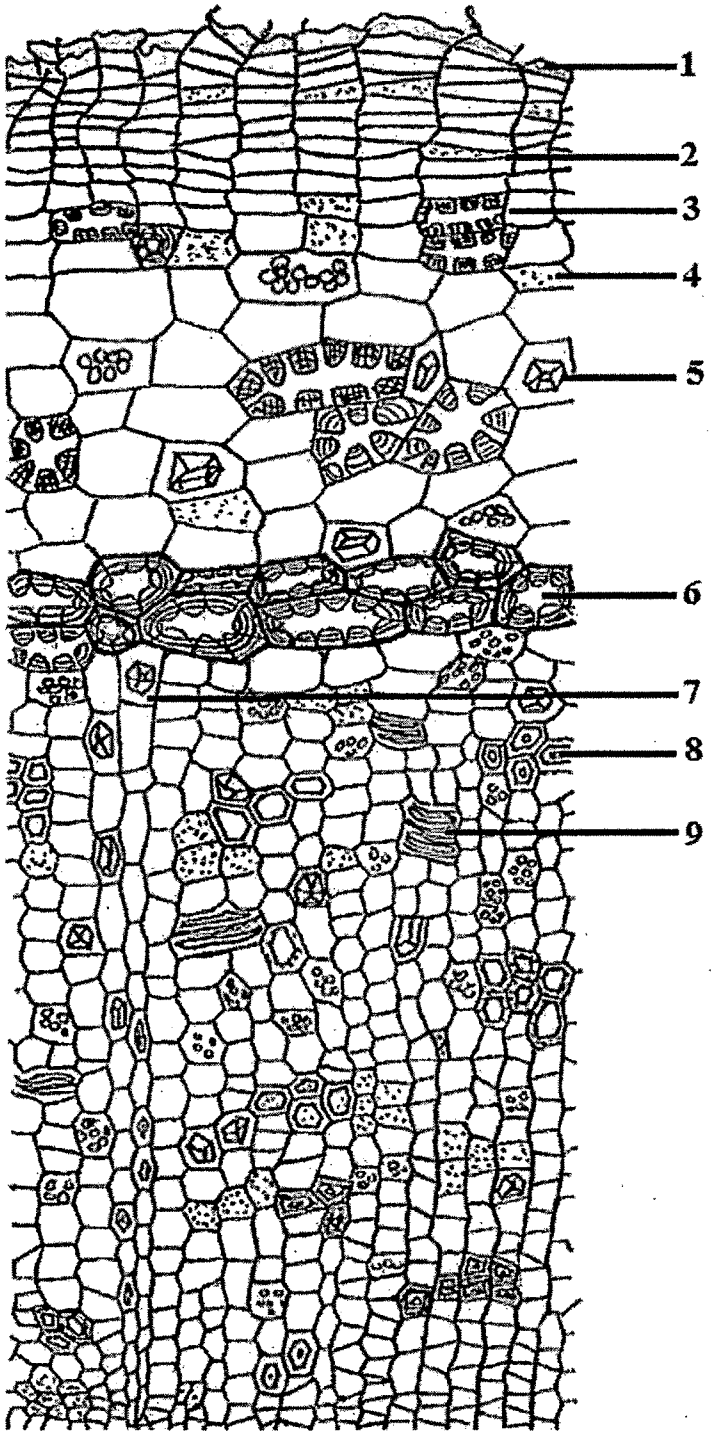


Fig. 135. *Saraca indica* bark, T.S: 1.Cork, 2.Phellogen, 3. Phelloderm with stone cell, 4. Parenchyma with yellow masses, 5. Rhomboidal crystal, 6. Stone cell, 7. Phloem rays, 8. Phloem fibres group, 8.Compressed obliterated thin walled phloem elements.

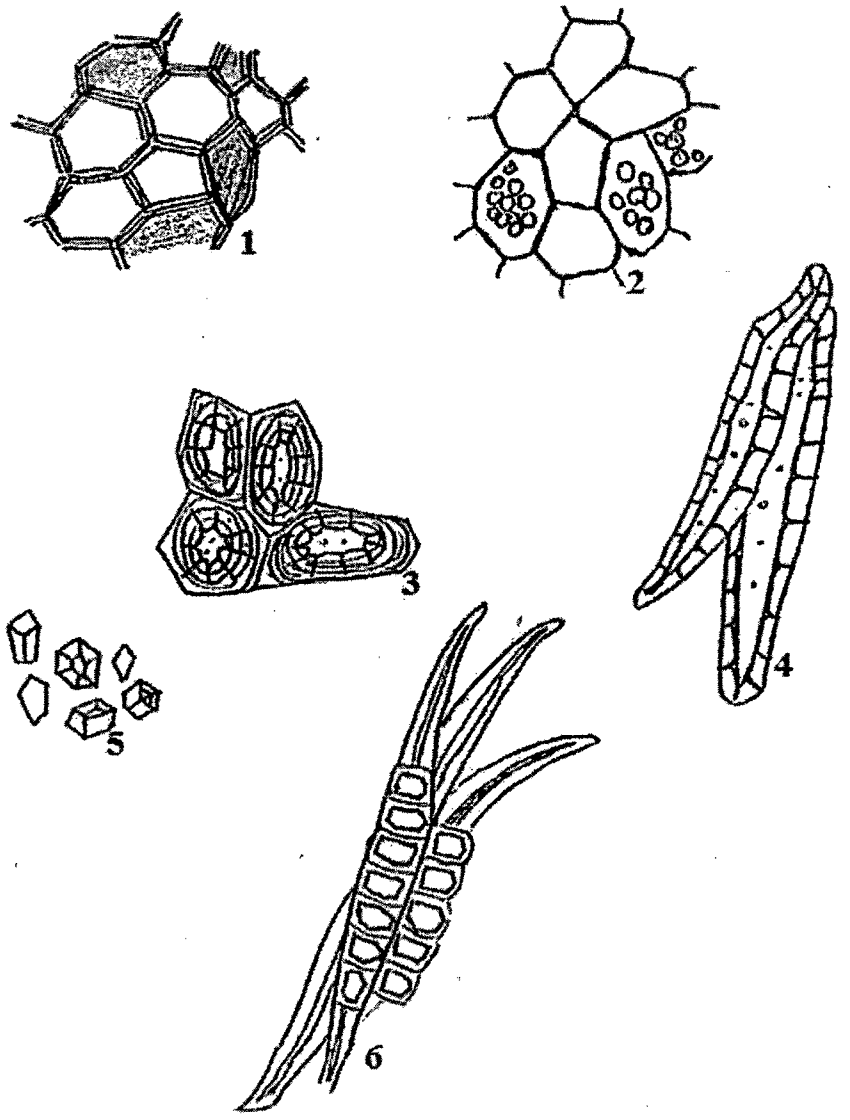


Fig. 136. *Saraca indica* bark, powder study: 1.Thick walled brown colour cork cells, 2.Parenchyma containing spherical starch grains, 3.Stone cells, 4.Sclerides, 5.Rhomboidal crystals, 6.Crystal fibres.

Distinguishing features

Phytochemical markers

1. Cyanidin.
2. Vanillic acid.
3. Syringic acid.
4. Glucose.
5. Xylose.

Pharmacognostic markers

1. Thick walled brown colour cork cells.
2. Parenchyma containing spherical starch grains.
3. Thick walled narrow lumened stone cells.
4. Sclereids.
5. Rhomboidal crystals.
6. fibers were septet and aseptet.
7. Crystal fibres.

Physico-chemical analysis:

Table 24 : Values obtained for the proximate analysis.

Sr.No.	Parameter	Mean ± SD (%)*			Average (%)
		Summer	Monsoon	Winter	
1.	Total Ash Content	10..28±0.14	10.26±0.19	10.18±0.22	10.24
2.	Acid Insoluble Ash content	0.99±0.46	1.03±0.31	0.99±0.24	1.00
3.	Alcohol soluble extractive	18.76±0.16	18.09±0.09	18.13±0.19	18.33
4.	Water soluble extractive	14.26±0.33	14.10±0.27	14.08±0.21	14.15

*Each value is a mean of 3 readings.

7.b.*Bauhinia variegata* Linn. (Caesalpiniaceae)

Sanskrit : Kancanaraka, Gandari.

Vernacular names

Assamese : Kotora, Kurol.

Bengali : Raktakanchan.

English : Orchid Tree.

Hindi : Goriyal, Barial, Gurial, Gwiar, Kachnar, Papri.

Kannada : Arisinantige, Ayata, Bilikanjivala, Irkubalitu, Kondaalka, Kovindaara.

Malayalam : Chovanna-Mandaru, Kovidaram, Chuvannamundiri, Unnu.

Manipuri : Chingthao-Angouba.

Marathi : Kavidara, Kanchan, , Raktakanchan, Thaur.

Mizoram : Vau-Favang, Vaube, Vaufawang.

Nepali : Takki.

Oriya : Vau-Favang, Vaube, Kachan.

Tamil : Mandarai, Segappumandarai.

Telugu : Bodanta, Daevakanchanamu, Kaanchanamu, Mandaara.

Distribution and habitat

The plant is a medium sized deciduous tree found wild in the sub-Himalayan tract and outer Himalaya upto 1300 m.,in Punjab, dry forests of Eastern, Central and South India, Assam, Sikkim, Chota Nagpur, Western Peninsula. Also cultivated largely as a garden and roadside.

Morphological features

The plant is an erect branched tree 7-10 m high. Leaves 10-12 cms. in diameter, roundish, about as broad as long, divided 1/3- ½ the way down into 2 obtuse or subacute lobes, faintly puberulous beneath, base cordate; main nerves 9-11; petioles upto 3 cm long, glabrous; stipules triangular-oblong, acute, pubescent, deciduous. Flowers in terminal and axillary few-flowered corymbosa racemes; bracts beneath the pedicels triangular, acute, pubescent; pedicels pubescent; 2-bracteolate below the middle. Calyx-tube slightly dilated upwards; limb upto 2 cm long, splitting into 2 coriaceous segments slightly divided at the

apex into 5 short teeth. Petals 5 upto 5 cms. long, subequal, erect, imbricate, the upper inner, oblanceolate, acute, with a long claw, white, rose or purple. Fertile stamens 3-4. Ovary with long stalk; ovules 16-20; style long; stigma oblique, peltate. Pods upto 30 cms., flat. Seeds 12-16, oblong-ellipsoid.

Medicinal uses

The bark of this plant is traditionally used for tonic, astrain; ulcers.it is also useful in skin disease (Manandhar, 2002). The bark is alterative, anthelmintic, astringent and tonic. The juice of the bark is used in the treatment of amoebic dysentery, diarrhoea and other stomach disorders. A paste of the bark is useful in the treatment of cuts and wounds, skin diseases, scrofula and ulcers. It can also be used in cough conditions, asthma, abdominal distention, also act as a gargle for sore throats, prevent from skin diseases, or internally as a remedy for diarrhea. It is helpful in managing skin discoloration (Gordon and David 2001, Vileges *et.al.*, 1997).

Previous Phytochemical reports

The stem bark showed presence of hentriacontane, octacosanol, stigmasterol. (Prakash and Khosa 1976) and of sterols, glycosides, reducing sugars and nitrogenous substances . (Prakash, and Khosa 1978).The stem yielded a flavonone glycoside characterized as 5, 7-dihydroxyflavonone-4 –O – Z -L – rhanmopyranosyl-e – D – glucopyranoside (Gupta *et.al.*, 1979).The isolation of e-sitosterol, lupeol, kaempferol-3-glucoside and a 5, 7-dimethoxyflavonone-4 –O –Z – L – rhanmopyranosyl-e- D-glucopyranoside was also reported from the stem of the plant.(Gupta *et.al.*, 1980, Duret and Paris 1977). Kaempferol-3-glucoside, was isolated from stem of this plant(Gupta and Chauhan. 1984). A new phenanthraquinone, named bauhinione, has also been isolated and its structure has been elucidated as 2, 7-dimethoxy-3-methyl-9, 10-dihydrophenanthrene-1, 4-dione on the basis of spectroscopic analysis (Zhao *et.al.*, 2005).

Previous pharmacognostic reports

Only data on T.S. was available on pharmacognosy of the stem bark of this plant. (Anon.1990, Anon.1999 and Malati and Pillai 2005).

Materials and methods

The plant material has been collected from Rajpipala, Gujarat. Phytochemical analysis of roots of the plant for their secondary metabolites such as alkaloids, flavonoids, phenolics, steroids, quinones, mucilages and other compounds were done by standard methods of chromatography and spectrophotometry described in Chapter 2. Pharmacognostic, HPTLC finger printing and physico-chemical studies were done by using standard methods described in Chapter 2.

Results

Phytochemistry

The stem bark is found to contain flavonoe kaempferol. The phenolic acids were vanillic syringic, protocatechuic and o-coumaric acids. Mucilage amounted to 4.3% consisting of rhamnose and glucose. The plant also showed the presence of unidentified and steroids.

Pharmacognosy

Macroscopic characters (Fig.137)

Stem bark was curved , externally rough, grayish brown and showed exfoliations and small transverse and longitudinal cracks and fissures with prominent longitudinal ridges. The fracture was outer short and inner fibrous.

Fig. 137. *Bauhinia variegata* bark

Microscopic characters

Bark : T.S (Fig. 138)

The T.S. of stem bark showed the cork made up of 12 to 16 rows of rectangular cells. The outer 3 to 5 rows of cells were slightly compressed and had thin light brown walls, While inner 3 to 9 rows of cells were broad rectangular with thick brown walls. Due to the formation of rhytidoma outer one or two rows of cork were found ruptured. The Phellogen was single row of narrow tangentially elongated thin walled cells. The phelloderm consisted of broad rectangular yellowish brown cells. They were 3 to 5 layered thick and showed the presence of isolated stone cells and pericyclic fibers in it. The secondary cortex was made up of tangentially elongated to isodiametric cells, the cells were thin-walled parenchyma. Some of these cells contained spherical starch grains, reddish-orange contents and abundant crystals. The crystals were of rosette, prismatic and rhomboidal types. Many small groups of stone cells and pericyclic fibres were also found scattered in this region. The stone cells were mostly elongated and thin walled, broad lumened with prominent pits and striations. The pericyclic fibres were broad, thick-walled with narrow lumened. The inner bark consisted of phloem tissue, bast fibres and medullary rays. This region was dominated by fibres, found in small groups of 6 to 12 fibres in each group, many of them found associated with rosette, prismatic or rhomboidal crystals . The phloem parenchyma cells were small thin walled, many of them contained rosette crystals and few spherical starch grains. Stone cells either isolated or associated with fibres were distributed throughout the phloem region. The stone cells were characteristically found associated with crystal fibers. The phloem fibers were thick-walled and narrow lumened. The medullary rays were mostly uni-or bi-seriate and funnel shaped. The cells were tangentially elongated in outer region and radially elongated in inner region and many of them containing rosette crystals. The stone cells were also present in the medullary rays.

Bark : Powder study (Fig. 139.)

The components present in the powder were thin and thick walled cork cells, parenchyma containing rosette crystals, spherical starch grains, prismatic and rhomboidal crystals, stone cells with thin walled and broad lumen, sclereids, phloem

ray containing rosette crystals, stone cells associated with crystal fibres, thick walled and narrow lumened fibers.

Distinguishing features

Phytochemical markers

1. Kaempferol.
2. *O*-Coumaric acid.
3. Vanillic acid.
4. Syringic acid.
5. Glucose.
6. Rhamnose.

Pharmacognostic markers

1. Thin and thick walled cork cells.
2. Parenchyma containing reddish-orange contents.
3. Starch grains.
4. Association of stone cells with crystal fibers.
5. Sclereids.
6. Rhomboidal and prismatic crystals.
7. Crystal fibres.
8. Stone cells present in the medullary rays.

Physico-chemical analysis:

Table 25 : Values obtained for the proximate analysis.

Sr.No.	Parameter	Mean ± SD (%)*			Average (%)
		Summer	Monsoon	Winter	
1.	Total Ash Content	7.88±0.42	7.72±0.16	7.93±0.39	7.84
2.	Acid Insoluble Ash content	3.13±0.05	3.05±0.03	3.20±0.06	3.13
3.	Alcohol soluble extractive	11.23±0.63	12.02±0.60	11.67±0.77	11.64
4.	Water soluble extractive	8.36±0.42	8.98±0.25	8.40±0.33	8.58

*Each value is a mean of 3 reading

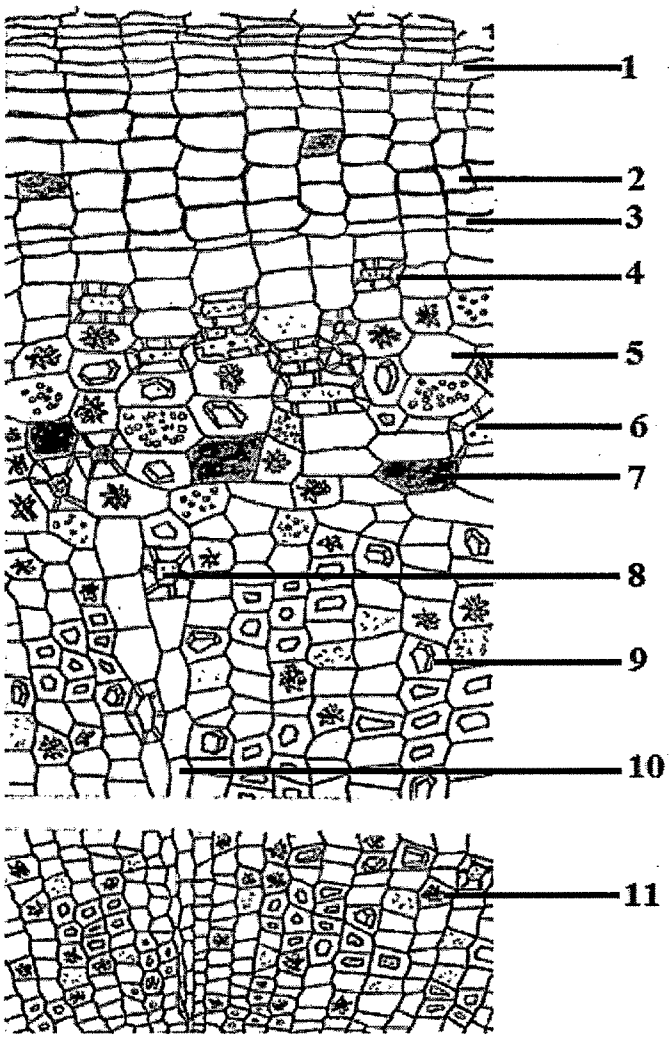


Fig. 138. ***Bauhinia variegata*** **bark, T.S**: 1.Thin walled cork cells, 2. Thick walled cork cells, 3. Phellogen, , 4. Phelloderm with stone cell, 5. Secondary cortex, 6.Sclereids, 7. Parenchyma containing reddish-orange contents, 8. Stone cells, 9.Rhomboidal crystals, 10.Phloem rays, 11. Rosette crystals.

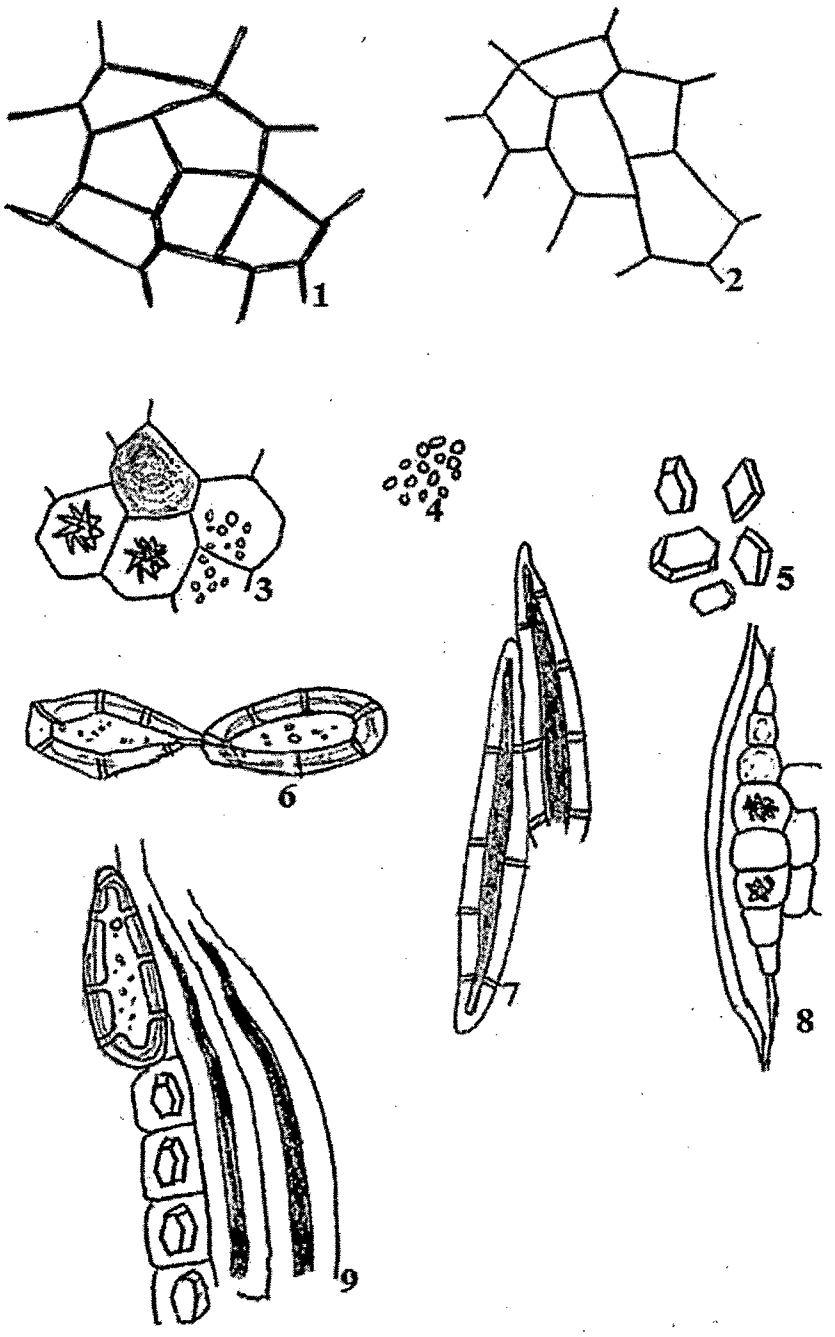


Fig. 139. *Bauhinia variegata* bark, powder study: 1.Thick walled cork cells, 2.Thin walled cork cells, 3.Parenchyma containing reddish-orange contents and rosette crystals , 4. Spherical starch grains, 5.Rhomboidal and prismatic crystals, 6.Stone cells, 7.Sclereids, 8.Phloem rays with rosette crystals, 9.Stone cells associated with crystal fibers.

7.c. *Bombax ceiba* Linn.(Bombacaceae)

Synonyms: *Bombax malabaricum* DC. , *Salmalia malabarica* (DC.) Schott &Endl.

Sanskrit: Salmali.

Vernacular names:

Assamese : Dumboil, Simalu.

Bengali : Simul, Shimool.

English : Silk Cotton Tree, Indian Silk Cotton Tree, Simul.

Hindi : Kantisembal, Pagun, Ragatsemal, Ragatsembal, Semal, Semul, Semur.

Kannada : Apurani, Buraga, Burla, Dudi, Elava, Hatti, Kempuburaga, Mullelava.

Malayalam: Ilavu, Mocha, Mullilavu, Poola, Semul.

Manipuri :Tera.

Marathi : Kanta-Sair, Savar, Saur, Semal,Simlo, Tamari, Vhadli-Savar.

Mizoram : Pang, Phunchawng.

Oriya : Pang, Phunchawng, Similikonta.

Tamil : Agigi, Ilavam, Ilavu, Kongu, Mullilavu, Pongar, Pulai, Purami, Sallagi.

Telugu : Buraga, Kondaburaga, Mundlaburaga, Pinnaburaga, Salmali.

Distribution and habitat

The plant is deciduous tree distributed throughout the hotter parts of the country upto 1500 m or more.

Morphological features

A tall tree with branches covered by small hard conical prickles. Leaves palmately compound with a long petiole; stipules triangular, caducous. Leaflets 5-7, glabrous, entire, elliptic-lanceolate, acuminate, attenuate at base, more or less leathery, unequal. Inflorescence many fascicles of 1-4 flowers borne, at or near the end of branches. Flowers large, showy, red (occasionally yellow or white); pedicel thick. Calyx 3-lobed (rarely 2-lobed), cup-shaped, smooth outside, densely silky within. Petals twisted in bud, stellate tomentose outside, sparcely pubescent inside, elliptic-oblong, usually recurved. Stamens c. 75 polyadelphous, united at base in 6 phalanges, each of 11-15 stamens, the inner-most phalange surrounding the pistil is composed of 15 stamens of which 5-innermost are the largest and forked; filaments flattened at base; anthers long, afterward twisted, violet. Ovary conical, green, covered with silky hairs; style simple 5.9-6.5 cm long; stigmas 5, filiform. Capsule

10-12.5 cm long; oblong, woody, 5 valved, profusely to finely tomentose. Seeds brown, smooth, obovid, 6 mm long, embeded in silky white wool.

Medicinal uses:

The roots are sweet, cooling, stimulant, tonic and demulcent, and are used in dysentery. The gum is astringent, cooling. stimulant, aphrodisiac, tonic, styptic and demulcent. It is useful in dysentery, haemoptysis of pulmonary tuberculosis, influenza, menorrhagia, burning sensation, strangury, haemorrhoids, blood impurities and vitiated conditions of pitta. The bark is mucilaginous, demulcent and emetic, and is used for fomenting and healing wounds. A paste of it is good for skin eruptions. Leaves are good for strangury and skin eruptions. Flowers are astringent and are good for skin troubles,.splenomegaly and haemorrhoids. Young fruits are useful in calculus affections, chronic inflammations and ulceration of the bladder and kidney. Seeds are useful in treating gonorrhoea, chronic cystitis (Warrier *et.al.*,1994).

Previous Phytochemical reports

The flowers showed presence of β-D-glucoside of β-sitosterol, free β-sitosterol, hentriacontane, hentriacontanol, kaempferol, quercetin and traces of an essential oil (Gopal and Gupta, 1972). The fresh petals of flowers were reported to yield two anthocyanidin glycosides named A and B which were characterized as pelargonidin-5β-D-glucopyranoside and cyanidin-7-methyl-ether-3β-glucopyranoside, respectively (Niranjan and Gupta. 1973). The seeds contained n-hexacosanol, palmitic acid, octabecyl palmitate, gallic acid, tannic acid, l-gallayl-β-glucose, ethyl gallate and a mixture of α-β- and γ-tocopherols (Dhar and Munjal, 1976). Riboflavin and thiamine were reported from the gum (Broker and Bhat. 1953).The stem bark was reported to contain lupeol and β-sitosterol (Mukherjee and Roy, 1971). In a preliminary study, the stem bark showed absence of saponins, alkaloids and flavonoids (Kapoor *et. al.*, 1969).The root afforded n-triacontanol, β-sitosterol and glycoside, identified as 5,7,3',4'- tetrahydroxy -6-methoxyflavan-3-0-β-D-glucopyranosyl-α-D-xylopyranoside (Chauhan *et. al.*, 1980).

Previous pharmacognostic reports

Only data on T.S. was available on pharmacognosy of the stem bark of this plant. (Anon.2001, and Malati G and Pillai 2005).

Materials and methods

The plant material has been collected from Vadodara, Gujarat. Phytochemical analysis of roots of the plant for their secondary metabolites such as alkaloids,

flavonoids, phenolics, steroids, quinones, mucilages and other compounds were done by standard methods of chromatography and spectrophotometry described in Chapter 2. Pharmacognostic, HPTLC finger printing and physico-chemical studies were done by using standard methods described in Chapter 2.

Results

Phytochemistry

The stem bark is found to contain cyanidin. The phenolic acids were vanillic, syringic and ferulic *(cis-* and *trans-* isomers) acids. Mucilage amounted to 4.3% consisting of rhamnose, galactose, arabinose and glucose. The plant also showed the presence of unidentified steroids.

Pharmacognosy

Macroscopic characters (Fig.140.)

Stem bark was slightly curved , externally gray in colour, rough with fragments of prickles and transverse and longitudinal cracks and. The fracture was fibrous.

Fig.140. *Bombax ceiba* bark.

Microscopic characters

Bark : T.S (Fig. 141.)

The T.S. of stem bark showed the cork made up of 6 to 18 rows of rectangular thin walled stratified cells. The outer 3 to 6 rows of cells were slightly compressed

and had brown walls, while inner 3 to 10 rows of cells were broad rectangular. Due to the formation of rhytidoma outer one or two rows of cork were found ruptured. The Phellogen was indistinct. The phelloderm consisted of broad rectangular and many of them contained orange brown contents. The stone cells were distributed in throughout cork were singly or in paired. The secondary cortex was 8 to 10 layered thick and made up of circular to isodiametric cells, the cells were thin-walled parenchyma. Many of these cells contained starch grains, orange brown contents and rosette crystals. The starch grains were mostly simple and shapes were circular to oval. This region also showed the presence of stone cells found in a singles or in groups, they were of two types i) thin walled and broad lumened with simple pits on their walls and ii) heavily thickened walled with prominent striations and narrow lumened with simple pits on their walls. The sclereids and mucilage canals were also found scattered in this region. Many sclereids showed the brown depositions. The inner bark consisted of phloem tissue, bast fibres and medullary rays. The phloem parenchyma cells were thin walled, many of them contained orange brown contents, few spherical starch grains and rosette crystals. Alternating with the parenohymatous elements were also found the presence of fibres, mostly in groups. The fibers were thick walled, narrow lumened and pointed tips. The medullary rays were heterogeneous (3 to 6 seriate). The cells were radially elongated and fairly thick-walled, most of them filled with rosette crystals while few with starch grains.

Bark : Powder study (Fig. 142.)

The components present in the powder were thin walled cork cells, parenchyma containing orange brown contents, rosette crystals, spherical starch grains, thin walled ,broad lumened stone cells, narrow lumened heavily thickened stone cells with striations, sclereids with brown depositions, phloem ray containing rosette crystals, thick walled narrow lumened fibers.

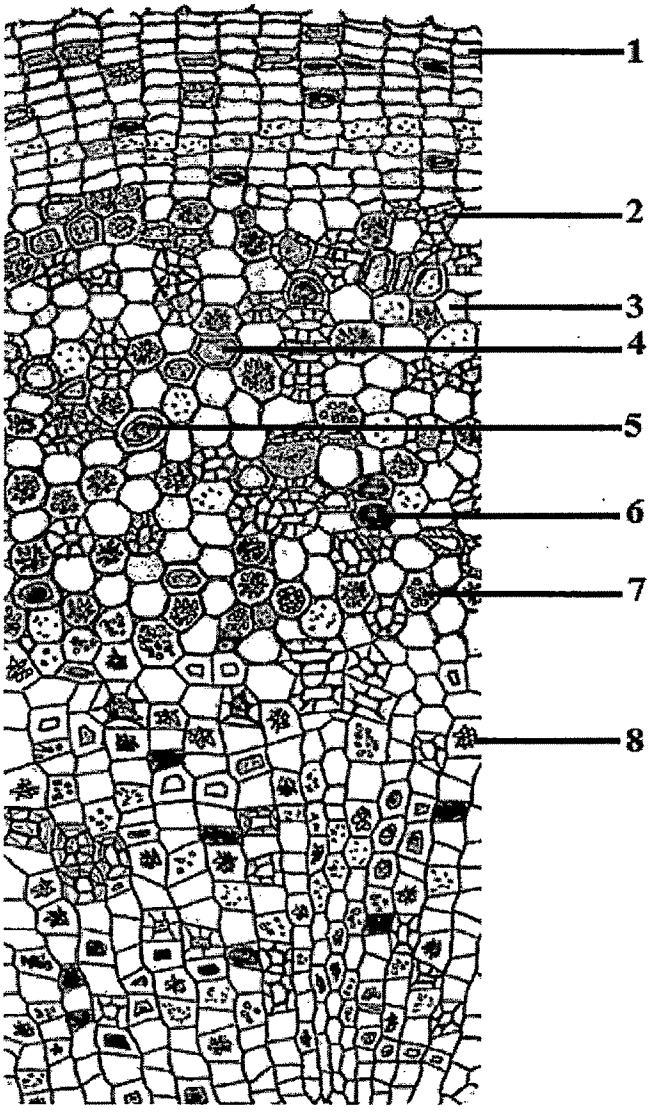


Fig. 141. ***Bombax ceiba*** **bark, T.S**: 1.Thin walled cork cells, 2. Stone cell, 3.Secondary cortex, 4. Sclereids, 5. Mucilage cells, 6. Parenchyma containing orange brown contents, 7.Starch grains, 8.Rosette crystals.

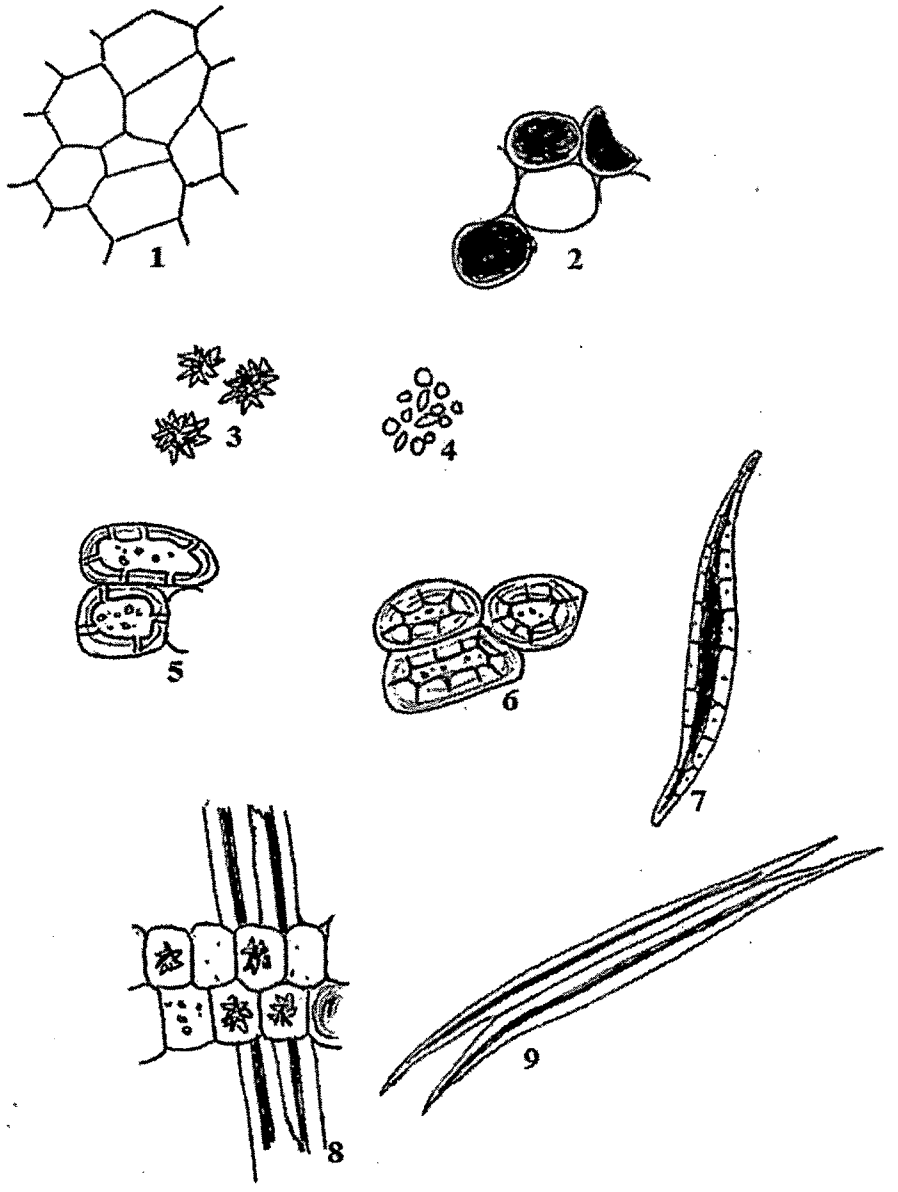


Fig. 142. ***Bombax ceiba*** **bark, powder study**: 1.Thin walled cork cells, 2.Parenchyma containing orange brown contents, 3. Rosette crystals, 4.Spherical starch grains, 5.Thin walled ,broad lumened stone cells, 6. Narrow lumened heavily thickened stone cells, 7.Sclereids with brown depositions, 8. Phloem ray containing rosette crystals, 9.Thick walled narrow lumened fibres.

Distinguishing features

Phytochemical markers

1. Cyanidin.
2. Vanillic acid.
3. Syringic acid.
4. Ferulic *(cis-* and *trans-* isomers) acid.
5. Rhamnose.
6. Galactose.
7. Arabinose.
8. Glucose.

Pharmacognostic markers

1. Thin walled cork cells.
2. Parenchyma containing orange brown contents.
3. Starch grains.
4. Stone cells.
5. Sclereids with brown depositions.
6. Rosette crystals.
7. Absence of crystal fibres.
8. Rosette crystals present in the medullary rays.

Physico-chemical analysis:

Table 26 : Values obtained for the proximate analysis.

Sr.No.	Parameter	Mean ± SD (%)*			Average (%)
		Summer	Monsoon	Winter	
1.	Total Ash Content	8.74±0.53	8.69±0.27	8.99±0.31	8.81
2.	Acid Insoluble Ash content	1.23±0.11	1.09±0.19	1.66±0.03	1.33
3.	Alcohol soluble extractive	7.44±0.28	6.83±0.27	6.86±0.31	7.04
4.	Water soluble extractive	11.43±0.19	11.01±0.04	10.93±0.17	11.12

*Each value is a mean of 3 reading.

7.d.*Polyalthia longifolia* Benth (Sonn.) Thwaites

(Annonaceae)

Sanskrit: Ashwapallava, Kasthadaru.

Vernacular names

Bengali: Debdaru.

English : Cemetery Tree.

Gujarati : Asopalav.

Hindi: Asoka, Debdari.

Kannada: Kambadarnara, Hessare.

Malayalam: Arena, Chorana.

Oriya: Asupal, Debdaru.

Tamil : Nettaingam, Assothi.

Telugu: Nara maamidl.

Distribution and habitat

The plant is an evergreen shrub or tree grows throughout the tropical and subtropical parts of India up to an altitude of 1500 m.

Morphological features

The plant showed the slender branches, short, about 1-2 m long, glabrous, and pendulous. Leaves alternate, exstipulate, distichous, mildly aromatic, 7.5-23 by 1.5-3.8 cm, shining, glabrous, narrowly lanceolate, tapering to a fine acuminate apex, margin markedly undulate, pinnately veined, leathery or subcoriaceous, shortly petiolate; petiole about 6 mm long. Flowers arise from branches below the leaves, nonfragrant, 2.5-3.5 cm across, yellowish to green, in fascicles or shortly pendunculate umbels; petals 6, 2 seriate, flat, from a broad base, lanceolate, long accumulate, spreading; and sepals 3, broad, short, triangular, the tips reflexed. Stamens many, cuneate; connective truncately dilated beyond the cells. Ovaries indefinite; ovules 1-2; style oblong. Ripe fruits ovoid, 1.8-2 cm long, numerous, stalked, glabrous, 1 seeded; stalk 1.3 cm long, short, glabrous. Seeds smooth, shining.

Medicinal uses

This plant has been used in traditional system of medicine for the treatment of fever,skin diseases, diabetes, hypertension and helminthiasis (Kirtikar and Basu 1995). The bark and leaves of this plant display effective antimicrobial activity, cytotoxic function and hypotensive effects (Katka, Suthar and Chauhan 2010).

Previous Phytochemical reports

The plant mainly contains diterpenoids, alkaloids, tannins, and mucilage. The chief components of the plant are O-methylbulbocapnine-*N*-oxide, polyfothine , *N*-methylnandigerine-*N*-oxide, oliveroline-*N*-oxide, pendulamine A, *N*-pendulamine B , 8-oxopolyalthiane, 16-oxo-5, 13-halimadien-15-oic acid , 16-Oxo-3, 13-clerodadien-15-oic acid, 16-hydroxycleroda-3, 13-dien-16, 15-olide.Two clerodane-type diterpenoids have been isolated and identified as 16α-hydroxy-cleroda-3,13(14)Z-dien-15,16-olide and 16-oxo-cleroda-3,13 (14)E-dien-15-oic acid on the basis of spectral properties. A γ-methoxybutenolide clerodane diterpene 2 has been isolated from the petroleum ether extract of the bark. Its structure has been deduced by spectral analyses and by chemical correlation with the corresponding γ-hydroxybutenolide diterpene 1, isolated earlier from this plant. Aporphine and azafluorene alkaloids, proanthocyanidins, h-sitosterol, and leukocyanidin, clerodane, and ent-helimane, diterpenoids were isolated from the leaves, stem, and stem bark. Carbohydrate was isolated from the seeds. A novel azafluorene alkaloid, polylongine (5-hydroxy-6-methoxy-1-methyl-4-azafluoren-9-ol), and 3 new aporphine *N*-oxide alkaloids named (+)-O-methylbulbocapnine-β-*N*-oxide, (+)-O-methylbulbocapnine-α-*N*-oxide, and (+)-*N*-methylnandigerine-β-*N*-oxide were isolated from the leaves. The leaf oil was almost exclusively composed of sesquiterpene derivatives, being represented by allo-aromadendrene (19.7%), caryophyllene oxide (14.4%), β-caryophyllene (13.0%), β-selinene (7.9%), α-humulene (7.0%) and ar-curcumene (6.8%). However, α-copaene and α-muurolol (approx 8.7%), β-selinene (8.6%), viridiflorene (8.1%), α-guaiene (7.8%), allo-aromadendrene (7.4%), and δ-cadinene (7.0%) were the major constituents in the oil of the bark.(Katka, Suthar and Chauhan 2010).

Previous pharmacognostic reports

Little data is available on pharmacognosy of the stem bark of this plant (Anon.1999 and Malati G and Pillai 2005).

Materials and methods

The plant material has been collected from Vadodara, Gujarat. Phytochemical analysis of bark of the plant for their secondary metabolites such as alkaloids, flavonoids, phenolics, steroids, quinones, mucilages and other compounds were done

by standard methods of chromatography and spectrophotometry described in Chapter 2. Pharmacognostic, HPTLC finger printing and physico-chemical studies were done by using standard methods described in Chapter 2.

Results

Phytochemistry

The bark was found to contain proanthocyanidins and the phenolic acids were vanillic, syringic and ferulic (*cis*- and *trans*- isomers) acids. Mucilage amounted to 4.9 % consisting of rhamnose, xylose and glucose. The plant also showed the presence of alkaloids and steroids.

Pharmacognosy

Macroscopic characters (Fig.143.)

Stem bark was flat to curved, externally rough, orange-brown and showed faint ridges and furrows with vertical lenticels. The fracture was hard and fibrous.

Fig.143. *Polyalthia longifolia* bark.

Microscopic characters

Bark : T.S (Fig. 144)

The T.S. of stem bark showed the periderm composed of 5 to 12 rows of tangentially elongated cork cells. The cells were with light brown thick walls. The outer few rows of cork cells were much compressed. Some of these cells contain yellowish- brown contents. Isolated stone cells were seen in this region. The Phellogen was single layered. The cells of phelloderm were thin walled and tangentially elongated. There were few groups of rectangular stone cells were embedded in this region .The simple rounded starch grains and prismatic crystals were also found present along with few cells containing light brown masses. The secondary cortex was very narrow composed of thin walled parenchymatous cells. The cells were polygonal to isodiametric shaped and compactly arranged with several prominent groups of sclereids, stone cells, mucilage canal and oilc ells embedded in this region. Starch grains, prismatic crystals and brown contents were also occurred in many of the cortical parenchyma. The presence of plenty of acicular crystals was characteristic. Very few stone cells found here were thickened walled, narrow lumened with prominent striations and simple pits on their walls. The phloem consisted of soft tissue, bast fibres and medullary rays. The phloem parenchyma cells were small thin walled, many of them contained brown contents , rounded starch grains, acicular and prismatic crystals. There were groups of fibres distributed in this region forming a discontinuous ring. The fibers were thickened walled narrow lumened and both sepetate and asepetate types. The stone cells present in this region were comparatively smaller than that of cortex and were in traces. The medullary rays were multi-seriate. The cells of the medullary rays were mostly filled with acicular and prismatic crystals while starch grains were found in intraces.

Bark : Powder study (Fig. 145)

The components present in the powder were thick walled cork cells, parenchyma with brown contents and starch grains, prismatic and acicular crystals, parenchyma with acicular crystals, sepetate and asepetate fibres.

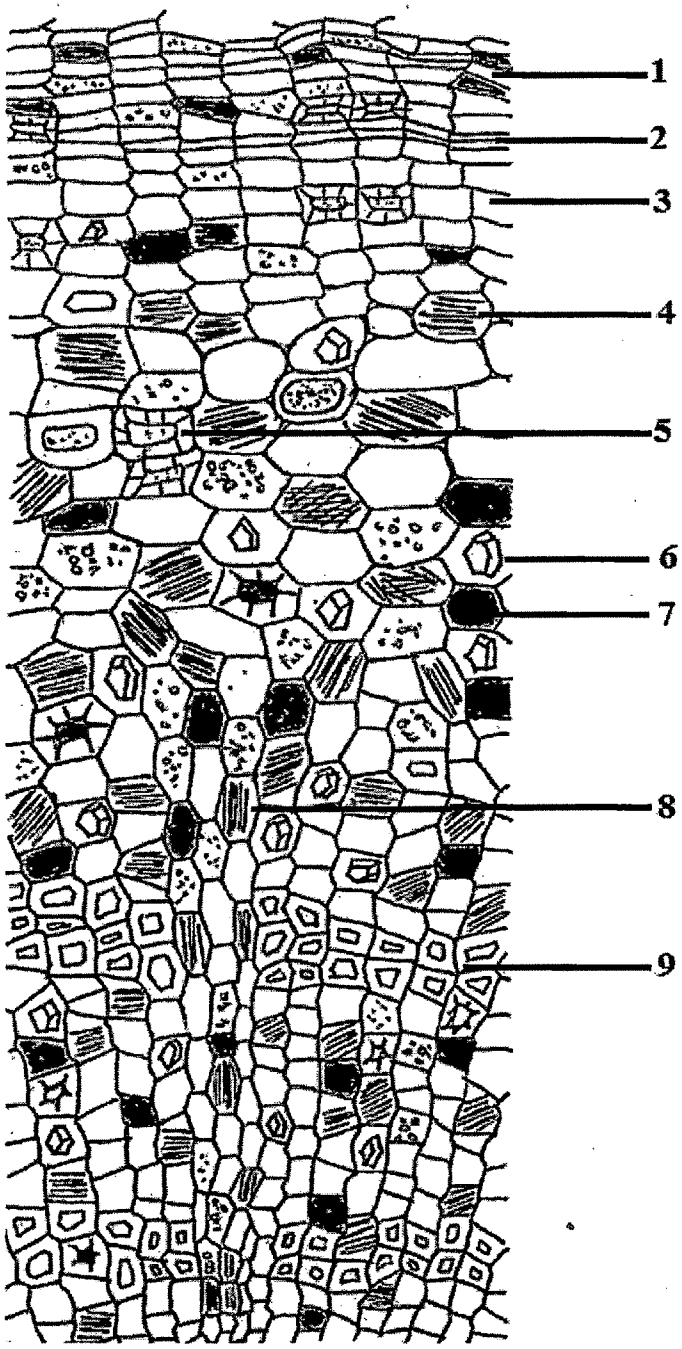


Fig. 144. ***Polyalthia longifolia*** **bark, T.S:** 1.Cork, 2. Phellogen, 3. phelloderm, 4.Parenchyma with acicular crystals, 5. Stone cells, 6. Prismatic crystals, 7. Parenchyma with brown deposits, 8. Phloem rays, 9. Phloem fibers.

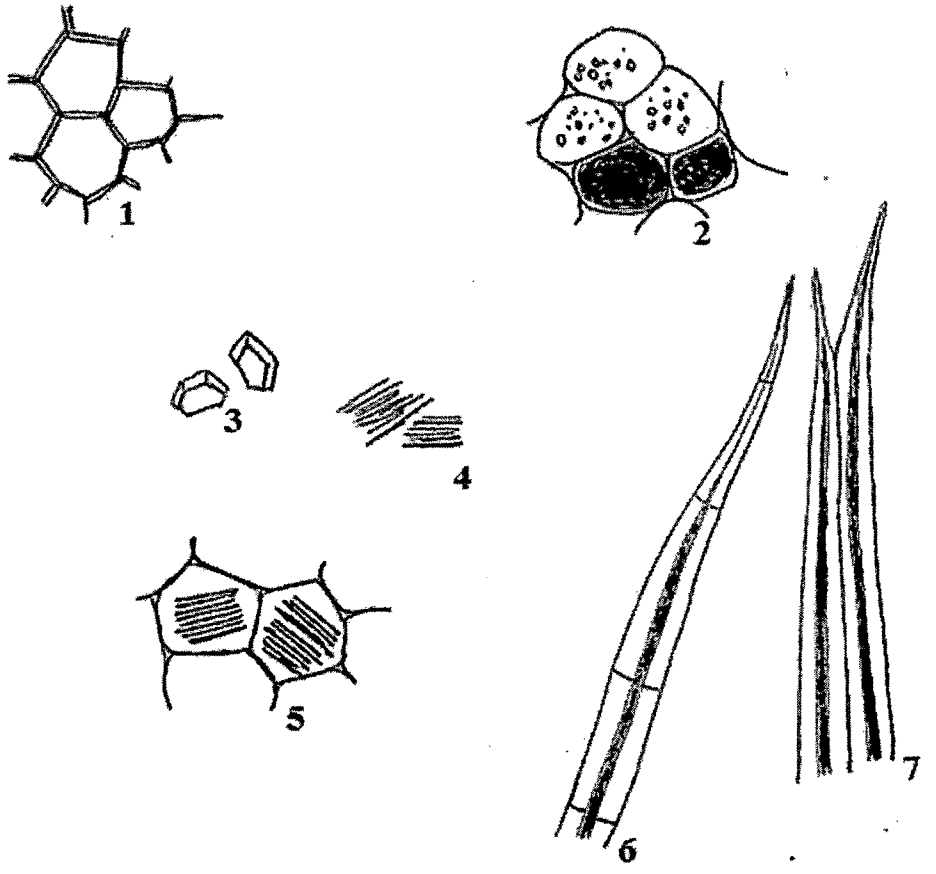


Fig. 145. *Polyalthia longifolia* bark, powder study: 1.Cork, 2. Parenchyma with brown contents and starch grains,3. Prismatic crystals, 4. Acicular crystals, 5. Parenchyma with prismatic crystals, 6. Sepetate fibers, 7. Asepetate fibers.

Distinguishing features

Phytochemical markers

1. Proanthocyanidins.
2. Vanillic acid.
3. Syringic acid.
4. Ferulic (*cis*- and *trans*- isomers) acid.
5. Rhamnose.
6. Xylose.
7. Glucose.

Pharmacognostic markers

1. Thick walled cork cells.
2. Parenchyma containing brown contents.
3. Starch grains.
4. Acicular crystals.
5. Septate and aseptate fibres.
6. Absence of crystal fibres.

Physico-chemical analysis:

Table 27: Values obtained for the proximate analysis.

Sr.No.	Parameter	Mean ± SD (%)*			Average (%)
		Summer	Monsoon	Winter	
1.	Total Ash Content	7.29±0.42	7.66±0.39	7.56±0.16	7.50
2.	Acid Insoluble Ash content	0.79±0.48	0.86±0.27	0.87±0.03	0.84
3.	Alcohol soluble extractive	17.37±0.41	16.37±0.44	16.56±0.28	16.77
4.	Water soluble extractive	19.09±0.33	19.29±0.19	19.33±0.51	19.24

*Each value is a mean of 3 readings.

7.e.*Shorea robusta* Gaertn. (Dipterocarpaceae)

Sanskrit: Agnivallabha, Asoka, Asvakarna, Vansha, Salah Ashvakarna, , Sarja.

Vernacular names:

Assamese : Sal.

Bengali: Shaalgaach.

English: Saltree, Shaal tree.

Gujrati: Shaal.

Hindi : Saal, Sakhuaa, Saakhu.

Kannada : Kabba, Saal

Malayalam:Saalvriksham,

Mulappumarutu

Marathi:Shaalvriksh

Oriya : Salva, Shaaluaagachha.

Punjabi : Shala.

Tamil : Saalam.

Telugu : Guggilam.

Distribution and habitat

The plant is large sub-deciduous tree, found extensively in parts of North-East and Central India.

Morphological features

The plant is 18-30 m in height. The leaves simple, ovate-oblong, acuminate, tough, coriaceous, glabrous, base cordate or rounded, lateral nerves 12-15 pairs; flowers yellowish, in axillary or terminal panicles, stamens upto 50, connectives with subulate bearded appendages, minutely 3-fid at the apex; fruits indehiscent, ovoid with 5 equal wings; seeds ovoid with fleshy unequal cotyledons.

Medicinal uses:

The bark and leaves are astringent, acrid, cooling, anthelmintic, alexeteric, anodyne, constipating, urinary astringent, union promoter, depurative and tonic. They are useful in vitiated conditions of kapha and pitta, ulcers, wounds, bacterial affections, diarrhoea, dysentery, gonorrhea, leucorrhoea, pruritus, leprosy, cough, hyperhidrosis , haemorrhoids and anaemia. The fruits are astringent, cooling, aphrodisiac, cholagogue and tonic, and are useful in dipsia, burning sensation,

tubercular ulcers, seminal weakness and dermatopathy. The resin is cooling, anodyne, vulnerary, antibacterial, deodorant, constipating, detergent, carminative, stomachic, aphrodisiac,expectorant, ophthalmic and tonic. It is useful in hypearhidrosis, vitiated conditions of pitta, wounds, ulcers, neuralgia, burns, pruritus, fever,diarrhea, dysentery, haemorrhoids, gonorrhea, menorrhagia, splenomegaly, obesity, cephalalgia, odontalgia, burning of the eyes and ophthalmodynia.(Warrier *et.al.*,1994).

Previous Phytochemical reports

The plant shows the presence of ursolic acid and α-amyrenone; α & β-amyrin (Hota and Bapuji, 1993, Mishra and Ahmed. 1997); bark contains ursonic acid and oleanane, Shoreaphenol (Harbone1999; Patra *et.al.*,1992); seed contains hopeaphenol, leucoanthocyanidin, and 3,7-dihydroxy-8-methoxyflavone7-*O*-α-l-rhamnopyranosyl-(1→4)-α-l- rhamnonopyrano- syl(1→6)-β-d-glucopyranoside (Prakash and Rao. 1999); while heartwood contains germacrene-D (Kaur *et.al* .,2001). The isolation of β-amyrin, friedelin, β-sitosterol, pheophytin-α, and dihydroxyisoflavone from mature leaves was also reported (Chauhan *et.al.*, 2002).

Previous pharmacognostic reports

No study has been done on the pharmacognostic characters of the bark of this plant.

Materials and methods

The plant material has been collected from Madhya Pradesh. Phytochemical analysis of bark of the plant for their secondary metabolites such as alkaloids, flavonoids, phenolics, steroids, quinones, mucilages and other compounds were done by standard methods of chromatography and spectrophotometry described in Chapter 2. Pharmacognostic, HPTLC finger printing and physico-chemical studies were done by using standard methods described in Chapter 2.

Results

Phytochemistry

The stem bark is found to contain flavonid, 3- OMe quercetin and anthocyanin pelargonidin derivatives. The phenolic acids were vanillic, syringic and *p*- hydroxy benzoic acids. Mucilage amounted to 5.2% consisting of rhamnose and glucose. The plant also showed the presence of steroids.

Pharmacognosy

Macroscopic characters (Fig.146)

Stem bark was curved , externally rough, yellowish brown and with deep prominent longitudinal fissures .The fracture was hard and fibrous.

Fig.146.*Shorea robusta* bark.

Microscopic characters

Bark : T.S (Fig. 147)

The T.S. of stem bark showed the periderm composed of 8 to 18 rows of squarish to slightly tangentially elongated cork cells. The cells showed the light brown thick walls. The outer few rows of cork cells were much compressed and their cell walls were wavy. Some of these cells contained reddish brown contents. The Phellogen was indistinct. The phelloderm made up of polygonal to isodiametric shaped cells and the walls were thin, interspersed in which were rhomboidal crystals , starch grains and sclereids. The middle bark which was mainly secondary cortex was composed of thin walled parenchymatous cells. The cells were polygonal to isodiametric shaped and compactly arranged with several prominent groups of sclereids. A few small spherical starch grains were also occurred in most of the parenchyma cells, while others contain rhomboidal crystals of calcium oxalate of various sizes and reddish brown contents. Abundant stone cells with various shapes were found present in the phelloderm and secondary cortex region and were with thick walled, broad lumened with distinct striations and pit canals. These region also showed the presence of few gum ducts as long tangential bands. The phloem consisted of sieve tubes, bast fibres and medullary rays. The phloem parenchyma cells were small thin walled, many of them contained reddish brown contents,

spherical starch grains and rhomboidal crystals. Alternating with the parenchymatous elements were also found the presence of fibres, mostly in groups of two. The fibers were aseptate type and found associated with rhomboidal crystals. The medullary rays were heterogeneous (3 to 7 seriate) and most of them filled with starch grains. The cells were radially elongate at outer and appeared tangentially elongated in the inner.

Bark : Powder study (Fig. 148)

The components present in the powder were thick walled cork cells with wavy walls, spherical starch grains, thick walled stone cells with broad lumen, sclereids, gum ducts, rhomboidal crystals, crystal fibres.

Distinguishing features

Phytochemical markers

1. 3- OMe Quercetin.
2. Pelargonidin derivatives.
3. *p*- Hydroxy benzoic acid.
4. Vanillic acid.
5. Syringic acid.
6. Glucose.
7. Xylose.

Pharmacognostic markers

8. Thick and wavy walled cork cells.
9. Parenchyma containing spherical starch grains.
10. Thick walled stone cells with broad lumen, distinct striations and pit canals .
11. Sclereids.
12. Gum ducts.
13. Rhomboidal crystals.
14. Heterogeneous medullary rays filled with starch grains
15. Crystal fibres.

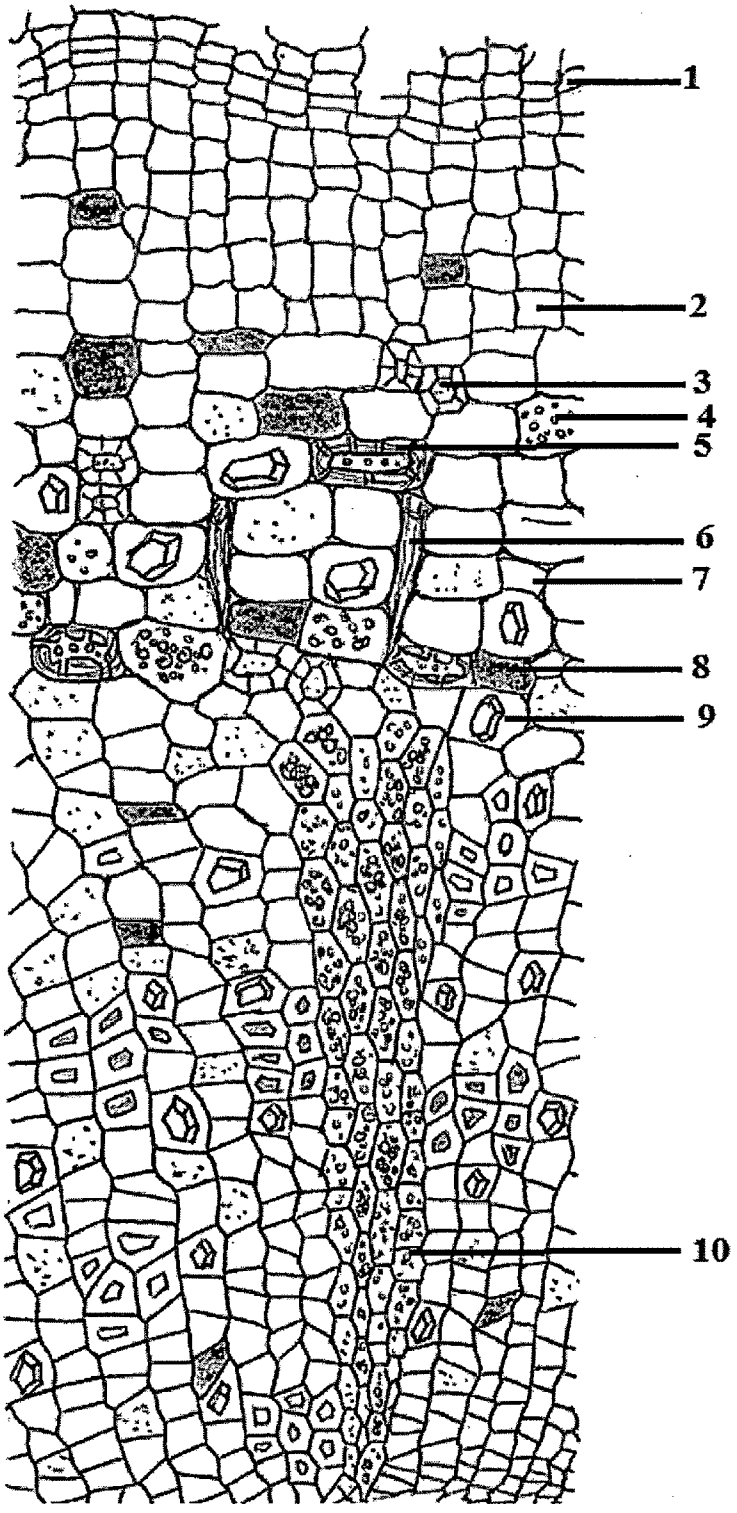


Fig.147. ***Sohrea robusta*** **bark, T.S:**1.Cork, 2.Phelloderm, 3.Sclereids, 4.Parenchyma with starch grains, 5. Stone cells, 6. Gum duct, 7. Secondary cortex, 8. Parenchyma with reddish brown deposites, 8. Rhomboidal crystal, 9.Phloem rayes.

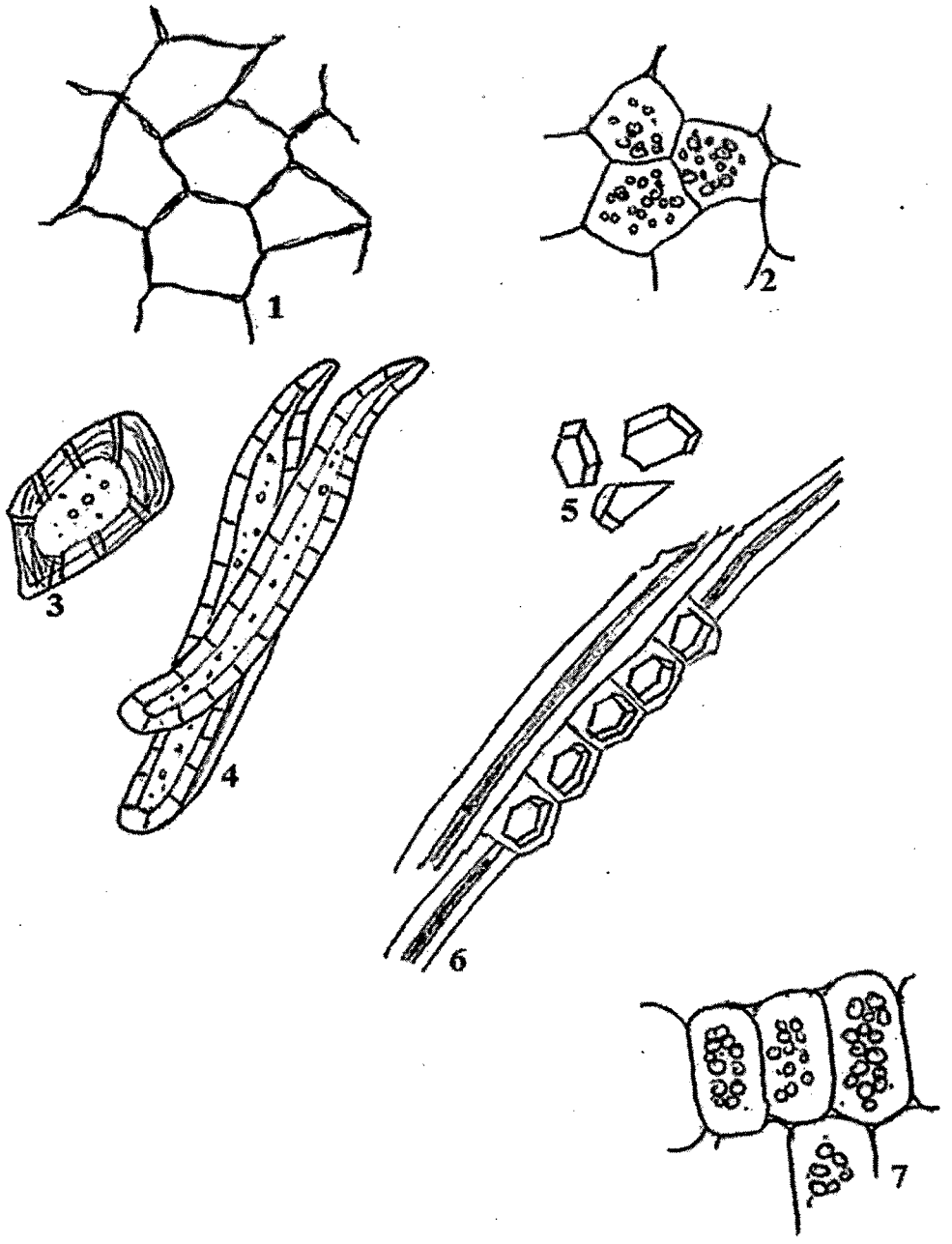


Fig. 148.*Sohrea robusta* bark, powder study: 1.Thick walled cork cells, 2.Parenchyma containing spherical starch grains, 3.Stone cells, 4.Sclerides, 5.Rhomboidal crystals, 6.Crystal fibres, 7. Phloem ray with starch grains.

Physico-chemical analysis:

Table 28: Values obtained for the proximate analysis.

Sr.No.	Parameter	Mean ± SD (%)*			Average (%)
		Summer	Monsoon	Winter	
1.	Total Ash Content	9.12±0.37	9.19±0.13	9.29±0.16	9.2
2.	Acid Insoluble Ash content	0.99±0.29	0.99±0.33	1.03±0.17	1.00
3.	Alcohol soluble extractive	11.59±0.54	11.20±0.49	11.39±0.29	11.39
4.	Water soluble extractive	12.18±0.33	12.01±0.21	12.09±0.34	12.09

*Each value is a mean of 3 readings.

7.f. *Trema orientalis* (L.) Blume (Ulmaceae)

Sanskrit: Jivanti, Swahili.

Vernacular names:

Bengali : Jiban

English : Charcoal tree, Pigeon wood, Indian nettle tree, Indian charcoal tree.

Gujarati : Gol.

Hindi : Jivan, Jivanti Kshayanashini, Parvati Pranak

Konkani : Khargul

Malayalam : Amaraaththi, Aamaththaali, Pottaama, Pottaamaram

Marathi : Gol, Kapshi Khargol

Sanskrit : Jivani, Jivanti Pranaka

Tamil : Pey-Munnai

Telugu : Boggu Chettu, Charapappuchettu, Morali Pruyalavriqshamu.

Distribution and habitat

This is an evergreen shrub or tree up to 18 m in height found in the lowland humid tropics. It has a very wide distribution, occurring from tropical Africa southwards to South Africa , and eastwards to southern Asia.

Morphological features

The plant is found with heavy branching and rounded to spreading crown. The slender branchlets are covered with white velvety hairs. Leaves simple, alternate, stipulate, along drooping branches, to 14 cmlong, papery, rough to the touch and dull above, short grey hairs below,the edge finely toothed all round, blade unequal sided.Flowers small, green or greenish-white, unisexual, borne in a crowdedinflorescence consisting mainly of male flowers with a few female ones atthe top.Fruit small, round and fleshy,glossy black when ripe, 4-6 mm, containing1 dull black seed embedded in bright green flesh.

Medicinal uses

The root of the plant is used in the treatment of diarrhoea, asthma and passing of blood in urine; the bark is used as poultic in muscular pain; the roots, barks and leaves are used in epilepsy. In African folk medicine, it is used in many diseases including cough, dysentery, hypertension, asthma.(Chowdhury and Islam,2004).It is used in the treatment of diabetes mellitus, respiratory diseases, oliguria, and malaria (Adinortey *et.al.*,2013).

Previous Phytochemical reports

The bark showed the presence of methylswertianin, decussatin, glycosides of decussatin, sweroside, scopoletin, (-)-epicatechin, lupeol, p -hydroxybenzoic acid, 3,4-dihydroxybenzoic acid, adian-5-en-3-one, 2a, 3a, 23-trihydroxyurs-12-en-28-oic acid, 2a, 3ß-dihydroxyurs-12-en-28-oic acid, ß-sitosterol, 3- O -ß-glucopyranosyl-ß-sitosterol and hexacosanoic acid.

(Tchamo *et.al.*,2001).

Previous pharmacognostic reports

No study has been done on the pharmacognostic characters of the stem bark of this plant.

Materials and methods

The plant material has been collected from Pavagadh, Gujarat. Phytochemical analysis of bark of the plant for their secondary metabolites such as alkaloids, flavonoids, phenolics, steroids, quinones, mucilages and other compounds were done by standard methods of chromatography and spectrophotometry described in Chapter 2. Pharmacognostic, HPTLC finger printing and physico-chemical studies were done by using standard methods described in Chapter 2.

Results

Phytochemistry

Along with reported scopoletin the bark was found to contain high amount of anthocynidin cyanidin. The phenolic acids were vanillic, syringic and *p*- hydroxy benzoic acids. Mucilage amounted to 5.2% consisting of rhamnose and glucose. The plant also showed the presence of alkaloids, iridoids and steroids.

Pharmacognosy

Macroscopic characters (Fig.149)

Stem bark was channeled , externally smooth, orange-brown and showed longitudinal wavy wrinkles and transverse corky spots. The fracture was short and fibrous.

Fig. 149. *Trema orientalis* bark.

Microscopic characters

Bark : T.S (Fig. 150)

The T.S. of stem bark showed the periderm composed of 5 to 10 rows of squarish to tangentially elongated cork cells. The cells showed the light brown thick walls. The outer few rows of cork cells were much compressed. Some of these cells contain yellowish- brown contents. There were few rectangular stone cells found present in this region. The Phellogen was single or two layered. The cells of phelloderm were almost squarish and little larger than cork cells and the walls were thin, interspersed in which were rhomboidal crystals , starch grains and sclereids. The secondary cortex was composed of thin walled parenchymatous cells. The cells were polygonal to isodiametric shaped and compactly arranged with several prominent groups of sclereids and stone cells. Rosette crystals of calcium oxalate and spherical starch grains were also occurred in many of the cortical parenchyma. The presence of yellow or yellowish brown contents in these cells were very common. Characteristically the stone cells were radially arranged one above the other, in various shapes from cubical to linear and of two types i) thin walled and broad

lumened with simple pits on their walls and ii) heavily thickened walled with prominent striations and narrow branched lumened with simple pits on their walls. The presence of yellow or yellowish brown contents in stone cells and sclereids were characteristics. The phloem consisted of phloem tissue, bast fibres and medullary rays. The phloem parenchyma cells were small thin walled, many of them contained yellowish brown contents, spherical starch grains and rosette crystals. There were groups of fibres distributed in this region. The fibers were of two types i) thin walled and broad lumened and ii) thickened walled narrow lumened. The medullary rays were mostly bi-seriate. Few of them filled with starch grains and with yellowish brown contents.

Bark : Powder study (Fig. 151)

The components present in the powder were thick walled cork cells, parenchyma with starch grains, stone cells and sclerides with yellowish brown contents, parenchyma containing yellow contents and rosette crystals, thin and thick walled fibres.

Distinguishing features

Phytochemical markers

1. Scopoletin.
2. Cyanidin.
3. Vanillic acid.
4. Syringic acid.
5. *p*- Hydroxy benzoic acid.
6. Iridoids.
7. Rhamnose.
8. Glucose.

Pharmacognostic markers

1. Thick walled cork cells.
2. Parenchyma containing yellow contents.
3. Thin and thick walled stone cells laid as rack.
4. Deposition of yellowish brown contents in stone cells and sclereids.
5. Rosette crystals.
6. Thin and thick walled fibres.
7. Absence of crystal fibres.

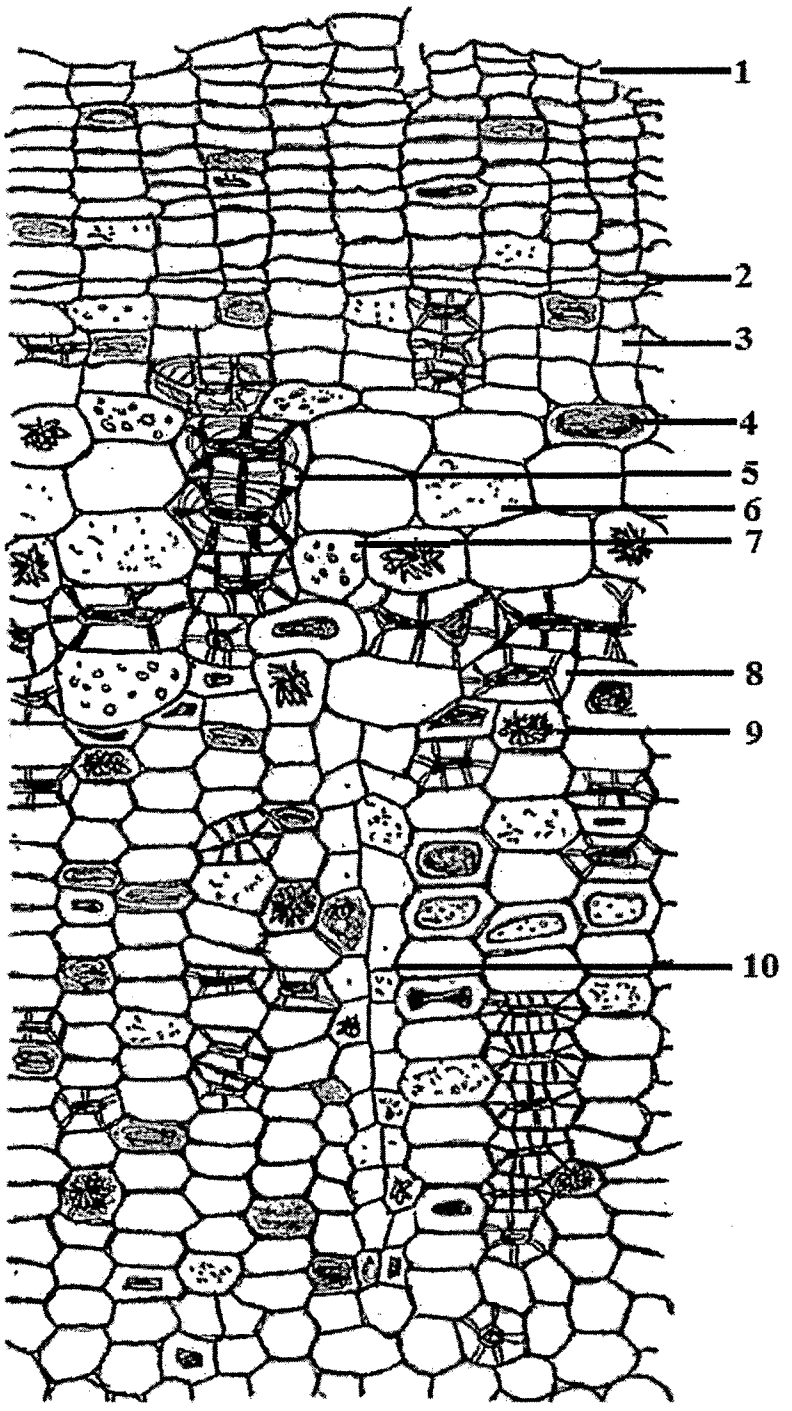


Fig. 150. ***Trema orientalis*** **bark, T.S:** 1.Cork, 2. Phellogen ,3. Phelloderm, 4. Parenchyma with yellowish brown deposits, 5. Stone cells, 6. Secondary cortex, 7. Starch grains, 8. Sclerides, 9. Rosette crystal, 10.Phloem rays.

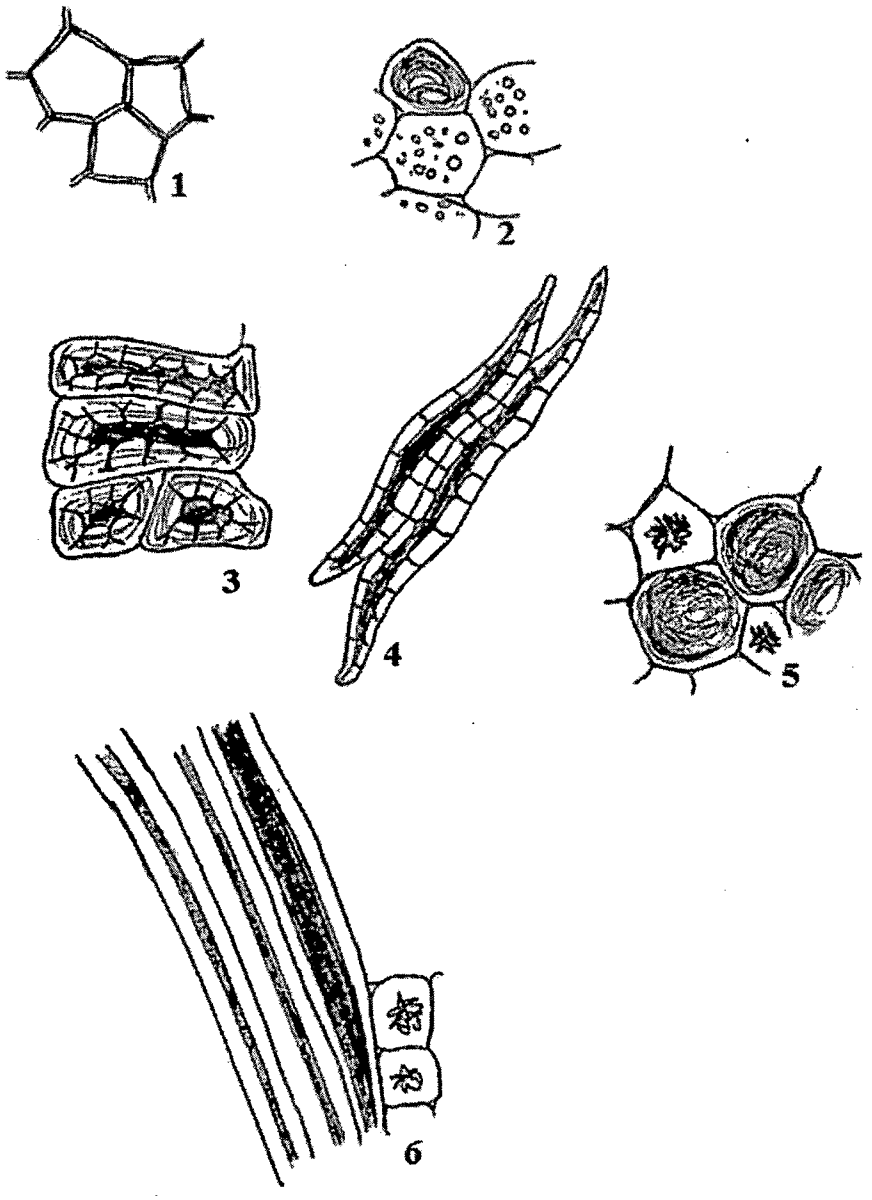


Fig. 151. ***Trema orientalis*** **bark, powder study:** 1.Cork, 2. Parenchyma with starch grains and yellowish brown deposits, 3. Stone cells with yellowish brown contents ,4. Sclereids, 5. Parenchyma with rosette crystals, 6. Thin and thick walled fibers.

Physico-chemical analysis:

Table 29 : Values obtained for the proximate analysis.

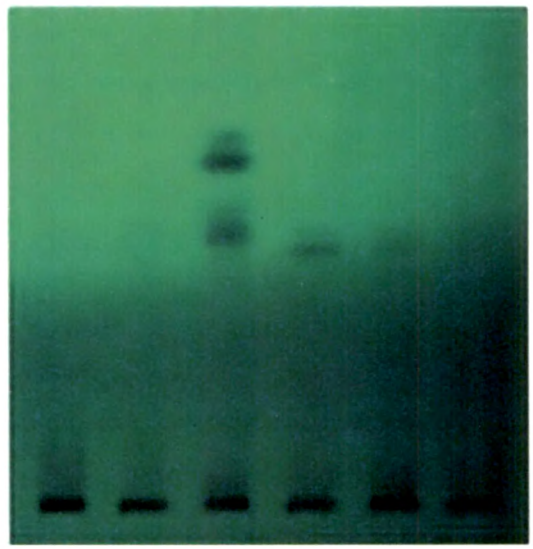
Sr.No.	Parameter	Mean ± SD (%)*			Average (%)
		Summer	Monsoon	Winter	
1.	Total Ash Content	4.13±0.29	4.08±0.31	4.14±0.29	4.12
2.	Acid Insoluble Ash content	0.89±0.21	0.86±0.19	0.87±0.22	0.87
3.	Alcohol soluble extractive	11.27±0.43	10.68±0.37	10.87±0.39	10.94
4.	Water soluble extractive	15.17±0.33	15.04±0.28	15.00±0.36	15.07

*Each value is a mean of 3 readings.

7.g. HPTLC fingerprinting and Physo-chemical analysis of *Saraca indica* and its substitutes/adulterants

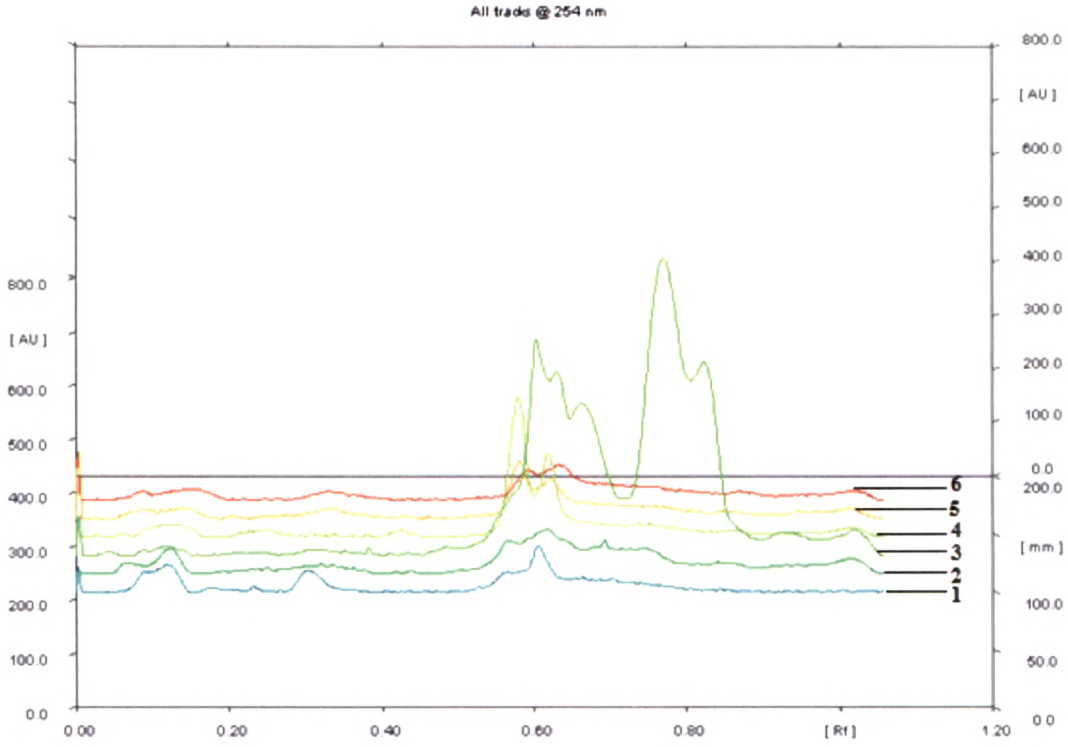
HPTLC fingerprinting

Figure 152.a: HPTLC chromatogram of *Saraca indica* and its substitutes/adulterants (UV 254 nm).



(a).T1-*Saraca indica*, T2-*Trema orientalis*, T3-*Polyalthia longifolia*, T4-*Bauhinia variegata*, T5-*Bombax ceiba*, T6-*Shorea robusta*.

Figure 152.b: HPTLC chromatogram of *Saraca indica* and its substitutes/adulterants (UV 254 nm).

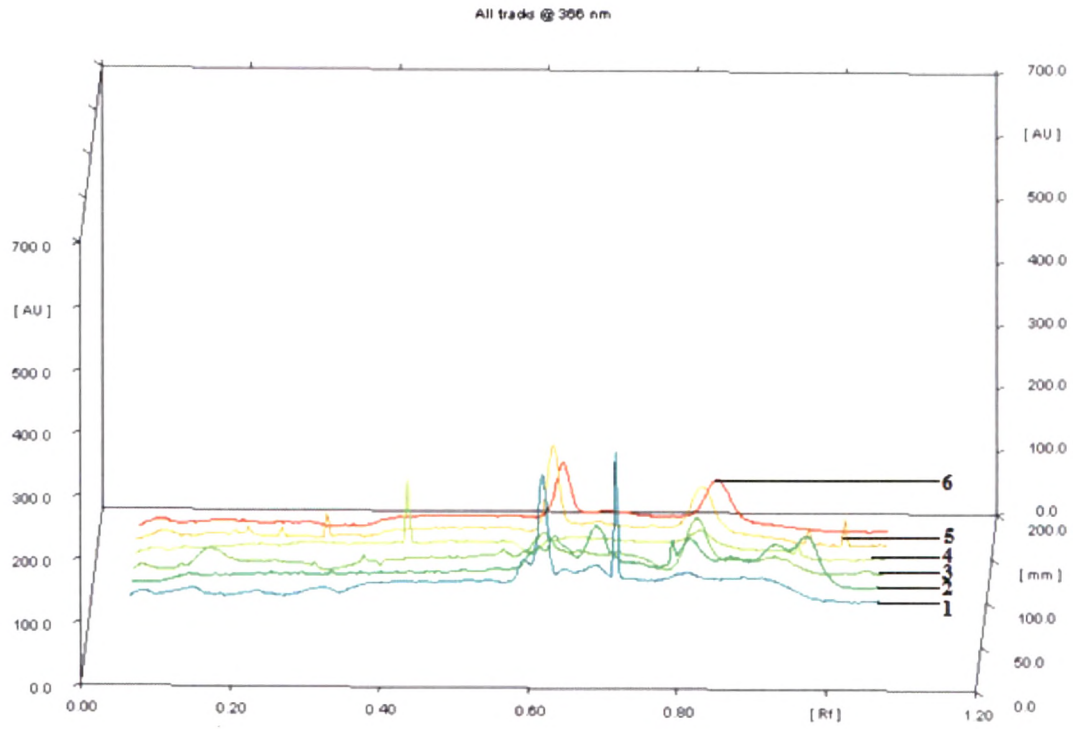


(b).1-*Saraca indica*, 2-*Trema orientalis*, 3-*Polyalthia longifolia*, 4-*Bauhinia variegata*, 5-*Bombax ceiba*, 6-*Shorea robusta*.

Figure 153.a : HPTLC chromatogram of *Saraca indica* and its substitutes/adulterants.(UV 366 nm).

(a).T1-*Saraca indica*, T2-*Trema orientalis*, T3-*Polyalthia longifolia*, T4-*Bauhinia variegata*, T5-*Bombax ceiba*, T6-*Shorea robusta*.

Figure 153.b : HPTLC chromatogram of *Saraca indica* and its substitutes/adulterants(UV 366 nm).



(b).1-*Saraca indica*, 2-*Trema orientalis*, 3-*Polyalthia longifolia*, 4-*Bauhinia variegata*, 5-*Bombax ceiba*, 6-*Shorea robusta*.

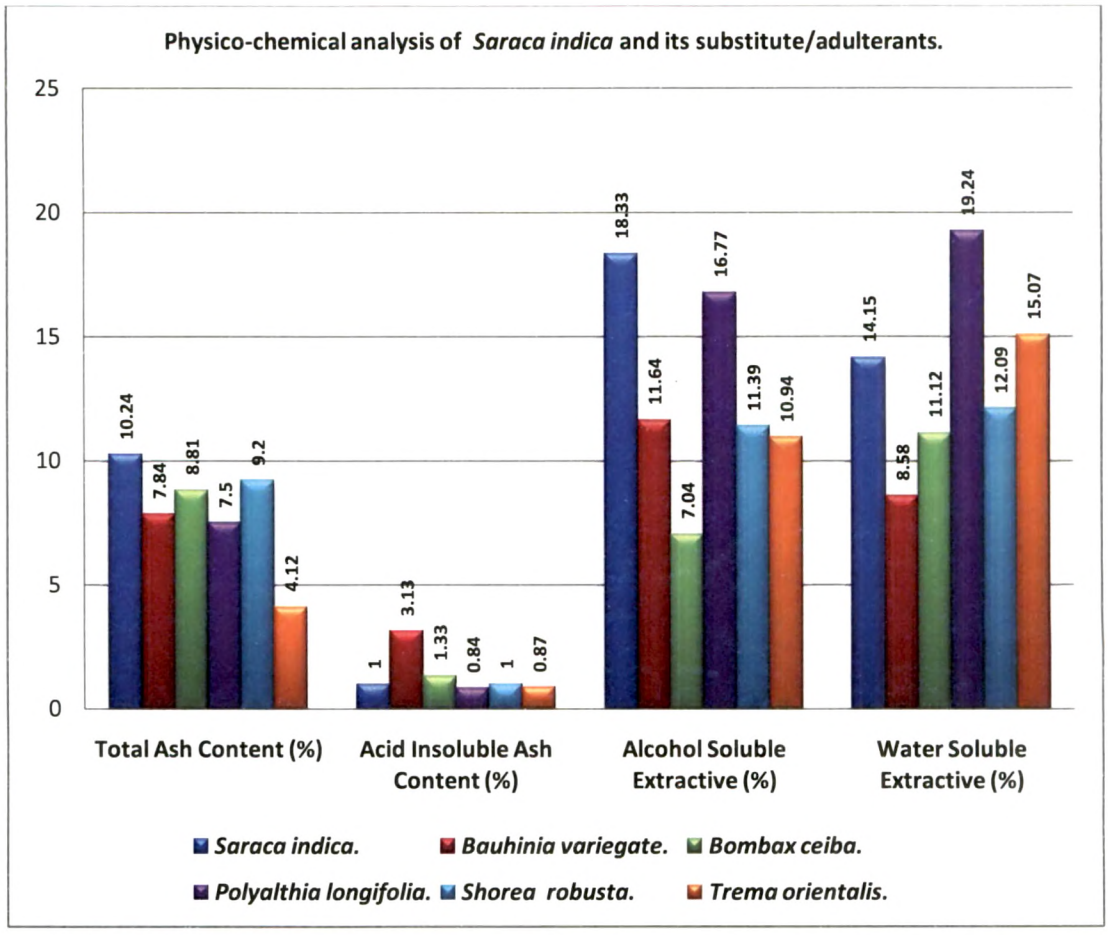
HPTLC profile of *Saraca indica* showed the presence of 5 peaks when observed under UV 254 nm (figure-152.a)and 9 peaks under 366 nm (figure-153.b). There were 4 major peaks found at R_f 0.12, R_f 0.30, R_f 0.56 and R_f 0.61 under UV 254 and 9 peaks at R_f 0.61, R_f 0.68 , R_f 0.70, R_f 0.80 and R_f 0.90 under 366 nm. That of *Trema orientalis* and *Bauhinia variegata* showed the presence of 7 peaks , *Bombax ceiba* and *Shorea robusta* 6 peaks and *Polyalthia longifolia* 11 peaks when observed under UV 254 nm.Under UV366 nm, *Trema orientalis*, *Polyalthia longifolia*, *Bauhinia variegata*, *Bombax ceiba* and *Shorea robusta* showed 8,7, 5, 9 and 3 peaks respectively.

HPTLC profile of *S. indica* and its substitutes/adulterants observed under UV 254 nm showed that *P. longifolia* was similar in 2 peaks but differed in 9 peaks. *T.orientalis*, *B. ceiba* and *S. robusta* were similar in 1 peak but *T. orientalis* differed in 6 peaks and *B. ceiba* and *Shorea robusta* in 5 peaks, while *B. variegata* did not show any peak similar to that of *S. indica* but differed in having 7 peaks.

HPTLC profile of *S. indica* and its substitutes/adulterants observed under UV 366 nm showed that *T. orientalis* was similar in 3 peaks but differed in 5 peaks. *B. ceiba* and *P. longifolia* were similar in 1 peak but differed *B. ceiba* in 8 peaks and *P. longifolia* in 6 peaks, while *B. variegata* and *S. robusta* did not show any peak similar to that of *S.indica* but *B. variegata* and *S. robusta* differed in having 5 and 3 peaks respectively.

Physico-chemical analysis

Physico-chemical analysis of *Saraca indica* and its substitutes/adulterants.



Total ash content

Total Ash Content of *Saraca indica* (10.24 %) along the material collected in different season does not show significant variation (Table-24) while the closest value to the substitute/adulterant in descending order is 9.2% (*Shorea robusta*), 8.81% (*Bombax ceiba*), 7.84% (*Bauhinia variegata*), 7.50% (*Polyalthia longifolia*) and 4.12% (*Trema orientalis*).

Acid insoluble ash content

Acid insoluble ash content of *Saraca indica* (1.00 %) along the material collected in different season does not show significant variation (Table-24). The adulterant *Shorea robusta* had the same value (1.00%) as of *Saraca indica*, while the closest value to the other substitute/adulterant in descending order is 0.87% (*Trema orientalis*), 0.84%(*Polyalthia longifolia*), 1.33% (*Bombax ceiba*)and 3.13 % (*Bauhinia variegate*).

Amongst the substitutes/adulterants of *S. indica* , the *S. robusta* showed the closest value of total ash content which showed that the *S. robusta* was more close to *S. indica* as compared to other substitutes/adulterants of *S. indica* .

Alcohol soluble extractive

Alcohol soluble extractive value of *Saraca indica* (18.33 %) along the material collected in different season does not show significant variation (Table-24) .The closest value to the substitute/adulterant was of *Polyalthia longifolia* (16.77%) while the values of *Bauhinia variegata*, *Shorea robusta* , *Trema orientalis* and *Bombax ceiba* was found to be 11.64%, 11.39%, 10.94% and 7.04% respectively .

Water soluble extractive

Water soluble extractive value of *Saraca indica* (14.15 %) along the material collected in different season does not show significant variation (Table-24). The closest value to the substitute/adulterant was of *Trema orientalis* (15.07%), but the *Polyalthia longifolia* showed the maximum extraction (19.24%) while values of *Shorea robusta*, *Bombax ceiba* and *Bauhinia variegata* was found to be 12.09%, 11.12% and 8.58 % respectively.

The alcohol soluble extractive value of the *P.longifolia* was very close and water soluble extractive value was higher than to that of *S. indica* indicates that amongst all substitutes/adulterants of *S. indica* , the *P.longifolia* showed the maximum extraction of phytoconstituents which reflect that the *P.longifolia* could be chemically rich as compared to other substitutes/adulterants of *S. indica.*