

M. G. C. Book Bank

PHARMACOGNOSY OF AYURVEDIC DRUGS (KERALA)



2132

PUBLISHED BY
THE CENTRAL RESEARCH INSTITUTE,
UNIVERSITY OF TRAVANCORE
TRIVANDRUM

Series I

1957

Number 3

PRICE RS. 10

PHARMACOGNOSY OF AYURVEDIC DRUGS (KERALA)

BY

K. NARAYANA AIYAR M. A.

(JUNIOR PROFESSOR OF BOTANY, UNIVERSITY COLLEGE)

HONORARY SUPERVISING OFFICER

PHARMACOGNOSY SECTION

AND

A. N. NAMBOODIRI M. Sc. and M. KOLAMMAL M. Sc.

(RESEARCH ASSISTANTS)



PUBLISHED BY

THE CENTRAL RESEARCH INSTITUTE,
UNIVERSITY OF TRAVANCORE
TRIVANDRUM.

Series I

1957

Number 3

PRICE RS. 10

This work was carried out with the cooperation and collaboration of the undermentioned members of the Pharmacognosy Committee appointed by the University of Travancore. Ayurvedacharya Sri. K. N. Kesava Pillai, Retd. Lecturer, Ayurveda College, Trivandrum compiled the Ayurvedic notes.

Dr. A. Abraham
Professor of Botany, University College

Dr. P. P. Pillai
Professor of Applied Chemistry

Vaidyasastranipuna Gaveśaka Tilaka

Dr. L. A. Ravi Varma

Dr. R. Kesavan Nair
Director, Govt. Gardens

Sri. M. N. Kesava Pillai
Director of Indigenous Medicines

Sri. K. Narayana Iyer
Hony. Supervising Officer Pharmacognosy

Dr. C. C. John
Vice Chairman, Council of Research
Convener, Pharmacognosy Committee

2132

CONTENTS

PAGE

List of illustrations	iii
-----------------------	-----	-----	-----	-----

PHARMACOGNOSY

SIRISAḤ

Ayurvedic notes	...	...	1
Source plants			
<i>Albizzia marginata</i> Merr.	...	...	4
<i>Albizzia lebbeck</i> Benth	...	...	11
<i>Albizzia odoratissima</i> Benth	...	...	16

NIMBA

Ayurvedic notes	...	...	21
Source plants			
<i>Azadirachta indica</i> A. Juss.	...	...	25

KAIDARYA

Ayurvedic notes	...	...	32
Source plants			
<i>Murraya koenigii</i> Spreng	...	...	34
<i>Melia azedarach</i> Linn	...	...	39
<i>Melia composita</i> Willd	...	...	42

VACĀ

Ayurvedic notes	...	...	43
Source plants			
<i>Acorus calamus</i> Linn	...	...	46

SAPTAPARNAḤ

Ayurvedic notes	...	...	50
Source plants			
<i>Alstonia scholaris</i> R. Br.	...	...	52

LAKṢMAṆA

Ayurvedic notes	...	...	57
Source plants			
<i>Ipomaea sepiaria</i> Koenig	...	...	60
<i>Ipomaea obscura</i> Ker. Gaul.	...	...	63

LODHRAḤ

Ayurvedic notes	...	...	65
Source plants			
<i>Symploos spicata</i> Roxb	...	...	68
<i>Symplocos racemosa</i> Roxb	...	...	72
<i>Symplocos crataegoides</i> Ham :	...	...	74
<i>Desmodium pulchellum</i> Benth	...	...	75

ASVATTHAḤ

Ayurvedic notes	...	...	77
Source plants			
<i>Ficus religiosa</i> Linn.	...	...	79

VATAḤ

Ayurvedic notes	...	...	84
Source plants			
<i>Ficus bengalensis</i> Linn.	...	...	87

UDUMBARAḤ

Ayurvedic notes	...	...	93
Source plants			
<i>Ficus glomerata</i> Roxb.	...	...	95

PLAKSAḤ

Ayurvedic notes	...	...	100
Source plants			
<i>Ficus retusa</i> ...	...	...	102
<i>Ficus tjakela</i> ....	...	...	105

LIST OF ILLUSTRATIONS.

Facing page

Fruits & seeds : <i>Albizzia lebbeck</i> & <i>A. Marginata</i>	...	1
<i>Albizzia marginata</i>	...	4
<i>Albizzia marginata</i> (Histology of the officinal part)	...	10
<i>Albizzia stipulata</i> : <i>A. odoratissima</i> <i>A. lebbeck</i>	...	11
<i>Albizzia lebbeck</i>	...	12
<i>Albizzia lebbeck</i> (Histology of the officinal part)	...	15
<i>Albizzia odoratissima</i>	...	16
<i>Albizzia odoratissima</i> (Histology of the officinal part)	...	20
<i>Azadirachta indica</i> (<i>Melia azadirachta</i>)	...	25
<i>Azadirachta indica</i> —Stem Bark	...	28
<i>Melia azadirachta</i> (Histology of the officinal part)	...	31
<i>Murraya Koenigii</i>	...	34
<i>Murraya Koenigii</i> (Histology of the officinal part)	...	38
<i>Melia azedarach</i>	...	39
<i>Melia azedarach</i> (Histology of the officinal part)	...	41
<i>Acorus calamus</i>	...	46
<i>Acorus calamus</i> (officinal part)	...	48
<i>Acorus calamus</i> (Histology of the officinal part)	...	49
<i>Alstonia scholaris</i>	...	52
<i>Alstonia scholaris</i> (Histology of the officinal part)	...	56
<i>Ipomaea sepiaria</i>	...	60
<i>Ipomaea sepiaria</i> (Histology of the officinal part)	...	62
<i>Ipomaea obscura</i>	...	64
<i>Symplocos spicata</i>	...	68
<i>Symplocos spicata</i> (Histology of the officinal part)	...	71
<i>Ficus religiosa</i>	...	79
<i>Ficus religiosa</i> (Histology of the officinal part)	...	83
<i>Ficus bengalensis</i>	...	87
<i>Ficus bengalensis</i> . (Histology of the officinal part)	...	92
<i>Ficus Bengalensis</i> ; <i>F. religiosa</i> ; <i>F. tjakela</i> ; Stem barks	...	93
<i>Ficus glomerata</i>.	...	95
<i>Ficus glomerata</i>	...	97
<i>Ficus glomerata</i> . (Histology of the officinal part)	...	99
<i>Ficus retusa</i>	...	102
<i>Ficus retusa</i> (Histology of the officinal part)	...	104
<i>Ficus tjakela</i>	...	105
<i>Ficus tjakela</i> (Histology of the officinal part)	...	109

LIST OF ABBREVIATIONS

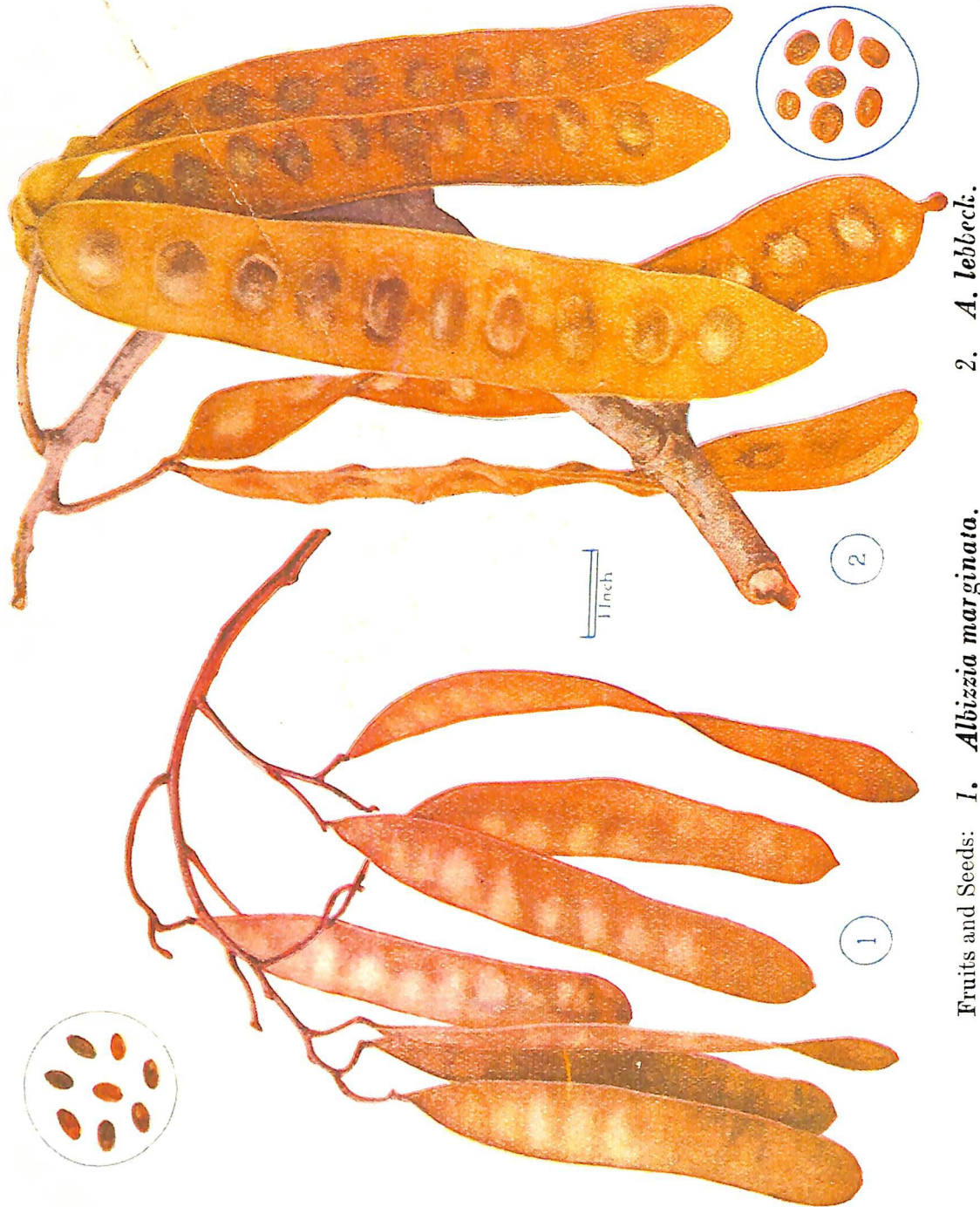
bt.	bast	pi.	pith
cam.	cambium	pn.	phellogen
ch. pl.	chloroplasts	rs. crl.	rosette crystal
ck.	cork	s.	starch
co.	cortex	sp.	space
crl.	crystal	scl.	sclerenchyma
crls. }	crystal	scl gp.	Sclerenchyma group
cy.	cavity	scr. cl.	secretory cell or secretory reservoir or cavity
en.	endodermis	st cl.	stone cell
ep.	epidermis	svt.	sieve tube
gl. t.	glandular hair or trichome	v.	vessel
it.	latex	v. b.	vascular bundle
itx. }		wd.	wood
mdr.	medullary ray	wf.	fibre
obl. ph.	obliterated (compressed phloem)	xp. or xy. par	xylem parenchyma
ph.	phloem	xy.	xylum

TABLE OF TRANSLITERATION

Sans.	Eng.	Sans.	Eng.	Sans.	Eng.
अ	A a	घ	GH gh	न	N n
आ	Ā ā	ङ	Ṇ ṇ	प	P p
इ	I i	च	C c	फ	PH ph
ई	Ī ī	छ	CH ch	ब	B b
उ	U u	ज	J j	भ	BH bh
ऊ	Ū ū	झ	JH jh	म	M m
ऋ	R r	ञ	Ñ ñ	य	Y y
ए	E e	ट	T t	र	R r
ओ	O o	ठ	Ṭ ṭh	ल	L l
ऐ	AI ai	ड	D d	व	V v
औ	AU au	ढ	DH dh	श	S s'
०	M m	न	N n	ष	S s
:	H h	त	T t	स	S s
क्	K k	थ	TH th	ह	H h
ख	KH kh	द्	D d		
ग	G g	ध	DH dh		

DRAVIDIAN SPECIALS

ॐ	Ū ū	ॐ	Ō ō	ॐ	R' r'
ॐ	É é	ॐ	T' t'	ॐ	N' n'
				ॐ	Z z



Fruits and Seeds: 1. *Albizzia marginata*. 2. *A. lebeck*.

SIRISAH

Source plant in Travancore-Cochin.*

Albizzia marginata Merr.
Mimosoideae.

Sanskrit Text.

Descriptive Synonyms.

“ शिरीषो भण्डिलो भण्डी भण्डीरश्च कपीतनः ।

शुकपुष्पः शुकतरुर्मृदुपुष्पः शुकप्रियः ॥ ”

(इति भावप्रकाशे)

“Siriṣo Bhaṇḍilo Bhaṇḍi Bhaṇḍiraśca Kapītanah
Sukapuṣpaḥ Sukatarurmṛdupuṣpaḥ S'ukapriyah ”

Bhāva Prakāś'a.

निर्दिश्यते शिरीषः शुकवृक्षः संसनीफलो भण्डी ।

मृदुपुष्पश्च शुकाहः कपीतनः श्यामवर्णश्च ॥

(अभिधानमञ्जरी)

Nirdisyate Siriṣaḥ S'ukavṛkṣaḥ Sramsani-phalo Bhaṇḍi |
Mṛdupuṣpaśca S'ukāhvaḥ Kapītanah Syāmavarṇaśca ||

(Abhidhānamañjarī).

नामानि —

शिरीषः शीतपुष्पश्च भण्डिको मृदुपुष्पकः ।

शुकोष्ठो बहिपुष्पश्च विषहन्ता सुपुष्पकः ॥

उद्दानकः शुकतरुर्ज्ञेयो लोमशपुष्पकः ।

कपीतनः कलिङ्गश्च श्यामलः शङ्खिनीफलः ॥

मधुपुष्पस्तथा वृत्तपुष्पः सप्तदशाह्वयः ।

(राजनिघण्टुः)

* *Albizzia marginata* Merr is used as the source of Sirisah in most parts of Travancore-Cochin probably because it is the most common *Albizzia* found in this region. Most books on Indian Materia Medica equate *Albizzia lebeck* Benth as the botanical source. *A. odoratissima* Benth *A. amara* Boir, and *A. procera* are also similarly considered or used as substitutes under various denominations as Kṛṣṇa Sīriṣ, Lāl Sīriṣ, Pita Sīriṣ etc.

S'irīṣaḥ S'itapuṣpaśca Bhaṇdiko Mṛdupuṣpakah |
 S'ukoṣṭho Barhipuṣpas'ca Viṣahantā Supuṣpakah ||
 Uddānakah S'ukatarurjñeyo Lomaśapuṣpakah |
 Kapitanah Kalingas'ca S'yamaḥ S'ankhinīphalah ||
 Madhupuṣpastathā Vṛttapuṣpah Saptadaśāhvayah |
 (Rājanighaṇṭu).

The synonym *S'ukapuṣpah* ie parrot flower or parrot like flower perhaps indicates the yellow-green colour of the flowers. *Bhaṇḍilāḥ* means auspicious (Bhaṇḍi Kalyāṇe). *S'irīṣaḥ* means that which bursts owing to tender nature (S'iryate va Saukumāryat).

Ayurvedic Properties and Uses.

शिरीषो मधुरोऽनुष्णस्तिक्तश्च तुवरो लघुः ।

दोषशोथविसर्पघ्नः कासत्रणविषापहः ॥

(इति भावप्रकाशे)

“S'irīṣo Madhuro ṣ nuṣṇstiktas'ca tuvaro laghuḥ
 Doṣa S'otha Visarpaghaṇaḥ Kāsavraṇa Viṣāpahāḥ ”
 Bhāva Prakāśa.

S'irīṣa is sweet, not hot, bitter, astringent and light. It cures vitiation of the Doṣās; oedema erysepalus and allied diseases, cough, wounds and ulcers as well as poison.

‘ शिरीषो विषघ्नानां

(अष्टाङ्गसंग्रहे)

‘S'irīṣo Viṣaghnaṇām’

(Aṣṭāṅga Sangrahaḥ).

In Aṣṭāṅga samgraha *S'irīṣa* is mentioned as the best remedy against poison. Caraka has included this under the group of drugs overcoming poisons and *Susruta* in the group of anti toxins other verses regarding properties and uses:—

‘ हरिद्रा मञ्जिष्ठा सुवहा सूक्ष्मैला पालिन्दी चन्दन कतक शिरीष -
 सिन्दुवार लेप्मातका इति दशेमानि विषघ्नानि भवन्ति ’
 (चरके)

‘Haridrā Mañjiṣṭhā Suvahā Sūkṣmailā Pālindi Candana Kataka S'irīṣa
 Sinduvāra S'leşmātaka iti Dasemāni Viṣaghnaṇi Bhavanti’
 (Carakaḥ).

समूलपुष्पाङ्गुरवल्कवीजात् काथः शिरीषात्किटु प्रगाढः ।

सलावणः क्षौद्रयुतोऽथ पीतो विशेषतः कीटविषं निहन्ति ॥

(सुश्रुते)

Samūlapuṣpāṅkuravalkabijāt Kvāthaḥ S'irisattrikaṭu Pragāṭhaḥ |
 Salāvṇaḥ Kṣaudrayuto ṣtha Pīto Viśeṣataḥ Kīṭaviṣam Nihanti ||
 (Susrutaḥ).

“ उष्णः शिरीषो विषहा कषायः कफवातहा ”

(हृदयप्रिये)

Uṣṇaḥ S'irīṣo Viṣahā Kaṣāyaḥ Kaphavātaḥ |
 (Hṛdayapriyā).

सन्धाने कृमिजा विषे शुक्तरुमेदोऽनिले गुल्गुलुः ।

(इति वाम्बटः)

Sandhāne Kṛmijā Viṣe S'ukatarurmedonile Gulguluḥ |
 (Vagbhataḥ).

अन्यच्च

गुणाः— शिरीषः कटुकः शीतो विषवातहरः परः ।

पामासृक्कुष्ठकण्डूतित्वग्दोषस्य विनाशनः ।

(राजनिघण्टु)

S'irīṣaḥ Kaṭukaḥ S'ito Viṣavātaḥarah Parah |
 Pāmāsṛkkuṣṭha Kaṇḍūti Tvagdoṣasya Vināśanaḥ |

(Rājanighaṇṭu).

Albizzia marginata Merr.(Syn. *Albizzia stipulata* Boiv).

(Mimosoideae)

Malayālam	Nenmenivāka, Pottavāga, Nenmenivāha, Jalavāha
Tamil	Pulivākai, Chilavākai, Silaivāgai.
Hindi	Siran.

Distribution and Habitat.

Albizzia marginata has been recorded as occurring in the sub-Himalayan tract and Himalayan valleys up to 4000 feet, Bengal, Assam and in South India, mainly from the hill forests of Northern Circars and Deccan up to about 3000 feet. It is also found in the lower open deciduous forests of the Western ghats and in most places of Travancore-Cochin, where the annual rainfall is not less than 30 inches. It grows under mesophytic conditions in moist localities.

Habit and general features.

Albizzia marginata Merr. is a fast-growing fairly tall or lofty, large sized, unarmed semi-deciduous tree with a straight trunk attaining a height of 80 feet and diameter of 2-3 feet or more, covered with greyish to dark grey bark, and a broad flat but thin crown bearing large conspicuously stipulate bipinnate 'feathery' leaves with numerous small falcate leaflets and bunches of fragrant yellowish white flowers. The tender shoots and branches are covered with fine golden yellow to rusty grey pubescence.

The plant is in flower from January to April (from the beginning to about the middle of the hot season). Flowering is generally accompanied, or immediately followed by the appearance of fresh foliage.

External morphology

Leaves: large, alternate, evenly bipinnate and stipulate. *Stipules* which are quite characteristic are fairly large, brownish or rusty brown, membranous, pubescent or downy unequally cordate or semi-



cordate at base, acute or acuminate and early deciduous. *Rachis*: eight to twelve inches long, rusty pubescent in young, but glabrous in older leaves, having one prominent gland about one inch from its pulvinate base and smaller glands between most of the upper pairs of pinnae. *Pinnae* six to fifteen or more pairs. Each pinna two to five inches in length and bears twenty to thirty or more pairs of leaflets. *Leaflets* small, sessile, half to less than three quarters of an inch long and about a tenth of an inch broad, the midrib close to the upper edge, falcate to linear oblong, semi-truncate or obliquely rounded on lower side at base, acute or pointed at apex, ciliate at the margin, membranous, and pale green and glabrous on the upper surface.

Flowers bracteate, nearly sessile, small, the open flowers about two thirds to one inch long up to the tip of the filaments, cream or light yellow, but appear pinkish due to colour of filaments, feebly scented or inodorous and arranged in small lax, five to ten flowered distinctly peduncled heads aggregated in axillary fascicles or in copious axillary or terminal compound racemes. The main peduncle is slender, erect and three quarters to one and a half inches long. The *peduncle* and its branches are densely pubescent. *Bracts* deciduous, small, ovate acuminate, membranous. *Calyx* about one eighth of an inch long, funnel-shaped, minutely five-toothed, cream or light yellow and pubescent. *Petals* five, connate to form a yellowish white densely pubescent funnel-shaped corolla nearly twice as long as the calyx, cleft nearly to midway down into five lanceolate acute lobes. *Stamens*: many; *filaments* slender, united at base, erect, long-exserted, four to six times as long as corolla, whitish below, pinkish above; *anthers* very small and not grand crested. *Ovary* superior, one chambered with many ovules.

Fruit: a large, straight, thin, strap-shaped, glabrous, subsessile pendent indehiscent legume, four to seven inches long, three quarters to one inch broad, unthickened at the sutures with a continuous cavity and containing eight to twelve seeds. *Seeds* nonendospermic, smooth, dark brown, about one fourth inch long, narrowly ovate to elliptical, much compressed, flat, and attached by filiform funicles. The fruits have an attractive dark violet tint when young but turn light brown on ripening.

Official parts

Root—, and stem-bark, leaf, seed and oil from seeds.

Description of stem bark.

The barks from small twigs and young branches are dark slate green in colour, with the surface smooth but studded with several transversely extended lenticels each nearly a quarter inch long. As the barks grow old more lenticels are developed which appear as thin transverse brownish ridges up to half inch in length. Numerous short vertical fissures are also formed on the surface, and the dark slate green becomes mottled with irregular variegated patches of lichens. In still older barks the lichen patches become larger and more conspicuous, almost masking the original colour. By now the lenticels appear as prominent brownish, elliptic eruptions about one tenth inch wide and one fourth inch long, arranged in close transverse and vertical rows.

In the younger branches the entire bark is less than a tenth of an inch in thickness. The rind is very thin and brittle. Its removal exposes a thin greenish tissue about 0.5 mm in thickness. The rest of the bark has a leathery texture and a cream white colour. The young bark has a mucilaginous sweetish taste at first but soon an acrid and astringent taste becomes pronounced.

Owing to the continued development of several lenticels and their eruptions the bark of the older branches and trunk become somewhat rough and cracked. In these, the surface is so much covered with several crustose lichen patches that the basic dark slate-grey colour becomes superimposed with irregular blotches of ash grey, greyish brown, brown, deep brown and black according to the species of lichen and the form and colour of its apothecia. The eruptive openings of the lenticels exposing their thickened brownish yellow corky flanges appear amidst these patches in transverse and longitudinal rows.

The thickness of the entire bark is about a tenth of an inch to half an inch or more in proportion to the age and thickness of the stem or branch. The outer bark or rind is easily separated from the inner tissues. It is comparatively thin and consists of a

crustaceous outer part and a slightly thicker and more compact inner portion which is bright yellowish brown externally and smooth and black on the inner surface. The officinal part of the bark viz. the portion below the rind, comprises nearly three fourths the thickness of the entire bark, and in the fresh condition is easily cut. Its peripheral part has a light reddish, reddish brown or in some cases even a deep blood red colour mottled with numerous white dots. The colour gradually fades towards the deeper portions. The middle region appears lighter and the portion nearest the wood is whitish and lamellated. In transverse section the rind is about a millimeter in thickness, its outer part appears as a dark brown streak and the inner part which is slightly wavy is of a lighter colour. Of the officinal part of the bark the outer region is very gritty or granular and the inner region mucilaginous and fibrous. On drying, the entire bark takes on a uniform dull purplish tint. The officinal part of the bark is extremely astringent and somewhat bitter.

Histology of stem bark

Young bark: The *cork zone* or *phellem* is fairly prominent and composed of several rows of comparatively thick walled tangentially elongate, narrow, rectangular cells four to five times as long as broad. The cells of the outer rows are filled with a reddish or reddish brown material which gives a distinct colour to that region. Fragments of collapsed and compressed rows of cells with deep purple or bluish purple tint are also found towards the periphery. The *phellogen* is distinct and is followed by a few rows of recently formed *phelloderm* and somewhat radially elongate thin walled cells containing chloroplasts.

The *cortex* is broad and composed of thin walled cells of varying sizes and shapes, those towards the outside being generally smaller. In the peripheral part of the cortex there is a scattered array of several groups of sclereids, the number of cells in a group varying from two to twenty or more. The sclereids are mostly oblong rectangular or polygonal and have thick pitted walls. Several cells of this region as well as some of those adjoining the groups of sclereids contain rectangular prismatic crystals. A distinct but irregular and discontinuous annular band of mechanical tissue composed of three to six or more rows of large sclereids or stone

cells is found in the cortex. A limited number of fairly big groups of sclerenchyma occur within and occasionally outside the band of stone cells. These cells are much smaller than the stone cells and have very thick but not pitted walls.

The inner bark or *bast* proper is a very broad zone and is composed of the regular phloem elements, medullary rays, tangential segments of sclerenchyma and occasional groups of stone cells. In the older (peripheral) portions of the bast a large number of closely spaced tangential strips of collapsed bast elements arranged in irregular annular bands, several spherical to tangentially elongate groups of sclerenchyma composed of small cells and a limited number of groups of stone cells can be distinguished. Only the more recently formed inner rows of bast elements show regular form and arrangement. Traversing radially across the bark there are several narrow uni-or biseriate medullary rays, which appear very flexuose towards the periphery. Most of the phloem parenchyma and the cells of the medullary rays are packed with starch grains. A distinct cambium can be made out just within the bast.

Older barks.

In the older barks the rind is fairly thick and composed of several rows of regular cork-cells (phellem), strips of collapsed bast elements, and sclereid groups, indicating the formation of successive layers of phellogen in the deeper parts of the bark. The cork cells are very narrow and tangentially elongate: those of the outer rows are thick-walled and contain reddish brown material as in the case of young barks. The secondary cortex is prominent; its characteristic feature is the presence of several large diversely oriented irregular groups of large sclereids two to five or more rows thick. Such groups are more prominent towards the periphery, but less conspicuous and sparse towards the deeper part, where they form only small groups of two to four cells. Cells containing prismatic crystals are found in the peripheral portions of this region also. The bast consists of the usual thin walled elements of phloem and short narrow tangential strips of sclerenchyma. The sclerenchymatous groups are narrow being formed mostly of one or two rows. Collapsed thin walled elements in irregular oblique strips are found throughout the bast except in the most recently formed portions. The medullary rays are narrow,

mostly biseriate or very rarely uni-or triseriate. They appear very flexuose or wavy and often traverse the bast obliquely due probably to radial compression. Some of the primary rays widen towards their distal ends and in these wedge-shaped distal portions the cells are loaded with small starch grains.

Distinguishing features.

A. Morphological

1. The bark is greyish to dark grey in colour, but often mottled due to the presence of lichen patches of various shades and the surface appears rough owing to the occurrence of shallow vertical fissures and several prominent lenticels.

2. The rind or outer bark is comparatively thin and is formed of an outer easily separable crustaceous layer, and a greyish to brownish yellow inner region, the inner surface of which is smooth and black in colour.

3. In the fresh condition the officinal part which comprises the portion of the bark beneath the rind is of a rose to deep red colour towards the periphery, but nearest the wood it is almost colourless and appears lamellated: the outer part is granular or gritty and the inner or deeper portion fibrous. On drying, the entire bark takes on a dull purplish tint.

B. Anatomical

1. The cork zone consists of several rows of fairly thick walled cells of which the peripheral rows have reddish or reddish brown contents. The surface rows of cells are compressed and collapsed and exfoliate in thin purplish strips.

2. The nature of the lenticels — The complimentary tissue of the lenticels is formed of vertical rows of slightly thick-walled typically oblong, radially elongate cells.

3. Several groups of large sized sclereids and cells containing prismatic, cubical or rectangular crystals are found in the cortex, especially towards the periphery.

4. A distinct, composite annular band of sclereids three to six or more rows in thickness, occasionally with adjacent big groups of sclerenchyma is present outside the bast.

5. The bast is a fairly broad zone with small tangential strips of sclerenchyma throughout. Conspicuous strips of collapsed bast elements occur in the older regions.

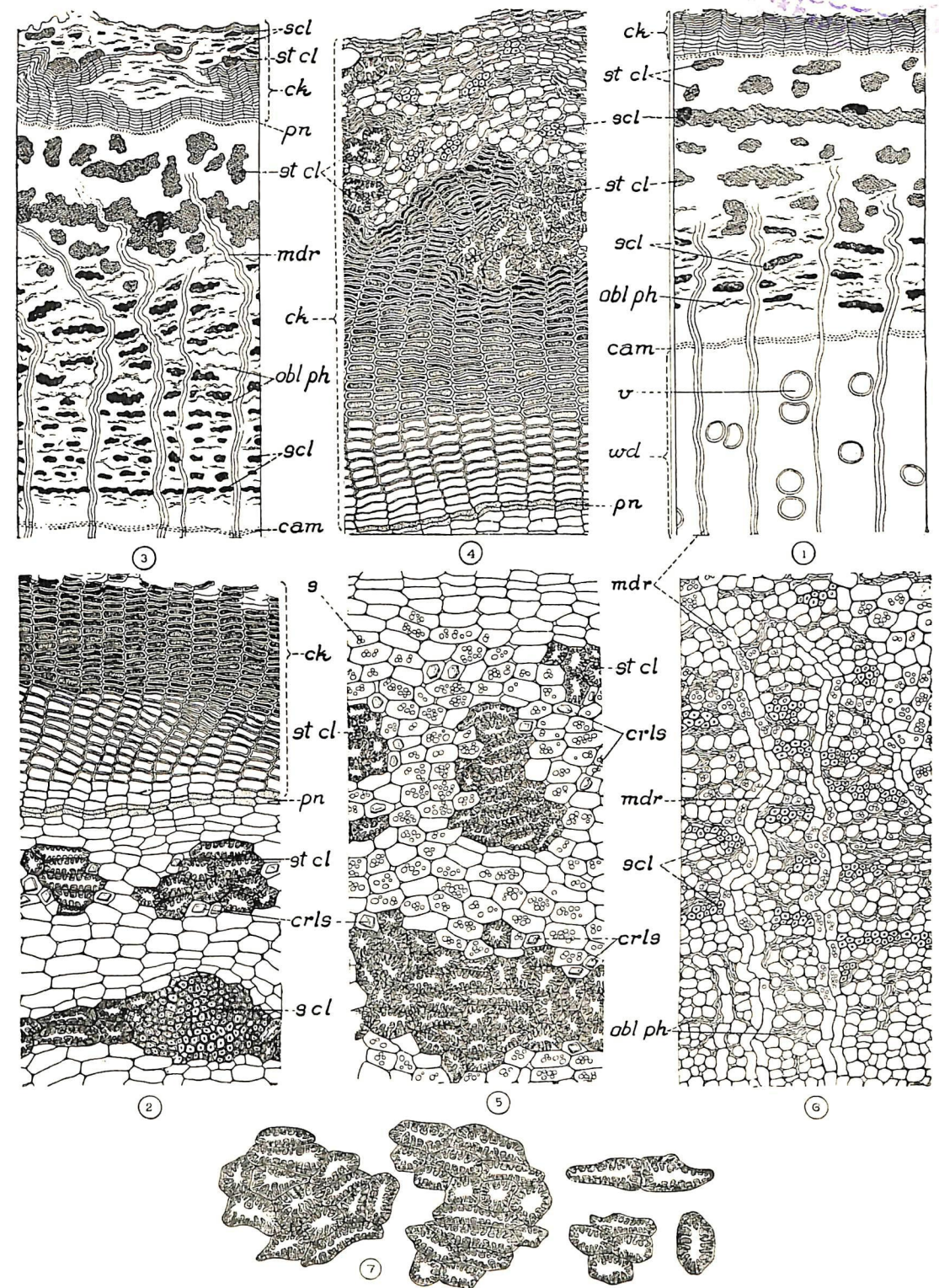
C. Taste and odour

The entire officinal part is slightly bitter and intensely astringent almost approaching acidity.

Albizia marginata

Histology of stem bark

- Fig. 1. Diagrammatic sketch of a segment of the T. S. of young bark
 2. Structure of the cork, phellogen and middle bark
 3. Diagrammatic sketch of a segment of the T. S. of an old bark
 4. Detailed structure of the cork zone
 5. Structure of the middle bark
 6. Structure of the bast region
 7. Stone cells slightly enlarged.



Albizia marginata

Histology of stem bark



1



2



3

Stem barks; 1. *Albizzia stipulata*. 2. *Albizzia odoratissima*. 3. *Albizzia lebbeck*.

Albizzia lebbeck Benth.*

Mimosoideae.

Malayālam	Malantakara, Kāttuvāka
Tamil	Vākai, Kāttuvākai, Peruvākai
Hindi	Siriṣ

Distribution and habitat.

Fairly common throughout India from sea level to about 4000 feet. It is recorded as occurring in "Tropical Himalayas" the Central Provinces, Khasia, Bombay, Konkan, South-Carnatic and drier parts of Travancore-Cochin. All soils seem to suit its growth. In South India it is very common in the plains and deciduous forests at low elevations. It is often cultivated as a shade tree, along road sides, by the side of irrigation wells, and tanks.

Habit and general features.

Albizzia lebbeck Benth. is moderate sized to large, unarmed tree, deciduous during the cold season, growing to about sixty feet in height. Trunk is comparatively short, about two to three feet in diameter with an extensive but rather thin crown. The stem and branches are covered with deeply irregularly cracked dark grey to brownish bark and bear evenly bipinnate leaves having fairly large obliquely oblong leaflets, globose heads of whitish or yellowish-white sessile flowers and characteristic straw-coloured strap-shaped pendulous pods.

The plant flowers in the hot season, usually March, April and May and fruits are formed from September onwards but usually persist on the tree even up to next March.

External morphology.

Leaves: about nine inches long, alternate, stipulate, evenly bipinnate; *stipules* are small and fall off early; main *rachis* round,

* *Albizzia lebbeck* is the plant equated as the source of Siriṣ in most books on Indian Materia Medica. In Travancore-Cochin it is found in the taluks of Thovala, Agasteeswaram, Shenkottah and some other dry places, but does not seem to be used as Siriṣah especially in places where *A. marginata* is available.

grooved on the upper side, tapering, glabrous or slightly pubescent, with a large gland about 2 mm. in diameter, one third to half an inch above its base, and a gland between the lowest or basal pair of pinnae; small glands also present near the base of the partial petioles and between the leaflets, but their presence and number is not always certain; *pinnae* two to four pairs, even-pinnate; *leaflets* four to eight pairs, opposite, short-stalked, one to two inches long and half to three quarters of an inch broad, rigidly subcoriaceous, entire, broadly obliquely oblong, broader on the lower side of the midrib, slightly curved upwards, rounded at base, obtuse retuse or emarginate at apex, paler, glabrous or finely grey pubescent beneath, with a prominent midrib and nearly equally prominent secondary nerves. The terminal leaflets semicordate.

The *inflorescences* arise from the axils of the upper most leaves and are short-peduncled, crowded, corymbose fascicles of a few or limited number of fairly large, many-flowered globose heads; peduncles slightly downy.

Flowers sessile or short pedicelled, all bisexual, pentamerous, regular, whitish or yellowish white and very fragrant; *calyx* about 0.125 inch long, slightly downy outside; *petals* five, greenish yellow or yellowish white, connate below the middle to form a funnel-shaped corolla with short lanceolate teeth; *stamens* indefinite; *filaments* long several times the length of the corolla, united at base and bearing comparatively very small anthers which are not gland-crested. *Ovary* sessile or very short stalked and many ovuled with filiform style ending in a minute stigma.

Fruit very characteristic of the species. It is a large straight or slightly curved, thin but firm, flat strap-shaped linear oblong, straw-coloured to yellowish brown, shiny, indehiscent or sub-indehiscent pod, six inches to one foot long and three quarters to one and a half inches broad, with a continuous cavity and enclosing six to twelve seeds. The fruits remain attached to the tree for a long time, often for more than an year. *Seeds* nonendospermic, yellowish brown, about a quarter to one third inch long, ovate or orbicular, flat, with a horse shoe-shaped compression near the margin; *testa* very hard; *funicles* slender and filiform.

Albizia lebbeck Benth.



Official parts The root and stem barks, leaf, seed and oil from seeds.

Description of stem bark

The bark is appreciably thick and rough, dark brown to greyish black with vertical and transverse deep fissures. The rind or outer bark often comprises nearly a third or more of the thickness of the entire bark, and shows a very characteristic structure. On the trunks and older branches the bark has a composite structure composed of discontinuous alternating strata of 'woody' and suberous layers. The 'woody' portion which is usually external is hard, thick, compressed, deeply fissured and easily separable or detaching in irregular pieces. The corky portion is generally thick yellowish brown with an occasional tint of light rose, soft, easily friable and composed of numerous, dry very thin or papyraceous layers. The middle and inner barks which comprise the officinal tissue is nearly two thirds the thickness of the entire bark. Its outer part has a characteristic reddish brown tinge, which often extends inwards nearly two thirds of the thickness of the living bark. The middle bark though gritty is soft, easily cut, somewhat juicy and appears faintly lamellated on account of the presence of a large number of dark reddish brown specks or streaks. The inner bark is comparatively thin and fibrous in texture. In the fresh condition it is whitish, but often, especially on drying, the portion turns reddish, so that the entire officinal part now assumes a uniform reddish or reddish brown colour. The living bark has a very astringent somewhat acrid and acidulous taste.

Histology

The outer bark or *rind* in the case of older barks is made up of alternate layers of hard 'woody' and suberous tissues. The hard 'woody' layers are composed of groups of stone cells and collapsed and compressed elements of secondary cortex. They occur in the form of close discontinuous tangential strips. The suberous layers are broad and consist of several easily separable rows of thin-walled rectangular cells some of which are empty while others are filled with yellowish to brown contents. In transverse sections the tangential strips of 'woody' tissues appear as narrow irregular islands amidst rows of cork cells. A distinct phellogen can be distinguished inner to the cork cells.

The *secondary cortex* or midbark which is situated immediately beneath the rind is composed of large thin walled oblong cells. Most of them are loaded with starch grains, while a number of others contain solitary prismatic crystals or yellowish brown contents, which give the tissue its characteristic reddish or reddish purple colour. In this region there are numerous scattered groups of sclereids or stone cells of various sizes and shapes. The stone cells comprising the groups are large, mostly oblong or spherical and very thick-walled. In most sections in addition to the scattered groups there is also a more or less continuous annular band of stone cells three to five or more rows wide.

The *bast* or inner bark is a fairly broad zone composed of thin-walled phloem alternating with tangential strips of sclerenchyma and medullary rays. The medullary rays are mostly biseriate while uni- and triseriate rays also occur. The cells of the medullary rays are thin-walled and devoid of starch grains. The sclerenchyma groups are two to five rows broad and six to twelve rows long. Tangential strips of collapsed phloem occur throughout the older regions.

Diagnostic features.

A. Morphological.

1. Entire bark thick, dark brown to greyish black, covered with patches of lichens, deeply fissured and rough.

2. Rind or outer bark is composed of hard 'woody' exfoliating portions and several layers of yellowish brown to grey or occasionally rose tinted, corky, very soft, easily friable inner tissue.

3. The officinal part of the bark in the fresh condition has a characteristic reddish or reddish brown colour which is of a deeper tinge in the periphery, while the inner most portion adjoining the wood is colourless. The outer part is soft and juicy though gritty, and appears faintly and irregularly lamellated while the inner portion is fibrous. On drying, the entire bark turns reddish and tough.

B. Anatomical.

1. The cork zone consists of numerous rows of rectangular thick-walled cells, which get easily separated from one another



leaving behind strips of dead 'woody' portions of secondary cortex, stone cells etc.

2. The middle bark or secondary cortex is a fairly broad zone, the cells of which contain starch grains, rhomboidal crystals or reddish brown contents as the case may be. In transverse section the entire area appears thickly or densely scattered with sclereid groups of various sizes and shapes. In addition an almost continuous annular strip of stone cells is also present.

3. The bast or inner bark is also thick and shows in addition to the usual thin-walled phloem elements, small tangential strips of sclerenchyma. Collapsed elements of phloem are found in the older regions.

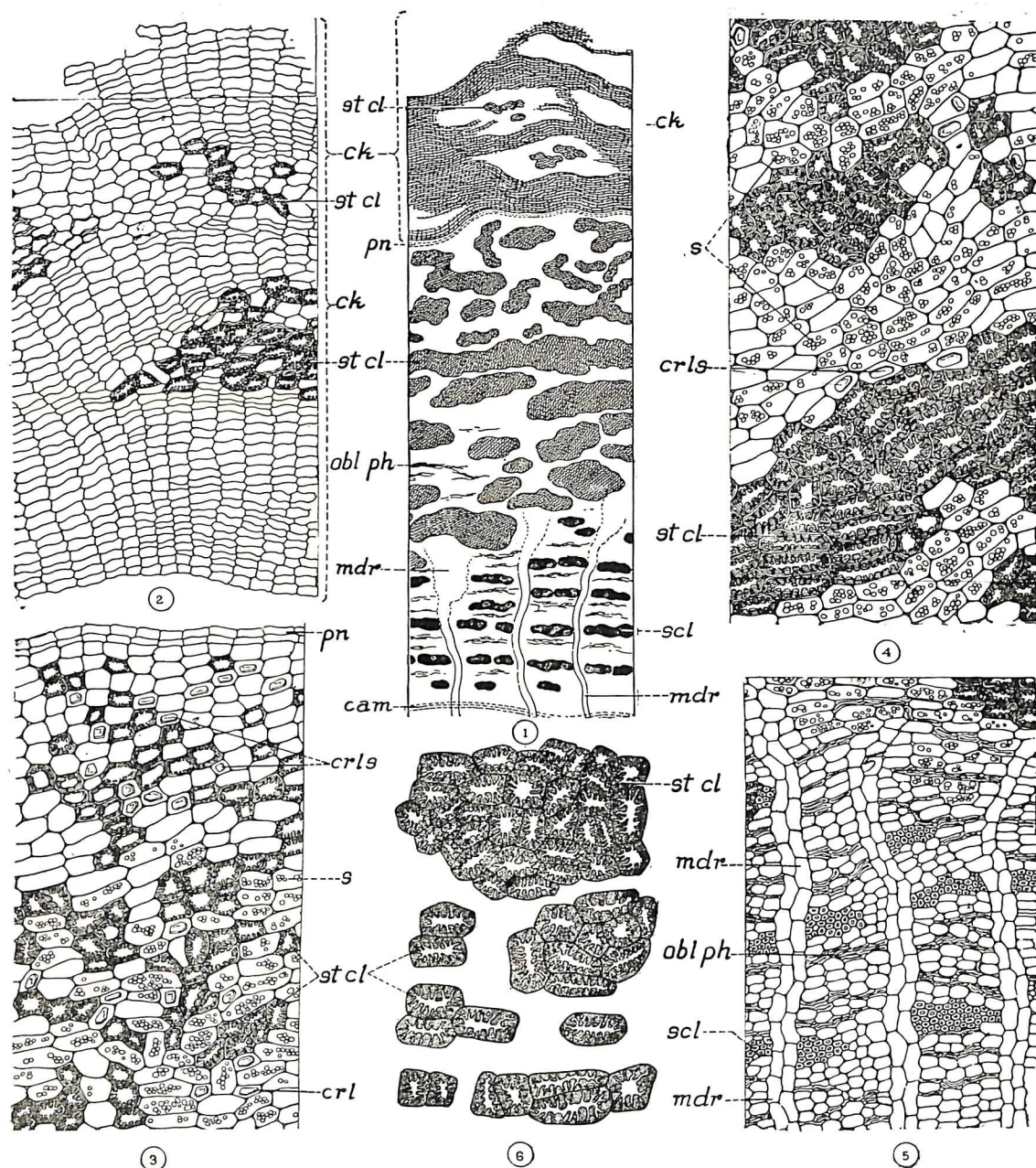
C. Taste and odour.

The entire living bark has an astringent acidulous taste.

Albizia lebbeck

Histology of stem bark

- Fig. 1. Diagrammatic sketch of a segment of the T. S. of old bark showing the disposition of various tissues.
2. Structure of the cork zone.
 3. Phellogen and secondary cortex.
 4. Structure of middle bark.
 5. Bast region.
 6. Groups of stone cells.



Albizia lebbeck

Histology of stem bark

Albizzia odoratissima* Benth.(Syn. *Mimosa odoratissima* Roxb.)

Mimosoideae

Malayalam	Pulivāha, Nellivāha
Tamil	Cittilavakai, Karuvakai
Hindi	Bansa, <u>Siris</u>
Engllsh	Black siris.

Distribution and Habitat

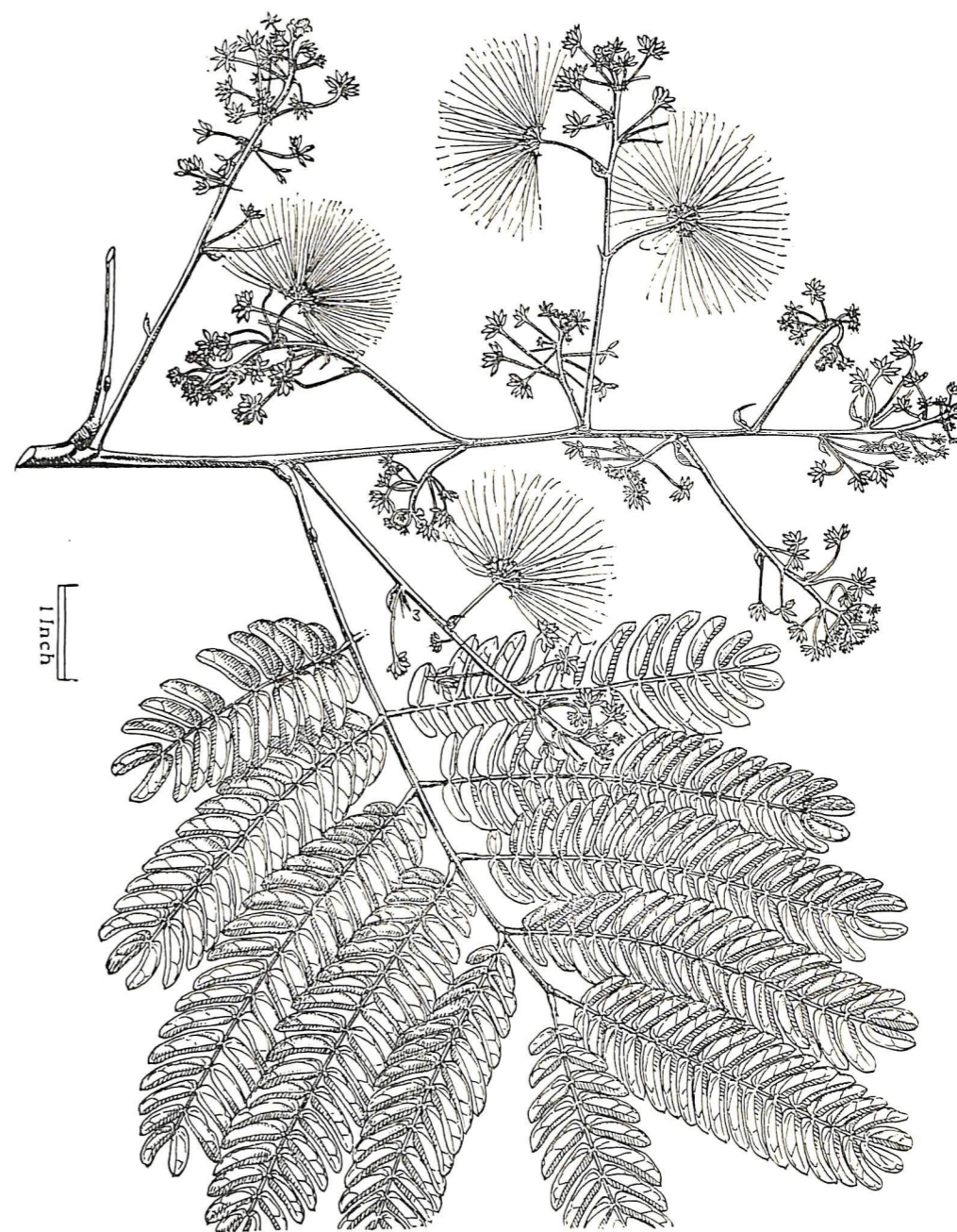
Throughout India from the Himalayas to Ceylon, but more common in the east coast of peninsular India, the Konkan, Western ghats, Nilgiris and Travancore-Cochin; grows in most soil conditions and is abundant in open deciduous and semi-deciduous forests, grasslands and hill slopes.

Habit and general features

Albizzia odoratissima Benth. is a large unarmed semi-evergreen tree reaching a height of about sixty feet, with a graceful spreading and drooping crown of dark green foliage. The trunk and older branches are covered with exfoliating dark grey to greyish black bark, encrusted with patches of lichens. The younger branches are dark coloured, pubescent and bear large bipinnately compound leaves with broadly oblong, very unequal sided leaflets on three to eight pairs of pinnae, small globular few flowered heads of fragrant pale yellow or whitish flowers, and flat broadly linear short-stalked glabrous brownish flexible pods. The tree grows rapidly and is very valuable for its timber.

External morphology.

Leaves: alternate, stipulate, evenly bipinnate with usually four or occasionally three to eight pairs of rather distantly placed pinnae, each nearly four inches long; *Stipules* very small, fugaceous; main *rachis* four to eight inches long and finely downy with a gland on the upper side near its basal part and often with similar glands at the bases of

Albizzia odoratissima Benth.

* *Albizzia odoratissima* Benth. is another tree equated as Sirisāh (Kirtikar & Basu's Indian Medicinal plants. Vol ii p. 939)

the first two pairs of pinnae. Each pinna has eight to twenty pairs of sessile leaflets articulated to the rachis. *Leaflets* about three quarters of an inch long and one third to half an inch broad, unequal sided being broadest on the lower side of the midrib, obliquely oblong, curved upwards, rounded or semicordate at base, obtuse or rounded at apex, or rarely apiculate, rigidly subcoriaceous, dark green and glabrous or slightly pubescent above, glaucous and pubescent beneath, with the midrib almost parallel to and nearer the upper edge, and prominent lateral veins.

Flowers: small, sessile, sweet-scented, whitish or pale yellow, bisexual and slightly pubescent, in small globose five to ten or more flowered heads, less than an inch across, arranged in large sized peduncled, corymbiform spreading panicles, arising from the tips of branches or from the upper leaf axils. *Calyx* sessile, minute, 0.05 inch long, campanulate, glabrous or slightly pubescent and indistinctly five-toothed or lobed. *Corolla* funnel-shaped, whitish to greyish, silky, nearly one sixth of an inch long, with ovate lanceolate lobes. *Stamens* many, filaments about twice as long as corolla, connate at base and exserted; *anthers* very small.

Official parts. Root and stem barks, leaves, flowers and seeds.

Stem bark: the fresh bark of young twigs is dark greenish brown in colour and nearly smooth except for the presence of several minute transverse lenticels each about a millimeter in length and half as broad. The entire bark is less than one tenth of an inch thickness and appears greenish in transverse section.

Bark of slender branches (two to three inches in diameter) is about a quarter of an inch thick. Its surface is somewhat rough (but not warty, fissured or cracked) and is covered with variously coloured patches of crustose lichens which almost completely mask the basic colour of the bark.

The barks from the trunk and older branches vary from half to one inch in thickness. The surface has a dark brown colour and appears quite uneven and rough with deep irregular vertical and transverse cracks confined to the outer bark. Surface is encrusted with patches of lichens. The outer bark or rind varies from one third to nearly three quarters of an inch or more in thickness and exhibits

a composite structure of irregularly alternating discontinuous strata of hard and suberous tissues. The hard tissue is unevenly thick and occasionally forms nearly three fourths of the entire thickness of the rind. It has a firm hard woody texture, appears dark brown to nearly black in transverse section and is easily separated from the inner adjoining strata of suberous tissue. Due to the formation of fissures the outer rind frequently flakes off as thick irregular woody pieces exposing greenish grey or cream coloured smooth shallow concavities of suberous tissue. The suberous part of the rind is softer and very often less than one tenth of an inch in thickness which in transverse section appears as an irregularly wavy, annular, greyish white strip. The officinal part comprising the middle and inner barks occupies about two thirds the thickness of the entire bark. The middle bark is reddish and has a homogeneous gritty or minutely granular structure. The inner bark is fibrous, faintly stratified or lamellated and of a lighter colour. The portion adjoining the wood appears whitish and can be peeled off in thin layers. The light red colour of the fresh bark gradually fades in storage. The bark has a highly astringent almost acrid taste, but is devoid of any characteristic smell.

Histology.

The 'woody' part of the rind is composed of dead elements of secondary cortex and aggregates of stone cells. The dead cortical cells are compressed between groups of stone cells, and are filled with a reddish or reddish brown substance. The cork tissue is formed of ten to twenty or more rows of regular, thin-walled rectangular cells, beneath which is the cork cambium. The formation of successive zones of phellogen or cork cambium within the cortex can also be made out. The secondary cortex has a limited number of rows of regular phelloderm cells towards its periphery. Several groups of stone cells of varying sizes and shapes are thickly scattered throughout the cortex. The stone cells in each group are more or less regular in shape and arrangement. In some barks the stone cells constitute more than eighty percent of the bulk, the entire tissue appearing as if made up of stone cell groups only. The cortical cells are filled with a reddish substance and some of them appear shrunken and distorted. The inner bark or bast is composed of narrow tangential segments of sclerenchyma two to four rows wide, alternating with thin-walled phloem elements. The sclerenchyma cells are smaller than the stone cells, but they are very

thick-walled. The older portions of bast show tangential strips of collapsed elements. Several of the parenchyma cells of the cortex and phloem contain starch grains. The medullary rays, the cells of which are loaded with starch grains are two to five seriate and run straight throughout the greater part of their length.

Distinguishing features.

A. Morphological

1. The bark is dark brown, often lichen encrusted and deeply cracked both transversely and longitudinally.
2. The rind or outer bark is appreciably thick and is a composite structure in old barks. Its outer part is very thick and 'woody' and flakes off in slices of irregular size and form. The inner part of the rind viz. the corky region is narrow compact and greyish yellow to ash white.
3. The living or officinal bark has a homogeneous bright reddish to reddish brown colour except in the portion nearest the wood. Its outer part – the middle bark is reddish purple and densely minutely granular; the inner part (bast) is lighter coloured or nearly whitish, fibrous, appears stratified and can be peeled off in thin layers.

B. Anatomical

1. The hard 'woody' part of the rind in old barks is composed of dead often compressed elements of secondary cortex and aggregates of stone cells. These alternate with zones of regular cork tissue composed of several rows of thin-walled rectangular cells.
2. The secondary cortex is appreciably thick and consists of thin-walled cortical cells and a very large percentage of densely disposed aggregates of stone cells.
3. The bast is composed of segments of thin-walled phloem and tangential strips of sclerenchyma.
4. Medullary rays are two to five seriate.
5. Parenchyma cells of the cortex and the bast as well as the cells of the medullary rays contain starch grains in plenty.

C. Taste and odour.

The bark has a highly astringent taste verging on acidity.

Albizzia odoratissima

Histology of stem bark

- Fig. 1. Diagrammatic sketch of a segment of the T. S.
 2. Structure of the cork and rhytidome.
 3. Secondary cortex with stone cells.
 4. Structure of the bast.
 5. A few stone cells.

Comparison of the barks of *Albizzia lebbeck* *A. odoratissima* and *A. stipulata*

The main points of difference are in the nature and colour of the outer surface; comparative thickness and differential nature of the outer and inner zones of the rind, the colour, texture, and homogeneity or otherwise of the officinal tissue; and the degree of astringency.

A. lebbeck.

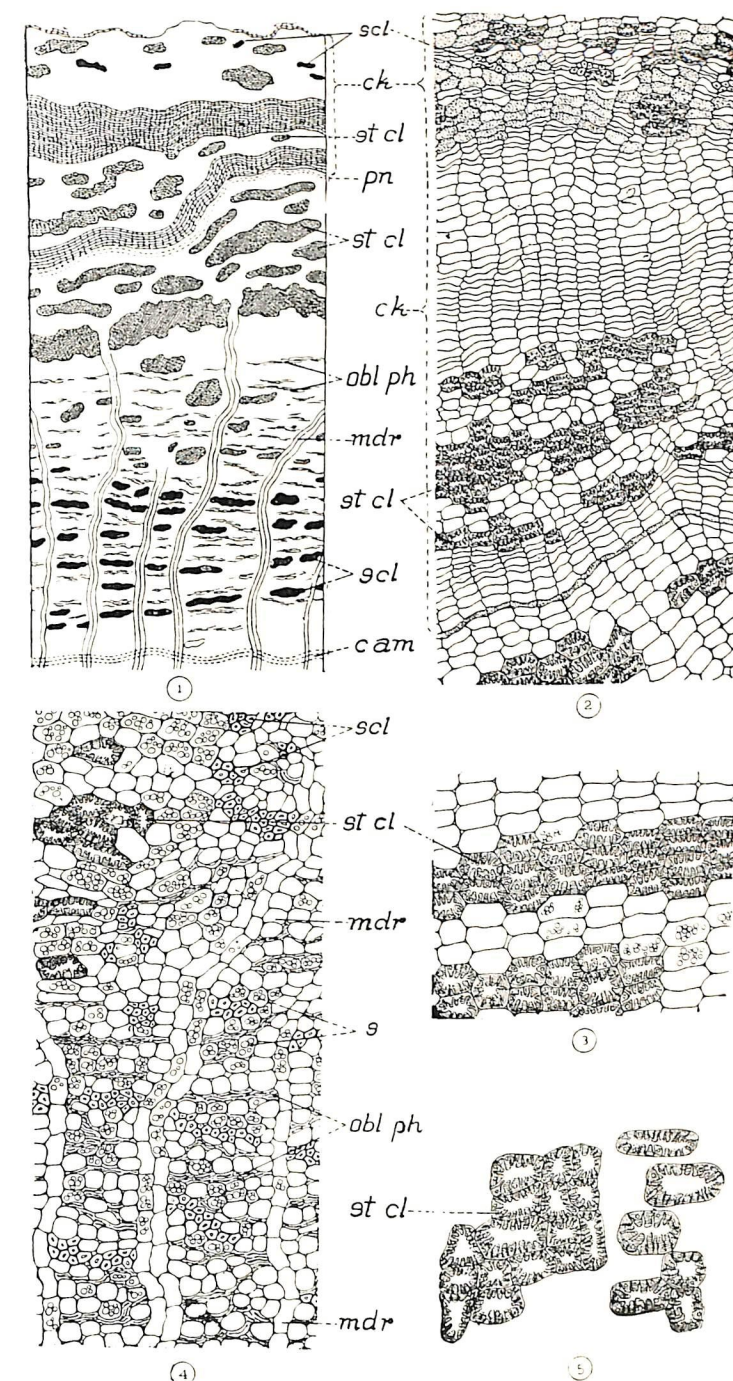
A comparatively thick friable many-layered orange yellow coloured inner rind is present. The officinal part of the bark is thick and has a greyish brown colour which is not easily soluble in water with its inner region - that nearest the wood-whitish. Taste is astringent.

A. odoratissima.

The inner rind is comparatively thinner, more compact, harder and ashy white in colour. It is seen as a narrow whitish streak in transverse section. The bark is more reddish or purplish and the colour is more easily soluble in water. The officinal part of the bark has a more or less homogenous appearance. Taste highly astringent.

A. marginata.

The inner rind is compact and thin being present as a very narrow whitish wavy strip more or less as in *A. odoratissima*. Officinal part forms bulk of the bark since the rind is thin. Its colour is not uniform the peripheral part being deep purplish and the inner whitish to yellowish brown. Taste distinctly astringent, slightly acid.



Albizzia odoratissima

Histology of stem bark

NIMBA

Source plant in Travancore-Cochin.

Azadirachta indica A. Juss.

(Synonym—*Melia azadirachta* Linn.)

Meliaceae

Sanskrit Text

Descriptive synonyms.

निम्बः स्यात् पिचुमर्दश्च पिचुमन्दश्च तिक्तकः ।

अरिष्टः पारिभद्रश्च हिङ्गुनिर्यास इत्यपि ॥

(भावप्रकाशः)

“Nimbaḥ syāt picumardas'ca picumandas'ca tiktakah
Ariṣṭaḥ pāribhadras'ca hinguṇiryāsa ityapi”

(Bhāva prakāśaḥ)

निम्बः स्यात् पिचुमन्दस्तिक्तोऽरिष्टश्च हिङ्गुनिर्यासः ।

नेता नियमननामा प्रभद्रकः कच्छुदार इति ॥

(अभिधानमञ्जरी)

Nimbaḥ syāt picumandastikto'riṣṭas'ca hinguṇiryāsaḥ |

Netā niyamananāmā prabhadraḥ kacchudāra iti ||

(Abhidhānamañjarī)

अथ निगदितः प्रभद्रः पिचुमन्दः पारिभद्रको निम्बः ।

काकफलः कीरेष्टो नेताऽरिष्टश्च सर्वतोभद्रः ॥

धमनो विशीर्णपर्णः पवनेष्टः पीतसारकः शीतः ।

वरतिक्तोऽरिष्टफलो ज्येष्ठामालश्च हिङ्गुनिर्यासः ॥

छर्दनश्चाग्निधमनो ज्ञेया नाम्नां तु विंशतिः ।

(राजनिघण्टुः)

Atha nigaditaḥ prabhadraḥ picumandaḥ pāribhadrako nimbaḥ |
 Kākaphalaḥ kīreṣṭo neta śriṣṭas'ca sarvatobhadraḥ ||
 Dhamano viśṛṇaparnāḥ pavaneṣṭaḥ pītasāraḥ sītāḥ |
 Varatikto śriṣṭaphalo jyeṣṭāmālas'ca hinguniryāsaḥ ||
 Chardanas'cāgnidhamano jñeya nāmnam tu vimsatīḥ |

(Rāja nighaṇṭuḥ)

Of the synonyms nimbaḥ means that which gives health to patients, tiktakaḥ = predominantly bitter, ariṣṭaḥ = that which is not inauspicious, (proof against injury), hinguniryāsa = exudate with asafoetida like odour, viśṛṇaparnī, indicates pinnate form of leaf, pītasāraḥ* = having yellow or reddish heart wood, and dhamana refers to sound produced somewhere within the plant.

Properties and uses.

निम्बः शीतो लघुग्राही कटुपाकोऽभिवातनुत् ।

अह्वयः श्रमतृट्कास^३वरारुचिकृमिप्रणुत्

व्रणपित्तकफछर्दिकुष्ठहृल्लासमेहनुत्

(भाव प्रकाशः)

Nimbaḥ sīto laghurgrāhī kaṭupāko śgnivātanut
 Ahṛdyāḥ śramatṛdkāsa jvarārucikṛmipraṇut
 Vraṇapittakaphacchardi kuṣṭhahṛllāsamehnut.

(Bhāva prakāśaḥ)

कृमिज्वरहरो निम्बः कुष्ठवातकफापहः ।

(हृदयप्रियाः)

Kṛmi jvaraharo nimbaḥ kuṣṭhavātakaphāpahaḥ ||

(Hṛdayapriyā)

* The synonym pītasāraka denoting wood yellow is found only in Rāja nighaṇṭu. The term kaitarya is applied to Nimba also. (Vide Kirtikar and Basu's Indian Medicinal plants, second edition) In *Melia azedarach* which is equated as Kaitarya and Mahānimba in a number of books on Indian Materia medica the wood is yellow. Could it be that the original source of Nimba and Kaitarya was *Melia azedarach*?

Nimba is sīta = cool, laghu = easily digested (or of quick action), grāhī = arresting or constipating, kaṭupāke = pungent on digestion, ahṛdya = not pleasing, and is useful in, or destroys fatigue or weakness, thirst, cough, fever, anorexia, intestinal worms or parasites in general, ulcers, pitta (secretory disturbances), kapha = excessive mucus secretion, vomiting, skin or cutaneous diseases, nausea, belching, and meha (urinary disorders with excessive micturition).

निम्बपत्रं स्मृतं नेत्र्यं कृमिपित्तविषप्रणुत् ।

वातलं कटुपाकं च सर्वारोचककुष्ठनुत् ॥

निम्बफल रसे तिक्तं पाके तु कटुभेदनम् ।

स्निग्धं लघूष्णं कुष्ठं गुन्मार्शः कृमिमेहनुत् ॥

(भावप्रकाशः)

“Nimbapatram smṛtam netryam kṛmipittaviṣapraṇut
 vātaḥ kaṭupakam ca sarvārocaka kuṣṭhanut
 Nimbaphalam rase tiktam pāke tu kaṭubhedanam
 snigdham laghūṣṇam kuṣṭhaghnam gulmārsaḥ kṛmimēhanut,”

(Bhāva prakāśaḥ)

Nimba leaf is agreeable to the eye, destroys parasites, pitta and poisons, augments vāta, is pungent on digestion, and useful in or destroys anorexia and skin diseases.

Nimba fruit is bitter in taste, pungent on digestion, laxative, demulcent, light, pungent, destroys skin diseases, gulma, (phantom tumour), piles, parasites and meha

“चन्दनलदकृतमालनक्तमालनिम्बकुटज सर्षपमधुकदारुहरिद्रा-
 मुस्तानीति दशेमानि कण्डूघ्नानि भवन्ति ”

(चरकः)

Caraka has included nimba in kaṇḍūghna varga (group destroying itching)

कुष्ठगुल्मोदरार्शोन्मं कटुपाकि तथैव च ।

करञ्जकिंशुकारिष्टफलं जन्तुप्रमेहनुत् ॥

(सुश्रुतः)

Kuṣṭhagulmodarārśoghnam kaṭupākī tathaiva ca |
Karañja kimsukāriṣṭa phalam jantupramehanut ||

(Susrutaḥ)

रक्तवृक्षस्य निम्बस्य मुष्ककार्कासनस्य च ।

कफपित्तहरं पुष्पं कुष्ठधनं कुटजस्य च ॥

(सुश्रुतः)

Raktavṛkṣasya nimbasya muṣkakārkaśsanasya ca |
Kaphapittaharam puṣpam kuṣṭhaghnam kuṭajasya ca ||

(Susrutaḥ)

Thus Susruta agrees with other authors. Of all parts root bark has more medicinal properties. Decoction gives complete relief in filarial fever by continuous use for a few months. It is found effective in *Gajacarma* also. Bark of tree more than hundred years old is found to have more medicinal value. Nīm oil is found to do good in chronic skin diseases and ulcers. Decoction of leaves can be used for washing ulcers. In the treatment of smallpox nīm leaf is used as (paste) an external application. Dried leaves ward off insects attacking books and cloth.

Azadirachta indica A. Juss. जिम्बू ✓

(Syn. *Melia azadirachta* Linn., *M. indica* Brandis)

(Meliaceae)

Malayalam	Vēppu, Aryavēppu
Tamil	Veppamaram, Vembu
Hindi	Nim, Nimb
English	Margosa, Neem tree.

Distribution and Habitat

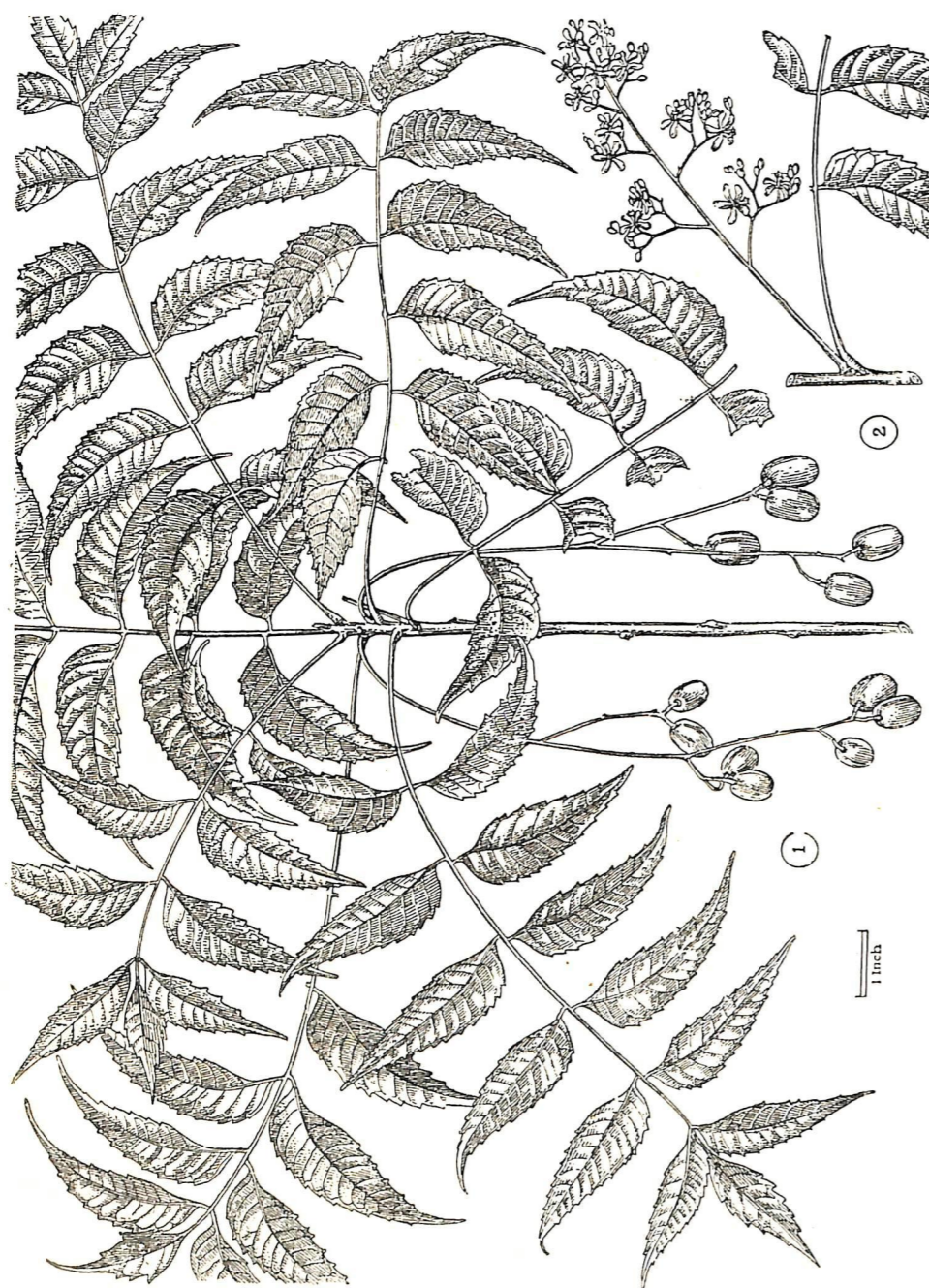
Azadirachta indica A. Juss. occurs throughout the greater part of India, and is found in the wild condition in parts of the Indo-gangetic plain, Deccan, Carnatic and the West Coast up to an altitude of 3000 ft. It grows well in most types of soil and being a hardy tree with dense foliage, is commonly cultivated in gardens, along roadsides, and by the side of irrigation wells, as a shade tree.

Habit and general features

Azadirachta indica is a moderate sized to fairly large, evergreen tree attaining a height of forty to fifty feet, with stout trunk and large spreading branches, supporting a dense circular crown with graceful foliage of glabrous imparipinnate leaves. The trunk and older branches are covered with moderately thick, dark brown, rough, longitudinally and obliquely furrowed bark, with exfoliating 'woody' rind. The tender parts are glabrous, with a thick waxy bloom or coating. All parts of the plant, especially the bark and leaves, are intensely bitter and astringent. In very dry regions the tree may become leafless for a very short period. The plant flowers during the hot months February to May and fruits are available in July and August.

External morphology.

Leaves: alternate, exstipulate, imparipinnate, six to fifteen inches long, closely clustered towards the ends of branches. *Leaflets* nine to fifteen or more, short petioluled, sub-opposite, sub-falcate-lanceolate, strongly oblique at base, coarsely dentate-serrate, acuminate, membranous, dark green and shiny above. *Rachis* long, slender, round, slightly thickened at base and longitudinally grooved above.



Melia azadirachta Linn.

Flowers: small, one sixth to one fifth of an inch long, white or cream coloured, honey scented, bisexual, five merous, arranged in lax flowered axillary cymose panicles up to one foot long; *Calyx:* short five-fid, with obtuse lobes. *Petals* five, free, shortly ciliate, much longer than the calyx, imbricate in bud and well spread out when open. *Stamens* ten, filaments united to form a narrow cylindrical tube slightly shorter than the petals and widening above, with nine or ten truncate or slightly toothed reflexed lobes at the rim bearing ten anthers within the tube at the top and opposite the lobes. *Ovary:* superior, three chambered, rarely five locular, with a slender, elongate or columnar style ending in a three lobed cylindric stigma. *Ovules* two in each cell, collateral.

Fruit: one celled, one or very rarely two-seeded, oblong to ellipsoidal fleshy drupe, half to less than three quarters of an inch long, yellowish green or occasionally slightly purple tinted when ripe. Skin or epicarp soft and leathery, enclosing a thin layer of slightly sweetish pulp, – the mesocarp, – which is adherent to the endocarp or ‘stone’, which is woody or bony. The dried fruits are slightly shrunken. *Seed* ellipsoid with a thin brownish testa, non-endospermic. The embryo retains its vitality only for a short period. It has a superior radicle and thick fleshy greenish white oily cotyledons, with a characteristic garlic-like smell and bitter taste.

Official parts: The bark, –root bark also in certain cases–, leaves, flowers, fruits, oil from seeds, exudate or gum resin and sap.

In Kerala mainly the bark, oil and leaves are used.

Fresh as well as dried barks obtained from stems and roots are used, the actual officinal portion being the middle and inner barks composed mostly of secondary cortex and bast.*

Description.

The *Stem bark* varies in appearance and thickness according to the age of the part of the tree from where it is taken, and to some

* *Note.* Roots of medium size, one and a half to three inches in diameter, are selected for extraction of the officinal portion. In such roots the officinal part is fairly thick, juicy and not very fibrous. In the case of stem barks, older barks are also taken but only the inner portion is used.

extent on environment and climate. Barks from younger stems or branches are smooth, soft and greenish or slightly rusty reddish or occasionally with alternating green and rusty green longitudinal bands. Barks taken from medium sized branches vary from half to one inch in thickness. In these the dead outer rind is rough, woody, very much fissured and peels off in fairly thick slices. In some old barks there is a narrow zone of dark yellowish brown, soft, suberous tissue within the outer ‘woody’ rind, as in root-barks. The living bark which is exposed on the removal of rind has a rose-purple to reddish or purplish brown colour. It varies from about one tenth of an inch or more in thickness and in a transverse section appears differentiated into three regions viz. (i) a comparatively narrow rose-purple to rarely light purplish brown peripheral part; (ii) a whitish middle portion comprising slightly less than half the thickness of the living bark and (iii) a fairly thick innermost region occupying the greatest bulk and composed chiefly of secondary bast. This part appears tangentially lamellated with alternating dull yellowish white and whitish striations.

The entire officinal bark has a characteristic garlic like odour and bitter astringent taste. In the fresh condition the inner bark is more intensely bitter than the outer rosy or dark coloured tissue which on the other hand is more astringent.

The dry barks as sold in the market are in the form of grooved or channelled cut pieces or flakes half to one foot or more long, two to four inches wide and half to one inch thick, and generally without the outer exfoliating woody rind. The three regions of the officinal tissue described in the case of fresh barks are not clearly discernible in the dry bark since the middle region is very much shrunken. The peripheral part is light purple or purplish brown or rarely brownish. Beneath this is a distinctly lamellated region which is easily separable into cream coloured or yellowish white thin papery fibrous flakes. Occasionally almost the entire officinal tissue appears purplish brown. It possesses in a lesser degree the characteristic odour and the bitter astringent taste as in fresh barks.

Histology

Structure of young stem bark.

In the young bark a hard outer rind is absent. The *phellem* or cork tissue forms the outer skin and is composed of twelve to fifteen or more rows of thin walled, narrow rectangular tangentially elongate cells. Of these a few of the outer-most rows are compressed and thick-walled. A distinct *phellogen* is discernible. The *cortex* is composed of several rows of fairly large oblong cells, most of which are loaded with starch grains while others contain cubical, rectangular and polyhedral crystals. Scattered throughout the cortex are several groups of sclereid-like cells, with pitted but not very thick walls, each enclosing a wide lumen. Most of these cells are nearly of the same size and shape as the surrounding cortical cells, but a few are tangentially elongate. It is noteworthy that such sclereid like cells are not usually found in older barks. The inner bark forms the thickest region and consists of radial segments of bast alternating with medullary rays. Each segment of bast consists of tangential bands of phloem with collapsed elements in the older portions alternating with groups of sclerenchyma. A few large secretory cavities are found scattered in the phloem. The phloem parenchyma cells contain starch.

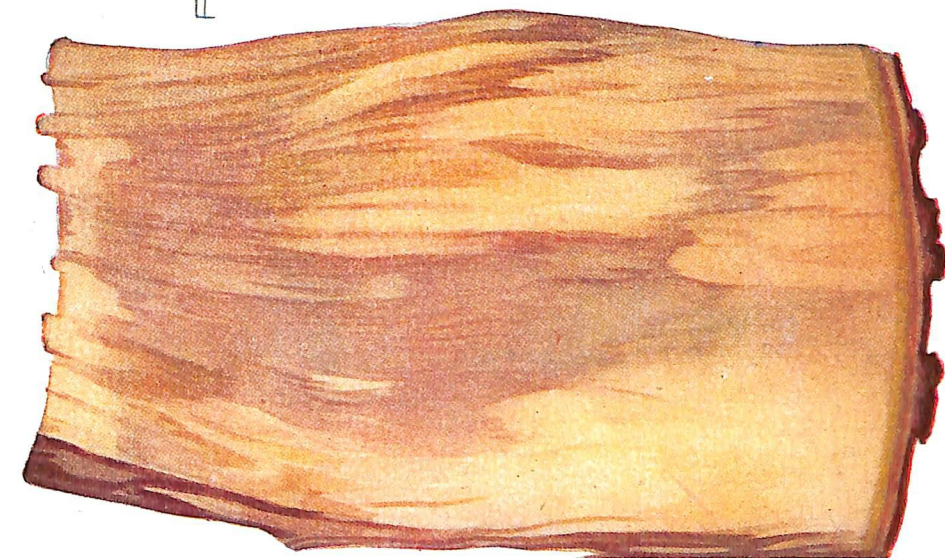
Structure of older stem bark.

The outer hard and 'woody' exfoliating rind which is considerably thick in old barks consists almost entirely of the dead elements of secondary bast, alternating with discontinuous tangential strips of compressed and hardened cork tissue. The former is composed of tiers of regularly arranged groups of sclerenchyma together with more or less collapsed thin walled phloem elements with reddish brown contents. Between the successive zones of cork tissue there may be three to five or more tiers of sclerenchyma groups, with intervening thin-walled and often collapsed elements of phloem. Each zone of cork tissue consists of several rows of regular thin-walled cells occasionally with a few compressed rows of thick walled cells towards its outer side.

Within this outer rind in most barks there are several rows of newly formed regular, thin-walled cork cells and one or two rows of *phellogen*. A secondary cortex is not generally present, the tissue



Azadirachta indica.



1 inch

1014

immediately beneath the phellogen being usually secondary bast. This is formed of radial segments of bast, eight to twelve cells wide, alternating with two to four seriate medullary rays. Each bast segment consists of tangential strips of thin walled phloem, alternating with groups of sclerenchyma, while collapsed phloem elements are found in the older portions. A few fairly large secretory cavities also occur in the phloem. Most of the phloem parenchyma cells contain starch. The groups of sclerenchyma or bast fibres, are fairly prominent, each group being ten to fifteen cells wide and five to eight rows deep. Sclerenchyma cells are polygonal and mostly isodiametric in transverse section, with thick unpitted walls.

The wood consists of several vessels, a large proportion of thick walled wood fibres, a small percentage of parenchyma and the medullary rays.

Diagnostic features of stem bark.

A. Morphological.

1. The entire bark is fairly thick, dark brown externally and with longitudinal and oblique furrows.

2. The outer bark consists of a thick hard 'woody' outer rind exfoliating in large slices or pieces and a comparatively thin corky inner portion.

3. In fresh barks the officinal part is fairly thick with its peripheral region rose or purplish red, the middle part lustrous starchy white, and the inner part tangentially lamellated in transverse section. In dry material the inner part easily separates into thin papery fibrous flakes.

B. Anatomical

1. The outer 'woody' part of the rind consists of zones of dead bast formed of groups of sclerenchyma and phloem elements, alternating with compressed strips of cork tissue. The inner part of the rind consists of a few rows of regular thin walled rectangular cork cells.

2. The officinal part consists almost exclusively of secondary bast formed of radial segment of bast alternating with medullary rays. Each radial segment consists of tangential zones of thin-walled phloem elements, alternating with bands of sclerenchyma. The

phloem parenchyma cells contain starch. A few scattered secretory cavities are present in the phloem.

C. Odour and taste.

The officinal bark has a characteristic nauseating garlic-like odour and a very bitter and astringent taste.

Root and root bark.

The root system consists of a comparatively short tap root and a number of long horizontally growing lateral roots and their branches. The roots are stout and woody.

The external appearance and general internal structure of the bark are usually similar in all roots irrespective of their size. But the relative thickness and the degree of hardness of the outer portions of the bark, as well as the texture of the wood, vary in accordance with the age of the root and to some extent with the nature of the soil. The bark however is fairly soft to cut.

The surface of the root bark is profusely covered with numerous large narrowly oblong lenticels, two to five millimeters long, arranged closely in regular longitudinal and intermittent transverse or annular rows. These rows of closely arranged lenticels give a rough appearance to the bark. The yellowish brown corky tissues fringing the opening of the lenticels irregularly alternate with thin narrow streaks of rusty brown tissue that forms the real skin. Thus even though the natural surface colour is rusty brown, it is masked to a great extent by the yellowish brown colour of the lenticels. The outer bark varies in thickness according to the size of the root. It is generally soft and corky and therefore can be easily removed by scraping or rubbing. It is composed mainly of several thin membranous to occasionally slightly crustaceous yellowish to rusty brown corky exfoliating layers. In the older roots and in the basal portions of the side roots there may be present alternating zones of thin hard crustaceous portions and soft corky tissue, or sometimes the rind may be harder with a fairly thick dark brown crustaceous outer part with layers of thick corky tissue underneath. Such roots appear rusty brown or grey, often with patches of the underlying yellowish brown tissues exposed. As in the case of stem bark the officinal tissue in the root bark can be differentiated into a leathery peripheral purplish

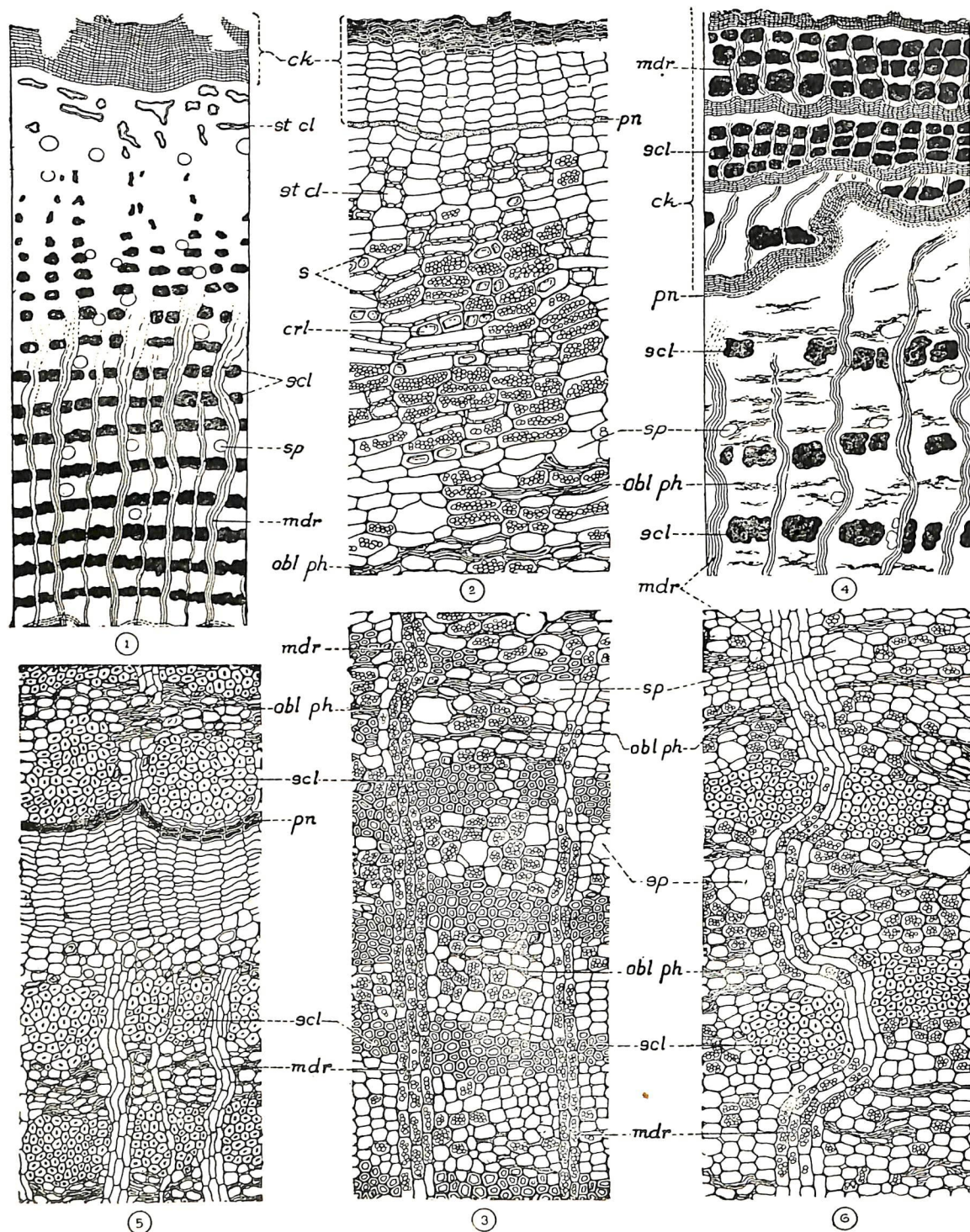
or rosy part, a somewhat mealy lustrous starchy white, soft middle region and a fibrous tangentially stratified inner portion. It also possesses the characteristic nauseating odour and bitter and astringent taste. The wood is light yellow. In transverse sections of the wood a large number of pores and many fine medullary rays are visible. In the younger portions the wood is highly porous, whereas in older roots it is denser and compact.

PLATE XI

Melia Azadirachta

Histology of stem bark.

- Fig. 1. Diagrammatic sketch of a segment of the T. S. of a younger bark,
 2. Structure of cork and cortex
 3. Structure of bast
 4. Diagrammatic sketch of a segment of the T. S. of old bark
 5. Structure of the rind, cork, phellogen and secondary cortex
 6. Secondary phloem in the old bark.

*Melia Azadirachta*

Histology of stem bark

KAIDARYA

Source plant in Travancore-Cochin.*

Murraya koenigii Spreng.
Rutaceae.

Sanskrit Text.

Descriptive Synonyms.

कैडर्योऽन्यो महानिम्बो रामणो रमणस्तथा ।

गिरिनिम्बो महारिष्टः शुक्लशालः (शाकः) कफाह्वयः ॥

(राजनिघण्टुः)

Kaiḍaryonyo mahānimbo rāmaṇo ramaṇastatha

Girinimbo mahāriṣṭaḥ suklaśālaḥ (śākaḥ) kaphāhvayaḥ

(Rājanighaṇṭuḥ.)

तृतीयः कृष्णनिम्बः स्यात् कौडर्यः कृष्णपुष्पिकः ।

कृष्णपूर्वेण निम्बस्य पर्यायेण च कथ्यते ॥

(अभिधानमञ्जरी)

Tṛtiyaḥ kṛṣṇanimbaḥ syāt kaidaryaḥ kṛṣṇapuṣpikāḥ

Kṛṣṇapūrveṇa nimbasya paryāyeṇa ca kathyate.

(Abhidhanamañjarī.)

कैडर्यः कालशाकश्च सुरभिः कृष्णनिम्बकः ।

श्रीपर्णिका कुमुदिका कट्फलः सुरभिच्छदः ॥

(संग्रह निघण्टुः)

Kaidaryaḥ kālasākaśca surabhiḥ kṛṣṇanimbakaḥ |

Śrīparṇikā kumudikā kaṭphalaḥ surabhicchadaḥ. ||

(Sangraha nighaṇṭuḥ.)

* In Travancore-Cochin (or Kerala) *Murraya koenigii* is used as **Kaidarya** mainly for its stomachic properties. It is doubtful whether this is the material contemplated under madanādigana or group of emetics. Rāja nighaṇṭu states "Kaid aryonyo mahanimbo . . . etc." The latter—**mahanimba** is evidently *Melia azadirach* according to Dymock and other authorities. The terms **Kaidarya** and **mahanimba** are applied to *Murraya koenigii* as well as *Melia azadirach* by Kirtikar and Basu and others.

Kṛṣṇapuṣpika = dark or black flowered, kālasakaḥ = dark leaves, surabhiḥ = scented, kṛṣṇanimbakaḥ = dark and nimba like, — the K pratyaya denoting only near likeness, — kumudika = white flowered, surabhicchadaḥ = scented leaves.

Properties and Uses.

कैडर्यः कटुकस्तिक्तः कषायः शीतलो लघुः ।

सन्तापशोषकुष्ठासकृमिभूतविषापहः ॥

(राजनिघण्टुः)

Kaiḍaryaḥ kaṭukastikṭaḥ kaṣāyaḥ śītalo laghuḥ

Samtāpa sōṣa kuṣṭhāsra kṛmi bhūta viṣāpahaḥ

(Rāja nighaṇṭuḥ.)

कालशाकं तिक्तकटु कफवातहरं लघु ।

दीपनं पाचनं स्वर्यं रुच्यं शोषगरप्रणुत् ॥

(हृदयप्रियः)

Kālasakam tiktakaṭu kaphavātaharam laghu

Dīpanam pācanam svaryam rucyam sōṣa garapranuṭ

(Hṛdayapriyaḥ.)

Kaiḍarya is katuka = pungent tikta = bitter ; kaṣāyaḥ = astringent, śītala = cool and laghuḥ = light (of quick action). It is useful in or cures sōṣa = emaciation or wasting conditions, skin diseases, diseases of the blood, trouble due to worms or pathogenic organisms, bhuta = neurosis, and poisons or toxins, Kaiḍarya also stimulates digestive factors in the alimentary canal (promotes appetite and digestion) improves voice, promotes taste and ends or destroys concocted poisons in the system.

Murraya koenigii Spreng(Syn. *Bergera koenigii* Linn.)

Rutaceae.

Malayālam	Kariveppu, Karuveppu
Tamil	Karuveppu
Hindi	Katnim

Distribution and habitat.

Murraya koenigii is common in most parts of India. It is recorded as occurring wild from Garwhal to Sikkim, Bengal, Pegu, Assam, the Deccan, Circar mountains, Western ghats, Coromandel and Travancore-Cochin. It is considered a native of the mountainous parts and grows up to an elevation of 3000 ft. In the plains it is not often found in the wild state, but is largely cultivated for the sake of its fragrant leaves.

Habit and general features

Murraya koenigii is an unarmed, semi-deciduous, aromatic shrub or small tree, ten to fifteen feet high, with slender but strong woody stem and branches covered with dark grey bark, closely crowded but spreading dark green foliage of imparipinnate leaves and terminal dense corymbiform cymose panicles of small white fragrant flowers followed by clusters of black berries. Its roots spread widely, and occasionally send up suckers. Flowers: February to May.

External morphology.

Leaves: alternate, exstipulate imparipinnate, six inches to one foot long, usually glabrous, sometimes slightly pubescent when young, very strongly aromatic; *Rachis* slender, terete, pubescent often with a light reddish tinge above; *petiolules* short, also reddish tinted. *Leaflets* nine to twentyfive or more, short-stalked, alternate, one half to one or two inches long and about half to three quarters of an inch wide, ovate to ovate-lanceolate, gland dotted and strongly aromatic (the lower leaflets being much smaller and more rounded), unequally cuneate or oblique at base, shortly and bluntly acuminate, and the tip slightly notched, minutely crenate, or rarely entire: the upper surface dark-green

Murraya koenigii Spreng.

glabrous or slightly pubescent, and under surface lighter in colour less pubescent and sprinkled with black dots: *midrib* cream yellow or whitish and pubescent, the *veins* somewhat dark greenish and forming a close meshed reticulum. The leaves have a slightly pungent, bitter and feebly acidulous taste. They retain their flavour and are supposed also to retain their officinal qualities even when dry.

Inflorescence. a terminal pedunculate many flowered compact corymbiform cymose panicle, with pubescent peduncles and pedicels.

Flowers: small, white, fragrant, about one third of an inch long, subcampanulate, ebracteate, or with minute bracts: the bracts when present being small, lanceolate and deciduous, and pressed close to the pedicels. *Calyx* deeply five-cleft, pubescent, the lobes or sepals small triangular and acute. *Petals* five, free, spreading, about a quarter of an inch long, whitish, glabrous, linear-oblong, obtuse or rounded at apex, gland-dotted and imbricate in bud. *Disc* short stalked and slightly elongate. *Stamens* ten attached around or outside the disc: *filaments* free, alternately short and long, linear subulate, (dilated towards the base and tapering above) and bearing small short anthers. *Ovary* superior, seated on the disc, two celled with one or rarely two ovules in each cell: *style* elongate, cylindric, thick, articulate and early deciduous with a capitate or grooved stigma.

Fruits occur in close clusters; they are small, ovoid or subglobose, apiculate, glandular minutely tuberculate berries, a quarter to one third inch in diameter, with a thin pericarp and mucilaginous pulp, enclosing one or two seeds. During ripening they turn from green to red and ultimately become black. *Seeds* nonendospermic with membranous, glabrous testa. Embryo small, with thick plano-convex, cotyledons, conspicuously auricled at their bases, and a villous radicle.

Officinal parts: Root, bark, leaf and petiole.

Description of root

The roots are woody, with a few branched wiry rootlets, and with or without woody side roots, and covered with a thick soft greyish-brown closely longitudinally fissured bark. The entire bark peels off easily in fresh roots, and is less than one eighth of an inch thick, of

which the outer corky part is about 0.02 inch in thickness. In transverse section the outer corky rind is greyish brown, the living bark starchy white and the wood light brown. The entire bark has a leathery texture while the inner part is fibrous and may be separated into three or more layers. The officinal part of the bark is faintly aromatic, pungent and slightly bitter to taste.

Histology of root bark.

The *phellum* or cork tissue consists of alternate zones of three to five or more rows of thin-walled, broadly rectangular cells of slightly varying sizes and thin strips of one or two rows of very narrow cells with thick yellowish brown walls. The phellogen is formed of one or two rows of narrow rectangular cells with rich protoplasmic contents but is not always visible or evident.

The *cortex* which is secondary in the older roots is a comparatively wide zone of rectangular oblong or polygonal cells, with small intercellular spaces. Small groups of sclerenchyma are scattered in the peripheral parts of the cortex. A few prominent secretory cavities are also present. Several of the cortical cells contain cubical or rectangular crystals of calcium oxalate. The inner bark consists of radial segments of regular phloem elements alternating with narrow uniseriate medullary rays. Each phloem segment consists of broad zones of phloem alternating with narrow tangential strips of sclerenchyma. The latter is two to three or four rows deep and six to fifteen rows wide. Associated with these groups there are also a few crystal cells. Collapsed elements of phloem occur in the older regions. Some of the phloem parenchyma cells contain cubical or rhomboidal crystals. As in the cortex a few secretory cavities are also present in the bast. It is noteworthy that starch grains are not found in any of the tissues.

The wood consists mainly of fibres, vessels and narrow medullary rays.

Stem bark.

The *stem bark* is slate grey to dark greenish grey. Its surface is fairly smooth in the younger branches, but in the older barks it shows slight reticulate fissures and numerous small lenticels. It is comparatively thin and when fresh, easily tears across. The

surface skin is just thick enough to be scraped but not peelable. On scraping the surface skin, a thin greenish tissue, the middle bark is exposed. The inner bark is whitish and breaks with a short fracture. The inner and middle barks which together form the officinal tissue has a pleasant aromatic odour and slightly pungent, sweetish, mucilaginous taste.

Histology of stem bark.

The *cork* zone consists usually of less than ten rows of small narrow rectangular cells, of which the outer three or four rows are thick walled, with yellowish brown contents. The phellogen is composed of one row of narrow cells, followed by a few rows of slightly larger phelloderm cells. The *cortex* which is comparatively broad is composed of somewhat closely packed large oblong cells most of which contain chloroplasts. Cubical and rectangular crystals are also present in several of them. Sparsely scattered many celled groups of small, thick-walled sclerenchyma and a few secretory cavities are also present in the cortex. The *bast* consists of segments of regular phloem elements, alternating with tangential strips of sclerenchyma. The phloem parenchyma cells are comparatively large, and some of them contain crystals. The strips of sclerenchyma are formed of very thick-walled cells one to three rows deep and reach the medullary rays on either side. The rays in the phloem part are mostly narrow and uniseriate, but appear broader and three or more seriate in the cortex, where the cells are tangentially elongate.

The wood, as in the root, consists mostly of fibres, vessels and narrow medullary rays. The vessels very often occur in radial rows, arranged in groups of three to five or more. Starch grains are not found in any of the parenchymatous elements.

Leaf rachis. The entire leaf rachis is half to one foot or more long, terete, strong and cordlike, pulvinate at base, tapering towards the tip, and faintly pubescent. It is dark green to reddish brown above, yellowish green below and very strongly aromatic. Its basal part up to a length of one or one and a half inches is naked, and the remaining portion bears alternate to sub opposite leaflets at close intervals with a terminal leaflet or occasionally ends as a short point. The rachis breaks with a short fracture evidently due to the presence of a large pith.

Histology of leaf rachis.

A transverse section of the basal part of the rachis is oval with irregular minutely wavy outline. The epidermis is composed of a single row of closely arranged broadly rectangular cells some of which are produced into simple hairs. The cortex is composed of twelve to fifteen or more rows of thin walled oblong or polygonal cells of varying sizes, with distinct intercellular spaces. Towards its periphery there are a few lysigenous secretory cavities which are often partly or completely surrounded by one or two rows of thick-walled cells. The inner boundary of the cortex is formed of an interrupted ring of sclerenchyma. The phloem is composed of broad segments separated by a few narrow rows of medullary parenchyma. Prismatic crystals are found in some of the phloem parenchyma cells. The xylem is formed of vessels and thick walled fibres. In the centre is a large core of well defined pith formed of thin walled spherical cells of various sizes.

Taste: sweetish, mucilaginous without any pungency.

PLATE XIII

Murraya koenigii Spreng

Histology of: Stem bark

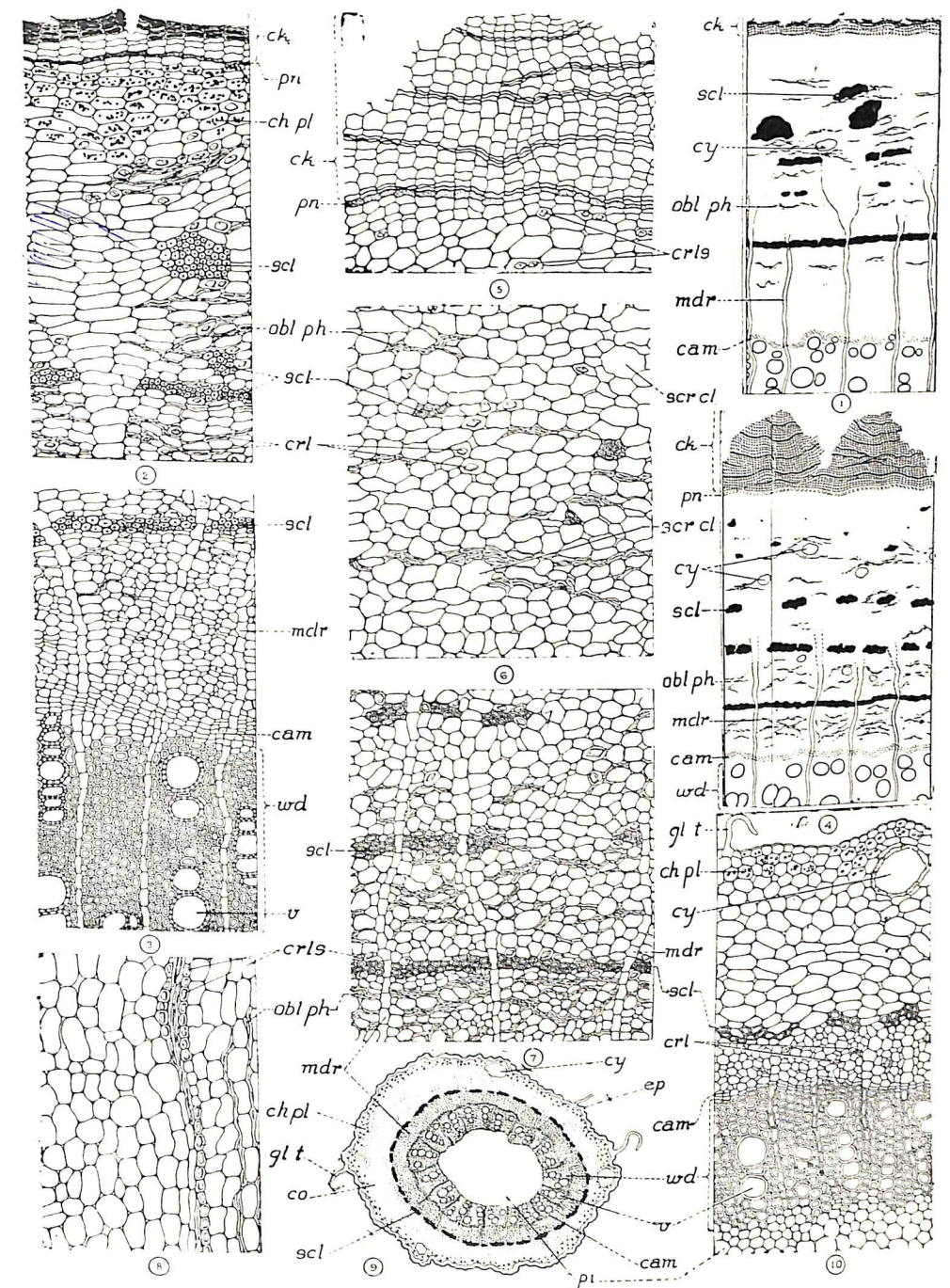
1. Diagrammatic sketch of a segment of a T. S.
2. Cork and cortex
3. Bast and wood regions with the cambium

Root bark

4. Diagrammatic sketch of a segment of a T. S.
5. Cork and phellogen
6. Details of cortex
7. Structure of the bast region
8. L. S. showing crystals associated with sclerenchyma groups

Petiole

9. Diagrammatic sketch of the T. S. of Petiole
10. Detailed structure of the different tissues as seen in a segment of the T. S.



Histology of *Murraya koenigii*

Melia azedarach Linn *(Syn. *M. Sempervirens* Sw., *M. bukayun*)

(Meliaceae)



Melia azedarach Linn.

Malayālam

Sīma veppu, Mala veppu †

Tamil

Malay vempu, Tuluka vempu, †

Hindi

Bakain, Mahanimb

English

The Persian lilac, Bastard cedar.

(It is also known as the bead tree since the stony fruits are commonly used as beads.)

Distribution and habitat.

This plant is indigenous to Baluchistan and the Jhelum valley in Kashmir. It is also recorded in a wild state in the sub-Himalayan tract from 2000 to 3000 feet. It is now found all over India being often cultivated as an ornamental tree for the sake of its beautiful flowers. It is capable of withstanding a much colder climate than *Azadirachta indica* the common Margosa or Neem.

Habit and general features.

Melia azedarach Linn. is a medium or moderate sized deciduous tree about forty feet high, with a short stout trunk covered with dark grey or greyish brown shallowly vertically fissured bark and a fairly broad spreading crown, bearing imparibipinnate or occasionally tripinnate leaves, fragrant (honey-scented) lilac flowers in many flowered axillary panicles towards the ends of the branches and small sub-globose drupaceous fruits half to three quarters of an inch in length. The young shoots and inflorescence are sparsely clothed with deciduous

* *Melia azedarach* Linn. (the Persian lilac) is equated as 'Kaitarya' 'Mahanimba' 'Hemadruma' etc. by Kirtikar and Basu (Indian Medicinal plants, 2nd edn. p. 542). It is equated as 'Mahanimba' also by Khorey and Katrick, Dymock and others. 'Mahanimba' (Kaitarya) is included in the Madanadigana (class of emetics) in the Ayurvedic texts and is said to possess almost the same properties and uses as *Azadirachta indica*. The Persian lilac has long been used by the Arabs and Persians who brought a knowledge of its virtues with them when they came to India.

† The Malayālam and Tamil names Mala Veppu and Malai Veppu respectively are applied also to *Melia composita* Willd.

stellate hairs. The tree is usually leafless from December to March or April. It flowers during the hot season – March to May and the fruits ripen in the cold season. It yields a soluble gum very similar to that obtained from *Azadirachta indica*.

External morphology.

Leaves: alternate, exstipulate, bi-or occasionally tripinnate, nine to eighteen inches long. *Pinnæ* three to four pairs, each with about five alternate or opposite, ovate or lanceolate entire or sometimes lobed, acuminate, glabrous leaflets, half to three inches long and one half to one and a quarter inch wide, on short slender petiolules.

Flowers: small, one fourth to one third inch long, honey-scented, lilac, or occasionally white externally and lilac along the distal margin, bisexual and five-merous. They are borne in large, long-peduncled many flowered, axillary cymose panicles which are generally shorter than the leaves. *Calyx* pubescent outside, deeply five lobed or partite, with ovate oblong to lanceolate, acute lobes which are imbricate in bud. *Corolla* formed of five free puberulous petals, much longer than the calyx, imbricate in bud and well spread out in flower. An annular disc is present just outside the stamens. *Stamens* ten with the filaments united into a purplish glabrous cylindric feebly ribbed tube $\frac{1}{3}$ inch long, slightly shorter than the petals, dilated and cut up into twenty to thirty linear teeth at the mouth; *anthers* glabrous, apiculate and situated within the tube at its top. *Ovary* superior, glabrous, five locular containing two superposed ovules in each chamber; style elongate or columnar and articulated to the top of the ovary with a clavate capitate or sometimes five lobed stigma.

Fruit: a sub-globose or ovoid or ellipsoid-globose fleshy dark purple drupe, about three quarters of an inch long, half to less than three quarters of an inch in diameter, with soft skin and a very hard woody or bony endocarp. It is five or fewer chambered, with one pendulous elliptic seed in each chamber. Testa crustaceous, albumen fleshy but scanty, and cotyledons foliaceous. The seeds retain their vitality only for about an year.



Official parts: Bark, root-bark, flower, fruits and leaves.

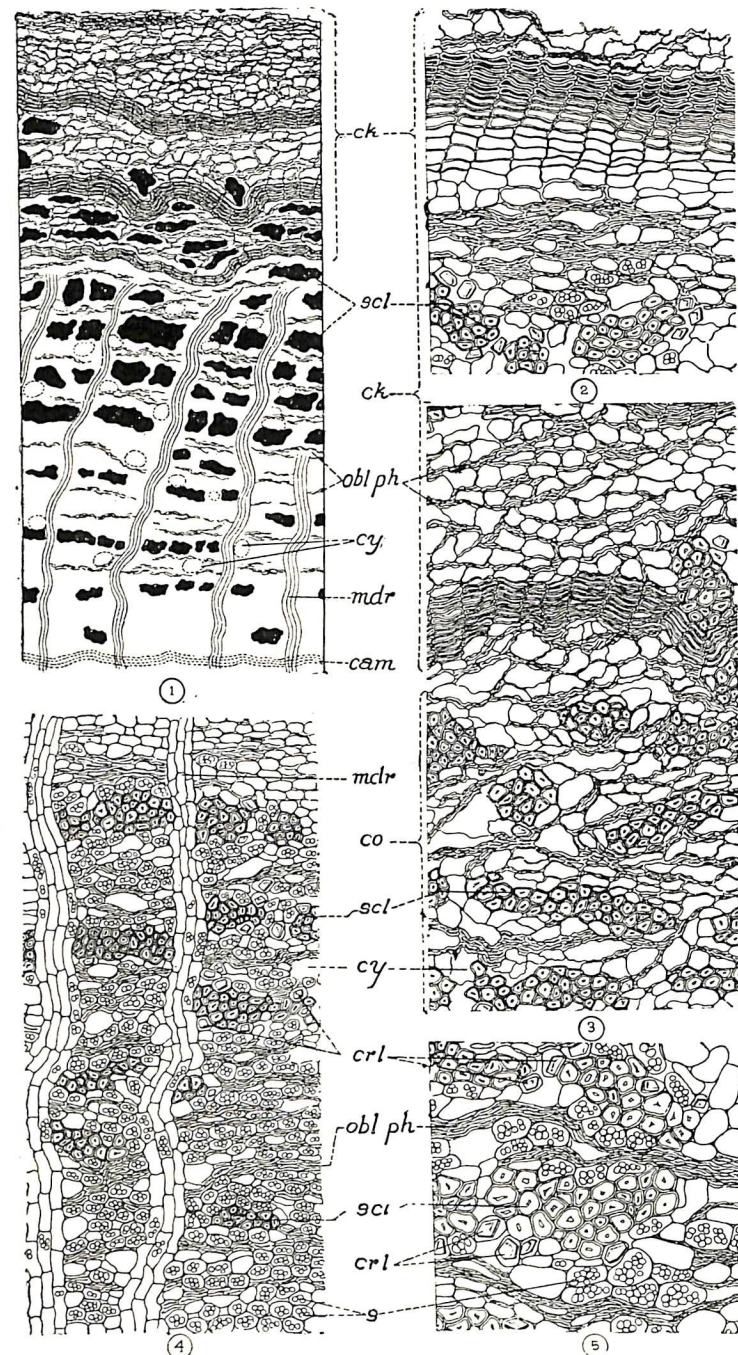
Description of stem bark.

The bark of *M. azedarach* has a dark grey to greyish black colour. Its surface is somewhat rough, being feebly fissured and exfoliating in small slightly 'woody' slices.

The entire bark is comparatively thin: in trunks about six inches in diameter the bark is less than a quarter of an inch in thickness. The *outer bark* constitutes nearly half the thickness of the entire bark. It is not easily detachable from the tissues within and its inner surface is pinkish brown. The exfoliating outer part of the rind is very thin and black and appears as a thin black line in transverse sections. The thickness of the inner region varies from 0.1 to 0.2 of an inch in different parts. It has a fibrous texture, but no characteristic taste or smell. The living or officinal part of the fresh bark is formed of thin cream yellow to whitish layers alternating with one another. The yellowish part of the living bark has a bitter taste.

Histology

In old barks there is a well defined outer rind (rhytidoma) formed of alternating strips of cork layers and dead secondary bast. The cork tissue is composed of many rows of compressed rectangular cells, often with reddish brown contents. Phellogen is not very distinct and a secondary cortex is not normally present. The secondary bast found next within is composed of groups of sclerenchyma, and medullary rays, and in the older parts collapsed and compressed phloem tissue is also present. The phloem parenchyma cells are fully packed with compound starch grains. Starch grains also occur in the cells of the medullary rays but in a much lesser proportion. Medullary rays are usually two to five seriate.



Melia azedarach
Histology of stem bark

PLATE XV

Melia azedarach

Histology of stem bark

1. Diagrammatic sketch of a part of the T. S.
- 2 & 3. Details of cork tissue.
4. Structure of bark with medullary rays.
5. A portion of fig. 4, enlarged.

Melia composita Willd.(Syn. *Melia dubia* Hiern),

Sanskrit.	Arangaka *
Malayalam	Malavembu, Aryaveppu, Malaveppu, Turukuvembu
Tamil	do Malaivembu,

Distribution.

The Eastern Himalayas up to about 6000 feet, Assam, Western Ghats, Northern Circars, Ganjam, Deccan etc. in moist localities.

Habit and general features.

Melia composita is a large tall handsome deciduous tree. The young shoots, petioles and panicles are very densely clothed with stellate pubescence, but become ultimately smooth.

External morphology.

Leaves alternate, very large, six to thirty inches long, bi-or sometimes tripinnate. Pinnae about three pairs oddpinnate. *Leaflets* three to seven pairs, one to three inches long, – the terminal the largest, – ovate lanceolate to ovate rotund, acute or acuminate, oblique at base and glabrous when mature.

Flowers numerous small about one third of an inch long, greenish-white, or white, fragrant in stellately pubescent, many flowered, axillary cymose panicles scarcely half the length of the leaves. Peduncles long, pedicels short *Calyx* and *petals* mealy outside. *Stamens* as in *Melia azedarach* but anthers longer than the teeth of the staminal tube. *Ovary* glabrous five chambered; stigma large with a five pointed apex.

Fruit. An ovoid fleshy drupe of the size of a large olive or plum one to one and a half inches long and yellowish green when ripe. The pulp of the fruit has a bitter nauseous taste.

* According to Dymock, and Kirtikar & Basu (Indian Medicinal plants: vol. II p. 545-46.)

VACĀ

Source plant in Kerala.

Acorus calamus Linn.

Araceae.

Sanskrit Text

Descriptive Synonyms.

वचोग्रगन्धा षट्ग्रन्धा गोलोमी शतपर्विका ।
क्षुद्रपत्री च मङ्गल्या जटिलोग्रा च लोमशा ॥

(भावप्रकाशः)

Vacogragandha ṣaḍgranthā golomī śataparvikā
Kṣudra patrī ca maṅgalyā jaṭilogrā ca lomaśa

(Bhāva prakāśaḥ).

वचोग्रगन्धा गोलोमी जटिलोग्रा च लोमशा ।
रक्षोघ्नी विजया भद्रा मङ्गल्येति दशाह्वया ॥

(राजनिघण्टुः)

Vacogragandhā golomī jaṭilogrā ca lomaśā |
Rakṣoghñī vijayā bhadra māṅgalyeti dasāhvayā ||

(Rāja nighaṇṭuḥ)

प्रोक्ता वचोग्रगन्धा जटिलोग्रा रोमशा च गोलोमी ।
रक्तान्या श्वेतवचा मेध्या षट्ग्रन्धिका च हैमवती ॥

(अभिधानमञ्जरीः)

Proktā vacogragandhā jaṭilogrā romasā ca golomī |
Raktānyā śvetavacā medhyā ṣaḍgrandhikā ca haimavatī ||

(Abhidāna manjarī)

Vacā indicates its property of making speech clear; *Ugrāanthā* denotes very strong smelling; and *śataparvika* presence of several nodes.

Properties and Uses.

वचोग्रगन्धा कटुका तिक्तोष्णा वान्तिवह्निकृत् ।
विवन्धाध्मानशूलघ्नी शकृन्मूत्रविशोधिनी ॥
अपस्मारकफोन्मादभूतजन्तवनिलान् हरेत् ॥

(भावप्रकाशः)

Vacograganthā katukā tiktosṇā vāntivahnikṛt
Vibandhādhmāna sūlagñi sakṛnmūtravisodhini
Apasmāarakaphonmāda bhūtajantvanilān haret

(Bhāva prakāśaḥ)

वचा बुद्धिप्रदाकण्ठ्या परं दीपनपाचनी ।
आन्त्रशूलप्रशमनी कफकुष्ठान्तिसाराजेत् ॥

(हृदयप्रियः)

Vacā buddhipradā kaṇṭhyā param dīpanapācanī |
Āntrasūlaprasamanī kaphakuṣṭhāntisārajit ||

(Hṛdayapriyaḥ)

पारसीकवचा शुक्ला प्रोक्ता हैमवतीति सा)
हैमवत्युदिता तद्वद्वातं हन्ति विशेषतः ॥

(भावप्रकाशः)

Parasikavacā sukṭā proktā haimavatitī sā |
Haimavatyudita tadvadvātam hanti viśeṣataḥ ||

(Bhāvaprakāśaḥ)

Vacā is strong smelling, pungent, bitter, causes vomiting, promotes digestive power, and is useful in vibandha = obstruction, flatulence and pain (abdominal?). It causes clear defaecation and micturition, cures hysteria, insanity (kapha variety) and destroys (bhūta) evil spirits, parasites.

Properties and uses of Mahabhari vacā popularly known as kulinjana.

सुगन्धाऽप्युग्रगन्धा च विशेषात्कफकासनुत् ।
सुस्वरत्वकरी रुच्या हृत्कण्ठमुखशोधिनी ॥
स्थूलग्रन्थिः सुगन्धास्यात्ततो हीनगुणा स्मृता ॥

(भावप्रकाशः)

Sugandhāpyugragandhā ca viśeṣātkaphakāsanut |
Susvaratvakarī rucyā hṛtkanṭhamukhasodhinī ||
Sthūlagrandhiḥ sugandhasyāttato hīnagunā smṛtā ||
(Bhāva prakāśaḥ)

पारसीकवाचा सूक्ता प्रोक्ता हैमवतीतीश
हैमवत्युदित तद्वद्वातम् हन्ति विशेषतः

(भावप्रकाशः)

Parasikavacā sukṭa proktā haimavatitīś
Haimavatyudita tadvadvātam hanti viśeṣataḥ.

Bhāva prakāśaḥ.

Bhava misra says that Parasikavacā is white and that it is especially effective in destroying vāta

In carakasamhita vacā is included in lekhanīya scraping away superfluous matter trptighna – dispelling the feeling of satisfaction in eating arśoghnā – curing piles, s'itapras'amanam = removing the feeling of cold and sañjāsthapaṇam = stabilising sense factors,

Vacā is considered to promote intellect in general.

Acorus calamus Linn.

(Araceae)

Malayalam	...	Vayampu
Tamil	...	Vasampu
Hindi	...	Bach, Gora vach, Gorbach
English	...	Sweet flag

Distribution and habitat

This plant is an original inhabitant of the warm temperate regions of Europe from where it was introduced in India in very early times. It is now found throughout India under cultivation as well as in the wild state, in plains, lower elevations and in Sikkim and Himalayas up to an elevation of 6000 ft. It grows well in damp marshy places such as meadows edges of lakes and banks of streams and rivers.

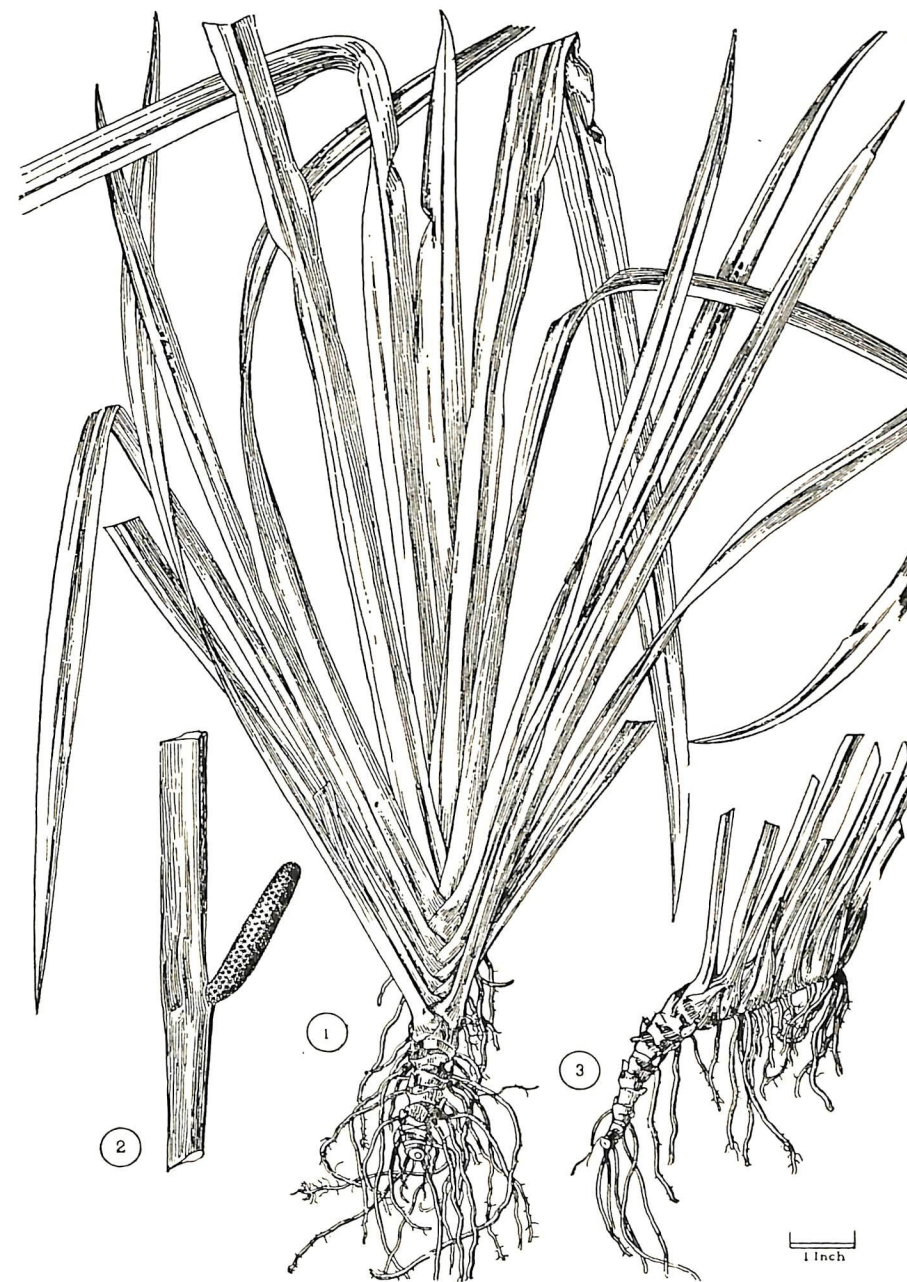
Habit and general features

Acorus calamus Linn. is a strongly aromatic gregarious perennial herb, with close set distichously arranged, erect narrowly ensiform, glossy green leaves, arising from a partially underground creeping and branching rhizome. When the older portions of the rhizome decay the branches which get separated become independent plants.

Flowering time: May to June, but the plants flower only rarely in the plains of South India.

External morphology

Leaves: Strongly aromatic, simple, alternate, distichous, very closely arranged, vertically oriented, linear to narrowly ensiform, two to three feet long and half to one inch broad, occasionally longer and broader, glossy bright green, with wavy margin, acute tip and a broad amplexicaul base. The base is continued some distance upwards as a feebly split sheath enclosing the next younger leaf on the opposite side. The upper half which constitutes the blade is slightly broader, and rapier shaped, (long and narrow with an acute apex.) A thickened or stout midrib like region extends along the entire length of the leaf. The leaves remain attached to the rhizome for a long time even after they become dry.

*Acorus calamus* Linn.

1. The Plant
2. Inflorescence
3. Side view of base of plant

The *inflorescence* is a short stumpy spadix, two to four inches long and half to three quarters of an inch in diameter. It is borne about a foot above the ground level on a leaflike but thicker scape $\frac{1}{8}$ " to $\frac{3}{8}$ " broad, with the spathe continued beyond attachment of the inflorescence, as a long leafy structure, varying from six to thirty inches in length. The spadix is sessile, cylindric, thick, greenish, slightly curved, obtuse and densely and compactly covered with a mass of numerous pale green flowers.

Flowers: bisexual, fragrant when bruised. Each flower has a perianth of six somewhat scarious free orbicular concave scaly segments almost as long as the ovary and with incurved tips. Stamens as many as perianth segments, with linear, flat, free filaments and yellow reniform anthers, the cells of which are confluent above. Ovary superior conical, two to three chambered containing six or more orthotropous ovules suspended from the top of the locules; stigma minute and sessile.

Fruit: a turbinate, prismatic, top pyramidal, three celled, fleshy capsule. *Seeds* oblong with fleshy endosperm.

Official part: the rhizome.

The dried rhizome of *Acorus calamus* is a common, valuable and favourite bazar medicine in India.

Description

The rhizome is tortuous creeping partially underground, and much branched with fairly thick, long adventitious roots, arising from the lower side. It is about half an inch in diameter, rather spongy and powerfully aromatic.

The dried rhizome as generally sold in the bazar, consists of simple or rarely branched subcylindrical to slightly flattened, somewhat tortuous or rarely straight, cut pieces of various lengths, pale to dark brown or occasionally orange brown in colour and with rough shrunken often deeply longitudinally wrinkled surface. The dry shrivelled, persistent bases of the older leaves are often found attached to the rhizome. In older parts of the rhizome the upper side is marked with alternately arranged large broadly triangular transverse leaf scars which almost encircle the stem. The marks left by

the vascular bundles can be made out in these scars. The lower side shows an irregular zigzag line of slightly elevated tubercular spots, representing scars of decayed roots. In each such area or spot two concentric rings or circles can be made out denoting the stele and cortex. The rhizomes are covered with a thin brownish corky outer skin. The scraped rhizome has a rough surface and pale-brown colour. In these the scales of fallen leaves and roots are less conspicuous.

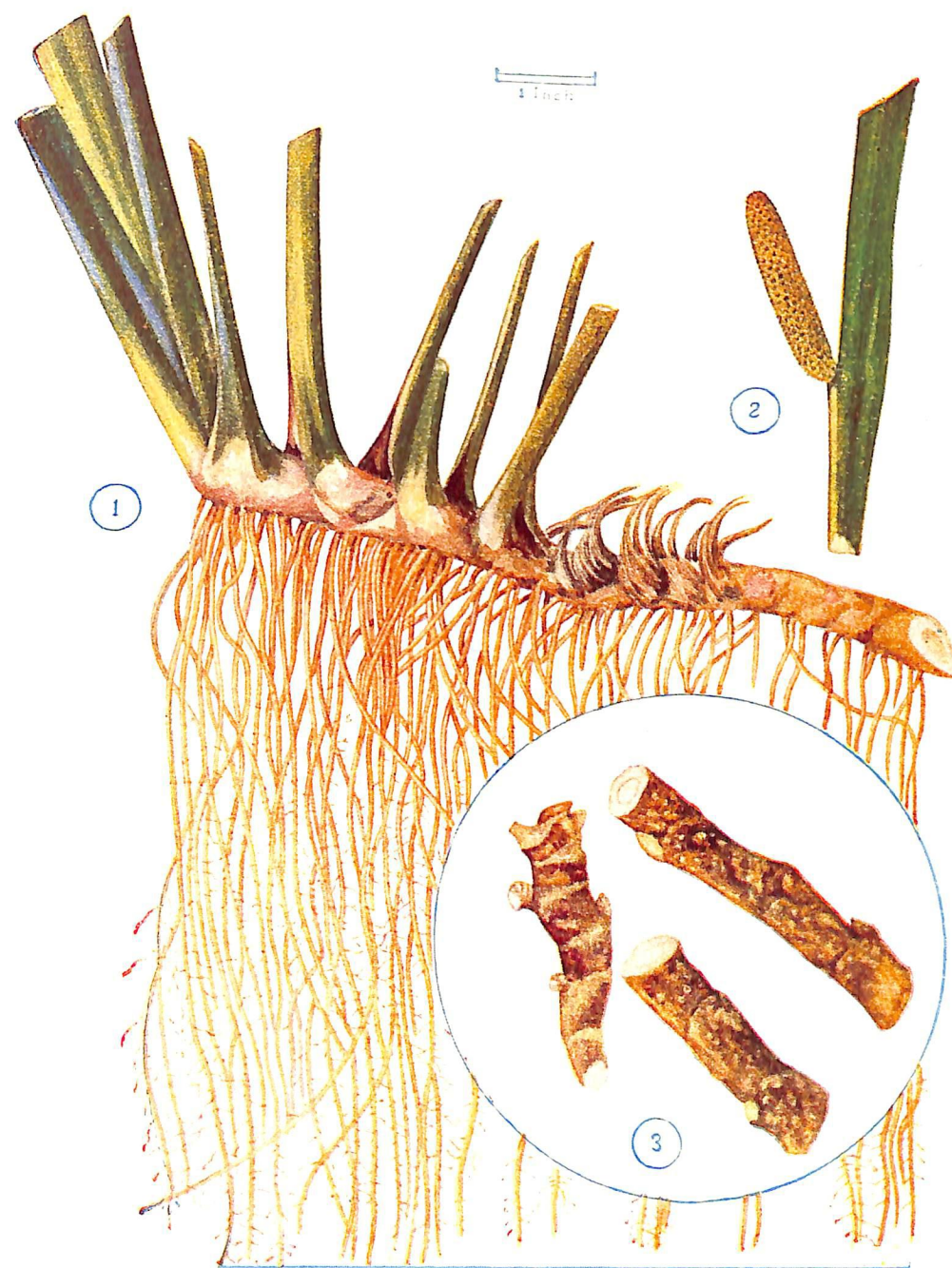
The rhizome breaks easily with a short fracture exhibiting a dull pinkish white to pale-brown somewhat spongy or very minutely porous interior. The freshly fractured drug emits an agreeably fragrant odour or aroma and has a slightly acrid or pungent and bitter taste.

Histology.

The transverse section of a fresh unpeeled rhizome is circular to oval with its outline slightly wavy. It reveals a single row of epidermis or rarely a very thin corky tissue or layer at the periphery followed by a broad cortex and a large stele or central cylinder. The demarkation between the cortex and the stele is quite distinct. The arrangement of the ground or fundamental tissue is similar in both the cortex and stele. It appears like a network composed of chains of neatly arranged spherical cells with the vascular bundles arranged in a scattered manner at the junctions of the network.

The outermost region (outer skin) in most cases consists of one or rarely two rows of thin-walled broadly rectangular cells very often with remnants of dead tissue outside. The cortex is a fairly wide zone and composed of spherical to oblong thin-walled cells of various sizes. The cells towards the periphery are smaller, at times somewhat collenchymatous, and more or less closely arranged. Those towards the inside are rounded and form a network of chains of single rows of cells enclosing large air spaces. Almost all the cells are thin-walled and packed with starch grains except a few which are larger and slightly thick-walled. These have light yellowish brown contents. A limited number of fibre groups and concentric fibro-vascular bundles as well as secretory cells can also be made out in the cortex.

A distinct *endodermis* separates the stele from the cortex. Its cells are thin-walled and show the casparian strips.



Acorus calamus. 411

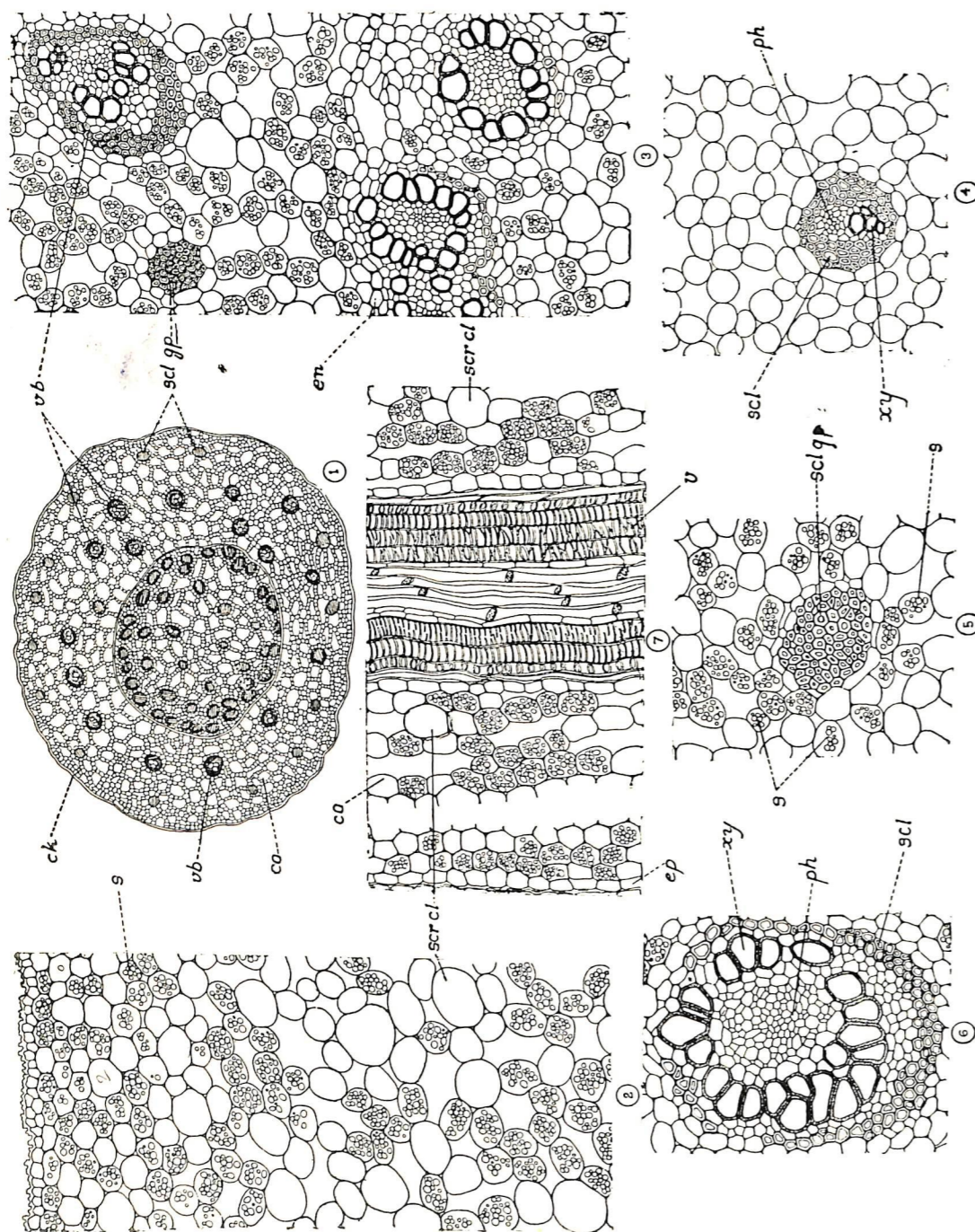
The *stele* is composed of rounded parenchyma or ground tissue cells arranged in chains of single rows enclosing large air spaces similar to those of the cortex, and several vascular bundles. These are found arranged closely crowded and in larger numbers nearer the endodermis. All of them are of the concentric type (phloem surrounded by xylem). Unlike those situated in the cortex, most of the stelar vascular bundles are generally without associated fibre elements, though a few are surrounded with a thin layer of thick-walled cells. The parenchyma cells are loaded with spherical starch grains. Secretory cells occur amidst the parenchyma cells.

PLATE XVIII

Acorus calamus

Histology of Rhizome

- Fig. 1. Diagrammatic sketch of a T. S. of the Rhizome.
2. Structure of the outermost portion of the rhizome.
 3. Details of middle region showing endodermis and vascular bundles.
 4. A bundle near the epidermis.
 5. Sclerenchyma group.
 6. A bundle within the endodermis.
 7. L. S. showing the epidermis cortex and a vascular bundle.

*Acorus calamus*

Histology of Rhizome



SAPTAPARNAH

Source plant in Kerala

Alstonia scholaris R. Br.

Apocynaceae

Sanskrit Text

Descriptive synonyms

सप्तपर्णो विशालत्वक् शारदो विषमच्छदः ॥

(भावप्रकाशः)

“Saptaparnō viśālatvak śārado viṣamacchadah”

(Bhāva prakāśaḥ)

सप्तच्छदो गुच्छपुष्पः शतपुष्पो बृहच्छविः ।

सप्तपर्णः सप्तपत्रः सप्ताहः सद्गसंज्ञकः ॥

श्रीपर्णः स्निग्धपर्णश्च सर्वक्षीरी सुपर्णकः

बृहत्त्वगिति विख्यातः शब्दैः पर्यायवाचकैः ॥

(अभिधानमञ्जरी)

Saptacchado gucchapuṣpaḥ śatapuṣpo bṛhachaviḥ ।

Sataparnah saptapatraḥ saptaḥvaḥ saptasamjñakah ॥

Sriparnah snigdhaparnas'ca sarvakṣīrī suparnakah ।

Bṛhatvagiti vikhyātaḥ śabdaiḥ paryāyavācakaiḥ ॥

(Abhidhāna mañjarī)

सप्तपर्णः शुक्तिपर्णच्छत्रपर्ण सुपर्णकः ।

सप्तच्छदो गूढपुष्पस्तथा शाल्मलिपत्रकः ॥

(धन्वन्तरि निघण्टुः)

Saptaparnah suktiparnas'chatraparnah suparnakah ।

Saptacchado Gūḍhapuṣpastathā śālmalipatrakah ॥

(Dhanvantari nighaṇṭu)

Sapta parna meaning seven leaves indicates the whorl of seven leaves at each node, *bahuparna* – numerous leaves, *viśamacchadah* = having leaves in odd numbers (seven) *viśālatvak* and *bṛhatvak* indicates the thick or stout bark, *gucchapuṣpa*, the flowers occurring in clusters and *śāradah* means flowering in autumn.

Properties and uses.

सप्तपर्णो व्रणश्लेष्मवातकुष्ठस्रजन्तुजित् ।

दीपनः श्वासगुल्मघ्नः स्निग्धोष्णस्तुवरः सरः ॥

(भावप्रकाशः)

“Saptaparnō vṛṇa śleṣma vātakuṣṭhāsrajanṭu jit

Dīpanaḥ svāsagulmaghnaḥ snigdhoṣṇastuvaraḥ saraḥ ॥

(Bhāva prakāśaḥ)

सप्तच्छदो वातकफौ गयेत् कुष्ठज्वरादिकान् ॥

(हृदयप्रिये)

Saptacchado vātakaphau jayet kuṣṭhajvarādikaṇ ।

(Hṛdayapriyaḥ)

सप्तपर्णस्तु तिक्तोष्णस्त्रिदोषघ्नश्च दीपनः ।

मदगन्धो निरुन्धोऽयं व्रणरक्तामयकृमीन् ॥

(राजनिघण्टुः)

Saptaparnastu tiktoṣṇastridoṣaghnaś'ca dīpanaḥ

Madagandho nirundheyfam vṛṇaraktāmayakṛmīn ॥

(Rāja nighaṇṭu)

Sapta parnah overcomes or is useful in ulcer, *kapha*, *vāta*, leprosy, *vātarakta*, and parasites, promotes digestive power, cures asthma etc. and phantum tumour, is demulcent, hot, astringent in taste and laxative (having permeating action).

Caraka has grouped this under drugs curing leprosy and *udara*. Leaf, stembark, rootbark and milky exudate are used in medicine. A decoction of the bark with pepper is found very effective in intermittent fevers.

***Alstonia scholaris* R. Br.**

(Apocynaceae)

Malayālam	Mukkampāla, Ezilappāla, Pāla
Tamil	Elilaipālai, Mukkampālai, Palai
Hindi	Satium, Chhatram.

Distribution and habitat.

Fairly common throughout India in most of the deciduous and evergreen forests from sea level to about 2000 feet. It is very common in Travancore-Cochin.

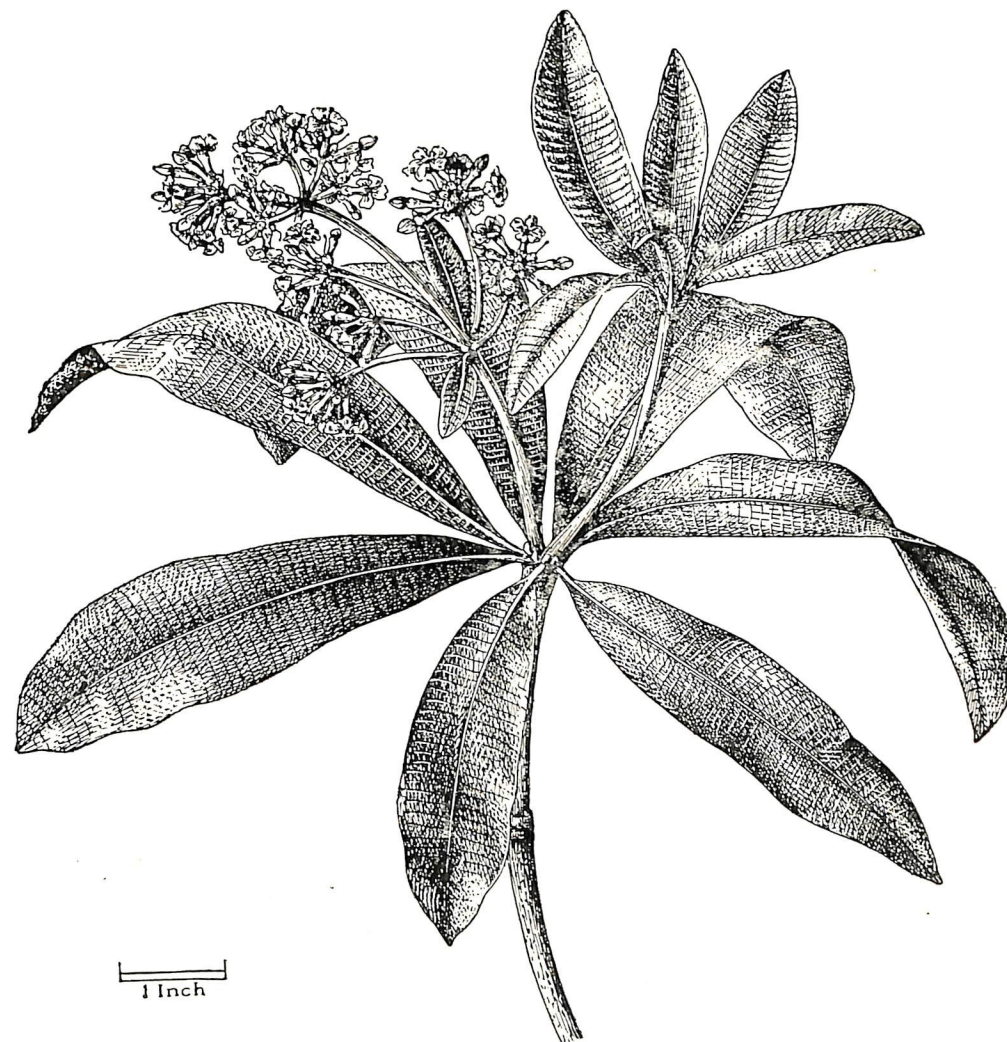
Habit and general features.

Alstonia scholaris R. Br. is a very large evergreen tree, sixty to eighty feet or more in height, with a tall unbranched bole three feet or more in diameter, in most cases prominently buttressed at base, and the branches in three or more tiers, arranged in whorls; bark of trunk and older branches thick, dark grey to greyish brown, somewhat rough, lenticellate and abounding in bitter milky latex; the branchlets profusely lenticellate, with whorls of five to seven smooth shining pinnately parallel coriaceous leaves. Flowers numerous, small, greenish white in corymbose umbellate panicles, and very strongly scented. Flowers during November, December and January.

External morphology.

Leaves: simple, short petioled, in whorls of four to seven elliptic-oblong, oblanceolate or oblong-lanceolate 4" to 8" long and 1 to 2½" broad, base acute, apex obtuse rounded or obtusely acuminate or rarely emarginate, entire, coriaceous, upper surface bright green and shining, lower surface paler and with whitish bloom, midrib prominent, with nearly sixty pairs of fine, slender, subdued, closely parallel, transverse nerves connected distally to an intra marginal nerve. *Petiole* stout, less than a quarter inch long, with an intra-petiolar stipule.

Flowers: almost sessile or sub-capitate, numerous, small, about half an inch long, greenish white, pubescent, regular, bisexual and very strongly scented, arranged in nearly globose composite corymbose umbellate cymes at the ends of the branches of erect terminal or subterminal panicles three to five inches long. Peduncle one to three inches long, often occurring in groups of three or four. *Calyx* about one

*Alstonia scholaris* Brown.

tenth of an inch long, gamosepalous, pubescent, with a short tube and five, glandular oblong obtuse ciliate lobes, which are imbricate in bud. *Corolla* salver-shaped, one third to half an inch in diameter, five lobed; tube cylindric, dilated opposite the stamens and devoid of scales; *throat* villous or hairy within; lobes rounded, twisted in bud. *Stamens* five included within the tube near the upper end with very short epipetalous filaments and oblong lanceolate acute anthers which are cordate at base. Disc annular or two lobed, the lobes alternating with the carpels. *Pistil* bicarpillary; ovaries distinct, hirsute with a common filiform style ending in an oblong or cylindric bifid stigma. *Ovules* many seriate, in each carpel.

Fruit a pair of pendulous, linear, very narrow, terete, follicular mericarps, one to two feet long and about one eighth of an inch thick. *Seeds* many, about one third inch long, peltately attached, linear, oblong, flattened and slightly grooved, somewhat rough and with tufts of very fine, silky brownish hairs at each end. *Testa* thin, rough and generally papillose; albumen scanty, *cotyledons* oblong, radicle superior.

Official part: The stem bark (popularly known as *dita* bark) root bark, leaves and milky exudate.

The bark is dark slate grey to greyish brown, but this basic colour is very often masked by patches of lichens that give a mottled effect to the entire bark. The external surface is uneven and rough due to formation of vertical fissures of varying lengths, prominent transverse lenticels bordered by a cream coloured spongy tissue and partial exfoliation of the outer rind in flakes of different size and thickness. The thickness of the entire bark varies from a quarter to half an inch or more, according to the age and size of the branch or trunk. In the fresh condition its inner surface is cream white but the colour gradually turns pale brown on exposure. The outer bark or rind is one tenth to about one fourth of an inch in thickness, slightly hard and brittle and can be easily separated or peeled off in thick flakes, exposing smooth cream yellow patches. It is devoid of any special taste or smell. In transverse sections the rind has a light cream yellow colour and is faintly lamellated. The officinal tissue is fairly thick, and can be differentiated into a narrow cream white to light yellowish brown region nearest the rind, a very broad, intermediate gritty region speckled with

numerous light brown spots or small patches and a whitish leathery inner region from which exudes plenty of latex when cut.

Taste: The officinal part especially the middle bark, is gritty, and bitter to taste.

Histology of stem bark.

Transverse sections of twigs and young branches show the following details:

- (i) The section is nearly circular with regular outline.
- (ii) There is a peripheral zone of *cork* composed of ten or more rows of thin walled narrow rectangular cells, two to three times as long as broad. Some of the cork cells contain cubical or rectangular crystals of calcium oxalate.
- (iii) The *phellogen* consists of one or rarely two rows of very narrow rectangular cells.
- (iv) The *phelloderm* is formed of comparatively broad tangentially elongate cells some of which contain crystals. Regularly spaced groups of polygonal cells containing chloroplasts occur in this region, each group being formed of 5, or 3-10 cells.
- (v) The *cortex* is composed of twenty to thirty rows of somewhat closely arranged thin walled spherical or oblong cells.
- (vi) The *bast* is composed mostly of regular thin walled phloem elements and medullary rays, in addition to a very limited number of small three to four celled groups of sclerenchyma, and latex tubes. The medullary rays are narrow and uni or biseriate, and their cells are richly loaded with simple spherical starch grains.

Histology of old bark

In old barks the *phellem* is considerably thick, with deep indentations and truncated pyramidal projections. It is composed of eighty to hundred or more rows of narrow rectangular cells with fairly thick light or cream yellow walls. Several of the cork cells contain cubical or rectangular crystals of calcium oxalate. Within the cork zone there is a well defined *phellogen* of narrow cells, followed by a few rows of newly formed thin walled tangentially elongate, broadly rectangular, *phelloderm* cells. The older *secondary cortex* is composed of large, thin walled nearly cubical to

rectangular cells and several groups of cubical to oblong sclereid-like cells, with fairly thick pitted walls, the thickness of which varies in different groups. These groups are of varying sizes irregular in outline and densely scattered through out the region. The pits in the walls are fewer when compared to those of typical stone cells. The *bast* consists of radial segments of phloem and medullary rays. Cut ends of several latex tubes can be distinguished amidst the phloem parenchyma. The elements of phloem are of the usual type and narrow tangential strips of collapsed elements, occur in the older portions. The medullary rays are uni or biseriate, their cells being rectangular and radially elongate in the portions nearer the wood but broader towards their distal ends. All the cells are filled with small simple, spherical starch grains.

Distinguishing features

A. Morphological.

1. The bark is dark slate grey to greyish brown, but often mottled with ash grey patches of lichens, and the surface is rough with deep fissures and warty lenticels.
2. The entire bark is fairly thick.
3. The rind or outer bark is slightly hard and brittle and easily separated and the cut surface is cream yellow.
4. The officinal tissue is fairly thick. Its outer part is gritty and appears speckled with numerous spots in transverse sections. The inner portion is whitish, leathery and when cut or wounded in the fresh condition, exudes plenty of latex.

B. Anatomical

1. The *phellem* is somewhat thick, deeply fissured and composed of eighty to hundred or more rows of narrow rectangular cells, with fairly thick, light yellow walls. Some of the cells contain calcium oxalate crystals.
2. The secondary cortex is fairly broad. The cortical parenchyma is composed of thin-walled cubical, broadly rectangular, and oblong cells. Irregular densely scattered aggregates of sclereid like cells with pitted walls of varying thickness also occur in this region.

3. The bast consists of radial segments of phloem and narrow medullary rays. Cut ends of several latex tubes can be made out in the phloem parenchyma. Collapsed strips of phloem occur in the old portions.

4. The ray cells are fully packed with small simple spherical starch grains.

C. Taste and odour

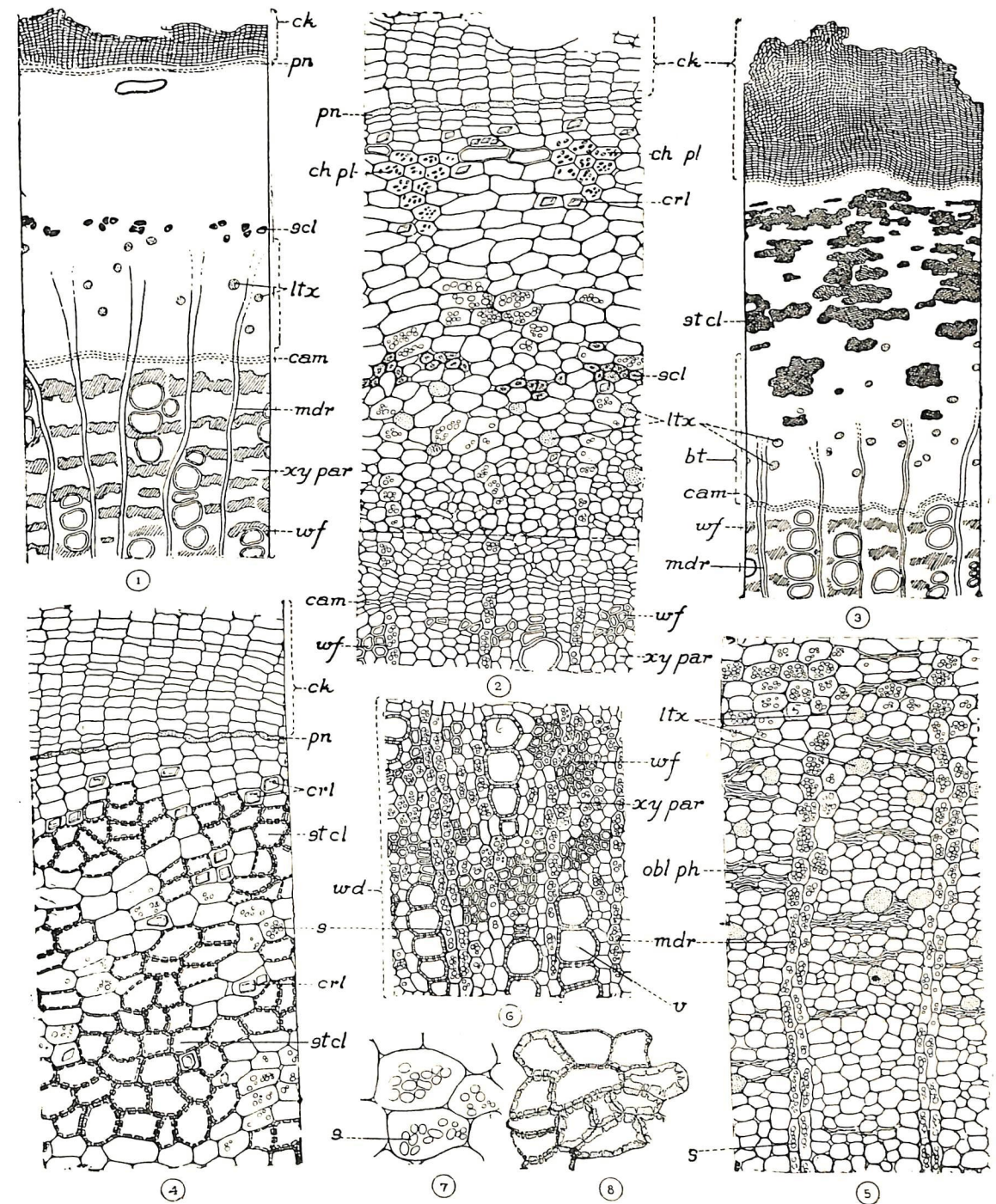
The officinal part of the bark is gritty with a bitter taste and devoid of any special odour.

PLATE XX

Alstonia scholaris

Histology of stem bark

- Fig. 1. Diagrammatic sketch of a segment of young bark with wood.
 2. Details of structure of the tissues.
 3. Diagrammatic sketch of a segment of the T. S. of old bark.
 4. Structure of cork and cortex.
 5. Structure of the bast region.
 6. Structure of wood.
 7. Cortical cells enlarged to show starch grains.
 8. A stone cell group enlarged.



Alstonia scholaris
 Histology of stem bark

LAKSMANA

Source plant in Travancore-Cochin*

Ipomaea sepiaria Koenig.
Convolvulaceae.

Sanskrit Text

Descriptive synonyms

पुत्रकाकारस्तल्पविन्दुभिर्लीञ्छितछदा
लक्ष्मणा पुत्रजननीवस्तगन्धाकृतिर्भवेत् ॥

(भावप्रकाशे)

Putrakākararaktālpa
Bindubhirlāñchitachadā
Lakṣmaṇā putrajananī
Bastagandhākṛtīrṭirbhavet.

(Bhāvaprakāśa)

लक्ष्मणा पुत्रजननी नागपत्नी च पुत्रदा ।
लक्ष्मणा पुत्रकन्दा च पुत्रदा नागिनी तथा ॥
नागह्वा नागपत्नी च तुलिनी मक्षिका च सा ।
अस्तविन्दुछदा चैव सुकन्दा दशधाह्वया ॥

(अभिनवबुटीदर्पण)

Lakṣmaṇā putrajananī nāgapatrī ca putradā
Lakṣmaṇā putrakandā ca putradā nāginī tathā
Nāgahvā nāgapatrī ca tulini makṣikā ca sā
Asrabinducchadā caiva sukandā dasadhāhvayā

(Abhinava Būṭī Darpaṇa)

* *Ipomaea sepiaria* Koenig (called *cuttittrutali* in Malayalam) and *I. obscura* Kergaul (tirutali in Malayalam) are both used as laksmāna, here the latter often as a substitute. The plant equated as *laksmāna* in most books on Indian materia medica is however *Atropa mandra gora* Linn. *Mandragora officinalis*. *Ipomaea obscura* Kergaul is equated as vacagandha by Kritikaṛ and Basu.

लक्ष्मणा क्लीतनी लक्ष्मी लघुपर्णी रविप्रिया ।
कलङ्कपर्णी स्थलजा प्राणाचार्यैः प्रकीर्तिता ॥
या लक्ष्मीर्जलजा सा स्यान्मधुपर्णी मधूलिका ।

(अभिधानमञ्जरी)

Lakṣmanā kṛitani lakṣmī laghuparṇī ravipriyā
Kaṭankaparṇī sthalaja prāṇācāryaḥ prakīrtitā
Yā lakṣmīrjalajā sā syānmadhuparṇī madhulikā

(Abhidhāna Mañjarī)

गोक्षिरसदृशं पुष्पं रोमवल्लीसमन्वितम् ।
रक्तविन्दुसमं पत्रं लक्ष्मणाकारमुच्यते ॥

(मदनपालनिघण्टुः)

Gokṣirasadr̥śam puṣpam romavallīsamānvitam
Raktabindusamam patram lakṣmaṇākāramucyate

(Madanapāla Nighaṇṭu)

Lakṣmaṇa is grouped under mantrākandah (big rhizome) in Rājanighaṇṭu. It is described as white and growing in the mountains.

Lakṣmaṇa means possessed of lucky signs or marks, *putradā* = child giver; the terms *raktālpabindubhirlāṇ chitachadā*, *asrabinduchadā*, *raktabindusamam patram* indicate presence of blood like (reddish) marks on leaves; *romavallī samānvitam* hairy nature and *kanda* presence of rhizome *Kalankaparṇī* = having dirty (?) marks on leaves; *gokṣīrasadr̥śam puṣpam* = flowers like cow's milk (white). Abhidana mañjarī mentions a watergrown (Jalajā) variety. Though either in *Ipomaea sepiaria* or *I. obscura* all the above marks are not clearly seen in leaves of *I. sepiaria* reddish brown patches occur and flowers of *I. obscura* are yellowish or white.

Properties and uses.

कथिता पुत्रदावश्यं लक्ष्मणा मुनिपुङ्गवैः ।

(भावप्रकाशे)

Kathitā putradāśvāsyam lakṣmaṇā munipungavaḥ

(Bhāva Prakāśa).

लक्ष्मणा मधुरा शीता स्त्रीवन्ध्यत्वविनाशिनी ।
रसायनकरी बल्या त्रिदोषशमनी वरा ॥

(राजनिघण्टुः)

Lakṣmaṇā madhurā śītā strivandhyaiva vināśini
Rasāyanakārī balyā tridoṣasāmanī varā

(Rāja Nighaṇṭu)

लक्ष्मी पित्तहरा वातश्लेष्मला भूतिगर्भदा ।

(हृदयप्रियः)

Lakṣmī pittaharā vātas'leṣmaḥ bhūtigarbhadā

(Hṛdayapriya)

All the authors are unanimous that *Lakṣmaṇā* cures sterility in women. This claim is supported by the experience of many physicians though controlled clinical statistics are not available.

Lakṣmaṇa is also cool, toning, promotes bodily strength corrects vitiation due to *tridoṣa*, reduces *pitta* and promotes *vāta* and *s'leṣma*.

***Ipomaea sepiaria* Koenig**

(Convolvulaceae)

Malayālam Cutti-tirutālī, Tiru-tālī.

Tamil ... Tālī-kodi, Tālī-kirai Mangikai (K. & B.)

Hindi Bankalami (K. & B.)

Distribution and habitat.

This plant occurs throughout India in the plains, especially near the coast and up to an elevation of about 500 feet in the hills. It grows commonly over hedges and thickets often near water margin, on banks of streams and rivers.

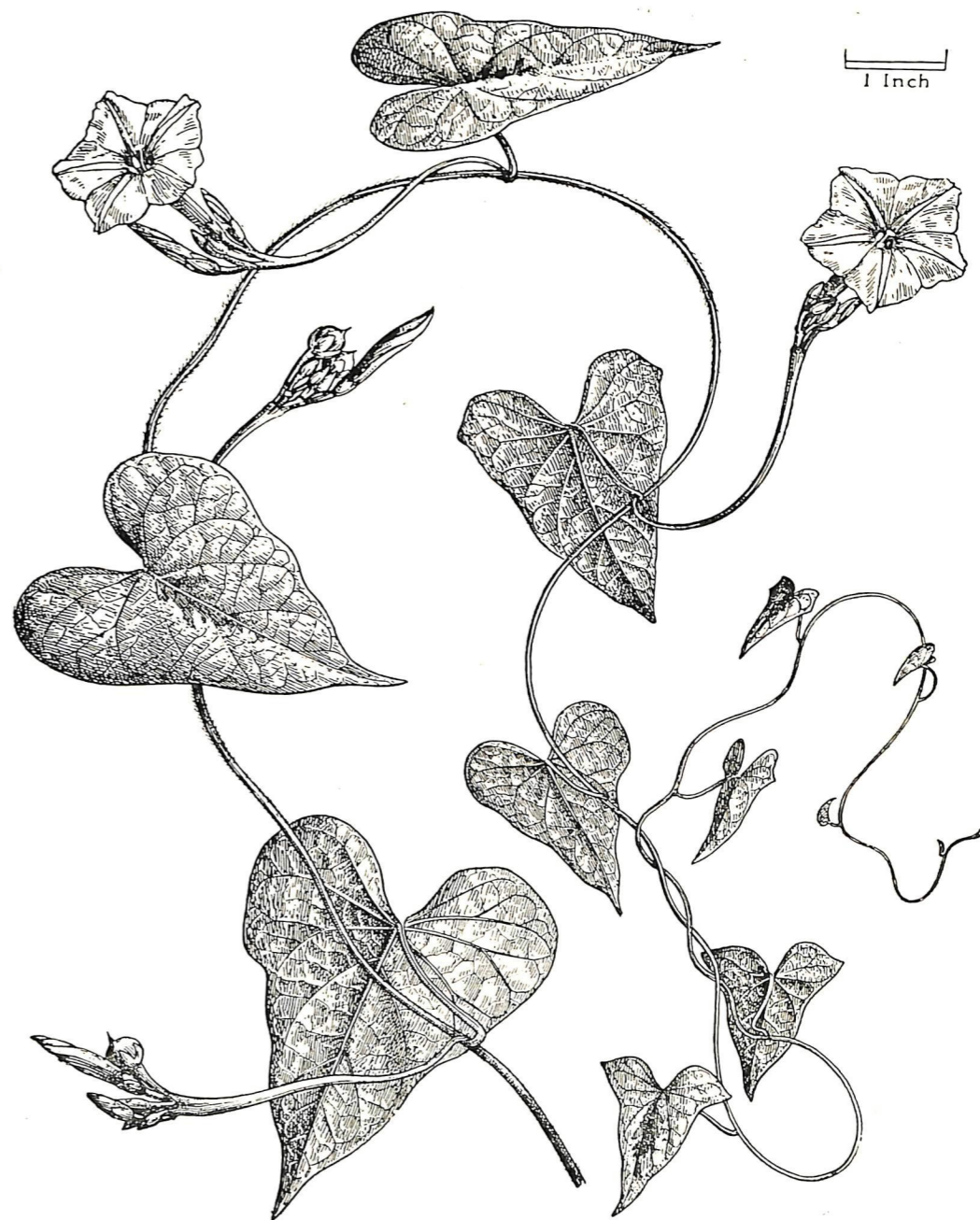
Habit and general features.

Ipomaea sepiaria is a glabrous or occasionally pubescent or hirsute, slender twiner with a slightly thickened or tuberous perennial root and very short stem producing annually or seasonally a number of terete villous, greyish purple branches bearing simple, cordate or ovate-cordate, variable medium sized leaves, very often blotched with dull purplish patches in the centre and pink to purplish flowers in cymose clusters on fairly long thickened clavate peduncles.

External morphology.

Leaves: alternate, petioled, one to three inches long and three quarters to two inches broad, usually glabrous or rarely somewhat pubescent, ovate-cordate, with a wide sinus and rounded basal lobes, to hastate with acute lobes, entire, sinuate or rarely lobed, acute at apex and most often blotched with brownish or purplish brown patches towards the centre. The hastate leaves are usually narrower, being only half to one inch broad and indented at the sides. *Petiole* one to two inches long.

Inflorescence a cymose subumbellate cluster of two to twelve or more flowers on a long thickened clavate smooth round axillary peduncles as long as or more often longer than the leaf, in which case it may vary from 4-9 inches.

*Ipomaea sepiaria* Koen.

Flowers pedicelled, showy, light pink to purplish, with purplish tube. *Pedicels* short 0.1 to 0.5 inch long, but become thicker and clavate in fruit. *Bracts* small, lanceolate and caducous. *Sepals* five, ovate or broadly elliptic, obtuse, sub obtuse or shortly apiculate, glabrous with membranous margin; the outer two slightly shorter scarcely 0.25 inch long and rugose outside. *Corolla* one and a half to two inches long, light pink, purple or rarely white with a dark eye; tube about one inch long, cylindric or tubular, funnel shaped, dark purple within, mouth abruptly widened; *limb* five lobed and five plaited with the lobes acute and shortly apiculate with shortly lobed margins. *Stamens* five, unequal, filaments filiform, included and hairy anthers at base, oblong. Disc annular. *Ovary* two celled and four ovuled with filiform style ending in two globose stigmatic lobes.

Fruit an ovoid capsule one fourth to one third inch in diameter, seeds four, 0.15 inch long, grey, minutely tawny and velvety.

Official part: The root.

Description of the root.

The root system consists of a fairly long, somewhat thickened taproot and several slightly thinner or slender branches, arising from its base with very few wiry rootlets. The main roots are light brown to slate grey with smooth non-lenticellate surface. The surface skin is soft, very thin and easily scrapable. The living tissue within is whitish when fresh, but exposure to air quickly turns it grey. It has a starchy sweetish taste with slight acidity. The centre of the root is occupied by a strong cord of woody tissue.

Histology.

The root is nearly circular in cross section with regular outline. The phellem is very narrow and consists of two to four rows of somewhat broadly rectangular cork cells with light brown walls. A distinct phellogen can be made out. The cortex is comparatively wide and formed of fifteen to twenty or more rows of large oblong thin walled cells, with irregular spaces. The majority of the cells are densely packed with starch grains. Several of the cortical cells contain spheric crystals. The cortex merges imperceptibly with a narrow band of phloem which is composed only of sieve tubes, companion

cells and parenchyma, mechanical elements being generally absent. The wood shows in most cases three or four broad prominent medullary rays starting from the centre and alternating with broad wedges of xylem containing several uniseriate rays. The xylem is composed mostly of large sized vessels and fibres, parenchyma being proportionately less. The cells of the medullary rays are thin walled and packed with starch. There is no pith in the centre.

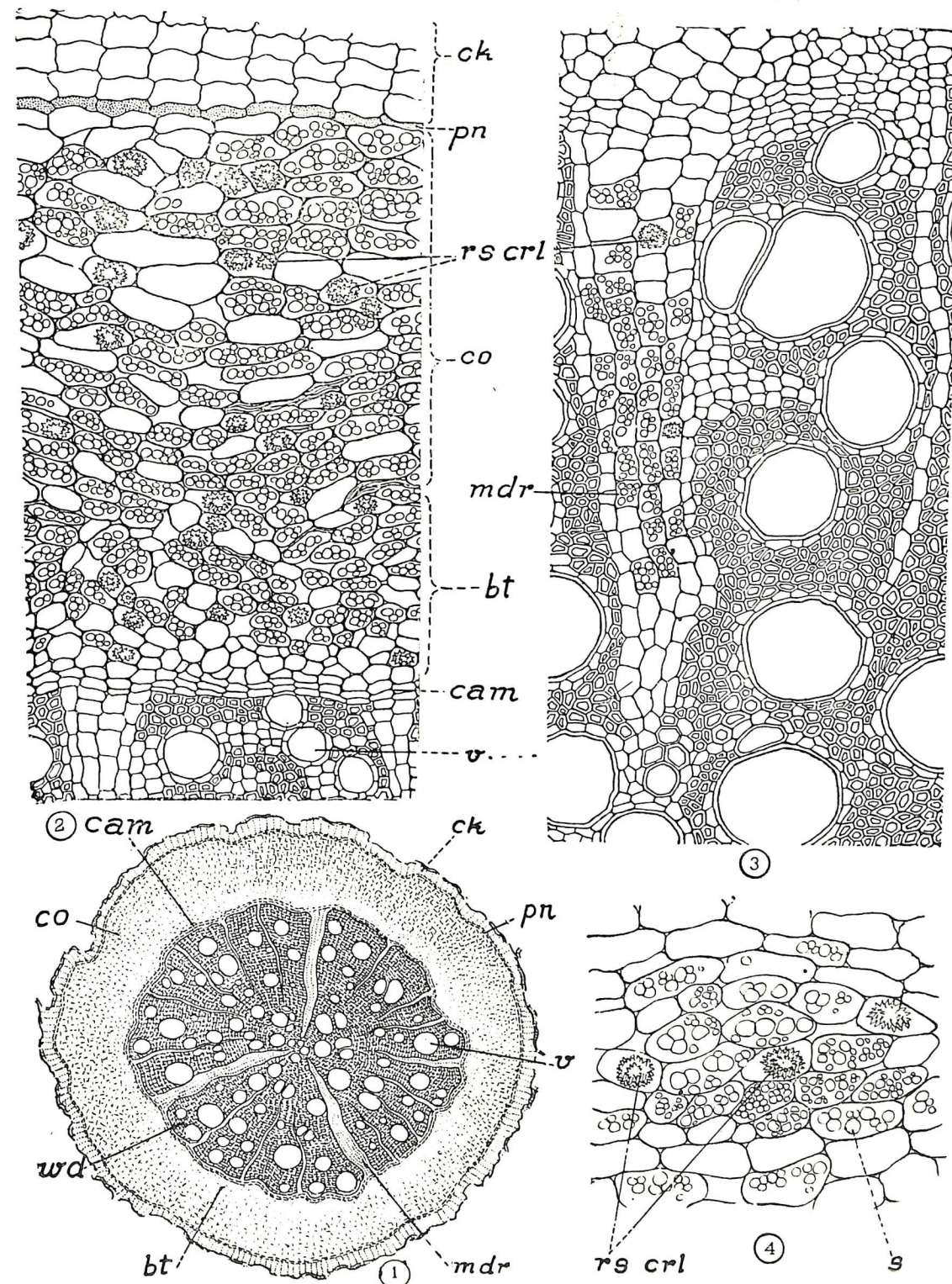
PLATE XXII

Ipomea sepiaria

Histology of root

Fig. 1. Diagrammatic sketch of T. S. of the root.

- Details of structure of the different tissues in the root bark.
- Structure of the wood region.
- A few cortical cells enlarged to show the crystals of calcium oxalate and starch grains.



Ipomea sepiaria

Histology of root

Ipomaea obscura Ker Gaul*

Malayalam	....	Tirutali, Cerutali
Tamil	....	Cirutali, Sirutali, Karugutali.
Hindi	....

Distribution and habitat.

This plant occurs all over India in the plains and low hills from sea level to 3000 ft. Though it is not very conspicuous it is one of the commonest of the Ipomaeas found on hedges and other supports.

Habit and general features.

More or less glabrous twining or trailing annual or occasionally perennial herb, with short stem and elongate slender wiry dark purplish branches about 1-2 mm. thick and up to four feet long, bearing simple, alternate cordate acuminate entire or undivided, thin glabrous leaves and generally solitary axillary yellowish or rarely white showy flowers with purple eye.

External morphology.

Leaves simple, alternate, exstipulate, broadly ovate-cordate, entire, nearly glabrous, deeply cordate at base, thin or membranous, pale bluish green above, glaucous beneath, one to two and a half inches long and nearly as broad. *Petiole* one to three inches slender and longer than the leaf.

Flowers: about one inch across, yellowish or white, showy, pedicelled, generally solitary or occasionally cymose clusters of two to three at the ends of axillary peduncles. *Peduncle* slender as long as or slightly longer than the petioles, one to two and a half inches long. *Pedicels* half to one and a half inches long, somewhat thick and articulated with the peduncle. *Bracts* linear lanceolate about $\frac{1}{8}$ inch long and sub-persistent. *Sepals* five, about 0.4 inch long, subequal, ovate-oblong, acute, apiculate, glabrous or puberulous, slightly wrinkled, the outer two shorter, occasionally slightly enlarged or broadened and reflexed in fruit. *Corolla* funnel-shaped, $\frac{3}{4}$ to 1 inch

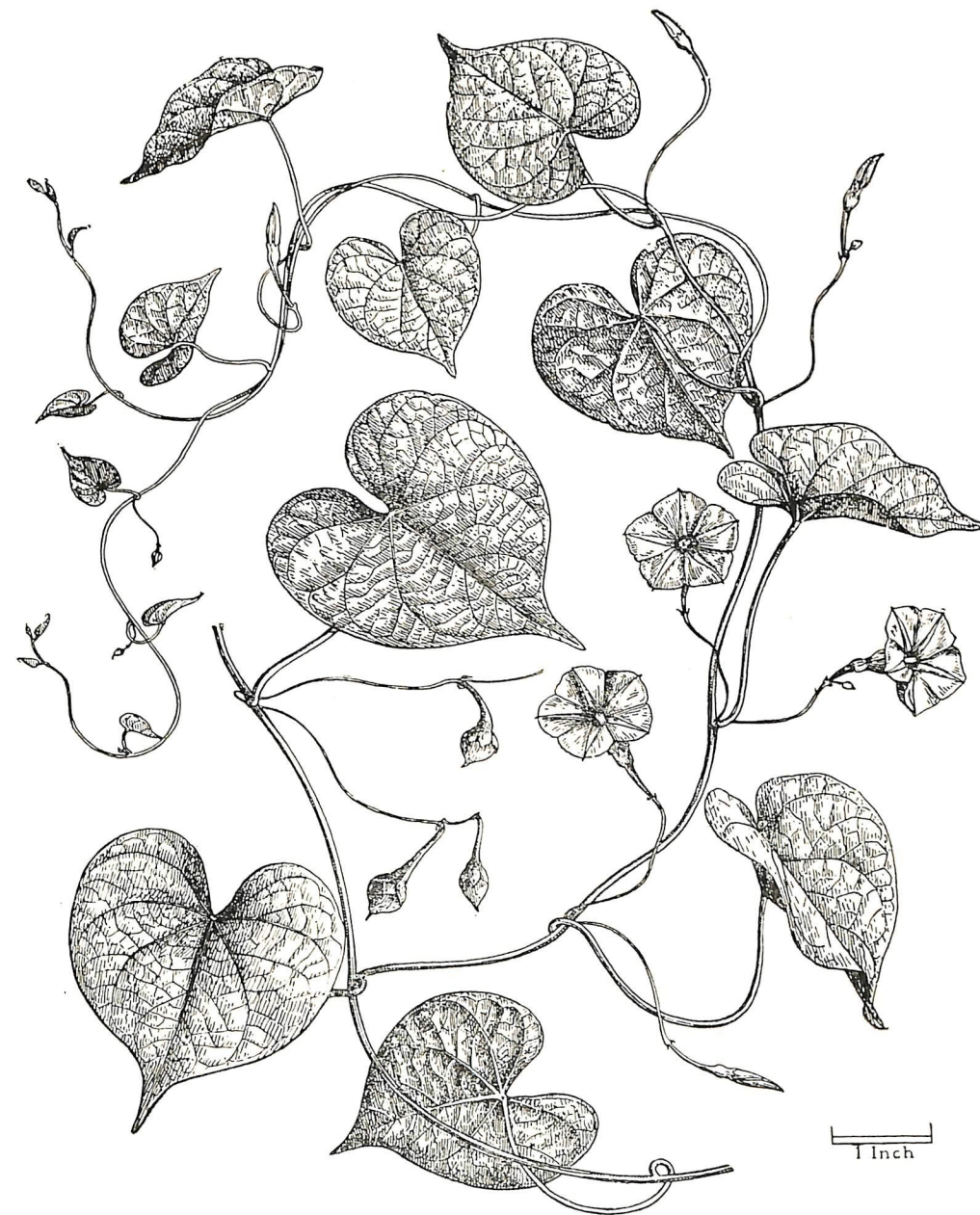
* Kirtikar and Basu in "Indian Medicinal plants" 2nd edition Vol. III, p. 1722-23 equate I. obscura as Vachagandha.

and about one inch across, light yellow or white with the base of the tube purple and more or less glabrous; *tube* narrow, mouth wide, limb shortly lobed, with five yellowish plaits; *stamens* five unequal and included: *filaments* filiform, dilated at base; anthers oblong, pollen grains spinulose; *Disc* annular *Ovary* 2 or rarely imperfectly four-celled near the base, four-ovuled, with filiform style ending in a capitate or bi-globose stigma.

Fruit an ovoid, sub acute, glabrous, two-valved, normally four seeded capsule, about one third inch long with thin dry pericarp. *Seeds* brown or dark brown, densely softly velvety, cotyledons crumpled and bilobed.

Official part: Root.

The root system consists of a strong tap root growing deep into the soil, with few lateral roots and wiry rootlets. The taproot is mostly unbranched, one to two or three feet long and a quarter to half inch thick, according to the age of the plant, nearly cylindrical or sometimes slightly ribbed, light or pale brown and with a smooth surface. The surface skin is very thin soft and easily separable. The entire bark is comparatively thin. The living bark has a cream white to light yellowish colour, a faint characteristic odour and a starchy taste. The central strand of food forms the bulk of the root.



Ipomaea obscura Ker.

LODHRAH

Source plant in Travancore-Cochin*

Symplocos spicata Roxb.
Symplocaceae

Sanskrit Text

Descriptive synonyms

लोध्रस्तिल्वस्तिरीटश्च शावरो गालवस्तथा ।
द्वितीयः पट्टिकालोध्रः क्रमुकः स्थूलवल्कलः ॥
जीर्णपत्रो बृहत्पत्रः पट्टी लाक्षाप्रसादनः ॥

(भावप्रकाशः)

Lodhra stilvastirīṭas'ca śābaro gālavastatha
Dvitiyah pattikalodhrah kramukah sthūlavalkalah
Jīrṇapatro brahatpatrah pattilakṣāprasādanah
(Bhāvaprakāśah)

लोध्रो रौध्रः शावरकस्तिल्वकस्तिलकस्तरुः ।
तिरीटकः काण्डहीनो भिल्ली शंबरपादपः ॥

(धन्वन्तरी निघण्टुः)

Lodhro rodhrah sabarakastilvakastilakastaruh
Tirīṭakah kāṇḍahīno bhilli sabarapādapah
(Dhanvantari nighaṇṭuh)

लोध्रस्तरुस्तिरीटो बहुलत्वक् तिल्वको महालोध्रः ।
नेत्रप्रसादनाहो व्रणसादी कामहीनश्च ॥

(अभिधानमञ्जरिः)

*. Most of the books on Indian Materia Medica equate *Symplocos racemosa* Roxb. as well as *S. crataegoides* Ham, as the botanical source of *Lodhrah* or *Rodhrah*. *Desmodium pulchellum* Benth, an undershrub belonging to Papilionaceae has been equated as *Lodhra* by Rama Rao (Flowering plants of Travancore), and by Sir R. N. Chopra (Indigenous drugs of India), but does not seem to be used as the source of *Lodhra* in T. C. State.

Lodhrastarustiriṭo bahulatvak tilvako mahālodhrah —
Netraprasādanāhvo vranasādī kāmāhinas'ca ॥

(Abhidhāna mañjarī)

शावरकलोध्रमपरं सितलोध्रं वक्रलोध्रं च ।
विज्ञेयमक्षिलोध्रं तत् परमप्यक्षिभेषजं चेति ॥
तदेव वल्कलाहं च तथातीसारभेषजम् ।
श्वेतलोध्रं हि कथितं शब्दैः पर्यायवाचकैः ॥

(अभिधानमञ्जरीः)

S'ābarakalodhramaparam sitalodhram vakralodhram ca |
Vijñeyamakṣilodhram tat paramapyakṣibheṣajam ceti ॥
Tadeva valkalāhvam ca tathātīsāra bheṣajam |
S'vetalodhram hi kathitam sabdaiḥ paryāyavācakaiḥ ॥

(Abhidhāna mañjarī)

Lodhrah (rodhrah) means stopping (diseases); *tilvah* = that which causes demulscence (*til snehane*); *sthūlavalkalah* = having thick bark.

Properties and uses.

लोध्रो ग्राही लघुः शीतश्चक्षुष्यः कफपित्तनुत् ।
कषायो रक्तपित्तासृग्ज्वरातीसारशोथहृत् ॥

(भावप्रकाशः)

Lodhro grāhī laghuḥ sitascakṣuṣyaḥ kaphapittanut
Kaṣāyo raktapittā srgjvarātīsāra sōphahr̥t

(Bhāva prakāśaḥ)

कफपित्तप्रमेहघ्नौ लोघ्नौ नेत्रहितौ हिमौ ।
तत्र श्वेतो गुणोत्कृष्टः शावरोऽनुगुणोऽस्य च ॥

(हृदयप्रियः)

Kaphapittapramehaghnau lodhrau netrahitau himau
Tatra sveto gunotkr̥ṣṭaḥ śābaro'nuguno'sya ca ॥

(Hṛdayapriyaḥ)

Lodhra is arresting (constipating), *laghu* = (light) *s'ita* = cool;
cakṣusyah = agreeable to the eye, overcomes *kapha* and *pitta*, is astringent
and is useful in *rakta pitta*, *vata rakta*, fever, diarrhoea and oedema

लोध्रयुग्मं कषायं तु शीत वातकफास्रजित्
चक्षुष्यं विषहत्तत्र विशिष्टो वल्करोध्रकः ॥

(राजनिघण्टुः)

Lodhrayugmam kaṣāyam tu sītam vāta kaphāsrajit
Cakṣuṣyam viṣahr̥ttattra viśiṣṭo valkarodhrakah

(Rāja nighaṇṭuḥ)

According to Rāja nighaṇṭu it is effective in poison also.

The white variety * (?) is more effective in eye diseases. The one with redflowers is more commonly used in vaginal diseases and ulcers. Both have got astringent action. Decoction of bark gives relief in *upakūṣa* (a disease of the mouth) by gargling.

Symplocos spicata* Roxb

(Symplocaceae)

Malayālam ... Paccotti
Tamil ... Kambhivetti. Vella-lothi

Distribution and Habitat.

This plant is found in most parts of India and has been recorded from Kumaon to Bhutan, Assam, Martaban, E. Bengal, hills of Tenasserim, Eastern Ghats, hills of Vizagapattam, Carnatic, Shevroy hills, Kollimalai hills and the Western Ghats. It grows well in the evergreen forests, ravines, and sholas up to about 3000 feet, and is also occasionally met within the plains of Travancore-Cochin.

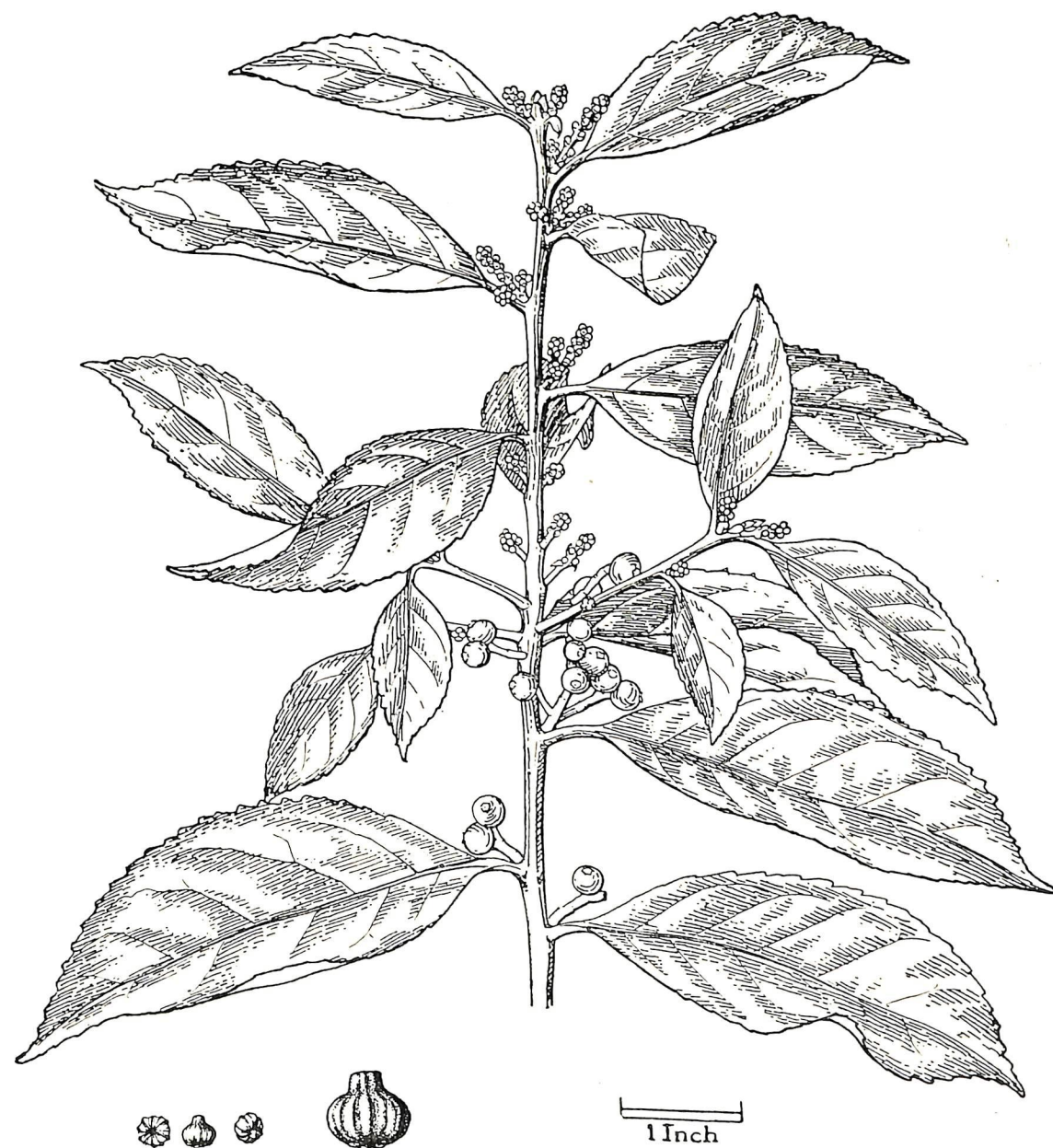
Habit and general features.

Symplocos spicata Roxb. is usually a medium sized tree or large shrub in the plains, but in sholas it often reaches a height of 60 ft., and a girth of 6 ft., with simple, nearly sessile, alternate, elliptic-lanceolate shiny, coriaceous leaves and small, sessile, regular, white, fragrant flowers arranged in short compact clusters on axillary spikes which are often branched. The plant flowers from December to May or occasionally twice a year. Fruits are found usually from April to June.

External morphology.

Leaves simple, alternate, exstipulate, sessile or very short petioled, up to seven inches long and two and a half inches broad, elliptic lanceolate or broadly lanceolate, cuneate at base, obtuse, to shortly acuminate at apex, irregularly crenate, serrulate or rarely entire and coriaceous, with the midrib and lateral nerves impressed.

Flowers small, sessile, bisexual, regular, white or yellowish-white, and fragrant; and arranged in close clusters of ten to twelve, on three branched or rarely paniced, glabrous or obscurely rusty pubescent, axillary spikes, two to four inches long. *Bracts* and *bracteoles* small, ovate, obtuse, persistent and almost enveloping the calyx-tube in the flower stage. *Bracts* rusty tomentose and slightly larger than the two bracteoles, which are partially connate, hairy and whitish. *Calyx tube* adnate to the ovary, short, with five ovate, obtuse, or



Symplocos spicata Roxb.

* *Symplocos spicata* Roxb., is the botanical source of *Lodhra* in Travancore-Cochin.

round, glabrous or slightly pubescent, imbricate spreading lobes, about $1/20$ inch long. *Corolla* whitish, fragrant, split almost to the base into five lobes each of which is about one-eighth of an inch long. *Stamens* many (from 15-40) with ovoid, globose two celled anthers; *ovary* inferior, generally three celled with an epigynous brownish annular fleshy disc: *ovules* two to four, pendulous from the inner angle of each cell: *style* filiform, arising from the centre of the disc and terminating in a capitate or slightly lobed stigma.

Fruit: drupaceous; globose or ampuliform, faintly twelve ribbed, about a quarter of an inch in diameter, glabrous and dark purple when ripe, and surmounted by a very short cylindric calyx tube. The endocarp is thick, hard, woody and ribbed. *Seeds* one to three, oblong, with thin testa, fleshy albumen and a curved embryo.

Official part: Stem bark.

Description

Bark of young branches are greyish green to slate grey, with smooth soft and easily scrapable thin skin, that of the trunk and older branches are grey or slate grey, but the basic colour is often masked to a large extent by ash white patches of crustose lichens and the surface is generally smooth and without prominent lenticels, cracks or fissures. Occasionally faint cracks are noticeable and this is probably due to some pathological condition.

The entire bark is comparatively thin, varying from a tenth of an inch in the case of the smaller branches to about half an inch in older branches and trunks. The outer bark is quite thin and in the fresh condition soft and scrapable, but adheres very firmly to the underlying tissue on drying. Beneath this layer there is a very thin zone of light greenish tissue which appears as a thin streak in transverse sections, but not clearly recognisable in dry bark. The middle and inner barks together comprising the officinal tissue has a very light brown colour and a minutely granular structure. The bark breaks with a short fracture and the exposed surface shows a number of short, thin projecting fibre-tips.

The fresh bark is slightly astringent and feebly bitter but has no characteristic odour.

Histology.

The *cork zone* is composed of a very limited number of rows of thin walled rectangular cells. The *cork cambium* is distinct and is followed by ten to fifteen or more rows of thin walled oblong chlorenchymatous cells, some of which contain starch grains also. The *cortex* is composed of regular thin walled spherical and oblong cells, almost all of which are loaded with starch grains. Cubical and rhomboidal crystals are present in a number of them. The *bast* forms the thickest part of the bark and is composed of narrow radial segments of thin walled phloem elements alternating with narrow, one to three seriate medullary rays. Cubical or rhomboidal crystals are present in a large number of parenchyma cells in the phloem. A characteristic feature of this region is the presence of many radially elongated groups of stone cells which are scattered over the entire area. The stone cells are spherical, oblong, elliptical or radially elongate and have thick pitted walls. Occasional sparsely scattered groups of sclerenchyma composed of two to five cells are also found. The wood or *xylem* is composed mostly of thick walled fibres (sclerenchyma), vessels and medullary rays. The cells of the medullary rays both in the xylem and phloem are densely packed with starch grains.

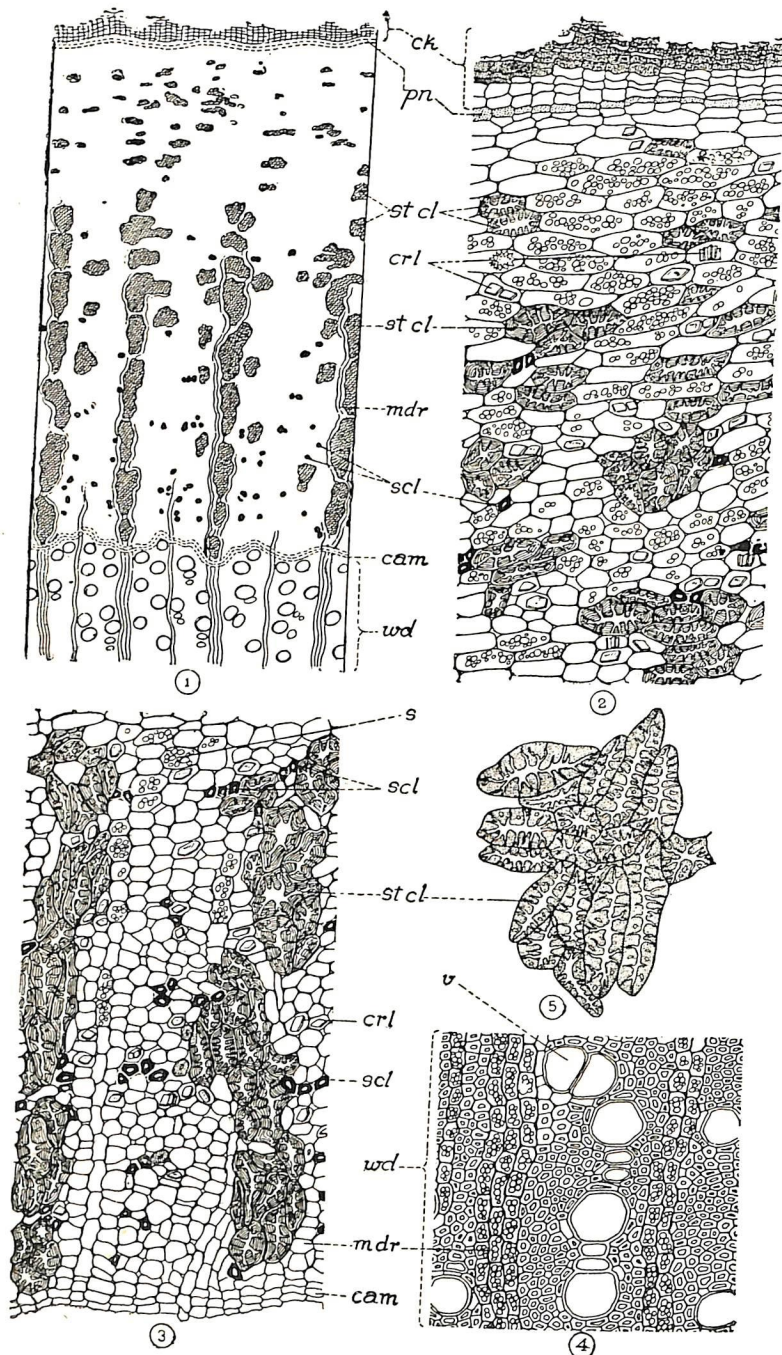
Bark of older branches and trunk.

The structure of the older bark is very similar to what has already been described except for the following differences.

1. The cork zone is slightly thicker and is formed of 15 to 20 or more rows of cells.
2. The chlorenchyma is thinner and contains only a fewer number of rows and
3. The groups of stone cells occur in regular tiers.

Distinguishing features.**A. Morphological.**

1. The entire bark is comparatively thin.
2. It has a basic slate grey colour which is often masked by lichen patches. The surface is generally smooth and devoid of prominent cracks or fissures.
3. The outer bark is thin. It is scrapable when fresh but adheres firmly to the underlying tissues in dry barks. In the fresh bark a thin greenish tissue is visible immediately beneath.



Symplocos spicata
Histology of stem bark

4. The officinal part of the bark has a light brown colour and a homogeneous minutely granular structure.

5. The bark breaks with a short fracture exposing short thin fibre tips.

B. Anatomical.

1. The cork zone is thin, composed of few rows of thin walled cells devoid of contents.

2. In fresh barks there are a few rows of chlorenchyma at the periphery of the cortex.

3. The majority of cortical cells are loaded with starch grains, and some contain cubical and rhomboidal crystals.

4. The bast is comparatively thick and is composed of radial segments of phloem alternating with narrow medullary rays. Several prominent radially elongated groups of thick walled stone cells and occasional groups of sclerenchyma occur in this region. Most of the phloem parenchyma cells contain cubical and rhomboidal crystals.

5. The medullary rays are narrow. Their cells, both in the xylem and phloem are packed with starch grains.

C. Taste and odour.

The officinal part of the bark has an astringent and feebly bitter taste, but does not possess any characteristic smell.

PLATE XXV.

Symplocos spicata

Histology of stem bark.

- Fig. 1. Diagrammatic sketch of a part of T. S. of the bark with wood.
2. Structure of cork and cortex.
3. Bast region with cambium.
4. Structure of wood.
5. A group of stone cells enlarged.

Symplocos racemosa Roxb.*

(Symplocaceae)

Bengal – Lodh, Lodhra, Hoorā.

Distribution.

The chief centres of occurrence are Burdwan, Midnapore, the Terai of Kumaon to Assam and Pegu, Chota, Nagpur and other areas of North East India where it is found growing up to an altitude of 2500 feet, above sea level.

Habit and general features.

Symplocos racemosa is a small evergreen tree from twelve to twenty or twenty-five feet in height. The trunk attains a diameter of half to one foot and is covered with somewhat rough grey or dark grey bark with an outer corky friable rind, and blaze pale yellow mottled with pale orange brown spots. Leaves alternate short-petioled ovate-oblong to broad lanceolate. Flowers nearly sessile in clusters on axillary pubescent peduncles.

External morphology.

Leaves: simple, alternate, exstipulate, short-petioled, four to six inches or more long and one to two inches broad, ovate elliptic-oblong or broad-lanceolate, acute obtusely acuminate or obtuse at apex, obscurely crenate or slightly serrulate or rarely entire glabrous above pubescent beneath when young, but ultimately glabrous or with few scattered hairs on the ribs and with about 9 pairs of lateral nerves which though indistinct become distinct when the leaves become dry. *Petiole* a quarter to about half an inch in length.

Flowers: very short pedicelled, about half an inch in diameter, whitish at first but soon turning a lively yellow with an ovate, villous or tomentose bract and two small bracteoles, and arranged in simple axillary or terminal, many flowered pubescent racemes, half to one inch long. *Calyx* (hypanthium) short, five-partite, persistent slightly enlarging in fruit, with the lobes broadly ovate to roundish obtuse,

* This is given as the source of *Lodhra* in books of Indian Materia Medica.

glabrous and imbricate in bud. *Corolla* rotate, five-partite nearly to the base lobes, oval, concave, smooth, about three times the length of the calyx. *Stamens* numerous many seriate, the outer longer, filaments as long as the corolla, filiform but flattened at base where they ordinate to the corolla; *anthers* small, short, two-celled, dehiscing longitudinally. *Ovary* inferior, shaped like an inverted cone, three or rarely two to four locular, generally with two pendulous ovules arising from the inner upper angle of each chamber; *style* short, filiform ending in a capitate or scarcely lobed stigma.

Fruit: a slightly fleshy, oblong, or subglobose, smooth, three chambered, one to three seeded drupe (pyrene), one third to less than half an inch long, crowned with the persistent calyx cup and purplish or purplish black when dry. *Endocarp* hard woody, and often ribbed. *Seed* oblong, with fleshy endosperm, *embryo* straight or covered with the cotyledons much shorter than the radicle.



Symplacos crataegoides Ham.

Distribution and Habitat.

Occurs, up to an elevation of 9000 feet, in the Himalayas, the Indus valley, Assam, Khassia hills and Burma.

Symplocos crataegoides is a large shrub or medium sized tree with its young branches more or less pilose. The leaves are membranous, two to four inches long, elliptic or ovate-elliptic, acute or acuminate, rounded or cuneate at the base, glabrous or pilose on the midrib, nerves prominent beneath, petiole short. Flowers pedicelled, generally white but becoming yellow, fragrant, arranged in cymose corymbs on elongate terminal and axillary panicles, those of the lateral branches often few and with longer pedicles; bracts small, linear, caducous, Calyx-tube obconic, glabrous or more or less pilose, with rounded or lanceolate and acute, ciliate lobes. Corolla three times longer than the calyx, 5 partite, Stamens twenty to sixty, equalling the corolla in length; filaments united in five bundles. Ovary two-celled. Fruit nearly globose less than one third of an inch long with the remains of the calyx limb, forming a crown and black when ripe.

Desmodium pulchellum Benth. *

(Syn: *Hedysarum pulchellum* Linn. Roxb.

Dicerma pulchellum D. C.)

Malayalam ... Paccotti (?) (RR)

Tamil ... Vellalothi (RR & Chopra)

Distribution and habitat.

Throughout India from sea level to about 3000 feet but not abundant anywhere. It is common in Travancore-Cochin where it occurs mostly as an undergrowth of deciduous forests as well as in the plains.

Habit and general features.

Desmodium pulchellum, is an erect slender shrub three to six feet high with finely grey-downy terete or at times slightly angled fragile woody branches, bearing pinnately trifoliate leaves, the leaflets being fairly large, ovate-lanceolate coriaceous and prominently reticulate, and small yellow concealed flowers in terminal as well as axillary, conspicuously distichously bracteate racemes one to two feet or more long. The plant is quite characteristic when in flower and fruit.

External morphology.

Leaves: large, alternate, stipulate, long-petioled, pinnately trifoliate; petiole a quarter to half inch or more in length, channelled above, densely downy. Stipules about 1/5 or 1/4 inch long ovate, long acuminate. Leaflets stipellate, ovate-elliptic, elliptic-oblong, or ovate-lanceolate three to six inches long, the end one being the largest and symmetrical while the laterals smaller and oblique, rigidly coriaceous, green, somewhat rugose and glabrous above, and paler finely downy and prominently reticulate beneath. There are 8-10 pairs of prominent secondary nerves with the tertiary reticulations also strongly marked.

* Rama Rao of "Flowering plants of Travancore" and Sir R. N. Chopra in "Indigenous drugs of India" equate *D. pulchellum* with *Lodhra*. It is however very doubtful whether this plant is used as the source of *Lodhra* anywhere in Travancore-Cochin or in India.

Inflorescence: terminal as well as axillary racemes a quarter to one to two feet or more long — usually much longer than the leaves with the flowers in umbelled fascicles of two to six, partially or completely concealed in the axils of conspicuous bifarious leafy bracts or floral leaves; each of two round or orbicular lateral leaflets only, the odd or terminal leaflet being reduced to a bristle nearly as long as the lateral leaflets. Each raceme may have twelve to fifty such umbels. The paired 'bracts' placed back to back and provided with short petiolules, are orbicular or rather oblique, three eighth to half inch long, and have the same texture and surface features as the leaves.

Flowers: Small, pale or greenish-yellow, papilionaceous. *Calyx* One twelfth of an inch long with the teeth lanceolate and shorter than the tube. *Corolla* exserted, about three times as long as the calyx, the standard or vexillum free above the middle and the wings more or less adhering to the keel petals which are incurved. *Stamens* diadelphous. *Ovary* unilocular, with few ovules, style incurved.

Fruit: a small two or rarely one to three seeded and jointed long apiculate indehiscent legume about one quarter inch long, constricted and villous on both the sutures glabrous on the sides and separating when ripe into nearly round one seeded indehiscent segments, about one eighth inch long.

AŚVATTHAH

Source plant.

Fiscus religiosa Linn.

(Urticaceae)

Sanskrit Text.

Descriptive synonyms

बोधिद्रुः पिप्पलोश्चत्थश्चलपत्रो गजाशनः । (भावप्रकाशे)

Bodhidruḥ pippalosvattha S'calapatro gajāś'anaḥ |

(Bhāva prakāśaḥ)

पिप्पलः श्यामलोश्चत्थः क्षीरवृक्षो गजाशनः ।

हरिवासश्चलदलो मङ्गल्यो बोधिपादपः ॥

(मदनपालनिघण्टुः)

Pippalaḥ S'yāmalosvatthaḥ kṣīravṛkṣo gajāś'anaḥ |

Harivāsaścala dalo maṅgalyo bodhipādapah ||

(Madanapalanighaṇṭu)

पिप्पलः केशवावासश्चलपत्रः पवित्रकः ।

मङ्गल्यः श्यामलोश्चत्थो बोधिवृक्षो गजाशनः ॥

श्रीमान् क्षीरद्रुमो विप्रः शुभदः श्यामलछदः

पिप्पलो गुह्यपत्रश्च सेव्यः सत्यः शुचिद्रुमः ॥

चैत्यद्रुमो धर्मवृक्षश्चन्द्रकरमिताहायः

(धन्वन्तरिनिघण्टुः)

Pippalaḥ keśavāvasaścalapatraḥ pavitrakaḥ |

Maṅgalyaḥ S'yāmaḷo S'vattho bodhivṛkṣo gajāś'anaḥ

S'rīman kṣīradrumo vipraḥ subhadaḥ syāmaḷachadaḥ |

Pippalo guhyapatrasca sevyāḥ satyāḥ suçidrumaḥ ||

Caityadrumo dharmavṛkṣaścandrakaramitāhvayaḥ |

(Dhanvanthari nighaṇṭu)

As'vattah means lasting long.

Pippalah — having water. *Kṣīravṛkṣo* — possessing milky latex, *calapatra*, *caladalaḥ* indicate the peculiarity of the leaves which move with the slightest breeze producing a rustling sound ; *maṅgalyo* bodhipādapah — the bodhi tree of sramaṇa *bodhidruk* — possessing knowledge (conscious tree).

Properties and uses.

पिप्पलो दुर्जरः शीतः पित्तश्लेष्म व्रणास्त्रजित् ।

गुरुस्तुवरको रूक्षो वर्ण्यो योनिविशोधनः

(भावप्रकाशे)

Pippalo durjarah sītaḥ pittaśleṣma vranāśrajit |

Gurustuvarako rūkso varṇyo yoniviśodhanaḥ ||

(Bhāva prakāśa)

अश्वत्थवृक्षस्य फलानि पक्वान्यतीवहृद्यानि च शीतलानि ।

कुर्वन्ति पित्तास्रविषतिदाहं विच्छर्दिशोषारुचिदोषनाशम् ॥

(राजनिघण्टुः)

Asvatthavṛkṣasya phalāni pakvānyatīvahṛdyāni ca sītālāni |

Kuravanti pittāsraviṣārti dāham vicchardis'oṣārucidosanāśam

(Rājanighaṇṭuḥ)

अश्वत्थोऽपि स्मृतस्तद्वद्रक्तपित्तकफापहः

(धन्वन्तरिनिघण्टुः)

Asvattho 'pi smṛtastadvadraktapittakaphāpahah

(Dhanvanthri Nighaṇṭu)

“अश्वत्थः सर्ववृक्षाणाम्”

(भगवद्गीता)

Asvatthah sarvarakṣāṇām |

(Bhagavat Gita)

Denotes importance of (asvatthah) Pippala is digested with difficulty, is cool, overcomes *pitta*, *kapha* ulcer and Vatarakta. It is heavy, astringent, causing dryness, improves complexion and cleans vagina. Caraka has included this in the group causing retention of urine. Susruta has grouped this under fruit astringents.

पिप्पलः सुमधुरस्तु कषायः शीतलश्च कफपित्तविनाशी ।

रक्तदाहशमनः स हि सद्यो योनिदोषहरणः किल पक्वः ॥

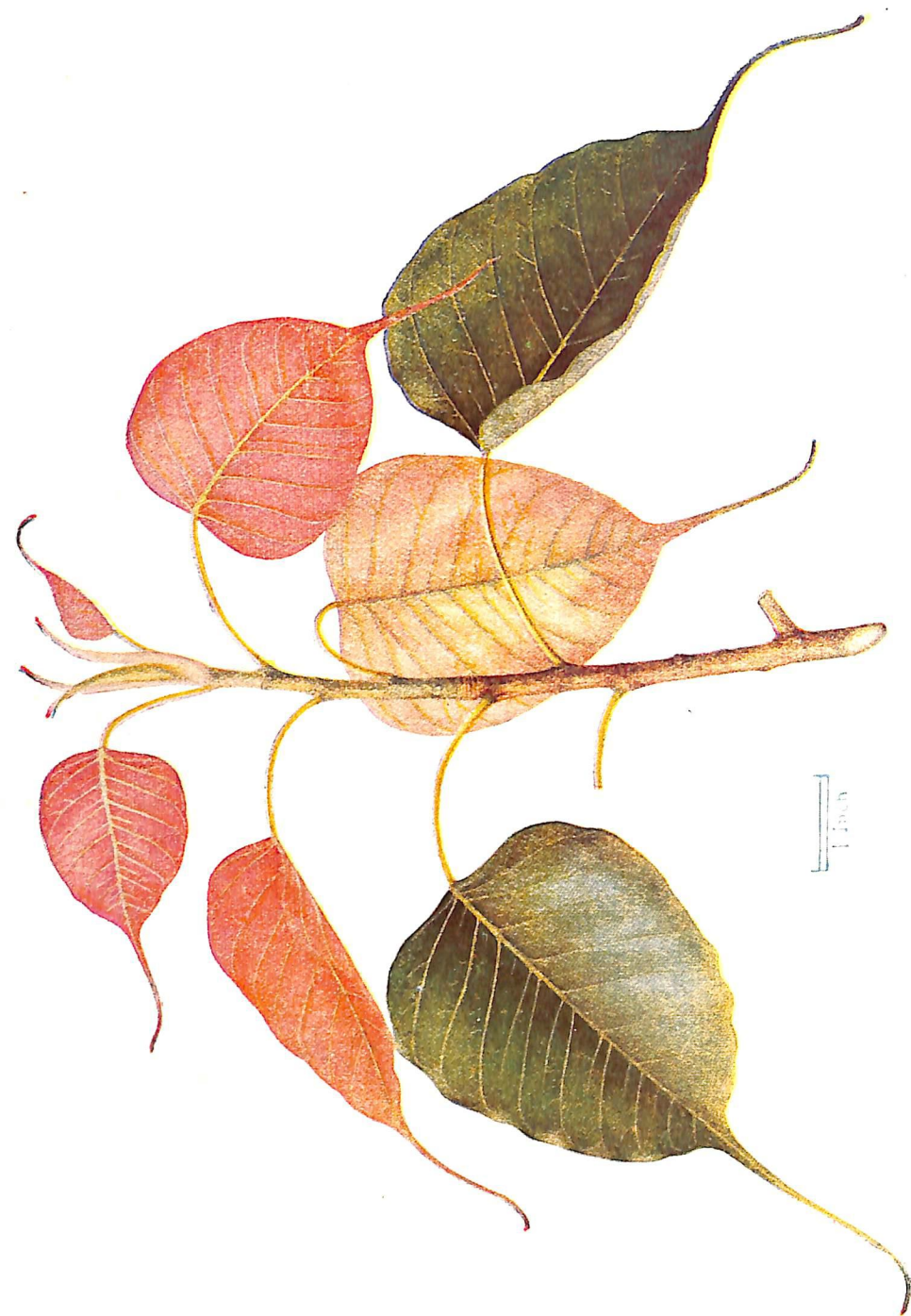
(राजनिघण्टुः)

Pippalaḥ sumadhurastu kaṣāyaḥ sītalaśca kaphapitta vināśi-

Rakta dāhaśamanaḥ sa hi sadyo yonidoṣaharaṇaḥ ||

(Rājanighaṇṭu)





Ficus religiosa.

***Ficus religiosa* Linn.**

(Urticaceae)

Malayālam	...	Arayal, Ariyalu
Tamil	...	Arasu, Arasumaram
Hindi	...	Pipal, Pipar

Distribution and Habitat.

This tree is common in most parts of India, though it is believed to be found in its wild condition only in the sub-Himalayan forests and Central India. It is frequently planted on village sites in the vicinity of temples or in temple grounds. It grows self sown in most places.

Habit and general features.

Ficus religiosa is a very hardy, large, semi-deciduous, entirely glabrous tree, growing to a height of about 70 to 80 feet with a comparatively short, stout trunk and numerous widely spreading branches. The ultimate branchlets are drooping and bear long-petioled, shiny, ovate-cordate, long caudate-acuminate leaves which produce a peculiar and characteristic rustling sound when the wind blows. This has given rise to its Sanskrit synonyms chalapatra, chaladala etc. Its growth during the first ten to fifteen years is very slow, but later the rate of growth is considerably accelerated. In young trees the trunk is erect, regular and circular in cross section, but as the tree grows old the trunk develops large, perpendicular ridges or buttresses.

External morphology.

Leaves: alternate, stipulate, very long petioled and pendulous; blade ovate-rotund to ovate-cordate, entire, undulate to strongly wavy, coriaceous, deep green and glabrous above, minutely tubercled beneath (when dry); base broad rounded to truncate or occasionally emarginate and cordate or very rarely slightly narrowed in young leaves; apex narrow, caudate-acuminate, the cusp of the leaf produced as a linear-lanceolate often partially twisted, curved tail one to three and a half inches long, or approximately about a third of the length of the leaf. The leaf blade including the cusp may reach a maximum length of eleven inches. There are about eight pairs of

primary lateral nerves with the fine but quite distinct tertiary reticulations. The tender leaves are rose to light red in colour. Petiole two to five inches long, round smooth and slender. Stipules small, sheathing, ovate-lanceolate, acute and caducous.

The syconia or fruit receptacles which occur in axillary pairs, are sessile, depressed globose, smooth, one third to half an inch in diameter, purplish when ripe, with three broad bifurcated spreading basal bracts. Male, female and gall flowers occur in the same receptacle. Male flowers few, situated near the mouth of the receptacles, sessile, with three broadly ovate perianth segments and a single stamen with short filament and ovate rotund anther. The pistillate flowers are sessile or stalked, with five lanceolate perianth segments and an ovary with a short lateral style ending in a minute stigma. The gall flowers most numerous and generally devoid of perianth segments.

Official parts. Stembark, root bark, leaf, leaf bud and seed.

Description of stem bark.

The bark is grey or ash coloured, and half to one inch or more in thickness. Those of younger branches are almost smooth, but in the older trunks and branches it exfoliates in irregularly circular woody flakes of varying sizes. The appearance of the bark as in the case of *Ficus bengalensis* varies according to the age of the stem or branch. Young barks are greenish to orange brown and have a fairly smooth and non-lenticellate surface. In these, the outer part of the rind, i. e. the outer skin exfoliates in extremely thin or membranous flakes that are easily scraped or rubbed off as in the case of *Ficus glomerata*. Barks of trunks and older branches half to one or one and a half inches in thickness, are light brown but covered with whitish or ash coloured crustose lichen patches. Portions of the outer bark frequently flake off, leaving deep irregularly round oval or elliptic orange brown depressions with scattered droplets of dried exudations of latex. As a result of the flaking the surface of the bark appears rugged and uneven, though devoid of prominent lenticels, cracks or fissures.

The rind or outer bark is not of uniform thickness. In old barks it consists of uniformly thin corky zones alternating with hard "woody" layers of varying thickness, which often exfoliate.

In transverse sections the fresh bark is deep pinkish or brownish towards the periphery but the shade becomes progressively lighter towards the inner region, until it becomes almost colourless and imperceptibly merges with the inner bark.

The middle bark is only about a quarter of the thickness of the entire bark and in transverse or longitudinal sections it appears as a brownish or light reddish brown granular tissue. The inner bark comprises more than two thirds the thickness of the entire bark. It is somewhat lamellated and consists of layers of light yellowish or orange-brown granular tissue, slightly more than a millimeter in thickness, alternating with light rose coloured, fibrous tissue. The inner most part, namely the portion adjoining the wood is whitish and more fibrous in texture, the fibres often running more or less obliquely. The lamellated condition of the inner bark with its alternating layers of granular and fibrous tissues, is an important structural feature which distinguishes the bark from that of *F. bengalensis*.—In *F. bengalensis* the cortical portion of the bark is fairly thick, coarsely granular and breaks with a short fracture. But in *F. religiosa* the cortical zone is narrower, more homogeneous and finely granular. In *F. bengalensis* the entire rind is comparatively thick and woody and the exfoliating pieces are generally larger and thicker.—On exposure the colour of the cut surface becomes light purplish at first. On drying, the entire cut surface assumes a characteristic uniform orange brown colour and the lamellation is clearly visible.

Histology.

The 'woody' part of the rind or outer bark consists essentially of dead elements of secondary cortex namely masses of stone cells, interposed with layers of collapsed, compressed cortical parenchyma with brownish contents. The phellem or cork tissue is composed of broadly rectangular to almost cubical, fairly thick-walled cells. A distinct phellogen and three or four rows of newly formed phelloderm are also present.

The cortex (secondary). The cells of the cortical parenchyma are thin walled and circular to oblong in transverse section. Most of them are loaded with starch grains, while several others contain rhomboidal crystals of calcium oxalate. Towards the periphery of the cortex there is an almost continuous, broad band of sclereids,

seven to ten or more rows deep, but in the inner region the sclereids occur in scattered irregular groups. The walls of the stone cells are pitted but comparatively thin. Broadened terminal portions of a number of medullary rays can also be made out in the cortex. There is no clear demarcation between the cortex and bast. The inner bark namely the bast region constitutes the widest part of the bark and consists of radial segments of phloem, alternating with three to five seriate medullary rays. The phloem contains in addition to the regular thin walled phloem elements, several scattered small sized groups of sclerenchyma, each group consisting of two to five to seven or ten cells. Their walls are very thick but not pitted. Several of the phloem parenchyma cells contain rhomboidal crystals of calcium oxalate. The medullary ray cells have *thick pitted walls* and are fully packed with compound, starch grains. A distinct *cambium tissue* of 4-6 rows of cells separates the bark from the wood. The wood is composed of large vessels and wood parenchyma.

Description of root and root bark.

Younger roots are yellowish brown with rows of narrow transversely extended blackish lenticles varying from one to one third of an inch in length and about 0.025 inch broad with the mouth a narrow streak bounded by two black margins. Except for the lenticels the surface is fairly smooth. Outer skin very thin or membranous and easily scraped exposing a turmeric yellow tissue beneath, often with a thin light reddish or orange coloured layer beneath the outer skin.

The roots are easily cut, the wood being soft and highly porous. Latex exudes in plenty from the inner part of the bark. The entire bark is about one tenth of the thickness of the root, the thin brownish yellow outer skin forming a very narrow outermost corky layer. The rest of the bark has a rose red tinge, the colour being deeper towards the periphery.

In *larger roots* the surface colour is more reddish or reddish brown with a turmeric yellow colour showing beneath with rows of transversely extended lenticels as in the younger roots. The lenticels are however, more numerous and in more closely arranged rows. The surface skin has a reddish brown colour. It is quite thin and soft, easily scrapable and more or less translucent. On scraping, the

exposed tissues appear dull white, but gradually turn reddish. The entire bark in transverse section is from one tenth to one eighth the thickness of the root. The outer most layer or skin is quite thin and the rest of the bark is made up of the living officinal tissue which shows a more or less homogeneous texture and light purple colour. The colour is deeper towards the inside with narrowly pyramidal zones of light purplish colour radially extending outside towards the periphery. The cut surface gradually turns deep purple and finally dark purplish brown. The wood has a very light yellow colour. It is quite soft and appears highly porous with large number of large sized vessels.

Distinguishing features of the root.

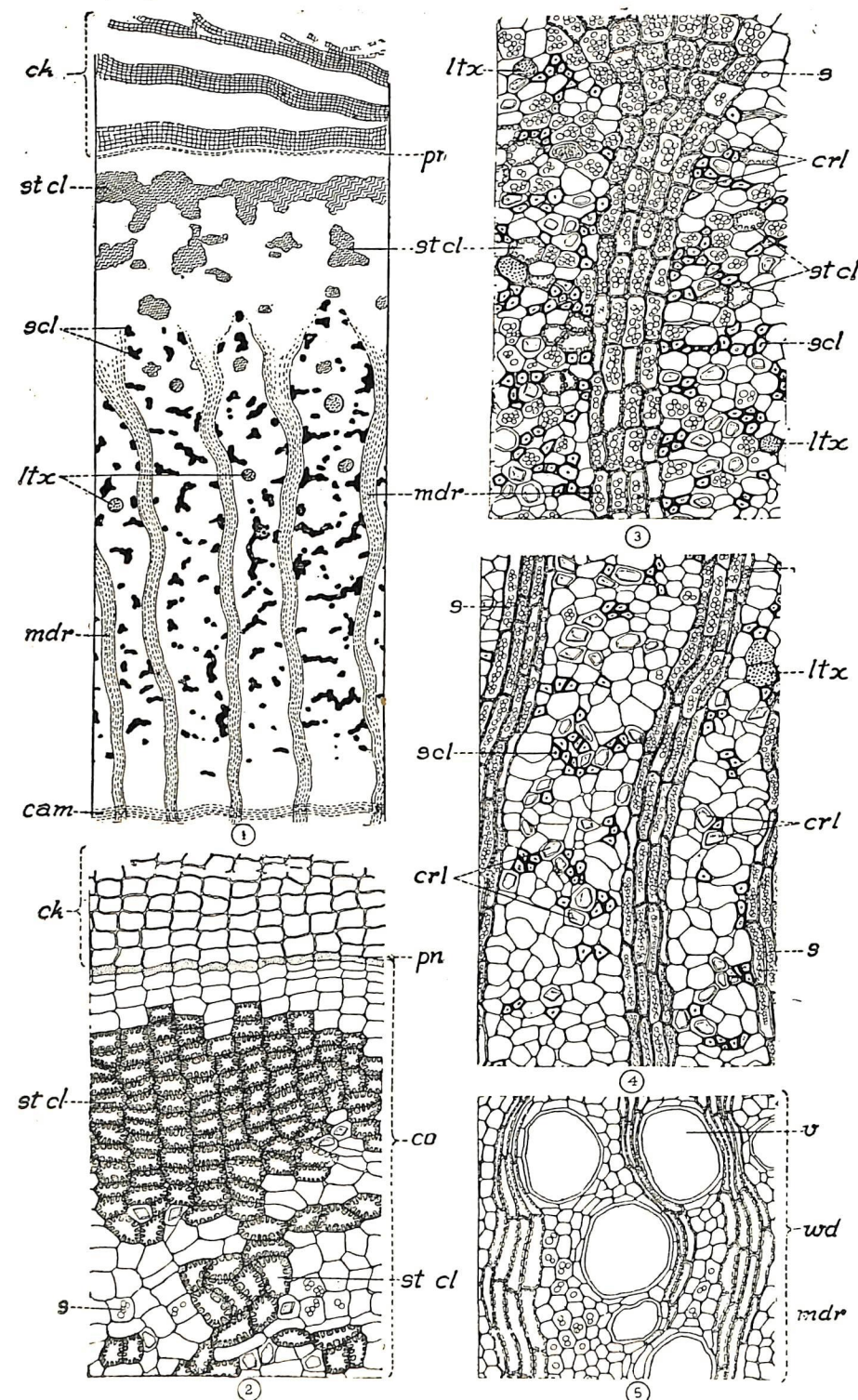
The yellowish brown soft, easily scrapable outer skin with transversely extended rows of linear or narrow blackish lenticels, the easily cut nature of the entire root and the highly porous wood with very large sized pores are distinguishing features.

PLATE XXVII

Ficus religiosa

Histology of the stem bark.

- Fig. 1. Diagrammatic sketch of a segment of a T. S.
 2. Details of structure of cork and cortex.
 3. & 4. Details of structure of bast region.
 5. Structure of wood.



Ficus religiosa
 Histology of stem bark

VATAH or NYAGRODHA

Source plant.

Ficus bengalensis Linn.

(Urticaceae)

Sanskrit Text.

Descriptive synonyms

वटो रक्तफलः शृङ्गी न्यग्रोधः स्कन्धजो द्रुमः ।

क्षीरी वैश्रवणावासो बहुपादो वनस्पतिः ॥

(भावप्रकाशे)

Vato raktaphalah s'ringi nyagrodhah skandhajodrumah |

Ksiri vaisravāṇāvāso bahupādo vanaspatih ||

(Bhāva prakāśah)

न्यग्रोधो बहुपादो रक्तफलः स्कन्धकोद्रयुपशृङ्गी ।

विश्वमनिलयश्च वटो यक्षावासो वनस्पतिर्भवति ॥

(अभिदानमञ्जरी)

Nyagrodho bahupādo raktaphalah skandhajodvyupas'ringi |

Visramanilayas'ca vaṭo yakṣāvāso vanhspatirbhavati ||

(Abhidhāna mañjari)

Vaṭah means wound around (by adventitious roots) (*vaṭvestae*); *raktāphalah*—having reddish fruits; *s'ringi*—aerial roots, *nyagrodha*—blocking the way (due to adventitious roots), *skandhaja* sprouting from the stem (cuttings take root), *drumah*—firm; *ksiri*—milky, indicating possession of latex; *baaupādah*—having many legs (adventitious roots supporting the branches); *vais'ravanāvāso*—the bodhi tree of sramaṇa or is it *vis'raṇā vāsa*, alluding to the shade.

Properties and uses.

वटः शीतो गुरुर्ग्राही कफपित्तत्रणापहः ।

वर्ण्यो विसर्पदाहघ्नः कषायो योनिदोषहृत् ॥

(भावप्रकाशे)

Vaṭah sito guruh grāhi kapha pitta vranāpahah |

Varṇyo visarpadāhaghnaḥ kaṣāyo yonidoṣahṛt ||

(Bhāva prakāśah)

वटः कषायो मधुरः शिशिरः कफपित्ताजित् ।

ज्वरदाहतृषामोहव्रणशोफापहारकः ॥

(राजनिघण्टुः)

Vaṭah kaṣāyo madhuraḥ sisirah kaphapittajit |

Jvaradāhatṛṣā moha vranas'opha pahārakah ||

(Rajanighaṇṭuh)

वटः शीतः कषायश्च स्तम्भनो रूक्षणात्मकः

तथा तृष्णाच्छर्दिमूर्च्छार्क्तपित्तविनाशनः ।

(धन्वन्धरिनिघण्टुः)

Vaṭah sitah kaṣāyas'ca stambhano rūkṣaṇātmakah

Tathā tṛṣṇā chardi mūrchā raktapitta vināśanah ||

(Dhanvanthari nighaṇṭuh)

Vata is cool, heavy, arresting, relieves *kapha*, *pitta* and ulcer, improves complexion, overcomes erysepelas and burning sensation, is astringent and cures vaginal diseases. According to Dhanvantari Nighaṇṭu it is also useful in thirst, vomiting, coma, scurvy (and allied diseases). The same authority mentions a variety *nadivaṭah* (river banyan!). Caraka and Susruta have grouped *vaṭah* under fruit astringents.

Vaṭah is widely used in the treatment of skin diseases with *pitta* and *rakta* predominance.

न्यग्रोधोदुम्बराश्चत्थप्लक्षणां पल्लवास्त्वचः ।

कषायाः शीतलाः पथ्या रक्तपित्तातिसारिणाम् ॥

एवं कपीतनस्यापि स्मृतं तैः पञ्चवलकलम् ।

(हृदयप्रियः)

Nyagrodhodumbarāsvatthapṛakṣānām pallavāstvacah |

Kaṣāyāḥ sītāḥ pathyā raktapittātisāriṇām ||

Evam kapitanasyāpi smṛtam taiḥ pañcavalkalam |

(Hṛdayapriyaḥ)

क्षीरवृक्षफलं तेषां गुरु विष्टम्भिशीतलम् ।

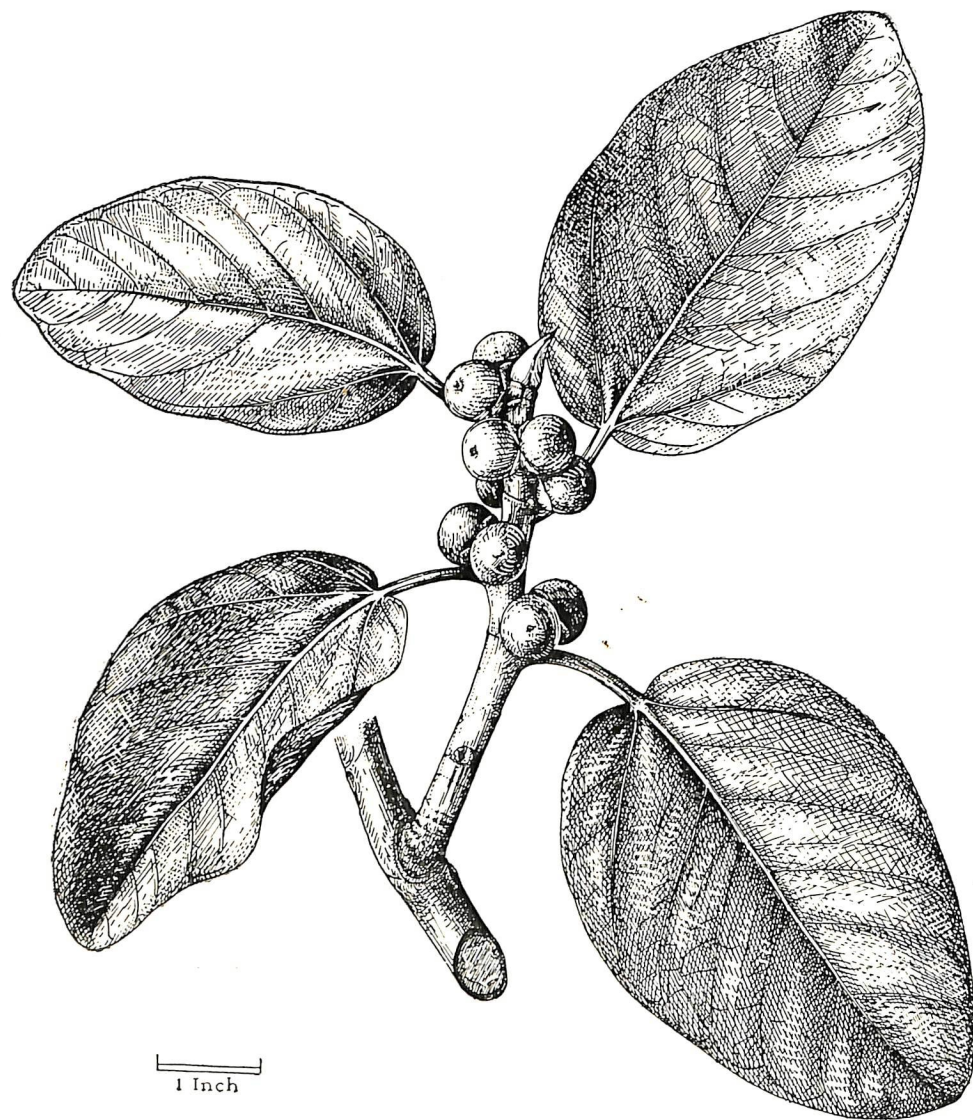
कषायं मधुरं साम्लं नातिमारुतकोपनम् ॥

(सुश्रुतसंहिता)

Kṣīra vṛkṣaphalam teṣām guru viṣṭambhi sītāḥ |

Kaṣāyam madhuram samlam nātimārutakopanam ||

(Susrutha Samhita)



Ficus bengalensis Linn.

***Ficus bengalensis* Linn.**
(Urticaceae)

Malayālam	...	Āl, Perāl
Tamil	...	Ālamaram, Vatamaram
Hindi	...	Bargat, Bor, Bar.

Distribution and habitat.

Commonly found all over India from sea level to an elevation of about 3000 ft. It grows wild on the sub-Himalayan tracts, Cincar mountains, lower slopes of the Deccan Hills and the Malabar coast in deciduous and semi-evergreen forests. Owing to its usefulness as a cool shade tree it is generally planted along road sides and in villages.

Habit and general features.

Ficus bengalensis is a very large semi-deciduous tree reaching a height of seventy feet or more, with a stout trunk attaining 20-30 feet in girth, long thick horizontally growing branches and an extensively spreading dense crown. The tender shoots are pubescent. A large number of aerial roots develop from the branches, several of which reach the soil. When first formed these roots are very slender but a number of them thicken considerably to form pillar like supports which are often indistinguishable from the parent stem and enable the branches to lead separate existence if they get severed from the parent stem or when the parent stem deteriorates. As the result of the continuous horizontal growth of the branches the tree spreads over a wide area. Latex exudes in plenty from cuts or wounds.

External morphology.

Leaves: found in clusters at the ends of the branches; they are alternate, stipulate, petiolate, four to eight inches long and two to five inches broad, broadly elliptic to ovate or orbicular-ovate, rounded, subcordate or slightly narrowed at base and blunt or obtusely cuspidate at apex, entire, coriaceous, pubescent or tomentose below, especially when young, glabrous or glabrescent when full grown, glandless and strongly three to five or occasionally seven ribbed from the base. There are four to six pairs of prominent secondary nerves

with their tertiary reticulations quite distinct. *Petiole* half to two inches long, stout, with a broad smooth waxy gland on the under-side of its distal end. *Stipules* coriaceous, three quarters to one inch long.

The fruit receptacles or figs: are axillary, sessile and occur in pairs,—each with three large broad rounded spreading nearly glabrous coriaceous basal bracts—, globose, half to nearly three quarters of an inch in diameter, puberulous, dull greenish at first and brickred when ripe. Male, female and gall flowers are found in the same receptacle.

The staminate flowers situated near the mouth of the receptacles, are sessile or short stalked, each flower consisting of four, rather broadly lanceolate, imbricate perianth segments and one stamen. *Pistillate flowers* have the perianth similar to that of the male but shorter; ovary one celled one ovuled with an elongated style. The *gall flowers* have perianth similar to pistillate flowers but the ovary has a shorter style.

Fruits: small, crustaceous seed like achenes, enclosed in the common fleshy receptacle.

Official parts: Stem bark, Root bark, adventitious roots, leaf, leaf bud and milky exudate.

Description of stem bark

The appearance and thickness of the bark varies according to the age of the branch or stem. The original colour of the bark is dark slate grey but this is most often masked by thin patches of closely appressed ashy white, light blue green, or grey, crustose lichens which imparts a mottled appearance to the surface. The young bark is comparatively smooth, even though longitudinal and transverse rows of small lenticels are present. The lenticels are generally spherical or oblong, one tenth to one fourth inch long but devoid of wide diverging rim. In older barks, the lenticels are more numerous, closely spaced and prominent. The rind is $1/4''$ to $3/4''$ in thickness. Its outer part frequently flakes off in hard woody circular or oblong slices. These pieces which can be easily lifted off with a knife are irregular in outline, about a quarter of an inch or more thick, about an inch wide and its inner surface is granular, light green,

yellowish brown or reddish brown. The inner part of the rind is about one or two mm. in thickness and adheres closely to the inner tissue. The fresh cut surface exudes plenty of latex, and is of a beautiful pale pinkish or fleshy colour mottled with numerous scattered specks of a deeper tint, and occasionally with somewhat larger whitish patches. But the colour is not uniform throughout the thickness of the bark. The outer two thirds has a deep pink to reddish tinge and a granular appearance. The inner third, that is, the part adjoining the wood is lighter coloured or even whitish and fibrous. This fibrous portion is composed of several layers of oblique fibres running in opposite directions in alternate layers. On exposure the entire cut surface turns a uniform dull rose brown and ultimately becomes light brown.

Fracture The outer two thirds of the bark breaks with a clean short fracture exposing a rosy coloured granular tissue; the inner portion which is fibrous does not easily break. The bark has an astringent taste.

Histology.

A transverse section of a very young bark of *Ficus bengalensis* shows the following details of structure. The outermost zone viz. the *cork-tissue* or *phellem* is composed of three to six rows of thick-walled rectangular cells nearly twice as long as broad. The cork cambium is distinct and is formed of two rows of narrow rectangular cells rich in protoplasm. The cortex is fairly wide and is composed of several rows of cells. A wide continuous or annular band of sclereids is present at the periphery of the cortex. The stone cells are mostly oblong to rectangular, spherical or polygonal and have thick, pitted walls. In addition to this band of mechanical tissue, the cortex contains several, scattered, one to few celled groups of stone cells. The cortical parenchyma cells are thin-walled and more or less cubical to oblong. Several of them are loaded with compound starch grains, while others contain calcium oxalate crystals or tannin. The *inner bark* or *bast* is thin and consists of radial segments of phloem alternating with two to five seriate medullary rays. Irregular groups of sclerenchyma as well as groups of stone cells and latex tubes also occur abundantly.

The wood is composed of vessels, wood fibres, wood parenchyma and medullary rays. The wood parenchyma and medullary rays are packed with starch. The walls of the medullary ray cells are pitted in the wood region. Vessels occur singly or in groups of two or three.

Structure of old bark The outer bark or rind is composed of compressed cork tissue and hard 'woody' dead elements of secondary cortex which include large masses of stone cells and compressed thin-walled cortical elements.

The regular cork cells are rectangular and somewhat thick-walled. Many of them have brownish contents. The cortex is a fairly wide zone forming more than half the thickness of the officinal bark. The entire cortex is secondary in origin and is almost completely beset with large groups of stone cells. The stone cells are rectangular oval, or cubical and thin or thick walled. Parenchyma is very sparse and occur between groups of stone-cells. Most of the parenchyma cells contain tannin while others contain rhomboidal crystals of calcium oxalate or compound starch grains.

Stone cells are also developed in the inner bark or bast. There are only very few phloem parenchyma cells and these are comparatively thick-walled. Sclerenchymatous groups are fewer. Latex tubes occur abundantly in the middle and inner barks. Medullary rays are two to five seriate and extend up to the middle bark. The medullary ray cells contain starch grains; some have pitted walls while others are thin-walled.

The cambium is composed of small rectangular thin-walled cells and the wood consists of xylem vessels, wood fibres, wood parenchyma and medullary rays. The medullary ray cells have pitted walls. Wood fibres and wood parenchyma are arranged in alternating bands. Vessels occur either singly or in groups of two or three. The medullary ray cells and wood parenchyma are thickly packed with starch grains.

Distinguishing features.

Morphological

1. The entire bark is comparatively thick. It has a dark slate grey colour and a fairly prominently lenticellate surface which is not

deeply fissured or cracked. The surface is invariably encrusted with ash grey or light blue lichen patches. Lenticels are developed mostly in longitudinal series but not densely.

2. The rind is comparatively thin, but hard and woody. In places where it becomes thickened its outer part flakes off as irregularly circular or oval slices leaving shallow depressions.

3. The officinal part of the bark has a rosy tint. The colour is deeper towards the periphery, where numerous granular specks of a deeper colour are present.

4. The outer bark breaks with a clean fracture, but the inner portion is distinctly fibrous.

Description of root-bark.

The *root bark* is generally of a dark purplish colour, but the younger roots are of a lighter tint. The bark is about 1/10th the thickness of the entire root. The outer bark or rind is thin and peels off in flakes. These flakes are almost thin in younger roots, but thicker and firmer in older roots. The surface is covered with transverse rows of lenticels placed 1/3" - 1/2" apart and each measuring up to about half inch in length, but devoid of fringes of corky tissue. In still older roots the lenticels appear irregularly scattered owing to the development of additional rows of lenticels in between the original rows.

Latex exudes in plenty from the bast region of fresh bark when cut or bruised. In transverse sections the bark has a light rose brown colour, the rosy tinge being more prominent at the periphery. The rind is formed of an outer blackish wavy strip, scarcely one fourth of a hair breadth in thickness, and a thinner whitish zone within. The middle bark is flesh coloured, the colour deepening on exposure. The inner bark is yellowish-brown especially in the region adjoining the wood.

The wood is very sparsely porous and striated with alternate concentric layers of whitish and darker tissues. The medullary rays are narrow or fine.

The general colour of the cut surface of living or officinal part of the bark in both stem and root are similar, but in the stem it is more granular and the demarkation between the granular and fibrous zone is quite distinct whereas in the root bark it is more or less homogeneous.

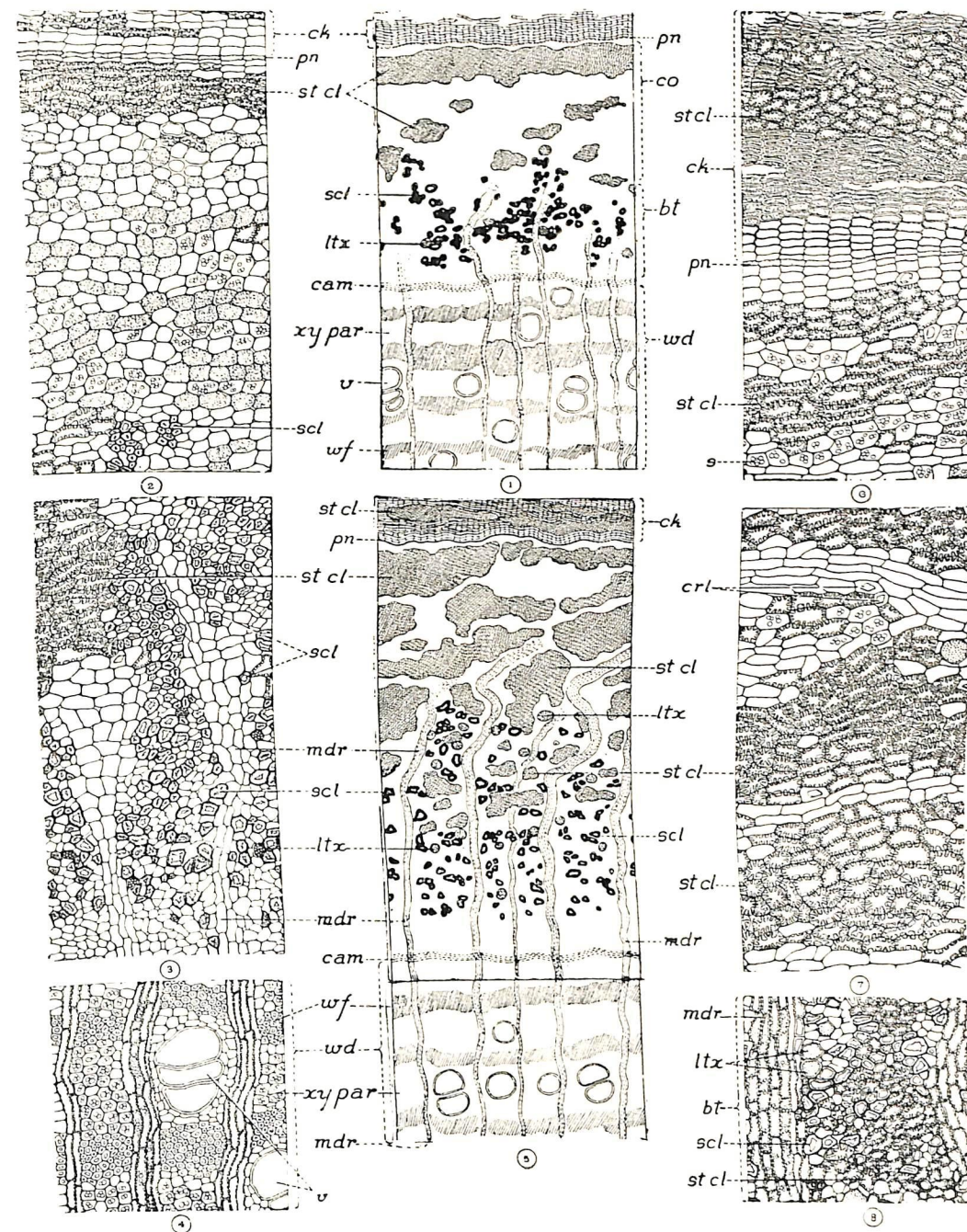
Taste slightly astringent but not so much as in the stem bark.

PLATE XXIX

Ficus bengalensis

Histology of Stem bark

- Fig. 1. Diagrammatic sketch of a segment of the T. S. of the young bark.
 2. Structure of the cork and cortex in the young bark.
 3. Structure of the bast region.
 4. Structure of wood.
 5. Diagrammatic sketch of a segment of T. S. of old stem bark.
 6. Structure of the cork and rhitydome.
 7. Structure of the middle bark.
 8. Structure of the bast.



Ficus bengalensis
 Histology of stem bark.

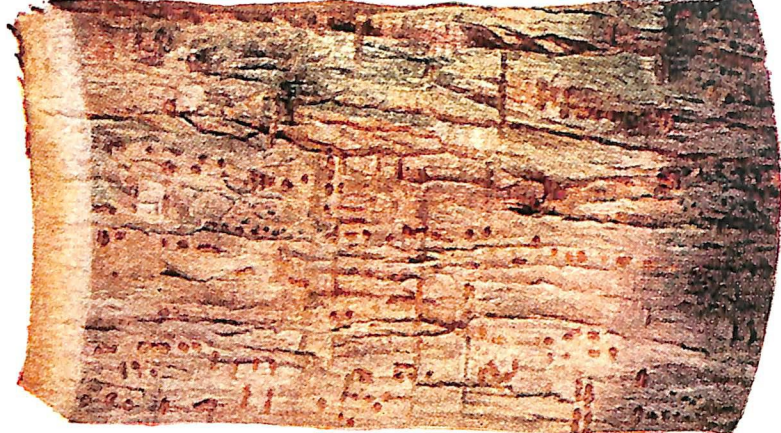
1 inch



1



2



3

Stem barks: 1. *Ficus bengalensis*. 2. *Ficus religiosa*. 3. *Ficus tjakela*.

UDUMBARAH

Source plant.

Ficus glomerata Roxb.

Moraceae (Urticaceae)

Sanskrit Text.

Descriptive synonyms

उदुम्बरो जन्तुफलो यज्ञाङ्गो हेमदुग्धकः ।

(भावप्रकाशः)

Udumbaro jantuphalo yajñāṅgo hemadugdhakaḥ |

(Bhāva Prakāśaḥ)

उदुम्बरः क्षीरवृक्षो हेमदुग्धः सदाफलः ।

अपुष्पफलसम्बन्धो यज्ञाङ्गः शीतवल्कलः ॥

(धन्वन्धरी निघण्टुः)

Udumbaraḥ kṣīravṛkṣo hemadugdhaḥ sadāphalaḥ |

Apuṣpaphalasambandho yajñāṅgaḥ śītavalkalaḥ ||

(Dhanvantari nighaṇṭuḥ)

कालस्कन्धो यज्ञयोग्यो यज्ञियः सुप्रतिष्ठितः ।

शीतवल्को जन्तुफलः पुष्पशून्यः पवित्रकः ॥

सौम्यः शीतफलश्चेति मधुसंज्ञः समीरितः ।

(राजनिघण्टुः)

Kāḷaskandho yajñayogyo yajñiyah supratīṣṭhitah |

Śītavalko jantuphalah puṣpaśūnyah pavitrakah ||

Saumyah śītaphalas ceti madhusamjñah samīritah |

(Rājanighaṇṭu)

Jantuphalah indicates presence of insects in the fruit; *hemadugdhah* means having milky exudate with golden colour, *kāḷaskandha* = black bark (wood); *yajñīha* and *yajñīya* mean sacrificial; *śrīmana* = fortunate *vipra* = wise, *sevya* worthy of worship and *pavitrakah* purifier.

Properties and uses.

उदुम्बरो हिमो रूक्षो गुरुः पित्तकफास्रजित् ।
मधुरस्तुवरो वर्ण्यो व्रणशोधनरोपणः ॥

(भावप्रकाशः)

Udumbaro himo rūkṣo guruḥ pittakaphāsrajit |
Madhurastuvaro varṇyo vranasodhana ropañah ||

(Bhāva prakāśah)

उदुम्बरं कषायं स्यात् पक्वं तु मधुरं हिमम् ।
कृमिकृत् पित्तरक्तघ्नं मूर्च्छादाहतृषापहम् ॥

(धन्वन्धरी निघण्टुः)

Udumbaram kaṣāyam syāt pakvam tu madhuraṁ himam |
kṛmikṛt pittaraktaghnam mūrccādhātṛṣāpaham ||

(Dhanvanthri nighaṇṭu)

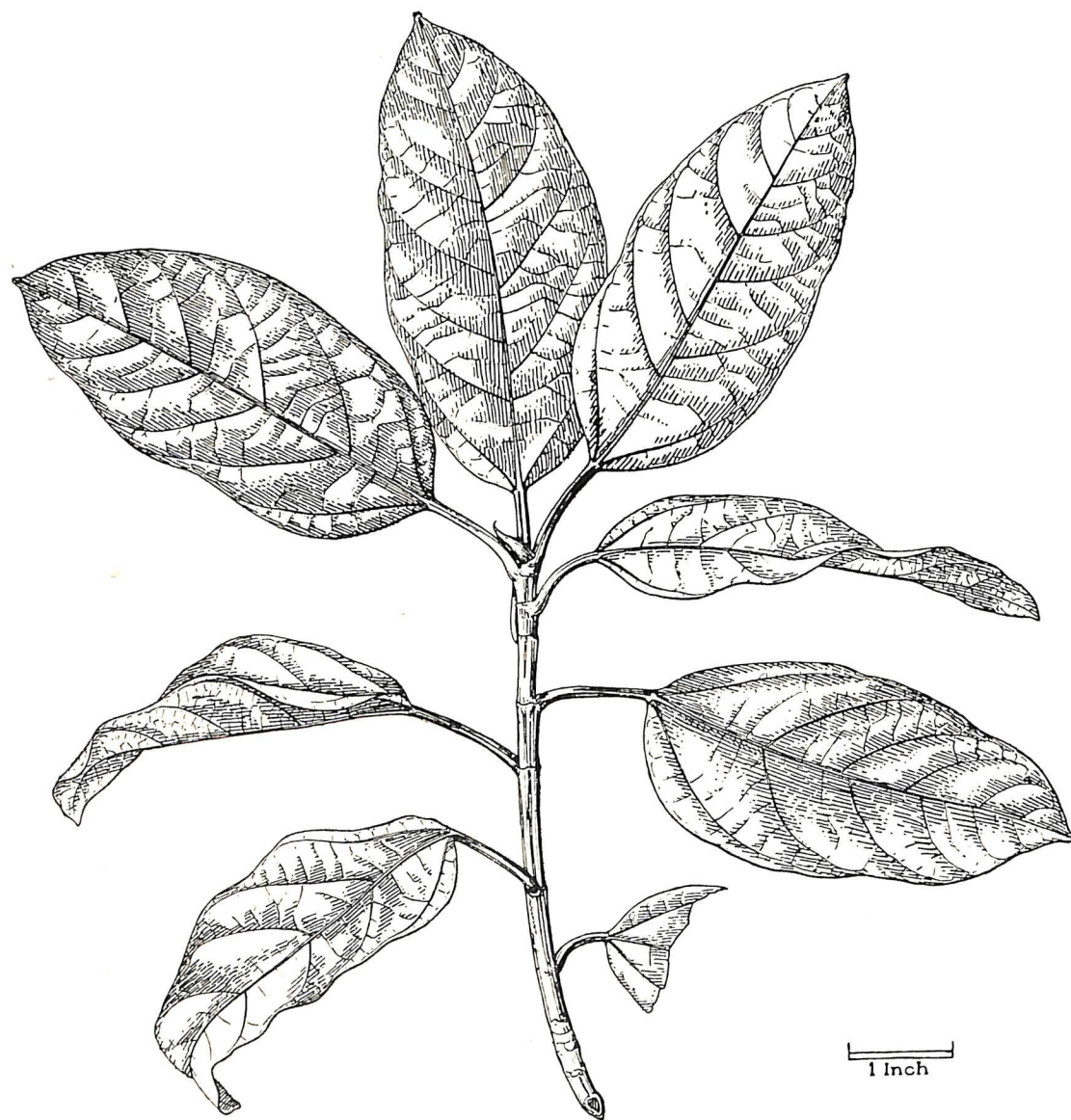
औदुम्बरं फलमतीव हिमं सुपक्वं पित्तापहं च मधुरं श्रमशोफहारी ।
आमं कषायमतिदीपनरोचनं च मांसस्य वृद्धिकरमस्रविकारहारी ॥

(राजनिघण्टुः)

Audumbaram phalamatīva himam supakvam |
Pittāpaham ca madhuraṁ śramasophahārī ||
Āmam kaṣāyamati dipanarocanam ca |
Māmsasya vṛddhikaramasravikāra hārī ||

(Rājanighaṇṭuḥ)

Udumbara is cool, dry, heavy, overcomes *pitta*, *kapha*, and *vātarakta*, is sweet, astringent promotes complexion and cleans and heals ulcer. According to Dhanvantari nighaṇṭu it also causes parasites, and relieves coma, burning sensation and thirst. Caraka has included this in the group causing retention of urine. Susruta is also of the same opinion.



Ficus glomerata Roxb.

***Ficus glomerata* Roxb.**

Moraceae (Urticaceae)

Malayālam	...	Atti
Tamil	...	Atti
Hindi	...	Umar, Gular.

Distribution and Habitat.

Distributed all over India, but more common in the outer and sub-Himalayan tracts, Rajaputana, the Salt Range. Assam, Bengal, Central, Western, and Southern India. It grows from sea level to an elevation of about 6,000 feet, in evergreen forests, and along the banks of streams in deciduous forests.

Habit and general features.

Ficus glomerata Roxb. is a medium sized or occasionally large erect laticiferous deciduous tree without prominent aerial roots. Aerial roots, if present, are generally few and short. Trunk tall, often crooked or irregular, but comparatively thick, two to eight feet in diameter, with grey to reddish brown or often rusty greenish to greenish brown, somewhat rough or scabrous bark. The branches are thin, but more erect than in any other species of *Ficus*, and bear glabrous light green, entire leaves. They exude plenty of milky latex when cut or injured. (*Kṣīravṛkṣa*). The young shoots are minutely hairy, but become glabrous when mature. Figs pedunculate, subglobose, and clustered on short, scariously scaly tubercled or warty branchlets which are generally leafless or occasionally bear a few reduced leaves. The tree usually sheds its leaves in August or soon after the rainy season.

External morphology.

Leaves: alternate, stipulate, $2\frac{1}{2}$ to 7 inches long and $1\frac{1}{2}$ to $2\frac{1}{2}$ inches broad, ovate, oblong, ovate-lanceolate or elliptic-lanceolate, entire, when mature smooth on both sides, rarely softly pubescent, light green, lower side paler, glabrous or asperous and covered with numerous minute green dots in the meshes of the network of veins, base - slightly narrowed, sometimes slightly inequilateral, three rib-

bed; apex - acute, or tapering to a blunt point; lateral nerves four to six or more pairs of irregular and indistinct ramifications. The leaves when dry are harsh and coriaceous. *Petiole* one to two inches long, rarely shorter, channelled above; *stipules* half to one inch long ovate-lanceolate and pubescent.

Fruit receptacles $\frac{3}{4}$ inch to $1\frac{1}{4}$ inch in diameter and with three basal bracts; short peduncled, -peduncles up to $\frac{3}{4}$ inch long-sub-globose, pyriform or turbinate, much contracted towards the base and with depressed umbilicus or opening. They are usually found densely clustered on short scariously scaly or tubercled or warty branchlets arising directly from the main trunk or large branches. These branchlets are generally leafless or occasionally bear a few reduced leaves. Staminate, pistillate, and gall flowers are all found in the same receptacle or the staminate and gall flowers are found in some and the pistillate flowers alone are found in others. The figs are smooth or rarely densely covered with very soft minute down. When ripe they are dull reddish, orange or orange-pink to dark crimson. The *staminate flowers* are sessile and situated near the opening of the receptacle. Each flower carries a perianth of three to four membranous inflated segments and one or two stamens with short cylindric filaments united at base, bearing subrotund to elongate ovate anthers. The *gall flowers* are found intermixed with male or staminate flowers. They are pedicelled and have a short gamophyllous three to four partite perianth which covers only the base of the pistillode. The lobes or segments are unequal, sometimes very small and teethlike. Pistillode sessile, ovoid and rough with a lateral elongate style ending in a clavate stigma. *Female flowers*: perianth as in gall flowers; ovary sessile, granulate, with an eccentric or lateral style, which is bearded above the middle and ends in a clavate or somewhat oblique stigma.

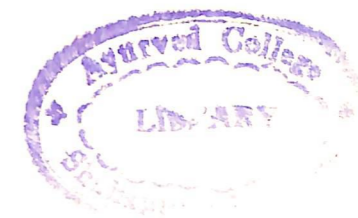
Fruit a small minutely tuberculate achene.

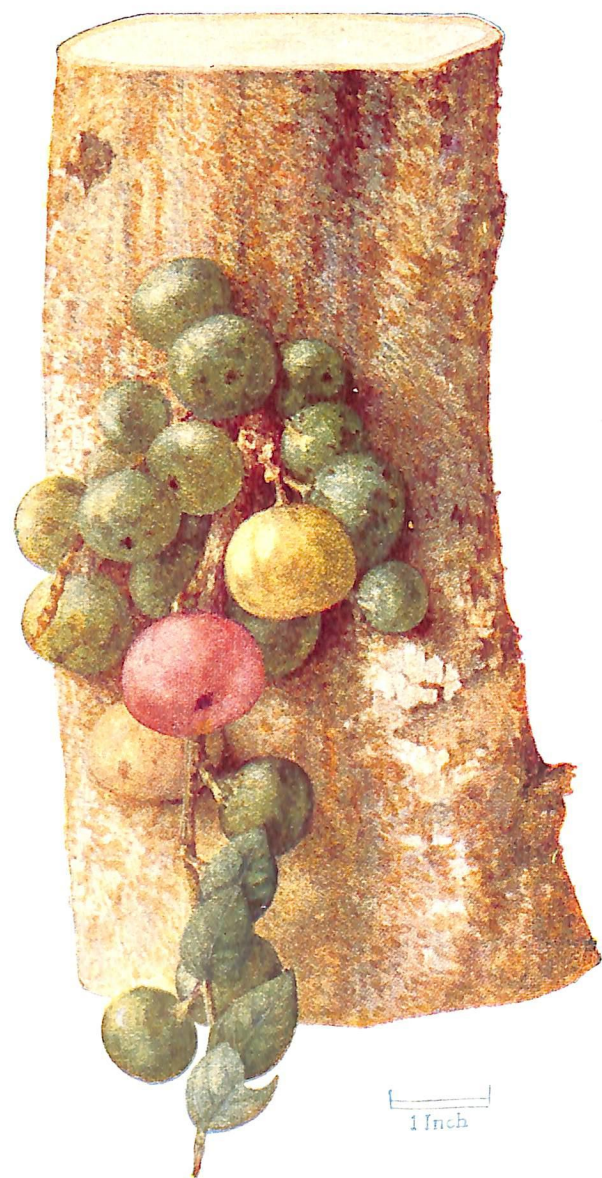
Official parts. Stem bark and root bark. *

Description of stem bark.

Barks obtained from fairly old trunks and branches appear rusty greenish, though the actual colour of the surface skin is rusty

* In Travancore-Cochin stem bark is used. But according to Dymock, Khory and Khatrik and others the root bark is the official part.





Ficus glomerata.

brown. The surface is fairly smooth and soft, and not deeply cracked or fissured or prominently lenticellate or with exfoliating woody outer rind as in *Ficus bengalensis* and *F. religiosa*. The thickness of the entire bark varies from less than a quarter of an inch to about three quarters of an inch, according to the age of the trunk or branch. The surface skin is extremely thin or thinly papyraceous and somewhat translucent. It is always found cracking in very close irregular vertical series and exfoliating in very small oblong or circular flakes about a tenth of an inch wide, except in very young bark in which it is very thin. Because of this condition the surface is almost invariably covered with minute separating flakes of whitish tissue which can be easily removed by rubbing. The freshly formed skin thus revealed, has a characteristic rusty brown tint. In places this skin gets cracked in close vertical series as the result of the constant expansion of the tissues within. Through these cracks an inner greenish tissue is exposed and this is responsible for the characteristic rusty green tint of the bark. In some of the older barks small areas of the outer bark ranging from a quarter to one inch or more in length and about a quarter to half an inch in width become hard and woody and these exfoliate as thin slices, leaving shallow depressions. In such cases the bark appears somewhat uneven. The entire bark has a more or less homogeneous leathery texture. In older and thicker barks the outer portion is slightly gritty. In transverse sections of the fresh bark the skin appears as a thin brownish streak. The rest of the bark has a more or less uniform light fleshy tint, which becomes lighter on drying. The bark has an astringent taste but no noteworthy odour.

Histology of stem bark.

The *cork tissue* or *phellem* is composed of ten or often a lesser number of rows of slightly thick-walled rectangular cells, generally with brownish content. Since the outer rows peel off at short intervals as fresh rows of cells are formed inside, the cork tissue does not thicken much. A distinct *phellogen* of one or two rows of narrow rectangular cells is present and beneath this is a *phelloderm* composed of six to ten or more rows of regularly arranged thin-walled rectangular cells, several of which contain starch grains and others rhomboidal crystals. The *cortex* is a fairly wide zone. The cortical parenchyma cells are spherical to oblong, thin-walled and a few have

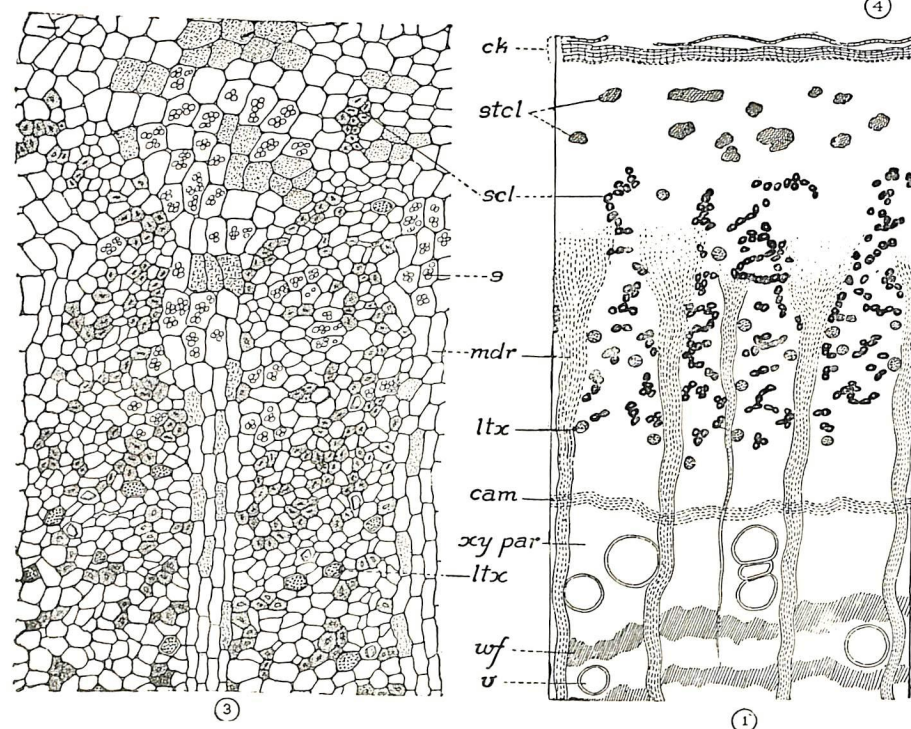
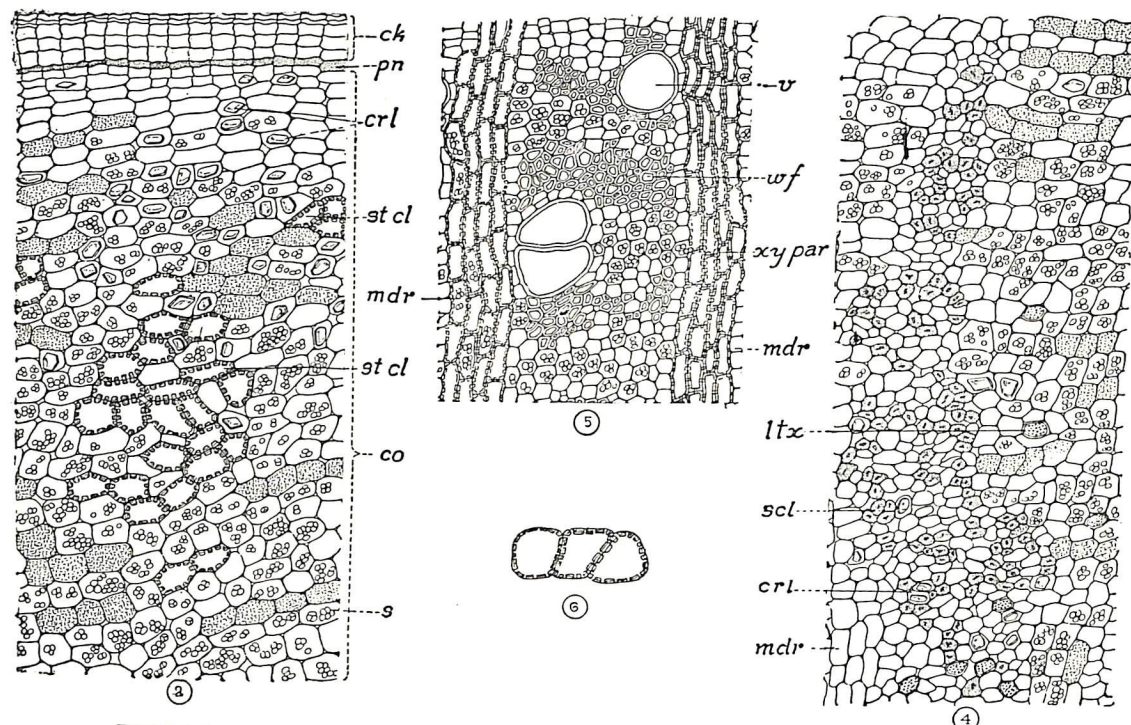
purplish brown contents. The cells of a few peripheral rows contain chloroplasts. The majority of remaining cells are packed with starch grains which occur as triad and tetrad groups, while others contain cubical and rhomboidal crystals of calcium oxalate. Sparsely scattered in the cortex are irregular groups of stone cells each group being formed of one to eight or more cells. The walls of the sclereids are comparatively thin but pitted. The medullary rays are two to five seriate and their distal ends are very wide, with large and tangentially elongate cells. These distal ends almost extend to the periphery of the cortex. The *inner bark* or *bast* forms the widest part of the bark. It is composed of alternating radial segments of phloem and medullary rays. The bast is somewhat densely scattered, with small groups of sclerenchyma. The sclerenchyma cells are fairly large, very thick-walled and occur as single or few celled groups without any regular arrangement. Some of the phloem parenchyma cells contain rhomboidal crystals of calcium oxalate. The cut ends of several latex tubes can be made out in the bast. The more recently formed phloem elements consist of thin-walled sieve tubes companion cells and phloem parenchyma. A number of the parenchyma cells have bluish purple contents.

The *wood* or *xylem* is composed of prominent groups of fibres xylem parenchyma, vessels and medullary rays. The vessels occur singly or in groups of two or three. The xylem parenchyma cells are loaded with starch grains. The fibre groups form irregular tangential segments between the medullary rays, which are three to five seriate. The cells of the medullary rays have pitted walls and contain aggregate starch grains.

Distinguishing features.

Anatomical.

1. The cork zone is very thin being formed only of a few rows of cells.
2. The cortex is a fairly broad zone. Groups of large sized, comparatively thin-walled stone cells occur in the cortex. Crystals of calcium oxalate occur in some cells. Many of the cells are loaded with compound starch grains.



Ficus glomerata
Histology of stem bark

3. The bast consists of regular thin-walled phloem elements and irregular groups of very thick-walled sclerenchyma. Cut ends of several latex tubes can be made out amidst the parenchyma cells, some of which contain crystals of calcium oxalate.

4. In the cortex as well as in the bast there are rows of thin-walled cells the contents of which turn purple on being stained with safranin.

5. The medullary rays are three to five or more seriate. The ray cells are packed with starch and their walls appear pitted in the xylem.

PLATE XXXIII

Ficus glomerata

Histology of Stem bark

- Fig. 1. Diagrammatic sketch of a segment of the T. S.
2. Details of structure of the cork and cortex.
3. Medullary rays in the bast region.
4. Structure of the bast.
5. Structure of wood.
6. Stone cell group slightly enlarged.

PLAKSAH

Source plant in Travancore-Cochin

Ficus retusa Linn.

(Urticaceae)

Sanskrit Text.

Descriptive synonyms

प्लक्षो जटी पर्करी च पर्कटी च स्त्रियामपि ।

(भावप्रकाशः)

Plakṣo jaṭī parkarī ca parkaṭī ca striyamapi

(Bhāva prakāśaḥ)

कथितः कपीतन इति प्लक्षस्तुङ्गी च गर्दभाण्डश्च ।

कपिचूडश्च सुपार्श्वप्लवकोऽसौ चारुदर्शनकः ॥

(अभिदानमञ्जरी)

Kathitaḥ kapītana iti plakṣastuṅgī gardabhāṇḍaśca

Kapicūḍaśca supārśva plavako/sou cārudarsanakaḥ

(Abhidhāna mañjarī)

प्लक्षः कपीतनः शृङ्गी सुपार्श्वश्चारुदर्शनः

प्लवको गर्दभाण्डश्च कमण्डलुवट प्लवैः ॥

(धन्वन्धरी निघण्टुः)

Plakṣaḥ kapītanah śṅgī supārśvaścārudarsanaḥ

Plavako gardabhāṇḍaśca kamaṇḍalu vaṭaplavaiḥ

(Dhanvanthai nighaṇṭuḥ)

Plakṣaḥ = adventitious roots growing downward (plakṣatyadho-gachati mūlaih); *kapītana* = that which turns water yellow; *kamaṇḍalu* (kam = water, maṇḍam = clear portion) = that which takes clear water, probably indicates habitat near fresh water; it may also refer to shape of fruit), *Jatī* = with matty adventitious roots, *supārśva* = few branches, *gardabhāṇḍa* = may refer to shape of fruit.

Properties and uses.

प्लक्षः कषायः शिशिरो व्रणयोनिगदापहः ।

दाहपित्तकफास्रघ्नः शोथहा रक्तपित्तहृत् ॥

(भावप्रकाशः)

Plakṣaḥ kaṣāyaḥ sisīro vṛṇayonigadāpahaḥ

Dāhapittakaphaśraghnaḥ śōthahā raktapittahṛt

(Bhāva prakāśaḥ)

प्लक्षः शीतो व्रणश्लेष्मपित्तशोथविसर्पजित् ।

(मदनपालनिघण्टुः)

Plakṣaḥ śīto vṛṇaśleṣma pitta śōthavisarpajit

(Madanapāla nighaṇṭuḥ)

प्लक्षः कटु कषायश्च शीतलो रक्तपित्तजित् ।

मूर्च्छाश्रमप्रलापांश्च हरेत् प्लक्षो विशेषतः ॥

(धन्वन्धरी निघण्टुः)

Plakṣaḥ kaṭukaṣāyaśca śītaḥ raktapittajit |

Mūrccāśramapralāpāṃśca haret plakṣo viśeṣataḥ ||

(Dhanvantari nighaṇṭu)

Plakṣa is astringent, cool, and cures ulcer, vaginal diseases, burning, vitiated *pitta*, *kapha*, and *rakta*, inflammation and oedema as well as the disease known as raktapitta. According to Madanapāla plakṣa is *visarpajit* i.e. it overcomes erysepelas.

Plakṣa is extensively used in the treatment of ulcers along with the other four ingredients in the group pañcavalka* (the five barks), in the form of decoctions for washing etc. In scabies affecting children this group is administered both externally and internally with very satisfactory results. In inflammatory and ulcerous condition of the vagina also, the above kaṣāyam or decoction is useful for douching. In the preparation of oils and ointments for external application in the treatment of ulcers it is found useful, having good healing property.

* According to Dymock the *pañcavalka* is constituted of the root barks of *Ficus religiosa*, *F. glomerata*, *F. bengalensis*, *F. tjakela*, and *Azadirachta indica*.

Ficus retusa Linn.*
(Urticaceae)

Malayālam	...	Kallithi
Tamil	....	Kallichi
Hindi	....	Kamarup

Distribution and Habitat.

Widely distributed throughout India in all districts, especially base of Eastern Himalayas, Khasia hills, Assam, Burma, Behar, Chota Nagpur, Madhya Pradesh, Deccan, Hills of Northern Circar, and Western Ghats. It thrives best in low country and forests from sea level to about 4000 feet. It is occasionally planted as an avenue tree.

Ficus retusa L. is a large sized compact glabrous evergreen shady tree growing to about sixty feet, with only few slender aerial roots. It is sometimes epiphytic in the early stages. The young shoots are slender, perfectly smooth and bear alternate, stipulate, short-petioled, entire, glabrous, ovate, or obovate to elliptic leaves with firm texture, bluntly or obtusely apiculate apex, and narrowed at base, with many small almost parallel and inconspicuous nerves and axillary pairs of small globose figs which become yellowish when ripe.

External morphology.

Leaves shortpetioled, two to four inches long and one to two and a half inches wide, stipulate, alternate, glabrous, coriaceous, entire, elliptic-ovate to obovate or rarely rhomboidal, apex shortly and bluntly apiculate or subacute slightly emarginate, base narrowed, obscurely three to five ribbed, with five to eight pairs of primary lateral nerves and a large number of intervening smaller parallel nerves. Since the main lateral nerves are not very prominent they could not be easily distinguished from the intervening smaller nerves, so that the leaf appears to possess numerous pinnately parallel secondary nerves all of which join the submarginal vein of the corresponding side. *Petiole*, quarter to half inch long, stout, smooth and

* The botanical source in Travancore-Cochin of Plaksa, locally known as Itti. Another species of *Ficus* also designated as Itti is *Ficus infectoria* Rox b.



Ficus retusa.

Hyurved College
LIBRARY

(U. G. C. Book 14)

slightly channelled above. *Stipules* lanceolate, about one third to half inch in length.

Fruit receptacles occur in axillary pairs. They are small, sessile, globose, smooth or occasionally finely pubescent about one third inch in diameter with the rind some what hard, and yellowish when ripe, and without any characteristic smell or taste. Male, female and gall flowers occur in the same receptacle. Each receptacle carries at its base three broadly ovate obtuse spreading persistent basal bracts. The ostiole or opening is about even with the surface or rarely very slightly raised and is occluded with many scaly bracts. *Male flowers* numerous, sessile or shortly pedicelled, scattered, with three sub-spathulate perianth segments and a single stamen. Anthers cordate-apiculate and as long as the filament. *Gall flowers* sessile or pedicelled with three broadly spathulate perianth segments and a smooth ovary. *Pistillate flowers* sessile or pedicelled, and its perianth is much smaller than in the male and gall flowers. *Ovary* ovoid with short style ending in a cylinric or clavate stigma.

Official part: Stem bark.

Description of bark.

Dark grey, comparatively thin, being less than a quarter inch on trunks about one foot in diameter, profusely lenticellate with horizontally extending lenticels 0.1 inch to 0.4 inch long and 0.05 inch wide, intersected by lesser number of similar vertical rows. The surface colour in many cases is almost completely masked by overgrowth of various types of lichen patches. The surface is more or less smooth except for the lenticels, and non-exfoliating. Outer bark corky and crustaceous, very thin, firmly adherent to inner tissues and easily powdered after removal. Within this outer bark is a thin greenish tissue which is followed by a light flesh coloured inner bark. Exudation of latex is not very profuse. The inner bark has a fibrous texture and sweet mucilaginous taste.

Histology.

As there is not much difference in structure of young and old barks except in the comparative thickness of the different zones of tissues, the older bark alone which is taken for official purposes is described.

Older bark.

The outer most zone or *phellem* is not very highly developed. It is composed of less than 20 rows of slightly thick-walled brownish rectangular cells twice or thrice as long as broad. The *phellogen* is a clear layer of one or two rows of narrow thin-walled rectangular cells. The cortex or middle bark forms the widest zone and the greater part of it is composed of predominant groups of sclereids. There is only very little parenchyma in between these masses of sclereids and these consist mostly of rectangular and oblong cells richly loaded with starch grains and containing cubical or rhomboidal crystals of calcium oxalate. The stone cells are moderately thick-walled rectangular oblong or cubical.

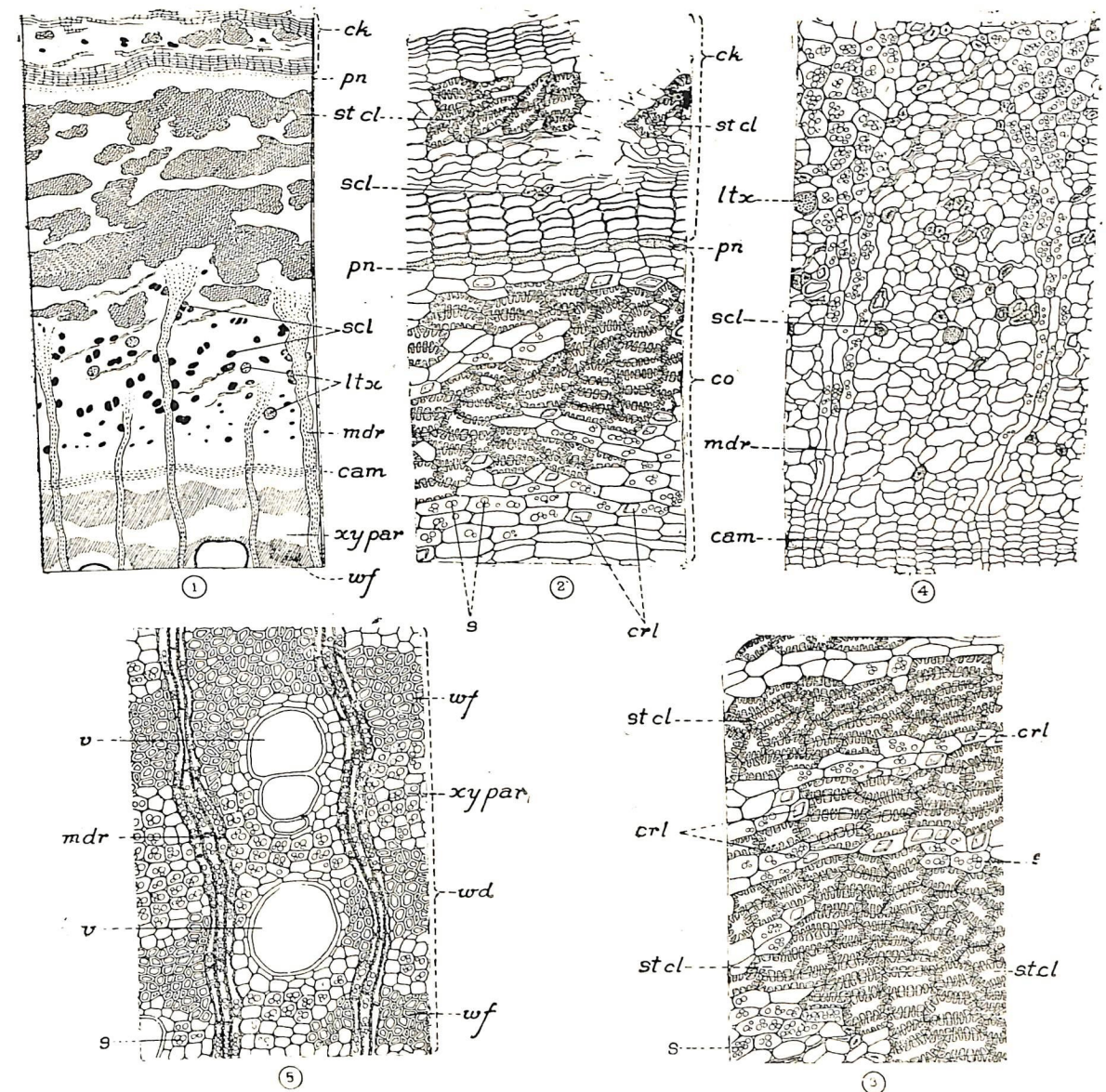
The inner bark or *bast* is composed of radial segments of phloem alternating with two to five seriate medullary rays. The cells of the medullary rays are thin-walled and contain numerous starch grains. One to three celled groups of bast fibres occur scattered in the phloem. Cut ends of latex tubes are also visible. Some of the parenchyma cells contain crystalline inclusions. The *cambiform tissue* consists of a few rows of narrow thin-walled rectangular cells. Wood consists of vessels, wood fibres, wood, parenchyma and medullary rays. Vessels occur isolated or in groups of one to three. Fibres and parenchyma and medullary rays are densely packed with starch grains.

PLATE XXXV

Ficus retusa

Histology of Stem bark

- Fig. 1. Diagrammatic sketch of a segment of the T. S. of stem bark indicating the position of tissues.
2. Structure of the cork and phellogen.
 3. Structure of the cortical tissue.
 4. Details of structure of bast.
 5. Structure of wood portion.

*Ficus retusa*

Histology of stem bark



Ficus tjakela.

Ficus tjakela* Burm

(Urticaceae)

Malayālam ... Kārāl

Tamil ... Kallāl

Distribution and Habitat.

Bengal, Deccan peninsula, forests of the Western ghats, Mysore, and Travancore-Cochin from sea level to 4000 feet elevation, usually found on waste lands, but not very common. Occasionally it is planted as a shade tree in coffee plantations. Flowers in March to April, and fruits in June to July.

Ficus tjakela Burm. is a large tall entirely glabrous much branched spreading tree with an uncommonly dense crown and an irregular thick trunk about three feet in diameter, covered with rough dark brown bark. The tree is generally devoid of aerial roots and is deciduous for a short time during the dry seasons. It is easily distinguishable by the large attractive, purplish red, reddish or scarlet membranous flacid fugaceous scaly stipules which become conspicuous when the buds open and the glistening large, long petioled coriaceous leaves.

External morphology.

Leaves: alternate, stipulate, four to ten inches long and 1.75 to 5 inches broad, very long petioled, ovate to elliptic oblong, coriaceous, entire, slightly undulate, base broad rounded, subtruncate or rarely narrowed, apex rounded, or shortly abruptly acuminate, surface dark-greenish grey, quite smooth and glossy or glistening above, paler below. Lateral nerves six to ten pairs, fairly prominent with distinct tertiary nerves. The leaves when young are greenish yellow, light rose, or red or occasionally pale green but turn dark greenish-grey and shining when mature. *Petioles* slender, 1.75 to 5 inches long. Normal stipules small, ovate lanceolate. (The protective bud scales are however longer. They are linear, lanceolate, reddish or purplish red, flaccid and early deciduous.)

* Equated as Plaksa by Dymock. It is the Tsjakala of Rheede.

The fruit receptacles or syconia, arise from short tubercles in the axils of leaves or near scars of fallen leaves in crowded fascicles or clusters of two to six together. They are sessile or rarely very shortly pedunculate, depressed globose, about 0.2 inches in diameter, yellowish white to dull grey purple with pale dots or spots when ripe and provided with three broad, deeply bifid and patent basal bracts. Each syconium contains male, female and gall flowers.

Male flowers: few, sessile, found only near the mouth of the receptacle, monandrous with three ovate perianth segments that are shorter than the stamen. *Filament* about as long as the anther. The *gall* and *female* flowers appear similar with three to four perianth segments. *Ovary* obovate with elongate style and cylindric stigma.

Official part. Stem-bark.

Description.

General features. The *stem bark* shows considerable variation in thickness and surface features. Its thickness ranges from about 1/10th of an inch in the smaller branches to nearly one inch in the thicker and older branches and trunk. Its surface appears somewhat rough on account of the presence of warty prominent lenticels and fissures. The lenticels are 1/10th to 1/8th of an inch long and about 1/25th of an inch wide. The basic surface colour is brown which may be lighter or darker according to its age or at times greyish or even dark slaty brown. In the older barks the fissures are more prominent.

The rind or outer bark is normally thin but hard and crustaceous. Its outer part is compact, brownish, rusty grey, or slate coloured, and the inner region, yellowish white and corky. Inner surface of the rind is quite smooth and brownish or pale reddish brown. The outer part of the rind sometimes exfoliates, otherwise the surface is uniform. The living bark exposed on the removal of the rind is reddish brown to deeply flesh tinted, the peripheral region being more deeply coloured in the case of the fresh barks. The colour becomes almost uniformly reddish brown on drying. This part of the bark comprises the bulk portion of the bark, the outer bark or rind even in thick barks being comparatively thin. In a clean cut transverse section the rind is seen as a thin line, its outer part grey or brown and

inner region yellowish. The living bark constitutes about the entire thickness. It has a beautiful fleshy to orange or reddish brown tint towards the periphery and lighter or cream coloured inside and shows a fairly homogeneous minutely granular structure in the younger barks. In older barks the outer part is slightly more granular and the inner more fibrous and lamellated especially the part nearest the wood. A limited number of irregularly radiating dark lines traverse the entire thickness of the bark from wood to rind.

Fracture: Short and slightly fibrous, the fractured part exhibits a distinct uniform or almost homogeneous structure and orange brown colour with groups of golden brown hairs (fibres) sticking out here and there.

Taste: astringent and slightly bitter.

Histology.

Ficus tjakela: Barks from twigs and younger branches show the following structure.

The *phellem* or cork tissue is composed of a few rows of compressed rectangular cells generally twice or thrice as long as broad and with brownish contents. Below the phellem the *phellogen* is very distinct. It consists of one or two rows of narrow rectangular cells. Next within can be made out a wide cortex composed of several rows of cells. A continuous or annular band of mechanical tissue composed of sclereids is present, at the extreme periphery of the cortex. The stone cells are mostly rectangular spherical or polygonal and are thick-walled. Cortical parenchyma cells are thin-walled and mostly rectangular. Almost all the cells have reddish brown contents in them. Starch grains are also present.

The inner bark or bast is not so very wide as in older bark. This is composed of radial segments phloem alternating with two to five seriate medullary rays. Six seriate medullary rays are also occasionally seen. Sclerenchyma cells as well as the cut ends of latex tubes are or found scattered in this region. Other cells contain few rhomboidal or cubical crystals of calcium oxalate. Collapsed elements of phloem also occur. The medullary rays widen in the middle bark and the cells contain starch grains.

Four to six rows of cambium composed of narrow thin-walled rectangular cells separate the wood and the bast. The wood is composed of generally isolated vessels, fibres, wood parenchyma, and medullary rays. Fibres and wood parenchyma are disposed in alternating bands. Walls of the medullary ray cells are pitted. Wood parenchyma and medullary rays are densely loaded with starch grains.

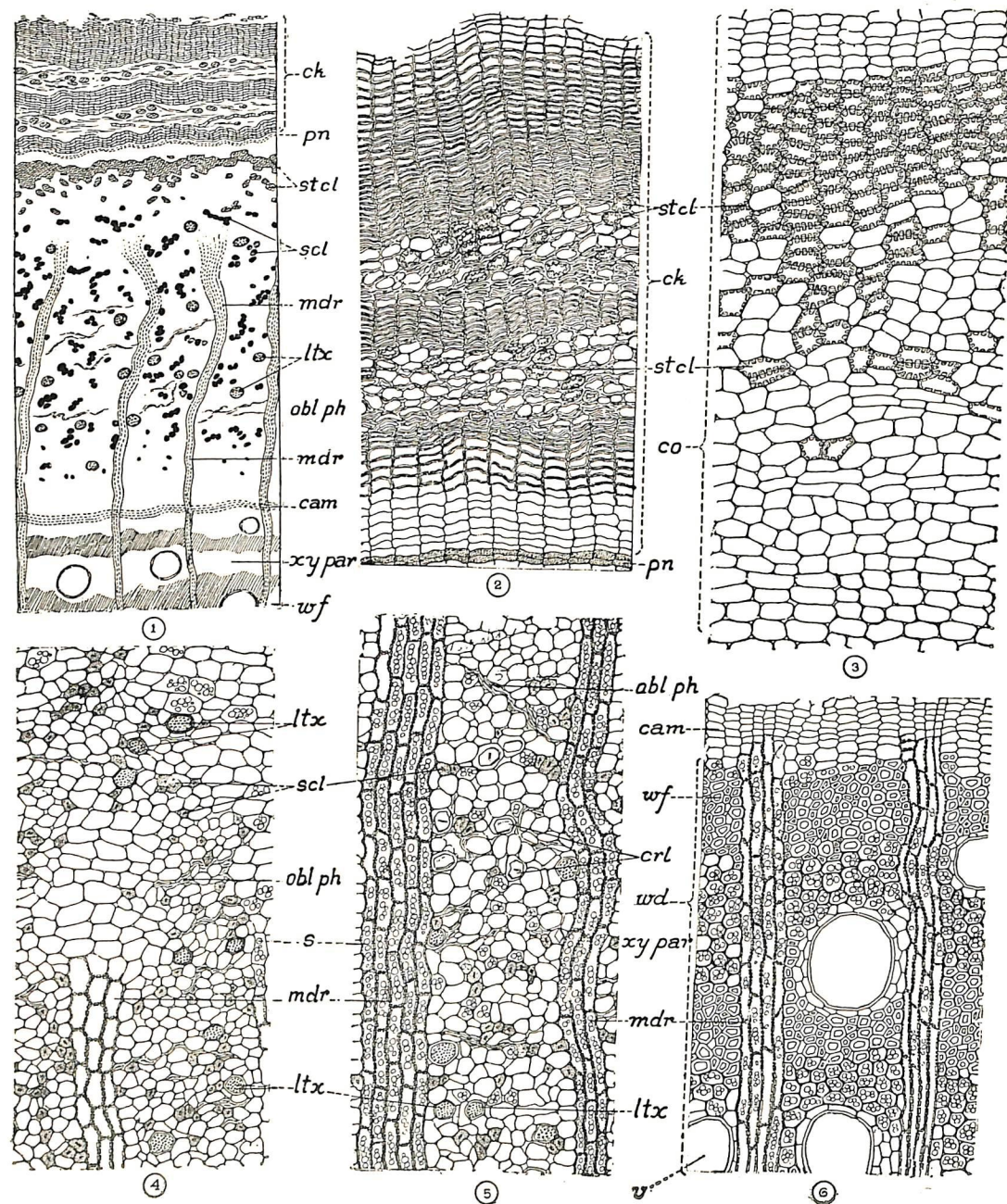
Histology of bark.

A cross section of the older bark shows a well developed rhytidome consisting of broad zones of cork separated by cortical stone cells and disintegrated parenchymatous cells. The cork layers of the rhytidome vary in thickness from 5-30 or more rows of cells, the outer most rows of which have brownish red contents. The cortical region is comparatively narrower. Immediately outside the phellogen is the freshly formed cork region. The distal portion of this region consists of brown, thick-walled cells, while recently formed cork cells have yellowish green walls. The phellogen is two cells deep. The phelloderm is also conspicuous. It is 4-8 cells deep, parenchymatous and devoid of any contents. The phelloderm is followed by a broad, 7-10 cell-deep stone-cell layer. In addition to this layer the cortex contains diffusely arranged groups of stone cells, sclerenchyma cells and latex vessels. The parenchymatous cells of the cortex are hexagonal, laterally compressed or rounded with prominent intercellular spaces. The cortical cells are usually without any inclusions.

The cortex imperceptibly merges with the phloem. Three to five seriate pitted medullary rays traverse the whole breadth of phloem. The raycells are rectangular, their length 4-7 times greater than their breadth. Starch grains are abundantly distributed in the ray cells. Scattered groups of sclerenchyma and latex vessels are noticeable in the phloem. Most other cells of this region are pitted, rounded or compressed. Highly compressed obliterated phloem cells occur. Some cells of this region contain calcium oxalate crystals while others are loaded with starch grains. *Cambium cells* are rectangular, and thin-walled. The cambium varies from 5 to 12 rows in different parts of the bark.

Wood contains scattered vessels, wood fibres and wood parenchyma. The medullary rays of this region are of the same

nature as in the bast. The greater part of the wood is composed of thick-walled wood fibres but isolated groups of wood parenchyma cells are also seen. These cells contain starch grains.



Ficus tjakela
Histology of stem bark

PLATE XXXVII

Ficus tjakela

Histology of Stem bark.

- Fig. 1. Diagrammatic sketch of a T. S. of old stem bark showing the disposition of various tissues.
2. Structure of cork.
3. Structure of cortical tissue of a medium sized bark.
4. Structure of the bast in a medium sized bark.
5. Bast of old bark.
6. Wood region showing structure of medullary rays and parenchyma with starch grains.

Printed at
THE ALLIANCE PRINTING WORKS.
Thycaud, Trivandrum.