

PHARMACOGNOSY OF AYURVEDIC DRUGS

(KERALA)



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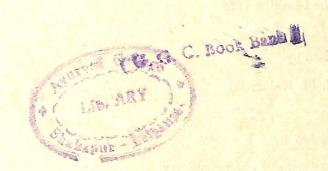
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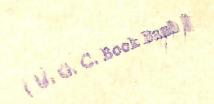
PHARMACOGNOSY DEPARTMENT
AYURVEDA COLLEGE
TRIVANDRUM
1978

Series 1

Number 2

PHARMACOGNOSY OF AYURVEDIC DRUGS





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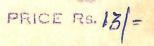
THE DEPARTMENT OF PHARMACOGNOSY

GOVERNMENT AYURVEDA COLLEGE
TRIVANDRUM

Series I

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PHARMACOGNOSY OF AYURVEDIC DRUGS

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Number 2.

First Published 1953

Revised Edition 1978

Revised by

Prof. M. Kolammal

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PREFACE

Being the most ancient of all the systems of medicine Ayurveda has the largest number of plants in its Materia Medica. An Ayurvedic Physician should be able to distinguish a particular medicinal herb from a number of allied unwanted plants. It is absolutely more essential that an ayurvedist should correctly identify the plants described in ancient books than to have much knowledge of the various chemical ingredients of the plants he uses. Due to the multiplication of substitutes of drugs the correct identification of plants and equating the same to its corresponding ayurvedic drugs has become difficult. It is chiefly to handle this aspect, this series is being published. The book has supplied a long felt need in the subject and is used throughout India. Orders are often received from abroad also. In this edition the slokas relating to the drugs dealt with, are also added in Sanskrit to the English transliteration. I hope that this reprinted edition will also be received by the scholars like the first edition.

I express my grateful thanks to the authorities of the Government of Kerala and the Department of Indigenous Medicine for giving sanction to bring forth this edition.

Pharmacognosy Unit, Poojapura, Trivandrum-12.

Prof. M. Kolammal

PREFACE TO THE FIRST EDITION

The Pharmacognosy Committee of the University of Travancore have pleasure in releasing the second number in the series "Pharmacognosy of Ayurvedic Drugs—Travancore—Cochin." This issue deals with eleven Ayurvedic drugs, involving the description of fifteen plants and their officinal parts.

When the first number in the series was published many experts in indigenous medicine and press reviewers commended the high standard attained in this work, and emphasised its extreme usefulness for the progress of Ayurveda. This has been a source of great encouragement to us in our further efforts and we take this opportunity to express our deep sense of gratitude to all of them for their valuable suggestions and constructive criticism.

A few persons have suggested that Devanagari script may be used instead of Roman script with diacritical Marks, for quoting verses from Sanskrit texts, but this was not adopted since we felt that such a change at this stage may not only alter the uniformity of the publication but will also be a serious handicap to those who are not familiar with Devanagari script.

Another suggestion which has been made by some of the reviewers is that the therapeutic value and mode of application of each drug may also be included in the subsequent issues. But we regret that we could not implement this suggestion since the inclusion of such details will completely alter the scope of this publication which is strictly confined to the description and method of cultivation of the source plants as well as the collection, storage, keeping quality etc. of their officinal parts. This is also the reason for not including verses from the works of Caraka, Susruta and Vāgbhata which do not give much information of pharmacognostic value.

The desirability of shortening the interval between the publication of successive numbers of this series has been suggested by some and we are endeavouring our utmost to do so. It is true that the first number of the series appeared only five years after the constitution of the Committee. This is because a great deal of preliminary work was necessary to identify the correct source plants from the different alternatives which are traditionally accepted by Ayurvedic physicians and herbalists in different parts of Travancore-Cochin. That part of the work having now been completed in respect of about and the Committee hopes to publish the pharmacognostic notes on at least thirty plants

The chemical composition of the drugs has not been included in this issue since the analytical work could not keep pace with the anatomical descriptions. So even though the analysis of a number of drugs described in this issue have already been completed it has been decided to publish the chemical notes separately as an appendix.

In the introduction to the first number, there has been a very unfortunate omission. The name of Dr. K. L. Moudgill which should have figured prominently in the list of acknowledgments was left out by oversight. As the first Director of Research of the Central Research Institute, it was Dr. Moudgill, who organised the Pharmacognosy Section. Later as the first Convener of the Pharmacognosy Committee he contributed substantially in shaping the programme of work of this section. We have no doubt that this work would not have materialised but for his sincere interest and clear vision of the needs of Ayurvedic science. We hasten to apologise for the unfortunate omission and though belated, wish to place on record our heartfelt gratitude to Dr. Moudgill for his singular services in piloting this scheme through its early stages of doubts and vicissitudes.

During 1951 and 1952, Dr. P. V. Nair and Dr. C. S. Venkateswaran successively held the office of the Convener of the Pharmacognosy Committee and we wish to express our thanks to both of them for all their help and encouragement.

We also wish to record our appreciation of the work of Sri K. Narayana Iyer, who has been in charge of the Pharmacognosy section from its commencement.

Trivandrum,
December 1952.

Dr. A. Abraham
Professor of Botany, University College

Dr. R. Kesavan Nair Director, Government Gardens

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Applied Chemistry Department

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Sri S. Venkateswara Iyer Chief Conservator of Forests

Sri K. Narayana Iyer Pharmacognosy Special Officer

Dr. C. C. John
Director of Research (Convener)

TABLE OF TRANSLITERATION

Sans.	En	ıg.	Sans.	En	g.
अ	A	a	Š	T	ţ
आ	Ā	ā	ठू	TH	ţh
इ	I	i ī	ड्र	Ď	d
ई	Ī	ī	ढ्र	ĎН	фh
उ	Ī U	u	ण	N	ņ
कक्ष ए अ ए अ ऐ औ	Ū	ū	त्	T TH D DH	t
ऋ	Ŗ	ŗ	थ्र	TH	th
ए	E	e	द्	D	d
ओ	0	0	घू	DH	dh
ऐ	O AI AU M	ai	न्	N	n
औ	AU	au	ď	P	p
•	M	ṁ	फ्र	PH	ph
8	H	ḥ	ब्र	В	b
क्र	K	k	भू	BH	bh
ख्र	KH	kh	म्	M	m
ग्र	G	g	यू	Y	У
घू	GH	gh	र्	R	y r l v
ङ्	N	'n	ल्र	L	1
चू	Ń С СН	c	व्र	R L V Ś	V
छ्	CH	ch	श्र	Ś	ś
ज्र	J	j	ष्	ș S	ş
ক' ভ' ন' ঘ' ড' ন' ভ' ন' জ' ন'	JH	jh ñ	ਲਾ ਲਾ ਲਾ ਲਾ ਜਾ ਜਾ ਬਾ ਜਾ ਜਾ ਸਾ ਲਾ ਕਾ ਜਾ ਜਾ ਸਾ ਸਾ ਸਾ ਸਾ ਨਾ ਨਾ ਕਾ ਜਾ ਲਾ ਲਾ		S
न्	N	ñ	ह	H	h

DRAVIDIAN SPECIALS

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ഒ				N'	
			G	Z	7.

LIST OF ABBREVIATIONS

bf.	bast fibre.
bt.	bast.
cam.	cambium
cdcl.	collapsed cells.
ck.	cork.
co.	cortex.
crl.	crystal.
crm.	ceratenchyma.
lx. t.	latex tube.
lt.	latex.
m. or pi.	medulla or pith
mr. mdr.	medullary ray.
ogl.	oil globule.
ph.	phloem.
ph¹.	primary phloem.
phd.	phelloderm.
phf.	phloem fibre.
pn.	phellogen.
rn.	rind.
S.	starch.
scl.	sclerenchyma.
stcl.	stone cell.
svt.	sieve tube.
v.	vessel.
wd.	wood.
wf.	wood fibre.
xp. or xy. par.	xylem parenchyma.
xy.	xylem.
v. b.	vascular bundle.

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M ŪR VĀ मूर्वा

Chonemorpha macrophylla G. Don.*

Family-Apocynaceae

Descriptive Synonyms

"मूर्वामधुरसादेवी मोरटा ते जनी सृवा ।
मध्लिका मधुश्रेनी गोकर्नीपीलुपण्यंपि" ।। (भावप्रकाशः)

"Mūrvā madhurasādevī moratā tejanī sruvā madhūļika madhusreņi gokarņi pīluparnyapi"

(Bhāva Prakāśa)

Other descriptive terms mentioned are 'drdhasūtrikā', 'dhanurmālā', 'dhanurguṇā', 'pṛthaktvaca' (Śāligrāma Nighantu).

'Mūrvā', 'madhurasā' and 'maduhuśreņī' indicate sweetness, 'dhanurmālā' and 'dhanurguņā' meaning bowstring, refer to its strong fibres used for making bowstrings; and girdle (maurvi) of the Kṣatriyās; 'pṛthaktvaca' refers to its easily separable or loose skin, and 'gokarņī' means like cow's ear.

Properties and Uses

''मूर्वा सरा ग्रहः स्वादुस्तिक्तापित्तास्रमेंहनुत् । त्रिदोषतृष्णा हृद्रोगकण्हुकृष्ठज्वरापहा''।। (भावप्रकाशः)

"Mūrvā sarā guruh svādustiktā pittāsramehanut tridosatrs, nāhrdrogakaņdūkusthajvarāpahā"

(Bhāva Prakāśa)

'Mūrvā' is 'sarā' laxative, 'guruh' heavy of digestion, 'svādu' sweet or agreeable and 'tiktā' bitter. It is useful in 'pittāsra' (is antiscorbutic), and 'meha' urinary diseases; controls 'tridoṣa', destroys 'tṛṣṇā' thirst, 'hṛdroga' heart(?) disease, 'kaṇḍu' pruritus, 'kuṣṭha' skin diseases, and 'jvara' fever. According to 'Rājanighaṇṭu' 'mūrva' is also 'kṣāyoṣṇa' astringent, and 'hot', 'kaphavātahṛt' overcomes 'kapha' and 'vāta', cures 'vami' vomitting, and 'viṣamajvara' intermittent fever. Other properties ascribed in 'Ṣāligrāma'.

^{*} In a number of authoritative publications $M\bar{u}rv\bar{a}$ is identified as Sanseviera roxburghiana Sch., belonging to Liliaceae (Haemodoraceae). This is also supported by the fact that in a number of Indian languages, as well as in Singhalese, S. Roxburghiana is called Mūrva, Moorba etc.

C. macrophylla may be considered as a substitute used in Keraja for Mūrvā

Clematis triloba Heyne (Ranunculaceae) is also considered a source plant by a number of authors.

Chonemorpha macrophylla G. Don.

Family—Apocynaceae

Malayālam .. Perumkur'umpa

Distribution and habitat.

The plant is recorded as occurring throughout India. It is very common in the moist and semi-deciduous forests of Kerala from the plains up to 2500 feet.

Habit and general features

Chonemorpha macrophylla is a large spreading profusely laticiferous, shrubby twiner with stout stem and branches coverd with soft greyish to rusty-brown bark. Leaves, large opposite short petioled broadly-elliptic or ovate to nearly orbicular, entire and prominently veined. The flowers are large whitish to cream-yellow, fragrant, and borne on few to rarely many flowered terminal or more often pseudo-axillary cymose panicles. The tender shoots have a markedly rusty to purlish-rusty pubescence and are often marked with minute elevated specks. The plant usually flowers from May to August.

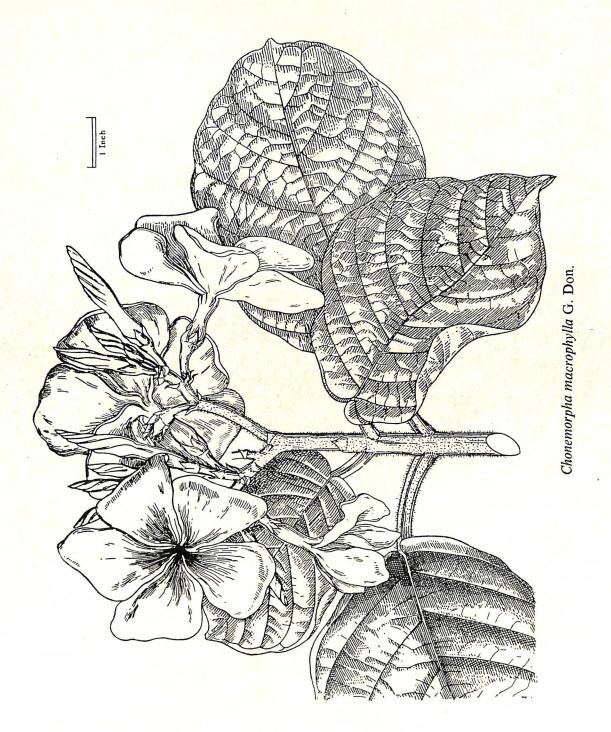
External morphology.

Leaves: Large, four to twelve inches long, three to six inches broad, simple, opposite, exstipulate, short-petioled, elliptic-ovate to broad ovate or occasionally nearly orbicular, leathery, entire, acute or cuspidate at apex, densely fulvous-pubescent beneath, with ten to twelve pairs of prominent distantly placed arching secondary nerves. Petiole one half to two inches long, varying according to the size of leaf.

Inflorescence: a terminal or more often pseudo-axillary cymose panicle with a strong erect peduncle, bearing few or rarely many flowers. Flowers: bracteate, regular, two to three inches broad, whitish, creamyellow or yellowish-orange and fragrant. Calyx-one third to half inch long, campanulate, funnel-shaped or slightly tubular, coriaceous, five toothed or lobed and usually provided with a ring of glands on the inner side of the base, lobes erect, sub-acute or rounded and imbricate in bud; Corolla-large, white or cream-yellow to yellowish-orange; tube very short, cylindrical, slightly expanded or gibbous above the base where the anthers are lodged, sometimes with five villous bands on the inner surface; mouth glabrous, lobes five, obliquely obcuneate, overlapping to the right, up to two inches long and one and a half inches broad; Stamens five, about half inch long and inserted on the corollatube; filaments short, broad and villous anthers included, sagittate, elongate-acuminate with short incurved spurs at base; the cells united at the sides, projecting over and weakly cohering or adhering to the stigma. A thick annular or cupular, entire or slightly crenate disc is present at the base of the pistil. Pistil bi-carpellary; ovaries separate, many ovuled, with a common simple filiform style, cleft at the base, grooved above as if composed of two portions firmly united and ending in a globose or hemispheric stigmatic head with bidentate apex.

Fruit: of two long straight trigonous to nearly terete, smooth, thick, woody, acute or pointed, almost parallel, pendulous, follicular mericarps, six inches to one and a half feet

Nighanţu' are that 'mūrvā' is 'pākakāle tu kaţukā'—becomes pungent on undergoing digestion,—and is useful in 'medorogam'—excessive fat,—mukhasoşa'—dryness in the mouth,—and 'bhramam'—giddiness, and that its 'kanda' or underground stem destroys worms and 'krmikīlakaroga'.



long and three quarters to nearly one inch thick. Seeds many, large, about three quarters of an inch long, flat, ovoidoblong, or spathulate, shortly beaked and tipped with ample quantity of long white silky coma. Albumin scanty. Embryo with thick, flat, oblong cotyledons and a short sub-cylindric superior radicle.

Officinal part.

The main root as well as the lateral and adventitious roots are commonly used for medicinal purpose.

Description: The root system consists chiefly of a large number of lateral or secondary roots and their branches which spread fairly close to the surface of the soil. They are long, cylindrical woody but light and ashgrey to light-brown in colour, sometimes also with a pale purplish or violet tinge. When cut in the fresh condition they exude plenty of latex. In the smaller roots the surface is nearly smooth, but in older ones, it is slightly longitudinally wrinkled and somewhat rough due to development of warty lenticles of various sizes. The entire bark is fairly soft, compact and thick forming about a sixth of the diameter in the smaller and medium sized roots but proportionately thinner in the stouter ones. The bark of the smaller roots shrivels up longitudinally on drying, but in the older ones there is not much shrinkage. The outer bark or rind is thick, corky, greyish white outside and whitish within. It is easily scrapable and sometimes even peelable in thin flakes, but is not very friable. It appears as a greyish compact thick line in transverse section. The middle and inner barks when fresh are whitish, but on exposure turn brown and finally dark brown, the colour change being deeper towards the periphery. The inner bark is laticiferous, comparatively thick and forms the bulk of the officinal bark. In fresh condition latex exudes copiously from the region near the wood. The enitre bark has a bitter soury astringent taste, and, in the case of smaller roots, a faintly camphoraceous or resinous aromatic odour is also sometimes noticeable. The wood is yellowish-white or cream-yellow and highly porous. It has a slightly sweetish taste without any bitterness or astringency. The medullary rays are not very prominent.

Histology.

In transverse section the root is circular or oval and in dry roots the outline is minutely wavy. The cork zone which is greyish or light brown compact tissue is composed of fifteen to twenty or more rows of narrow rectangulr, tangentially elongate thin-walled empty cells. The formation of successive zones of cork can be clearly made out in older barks.

The phellogen is composed of one or two rows of cells and just within it is a narrow but distinct zone of secondary cortex (phelloderm) composed of a few rows of large, oblong, tangentially elongate, somewhat thick-walled cells without prominent inclusions. This tissue merges imperceptibly into a fairly wide well-marked zone composed of several rows of thin-walled cells of various shapes and sizes. Scattered in the peripheral part of the latter are several groups of closely aggregated polyhedral stone cells with thick pitted walls, a number of latex tubes, and the broadened distal portions of medullary rays. The number of stone cells in a group as well as their size varies. These groups of stone cells form the only mechanical element in the entire cortical region.

The more recently formed bast, situated immediately within, forms the widest zone of the bark and consists of radially alternating segments of phloem and narrow medullary rays. Each strip of phloem between successive medullary rays consists of two to three

.

or more radial rows of thinwalled phloem elements, viz. sieve tubes, companion cells and pholem parenchyma, together with a large number of latex tubes arranged in almost regular radial rows lying close to the medullary rays. The pholem parenchyma cells are small, thin-walled and polygonal and some of them contain strach grains. The sieve tubes are comparatively large. The medullary rays which have a more or less straight course, are narrow and mostly uniseriate. A fairly large number of bi-and tri-seriate rays also occur. The medullary-ray cells are large being nearly double the size of the neighbouring parenchyma cells, thin-walled, narrow, radially elongate in the portions nearest the wood but tangentially elongate towards the distal portions, and richly stored with small spherical strach grains. The ray cells in the xylem part are similar to those in the phloem region nearest the wood, but have thick pitted walls. The cambium is a thin but distinct zone of two to three rows of very narrow rectangular cells. The wood has a highly porous structure and consists mainly of very thick-walled sclerenchyma, scattered vessels of various sizes and the medullary-rays. The sclerenchyma cells appear triangular four-sided or polygonal in outline and fill up most of the space between the vessels. The xylem parenchyma is only feebly developed. There is no pith in the centre.

Distinguishing features.

A. Morphological

1. The root is cylindrical, woody but light, laticiferous when fresh and of an ashgrey to light brown colour, occasionally with a purplish tint. The surface of dried roots is longitudinally shrivelled.

2. The rind is compact, corky, somewhat peelable but not friable, greyish outside

and whitish within.

3. The middle and inner barks together form a fairly homogenous tissue, whitish and juicy when fresh but turning dark-brown on exposure.

4. Wood cream-white to light-yellow and highly porous.

B. Anatomical.

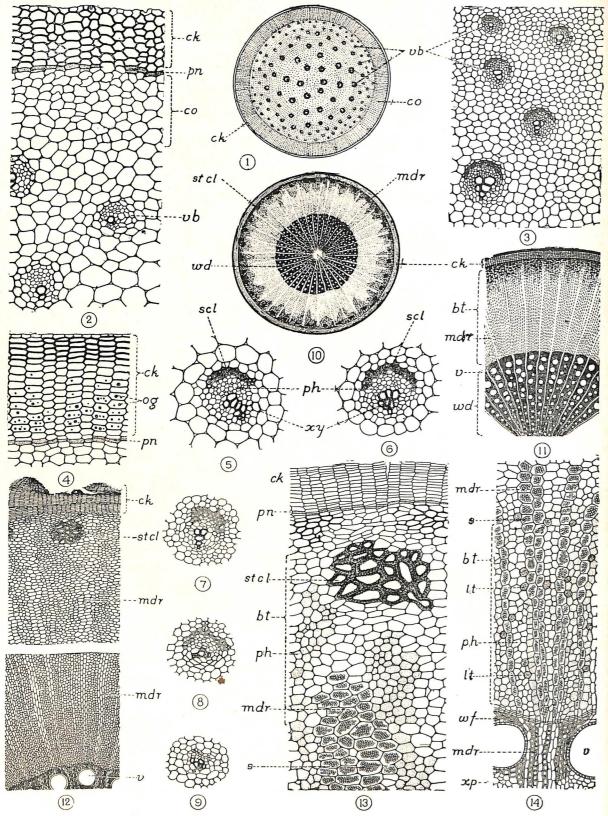
- 1. Transverse section circular to oval, with a ridged or wavy margin.
- 2. The cork tissue which appears as a thin brownish strip is composed of several rows of tangentially elongate, thin-walled cells devoid of cell contents.
- 3. The middle bark consists of several rows of thin-walled oblong cells of various sizes. A number of groups of stone cells and cut ends of latex tubes are found in the peripheral portions of this tissue.
 - 4. The inner bast consists of strips of phloem alternating with narrow medullary rays.
 - 5. Mechanical elements other than the groups of stone cells are not found in the bark.
- 6. The wood is composed mostly of thick-walled sclerenchyma, a scattered array of large vessels and narrow medullary rays most of which are uni-seriate. The cells of the medullary rays are loaded with starch grains.
 - 7. There is no pith.

C. Taste and Odour,

The root bark has a sour or bitter astringent taste. Its wood when fresh is feebly sweetish.

Collection, mode of use, keeping quality etc.

The small and medium sized roots are those commonly brought or exhibited for sale.



Histology of Chonemorpha root and Sanseviera rhizome.

PLATE II Histology of Chonemorpha and Sanseviera.

A. Sanseviera rhizome.

- Fig. 1. Diagram of Transverse section of rhizome.
 - 2. Details of structure of cork and coretx.
 - 3. Vascular bundles and ground tissue.
 - 4. Portion of cork tissue showing details.
 - 5, 6, 7, 8 & 9. The types of vascular bundles.

B. Chonemorpha root.

- Fig. 10. Diagram of transverse section of root.
 - 11. Portion of fig. 10. enlarged.
 - 12. Segment of the root showing details.
 - 13 & 14 Structure of cork, secondary cortex, bast and xylem.

Sanseviera roxburghiana Schult, f.*

(Syn. S. zeylanica Roxb.)

Family—Liliaceae

English .. The bow-string hemp.

Tamil .. Marul, Mottamanji

Malayalam .. Maral, Malar

Hindi .. Murhari, Marul

Distribution and habit.

The plant is indigenous to and distributed throughout India and Ceylon. It thrives well in low and intermediate elevations, from sea level to about 2000 feet, in arid or semi-arid localities such as exposed slopes, rock crevices, fringe of forests etc., and in almost any type of rocky, sandy or gravelly soil.

Cultivation.

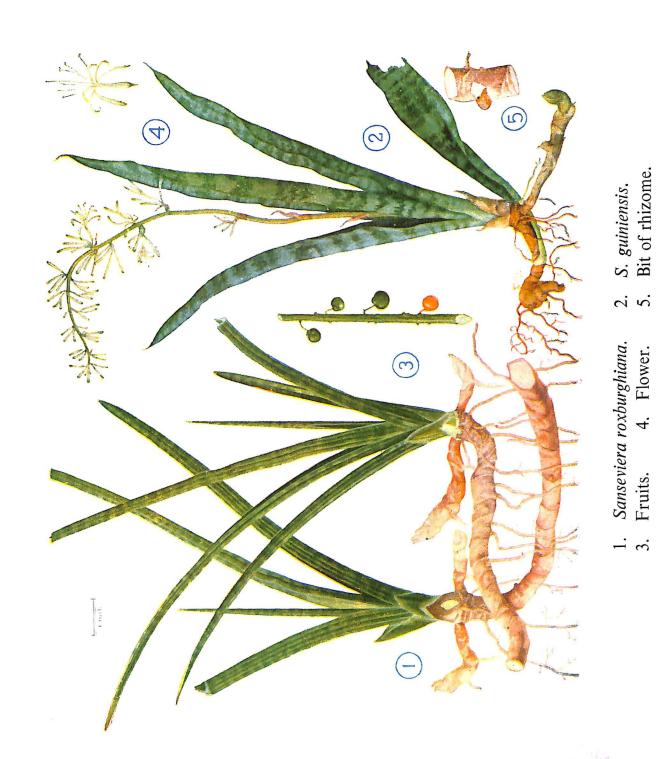
The plants are easily propagated by division of rhizome, as well as by seeds and leaf cuttings. It is not however, ordinarily cultivated for officinal purpose, though occasionally grown for the very strong fibers obtained from its leaves, used in ancient days for making bow strings c.f. the English name Bowstring hemp and the Sandkrit terms *Dhanurmālā* and *Dhanurgunā*.

Habit and general features.

Sanseviera roxburghiana Sch. is a semi-succulent gregarious perennial herb without any distinct erect aerial stem. The aerial part (the shoot portion) is mainly composed of bunches of erect straight or curved, linear to narrowly sword-shaped angular channelled greenish or greyish green radical leaves sprouting from a sympodial stoloniferous underground rhizome. The tips of the branches of the rhizome after a short horizontal run underground, come up as stumpy aerial shoots of limited growth, with a few short broad spreading basal leaves and a larger number of much longer narrower inner erect leaves. Other branches arise later on from the bases of these shoots. By this means the plant effectively spreads in all directions and ultimately establishes itself in the whole area in a densely gregarious manner. It is rather difficult to eradicate the plant once it has established itself since small bits of the rhizome and even cut bits of leaves left over in the soil retain their vitality for a long time and function as organs of vegetative propagation.

External morphology.

Leaves: radical, mostly vertically oriented or erect, in bunches of three to ten or more. They are slightly fleshy to cartilaginous pale greenish to greyish green somewhat striated and most often with fairly broad, transverse blotches of grey or lighter green alternating with brighter and deep green patches. Nerves many, small, immersed. The outer or basal leaves are short (one to three inches in length) comparatively very broad, ovate to ovate lanceolate and acute like a cow's ear (gokarni) and spreading. These soon wither. The inner ones are longer, one to three feet or more in length, erect or sometimes curved outwards, linear to narrowly sword shaped, angular, obtusely keeled on the back and often deeply concave or channelled on the upper side, with a number of longitudinal greenish lines. They are narrowed towards the base, and shortly acuminate and tapering to or ending in a stout,



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^{*} Sanseviera roxburghianea Schult is equated as Murva in books on Indian Materia Medica.

short or long rounded subulate point at the tip. Margins often slightly reddish and shallowly wavy.

The inflorescence arises from the centre of the cluster of leaves and is a slender, erect, elongate scape, one to two feet long including the flower bearing part. The rachis is round, smooth, faintly striated and about as thick as a small rattan or quill, generally less than a quarter of an inch in thickness. Its lower or basal half does not bear flowers, but has four or more, regularly spaced, alternate, pointed or acuminate, membraneous nodal sheaths. The distal half which comprises the actual flower bearing part is smooth and striated and measures a foot or more, in the longer types.

The flowers arise in fascicles of four to six from regularly spaced small tuberosites on the rachis. They are medium sized (from 0.6 to 0.8 inch long) greenish white and ascending, with small membraneous, deciduous bracts about one eighth inch long. Pedicels erect short-one fifth to one third inch long and jointed about the middle. Perianth tube slender, narrowly funnel shaped cleft to about the middle: lobes six, narrow long and curved outwards in the open flower. Stamens six, inserted opposite to and attached to the base of the lobes; filaments filiform, about equalling the perianth segments; anthers dorsifixed incumbent linear oblong. Ovary superior three lobed, three celled with one erect ovule attached to the inner angle of each cell; style filiform, about the length of stamens ending in an entire three sided clubshaped stigma.

The fruit has a membraneous evancescent pericarp that gets ruptured as the seeds ripen. The seeds are large, globose, about a quarter to half an inch in diameter, fleshy, one to three together in slightly united condition, orange to reddish orange when ripe and perispermic. Embryo simple, lodged near the base of and outside the perisperm.

Officinal parts: Rhizome and leaves

Description of rhizome. The rhizome is a sympodially branching stoloniferous structure growing horizontally underground close to the surface of the soil or occasionally exposed to light and air. It is nearly uniformly cylindrical one third to half an inch in thickness straight or more often irregularly bent or curved and light greyish to light brown, often with a rose or reddish tinge or completely rosy or occasionally in the case of those exposed to sunlight greensih in colour. When fresh it is slightly tuberous, juicy or semisucculent and fibrous. A large number of strong narrow roots, about a tenth of an inch in diameter or smaller, arise from the sides and lower part of the rhizome and in the material brought for sale these are invariably found along with a number of wiry fibrous rootlets. The roots and their branches very closely resemble the rhizome in their surface colour but differ in size and other features. The younger or tender portions of the rhizome are usually covered with thin scarious sheathing scale leaves which soon fall off. They are tender, quite turgid, brittle and have a greyish white, thin somewhat translucent skin or rind, free from wrinkles or furrows. Older or mature portions of the rhizone are marked with the scars of fallen scale leaves at shortly spaced slightly raised oblique nodal ridges and their surface except for the scars may be considered fairly smooth. These are more tough and fibrous, appear deep grey to rosy red and their rind is somewhat leathery, stronger, peelable (prtaktvava) and slightly longitudinally wrinkled. Even where the surface is greyish, it appears reddish when wetted though it regains the original greyish tinge on drying. In most cases the rind appears as a fairly thick orange or light reddish coloured strip with a characteristic orange to brick-red colour(raktala?) inside. It has a slightly warm sweetish taste and a faint agreeably aromatic smell. In tender portions of rhizome the tissue immediately within the rind often has a light greenish tinge, but in the older portions it appears uniformly whitish. On exposure to air, its colour turns duller becoming finally brownish. This tissue is juicy, exhibits a fairly homogenous structure and has a slightly mucilaginous sweetish taste (madhurasa?) but no aroma. It may sometimes be slightly acrid (due probably to the presence of raphide bundles in the tender portions). The rhizome easily breaks with a short fracture, exposing the free ends of number of fine fairly strong fibers at the cut surfaces.

Histology

The transverse section of the rhizome is circular with the outline entire or slightly ridged in dried specimens. In young rhizomes a single layered epidermis is present at the periphery. In older rhizomes this layer appears mostly torn or absent and is replaced by a well developed zone of cork tissue composed of few to fifteen or more rows of cells accor ding to the age of the rhizome. The ultimate shape of the cork cells as well as their arrangement are somewhat peculiar. They have fairly thick walls and appear square or rectangular or trapezodial in transverse section with the radial walls often slightly flexouse. In the peripheral rows the cells are mostly empty, but orange or reddish brown globules of oil are present in a number of cells in the more recently formed inner rows. The phellogen is not always clearly differentiated. Next within and located outside the zone of vascular bundles is a narrow but clearly perceptible region of a limited number of rows of circular or oblong thin walled parenchymatous cells, with very small intercellular, spaces. These cells are normally devoid of inclusions like strach grains or oil globules, though larger cells containing raphide bundles are occasionally found here. This region merges imperceptibly into the central bulky mass of fundamental tissue wherein the vascular bundles are situated. The cells of the former are large, nearly uniform, spherical or oblong and thin walled, with distinct intercellular spaces and usually without inclusions. Cells with raphide bundles occur here also. Mechanical elements other than those associated with the vascular bundles are not present in the entire zone.

The vascular bundles are of the usual monocot type, but limited in number. Those situated at the extreme periphery are the smallest. Towards the interior they gradually increase in size. They may be grouped into three main types according to their size, shape and the presence or absence and the partial or completely enveloping nature of the associated mechanical elements viz:

- (i) Those at the extreme periphery. These are very small, nearly circular to tangentially oblong in outline and as seen in transverse section consists of only one or two xylem vessels, a small patch of thin walled pholem and surrounding parenchyma.
- (ii) Those situated towards the centre. These are the largest. In them the elements of xylem are arranged in a wedge shaped manner and include a number of vessles of wide lumen in addition to a few narrow ones. The pholem is also well developed and exhibits the typical monocot structure, There is a crescentic or semicircular arch of sclerenchyma, just outside the pholem.
- (iii) Vascular bundles of a medium or intermediate size situated in the wide region in between the above mentioned types. Here also the xylem and phloem are well defined as in the largest types. The thick walled elements almost completely surround the xylem and

phloem. Of these, those just outside the phloem are small sized, very thick walled compactly arranged and form a well defined narrow crescentic strip or patch of sclerenchyma. The inner and lateral sides of the vascular bundles are bounded by larger cells with less thick walls.

Diagnostic features of rhizome.

A. Morphological.

- 1. The rhizome is sympodially branching, almost uniformly cylindrical, about half an inch in thickness, light rose or reddish brown, juicy or semi-succulent, slightly fibrous, and provided with a number of small lateral roots. In rolder portions the surface is slightly longitudinally wrinkled and marked with raised oblique scars of fallen leaves.
- 2. The skin is somewhat thick, tough and peelable. It has often an orange to brick red colour inside, and a characteristic taste and aroma. In transverse section it appears as a thin orange coloured strip.
- 3. The region within the rind comprising the rest of the section shows a homogeneous whitish appearance with a scattered array of dark spots.
 - 4. Fracture short. A number of fine fibres project out at the cut ends.

B. Anatomical.

- 1. The transverse section is circular, with the outline entire or slightly ridged.
- 2. The cork zone is composed of regularly arranged cells with characteristic form and thick orange to light reddish walls. Some of them contain globules of oil.
- 3. Within the cork zone is a narrow but well defined cortex composed of small circular or oblong thin walled cells usually without inclusions except a few which contain raphide bundles.
- 4. The ground tissue forms the bulk part of the rhizome and consists of large circular or oblong thin walled cells similar to those of the cortex. A few cells contain raphide bundles.
- 5. The vascular bundles are limited in number. Those nearest the periphery are the smallest and without associated mechanical elements. The largest are found towards the centre and medium sized ones occupy the intermediate region. The larger types are partially or completely surrounded by thick walled mechanical elements.
- 6. No element of mechanical tissue other than those associated with the larger vascular bundles are present. So also storage starch does not occur in any of the tissues.

C. Taste and odour.

The rind has a warm sweetish taste and an aromatic smell. The rest of the rhizome composed of the massive ground tissue has a mucilaginous sweetish taste and is at times slightly acrid, but there is no characteristic smell.

D Ā R V Ī (दार्ची)

Coscinium fenestratum (Gaertn) Colebr.*

Family—Menispermaceae

Descriptive Synonyms

दार्वी दारुहरिद्रा च पर्जन्या पर्जनीति च।
कटङ्कटेरी पीता च भवेत्सैव पचम्पचा ॥
सैव कालीयकः प्रोक्तस्तथा कालेयकोऽपि च॥ (भावप्रकाशः)

"Dārvī dāruharidrā ca parjanyā parjanīti ca kaṭaṃkaṭerī pītā ca bhavetsaiva pacaṃpacā saiva kālīyaka proktastathā kāleyakopi ca"

(Bhāva Prakāsa)

"Dārvī" = woody; 'dāruharidrā' = turmeric like wood, 'pītadru', 'haridru' 'pītadāru' and 'atipīta' mean yellow wood. 'Pītakam' also indicates that the material is yellow in colour. 'Kālīyaka' and 'Kāleyaka' refer to its slightly darkish tinge. Putting all these together there is indication that 'Dārvī' is a yellow wood or woody substance with a slightly darkish tinge.†

Properties and Uses:

तिक्ता दारुहरिद्रा तु कदूष्णा व्रणमेहनुत् । कण्डू विसर्पत्वग्दोष विषकर्णाक्षि दोषहा ।। (राजनिघण्टुः)

"Tiktā daruharidrā tu kaṭūṣṇā vraṇamehanut kaṇḍū visarpa tvagdoṣa viṣakarṇākṣi doṣahā"

(Rāja Nighantu)

'Dārvī' is bitter and at the same time 'katūṣṇa' aromatic (pungent), 'hot'—(catabolic promoter), 'vraṇamehanut' useful in ulcers and 'meha' a group of urinary diseases, 'kaṇḍu'—pruritus, 'viṣarpa' erysipelas, 'tvagdoṣa'—skin affections, 'Viṣa'—poison, 'karṇadoṣa'—affections of the ear, and 'akshidoṣa'—affections of the eye.

According to Bhāva prakāśa

दार्वी निशागुणा किन्तु नेत्रकर्णास्यरोगनुत् ।। (भावप्रकाश:)

"Dārvī niśāguņā kintu netrakarņāsya roganut"

Dārvī possesses the properties of 'niśa' or turmeric and at the same time is useful in diseases of the mouth eye and ear. And

यदि नस्याहारुनिशातदादेयानिशाबुधैः।

"Yadinasyāddāruniśā tadā deya niśābudhaih"

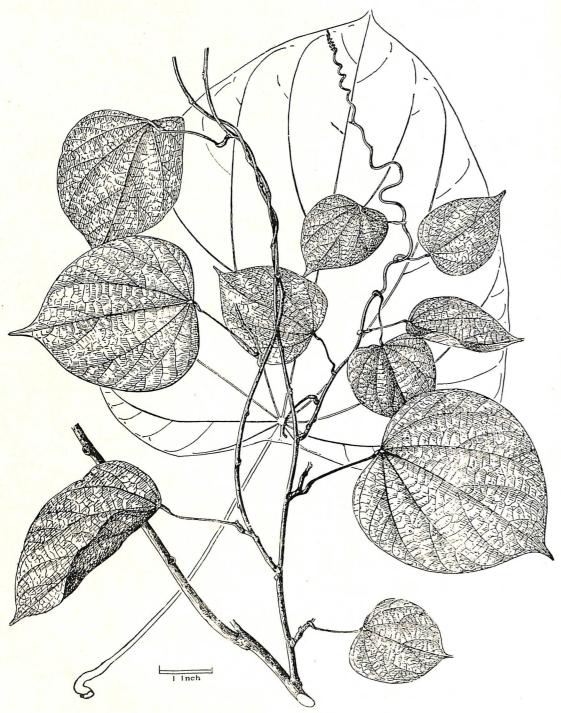
If dāruniśā ie, wood turmeric is not available let turmeric be given by the wise.**



^{*} The source of the drug accepted as Dārvī or Dāruharidrā according to Kirtikar and Basu, 'Khori and Katrick, and the Indian Addenda to the Pharmacopoeia (Ghosh Materia Medica p. 724) etc. is Berberis aristata D. C., B. asiatica Roxb., B. vulgaris, etc. belonging to Berberidaceae.

[†] The sense contained in the Sanskrit synonyms is applicable to both Berberis and Coscinium fenestratum.

^{**} It is worth enquiring whether the yellow colouring matter or any other factor present in this as in turmeric has any antiseptic property.



Coscinium fenestratum Colebr.

Coscinium fenestratum Colebr.

Synonym Menispermum fenestratum Gaertn.

Family—Menispermaceae

Malayalam

... Maramaññal

Tamil English ... Manjalkodi, Maramañjal... Tree-turmeric, False calumba

Distribution and habitat.

Central and Southern India especially in the Western Ghats, Nilgiris and Travancore as well as in Ceylon, Singapore, the Malaya States etc. It grows best in the humus soil of the moist evergreen and semi-deciduous forests under conditions of good rainfall.

Cultivation and collection.

The plant is not cultivated for medicinal purpose. The officinal parts are collected from the forest seasonally or as and when required.

Habit and general features.

Coscinium fenestratum Colebr. is a very large woody climber with stout stem and branches which are somewhat slightly twisted, striated, distantly nodose and covered with greenish or greenish-yellow corky fissured bark. The leaves are thick, leathery, large and petiolate, broadly ovate to orbicular-deltoid and palmately veined. Plants dioecious with small sub sessile flowers in globose aggregates at the ends of peduncles which arise from the older branches. Female flowers give rise to one to three fleshy villous stipitate drupaceous fruitlets. The young shoots and undersides of leaves have a dense covering of fine cineraceous (ash-grey) or greyish-yellow tomentum. The plant flowers during the cold season—November to December.

External morphology.

Leaves: alternate, petiolate, exstipulate. Petiole sub-peltately attached to and shorter than the blade, one to five inches or more in length according to size of blade, thick round downy or wooly, and with a partially twisted prominent dilatation or pulvinus at its base. Blade broadly ovate to oblong-deltoid, or suborbicular, three to nine inches long and two to six inches broad, entire, rounded truncate or slightly cordate at base, obtuse or acuminate at apex, leathery, when mature smooth and shiny above, and hoary yellow tomentose underneath with prominently reticulate veins and veinlets.

Flowers: unisexual—the male and the female on separate plants—subsessile, of a dull greyish green colour and villous. They are aggregated in dense globose fascicled or umbelled heads or capitules half to three quarters of an inch in diameter, borne at the ends of round downy peduncles about one inch long several of which arise from the same node on older and larger woody branches. Bracts reniform villous and closely pressed on the calyx: those of the peduncles being small. Caltyx, persistent of six free sepals in two series, the outer three small oval and very downy outside, the inner ones comparatively larger; Petals,

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larger than the sepals, very downy, elliptic-acute and spreading. The staminate flowers have six stamens of which the outer three are free and the inner connate to the middle. Anthers small oval adnate; outer ones one-celled, inner ones two-celled. The pistillate flowers have three to six free, sub-globose carpels with slender subulate reflexed or recurved styles and six staminodes.

Fruit: An aggregate of one to three or more stipitate nearly globose, villous fleshy one-seeded drupelets about half an inch in diameter with thick and bony endocarp and surrounded by the calyx and persistent petals. Seed: superficially subglobose, but hollow within, it being convolute round a condyliform process. Embryo with very thin divaricate cotyledons having an irregular or undulate margin and a small superior radicle.

Officinal part.

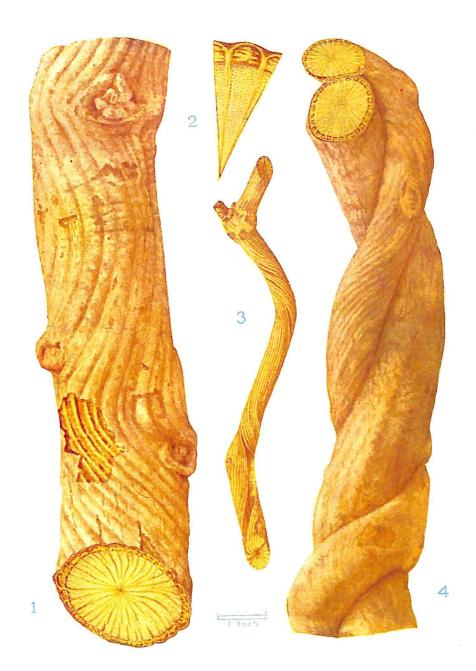
The bark from older stems and branches cleared of its outer corky rind is used in medicine.

Description.

The material as met with in the bazaar consists of dried cut lengths of the stem and branches varying from half a foot to two feet or more in length and from less than an inch to about five inches in thickness. These bits according to their age vary in their surface features as well as in thickness and texture of the outer corky rind. The younger pieces which are generally the long internodal regions of the tender branches are mostly nearly uniformly cylindrical, one third to about an inch in diameter, straight or occasionally slightly twisted, and pale-grey or greyish-yellow, with a fairly smooth suface often marked with twenty to thirty or more parallel somewhat spiral longitudinal striations spaced about a millimeter apart. The cut surface has a slight yellowish to greenish-yellow colour. The entire bark is comparatively thin. The outer corky rind is proportionately thick, compact, slightly hard and cream yellow in colour. The removal of the rind exposes a hard yellow zone, which in transverse section appears as an annular crenate band or strip close to the periphery. The officinal bark comprised of the middle and inner barks is a narrow light greenish to greyish yellow region. The wood which forms the thickest part is pale yellow and shows a beautiful array of several yellowish medullary rays all radiating from a well defined centrally placed pith and meeting the convergent inpushings of the crenate band of hard tissue near the periphery. The pith is often whitish. Its outer portion is harder than the central region.

Older pieces which are one inch or over in diameter are also mostly cylindrical, but often curved or twisted and slightly nodose. In them the rind is greyish, slightly harder, somewhat crustaceous, and fissured at several places with shallow vertical slits of varying lengths. Other features viz. the thickness of the officinal part and structure of the wood, are similar to those of the younger bits.

Still older pieces are more woody, heavier, light greenish white to greyish-brown with the surface slightly longitudinally ridged and more or less rough on account of the formation of wider and deeper fissures. They are often encrusted with patches of lichens and dried remnants of mosses and liverworts. The rind is comparatively thick. Its outer part is softer and more friable than the inner region which retains its compact texture. The officinal part of the bark is comparatively thicker, and hence these may be preferred to the smaller bits for officinal purpose.



Coscinium fenestratum

- 1 & 4. Bits of stem.
- 2. A Diagram of a segment of the stem (enlarged)
- 3. Appearance of stem after removal of bark.

Histology.

The transverse section is circular, or oval, its outline more or less regular and closely and shallowly crenate. The cork layer which forms the outer most zone is thick, cream coloured or yellowish-white and composed of twenty to thirty or more rows of nearly uniform, moderately thick-walled cells, except the more recently formed inner most four or five rows whose cells are thin walled. A distinct phellogen of one or two rows of narrow cells is found within the cork in fresh specimens, but is not quite evident in dry material. The cortex consists of several rows of cells but is nevertheless a comparatively narrow zone. Its cells are thinwalled mostly polyhedral, tangentially elongate and generallly without content except a few which contain droplets of an oily nature. The most conspicuous feature of this region is the presence of a very prominent yellowish annular crenate band of hard tissue composed of a large number of arches and forming its inner boundary. The arches are nearly semicircular and their conjoined adjacent ends form wedgelike processes projecting into the broadened distal ends of the medullary rays. One such arch together with the adjacent inpushings is found outside a patch of phloem. Two types of sclerotic elements are found in each arch viz. (i) tangentially curved short segments of sclerenchyma composed of small thick walled sclerenchymatous cells located just outside the phloem and (ii) bright yellow groups of large cubical, oval, oblong rectangular or elongated stone cells with very thick pitted walls. The latter compose the bulk portion of each arch. The wood consists of several narrow radiating wedge-shaped xylem strips and alternating medullary rays. Each strip of xylem is composed of large sized vessels prominent zones of thick walled fibres and narrow bands of thin walled parenchyma. In older stems parenchymatous elements are often absent, the xylem consisting of thickwalled fibres and vessels. The medullary rays are very prominent, and twenty to thirty or more in number. Most of them extend from the pith to the periphery. These are very broad and multiseriate consisting of fifteen to twenty or more radial rows of cells. Their walls are very thick, provided with simple pits and ultimately become lignified and sclerotic. In transverse sections of dried stems the cells towards the distal ends of the medullary rays appear obliquely tilted upwards and outwards with reference to a central radial series of one or more rows of cells, and present a characteristic appearance. In addition to these there are also a number of narrower secondary medullary rays between the primary rays. These however do not meet the inpushings of the main arches. The phloem appears as a broadly crescentic to semicircular patch of tissue outside each strip of xylem with its peripheral (older) portions in a highly compressed and disorganised condition.

There is a well marked pith in the centre. The cells towards its centre are large, circular to polyhedral, and fairly thick walled, while those towards the periphery are smaller and much more thickwalled. Occasionally a few, two to four or more celled groups of stone cells are found towards the centre of the pith.

Distinguishing features.

A. Morphological.

1. The pieces of stem or branches are cylindrical, straight, curved or twisted, comparatively light though woody, pale green, greyish yellow or dull brownish yellow according to age, with the surface often longitudinally striated and in older pieces fissured or cracked and occasionally encrusted with remnants of lichens, dried moss etc.



- 2. The rind is fairly thick, compact, corky and in older bits slightly friable. In transverse section it appears as a thick yellowish white strip.
 - 3. Just within the rind and outside the wood, there is a hard yellowish tissue.
- 4. The wood is pale yellow. On a transverse section it appears highly porous and shows several broad yellowish medullary rays starting from a central pith and extending as far as the annular band or strip of hard tissue.

B. Anatomical.

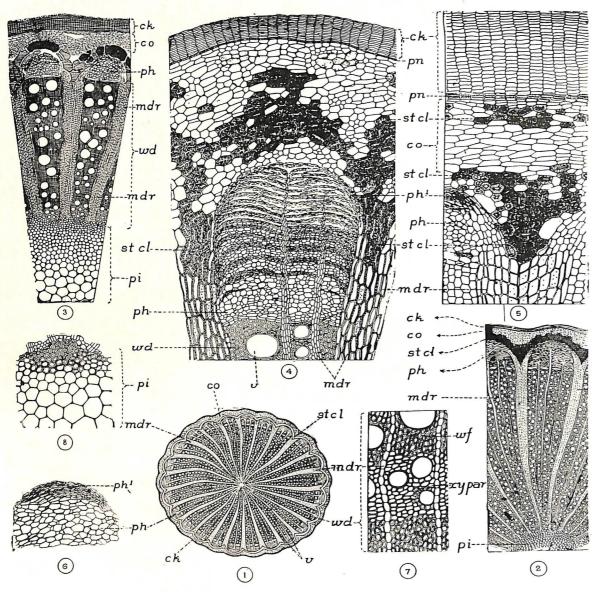
- 1. The transverse section is mostly circular, with the outline slightly crenate.
- 2. The cork zone consists of several rows of regular uniform empty thick walled cells.
- 3. The cortical zone is narrow and consists of tangentially elongate, oblong or polyhedral cells generally without contents.
- 4. An yellowish crenate annular band of hard tissue composed of several crescentic to semi-circular arches is present within, forming an inner boundary of the cortex. Each arch especially in the younger stems consists of a short crescentic strip of sclerenchyma just outside the phloem with on either side closely packed groups of large stone cells with very thick pitted walls. The presence of the crenate annular band of hard tissue and its structure are important diagnostic features.
- 5. The phloem proper consists of the usual type of thin walled elements and occurs as semicircular patches separated by the medullary rays outside each strip of xylem, and located within the crescentic arches of hard tissue. In older pieces it also shows towards its periphery patches of compressed and disorganised elements of previously formed phloem.
- 6. The wood is composed of several large sized vessels, broad zones of thick walled fibres and narrow strips of wood parenchyma.
- 7. The medullary rays are twenty to forty or more in number. They are comparatively broad and very prominent. Each ray consists of ten to fifteen or more radial rows of elongate thick walled cells. In dried specimens the cells at the distal ends of the rays appear obliquely tilted upwards and outwards with reference to a central series of cells or cell rows.
- 8. A well defined pith composed of closely packed thick walled cells is present in the centre.
- 9. The absence of storage starch in any of the parenchymatous elements is also a noteworthy feature.

C. Taste and odour.

The officinal part of the bark has a tolerable bitter taste, but it has no special odour.

Collection, mode of use etc.

The stems and branches are collected from the forests and brought to the market by the local crude-drug collectors. They are not immediately used but allowed to dry for a



Histology of Coscinium fenestratum (stem)

few weeks before being sold. The dried stems do not seem liable to attack of insect pests and can be kept in good condition for comparatively long period.s They do not thereby appear to lose their medicinal value. In preparing them for use the stems are first scraped to remove the outer corky rind and then gently beaten with wooden mallets when the officinal part easily separates from the wood. The wood is not ordinarily used for medicinal purpose.

Constituents.

The stem of the plant is reported to contain ceryl-alcohol, hentriacontane, sitoterol, palmitic and oleic acids sitosterol glucoside, saponins and berberine (1.6% on the dry basis).

Total extractives:-

Petrol ether 2.1%; ether 2.5%; Alcohol 6.9%; cholroform 3.4%; Acetone 4.1%; benzene 2.7%; and water 5.1%.

Histology of stem of Coscinium fenestratum.

- Fig. 1. Transverse section of stem (Diagrammatic).
 - ,, 2. A segment of figure 1 enlarged.
 - , 3. Ditto from an older stem.
- ,,4&5. Details of structure of cork cortex, stone-cells phloem etc and distribution of stone-cells.
- " 6. Structure of phloem.
- ,, 7. Strip of xylem showing details.
- , 8. Structure of pith cells.

ARKA अर्कः

Calotropis gigantea R Br.*

Family—Asclepiadaceae

Descriptive Synonyms

इवेताकों गणरूपः स्यान्मन्दारो वसुकोऽपि च । इवेतपुष्पः सदापुष्पः सचालाकः प्रतापसः ।। रक्तोऽपरोऽर्कनामा स्यादकंपणोविकिरिणः । रक्तपुष्पः शुक्लफलस्तथा स्फोटा प्रकीस्तितः ।।

(भावप्रकाशः)

"Śvetārko gaṇarūpaḥ syānmandāro vasukopi ca svetapuṣpaḥ sadāpuṣpaḥ sa cālarkaḥ pratāpasaḥ rakto parorkanāmā syādarkaparṇo vikīraṇaḥ raktapuṣpaḥ śukļaphalastathā sphoṭā prakīrtitaḥ"

(Bhāva Prakāśa)

अर्कसूर्यह्वयपुष्पी विक्षोरोथविकीरनः । जंभलः क्षीरपर्णी स्यादास्फाटो भास्करो रविः ।। (धन्वन्तरिनिघण्टुः)

"Arkasūryahvayah puṣpī vikṣīrotha vikīraṇaḥ jambhalah kṣīraparṇī syadāsphoṭo bhāskaro raviḥ" (Dhanvantari Nighantu)

क्षीरदलं गुकफलं तुलार्कश्च सदासुमः ॥

(शालिग्रामनिघण्टुः)

"Kṣīradaļam śukaphalam tūlārkasca sadāsumah" (Śāligrāma Nighaṇṭu)

"तुलाफलः" "सदापुष्पः" ॥

(राजनिघण्टुः)

"Tūlaphalaḥ", "Sadāpuşpaḥ"

(Rāja Nighantu)

In Calotropis gigantea there are two varieties viz. (i) a lilac or purple flowered type which is the common form and (ii) a variety with pale greenish—white flowers which is not so common. In Travancore—Cochin both the purple as well as the 'white' flowered variety are taken for officinal purposes though the 'white' flowered is preferred wherever obtainable.

Three varieties of Arka are mentioned in Dhanvantari Nighantu viz. Rajarkah (alarka), Suklarkah and Svetamandarah. It is doubtful whether these varieties are recognised in Kerala.

'Arka' meaning Sun may refer to the caustic rupturing or blistering nature of the plant especially of its milky exudate. So also the terms 'vasuka' 'pratāpa' 'vikīraṇa' 'sphota' etc. 'Sadāpuṣpa' and 'sadāsuma' mean bearing flowers throughout the year. 'Sukaphalam' and 'tūlārka' refer to the cotton like pappus attached to the seeds.

Properties and Uses:

अर्कद्वयं सरं वातकुष्ठकण्डूविषव्रणान् । निहन्ति स्नीहगुरुमार्शः श्लेष्मोदरयकुत्समीन् ॥

(भावप्रकाशः)

"Arkadvayam saram vātakusthakāņdūvisavraņān nihanti pļīhagulmārsah slesmodarayakrtkrmīn"

(Bhāva Prakāśa)

Both varieties of 'Arka' are 'saram'—laxative, overcomes 'vāta'—derangement of the nervous factors, 'kuṣṭha'—skin diseases, 'kaṇdu'—pruritus, 'viṣa'—poison, 'vraṇān'—ulcers, 'pl īha'—enlargement of the spleen, 'gulma'—colics, 'arśa'—piles or polypi, 'sleṣmodara'—enlargement of the abdominal glands, 'yakṛt'—enlargement of the liver, and 'kṛmīn'—worms.

अर्कः कृमिहरस्तीक्ष्णः सरोऽर्कःकफनाशनः । तत्पुष्पं कृमिदोषघ्नं हन्ति शूलोदरानि च ॥ (धन्वन्तरिनिघण्टुः)

"Arkakṛmiharastīkṣṇaḥ saro rśaḥkaphanāśanah tatpuṣpamkṛmidoṣaghnam hanti śūlodarāṇi ca" (Dhanvantari Nighaṇṭu)

अर्कस्तृ कटुरुष्णाश्च वातिजदवित्दिवीपकः । शोफत्रणहरः कण्डुकुष्ठिकिमिविनाशनः ।। (राज

(राजनिवण्टुः)

"Arkastukaţuruşnaśca vātajidvahnidīpakaḥ śophavranaharah kandūkuştha krmivināśanah"

(Rāja Nighantu)

Additional properties ascribed in the above are that 'arka' is 'tikṣṇa'—quick in action, 'kaṭu'—pungent, 'uṣna'—(hot), 'vahnidīpakaḥ'—promoter of digestive power, and 'sophahara'—useful in anasarca. Its flower is 'kṛmidoṣaghnam'—useful in worms, 'śūla'—colics, and 'udarāṇi'—the various types of abdominal tumours (ascites?)

"श्वेतमन्दारको त्युष्णस्तिक्तोमलविशोधनः । मूत्रकृच्छ्व्रणान्हन्तिकृमीनत्यस्तदारुनान्" ।।

"राजार्कः कटुतिक्तोष्णः कफमेदोविषापहः । वातकुष्ठवणान् हन्ति शोफकण्डविसर्पन्त" ।।

(शालीग्रामनिघण्टुः)

"Svetamandārako tyuṣṇastiktomalaviśodhanaḥ mūtrakṛchravraṇānhanti kṛmīnatyantadāruṇān"

"Rājārkah katutiktosnah kaphamedovisapahah vātakusthavrananhanti sophakandūvisarpanut"

(Śāligrāma Nighantu)

The white variety is 'atyuṣṇa'—very 'hot', 'tikta'—bitter, malaviśodhanaḥ'—expels effete products, cures 'mutrakṛchra'—difficult micturition, 'vraṇān'—ulcers, and

^{*} In North India both Calotropis gigantea, and Calotropis procera, are used where they are available. Calatropis gigantea, R. Br. the common South Indian type popularly known as Erukku or Erikku is cosmopolitan in distribution being found throughout India, whereas Calotropis procera, is almost exclusively North Indian, (though very rarely found cultivated or growing as a garden escape in some of the hills of South India). The two plants are known by the same vernacular names and are used as the source of the drug Arka in their respective areas of distribution. They are essentially similar in appearance, though Calotropis procera, is slightly smaller, and has a more compact habit.

'kṛminatyanta dāruṇān'—worms of virulent types. 'Rājārka'—the bigger(?) variety, is 'kaṭu'—pungent, 'tikta'—bitter, 'uṣna'—hot, 'kaphamedoviṣāpaha'—overcomes 'kapha', 'meda'—fat, and 'viṣa'—poison, and is useful in 'vāta', 'kuṣṭha'—skin diseases, 'vraṇān' ulcers, 'sopha' swelling, 'kaṇdu'—pruritus, and 'visarpa'—erysipelas.

Properties and uses of Flowers

अलर्ककुसुमं वृष्यं लघुदीपनपाचनम् । अरोचक प्रसेकाशः कासश्वासनिवारणम् ॥

(भावप्रकाशः)

"Alarkakusumam vṛṣyam laghudīpana pācanam arocakaprasekarśaḥ kāsaśvāsanivāraṇam"

(Bhāva Prakāśa)

Flower of ālarka (the white (?) variety) is 'vṛṣyaṃ'—aphrodisiac, 'laghu dīpana-pācanam'—promoter of digestive factors and digestion, removes 'arocaka'—want of taste for food, 'pṛaseka'—excessive secretion in the mouth requiring constant spitting 'aṛśaḥ'—piles, 'kāsa'—cough, and 'śvāsa'—difficult breathing.

रक्ताकंपुष्पं मधुर स्तिवतं कुष्ठक्रमिष्नं कफनाशनं च । आखोरविषं हन्ति च रक्तपित्तं संग्राहि गुल्मेश्वयथ् हितं तत् ।।

(शालीग्रामनिघण्टः)

"Raktārkapuspam madhuram satiktam kuşthakrmighnam kaphanāsanam ca ākhorvişamhanti ca raktapittam samgrāhi gulme svayathu hitam tat"

(Śāligrama Nighantu)

Flower of the red variety is 'madhuram'—sweet, 'satiktam'—also bitter, is useful in 'kuṣṭha'—skin diseases, 'kṛmi'—worms, 'kapha'—mucus etc. and 'raktapittam'—haemorrhagic disease caused by the mutual and simultaneous vitiation of 'rakta' and 'pitta'. It destroys ākhorviṣam—rat poison, is 'saṃgrāhi'—arresting of free defaecation and is beneficial in 'gulma'—gas tumour (colics), and 'śvayathu'—swelling.

Properties of the milky exudate

क्षीरमक्सिय तिक्तोष्णं स्निग्धं सलवणं लघु। कुष्ठगुरुमोदरहरं श्रेष्ठमेतद्विरेचनम् ।।

(भावप्रकाशः)

"Kşīramarkasyatiktoşņam snigdham salavaņam laghu kuşthagulmodaraharam śreşthametadvirecanam"

(Bhāva Prakāśa)

The milky exudate of 'arka' is bitter, 'hot', demulcent, saltish and light. It is useful in skin diseases, gas tumour and ascitis. It is a very good or effective purgative.





Calotropis gigantea R. Br.

Calotropis gigantea R. Br.

Family—Asclepiadaceae.

Malayalam ... Erikku
Tamil ... Erukku
Hindi ... Madar, Ak

Distribution and habitat.

Calotropis gigantea, is found distributed throughout India. Its range extends from Punjab to Assam in the north, to Tinnevelly and Travancore, as far as the Cape, in the south. It occurs very commonly in the plains and occasionally in the hills, up to an altitude of 3,000 feet. It grows well in most types of soils, sometimes even where nothing else will grow such as sandy barren ground, but luxuriates chiefly on rubbish heaps, on waste land by the sides of roads, on ruins of dilapidated buildings or edifices and similar places. The plant is in flower and fruit almost throughout the year (şadāpuş'pa').

Habit and general features.

Calotropis gigantea, is a hardy, much branched, large sized, erect pale greyish, profusely milky, somewhat nauseatingly odorous shrub, three to eight feet high, usually with only a very short thick stumpy stem, —a quarter to half a foot or more in diameter, from the basal part of which or close to the ground level arise a number of stout woody branches bearing simple opposite subsessile leaves, and many flowered bunches of beautiful lilac rosy or purple tinted medium sized flowers. The trunk and older branches are covered with thick, light yellowish white or ash grey, corky soft and friable, deeply fissured bark. The tender shoots and inflorescence have a thick covering of soft loosely appressed whitish waxy somewhat powdery hairs that give them the characteristic pale hoary appearance.

External morphology.

Leaves: simple, opposite, sub-sessile, slightly thick, fleshy coriaceous, four to six inches long by two to three inches broad, broadly cuneate obovate, or obovate oblong, slightly cordate and auricled at base with tufts of short simple hairs on the upper side near place of attachment to the petiole. The tender leaves are covered with ash grey pubescence. Mature leaves are nearly smooth or even glabrous and pale green.

The flowers: are regular, bisexual, lilac or pale rose purple or rarely light greenish yellow and have a faint odour. They are arranged in simple or rarely compound cymose corymbs at the ends of laterally placed or interpetiolar peduncles arising from alternate sides of the nodes. Each cluster is surrounded by an involucre of several small oblong pointed scaly caducous bracts. Flower buds ovoid. Calyx-five lobed; lobes broadly ovate with small fleshy teeth-like glands at the base within. Corolla-regular, gamopetalous, pale rose purple or lilac within and at the margins of the lobes, rarely greenish yellow, subrotate to broadly sub campanulate with a short tube and five broad ovate lanceolate valvate spreading lobes. These are free for more than half their length and get partially reflexed and twisted sometime after opening. Stamens-five, inserted at the base of the corolla. Filaments united to form a large staminal column provided with five conspicuous radiating coronal appendages that are completely adnate to, but slightly shorter than the column. The appendages are

fleshy, pale purplish or yellowish white and laterally compressed with a circinately recurved hollow dorsal spur at base and two short obtuse obliquely divergent auricles towards the top just below the apex. Anthers-short, broad, somewhat horny, with broadly triangular membraneous anther tips that are inflexed over the sides of the stigmatic head. Anther cells shallow, each containing a solitary waxy flattened and compressed pendulous pollen mass or pollinium affixed to the attenuated apex and attached by slender caudicles to the oblong pollen carriers. Pistil of two carpels, with distinctly separate ovaries and styles which are united at the top to form a depressed five angular muticous stigmatic head.

Fruit: of two, or more often of only one, large inflated smooth or ventricose, ash grey or greyish green, thick fleshy ovate slightly beaked recurved follicular mericarps three to four inches long and one and a half to two inches broad. Seeds many, thin, broadly ovate, about quarter inch in diameter, plano-convex; the apex surmounted by a coma of long slender silky hairs.

Officinal parts.

The parts used are, 'puṣpa'-flower, 'kṣira'-the milky juice-mainly for external use, and, 'mūla twak'-root bark, used mostly as an antidote. Occasionally the leaves are also used.

Description of roots.

The material brought for sale or exhibited are cut lengths of roots that range from less than a foot to three feet or more in length and from less than an inch to three or four inches in diameter. The pieces are simple or branched, cylindrical, often bent or curved, very seldom straight, woody but not heavy, greyish white or greyish yellow and covered with a thick bark. In the fresh condition plenty of whitish latex exudes from cuts or wounds in the bark. As the roots dry up the flow of latex gradually diminishes until it ceases altogether. The surface is deeply and closely longitudinally furrowed and hence appears rough, but is not hard. In young roots the clefts are comparatively narrow short and shallow, whereas in older roots they are half to two inches or more in length, deep, wide, and very prominent with the edges recurved. These do not usually anastomose, though they may become longer and deeper. In all cases the depth of the furrow is limited to the thickness of the outer corky rind. In dry roots a number of irregularly spaced short shallow transverse cracks extending half way around the root are found on the concave side of the bends. The rind or outer bark is appreciably thick, distinctly corky, soft and easily friable. In transverse section it has a cream yellow colour. In older and stouter roots its width often exceeds that of the rest of the bark and shows differentiation into a slightly dark coloured and finely lamellated peripheral portion and a more compact lighter coloured inner region. The rind does not peel off but being soft most often gets worn away or rubbed off as a result of rough handling, making the surface ultimately smooth.

The officinal part of the bark is about a tenth of an inch in thickness in the smaller roots but is considerably thicker in stouter roots. It is easily separated from the wood in the fresh condition and has a starch white colour as seen in transverse section, in contrast to the light yellow colour of the wood and cork. Latex exudes from several points in the peripheral part as well as from the region nearest the wood and hence the cut surface often appears mottled with spots.

Histology.

The roots exhibit a simple internal structure. The outline in cross sections of smaller roots, is minutely wayy, and in those of the thicker roots is distinctly and broadly dentate, the teeth corresponding to the corky ridges. The cork zone is composed of thirty to fifty or more rows of polyhedral to nearly cubical thin walled cells, those of the extreme periphery being often compressed and out of shape. Very small sized cubical crystals are found in a few cells of the inner rows. Except for these, the cells appear devoid of contents and the walls free from any special coloration. The phellogen is distinct and composed of two or three rows of narrow tangentially elongate thin walled cells. The cortex is a comparatively narrow region of few rows of cubical rectangular or oblong thin walled cells most of which are loaded with numerous starch grains. Cut ends of latex tubes can be made out in the region. The bast forms the broadest part of the bark and consists of a number of broad radial bands of thin walled phloem elements alternating with very narrow strips of straight medullary rays. The phloem parenchyma cells are regular; some of them contain cubical crystals. The cut ends of a number of latex tubes can be made out in the phloem as in the cortex. No mechanical elements are present in the cortex or bast. The cambium (cambiform tissue) is quite distinct and consists of three or four rows of very narrow rectangular cells. The medullary ray cells are thin walled cubical to oblong and fully loaded with starch grains. Those situated towards the inside are narrower and radially elongate while those towards the distal portion are broader and tangentially elongate.

The wood is composed mainly of wood parenchyma with sparsely scattered groups in radial rows of large xylem vessels and narrow medullary rays. The xylem parenchyma cells are small in size, comparatively thick walled, and in transverse section appear triangular, cubical or polygonal in outline. There are usually three to six rows of xylem parenchyma alternating with a single uniseriate medullary ray. A very limited number of bi-or tri-seriate rays are occasionally present. The medullary rays of the wood are continuous with those of the bast and most of them extend from the centre to the periphery. The cells of the medullary rays in the xylem part are nearly rectangular to polygonal and radially elongate with fairly thick pitted walls. Several of them contain numerous, small sized, starch grains. Sclerenchymatous elements are not normally found in the xylem, and there is no pith in the centre.

Distinguishing features.

A. Morphological.

- 1. The roots are woody but light, greyish white or greyish yellow, cylindrical and often curved, with the surface condiserably fissured longitudinally.
 - 2. The rind or 'outer bark' is appreciably thick, corky, soft and easily friable.
- 3. In the fresh condition the officinal part of the bark is bulky, starchy white, has a fairly homogeneous structure and exudes plenty of latex. In dried roots it is thinner greyish and somewhat friable.

B. Anatomical.

1. The transverse section is nearly circular or oval and outline minutely wavy to dentate.

- 2. The cork zone is deeply and widely fissured, and composed of several rows of small cubical or rectangular regularly arranged thin walled cells.
- 3. The cortex is comparatively narrow, and comprised of a few rows of thin walled cells loaded with starch grains. The starch grains have a characteristic form.
- 4. The bast forms the bulkiest portion and consists of broad radial bands of thin walled phloem elements alternating with narrow medullary rays.
 - 5. Latex tubes occur in the cortex and bast.
- 6. Wood consists mostly of xylem parenchyma, regular radial rows of vessels and several medullary rays.
- 7. The medullary rays are straight and mostly uni-seriate or very occasionally biseriate. Their cells in the phloem part are thin walled and in the xylem thick walled. All the cells are loaded with starch grains.
 - 7. There is no pith in the centre.
- 8. The absence of mechanical elements of any type in the bark may also be considered a noteworthy feature.

C. Taste and odour.

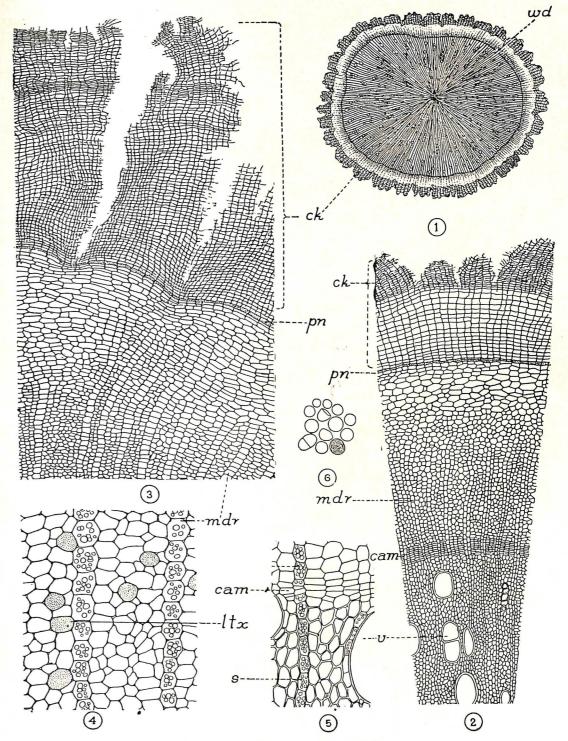
The bark has a distinctly bitter taste which is more marked in the older roots. It has no special odour.

Collection, mode of use etc.

The roots are usually collected during the months of March, April and May and gradually allowed to dry in shade. Ordinarily the roots are taken up for use only after drying is completed though this is not always so, since for external use the latex itself is used. In preparing the root bark for officinal use the soft outer bark is scraped. The roots cannot be kept for any length of time since the bark is easily attacked and damaged by worms insects, etc. Rats nibble off the bark even in the fresh condition.

Histology of Calotropis gigantea Root.

- Fig 1. Transverse section (Diagrammatic).
- ,, 2. Sketch of a sector of the T. S. enlarged.
- ,, 3. Cork, cortex, and adjacent tissues.
- ,, 4. Portion of bast region.
- ,, 5. A portion of newly formed wood and phloem.
- ,, 6. Starch grains.



Histology of Calotropis gigantea Root.

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AGNIMANTHAH (अग्निमन्थ)

Premna serratifolia Linn.*
Family—Verbenaceae

Descriptive Synonyms

अग्निमन्यो जयः सस्यात् श्रीपर्णी गणिकारिका । जया जयन्ती तर्कारी नादेयी वैजयन्तिका ॥

(भावप्रकाशः)

"Agnimantho jayā sa syāt śrīparņī gaņikārikā jayā jayantī tarkārī nādeyī vaijayantikā"

(Bhāva Prakāśa)

"हविर्मन्थः" "कणिका" "गिरिकणिक" 'भिर्याणकामाने 'भि

(शालिग्रामनिघण्ट्र:)

(Śāligrāma Nighanţu)

'Agnimantha', 'Arani', 'Havirmantha', 'Vahnimantha' etc. mean producing fire by friction, on account of its wood being used for producing fire by churning.

Properties and Uses:

अग्निमन्थः श्वयथुनुद्वीर्थोष्णः कफवातहृत् । पाण्डनुत्कट्क स्तिक्तस्नुवरो मधुरोऽग्निदः ।।

(भावप्रकाशः)

"Agnimanthah śvayathunudvīryoṣṇaḥ kaphavātahṛt pāṇdunutkatukastiktastuvaro madhurognidaḥ"

(Bhāva Prakāśa)

तर्कारी कटुकातिकता तथोष्णानिलपाण्डुजित् । शोथव्लेष्माग्निमाद्यार्शोविडविबन्धामिवनाशिनी ।। (धन्वन्तरिनिघण्टुः)

"Tarkārī katukā tiktā tathosņānilapāņdujit śotha ślesmāgnimāndyārśo vidvibandhāmavināśini" (Dhanvantari Nighantu)

अग्निमन्थो वृहत्प्रोक्तः कटुश्चोष्णोमधुःस्मृतः ।
तिक्तस्तुतुवरश्चाग्निदीपको वातनाशनः ॥
प्रतिश्यायं कफशोधमशंश्चैवामवातकम् ।
मलरोधचाग्निमाद्यं पाण्डुरोगं विषं तथा ॥
आमंचमेदोरोगं च नाशयेदितिकीर्तितम् ।

(निघण्टुरत्नाकरम्)

"Agnimantho bṛhatproktaḥ kaṭuścoṣṇo madhusmṛtaḥ tiktastu tuvaraścāgnidīpako vātanāśanaḥ pratiśyāyaṃ kaphaṃ śothamarśaścaivāmavātakam malarodhaṃcāgnimāndyaṃ pāṇḍurogaṃ viṣaṃ tathā āmam ca medorogam ca nāśayediti kīrtitaṃ" (Nighaṇṭu Ratnākara)

'Agnimantha' is pungent, bitter, astringent and sweet; it is hot in action, gives digestive power and is useful in 'kapha', 'vāta', anemia, weak digestion, piles, constipation and 'āma', and overcomes oedema, coryza, poison and excessive fatty condition of the body

^{*} Roots of a few other species of *Premna* such as *P. coriacea* Clarke, *P. latifolia* Roxb. etc. are often used as substitute or adulterant.



Premna serratifolia Linn.

Family—Verbenaceae

Tamil

...Muññay, Peymiññay.

Malayalam

... Muñña.

Hindi

... Agetha, Arni, Arani.

Distribution.

The plant is common in many parts of India. It is recorded as occurring in Sylhet, Bombay, S. Carnatic and Travancore—Cochin, where it grows under mesophytic conditions at all places in the plains.

Habits and general features.

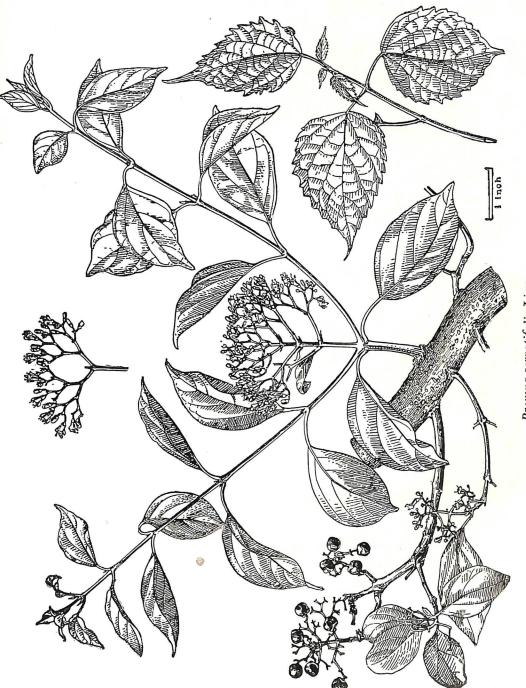
Premna serratifolia Linn, is a small sized tree or large shrub with a comparatively short trunk and numerous branches, bearing simple, opposite dark green leaves and cymose panicles of small inconspicuous flowers. Its older parts are often armed with large, opposite, straight, strong, woody spines that represent the basal parts of stunted branches. Bark smooth, thin, dark brown or brownish yellow and lenticellate. The leaves and flowers emit a very strong offensive or unpleasant odour when bruised. Flowering time before or at the beginning of the rains (April-June).

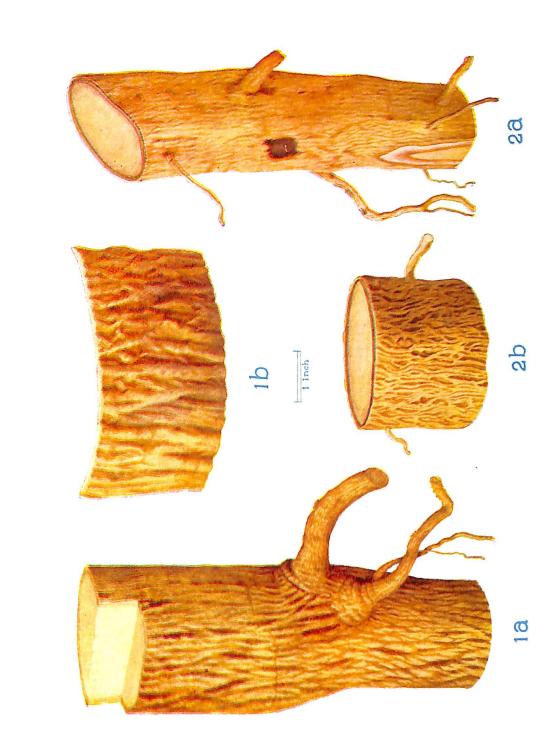
Root-woody, thick and much branched; its bark has an agreeable strongly aromatic smell.

External morphology.

Leaves: Simple, opposite or rarely whorled, exstipulate, dark green and shining above, dull below, membraneous when young, harshly coriaceous when mature ovate to elliptic or broad ovate, entire or irregularly toothed (crenate—serrate or dentate) rounded or sub-acute at base and acute at apex, with four to six pairs of primary lateral nerves which are generally pubescent beneath. Petiole one third to half an inch long. The size shape and margin of the leaf shows considerable variation even in the same plant.

Flowers: very small, generally less than an eighth of an inch long, bracteate, pale greenish white or greenish yellow, bisexual or polygamous, and arranged in many flowered terminal, short peduncled, corymbiform cymose panicles with a spread or diameter of two to four inches. The primary divisions of the panicle are opposite whereas the terminal ones are twoforked or dichotomous. Bracts—small, about one sixteenth of an inch long, lanceolate, pubescent. Calyx—shallowly cupular, glabrous, persistent,—becoming slightly larger and saucer shaped in the fruit—, subentire or obscurely two lipped with either one lip entire and the other two lobed or one lip subentire or two lobed and the other three lobed: lobes obtuse, about one sixteenth to one tenth of an inch. Corolla-greenish yellow about twice the length of the calyx, glabrous outside, tubular, obliquely funnel-shaped or slightly bilabiate, five lobed or subequally four lobed, the posterior lobe narrow undivided and nearly double the length of the other which is broad and three parted; throat hairy or villous within. Stamens-four, about the length of the calyx, rarely slightly exserted; filaments hairy at the base; anthers ovate or rounded, divergent from base; Ovary-two or four celled and four ovuled with a linear style ending in a shortly bifid stigma.





1 a. Calotropis gigantea root. 1 b. Portion of bark enlarged 2 a & 2 b. Prenna serratifolia root.

Fruit: a small globose or oblong or rarely pear shaped, entire one to four chambered and one to four seeded drupe, less than a quarter inch in diameter, and black when ripe with the persistent saucer shaped calyx, surrounding its base. Seeds small enclosed within the rigid bony endocarp.

Wood: light cream yellow to light brown, moderately hard, and feebly scented.

Officinal parts.

The roots, root bark and leaves are used in medicine.

Description of roots.

The roots are light brownish or yellowish brown, woody, strong, and possess a very agreeably scented bark. Those exhibited or brought for sale are simple or branched cut bits of the larger roots and vary from less than an inch to four inches or more in diameter. The smaller of these roots often have a large number of very fragrant small wiry fibrous rootlets attached to them. The entire root bark is thin and varies from about a sixteenth of an inch in the smaller roots to about one quarter of an inch in the stouter ones. The rind is comparatively thick, light brownish yellow to light brown, corky, soft and very easily friable. The surface is fairly smooth in the smaller roots but shallowly cracked or fissured in the thicker roots and normally without prominent lenticels or other surface irregularities. Immediately within the corky tissue and in close contact with it, is a conspicuous, dark turmeric yellow to reddish brown, easily scrapable and strongly aromatic oily or resinous tissue, about a hair's breadth in thickness. This layer is readily exposed on scraping or rubbing off the corky covering and is the region responsible for the delightful scent of the roots. The living bark which is next within, is creamy white in fresh roots, but its colour gradually turns to a characteristic blue black when exposed to air. This change of colour is especially well marked in the portion nearest the wood so that in a transverse section of the root this region usually appears dark brown to balck and often imparts a blue black pigmentation even to the outer regions of the wood. The fresh root bark is mucilaginous and slightly sweetish at first but later on the taste becomes bitter and even pungent.

The wood is hard, close grained, very minutely porcus and shows an exceedingly large number of very fine whitish medullary rays. It has a mild fragrance somewhat similar to that of sandal wood.

Histology.

The cork zone is composed of two distinct types of cells which regularly alternate with each other viz., thin or narrow zones composed of three or more rows of comparatively thick walled brownish yellow rectangular cells and broader zones of four to eight or more rows of narrow rectangular thin walled empty cells. The cells of the innermost rows of cork show yellowish or yellowish brown contents. Phellogen is composed of one or two rows of fairly big tangentially elongate rectangular cells rich in protoplasmic centents.

In young roots the *cortex* or middle bark is a proportionately wide region of several rows of cells occupying about half the thickness of the entire bark. The cells are thin walled and mostly polyhedral though of various sizes and shapes. Some are even tangentially

elongate. The bast consists essentially thin walled phloem elements. These are of the normal type and composed of large sized sieve tubes and regularly arranged rectangular to nearly isodiametric phloem parenchyma cells. In addition, isolated few celled groups of stone cells are found in the bast amidst the phloem elements. The stone cells are small and very thick walled. Medullary rays are many and mostly uniseriate, with occasional two to three seriate rays. Their cells in the phloem part are thin walled and rich in protoplasmic contents but otherwise ordinarily devoid of inclusions like starch. They are narrow and radially elongate in the portions near the wood but gradually become tangentially elongate as the rays approach the cortex. The medullary ray cells in the xylem have thick pitted walls and contain starch grains. The cambium is a narrow zone comprised of one or two rows of cells. The wood appears distinctly porous and is composed mainly of vessels of various sizes and thick walled sclerenchyma. The bulkof the wood is constituted of sclerenchyma, the cells of which appear polygonal in transverse sections. There is no pith in the centre.

The structure of the bark from the older roots differs in certain important respects from that of the young bark. The zone of cork is considerably thick and composed of several rows of cells formed from successively developed layers of phellogen. As in the case of younger barks here also narrow layers composed of few rows of thick walled narrow cells alternate with broader zones composed of a larger number of rows of thin walled broadly rectangular cells. The cells of the former especially those of the innermost rows contain yellowish brown contents (oil?). The development of fresh layers of phellogen finally results in the complete elimination of all primary tissues of the cortex. The region next within has a homogeneous structure being composed almost exclusively of the regularly arranged secondary bast elements as far as the wood. The cells of phloem parenchyma are mostly isodiametric—cubical to polygonal in outline—,thin walled, and appear empty except some which show finely granular contents. There are usually two five rows of phloem elements between adjacent medullary rays. Sparsely scattered amidst the bast elements are one to five or more celled groups of stone cells arranged in irregualr concentric rings.

Medullary rays of the bast are continuous with those of the wood. They are narrow and extend as far as the cork tissue, almost abutting into the latter. They are more or less of uniform width and radially straight. Each ray consists of one or two or rarely three rows of thin walled rectangular radially elongate cells nearly twice as long as broad, with finely granular contents. The cells of the medullary rays and to some extent those of the bast are tangentially extended towards the periphery.

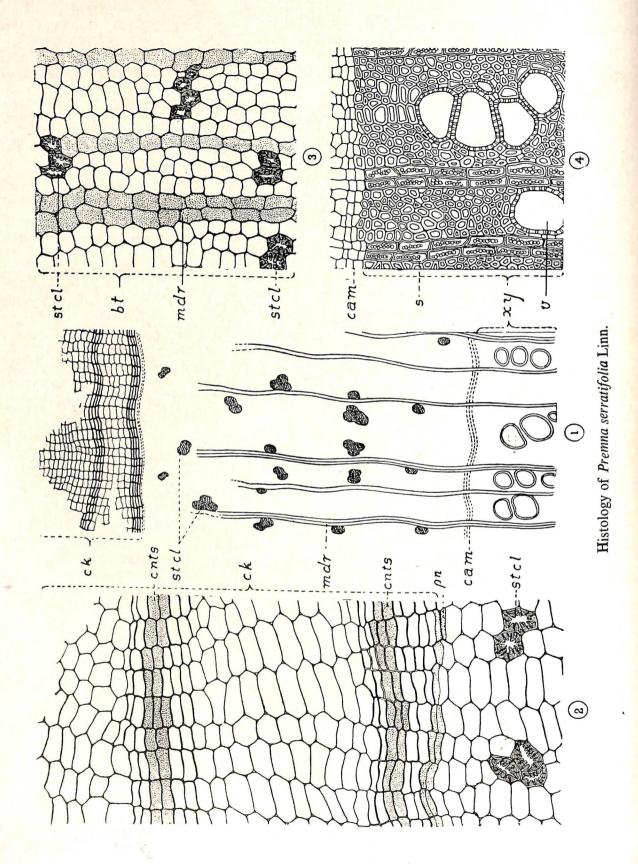
Wood consists of radial rows of vessels of various sizes, very thick walled wood fibres and several narrow medullary rays. The walls of vessels as well as those of the medullary rays are pitted. The medullary ray cells in the wood are fully packed with starch grains.

Distinguishing features of root.

A. Morphological

1. The roots are light yellowish brown to light brown, woody and strong with the surface shallowly fissured.

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- 2. The outer bark or rind is fairly thick, corky, soft and easily friable. On scraping or removing the soft tissue a brownish or reddish yellow (turmeric coloured) strongly aromatic oily layer is exposed.
- 3. The living bark in fresh roots is juicy, cream white in colour and has a fairly homogeneous structure. On exposure, the tissue takes on a characteristic blue-black tint. (In roots kept for sale or otherwise stored the surface shows patches of blue wherever the outer bark has been rubbed off).
- 4. The wood is whitish, hard, close grained and in transverse section shows a finely porous appearance.

B. Anatomical.

- 1. The transverse section is circular or oval but the outline is not regular.
- 2. The cork tissue is composed of two types of elements—narrow zones of two to five or more rows of cells with thick walls alternating with broader zones of four to eight or more rows of thin walled broadly rectangular cells.
- 3. The cortical zone—evident in young root bark only—is composed of thin walled cells of various sizes.
- 4. The bast forms the most prominent part of the bark and shows broad segments of phloem composed of regularly arranged parenchymatous elements and large sieve tubes. Few celled groups of stone cells either isolated or arranged in irregular concentric rings occur in the bast.
- 5. The medullary rays are many, narrow, and mostly uniseriate with occasional two and three seriate rays. Their cells in the phloem are thin walled, but in the xylem they have thick pitted walls and are loaded with starch.
 - 6. There is no pith in the centre.

C. Taste and odour.

The root bark has a characteristic agreeable odour. The fresh bark is at first mucilaginous sweetish, but bitter and pungent later. The wood is mildly scented.

Histology of root of Premna serratifolia Linn.

- Fig. 1. Diagram of T.S. of a radial segment of the root, showing disposition of tissues.
- Fig. 2. Details of structure of cork and adjacent tissues as seen in T.S.
- Fig. 3. Details of bast region.
- Fig. 4. A portion of wood showing structural details.



SYONĀKAḤ (श्योनाकः)

Oroxylum indicum Vent. (Syn. Calosanthes indica Blume)*

Family—Bignoniaceae

Descriptive Synonyms

श्योनाकः शोषणश्च स्यान्नट कटुवङ्ग टुण्टुकाः ।

मण्डूकपर्णं पत्रोणं शुकनास कुटन्नटाः ॥
दीर्घवन्तोऽरलश्चापि पथिशम्बः कटम्भरः ।

(भावप्रकाशः)

"Syonākah sosaņascasyānnata katvanga tuņtūkāh maņdūkaparņa patrorņa sukanāsa kutannatāh dīrghavrntoraluscāpi prthusimba katambharāh"

(Bhāva Prakāśa)

"Mayūrajangha" and "priyajīvi" are two other terms mentioned in Sāligrāma Nighaņţu.

'Patrorṇaṃ' = silk or silk garment, may indicate the thin silky membraneous texture of the wings of the seed. 'Sukanāsa' = having an aquiline nose; the flower buds are aquiline in form. 'Dīrghavṛntaḥ = having long stalk. 'Pṛthuśimba' = having broad fruit wall: the fruits are long and broad like a scabbard. 'Mayūrajaṅgha' = like peacock's leg—may refer to the warty nature of the rachis.

Properties and Uses

रयोनाकोदीपनः पाके कटुकस्तृवरो हिमः। ग्राहीतिक्तोऽनिलह्लेष्मपित्तकासप्रणाद्यानः॥

(भावप्रकाशः)

"Syonākodīpanah pāke katukastuvaro himah grāhī tiktonilas leşmapittakās apraņā sanah"

(Bhāva Prakāśa)

'Syonākaḥ' stimulates digestion, on digestion becomes pungent, is astringent and 'cooling', is costive, bitter, and controls cough caused by 'vāta' 'kapha' and 'pitta'.

श्योनाकस्तुवरस्तिकतः कटुश्चाग्निप्रदीपनः । ग्राहकः शोतलो वृष्यो बलदौ वातिपत्तहा ॥ सन्निपातज्वर कफत्रिदोषारुचिनाशनः । आमवातक्रमिवमीकासातीसारनाशनः ॥ तृष्णां कुष्ठं नाशयतीत्येवमाहर्मनीषिणः ।

"Syonākastuvarasthiktaḥ kaṭuścāgnipradīpanaḥ grāhakaśśitaļovṛṣyo baladovātapittahā sannipāta jvarakaphatridoṣārucināśanaḥ āmavātakṛmivamīkāsātīsāranāśanaḥ tṛṣṇāṃkuṣṭhamnāśayatītyevamāhurmanīṣiṇaḥ"

दुण्दुकोवातजिद्रक्षः शोफहाग्निबलप्रदः । तुवरः शीतलस्तिक्तो बस्तिरोगहरः परः ॥ पित्तक्षेष्मामवातारिः श्वासकासारुचीणीयेत ।

(शालिग्रामनिघण्टः)

"ṭuṇḍukovātajidrūkṣaḥ śophahāgnibalapradaḥ tuvaraśśītaļastiktovastirogaharaḥparaḥ pittaślesmāmavatārih śvāsakāsārucīrjayet."

(Sāligrāma Nighantu)

Other properties ascribed in the above are that Syonākah is 'vṛṣyaḥ'—aphrodisiacs 'baladaḥ'—strength giving, 'sannipātajvarahara'—curing fever where all the three doṣas, 'vāta', 'pitta', and 'kapha', are deranged, is 'rūkṣa'—'dry' or devoid of 'sneha', and is useful in anorexia, 'āmavāta', 'kṛmi'—worms, 'vami'—vomitting, 'kāsa'—cough, 'atīsāra'—diarrhoea, 'tṛṣṇā'—thirst 'kuṣṭha'—skin diseases including leprosy, oedema, and 'vastiroga'—bladder conditions.

Properties of the tender fruit

दुण्टुकस्यकलं बालं रूझंवातकफापहम् ॥ हृद्यं कषायं मधुरं रोचनं लघुदीपनं । गुल्मार्शं क्रमिहत्.....

(भावप्रकाशः)

कोमलं तुफलं चास्यतुवरं मधुरं लघु । हृद्यं रुच्यं पाचकञ्च कण्ट्यंचाग्निप्रदीपकम् ॥ उष्णाञ्चकटुकंक्षारं गुल्मवातकफार्शनुत् । अरुचि च क्रमिरचैव नाश्येदितिकीत्तिम ॥

(शालिग्रामनिघण्टः)

"Tuṇḍukasyaphalaṃ bālaṃ rūkṣam vātakaphāpahaṃ hṛdyaṃkaṣāyaṃ madhuraṃ rocanaṃ laghu dīpanaṃ gulmārśaḥkṛmihṛt......"

(Bhava Prakāśa)

"Komaļam tu phalam cāsya tuvaram madhuram laghu
hṛdyam rucyam pācakam ca kaṇṭhyam cāgnipradīpakam
uṣṇam ca kaṭukam kṣāram gulma vāta kaphārśanut
arucimcakṛmīścaiva nāśayeditikīrtitam" (Śāligrāma Nighaṇṭu)

The tender fruit of 'tunduka' is dry, removes 'vāta' and 'kapha', is pleasing or agreeable (to the heart?); is astringent, sweet, light, promotes taste, and digestive fire, and destroys 'gulma' (gas tumour?), piles and worm.

The tender fruit is also 'kanthyam'—useful in throat conditions. It is 'uṣṇam'—hot, 'kaṭukaṃ'—pungent, and 'kṣāraṃ'—alkaline or caustic.

Properties of mature (but not ripe) fruit

.....प्रौढं गुरु वात प्रकोपणम् ॥

(भावप्रकाशः)

".....praudham guruvātaprakopanam" (
The mature fruit is 'guru'—difficult of digestion, and exites 'vāta'.

(Bhāva Prakāśa)

^{*} Source plant in Kerala.

(Syn. Calosanthes indica Blume.)

Family—Bignoniaceae

Tamil

... Pevākai, Pezvākai, Vengāzāntai

Malayalam

... Palakappayyāni, Peyyāzānta

Hindi

... Sona, Arlu, Sonapatha, Phalphala.

Distribution and habitat.

Fairly common throughout India from the Himalayas southwards to Konkan, Malabar, the Ghats and Coromandal, It is found sparsely scattered throughout the evergreen forests and in moist places of the decidous forests from sea level to about 2,000 feet, but is not abundant anywhere.

Habit and general features.

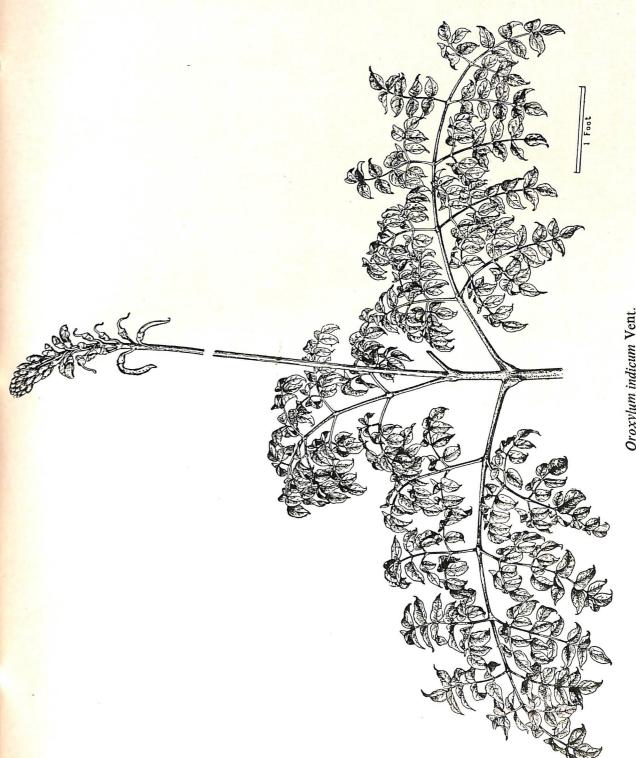
Oroxylum indicum is a medium sized to large conspicous but rather ungainly sparingly branched thin foliaged deciduous tree, reaching a, height of twentyfive to fifty feet or more, with tall straight but not stout trunk and a few decussate horizontal branches bearing considerably large sized ternately two to three pinnate leaves having several large leaflets terminal spikes of large lurid or brownish yellow flowers and large transversely compressed swordshaped pods. Both the trunk and branches are covered with thick soft smooth somewhat greyish spongy bark tinged bright green inside and prominently marked outside with the large broadly-elliptic smooth slightly sunken scars of fallen leaves, and very often also mottled with patches of variously coloured lichens. The tree when in fruit with numbers of them hanging from the ends of leafless branches presents a rather weird apprearance. Wood yellowish-white to deep-yellow, soft, spongy and without a distinct heart wood (Nissāraḥ) Flowering time the beginning of the cold season—January to March. Fruits-April to July.

External morphology.

Leaves: Opposite, exstipulate, considerably large, three to six feet or more long and two or four feet broad, triangular in outline, ternately two to three pinnate, with about five or more pairs of primary pinnae. The rachis is very stout, cylindric, swollen at the junction of the branches and has a warty lenticellate rough surface. Leaflets, many, with short petiolules, unequal, three to five inches long and two to three inches broad, broadly ovate, entire, rounded at base, suddenly and shortly caudate-acuminate or obtuse at apex glabrous and dark-green above and paler beneath with the nerves prominent.

The inflorescence is an erect terminal raceme up to about four feet long with one or two feet of nearly quadrangular scabrous flowerless basal portion. Bracts partially fused with the pedicels.

Flowers: Many, large, and fleshy. They are dark lurid to reddishpurple outside, dull or pale pinkish-yellow within, and have an unpleasant odour. The pedicels are short stout, glabrous, spreading, up to two inches long, and articulated at base. Calyx large, one inch by three quarters of an inch, leathery of fleshy, glabrous, oblong campanulate, truncate



Oroxylum indicum Vent.

Corolla-large, two to three inches long, white to purplish, fleshy, campanulate, and ventricose below: tube short; limb somewhat two-lipped and five lobed with the upper pair partially connate; mouth two to three and a half inches in diameter; lobes sub-equal round crisped much crumpled in bud and thickly covered on both sides with papillose hairs. Stamensfive, all fertile, shortly or scarcely exserted; filaments free, unequal inserted near the base of the tube, very wooly at base, with the exterior pair which is the longest incurved under the upper lip of the corolla: anthers—glabrous, two celled; cells—oblong, parallel, pendulous from the top of the connective, and diverging below with the connective slightly produced above the anther lobes as a short mucro. A large fleshy, cushion-like somewhat pentagonal disc is present surrounding the base of the ovary. Ovary—sub-sessile, glabrous, oblong, somewhat compressed contracted towards the base, two-celled with many ovules in each cell. Style about the length of the filaments, two to two and a half inches—, hollow along its whole length and opening out as a funnel-shaped mouth between the membraneous slightly incurved semi-circular lobes of the stigma.

Fruit: a very large, woody, broadly linear or sword-shaped, flattened or strongly compressed two valved retrofracted septifragal capsule, one to three feet long, two to three and a half inches wide, half to three quarters of an inch in thickness, tapering at both ends, dehiscing along both the incurved margins and compressed parallel to the septum. Valves woody; septum or dissepiment, thin flat, and parallel to the valves; seeds-very many, closely woody; thinly discoid-very flat and thin-oblong or rectangular, with broad hyaline or imbricated, thinly discoid-very flat and thin-oblong or rectangular, with broad hyaline or transparent membraneous wings on three sides except at the basal side, and including the wing, two to three inches long. Embryo small; cotyledons emarginate.

Officinal part

Root bark and tender fruits

Description of root: The roots are stout and woody but not very heavy, greyish brown to light brown, often tinged with a light purple or rose colour, with the surface fairly smooth, but often uneven or irregular due to pressure from soil components, distantly and sparsely lenticellate and marked with a large number of faint narrow vertical streaks or cracks at close intervals. The entire bark is a quarter to half an inch or more thick, soft, juicy, and easily cut. In the fresh roots the living bark has a light cream-white to cream yellow colour and nearly homogenous texture. Cut or otherwise exposed portions of the bark, within a very short time of exposure to air, take on a greenish tint in a characteristic manner. The tissues at first turn greenish-yellow, then light green and finally dark green. The change usually begins and is distinctly marked in the portion nearest the wood and gradually the colour change extends outwards until the entire cut surface appears greenish. The peculiarity is observable in the case of the stem bark also and may be considered a noteworthy feature of the bark.

The surface skin is very thin, often less than 0.2 m.m. in thickness, soft, easily scrapable and injured on slightest abrasion or rubbing. Hence on the surface of the pulled out roots a number of greenish patches representing the exposed or wounded portions of the inner tissue are usually found. The inner bark is whitish, slightly fibrous

and presents a faintly lamellated appearance due to the presence of intermittent tangential layers of fibrous tissue.

The transversely cut section of a root about a quarter inch in thickness is circular with its outline minutely denate or wavy. Three regions are clearly made out viz., rind, bark and wood. The rind appears as a distinct cream-yellow to light orange or reddishbrown or rarely greyish brown strip about a hair's breadth or slightly more in thickness. The rest of the bark comprising the cortex and bast is fairly broad comprising slightly less than a third of the thickness of the root.

The proportionate thickness of the different parts varies according to the age and size of the root though not in direct proportion, the wood being considerably bulkier in the thicker roots.

The fresh bark has a sweet initial taste which may turn faintly bitter later on, but is without any marked or perceptible acridity or offensive smell.

Fracture of bark, short, but slightly fibrous inside.

On drying, the entire bark shrinks considerably on account of which the surface appears longitudinally shrivelled with its outer skin closely adherent to the tissues within. In such dried material, or after it has been kept for a few days, even the slight bitterness of the fresh bark is not evident. The stem bark is less juicy and less sweetish, but more leathery or tough.

The wood is soft, being easily cut and shows an almost homogeneous highly porous structure with a few irregularly wavy concentric lines. Medullary rays very fine, not clearly discernible with the naked eye.

Histology

The cork tissue is comprised of twenty to thirty or more rows of tangentially elongate narrow rectangular thin walled cells, the majority of which are without contents. The walls of the peripheral rows are dark reddish brown while those inside are brownish or devoid of any colour. Deep broadly wedge shaped fissures which often extend to inner most rows, cut up the cork tissue into a number of truncted pyramidal projections.

The phellogen is distinct and consists of one or two rows of still narrower tangentially elongate cells.

A phelloderm of three to five or more rows of broadly rectangular tangentially elongate thin walled empty cells is found next within.

The portion of the bark between the cork zone and the wood forming the living or officinal part of the bark can be differentiated into two regions, though there is no clear line of demarcation between the two. These are (i) a peripheral region of twelve to thirty or more rows of thin walled tangentially elongate, polyhedral cells of various sizes devoid of mechanical elements;— the cells of the outer rows are oblong and somewhat smaller than those of the inner rows which are elongated tangentially, and, (ii) the bast proper, consisting of small thin walled phloem elements of the usual type and narrow tangential segments of sclerenchyma. In the older portions of the bast, collapsed or crushed up phloem elements

can be made out. The phloem parenchyma cells are small and rounded or polygonal. The groups of mechanical elements in the outer portions appear as small dots or short segments, composed of very few cells and arranged in irregular concentric series at distant intervals, whereas those in the interior form more closely and regularly spaced tangentially elongate strips separated by narrow medullary rays only. The sclerenchyma cells are small, polygonal in outline, and very thickwalled.

The cambium is distinct and composed of two or three layers of thinwalled tangentially elongate cells.

Wood consists of a large number of irregularly disposed vessels of various sizes, broad zones of xylem parenchyma and a meagre development of sclerenchyma which appear as small concentrically arranged patches amidst the xylem parenchyma. The xylem parenchyma cells are thick walled nearly rectangular and without inclusions. The cells of sclerenchyma are smaller, polygonal in outline and have very thick walls. The xylem vessels often occur in groups of two to three or more. Their walls are thick and have numerous transversely extended pits.

Medullary rays many, usually two to four seriate, occasionally uniseriate; most of them extend continuously from the centre to almost the middle of the bark. The ray cells in the xylem portion are rectangular radially elongate with comparatively thick pitted walls and without inclusions like starch. The cells in the distal portion of the rays are thin walled, larger and tangentially elongate.

At the centre of the root is a pith like tissue composed of small sized, circular thick walled cells.

Diagnostic features.

A. Morphological.

- 1. The fresh roots are greyish, or light brown, often with a rose or light purplish tint, cylindrical, stout and woody, with the surface fairly smooth though faintly fissured. On dried roots the surface appears shrunken and longitudinally wrinkled.
- 2. The surface skin is soft, thin, easily scrapable and liable to injury even by mere abrasion.
- 3 In fresh roots the officinal part of the bark is appreciably thick, juicy and turgid. It is dull white but on exposure to air quickly turns green. In fresh cut transverse sections this change begins near the wood and gradually spreads outwards. The bark on drying shrinks considerably and adheres closely to the wood.
 - 4. The wood is soft, highly porous and slightly fibrous.

B. Anatomical

- 1. Transverse section nearly circular or oblong, but outline irregularly and bluntly dentate.
- 2. The cork zone is appreciably thick and comprised of thirty to forty rows of very thin walled rectangular empty cells. The outer portion is deeply fissured. The fissures cut up the cork into truncated pyramidal projections.

- 3. The mid bark is also composed of several rows. Its cells are small, thin walled, polyhedral or oblong, of various sizes and usually without inclusions like starch. The inner bark or the bast proper shows narrow tangential strips or segments of mechanical tissue alternating with broad bands of thin walled phloem. Collapsed and compressed elements of phloem are found in the older portions.
- 4. The wood is composed of irregularly disposed vessels of various sizes, xylem parenchyma, a small quantity of sclerenchyma and several medullary rays.
- 5. The medullary rays are mostly two to four seriate. Their cells are thick walled and rectangular in the xylem part and thinwalled and broader in the phloem and outwards.
 - 6. There is a central pith like region of thick walled nearly spherical cells.
- 7. The absence of storage starch in any of the parenchymatous elements may also be considered a noteworthy feature.

C. Odour and Taste

The juicy part of the fresh bark is at first sweetish mucilaginous but later on feebly bitter. There is only very little of bitterness in dried barks. Neither the bark nor the wood has any characteristic odour.

Mode of use and keeping quality. The living bark is the part prescribed as officinal but the entire root is often used after scraping and cleaning the surface. The roots are liable to attack at of insects. They lose their vitality after a few months.

Chemical constituents

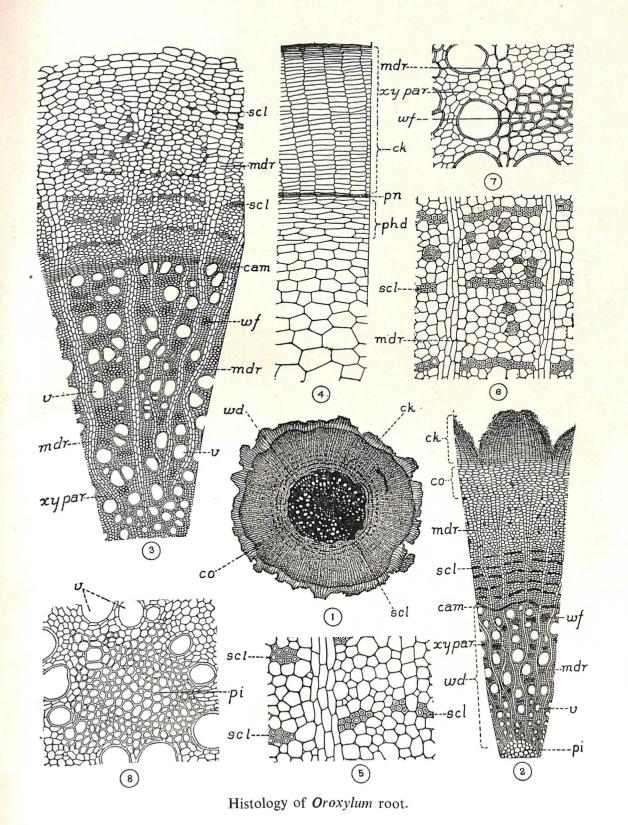
The chief constituent of the plant is an yellow crystalline principle oroxylin, which amounts to 0.84% on the dry root bark and 1.01% on the dry stem bark.

Total extractives:

- (i) Of the root bark: Petrolether 0.43%; ether 1.2%; alcohol 29%; acetone 3.34% chloroform 2.82%; and benzene 2.0%.
- (ii) Of the stem bark: Petrol ether 1.42%; ether 4.55%; alcohol 17.35%; chloroform 2.93%; acetone 7.33%; and benzene 2.3%;

Histology of Oroxylum root

- Fig. 1. Diagram of transverse section.
 - 2. Part of a sector of the T.S. enlarged.
- ,, 3. A semi diagramatic sketch showing pholem, cambium and xylem.
- 4. Structure of cork and cortex.
- .. 5&6. Details of structure of bast region.
- ,, 7. Structure of xylem.
- 8. Structure of the central pith like region.



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Stereospermum tetragonum D. C.*
(Syn. S. Chelonoids C. B. Clarke) belonging to Bignoniaceae.

Descriptive Synonyms

पाटिलः पाटलाडमोघा मधुदूती फलेक्हा । कृष्णवृत्ता कुबेराक्षी कालस्थात्यिलवङ्कमा ॥ ताम्रपुष्पी च कथिताऽपरा स्यात्पाटला सिता । मुष्कको मोक्षको घण्टापाटिलः काष्ठपाटला ॥ कालस्थालीत्यत्र काचस्थालीत्येके ॥

(भावप्रकाशः)

"Pāṭaliḥ pāṭalā fmoghā madhudūtī phaleruhā Kṛṣṇavṛntā kuberākṣī kālasthālyalivallabhā tāṃrapuṣpī ca kathitā fparā syātpāṭalā sitā muṣkako mokṣako ghaṇṭāpāṭaliḥ kāṣṭhapāṭalā kālastālītyatra kācasthālītyeke"

(Bhāva Prakāśa)

पाटलाकर्बु राऽमोघोफलेरहाम्बुवासिनी । कृष्णवृन्ताकालवृन्ताकुम्भीतोय।धिवासिनी ॥ दितीयापाटलाक्वेतानिदिष्टाकाष्ठपाटला ॥

(शालीग्रामनिघण्टः)

"Pāṭalā karburā f moghā phaleruhāmbuvāsinī kṛṣṇavṛntā kālavṛntā kumbhī toyādhivāsini dvitīyā pāṭalā švetā nirdiṣṭā kāṣṭhapāṭalā"

(Śāligrāma Nighantu)

Other descriptive terms mentioned in the Śāligrāma Nighantu are 'vasantadūtī', 'sthiragandhā', 'kāmadūtī' and 'kokilā'.

Bhāva Prakāśa Nighaņţu and Śāligrāma Nighaņţu make mention of a white variety also. Three other varieties 'Bhūmipāṭalā', 'kṣudrapāṭalā' and 'vallīpātalā' are mentioned in Sāligrāma Nighaṇṭu. It is doubtful whether such different varieties are recognised in Keraļa.

'Pāṭaliḥ' and 'pāṭalā' meaning pale red or pink, may indicate the colour of flowers. The young leaves are also pale red or pinkish violet. 'Amoghā' meaning unerring or reaching the mark may indicate the sure action of the drug; 'madhudūtī' means messenger (fore-runner) of Spring season; 'phaleruhā' = sprouting in fruit; 'kṛṣṇavṛnta' and

^{*} Stereospermum suaveolens D. C. is referred to as the source plant in authoritative books on the Materia Medica of India, which probably is the plant from which the drug is obtained in other parts of India. This is available in Travancore, but whether it is also used for extraction of the drug is doubtful.

Radermachera xylocarpa, Sch. (Syn. Stereospermum xylocarpum, Benth. & Hook) is also by some considered as a variety of Pāṭalā (pātiri) and may probably represent the "other variety" referred to in Ayurvedic texts as Ghantāpaṭala, kaṣṭhapaṭala, setapaṭala etc. (white tinged with red) or it may be simply an unauthorised substitute.

'kālavṛntā' indicate a dark or black stalk; 'kuberākṣī'=like 'Kubera's eye' (?) (Kubera is described to have only one eye, there being only a yellow patch in the place of the other); 'kālasthālī'=black bowl; 'aļivallabhā'=favourite of the beetle; 'tāmrapuṣpī'=copper coloured (flowers); 'ghaṇṭāpāṭaliḥ'=bellshaped flower, 'kāṣṭhapāṭalā'=woody; 'karburā'=greyish white (flower); 'ambuvāsinī'=capable of perfuming water; 'kumbhī'=pot shaped; 'sthiragandha'= with stable smell; 'kokiļā' = black.

Properties and Uses:

पाटलातुवरातिक्ताऽनुष्णा दोषत्रयः।पहाः । अरुचिश्वासञोषास्रच्छदिहिक्कातुषाहारी ॥

(भावप्रकाशः)

"Pāṭalā tuvarā tiktā fuuṣṇā doṣatrayāpahā aruciśvāsaśotharśacchardihikkātṛṣāhārī"

(Bhāva Prakāśa)

'Pāṭalā' is astringent and bitter, not hot, relieves the three 'doṣās' and destroys or overcomes anorexia, difficult breathing, anasarca, piles, vomitting, hiccough and thirst.

पाटला तु रसेतिकतः कटूब्णाकफवातजित् । शोफाष्मानविमिश्वासशमनी सन्निपातनुत् ॥

(राजनिघण्टुः)

Pāṭalā tu rasē tiktā kaṭūṣṇā kaphavātajit śophādhmāna vamiśvāsaśamanī sannipātanut"

(Rāja Nighantu)

'Pāṭalā is bitter and pungent in taste, hot, overcomes 'kapha' and 'vāta'; and is useful in oedema, tympanitis, vomitting and difficult breathing and in 'sannipāta' (a condition in which all the three 'doṣās' are vitiated).

पाटलाऽहिन्हायास्यासतृद्व्छिदिनाशिनी । नात्युष्णं तुवरं स्वादुतत्पुष्पं कफवातनुत् ॥ पित्तातीसारदाहृष्टं फलं हिक्क्षःस्रपित्तनुत् ।

(धन्बन्तरिनिघण्टु)

"Pāṭalā frucisothāsra svāsatṛṭcchardināsinī nātyuṣṇam tuvaram svādu tatpuṣpam kaphavātanut pittātīsāradāhaghnam phalam hikkāsra pittanut" (Dhanvantari Nighaṇṭu)

'Pāṭalā' is useful in anorexia, oedema, haemothermia, difficult breathing, thirst and vomitting; it is not 'very hot'; it is astringent and sweet. Its flower is useful in 'kapha' and 'vāta', in 'pittātīsāra' and burning sensation. Its fruit is useful in hiccough and 'asrapitta' (a condition in which 'rakta' and 'pitta' become excessive, vitiated and mutually vitiating.

रक्तपाटलिका तिक्ता कट्वीचोब्णा कफापहा । सन्निपात श्वासविम शोफाब्मानानि नाशयेत् ॥

(राजनिघण्टुः)

"Raktapāṭalikā tiktā kaṭvīcoṣṇa kaphāpahā sannipātasvāsavamisophādhmānāni nāsayet"

(Rāja Nighantu)

The red 'Pāṭalā' is bitter, pungent and hot, relieves 'kapha', and is useful in 'sannipāta', difficult breathing, vomitting, oedema and flatus.

सितपाटलिका तिक्तागुर्व्युष्णा वातदोषजित्। विमित्रिक्का कफारनी च श्रमशोषापहारिका ॥

(धन्वन्तरिनिघण्टुः)



- 1. Oroxylum root.
- 2. Stereospermum tetragonum root.

"Sitapāţalikā tiktā gurvyuṣṇā vātadoṣajit vamihikkākaphaghnī ca śramaśoṣāpahārikā"

(Dhanvantari Nighanțu)

The white Pāṭalā is bitter, 'guru'—(heavy), and hot, and is useful in neurotic oedema, vomitting, hiccough, 'kapha', and weakness and emaciation (consumption).

इवेतातुपाटला चोष्णातिक्तागुर्वीसुगन्धिका । रक्तदोषारुचिशोफ श्वासतृङ् वान्तिनाशिनी ।। हिङ्का कफं च वातञ्च नाशयेदिति कीर्तितम् ।

(निघण्ट्ररत्नाकरः)

"Svetā tu pāṭalācoṣṇā tiktā gurvī sugandhikā raktadoṣāruciśophaśvāsatṛḍvāntināśinī hikkāmkaphaṃcavātamca nāśayediti kīrtitaṃ."

(Nighanțu Ratnākara)

The white Pāṭalā is bitter, 'guru' (heavy) and sweet-smelling and is useful in blood impurities, want of taste for food, oedema, difficult breathing thirst, vomitting, hiccough, 'kapha' and 'vāta'.

Properties of Flower and Fruit

पुष्पं कषायं मधुरं हृद्यं कफास्रनुत् । पिचातीसारहृत्कण्ठ्यं फलं हिङ्काऽस्रपित्तहृत् ।।

(भावप्रकाशः)

Puṣpaṃ kaṣāyaṃ madhuram himam hṛdyam kaphāsranut pittātīsārahṛtkaṇṭhyaṃ phalaṃhikkāsrapittanut" (Bhāva Prakāśa)

Flower is astringent, sweet, cool, pleasant, or agreeable (to heart?), is useful in 'kapha' and 'asra', diarrhoea of the 'pitta' type and is agreeable for the throat. The fruit is useful in hiccough and 'asra-pitta.'

पुष्पाणिपाटलायास्तु स्वाद्गि तुवराणिच ।
हृद्यानिशीतवीर्याणि रक्तदोष हराणिच ॥
दाहं कफं पित्तरोगं पित्तानीसारहानिच ।
फलानिपाटलायास्तु शीतलानिच गुरूणिच ॥
तुवराणि च तिक्तानि मधुराणि बुघाजगुः ।
मूत्रकुच्छुं रक्तपित्तं हिङ्कावातहराणिच ॥

(राजनिघण्टु:)

"Puşpāņi pāṭalāyāstu svādūni tuvarāņica hṛdyāni śītavīryāņi raktadoṣa harāṇi ca dāham kapham pittarogam pittātīsārahāni ca phalāni pāṭalāyāstu śītaļāni ca gurūṇi ca tuvarāṇi ca tiktāni madhurāṇi budhājaguḥ mūtrakṛchram raktapittam hikkāvātaharāṇi ca."

(Rāja Nighantu)

In addition to the properties given in Bhāva Prakāśa, Rāja Nighaṇṭu states that the fruits are considered cooling in action, 'heavy' of digestion, astringent, bitter and sweet, and useful in difficult 'micturition' and 'vāta'.

Stereospermum tetragonum D. C.

(Syn. S. Chelonoides C. B. Clarke)

Family—Bignoniaceae

Tamil

... Pūmpātiri, Vella patiri.

Malayalam

... Patiri, Pūmpatiri, Karinkūra.

Hindi

... Padri, Pader, Para.

Distribution and habitat

Throughout India, Burma and Ceylon, chiefly in the moist deciduous forests from sea level to about 4,000 feet. It is recorded as occurring in Sikkim, Oudh Forests, Silhet, Chittagong, Deccan, Western peninsula (on the Northern side from Konkan southwards), Nallamalai hills, Veligonda hills mountainous parts of Coromandel and southwards to Travancore.

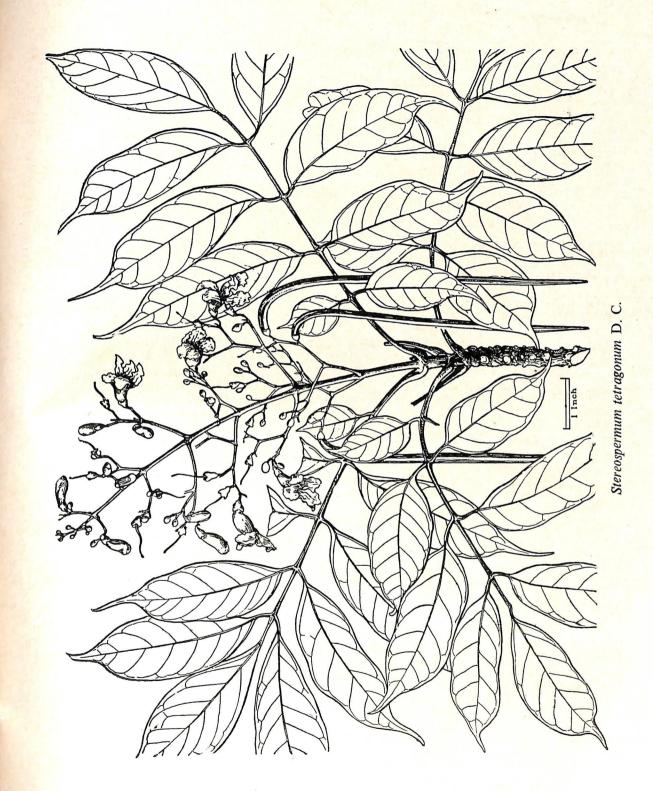
Habit and general features

Stereospermum tetragonum D.C. is a large deciduous, nearly glabrous tree, thirty to sixty feet high, with thick straight trunk, attaining a girth of ten feet or more, many spreading branches, covered with thick fairly smooth yellowish brown bark, and bearing large opposite imparipinnate leaves clustered towards the end of the branchlets, large fragrant reddish veined yellowish flowers borne in lax drooping terminal cymose panicles and linear four angled spirally curved pendulous pods. The lower branches are spread out nearly horizontally while the others gradually become more erect towards the top. The leaves are shed about February to March, and new leaves appear in April. Flowering time April to June with or after the formation of the new leaves. Fruits November to December.

External morphology

Leaves: opposite, imparipinnate, one to one and a half feet long. Rachis six to nine inches long, channelled, smooth. Leaflets five to eleven, short stalked, two to six inches long and one to three inches broad, the basal ones usually smaller, ovate, oblong or elliptic-ovate, acute or rounded and often unequal sided at base, acute to suddenly long caudate-acuminate at apex entire, or shortly serrate on young plants and coppice shoots. Main nerves eight to ten pairs. Tender leaflets are purplish or pinkish violet and somewhat downy. Mature ones are nearly glabrous, harsh and crustaceous. Petiolules have a characteristic dark violet colour. (Krsnavrnta).

The inflorescence is a lax flowered terminal cymose panicle with decussate glabrous branches and slender drooping articulated end branchlets. The latter are forked, bear a sessile flower in the cleft, and terminate as cymules. Peduncles and pedicels round, marked with oblong, grey scabrous specks Bracts small caducous. Flowers: large about three quarters of an inch long, very fragrant, yellow with reddish veins, bilaterally symmetrical. Calyx: about a quarter inch long, campanulate glabrous coriaceous, shortly and acutely three to five toothed. Corolla: slightly less than one inch long, bilabiate, yellow with reddish purple veins and more or less pubescent outside: tube: companulate; lobes: three to four



yellowish or of pale flesh colour, short and rounded with crisped margins. Androecium of four fertile stamens and a posterior staminode: filaments free, covered with a short tuft of woolly hairs at base. An annular fleshy yellow nectariferous disc is present surrounding the base of the ovary. Ovary sessile, elongate, two chambered with numerous biseriate ovules in each chamber. Style slender ending in two stigmatic branches.

Fruit: a pendulous four angled or ribbed or roughly quadrangular linear, slender, smooth, glabrous, somewhat twisted or spirally curved, pointed pod-like loculicidally two valved capsule, half to two feet long and one third to half inch thick, often speckled with small grey or white patches. Valves coriaceous with raised midrib. Septum thick spongy or corky, brownish white, sub-cylindric compressed with deep open notches wherein the seeds are lodged. Seeds winged sub-trigonous, or wedge shaped one to one and a half inches long, with a transverse furrow in the middle along which it readily breaks.

Wood: coarse and hard, greyish brown with darker patches of brighter brown. There is no recognisable heart wood.

Officinal parts

Root bark, wood of root (in Kerala) flowers and tender fruits.

Description of root and root bark.

The roots are light—grey to greyish brown, fairly stout, with hard heavy wood and covered with a tough, slightly rough but not hard bark which in fresh roots is easily separable the wood. The bigger roots brought for sale massive with a tough, slightly rough but not hard bark which in fresh roots is easily separable covered which the wood. The bigger roots brought for sale measure up to three feet in length and from the wood in thickness whereas the smaller roots range in thickness from half an inch half to one lose in most cases is not even. In the case of the smaller roots it is shallowly upwards. The surface in most cases is not even. In the case of the smaller roots it is shallowly upwards. In close oblique and longitudinal rows, presenting a sort of narrowly latticed furrowed in close with very narrow interstices and ridges. In older roots the surface is also marked or appearence with very narrow interstices and ridges. In older roots the surface is also marked or appearence with slightly raised transversely elongate lenticles arranged in shortly spaced transverse studded with slightly raised transverse from about an eighth of studded with signal studded with signal to the studded with signal students with signal s of nearly one inch to about half an inch in thicker roots. The thickness of the bark does not of nearly of the proportion to that of the root. The rind or outer bark is about a hair's breadth vary in direct proportion. It is corky, but vary in thickness. It is corky, but quite compact and somewhat brittle. It does not usually exfoliate. In fresh roots it can be easily separated from the inner tissues by mere application of slight pressure, but adheres more closely on dried roots. It is greyish outside and dull white within. The irregularly anastomosing array of oblique and longitudinal depressions and ridges of the root are fairly prominent. The rest of the bark viz. the actual officinal part composed of the middle and inner barks (cortex and bast) comprises more than four fifths of the entire thickness of the bark. When freshly exposed i.e., in fresh roots, it is almost pure white or cream white and juicy, but on drying gradually turns dull vellowish-white, then dull brown and finally dark brown. It can be easily differentiated into (i) an outer juicy non-fibrous part viz. the middle bark which is bitter and in the case of smaller roots bulkier and (ii) an inner fibrous tough or leathery part-inner bark—which appears distinctly tangentially lamellated in transverse section. The inner bark in the case of smaller roots is a comparatively narrow zone but it is more prominent in older roots. The wood is very hard and compact and in transverse section appears beautifully striated with close series of very narrow, haid, shiny dark-brown concentric rings alternating with similar narrow zones of softer porous tissue. Numerous fine medullary rays radiate from the centre to very near the periphery of the bark. A heart wood is not differentiated. Pith is absent.

Taste

The fresh bark is juicy and quite bitter, the bitterness being more predominent in the outer region of the officinal tissue. The bitterness persists even after drying. The corky rind has a feeble earthy odour, but no particular taste.

Histology.

The transverse section reveals the following details:

The cork zone is comparatively narrow. It is composed of six to twelve or more rows of nearly cubical thin walled empty cells. A phellogen of one or two rows of narrow rectangular cells is found within the cork. Next within is the phelloderm which is a very narrow zone of regularly arranged thinwalled rectangular cells deviod of inclusions. The cortex is composed of several rows of cubical to rectangular thin walled cells also devoid of inclusions. Numerous groups of closely and regularly packed stone cells are present in this region in an irregularly scattered manner. The size, form and the number of cells constituting a group vary, but their general structure is similar. As seen in transverse sections their outline is irregular. The stone cells are comparatively small, cubical to rectangular, have very thick lamellated pitted walls and narrow lumen. They are arranged in brick work pattern, three to eight rows wide and three to fifteen rows deep. The inner bark or bast is composed of broad concentric zones of phloem, alternating with narrow strips of sclerenchyma, and the medullary rays. In transverse section the zones of phloem and sclerenchyma appear as tangential segments separated by the medullary rays. The elements of phloem are fairly large sized. As is usual, where secondary growth has taken place, only the more recently formed phloem elements are regualr showing normal form and structure. In most of the outer segments patches of shrunken or collapsed and distorted base elements are found. The sclerenchyn atous cells are small and arranged three to six or more rows wide in each segment. The segments towards the periphery are smaller and less regularly arranged. The meduallary rays are many in number, narrow and mostly two to four-seriate. Their passage is radially straight in the wood and inner portions of the bast, but towards the periphery they become flexuose and appear broader. The cells of the medullary rays are thin walled and without inclusions.

Distinguishing features of root and root bark.

A. Morphological.

- 1. The roots are greyish to dull brown, cylindrical, woody, hard and heavy with the surface shallowly furrowed in close oblique and longitudinal series. In older roots regularly spaced rows of transversely extended lenticels also occur.
- 2. The rind or outer bark is thin, campact somewhat brittle and in fresh roots easily separable on slight pressure.

- 3. In fresh roots the official bark is whitish and differentiated into an outer more or less homogeneous juicy portion and an inner lamellated fibrous region. The whole region turns dull brown on exposure and drying.
- 4. The wood is not differentitated into heart wood and sap wood, but appears concentrically striated and has numerous fine radiating medullary rays.

B. Anatomical.

- 1. Transverse section is nearly circular or oblong with its outline slightly or minutely wavy.
- 2. The cork zone which appears as a thin greyish strip is composed of a limited number of rows of uniform thin walled empty nearly cubical cells.
- 3. The cortex is composed of small oblong thin walled cells, normally without inclusions like starch etc. Densely scattered throughout the region are several groups of regulary aggregated small cubical to rectangular stone cells.
- 4. The bast region is fairly broad and made up of broad zones of phloem alternating with narrow tangential segments or strips of sclerenchyma.
- 5. Wood shows narrow annular strips of dark brown shiny thick walled fibrous elements alternating with lighter coloured bands of softer thin walled parenchyma.
 - 6. There is no pith in the centre.
- 7. The almost complete absence of starch grains in any of the parenchymatous elements is a noteworthy feature.

C. Taste and odour.

The bark is bitter to taste. It has no special odour.

N.B. Since the action is diaphoretic, diuretic or antipyretic, the constituents of the drug may be isolated and chemically and pharmacologically studied to see if it contains anything that may produce diaphoretic or diuretic or antipyretic action. It is also credited with antispasmodic action (śvāsahari). Hence an antispasmodic principle may be looked for.

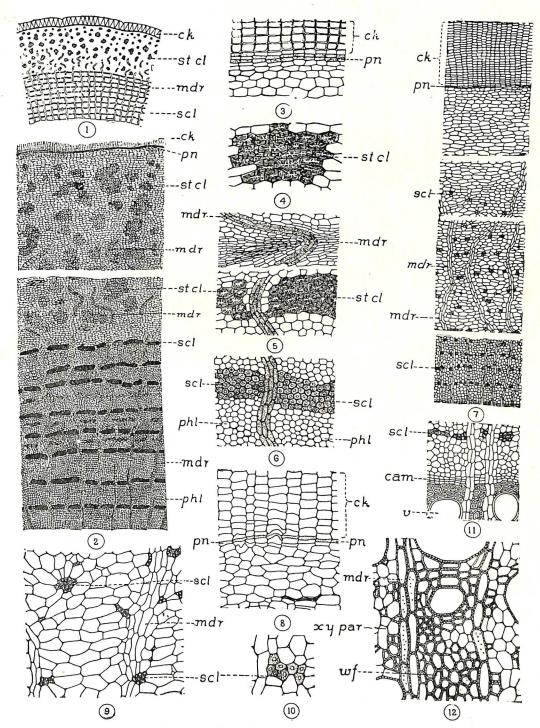
Histology of Stereospermum tetragonum D.C. and Radermachera xylocarpa K. Schum.

A. Stereospermum tetragonum

- Fig. 1. Diagramatic sketch of a part of the T.S. of root bark showing arrangement of tissues.
- Fig. 2. A radial segment of the above enlarged (semi-diagramatic sketch).
 - "3. Cork, phellogen, and cortex.
 - ,, 4. A group of stone cells from the cortex.
 - "5. Part of cortex showing the distal end of a medullary ray with adjoining tissues.
 - "6. Structure of bast.

B. Radermachera xylocarpa

- Fig. 7. A radial segment of the T.S. of root; (semi-diagramatic sketch).
 - "8. Cork, phellogen and cortex.
 - "9. Structure of bast region.
 - "10. A group of sclerenchyma from the bast.
 - "11. Phloem, cambium and wood.
 - "12. Details of structure of xylem.



Histology of root bark of Stereospermum tetragonum D. C. and Radermachera xylocarpa K. Schum.

Radermachera xylocarpa K. Schum.*

(Syn. Stereospermum xylocarpum, B.& Hk. f., Bignonia xylocarpa Roxb., Spathodea xylocarpa T. And.)

Family—Bignoniaceae

Tamil

... Vedanguruni, Vadencarni, Pātiri

Malayā lam

... Vedangkonna, Edangkorna, Vedangkonnai.

Distribution and habitat.

Central India extending north up to the Satpura range, the Deccan, Madras States and the Western Peninsula southwards to Travancore-Cochin. The plant grows well in good humus soil, in places of moderate to heavy rainfall from sea level to 5000 ft.

Habit and general features.

Radermachera xylocarpa is a moderate sized to large, elegant deciduous tree thirty to sixty feet in height with sparsely branched straight trunk two to three feet in girth, covered with light grey, ash-coloured or pale brown, somewhat spongy, thick, cracked or rough flaky bark, bearing large opposite bi-or occasionally tri-pinnate leaves one to four feet long, terminal cymose panicles of large fragrant whitish flowers, and hard woody, rough elongate curved or twisted conspicuous fruits. Flowering time March to May when the tree is generally in a leafless condition or along with the advent of fresh foliage.

External morphology.

Leaves: large, up to four feet long, opposite, bi-pinnate occasionally tri-pinnate with about four pairs of lateral and an odd terminal pinna, each pinna having three to nine leaflets. Leaflets sessile, two to five inches long and three quarters to one and a half inches broad, oblong to lanceolate or rarely semicordate, entire, sometimes oblique at base, acute or pointed at apex nearly glabrous, membraneous and dull-purplish when tender, but harder and slightly rough when full grown or mature. The main rachis as well as the lateral ones are dark-purplish, grooved above, and somewhat rough due to numerous elevated greyish specks.

Flowers: large, one and a half to two inches long, pleasingly fragrant, white tinged with yellow or pink, arranged in the corymbiform branches of some what rigid dense flowered erect terminal di—or trichotomously compound sparsely pubescent cymose panicles. Calyx-campanulate, half to two thirds of an inch long, unequally five-toothed, or rarely truncate, pubescent when young, but glabrous when mature. Corolla—one and a half to two inches long, zygomorphic, sub-glabrous, funnel shaped, with a nearly straight tube slightly inflated on one side near the base, expanding into a broad throat and ending in a sub-bilabiate five partite limb with the segments nearly equal rounded or sub-orbicular, much curled at the

^{*} Radermachera xylocarpa K. Sch. is considered by some as the other variety of Patala (seta patala) or, it may be considered as an unauthorised substitute.

margin, and spreading out. Androecium, of four fertile stamens and a small posterior staminode; filaments slender; anther cells divaricate. A cupular or annular fleshy disc is present outside the ovary. Ovary oblong or cylindrical, two celled with numerous ovules in many series attached to two thick equidistant placentae on either side of the partition. Style slender about the length of the filaments ending in two thin oblong or linguiform (tongue shaped) stigmatic lobes.

Fruit: A very hard, woody, extremely rough elongate or linear, slightly curved twisted, two valved capsule, one to nearly three feet long and one to one and half inches thick with the surface covered with numerous large, irregular, prominent hard tubercles; valves woody; the septum or partition is sub-cylindric, nearly 0.5 inch thick, spongy, faintly pitted and bears on each side a double row of seeds. Seeds many, arranged in four series or rows, small somewhat shining, thinly discoid, with a membraneous wing at either end, and including the wings one to one and a quarter inch long and nearly half inch broad. They are non-endospermic. Embryo with thin narrow nearly flat or semi-terete cotyledons and a short minute radicle.

Officinal parts

Root-bark and fruit. In Travancore-Cochin, the wood of the root is also often used.

Description of the root and root-bark

The roots are light grey to greyish brown, at times with a pale rose tinge, woody, hard and heavy, and covered with thick leathery, fissured bark. In young and small sized roots, upto about one and a half inches in diameter the bark is comparatively thick and the central core of wood slightly less than a third of the diameter. In older and thicker roots, the bark is not however proportionately thicker. In these the wood occupies the major portion. The entire bark is tender, juicy and easily cut, though the portion nearer the wood is somewhat leathery. The rind or outer bark is soft, corky and shallowly fissured with series of short longitudinal clefts but otherwise smooth being non-exfoliating and normally devoid of prominent warty lenticels or deep fissures. Its thickness varies from less than half a millimeter in the smaller roots to one or one and a half millimeters in the thicker roots. The outer part of the rind is thicker and brownish. The inner part which adheres to the former is thinner, nearly membraneous and whitish. It can be peeled off like tissue paper. In most of the specimens brought for sale the rind on account of its softness and rough handling is found to be worn out or smoothened.

The officinal part of the bark is considerably thick. Its outer part in the fresh condition is soft, juicy and cream white to light brown but the colour turns to dark brown on exposure or drying. The inner bark is more compact, has a leathery texture, and proportionately thicker in the older and stouter roots. In transverse section it appears finely tangentially lamellated with alternating strips of brownish and whitish tissues.

The wood is light brown in colour. It is very hard and heavy, and appears finely concentrically lamellated. There is no pith in the centre.

Taste: The fresh bark is quite bitter and slightly mucilaginous.

Histology

The cork tissue consists of 25 to 40 rows of thin walled rectangular cells about twice as long as broad, with their radial walls somewhat wavy due to compression.

Phellogen is a single row of narrow cells. The cortex (secondary) is an appreciably wide zone and is composed of several rows of thin walled oblong cells of various sizes, usually devoid of inclusions. The flexuose terminal portions of a number of medullary rays as well as a few scattered small sized groups of sclerenchyma can be made out in the inner portions of the cortex. The groups of sclerenchyma consist of two to five cells as seen in transverse sections.

The bast is also a wide zone and is composed of several rows of almost regularly arranged cells. Short segments of sclerenchyma arranged in more or less regularly spaced tangential rows can be made out in this region. The segments of sclerenchyma as seen in transverse section appear two or three rows long (tangentially) and one or two rows wide. The phloem elements which occur between the former are of the usual type and without any other associated mechanical cells. The medullary rays radiating across the bast are narrow. The cambiform tissue of cambium is a narrow zone of three or more rows of tangentially elongate very narrow cells nearly five times as long as broad.

The wood consists of vessels of various sizes arranged in regular rows, xylem parenchyma, thick-walled fibrous elements, and the medullary rays. Comparatively wide but not very regularly arranged zones of thick-walled fibrous tissue alternate with zones of thin walled parenchyma. The medullary rays are two to four seriate. In transverse sections the radial and tangential walls of their cells are thick and pitted in the xylem part but thinwalled and without pits in the portions outside the wood. There is no pith in the centre.

As in the case of Stereospermum tetragonum D.C., here also starch grains are not found in the cells of any of the parenchymatous tissues. The essential difference between the bark of this species and that of Stereospermum tetragonum is the presence in the peripheral regions of the bark in the latter of a very large number of scattered groups of regularly arranged small sized stone cells. Other mechanical elements such as sclerenchyma are also only poorly developed in the bark of this species.

Distinguishing features of the root and the root bark.

A. Morphological

- 1. The roots are greyish to greyish brown, cylindrical, woody, hard and heavy, with the surface shallowly fissured, but not exfoliating, and devoid of prominent warty lenticells.
- 2. The rind has an outer thicker easily friable corky portion and a thin membraneous but tough papery inner part.
- 3. In fresh barks the officinal part is soft, juicy and whitish but turns dull brown on exposure. Its inner part is tangentially lamellate.

4. The wood is light brown, and presents a finely concentrically lamellated structure.

B. Anatomical.

- 1. The cork zone is narrow and consists of twenty to forty rows of thin-walled cells.
- 2. The cortex and bast are wide zones composed of several rows of thin-walled cells. Short segments of sclerenchyma composed of very few cells arranged in tangential rows are found in the inner portions of the bark.
- 3. Wood shows zones of concentrically arranged fibrous tissue alternating with thin-walled parenchyma.
 - 4. There is no pith in the centre.
- 5. The complete absence of storage starch in any of the parenchymatous tissues is also a noteworthy feature.

C. Taste and odour.

The root bark is bitter and slightly mucilaginous. It has no special odour.

KĀSMARĪ (काइमरी)

Gmelina arborea Roxb.* belonging to Verbenaceae.

Descriptive Synonyms

गम्भारी भद्रपर्णी च श्रीपर्णी मधुपणिका । काश्मीरी काश्मरी हीरा काश्मर्थ: पीतरोहिणी ॥ कृष्णवृन्ता मधुरसा महाक्स्मिकाऽपिच ।

(भावप्रकाशः)

"Gambhārī bhadraparņī ca śrīparņī madhuparņikā Kāśmārī kāśmarī hīrā kāśmaryaḥ pītarohiņī Kṛṣṇavṛntā madhurasā mahākusumikāpi ca"

(Bhāva-Prakāśa)

Additional terms found in Sāligrāma-ņighaņţu and Rāja-nighaņţu are.

'Sarvatobhadrā', 'Gopabhadrika', 'Kumudā', 'Sadābhadrā', 'Kṛṣṇaphalā', 'Snigdhaparṇī', 'Kṣīriṇī', 'Sthūlatvacā', 'Sudṛdhatvacā' and 'Pītaphalā.'

'Pītarohiṇī'=Yellowish-red (may denote the colour of the flower), 'Kāsmaryaḥ-(habitat?). 'Madhuparṇika' = sweet leaf?, 'Gāmbhārī' or (Kambhārī) = varie-gated or wooly?, 'Kṛṣṇavṛntā' = darkish petiole or pedicel?, 'Kṣīriṇī—milky exudate(?), Sthūlatvacā' thick bark.

Properties and Uses.

"काश्मरी तुवरा तिक्ता वीर्योष्णा मधुरा गुरु ॥ दीपनी पाचनी मेध्या भेदिनी अमशोषजित् । दोषतृष्णाऽमशूलार्शो विषदाहज्वरापहा"॥

(भावप्रकाशः)

"Kāśmarī tuvarā tiktā vīryoṣṇā madhurā guruḥ Dīpanī pācanī medhyā bhedinī bhramaśoṣajit Doṣatṛṣṇāmaśūlārśo viṣadāhajvarāpahā"

(Bhāva-Prakāśa)

'Kāśmarī' is 'tuvarā'-astringent, 'tiktā'-bitter, 'vīryoṣṇa'-pungent (destructive?) in action, 'madhurā'-sweet, and 'guruḥ'-(heavy?). It promotes digestive power, is digestive, improves retentive faculty (memory), is laxative, overcomes giddiness, and is also useful in emaciation (consumption), vitiation of the 'doṣās', thirst, colic pain due to indigestion, piles(?) poison, burning sensation and fever.

Attributes mentioned in other texts

श्रीपणीं मारुतद्दलेष्मशोफमेह कुमीञ्चयेत् । (शालीग्रामनिघण्टु)
"Srīparņī mārutaśļeṣmaśophamehakṛmiñ jayet" (Sāligrāma-nighaṇṭu)

काश्मरी कट्कातिक्ता स्वाब्धुष्णा तुवरा गुरु: ।
मधुरादीपनीमेध्या पाचनी भेदिकामता ॥
ह्या तुषामश्र छहनी कफशोफ त्रिदीषहा ।

^{*} Gmelina asiatica Linn locally known as Kumil or Kumiz is occasionally used as a substitute.

विषदाहज्वररक्तदोषार्शोभ्रमनाशिनी ॥ शोषनाशकरी प्रोक्ता.....

(निघण्ट्ररत्नाकर:)

"Kāśmarī kaṭukā tiktā svādvyuṣṇā tuvarā guruḥ madhurā dīpanī medhyā pācanī bhedikā matā hṛdyā tṛṣāmaśūlaghnī kaphaśophatriḍoṣahā viṣadāhajvararaktadoṣārsobhramanāśinī śoṣanāśakarī proktā......"

(Nighanţu-ratnākara)

According to the above slokas, other attributes of 'Sriparņi' are that it is pungent, sweet and agreeable, overcomes oedema, urinary disorders (polyuria etc.) and worms, and is useful in blood disorders.

Properties of the fruit

तत्फलं बृंहणं वृष्यं गुरुकेश्यं रसायनम् ॥ वातिपत्ततृषारक्तक्षयमूत्रविबन्धहृत् ॥ स्वादुपाके हिमं स्निग्धं तुवराम्लं विद्युद्धिकृत् ॥ हन्यादाहतृषावातरक्तिपत्तक्षतक्षयात् ॥

(भावप्रकाश:)

"Tatphalam bṛmhaṇam vṛṣyam guru keśyam rasāyanam vātapittatṛṣāraktakṣayamūtravibandhanut svādu pāke himam snighdam tuvarāmļam viśuddhikṛt hanyād dāhatṛṣāvātaraktapittakṣatakṣayān" (Bhāva-Prakāśa)

गाम्भारिका फलं ग्राहि स तिक्तमधुरं गुरु । केश्यं रसायनं मेघ्यं शीतलं दाहिपत्तजित् ॥

(राजवल्लभनिघण्टु:)

"Gāmbhārikāphalam grāhi satiktamadhuram guru kesyam rasāyanam medhyam sītaļam dāhapittajit"

(Rāja-vallabha-nighaṇṭu)

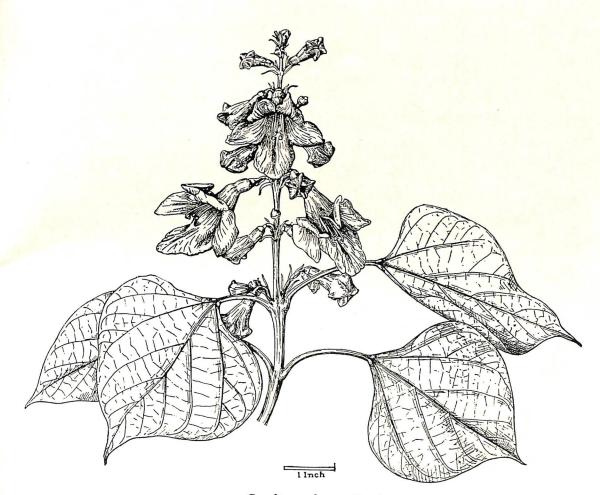
......फलं वृष्यं गुरुस्मृतम् ।
धातुवृद्धिकरं केश्यं स्वादुशीतं रसायनम् ॥
स्निग्यं बुद्धिप्रदंचाम्लं तुवरं मूत्रलंगुरु ।
मूत्रकृच्छ्रं रक्तिपत्तं रक्तदोषामवातकम् ॥
तृषां दाहं क्षयं वातं रक्तिपत्तंक्षतक्षयं
प्रदरं नाशयत्येव....

(राजनिघण्टु:)

dhātuvṛddhikaraṃ keśyaṃ svādu śītaṃ rasāyanaṃ snigdham buddhipradam cāmļaṃ tuvaraṃ mūtralaṃ guru mūtrakṛchraṃ raktapittaṃ raktadoṣāmavātakaṃ tṛṣāṃ dāhaṃ kṣayaṃ vātaṃ raktapittaṃ kṣatakṣayam pradaraṃ nāśayatyeva......"

(Raja-nighaṇṭu)

The fruit produces corpulency, promotes sexual power, is 'guru' (heavy?), good for hair, is tonic, overcomes 'vata', 'pitta', thirst, loss of blood and obstruction of urine. It is sweet on digestion, 'cooling', demulcent astringent, sour, cleansing, and overcomes burning thirst, vātarakta, 'pitta' and pleural and lung conditions. It is antilaxative, sweet and bitter, improves retentive faculty (memory), is diuretic and useful in difficult urination, vitiation of blood, rheumatism and discharge from the female genitals.



Gmelina arborea Roxb.

Gmelina arborea Roxb.

Family—Verbenaceae

Malayālam ... Kumbil; Kumpil.

Tamil ... Kumpil; Perungumpil.

Hindi ... Gumari; Gumbhar.

Distribution and habitat

Found wild throughout India from the foot of the Himalayas to Kerala, in moist, semi-deciduous and open forests, from low levels to about 1500 meters. "Sporadic but not abundant anywhere" says Gamble. It is also often planted in avenues and gardens

Habit and general features

Gmelina arborea Roxb. is a medium sized to rarely large, unarmed dense foliaged deciduous tree, reaching a height of forty to sixty feet-the size depending on its habitat and locality-with a usually straight trunk attaining a girth of seven to ten feet, covered with smooth corky greyishwhite bark, and numerous spreading branches, bearing, long-petioled, opposite, large ovate-cordate leaves and panicles of fairly large handsome, yellowish brown flowers. The branchlets as well as other young parts are densely clothed with fine white tomentum. Flowering time-usually the hot season-March, April and May, the flowers appearing along with or more often just prior to the formation of fresh foliage.

External morphology

Leaves: simple, opposite, long-petioled, four to nine inches or more in length and three to six inches broad, entire, broadly ovate-cordate, shortly cuneate or truncate at base with three to five basal nerves and two to four conspicuous shiny glands near insertion of petiole. The mature leaves are glabrous and green above, but often covered with very soft greyish white fulvous stellate tomentum beneath. Petiole—two to four inches or more long, nearly cylindrical slightly grooved on upper side, puberulous and glandular at top. The leaves are shed in February to April and the plant puts forth fresh foliage during April-May.

The inflorescence is a many flowered, terminal, or rarely axillary raceme like cymose panicle, about a foot long with its secondary branches decussate and the ultimate branchlets ending in three flowered cymules.

Flowers: fairly large, opposite, drooping, sulphur yellow tinged with brown or reddishbrown outside and subtended by linear lanceolate deciduous bracts. Flower buds are clavate angular. Calyx persistent, about one fifth of an inch long, densely fulvous tomentose, broadly campanulate with very small triangular teeth or sometimes subentire. Corolla-gamopetalous, about one and a quarter inch long, zygomorphic, obliquely campanulate, hairy yellowish brown outside and orange pink within; tube slender below, ventricose upwards; limb oblique, five or rarely four lobed with the lobes curled back. Upper lip three eighths to half inch long, deeply divided into two oblong obtuse lobes, lower lip about

twice as long, three lobed and protruding, with the lateral lobes obovate or rounded, and the middle lobe much longer with a crenulate margin. Stamens four didynamous included, filaments inserted below the throat, those of the longer pair considerably incurved; anther cells oblong, pendulous, bifid, or slightly separate, attached to the filament by a small point. Ovary round, four chambered with one ovule in each chamber attached to its top inner angle; style slender, as long as the filament; stigma bifid, one of the lobes much longer and recurved.

Fruit: An ovoid, or oblong, or pyriform succulent one to two seeded drupe, three quarters to one inch long, yellow or orange yellow when ripe, with a smooth shining leathery pericarp, pulpy mesocarp, and hard bony endocarp. The fleshy part of the fruit is bittersweet and mucilaginous in taste. Seeds, ovoid oblong, with thin testa, non-endospermic; cotyledons-fleshy.

Wood: greyish white glossy smooth evengrained light and strong.

Officinal part

The root bark and fruits are used in medicine. (In Kerala the entire root is often used).

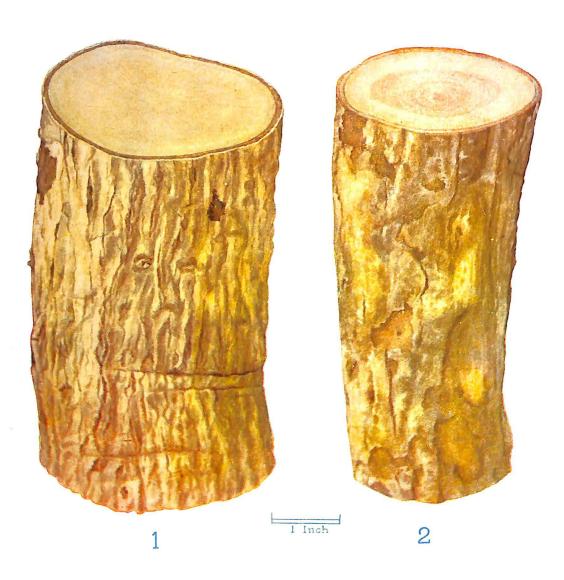
Description of roots.

The roots are strong woody and cylindrical. The diameter of the cut bits exhibited for sale varies from half an inch to nearly one foot. In the case of the smaller roots the surface is greyish white to greyish brown, fairly smooth, though uneven and sparsely lenticellate. In the thicker roots on account of the development of more lenticels in longitudinal series and consequent formation of shallow cracks or fissures and exfoliation of the outer skin, the surface appears somewhat rough. The lenticels vary in length from a quarter to half inch and have narrow vertical openings. At first these are few, but their number gradually increases so that in bigger and older roots the surface appears longitudinally fissured along the lines of development of these lenticels.

Root bark: The entire bark in the fresh condition is comparatively thick (sthūlatvaca) ranging from about a quarter to half an inch or more according to the diameter of the root and easily separable from the wood. The rind or outer bark is dull greyishwhite or greyish brown and nearly half a millimeter thick. It is slightly hard, brittle or crustaceous, and devoid of any characteristic taste or smell. In fresh roots it is easily separated from the inner living bark and has a lighter or cream yellow coloured inner surface provided with numerous blunt papillae. The middle and inner barks together—the officinal part—form the bulk tissue. In fresh roots this part is fairly thick, soft, juicy, non-fibrous and easily cut. The part nearest the wood appears faintly tangentially striated. On exposure or drying the cut surface gradually turns cream yellow and then dull brown. The official part of the bark has a mucilaginous sweetish taste at first but later on it turns slightly bitter. In dry roots the surface colour is the same, but the rind though still brittle is found to adhere more closely. The entire bark is somewhat gritty, sweetish, usually devoid of any bitterness and faintly aromatic.

The wood is comparatively light, sparsely porous, even grained, and faintly aromatic. Its peripheral part (portion nearest the bark as seen in transverse section) turns light greenish





1. Gmelina arborea root.

2. Gmelina asiatica root.

yellow on exposure, but this colour disappears soon, so that in roots kept dry, after a few days the wood shows a more uniform colouration. Heart wood and pith are not evident.

Histology of the root bark

The cork tissue or phellem consists of twentyfive to forty slightly wavy rows of thin walled rectangular cells. These appear narrow and vertically elongate in longitudinal section.

The cortex is a comparatively narrow zone in the older and thicker barks. It consists of twenty to forty rows of thin walled compactly arranged cells of various sizes and shapes, most of which are polyhedral, while others are oblong or spherical. The cells are richly stored with aggregates of small sized starch grains. Many of the cells of the peripheral rows often contain conspicuous large sized spherical or globular bodies. The presence of these within the cells is a noteworthy feature here. Sparsely scattered throughout the ground tissue are oblong or spherical groups of cubical or rectangular or polygonal stone cells with thick pitted walls. Each group of sclereids consists of three to ten or more cells either way. Extending almost to the periphery of the cortex are the terminal portions of a number of medullary rays of nearly uniform width most of which are three to four seriate. Their cells are thin walled, rectangular, and packed with aggregates of small sized starch grains. The hast forms the widest part of the bark and shows several rows of regularly arranged thin walled cubical to rectangular parenchymatous cells as well as fairly large sized sieve tubes and companion cells. The parenchyma cells contain aggregates of minute starch grains each group composed of two to five particles. The separated particles have two or more flat faces and one convex face. The sieve tubes are clearly made out (as large sized structures) in the recently formed bast, but those in the older parts are found in a compressed and collapsed condition. Such disorganised groups of cells appear as irregular narrowly reticulated or lammellated tangential hyaline strips or patches with a silvery white lustre. These almost regularly alternate with broader zones of more regularly arranged thin walled cubical to rectangular parenchymatous cells. Mechanical elements such as fibres are not usually found in the bast. The meduallary rays are broad and three to five or more seriate Their cells are rectangular, mostly radially elongate (except those at the margins which are broader and cubical) and loaded with starch grains. The cambium together with the newly formed rows of cells appears as a narrow but distinct strip of annular tissue composed of five to ten rows of narrow rectangular tangentially elongate cells.

The wood is composed of vessels of various calibre, thick walled parenchyma, a large proportion of fibres and several narrow medullary rays. The vessels are mostly of wide lumen though of various sizes. Those situated towards the centre are arranged in a scattered manner, whereas those situated towards the outside appear in groups, each group composed of a few large vessels and some narrow ones. The walls of the vessels are thick and profusely pitted. The xylem parenchyma cells are of various sizes and are mostly found adjacent to the vessels. They appear polygonal in transverse section and vertically elongate—3 to 5 times as long as broad—in longitudinal sections. They have thick pitted walls and are loaded with aggregate starch grains. The fibres are elongate, narrow and thick walled. The medullary rays of the wood are continuous with those of the bast but comparatively narrower being mostly uni-seriate or bi-seriate with occasional five or more seriate rays. The cells have thick pitted walls and are normally devoid of inclusions.

Diagnostic features.

A. Morphological.

- 1. The roots are light grey to greyish brown nearly cylindrical, and woody but not heavy. In the case of the older roots the surface is lenticellate and shows shallow longitudinal cracks. The entire bark is comparatively thick.
- 2. The rind or outer bark is slightly thick, compact and somewhat brittle. In fresh roots it is easily separated in small pieces from the rest of the bark.
- 3. The middle and inner bark in the fresh roots is whitish, juicy and non-fibrous. On drying the colour turns greyish and then dull brown.
 - 4. The wood is light, even-grained and porous.

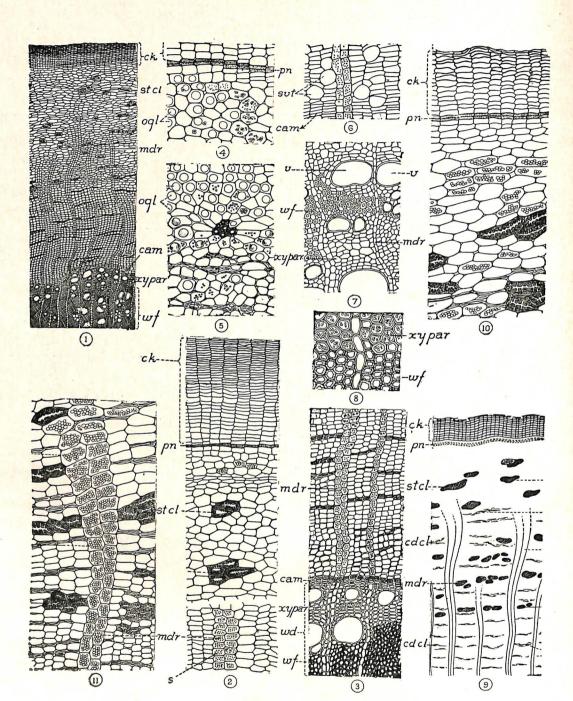
B. Anatomical.

- 1. The transverse section of the root is circular to oblong and the outline irregular.
- 2. The cork zone consists of several rows of thin walled rectangular cells without contents.
- 3. The middle bark is composed of thin walled oblong cells of various sizes most of which contain aggregate starch grains. A noteworthy feature is the presence of large sized globular bodies in several cells of the peripheral rows. A limited number of regularly arranged few celled groups of stone cells are also found in this region.
- 4. The bast proper is fairly wide. The parenchymatous elements are regular, stored with starch, and form broad bands in which can be made out more or less regularly spaced tangential strips of collapsed elements. Fibrous mechanical elements are not found in this region.
- 5. Wood appears porous, and consists principally of thick walled fibres, vessels of different sizes, a small quantity of xylem parenchyma and the medullary rays. The xylem parenchyma cells contain starch.
- 6. The medullary rays are two to four seriate. Their cells are thin walled and packed with starch grains in the phloem, but have thick pitted walls and appear without contents in the xylem

C. Taste and odour.

The officinal part of the bark has a mucilaginous sweetish initial taste, which later on turns bitter.

Marie Day		
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Histology of Gmelina arborea and G. asiatica roots.

Histology of Gmelina arborea and G. asiatica roots.

A. Gmelina arborea.

- Fig. 1. T. S. of a radial segment of the bark and adjoining wood tissue from a young root (Semi-diagramatic.)
- ,, 2 & 3. Structure of bark and portion of wood from old root.
- ,, 4 & 5. Details of cork, phellogen and cortex.
 - 6. Structure of recently formed phloem.
- "7 & 8. Details of wood portion.

B. Gmelina asiatica.

- Fig. 9. Diagram of T. S. of a radial segment of the root bark showing disposition of tissues.
- , 10. Cork, phellogen, and cortex.
- 11. Structure of bast.

Gmelina asiatica Linn.*

Family—Verbenaceae

Malayāļam ... Kumiz, Nilakumiz
Tamil ... Nilakumiz, Nilakummil

Hindi Badhara (?)

Distribution and habitat.

Distributed chiefly in South India, in the districts of E. Deccan, Circars, Carnatic, Coromandel and Kerala. It is a common plant of poor or barren ground and uncultivated places of the coastal regions and of the scrub jungles inland. Being thorny and capable of growing on poor soil, it is often cultivated as a hedge plant in such localities.

Habit and general features

Gmelina asiatica Linn. is a large sized, thin foliaged, ramous spinescent shrub or rarely a small tree, with a short crooked trunk (at times even without a distinct trunk) and many irregular puberulous or slightly hairy branches bearing small simple opposite leaves which appear in fascicles in the older branches, and panicles of large yellow flowers. A good number of the branches very often turn abortive and persist as strong leaf-bearing divaricate spines.

External morphology.

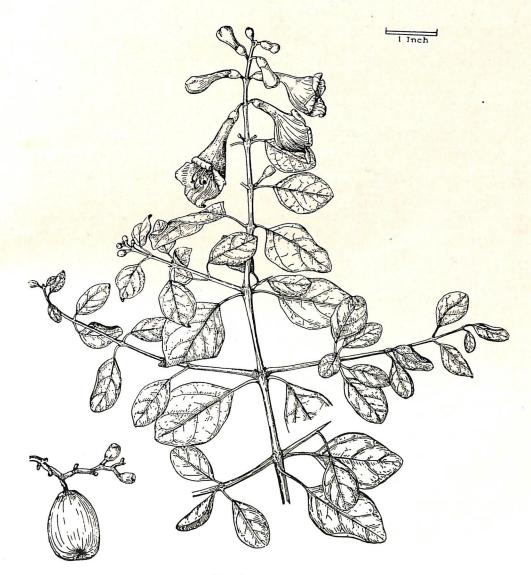
Leaves: simple, opposite or subopposite, short petiolate usually small, half to one and a half inches long and one third to one inch broad, ovate or obovate, entire or irregularly lobed, often narrowed towards the base, obtuse at apex, coriaceous, greyish green and finely pubescent when young. The mature leaves are glabrous above and glabrescent beneath. Petiole-about a quarter inch in length.

Flowers: fairly large, yellow, opposite and drooping. They are similar to those of Gmelina arborea and are arranged in narrow racemiform, densely pubescent terminal panicles subtended by lanceolate, concave caducous bracts. Calyx—cup shaped, less than one inch long, four toothed or sometimes truncate, pubescent and clothed with flattened round glands. Corolla gamopetalous irregular (two lipped), bright yellow, finely pubescent outside, one and a half inches long; tube curved, narrowed below and much inflated upwards; limb oblique, five of four lobed; lobes ovate, sub acute, the lower one the longest. Stamens four, didynamous, epipetalous; anther cells oblong, pendulous, slightly separate. Ovary superior, four chambered and four ovuled, with simple style; stigma two parted, the lower about four times longer than the upper and revolute.

Fruit: An ovoid or obovoid four chambered (when young) one to two seeded drupe, three quarters to one inch long, about three fourths as broad and yellowish when ripe.

Officinal parts.

The root bark and (in Kerala) also wood of root.



Gmelina asiatica Linn.

^{*} Gmelina asiatica is occasionally used as a substitute for G. arborea. At times both are used together.

Description of root

The roots are woody but not very stout, and light grey to dark greyish brown, according to the age of the root. The entire root bark is comparatively very thin.

In the small sized or younger roots less than an inch in diameter the surface is light greyish brown, fairly smooth or very faintly longitudinally furrowed and with a few scattered transversely extended oblong lenticels nearly a quarter inch in length. The entire bark is only about 1/12th to 1/8th of an inch thick, (much thinner than in G. arborea). It is easily separable from the wood in the fresh condition and has a fibrous texture. The outer bark or rind is thin soft corky and easily scrapable but not peelable.

In older and stouter roots, the rind is harder, more compact, proportionately thicker, comprising nearly a third of the thickness of the entire bark—and often exfoliates in thin hard woody flakes of various sizes and shapes leaving smooth shallow irregular depressions covered with a thin soft corky light grey skin. At other places the original bark with its darker grey or brown colour persists and on account of these and the presence of a few faint longitudinal cracks, the surface appears uneven and not quite smooth. The officinal part of the bark is proportionately thin. In fresh roots it appears homogeneous and has a whitish to cream yellow colour, but on exposure the colour turns brown or dull rusty brown especially near the periphery. Wherever the rind has been removed and the living tissue exposed the change of colour is noted.

The fresh bark tastes sweetish at first but later on bitter and has a faint aroma. Those from smaller roots are usually more sweet and less bitter and in them the sweetness persists for some time. In those from older roots however the bitterness predominates. They also possess a faint aromatic odour.

Histology of the root bark.

The cork is a thin zone of ten to fifteen rows of tangentially elongate rectangular cells without contents. The cell walls of the outer rows are dark brown and slightly thick whereas those of the more recently formed ones are thinner and light brown. Phellogen is a single or double row of narrow thin-walled cells. The region immediately within the phellogen especially in young roots is a broad zone comprising nearly half the thickness of the entire officinal bark and composed of several rows of thin walled tangentially elongate oblong cells with small intercellular spaces and stored with starch. Scattered amidst this tissue are several groups of large sized stone cells of various shapes with thick pitted walls. Each group consists of one to fifteen or more cells. The cells are cubical, polygonal, oblong, elliptic or rarely even elongate. The presence, as well as the shape and size of these groups of stone cells in the periphery of the bark is a noteworthy feature. In addition the widened terminal portions of a number of medullary rays with their cells loaded with starch, can also be made out. This region merges imperceptably into the bast which is next within. In barks from young roots the primary bast can usually be made out as a distinct narrow zone. The bast in older barks constitutes a proportionately wide zone and the bulk of its tissue is made up of the more recently formed phloem elements. The phloem parenchyma cells are mostly isodiametric (nearly cubical), regularly arranged and form broad tangential segments or zones alternating with almost regularly spaced narrow strips of compressed collapsed bast cells. The medullary ray cells which cut up the bast into a number of radial segments are thin walled and fully packed with starch grains. The cambiform tissue is seen as a distinct layer composed of five or more rows of cells.

Wood. The wood is chiefly composed of very thick walled fibres or sclerenchyma, narrow vessels of various sizes arranged in radial rows, and a small quantity of parenchyma. Wide zones of sclerenchyma with only a limited number of small sized vessels alternate with narrower segments of thin walled xylem parenchyma wherein are located a larger number of comparatively bigger vessels. The medullary rays are many, two to three seriate and their cells are packed with starch.

Diagnostic features.

A. Morphological.

- 1. The roots are woody, cylindrical and greyish brown. In young roots the surface is fairly smooth.
- 2. The entire bark is comparatively thin. In old roots the rind is somewhat hard and often exfoliates in large slices.
- 3. The living bark in fresh roots is cream white, soft and juicy but the colour turns brown on exposure.

B. Anatomical.

- 1. The roots have a thin layer of cork composed of ten to fifteen rows of cells.
- 2. The middle bark is comparatively thick. Its cells contain starch. Several scattered groups of stone cells of various shapes are found in this region.
- 3. The inner bark is composed mainly of regularly arranged isodiametric cells, alternating with narrow irregular tangential strips of collapsed cells at frequent intervals.
 - 4. The bulk of the wood is composed of fibres.
- 5. The medullary rays are two to five seriate. Their cells are packed with starch grains.
 - 6. Pith absent:

C. Taste and odour.

The fresh bark has a sweetish initial taste but later on it becomes bitter. The bitterness persists and predominates in the older roots even after drying.

GOKŞURAḤ* (गोक्षुरः)

Tribulus terrestris Linn. belonging to Zygophyllaceae.

Descriptive Synonyms

गोक्षुर: क्षुरकोऽपि स्यात्त्रिकण्टः स्वादुकण्टकः। गोकण्टको गोक्षुरको वनश्रुङ्गाट इत्यपि ॥ पलञ्जूषा श्वदंष्ट्राच तथा स्यादिक्ष्मान्धका।

"Gokşurah kşurako f pi syāt trikantah svādukantakah gokantakogokşurako vanasrngāta ityapi palankasā śvadamstrā ca tathā syādiksugandhika"

'Goksurah', 'goksurakaḥ', and 'kṣurakaḥ', meaning hurting (the cow) as well as the terms 'trikaṇṭaḥ', 'svādukaṇṭakḥ', 'gokaṇṭakaḥ', 'śvadamṣṭrā' indicate the armed or spiny nature of the fruit. 'Vanaśṛṅgāṭa' = wild 'śṛṅgātaka'—denotes resemblance to śrṅgataka—Trapa bispinosa—whose fruits are similarly armed with spines. 'Palaṅkaṣā' = injuring the flesh-also indicates the presence of sharp thorns. 'Ikṣugandhikā' = smelling like sugarcane.

Properties and Uses:

गोक्षुर: शीतल: स्वादुर्बल कृद्वस्तिशोधन: ॥
मधुरोदीपनोवृष्य: पृष्टिदश्चाइमरीहर: ।
प्रमेहश्वासकासार्श: कुच्छृहृद्दोगवातनुत् ॥ (भावप्रकाश:)

"Gokşurah sitalah svādur balakrd vastisodhanah madhuro dipano vrsyah puştidascāsmariharah pramehasvāsakāsārsahkrchra hrdrogavātanut"

(Bhāva-Prakāśa)

(Rāja-nighantu)

'Gokşuraḥ' is cooling, 'svādu', gives strength, purifies bladder (diuretic action), promotes digestive power, is aphrodisiac, nutrient, and is useful in renal calculus, urinary disorders, difficult breathing, cough, piles, difficult micturition, 'hrdroga' and 'vāta'.

Attributes mentioned in other texts

स्यातामुभौगोक्षुरकौ सुशीतलौ बलप्रदो तोमधुरौ च वृंहणो । कृच्छा३मरीमेहविदाहनाशनौ रसायनौ तत्रबृहद्गूणोत्तर: ॥ (राजनिघण्टु:)

"Syātām ubhaugokṣurakau suśītaļau balapradau tau madhurau ca bṛmhaṇaukṛchrāśmarīmehavidāhanāśanau rasāyauau tatra bṛhatguṇottaraḥ"

^{*} Two varieties are seen mentioned in Saligrama-nighanţu, viz. the wild and the country. The former is described as more erect, having yellow or white flowers, and fruits with four thorns one at each conical portion; and the latter as more prostrate with yellow flowers and fruits, having three pairs of thorns one at each conical portion. The erect form with four spined fruit is evidently Pedalium murex considered by some as a large form of Gokşuraḥ and the prostrate form Tribulus terrestris proper.

गोक्षुरः शीतलोबल्यो मधुरो वृहणोमतः । वस्तिशुद्धिकरो वृष्यः पृष्टिकश्च रसायनः ॥ अग्निदोप्तिकरः स्वादुर्मूत्रकृच्छादमरीहरः । दाहमोहश्वासकास हद्रोगाशंविनाशनः ॥ वस्तिवातं त्रिदोषञ्च कृष्ठशूलं च नाशयेत् । (शालीग्रामनिषण्टुः)

"Gokşurah śītalo balyo madhuro bṛṃhaṇo mataḥ vastiśuddhikaro vṛṣyah pauṣṭikaś ca rasāyanaḥ agnidīptikarah svādur mūtrakṛchrāśmarīharaḥ dāhamohaśvāsakāsahṛdrogārśavināśanāḥ vastivātaṃ tridoṣam ca kuṣṭham śūlam ca nāśayet" (Sāligrāma-Nighaṇṭu)

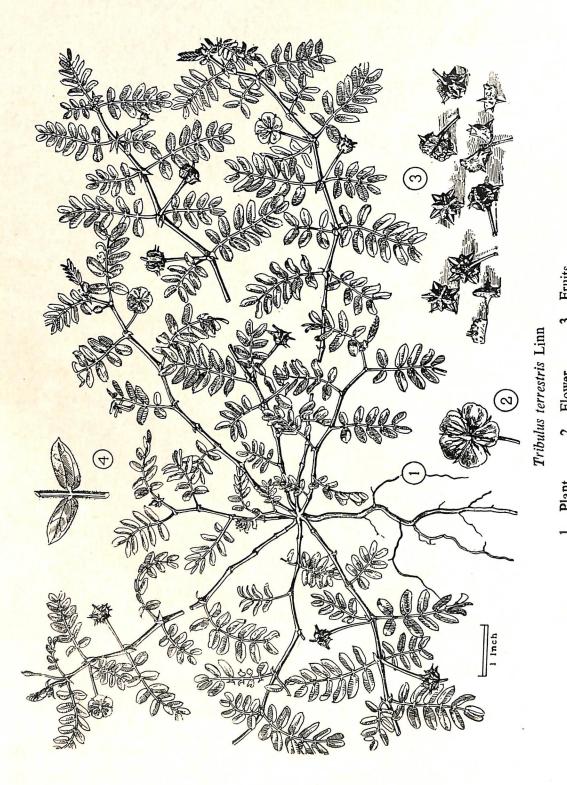
According to the above it produces corpulency, is a tonic, and overcomes excessive burning sensation, syncope; 'tridoşa'—skin diseases, and colicky pain.

Properties of the Fruit

बीजं गोक्षुरकं शीतं मूत्रलं शोधवारणम् । (आत्रेयसंहितः)

"Bijam gokşurakam sîtam mütraļam sophavāraņam" (Atreya-samhitā)

The fruit is cooling, diuretic, promotes sexual vigour and longevity, and is useful in oedema, spermatorrhea and difficult micturition.



Tribulus terrestris Linn.

Family—Zygophyllaceae

Malayalam

. Ñeriññil

Tamil

.. Nerunji, Siru nerinji

Hindi

Gokhru, Chottagokru

Distribution and habitat.

Distributed throughout India, ascending to 11,000 ft. in Western Tibet. The plant is a common weed of pasture land, roadsides and other waste places chiefly in hot dry or sandy localities.

Habit and general features.

White or rusty brown, prostrate herb with many slender spreading branches, one to two feet or more in length and about 0.05 inch in thickness, bearing unequal pairs of abruptly pinnate leaves and small solitary stalked yellowish flowers or spiny fruits at each ncde. The entire plant has a faint aroma and hence perhaps the name 'lkşu gandhika'. It is found in dower and fruit during the greater part of the year.

External morphology.

Leaves: opposite, abruptly pinnate, with persistent lanceolate acute stipules. Of the pair of leaves at a node one is most often considerably smaller or occasionally absent. The pair of leaves at a node one is most often considerably smaller or occasionally absent. Leaflets—three to six or more pairs, almost sessile or with short petiolules, 0.2 to 0.5 inch long, subequal, oblong, entire, rounded or oblique at base mucronate at apex and with a close pressed grey villous pubescence.

Flowers: pseudo-axillary or leaf opposed, solitary, regular, bisexual, bright yellow or rarely white, faintly scented, half to about three quarters of an inch across, on slender lairy stalks which are generally shorter than the leaves. Sepals five, free, about a quarter of an inch long, linear or lanceolate acute, imbricate, and deciduous. Petals five, free, spreading, about equalling the sepals or longer,—upto half inch in length,—rounded, shortly clawed, imbricate and fugaceous. A ten lobed annular eglandular disc is present outside the stamens. Stamens: ten, inserted at base of disc; filaments naked filiform free; those opposite the petals are longer and alternate with five shorter ones which have little glands outside. Ovary: sessile, hairy or bristly five or more lobed, usually five chambered, with one to five pendulous superposed ovules in each chamber: style short, pyramidal or filiform or scarcely recognisable; stigma five ribbed or of five to twelve stigmatic lobes.

Fruit: A five angled or winged, spinous tuberculate, hairy or glabrous woody schizocarp separating into five cocci. The entire fruit often resembles a ribbed spiny spherical ball. Each coccus is provided with two long, hard or stiff, sharp divaricate spines towards the distal half and two shorter ones nearer the base. Seeds one or more in each coccus, superposed with woody transverse partitions between. They are non-endospermic. Testa thin or membraneous.

Officinal parts.

The fruits and root are used in medicine; occasionally the entire plant is used.

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Description of fruit

Each fruit is a stalked greyish spiny tuberculate five ribbed or angled more or less spherical structure with the base and apex flattened, resembling a miniature pumpkin and covered with a matting of short stiff or somewhat pubescent hairs. It is about half an inch in diameter, one third of an inch in thickness, has five pairs of prominent, outwardly directed sharp stiff spines towards the top and five pairs of smaller shorter basal spines pointing downwards. Pedicel one half to three quarters of an inch long and articulated to the fruit at its top. In the mature fruit the tips of the adjacent longer divergent spines almost meet in pairs and cover one of the five turberculate projecting edges or angels, the whole together forming a regular actutely pentagonal structure or frame work around the fruit. Occasionally the smaller basal pairs are absent. The ripe fruit ultimately separates into five indehiscent segments or cocci each of which stimulates a single fruit or seed in form and appearance. Each coccus is a greyish or greyish yellow, semilunar or planoconvex structure wedgeshaped in transverse section, convex outside and narrow towards the centre. The fruit wall is very hard, woody and tuberculate, the tubercles or projections being more prominent and somewhat pyramidal on the outer face. It is also armed with a pair of prominent comparatively long, divaricate, upwardly and outwardly directed spines starting from about its middle and very often also with a pair of stiff smaller spines. Each coccus is one chambered and contains two to four or rarely more small seeds arranged one above the other with individual partitions or septa in between them. Seeds small, about one millimeter in length, non-endospermic and oily, with thin or membraneous testa.

From the supposed resemblance of each coccus to the cloven hoof of a cow, the name 'Gokşura' is given.

Taste and odour

The seeds have an astringent taste and an agreeable aroma.

Common substitutes and adulterants.

- 1. The fruits of *Pedalium murex* Linn are occasionally substituted being often considered as a larger form (Burra gokru).
- 2. The fruits of Acanthospermum hispidum DC. resemble the individual cocci of Tribulus and are frequently found mixed with the latter.

Description of root.

The roots are slender, cylindrical somewhat fibrous, four to six inches or more long, light brown in colour, and faintly aromatic. They have a sweetish astringent taste.

VILVA (विल्व)

Aegle marmelos Coir. belonging to Rutaceae.

Descriptive Synonyms

विल्वः शाण्डिल्यशेलुषो मालूरश्रीफलावि ।

(भावप्रकाशः)

"Vilvaḥ śāṇḍīlya śailūṣo mālūraśrīphalāyapi"

(Bhāva-Prakāśa)

Other terms mentioned in texts are: 'mahākapittha', "goharītakī", 'pūtivātaḥ', mangalyaḥ', 'atimangalya', and 'trisikha.'

'Mangalya' and 'atimangalya' mean very auspicious; 'śrīphala' derived from 'śrī'-goddess of abundance and 'phala'—fruit—may mean an emblem of increase and/or fertility, 'trisikha'=three branched, (the leaves are trifoliate) 'mahākapittha'=like Feronia; 'pūtivātaḥ' and 'pūtimārutaḥ' mean illsmelling or offensive (?).

Properties and Uses:

श्रोफलास्तुवरस्तिक्तो ग्राहोरूक्षोऽग्निपित्तकृत्। वातक्षेप्महरो बल्यो लघुक्ष्णश्च पाचनः॥

(भावप्रकाशः)

Śrīphalastuvarastikto grāhīrukṣognipittakṛt vātaśļeṣmaharo balyo laghuruṣṇaścapācanaḥ"

(Bhāva-Prakāśa)

"Śriphala' is astringent, bitter, antilaxative, dry, promotes digestive power, produces pitta' overcomes 'vāta' and 'śleṣma', promotes strength, is light, hot, and digestive.

वित्वस्तुमधुरोहृद्यः कषायोध्णो रुचिप्रदः। दीपनोग्राहकोरूक्षः पित्तलस्तिकतकः कटुः॥ गुरुः पाचनकर्त्ताचवातातीसारजूत्तिहा। विव्वमूलं तुमधुरं त्रिदोषच्छिद्द्यूलनुत्॥ लघु कुच्छृहरंवातकफपित्तस्यनाशकम्।

(निघण्ट्रत्नाकरः)

"Vilvastumadhuro hrdyah kaşāyoşno rucipradah dīpanogrāhako rūkṣah pittalastiktakah kaṭuh guruh pācanakartā ca vātātīsārajūrtihā vilvamūlamtu madhuram tridoṣacchardi sūlanut laghu krchraharam vātakaphapittasya nāśakam"

(Nighantu-ratnākara)

It is also sweet, agreeable or pleasant (for the heart?), pungent, cures diarrhoea (the 'vāta' type) and fever; and is useful in 'tridoṣa', vomitting, colicky pain, and difficult micturition.

Tender fruit

बालंबित्वफलंस्निग्धंगुरुरुच्यंच दीपनम् ॥ ग्राहकं पाचकं तिक्तं लघुचोष्णञ्चतुवरम् । शूलामवातग्रहणी कफातीसारनाशनम् ॥

(निषण्ट्रत्नाकरः)

"Bālam vilvaphalam snigdham guru rucyam ca dīpanam grāhakam pācakam tiktam laghucoşņam ca tūvaram sūlāmavātagrahaņī kaphātīsārnāsanam" (Nighaṇṭu-ratnākara)

The tender vilva fruit is demulcent, 'guruḥ' (heavy or difficult of digestion?) improves taste, promotes digestion, is antilaxative, digestive, bitter, 'laghu' (easily digestible) 'hot', astringent, and cures colicks, āmavāta (gout?) sprue and diarrhoea (kapha type).

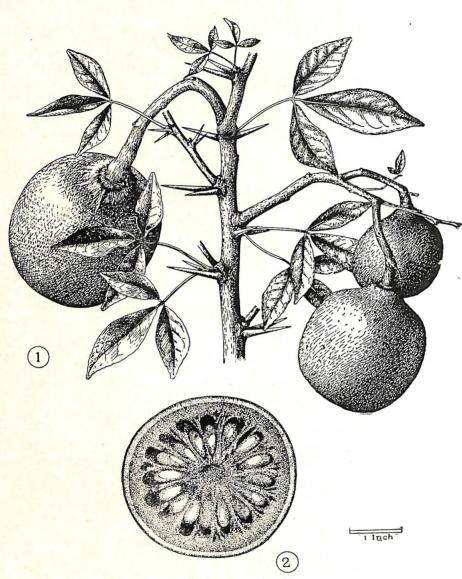
तरुणं तुफलंबिल्बंग्राहि तुवरमम्लकम् ॥ स्निग्धं च कटुतीक्ष्णञ्च उष्णं च लघुदीपनम् । पाचकं कफवाय्वोश्च नाशकं हृदयप्रियम् ॥ (शालिग्रामनिघ॰टूः)

"Taruṇam tu phalam vilvam grāhī tuvaramamļakam snigdham ca katutīkṣṇam ca uṣṇam ca laghu dīpanam pācakam kaphavāyvośca nāśakam hṛdayapṛiyam" (Sāligrāma-nighaṇṭu)

The young fruit is antilaxative, astringent, sour, demulcent, pungent, quick acting, 'hot' 'laghu' promotes digestion, is digestive, useful in 'kapha' and 'vāta' and 'Hrdaya-priyam' (pleasant or agreeable for the heart).

द्राक्षा विल्व शिवादीनां फल शुक्लं गुणाधिकम् ॥ (भावप्रकाशः)
"Drākṣā vilva śivādīnām phalam suklam guṇādhikam" (Bhāva-prakāsa)

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Aegle marmelos Coir.

1. Twig with fruits. 2. T. S. of fruit.

Aegle marmelos Coir.

Family-Rutaceae

Malayalam Tamil Hindi

Kūvalam, Vilvam Vilvam, Kūvalam Bel, Sriphal, Sirphal

Distribution and habitat.

Found throughout India - the Sub-Himalayan tract, Jhelum to Assam, Central India, Deccan, and in districts of the northern Circars, Carnatic, Coromandel, West Coast and Travancore. The plant is very hardy and mostly grows wild. It thrives well in mesophytic and dry habitats from sea level upto about 4,000 feet. It is often cultivated by the Hindus near places of worship and in private dwellings, being considered a sacred tree.

Habit and general features.

Aegle marmelos Coir. is a medium to fairly large sized semi-deciduous thorny tree attaining a height of thirty to forty feet, having only a limited number of branches that are generally irregular or crooked with the ultimate divisions or branchlets long tender and drooping and bearing alternate, trifoliate, gland dotted semisucculent glabrous leaves. The trunk and larger branches are covered with fairly thick grey or ash-grey, corky fissured bark, and armed with divergent pairs of strong woody straight sharp axillary spines.

The plant is propagated by seeds as well as by root cuttings that develop when the the roots are cut or injured.

External morpology.

Leaves: Alternate - often in apparent bunches in older portions-exstipulate, pinnately trifoliate, or rarely five-foliate with terete petioles one to two inches long; leaflets entire or minutley crenulate, glabrous rarely pubescent and slightly fleshy to sub-crustaceous. They are studded with minute translucent glands containing volatile oil. The terminal leaflet is long-petioluled, ovate, oblong,, or broad lanceolate, and unally much larger than the laterals being two to four inches long and one to two and a half inches broad. The lateral leaf lets are subsessile, small and ovate lanceolate. Pairs of persistent, straight, sharp divergent, woody spines upto about one and half inches in length of which one is nearly always slightly shorter, occur in the leaf axils.

Flowers: Fairly large, nearly one and a half inches in diameter, regular, bisexual or polygamous dull white or greyish-white, sweet scented and arranged in short axillary few flowered cymose panicles. Calyx: small, deciduous, with five or rarely four rounded or obscure lobes. Corolla: of five free long thick gland-dotted imbricate spreading petals that are considerably longer than the calyx. Stamens: thirty to fifty or more, inserted around an insignificant disc; filaments: short, subulate, free or rarely united at base in a few bundles, and bear elongate erect apiculate anthers. Ovary: superior, multilocular-eight to twenty chambered-with a thick prominent central axis, and containing many ovules arranged in two series attached to the inner angle of each chamber. Style short with a fusiform or capitate deciduous stigma.

Fruits: Sub-spherical to pear shaped, and fairly large, measuring two to five inches by two to three inches, with a thick hard woody, smooth or slighty tubercled rind, greyish-brown or yellowish-brown on ripening. They are eight to fifteen or more chambered, and each chamber contains ten or more seeds embedded in a copious mass of viscous, honey coloured, somewhat sweet, faintly aromatic very sticky or glutinous translucent pulp. Seeds non-endospermic about a quarter to one third of an inch long, oblong slightly compressed and with a hard finely hairy or wooly testa. Embryo with thick fleshy cotyledons.

Officinal parts.

The root bark, fruit, succus of leaves and flowers are used.

Description of root

The roots are strong, woody fairly large and often curved. Those generally exhibited or brought for sale consist mostly of cut lengths of the basal portions of the stouter lateral roots varying from one to four feet in length and half to one foot in thickness, or the entire stumpy underground basal part of the root-system of a single tree. Smaller or narrower roots are only rarely brought or found exhibited for sale, though in proportion to their weight they contain a greater quantity of the living bark (mūla tvak) which is indicated in texts as the officinal part. This is probably due to the fact that in many parts of Kerala the entire root or more often the wood alone of the larger roots almost completely devoid of the bark, is accepted as officinal.

The root bark is cream-yellow or greyish or yellowish-brown, firm or compact, leathery and slightly aromatic. The surface though profusely lenticellate, is not warty or very rough but comparatively soft. The surface skin is thin fairly tough, many layered, and peels off in thin small irregular pieces. Some difference is noted in the surface features, structure and texture of the bark and structure and appearance of the wood between the smaller roots and the more woody stouter mature roots.

Small roots upto about half an inch in diameter are yellowish-white to light-brown often with an additional light-purple or rose tint. In these the entire bark is nearly 0.05 to 0.1 inch thick. Their surface shows the formation of numerous lenticles in several close longitudinal series. The outer rind or surface skin is thin but tough enough to withstand peeling and is found slit here and there along the lines of development of the lenticles. The fresh or living bark that is exposed when the skin is removed is whitish or cream white, and often tinged with a green or yellowish-green tint. It shows a fairly homogenous structure and has a slightly leathery texture. The wood is light, porous and has a cream yellow colour. In transverse section the central part of the wood appears light yellowish and closely porous and the peripheral part lighter coloured or whitish and more diffusely porous.

Roots which are about one and a half to two inches in diameter have more or lesss the same light-yellowish white to yellowish brown colour, but are usually devoid of the rosy tinge. The entire bark is thicker (upto about 0.125 inch) and its surface profusely lenticellate.

The surface skin is thin and tough, somewhat corky and appears many layered. It is found fissured all over with a series of short vertical slits formed as a result of the bursting out of the lenticels. The free or cut edges of the slits in the outer skin are found curled outwards exposing a smooth yellowish or greyish yellow inner surface. These also reveal the many layered nature of the outer skin. In fresh roots the officinal part of the bark has a cream white colour which turns brown on exposure. It can be clearly differentiated into a somewhat starchy and pithy peripheral region and an inner fibrous portion. Wood is lighter coloured, mostly cream-yellow and shows a more homogeneous structure than in the younger roots.

The large sized woody roots are mostly pale yellowish brown and almost covered with longitudinal and transverse series of closely arranged prominent lenticles and their soft thick corky cream coloured flaring edges. On account of this the surface appears somewhat rough but not hard, and irregularly and shallowly ridged along the lines of development of the lenticels. The surface skin is found ruptured all over and peeling off in layers wherever these ridges have developed and adhering only in the narrow furrows or depressions between the ridges as thin small brownish strips. The predominance of the creamy white corky bordering tissues of the lenticels not only give a general lighter tone to the natural brown colour of the surface but also makes the surface soft and somewhat easily friable. In most roots exposed for sale, as a result of the rubbing cff of this soft and corky part of the rind during handling, the surface appears almost smooth and cream coloured dull-white and motted with short narrow brownish streaks. In these roots the thickness of the officinal bark is not at all in proportion to their diameter. In most cases it is only about an eighth of an inch in thickness. In transverse sections the thin rind appears as a light brown strip and the inner officinal part as a very light brown tissue differentiated into an outer zone-the middle bark-occupying about a third of the thickness of the entire bark and an inner regionthe inner bark- comprising nearly two thirds of the thickness. The latter appears concentrically lamellated due to narrow annular strips of hard tissue alternating with broader bands of softer tissue.) A large number of narrow medullary rays radiate across extending beyond the middle of the bark. The entire bark has a firm leathery texture and in fresh roots is bitter slightly pungent and faintly aromatic. The outer part of the bark viz. the region just within the rind is gritty. These features are found in dried material also though it is sometimes less aromatic.

The wood which forms the major part of the larger roots is cream white to cream yellow, hard, compact, and exhibits a fairly homgeneous structure. In transverse section it appears minutely diffuse porous and marked with close series of narrow concentric rings of dark tissue and numerous very fine radiating medullary rays. The wood is mildly fragrant and slightly sweetish.

Histology

The cork tissue consists of several rows of thick walled narrow rectangular cells, compressed to form a compact narrow zone. The rows of cells are not however similar. Single or double rows of narrow cells with thick bright yellow walls alternate with compressed zones of eight to ten or more rows of broader empty cells with thin brown walls. When the former is ruptured or exfoliates the compressed rows as a result of their release from pressure spread out fanwise. Some of the newly formed cells of cork contain cubical or polyhedral crystals. A cork cambium is evident below the cork.

The secondary cortex is a wide zone of several rows of cells. The cells are fairly big, thin-walled and of various shapes being spherical, oblong, or even tangentially elongate. Almost all of them are partially or completely packed with spherical starch grains of various sizes. Scattered in the peripheral portions of this region the following are made out:-

- (i) A number of large sized, thinwalled cells, with granular contents or appearing empty.
 - (ii) Secretory cavities with yellowish white contents.
- (iii) Groups of considerably big sized cubical to rectangular stone cells. These are distributed throughout the cortex and the size form and arrangement of these sclereids constitute a characteristic feature. The number of stone cells constituting each group varies from few to many. Large sized solitary sclereids also occasionally occur.
 - (iv) Small short segments of sclerenchyma arranged in irregular concentric rows. and
- (v) The flexuose terminaal portions of medullary rays which appear as one or two seriate wavy ribbons of short length often traversing radially across the cortex.

The bast is a considerably broad region consisting of concentrically arranged zones of phloem proper alternating with narrow strips of sclerenchyma. The medullary rays cut up both the cortex and bast into several tangential segments. The early formed phloem elements which are situated towards the periphery are found in a collapsed compressed and partially deranged condition. The more recently formed phloem elements show more regular arrangement. They are thinwalled and in transverse section appear mostly isodiametric though of various sizes. The segments of sclerenchyma in the peripheral portions of the bark appear as short narrow strips widely separated from each other and not regularly spaced or arranged, wheras those nearer the wood in the more recently formed bast appear as regular concentric bands composed of tangential segments of uniform length separated by the medullary rays. A distinct ring of cambium is present outside the wood.

Wood: shows concentric zones of fairly broad fibrous woody tissue alternating with very narrow strips of one or more rows of thinwalled parenchyma. The vessels have thick pitted walls and are surrounded by thick walled parenchyma.

There is no pith in the centre.

Medullary rays. Many in number. They are mostly uniseriate or rarely biseriate. Their passage in the wood and portion of the phloem or bast nearest the wood is straight and radial but as they near the periphery they appear broader and flexuose. The cells of the medullary rays are rectangular and radially extended in the wood and the newly formed bast, but the cells in the distal part are broader and tangentially extended. They have thick pitted walls in the xylem part but the walls are thin in the bast region. Almost all the cells are loaded with starch grains.

Distinguishing features of the roots.

A. Morphological

1. The roots are light pinkish-grey to greyish-brown, cylindrical, with the surface profusely and prominently lenticellate. The lenticels are fairly large and are arraged closely



Aegle marmelos

1. A mature root.

2. Branch root.

along longitudinal and transverse ridges and have thick soft triable, corky, cream-white to hight-yellow flaring edges.

- 2. Skin or outer rind is thin fairly tough and exfoliating. It is brownish outside and lighter coloured within. In older roots it is found only as small narrow strips adhering to depressions between the ridges.
- 3. In fresh roots the living bark is whitish but on exposure or drying turns greyish-brown. It has a firm tough texture and can be differentiated into a narrow whitish starchy granular peripheral portion and a bulkier tangentially lamellated fibrous inner region.
- 4. The wood is hard. It has a light cream-yellow colour and a fairly homogenous close grained minutely porous structure.

B. Microscopical.

- 1. The transverse section is circular, oval or oblong.
- 2. The cork tissue consists of zones of single or double row of yellowish thick walled cells, alternating with broader zones of ten or more rows of thin walled brownish cells.
- 3. Cortex consists of several rows of thin walled oblong cells most of which contain starch grains. In addition it also shows one to few celled groups of large stone cells, a large number of remarkably large thin walled empty cells, a number of secretory cavities and short flexuose segments of the terminal portions of medullary rays.
- 4. Bast is broad and shows broad bands of phloem proper alternating with narrow tangential segments of sclerenchyma. Secretory cavities occur here also.
- bands of thin walled parenchyma and vessels of various sizes. The medullary rays are narrow and mostly one or two seriate. Their cells are rectangular and thin walled in the phloem part but have thick pitted walls in the xylem. They are radially straight in the wood and in portions of the bast nearer the wood, but appear wavy or flexuose towards their distal ends. All the cells are packed with starch grains.

There is no pith in the centre.

C. Taste and odour.

The root bark is gritty, bitter and warm or slightly pungent.

Description of Vilva fruit.

The ripe fruits are woody large, two to four inches long and two to three inches wide, spherical, oblong or pear shaped with a more or less smooth or slightly tuberculate surface. They are borne on strong woody stalks which leave a conspicuous radially ridged depression at the base of the fruits on getting separated. Young fruits are greenish but ripe ones are greyish or dull yellowish brown. The rind is hard woody and thin, about one eight of an inch thick and has a dull white colour in transeverse section. The peripheral part of the

along longitudinal and transverse ridges and have thick soft friable, corky, cream-white to light-yellow flaring edges.

- 2. Skin or outer rind is thin fairly tough and exfoliating. It is brownish outside and lighter coloured within. In older roots it is found only as small narrow strips adhering to depressions between the ridges.
- 3. In fresh roots the living bark is whitish but on exposure or drying turns greyish-brown. It has a firm tough texture and can be differentiated into a narrow whitish starchy granular peripheral portion and a bulkier tangentially lamellated fibrous inner region.
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- 4. Bast is broad and shows broad bands of phloem proper alternating with narrow tangential segments of sclerenchyma. Secretory cavities occur here also.
- 5. Wood consists of broad bands of thick walled fibrous cells alternating with narrow bands of thin walled parenchyma and vessels of various sizes. The medullary rays are part but have thick pitted walls in the xylem. They are radially straight in the wood in portions of the bast nearer the wood but appear wavy or flexuose towards their distal ends. All the cells are packed with starch grains.

There is no pith in the centre.

C. Taste and odour.

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Description of Vilva fruit.

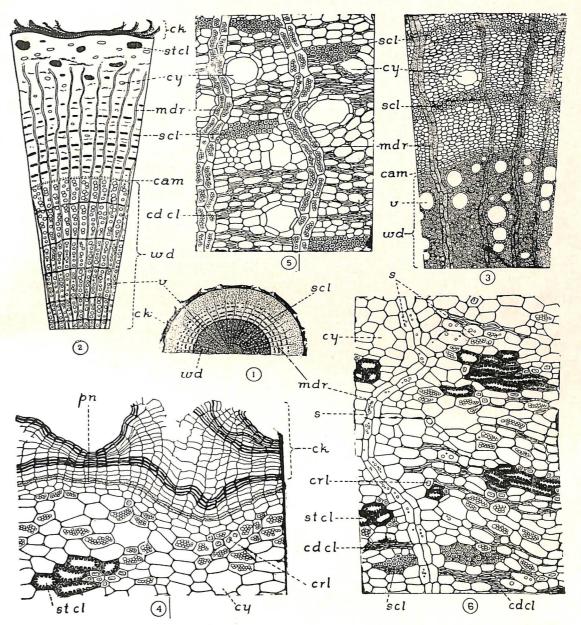
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fruit just within the rind is fleshy thick and has a pleasant resinous odour. The cross section shows a stout central axis and ten or more chambers separated by thick walls. The walls as well as the central axis have a light yellow tint at first that turns deeper yellowish brown on exposure. They have a warm or slightly acrid bitter taste. The chambers are full of an amber or honey coloured viscous very sticky or glutinous translucent pulp which is slightly sweet and feebly aromatic. Several seeds with fine wooly testa are found embedded in the pulpy mass.

Histology of root bark of Aegle marmelos

Fig. 1. Transverse section (diagramatic sketch)

- 2. A sector from Fig. 1 enlarged.
- 3. Details of bast and xylem.
- 4. Cork and adjacent cortical tissue.
- 5&6. Details of cortex.



Histology of root bark of Aegle marmelos.

S'ĀLIPARŅĪ* (शालिपणी)

Pseudarthria viscida W. & A.

Descriptive Synonyms

शालिपणींस्थिरा सौम्या त्रिपणींपीवरीगृहा । विदारिगन्वा दीघींङ्गीदीर्घपत्रांऽशुमत्यपि ॥

(भावप्रकाशः)

"Sāliparņī sthirā saumyā triparņī pīvari guhā vidārigandhā dīrghāngī dīrghapatrā fmsumatyapi"

(Bhāva-Prakāśa)

'Dirghamūlā', 'pītinī', 'vrīhiparņikā', 'ekamūlā', 'sālaparņī' and 'supatrikā' are other descriptive terms mentioned in Sāligrāma-nighaņţu and Dhanvantari-nighaņţu. 'Sāliparņī' and 'vrīhiparņikā' meaning leaves like those of paddy, and 'Dīrghapatrā' indicate that the leaves are long and narrow. 'Sālaparnī'=leaves like those of Sal or Shorea robusta. 'Supatrikā' large (clearly formed) leaf; 'Sthirā'=permanent, perennial or woody? 'Saumyā'=mild; 'Triparņī'= three leaved; Pīvariī= fattening; producing corpulency; 'Vidārigandhā'= smelling like vidari (Ipomaea digitata), 'Dīrghāngī'=long limbed (branches long), 'Amśumatī'=with streaks or rays; 'Dīrghamūlā'=with long roots; 'Pītinī'=yellowish 'Ekamūlā'=single (unbranched) root.

Properties and Uses.

शालिपणी गुरुव्छि विज्वरश्वासातिसारिजत् ॥ शोषदोषत्रयहरो वृंहण्युक्ता रसायनी । तिकता विषहरो स्वादुः क्षतकासिक्रिमिप्रणुत् ॥

(भावप्रकाशः)

"Sāliparņī guracchardi jvarasvāsātisārajit šoṣadoṣatrayaharī bṛmhaṇyuktā rasāyanī tiktā viṣaharī svāduḥ kṣatakāsa krimipraṇut"

(Bhāva-Prakāśa)

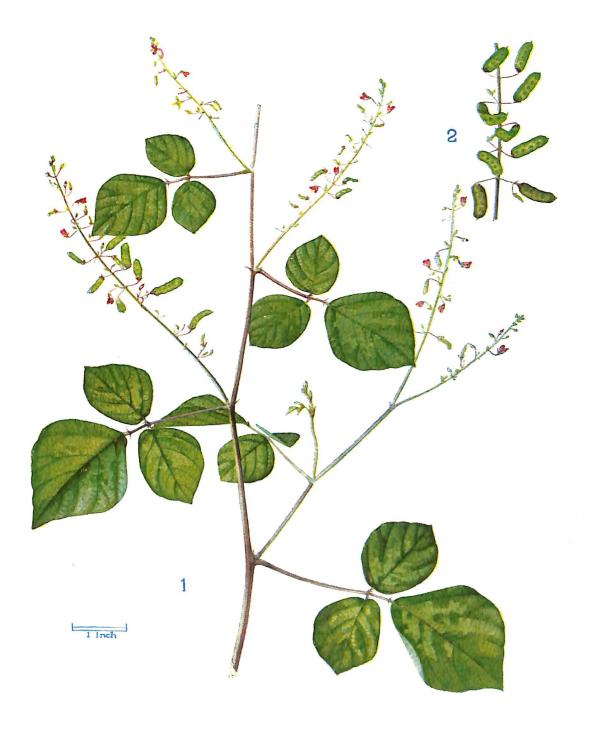
^{*} Saliparņī and Pṛṣniparņī have a number of common descriptive terms such as 'Guha' "Atiguha', 'Sthira', 'triparņi', 'Dīrghaparņī', 'Dīrghapatra', etc. Bhava Miṣra recommends the use of Simhapucchī (given as a synonym for pṛṣniparṇī) in the absence of pṛṣniparṇī (?) "Abhave pṛṣniparṇaṣca simhapucchī vidhīyate"-indicating that they are separate plants (?) Probably on account of these and other factors there is some confusion in equating the identity of the sources of pṛṣniparṇī and ṣaliparṇī. In all the books on Indian Materia Medica, ṣaliparṇī is equated with Desmodium gangeticum and pṛṣniparṇī with Uraria lagopoides and/or Uraria picta. In Travancore-Cochin curiously enough by many vaidyans. Desmodium gangeticum called Orila in Malayaṭam is equated as pṛṣniparṇī and Pṣeudarthria viscida commonly known as Mūvila, accepted as ṣaliparṇī. Pṣeudarthria viscida is equated as sanaparni by Kirtikar & Basu in Indian medicinal plants. In Tenmalai and other places in Travancore, Uraria hamosa Wall, which is also locally known as Mūvila is occasionally used instead, or as an adulterant. See also note on Pṛṣniparnī.

'Sāliparņī' overcomes concocted poison, and is useful in vomitting, fever, difficultive breathing, diarrhoea, dysentery, consumption and the three 'doṣas'. It is also a 'krimipraņut' or anthelmintic.

शालिपणीरसेतिकता गुर्व्युष्णाधातुर्वाद्धका ।
रसायनीस्वादुवृष्याविषमज्वर वातहा ॥
मेहार्श: शोयसन्तापज्वर श्वासविषक्वमीन् । (निघण्टुरत्नाकरः)
त्रिदोषशोषच्छिदिन्नी क्षतकासातिसारहा ॥ (शालिग्रामनिघण्टुः)

"Sāliparņī rase tiktā gurvyuṣṇā dhātuvarḍdhikā
rasāyanī svādu vṛṣyā viṣamajvara vātahā
mehāṛṣaḥ sotha saṃtāpajvara svāsa viṣakṛmīn"
"Tridoṣa soṣacchardighnī kṣatakāsātisārahā" (Nighaṇṭu-ratnākara)

'Śāliparņī' is 'tiktā' (bitter), 'svādu' (sweet), 'uṣṇā'—'hot' (promotes katabolism) 'gurvī'—difficult of digestion,? 'dhātuvardhikā'—promoter of body tissues, 'puṣtikā'—strength giving, is a 'rasayan' or tonic, 'vṛṣyā'—aphrodisiac, 'vātaghnī'—sedative (?), and 'viṣamajvaravātahā'—overcomes intermittent fever, and 'vāta'. It is also useful in urinary diseases, tumours, oedema, burning feel, difficult breathing, and toxic conditions, and controls loss of flesh.



Pseudarthria viscida

1. Twig with inflorescence.

2. Fruits.

Pseudarthria viscida W. & A.

Family—Papilionaceae

Tamil Malayālam

... Neermalli, (R.R.) Mūvila

... Mūvila

Distribution and habitat.

Found nearly in all districts of Southern India, from Godavari southwards. It is fairly common in Kerala where it is found from sea level upto 3000 feet in the hills. It grows well in dry gravelly soil under cover and also as an undergrowth in damp forests.

Habit and general features.

Pseudarthria viscida W. & A. is a villous or viscid-pubescent, semierect, or more often diffusely creeping "Desmodium-like" perennial undershrub upto two feet high with several slender, mostly prostrate or trailing branches, with long internodes often rooting at the nodes, bearing pinnately trifoliate leaves almost invariably variegated with pale green or greenish white irregular patches, elongate filiform racemes of small bright purplish or pink flowers and very sticky or adhering greenish somewhat membraneous pods about three quarters of an inch long and a quarter inch broad.

Flowers appear in the cold season (October to December) or occassionally nearly throughout the year.

External morphology.

Branches: many, two to four feet or more long, clothed with fine soft greyish-white pubescence.

Leaves: pinnately three-foliate, alternate, stipulate. Stipules free hairy, lanceolate-subulate or cuspidate, striate, 4.5 to 6 m. m. long, deciduous; Leaflets with filiform stipels upto 3 m. m. long, sub-coriaceous, obscurely bristly hairy above, densely grey-pubescent below. Lateral leaflets rhombiform or ovate, one to two inches either way, terminal one rhomboid-ovate, obtuse or acute two to four inches long by one and a half to two inches broad. Petiole densely hairly, half to one inch long.

Inflorescence: a fairly long terminal, erect, hairy raceme often with one or more smaller branches arising from the axils of the uppermost leaves.

Flowers: many, small, deep purple, red or pink, arranged in distantly placed fascicles of two to four on comparatively long spreading, filiform pedicels, jointed or articulated close beneath the calyx. Bracts-narrow, lanceolate subulate. Calyx-about a tenth of an inch long, hairy campanulate cleft to the middle in two obscure lips, five toothed—the two upper subconnate forming an upper lip, the lower distinctly three partite of which the middle one is the longest. Corolla-nearly twice as long as the calyx, papilionaceous, exserted, with the

petals nearly equal; standard sub-orbicular or roundish; wings obliquely oblong; keel petals obtuse, not spurred. Stamens diadelphous—nine and one; anthers-uniform. Ovary-subsessile with many ovules; style short, subulate or filiform, inflexed, ending in a small capitate stigma.

Fruit: A flat compressed or slightly inflated linear-oblong indehiscent one celled legume half to three quarters of an inch long and about one quarter inch broad, with its chamber continuous within. The valves of the fruit are membraneous transversely veined and closely covered with many stiff hooked viscid hairs; the sutures (margins) are densely ciliate but not usually indented or only very slightly indented. Seeds—four to six, brownish black, compressed, somewhat reniform.

Officinal part.

The roots, or more often the whole plant.

The root system consists mainly of a number of lateral roots as in *Desmodium gangeticum* and *D. latifolium*. These are however fewer, smaller, and neither very stout or long. In the material brought for sale in addition to the main roots there is most often present a large number of dried leafy branches with attched smaller roots arising from the nodes.

The roots are woody, but slender, and dark brown. As in the case of *Desmodium latifolium* (Ref. *Prśniparni*) the surface appears rough, being covered with a very large number of lenticels in close longitudinal series. The surface skin is thin and membraneous with a light brown layer within.

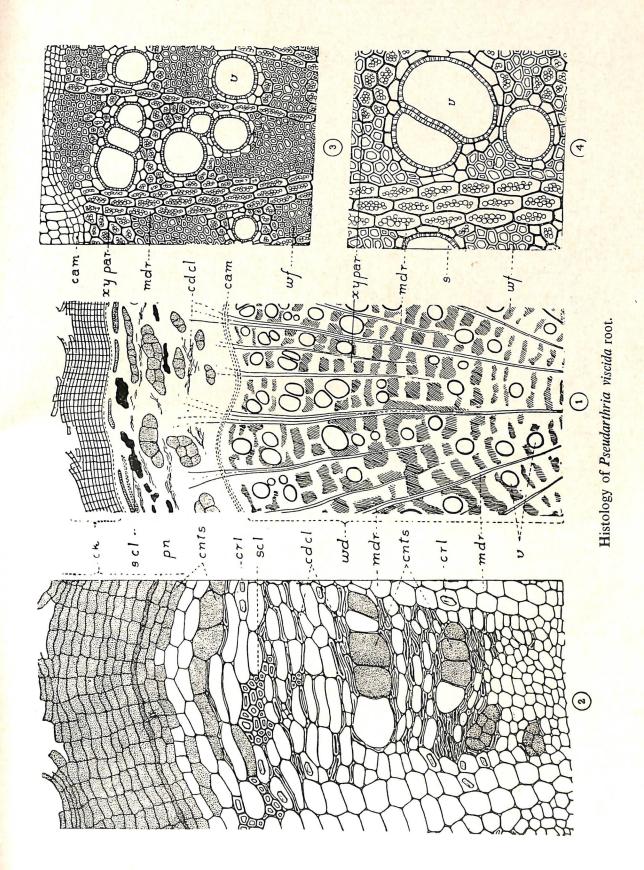
A large number of wiry or fibrous rootlets with many small attached bacterial nodules are found amidst the roots or attached to their distal ends as in the root systems of Desmodium latifolium and D. gangeticum.

The roots have an astringent taste, but no characteristic cdour.

Histology.

The transverse section is circular. It shows a central strand of wood a narrow bark and a thin dark-brown strip of cork.

The cork tissue is composed of ten to fifteen rows of thick walled rectangular cells. Those towards the periphery often have dark brown contents. A distinct phellogen with a few rows of phelloderm within is made out. The cortex is comparatively narrow and composed of oblong cells. A noteworthy feature of this region is the presence of short tangential rows or series of very large thin walled cells filled with brownish contents between the broadened distal ends of the medullary rays. Small irregular groups of sclerenchyma also occur here. The medullary rays are two to three seriate and their cells are loaded with starch The bast or phloem is of the usual type. The xylem or wood is composed of a large proportion of wood fibres, a small amount of xylem parenchyma and xylem vessels, in addition to the medullary rays. The xylem parenchyma cells contain starch. There is no pith in the centre.



Diagnostic features.

A. Morphological

The roots are comparatively narrow, woody, dark brown in colour with the surface profusely lenticellate and somewhat warty but not hard. The surface skin is thin and exfoliating. It has a light brown inner layer.

There is a thin strand of wood in the centre.

B. Anatomical

- 1. The cork tissue is composed of ten to fifteen rows of rectangular cells with fairly thick brown walls.
- 2. The cortex is a narrow zone. A conspicuous and noteworthy feature of this region is the presence of few celled groups in tangential rows of very large thin walled cells with brownish contents. Small groups of sclerenchyma also occur.
- 3. The wood is composed of a large proportion of wood fibres. The cells of the medullary rays as well as those of the xylem parenchyma contain starch grains.

C. Taste and Odour.

The roots have an astringent taste but no special odour.

Histology of Pseudarthria viscida root

- Fig. 1. Transverse section (diagrammatic sketch).
 - 2. Details of cork, cortex and bast.
 - 3. Details of xylem.
 - 4. Portion of fig. 3 enlarged.



PŖŚNIPAŖNI* (पृद्धिनपणी)

Desmodium gangeticum D. C. (Syn. D. collinum Roxb)—belonging to Papilionaceae.

Descriptive Synonyms

पृहिनपर्णी पृथकपर्णी चित्रपर्ण्यपि । कोष्टुविन्ना सिंहपुच्छी कलशी धावनिगुहा ॥

"Pṛśniparṇī pṛthakparṇī citrāparṇyahiparṇyapi krostuvinnā simhapucchī kalaśī dhāvanī guhā"

(Bhāva-Prakāśa)

Other terms mentioned are:

'Tanvī', 'triparņi', 'pūrņaparņī', 'dīrghā', 'kankasatru'
'cakraparņī', 'dīrghaparņī' etc. (Sāligrāma-nighanţu commentary)

'Dīrghaparṇi'=long leaved; 'pṛṣniparṇi', 'citraparṇi', 'ahiparṇi', 'cakraparṇi'=leaf having marks (like those in the hood of the cobra), variegated or spotted; 'kroṣtuvinnā', sṛgālavinnā', 'simhapucchī'=foxtail like—indicates a caespitose of tufted or bushy condition (the inflorescence of *Uraria lagopoides* is some what dense and bushy); 'kalaśī'= like a pitcher or jar; 'dhāyanī', 'dhāyanam'=running, cleansing, purifying (?); 'guhā'=a cave, cavern, hiding place (hiding) well protected; 'anghribalā'=strong rooted.

Properties and Uses

पृक्षितपर्णी त्रिदोषघ्ती वृष्योष्णा मधुरासरा । हन्तिदाहज्वर श्वास रक्तातीसारतृड्वमीः ॥

(भावप्रकाशः)

"Pṛśniparṇī tridoṣaghnī vṛṣyoṣṇā madhurā sarā hanti dāhajvaraśvāsa raktātīsāra tṛḍvamīḥ"

(Bhāva-Prakāsa)

'Pṛśniparṇī' is 'hot', 'sweet', and laxative, and useful in or overcomes corruption of the three 'doṣās', burning sensation, fever, difficult breathing, dysentery, thirst and vomitting.

पृ<mark>श्चितपर्णी बहुष्णा च तिक्तातीसारकासनुत् ।</mark> वातरक्तज्वरोन्मादव्रणदाहिवनाशिनी ॥

(गणनिघण्टः)

"Pṛṣṭhiparṇī kaṭūṣṇā ca tiktātīsārakāsanut vātaraktajvaronmāda vraṇadāhavināśinī"

(Gananighantu)

It is also aromatic (pungent), bitter, useful in cough, 'vātarakta', insanity and ulcers.

^{*} Books on Indian Materia Medica equate Uraria lagopodioides Merr (U. lagopoids D.C.) and/or Uraria picta Desv. as the source of preniparni and its synonyms such as citraparni, priethiparni etc. Desmodium gangeticum D.C. is mentioned as the botanical source of Saliparni in these books. Another species of Desmodium viz., D. latifolium D.C. is also very freely used in several places in Kerala as an unauthorised alternate source to D. gangeticum.



Desmodium gangeticum D. C.

Desmodium gangeticum D.C.

Family—Papilionaceae

Malayālam

... Orila.

Tamil

... Pulladi, Orila

Hindi

... Sariwan, Salpan, Salparni, Salwan.

Distribution and habitat.

Throughout India; its range extends from the Himalayas where it ascends to 5000 feet in the Chenab, southwards to Kerala. It is very common in Bengal, Silhet, Assam, Monghyr, N. Circars, the Mahendragiri hills, Shevroy hills of Salem, Coromandel, Western ghats and Travancore. The plant usually grows as an undergrowth of the semideciduous forests at low elevations. It is also found in the plains, though not so commonly.

Habit and general features.

Desmodium gangeticum' is a slender suberect diffusely branched undershrub, two to three feet high with a short woody stem and several long slender irregularly angled branches clothed with upward'y directed short soft grey hairs, bearing uni-foliate ovate to ovate-lanceolate, acute, membraneous leaves very often mottled with grey patches, and, elongate lax flowered terminal or sometimes also axillary racemes of small whitish or light purple to lilac tinted flowers.

External morphology.

Leaves: unifoliate compound, (apparently simple) alternate, stipulate; stipules dry or scarious and subulate with a broad striate base: petiole half to one inch long; blade ovate or ovate lanceolate, rarely ovate oblong, two to six inches long and about one third, one half, or occasionally one fourth, as broad, rounded at base, acute or narrowed gradually to an acute point, thickish membraneous, the upper surface glabrous or glabrescent and green, very often mottled with small irregular light grey patches, (citra parni) lower surface paler and sparsely or occasionally densely clothed with soft whitish or greyish white appressed hairs. There are nine to twleve pairs, of very prominent secondary nerves. Stipels subulate.

The inflorescense is a terminal or axillary, many flowered, slender, elongate raceme, six to twelve inches long with a few ascending branches in the lower part. Rachis slender pubescent and somewhat angular.

Flowers: small about 0.1 inch long, with minute setaceous bracts on short upwardly directed pedicels. They are white, pale rose or purple, or lilac tinted and arranged in pairs or few flowered fasicles at each node on the rachis. Calyx tube short, less than one twelfth of an inch long, campanulate, finely downy, and cleft to the middle into two lips; upper lip two cleft, the lower three partite; teeth short triangular or rarely lanceolate. Corolla-one sixth to one fourth of an inch, exserted; standard or bicular, cuneate at base; wings

obliquely oblong, more or less adhering to the keel; keel petals obtuse, incurved. Stamens—diadelphous,—one and nine,—anthers uniform. Ovary sessile or stipitate, many evuled; style filiform, incurved, with minute capitate stigma.

Fruit: A compressed, slightly falcate, moniliform six to eight jointed glabrescent lomentum, slightly indented above, but notched to near the back on the lower surface joints separating when ripe, indehiscent, one seeded, more or less straight or slightly curved above and rounded on the lower side.

eeds compressed, reniform without a strophiole.

Officinal part. The roots.

The root system in most cases consists of a poorly developed tap root and five to lifteen or more, long deep-growing prominent spreading lateral roots arising from its basal part. The lateral roots are very strong and cord like, two to three feet or more long, upto a quarter inch in thickness, nearly uniformly cylindrical, light yellow or yellowish white and nearly smooth, being free from attached rootlets or lenticel development through the greater part of their length. They have a thick central strand of wood surrounded by a comparatively thin but tough bark, and bear at their distal ends a large number of small very much branched fibrous rootlets with several bacterial nodules of various sizes attached to them.

The root bark is neither thick or fleshy. It has a characteristic; yellowish white colour (pītinī) and a leathery texture. It is easily peelable The outer skin is very soft. The portion next within-the middle bark-has a slight yellowish tint and the part nearest to the wood-inner bark-appears lighter coloured than the parts outside. The wood itself is whitish. The bark has no characteristic smell but possesses a slightly mucilaginous sweetish taste.

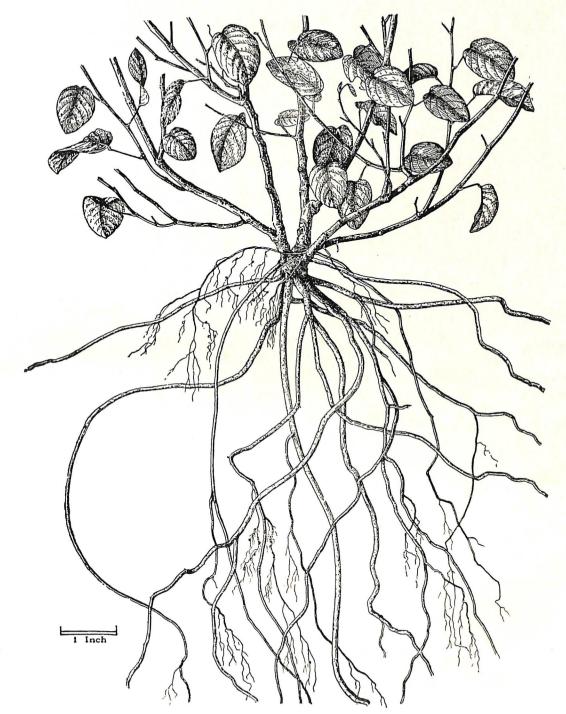
Histology.

The transverse section is circular and the outline regular. There is a broad strand of wood in the centre. The cork tissue which appears as a thin light yellowish brown strip consists of four to eight or more rows of rectangular cells nearly twice as long as broad with fairly thick brown walls. The phellogen is evident as a narrow layer. The cortex in most roots is comparatively broad and composed of several rows of thin walled oblong cells with the broadened distal ends of the medullary rays radiating across. The entire region in between the rays is practically littered with sclerenchy matous groups of various sizes and shapes, each group consisting of four to twenty or more small thick walled cells. The bast is a narrow zone and consists of pholem, parenchyma and sieve tubes. A distinct cambium is present. The wood or xylem consists of thick walled xylem parenchyma that forms the bulk tissue, radial rows of vessels of various sizes, patches of sclerenchyma mostly associated with the vessels, and, the medullary rays. The medullary rays are not very many. Those that reach the centre are broad and three to five seriate. The others are uni-or bi-seriate. Their cells especially in the xylem contain starch grains. There is no pith in the centre.

Diagnostic features.

A. Morphological.

1. The root system consists mainly of long narrow, cylindrical, nearly uniformly thick strong cordlike, yellow or yellowish white lateral roots with a fairly smooth and soft surface.



Root system of Desmodium gangeticum D. C.

Histology of roots of Desmodium gangeticum and D. latifolium.

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- 2. The entire bark is thin, but tough or leathery and in fresh roots easily peelable.
- 3. The centre of the root is occupied by a strong woody strand.

B. Anatomical.

- 1. The cork zone is thin, being comprised of only a few rows of cells.
- 2. The cortex shows several scattered groups of sclerenchyma.
- 3. The xylem or wood consists mostly of thickwalled xylem parenchyma, in addition to the vessels of various sizes and patches of sclerenchyma. There is no pith in the centre.

C. Taste and odour.

In fresh roots the bark has a sweet mucilaginous taste, but no characteristic odour.

Histology of roots of Desmodium gangeticum and D. latifolium.

A. Desmodium gangeticum.

- Fig. 1. Transverse section (diagramatic)
 - 2. Details of cork and cortex.
 - 3. Do. of bast and wood.

B. Desmodium latifolium.

- 4. Transverse section (diagramatic).
- 5. Structure of cork, phelloderm and cortex.
- 6. Portion of wood and newly formed phloem.



Root system.

Desmodium latifolium D.C.*

Family—Papilionaceae

Malayalam

... Valia orila, Orila (R.R.)

Tamil

... Chithamalli ? (R.R.)

Distribution and habitat.

Distributed throughout South India. Fairly common in N. Circars, hilly parts of the Konkan, hills of Godavari, the Western ghats and Kerala. It is found growing in dry open forests or in open glades from sea level upto about 3000 feet.

Habit and general features.

Desmodium latifolium D.C. is a much branched undershrub or shrub, larger than Desmodium gangeticum,-three to six feet or more high-with a short woody, almost smooth terete stem and a number of oblique branches clothed with short brown or fulvous hairy tomentum, bearing short petioled, unifoliate, alternate broadly ovate to roundish-cordate slightly repand coriaceous leaves, and long slender axillary and terminate racemes of numerous small bright purple flowers, followed by small three-to five jointed moniliform hairy pods. Flowering time-November and December or occasionally nearly throughout the year.

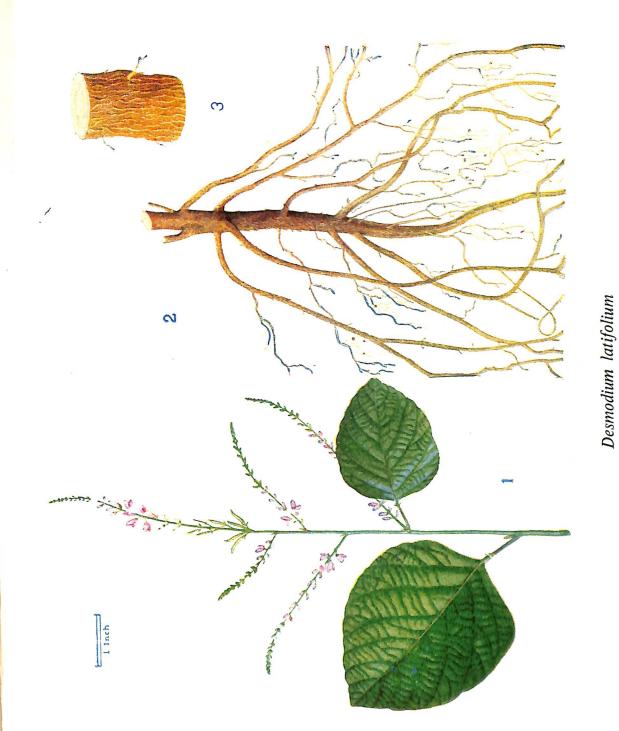
External morphology.

Leaves: short petioled, unifoliate, alternate, bifarious, stipulate; Stipules subulate with a broad striate base; Petiole quarter to half an inch long; Leaflet (blade) broadly ovate, deltoid, or ovate to roundish- cordate, or rarely reniform, three to six inches long and about the same or one half to two thirds as broad, thick or sub-coriaceous, more or less repand, obtuse, or sub-acute at tip, truncate or rarely deltoid at base, densely and harshly pubescent with persistent adpressed bristly hairs above and clothed with short soft brownish tomentum beneath.

Inflorescence. A simple or rarely compound, terminal, dense flowered, spike-like raceme, two to six inches or more long bearing numerous flowers fascicled in threes at each node. The rachis is clothed with small hocked bristles.

Flowers: small, short pedicelled of a bright purple colour: pedicels about one twelfth of an inch long, densely downy. Bracts and bracteoles setaceous, minute, triangular, acute; Calyx-very small-about one millimeter in length. Corolla, three to four times the calyx, bright rose or purple papilionaceous; Samens diadelphous. Pistil monocarpellary with many ovules

Legume: half to three quarters of an inch long and about one twelfth of an inch broad, flat, moniliform, three to six jointed, the upper or dorsal suture straight or slightly indented, the lower notched more deeply almost to the middle. It is densely pubescent, and is also beset with minute hooked hairs.



^{*} Desmodium latifolium D.C. is often used as a substitute for D. gangeticum in parts of Kerala.

Officinal part: The roots.

Root system. The root system as in Desmodium gangeticum consists mainly of a number of strong lateral roots. The tap root is however more prominent and the lateral roots comparatively longer and larger or stouter. These have a light reddish brown or dark brown colour (more black than brown) and the surface is rough due to formation of short vertical slits and subsequent exfoliation of the surface skin in thin flakes. A number of rootlets of a wiry or fibrous type with attached bacterial nodules are found amidst the larger roots. The roots are woody and quite strong. The entire bark as in D. gangeticum is comparatively thin though in this case the outer bark is more prominent. Immediately within the outer skin there is a tough whitish tissue and in the centre a very thick strand of wood.

Taste of bark astringent, often with a feebly nauseous smell. The root breaks with a short fracture.

The specimens brought for sale consist of the root system of one or more plants wound or bundled up often with the short stumpy stem and few attached leaves.

Histology.

The internal structure of the root of *Desmodium latifolium* is almost similar to that of *D. gangeticum* except for a more prominent cork tissue and the presence of greater quanity of fibre groups.

The cork zone is composed of six to ten or more rows of rectangular cells twice or thrice as long as broad with thick brown walls. Lenticels occur in abundance and there is exfoliation of the outer rows. A well defined phellogen is present within the cork tissue. The cortex is comparatively narrow. Its cells are oblong, thin walled and often contain starch grains. Other cells contain cubical and rectangular crystals. Sclerenchymatous groups of various sizes,-most of them small-occur throughout this region between the broadened distal protions of the medullary rays. The cells of the medullary rays are loaded with starch grains. The bast consists of the usual types of elements. The cambium is distinct. Wood or xylem. There is a preponderance of sclerenchymatous elements compared to xylem parenchyma. Vessels occur in groups towards the centre.

Distinguishing features.

A. Morphological.

- 1. The roots are strong and woody, a quarter to half inch or more thick, brownish to dark-brown externally and have a somewhat rough lenticellate surface.
 - 2. The outer skin is thin and exfoliating.
 - 3. The entire living bark is comparatively thin but tough or leathery
 - 4. There is a prominent central woody strand.

B. Anatomical

1. Cork zone is narrow and composed of six to ten rows of rectangular cells with fairly thick brown walls.

- 2. The cortex is also a narrow zone. Scattered throughout this region are a large number of small sclerenchymatous groups. Most of the cortical cells contain starch and others cubical or rectangular crystals.
 - 3. There is a preponderance of fibre elements in the wood.
 - 4. There is no pith in the centre.

C. Sensory.

The living or officinal part of the bark has an astringent taste. Stored specimens emit an offensive odour.

Desmodium gangeticum

Small plant with long slender diffusely spreading irregularly angled branches.

Leaves unifoliate ovate to ovate-lanceolate thickish membraneous, acute.

Flowers small, many, mostly whitish, on slender elongate peduncles.

Fruit a more or less falcate, thin, six to eight jointed lomentum not more than one tenth of an inch in width and covered with minute hooked birstly hairs.

Root system mainly of long, cordlike yellowish white, smooth, lateral roots with few wiry rootlets admist the former or attached to their distal ends. Bark thin leathery. It has a sweetish mucilaginous taste.

Desmodium latifolium.

Plant larger, branches stouter and more erect.

Leaves larger in size, broadly ovate, slightly repand, coriaceous obtuse.

Flowers small bright purple or rose coloured.

Similar but notches fewer.

Root system comparatively stouter and more woody: consists of a number of prominent lateral roots, as in D. gangeticum, but colour light reddish to dark brown, and surface lenticellate and somewhat rough due to exfoliation of the outer skin in thin flakes. Bark thin but tough and astringent.

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