



MACROSCOPIC AND MICROSCOPIC STUDY OF DALBERGIA SISSOO

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ABSTRACTS

In Astang Ayurveda Health's preventive & curative properties are based on Dravya. That's why Dravya is mentioned in chikitsa chatuspad. These Dravya's have several gunas, these gunas are responsible for karma. Guna & Karma both are complementry of each other. According to Ayurveda Guna is "Nischestyā" but Karma have "Chestyā" property. It means, karma directly represents the Gunas which are dependable in any substance / Dravya. The term pharmacognosy is derived from two Greek words 'Pharmacēn' means drugs and Gignosco or Gnosis - to acquire knowledge. The original and basic approach towards phrmacognosy includes study of morphological system, study of the cell structures and organization and study of tissue system, which still holds a key in identification and the better understanding of the correct species of the plant and also to help us to differentiate between closely related species of the same genus. It is also the first step to standardize a drug, which is the need of today.

KEYWORDS: term pharmacognosy, Chestya, Gignosco or Gnosis.

INTRODUCTION

Since vedic kala and Samhita kala even, our Acharyas have stressed on proper identification of the drug before use. In Nighantu kala, Raj Nighantukar(1/13) has given 7 methods for identification of drug, these are Rudhi, Swabhav, Desh, Lanchan, Upama, Virya and Atidesh.

But later on with the increasing in number of the drugs and Nighntu, which are hotchpotch of synonyms, drugs became controversial. Moreover today, in the age of globalization, raw drugs collection is done by unskilled persons causes doubt in the genuineness and possible adulteration. Unlike the traditional methods the participation of traders in the chain of procurement of drugs, adulteration is increasing day by day when the original genuine material is not available in sufficient quantity; the allied species of plant with proven efficacy or similar chemical constituents can be used as substitute and in such instances efforts should be made for a systematic identification by phrmacognostical methods.

Shinshapa and Arjuna are generally non controversial drug. Though two varieties are taken as Shinshapa now a days i.e. *Dalbergia sissoo* Roxb. and *Dalbergia latifolia* Roxb. Among them, *Dalbergia sissoo* Roxb. is accepted all over as Shinshapa. In this study, stem bark of *Dalbergia sissoo* Roxb. is taken. To authenticate that the stem bark which have been used in the study is original and not adulterated or confused with any other drug, pharmacognostic study is undertaken.

AIMS AND OBJECTIVES

1. To evaluate stem bark and powder of *Dalbergia sissoo* Roxb. for their organoleptic characters.
2. To study morphological and microscopic features of stem bark of the drug.

Pharmacognostic Study

Organoleptic Study

The stem bark and their powder were separately evaluated by organoleptic characters like taste, odour, colour and touch.

Macroscopic Study

Macroscopic characters of the stem bark was studied systematically as mentioned in the standard text book of Botany and Pharmacognosy.

3. Microscopic Study

Stem bark: Microscopic characters of the stem bark was studied systematically as mentioned in the standard text books.

1. Organoleptic Study Shinshapa

Organoleptic characters of stem bark and powder of Shinshapa (*Dalbergia sissoo* Roxb.) are tabulated below.

Sr.	Characters	Stem bark of <i>D. sissoo</i> Roxb.	Powder of <i>D. sissoo</i> Roxb.
1.	Taste	Bitter	bitter
2.	Colour	Light black	Dark brown
3.	Odour	Nothing special	Nothing special
4.	Touch	Rough	smooth

2. MACROSCOPIC STUDY (*Dalbergia sissoo*)

Family - *Leguminosae*

This is the second biggest family among the dicotyledons (being second only to Compositae), and has varying characteristics. Total 12,000 species found all over the world, among them 951 species found in India. According to Bentham and Hooker and also Engler, the order Rosales includes both *Rosaceae* and *Leguminosae*, while Hutchinson has separated *Leguminosae* from Rosales and raised it to the rank of an order with three families – *Caesalpiaceae*, *Mimoseae* and *Papilionaceae*. The division is primarily based on the characteristics of the corolla and the stamens. All these sub-families are well represented in India. From an economic standpoint, this is one of the most important families. It probably ranks second to *Gramineae* in the order of importance.

Habit : These are herbs, shrubs, trees, twiners or climbers.

Roots : The roots of many species, particularly of *Papilionaceae*, have tubercles.

Leaves : These are alternate, pinnately compound, and rarely simple, with a swollen leaf-base known as the pulvinus. There are 2, usually free, stipules.

Flowers : These are bisexual and complete, regular or zygomorphic or irregular, and hypogynous or slightly perigynous.

Calyx : There are usually 5 or (5) sepals, with the odd one anterior (away from the axis). Sometimes there are 4 sepals. They may be united or free.

Corolla : There are usually 5 petals, with the odd one posterior (towards the axis). Sometimes there are 4 petals, free or united.

Androecium : There are usually 10 or more stamens (often less than 10 by reduction) free or united.

Gynoecium : There is one carpel. The ovary is 1-celled, with 1 to many ovules. It is superior and the placentation is marginal. The ovary often borne on a long or short stalk, called the stipe or gynophore.

Fruit : This is mostly a legume or pod (dehiscent), or sometimes a lomentum.

Sub Family – Papilionaceae : This is an extremely important family, as from its members are obtained nutritious foods, valuable medicines, and virulent poisons. Total 754 species of *Papilionaceae*, found in India.

Habit : These are herbs, shrubs, trees and climbers.

Leaves : unipinnate, sometimes trifoliolate, rarely simple; stipels often present.

Inflorescence : usually a raceme.

Flowers : zygomorphic, polypetalous and papilionaceous.

Calyx : usually 5 sepals, gamosepalous, often imbricate, sometimes valvate.

Corolla : usually 5 petals, free, of very unequal sizes, the posterior and largest one being the vexillum or standard, the two lateral ones being the wings or alae, and the two innermost ones (apparently united) forming the keel or carina; aestivation vexillary.

Androecium : stamens 10, diadelphous- (9) + 1, rarely 10, free or (10), connate.

Floral Formula - $K_{(5)}C_5A_{(9)+1}\underline{G}_1$.

Genus – Dalbergia Linn., Roxb.

The generic name has been assigned in the honour of Nicholas Dalberg, a Swedish botanist who died in 1820. 300 species are distributed in the tropical and subtropical parts of the world and S. Africa. 25 species have been reported from India. Which include two of the most valuable of Indian timber trees, i.e. *Dalbergia sissoo* Roxb. and *Dalbergia latifolia* Roxb.

Habit : Trees or shrubs often climbing.

Leaves : Alternate, imparipinnate or rarely 1- foliolate

Leaflets : Usually alternate, exstipellate, subcoriaceous.

Flowers : Small, set in branching clusters, and white or purplish in colour. copious, in terminal or lateral panicles; bracts small subsistent; bracteoles usually minute.

Calyx : Campanulate; teeth 5, short, distinct, the lowest usually the longest.

Corolla : Exserted; standard broad; wings oblong; keel obtuse, its petals joined at the tip and shorter than standard.

Stamens : 8-10, all connate into a tube split down the upper side, or the tube

split into 2 equal bundles; anthers minute; basifixed, with the cells back to back, dehiscing usually by an apical (rarely a longitudinal) slit.

Ovary : Stalked; ovules few; style incurved, short; stigma small, terminal.

Pod : Oblong or strap – shaped, membranaceous, reticulately veined, oblong linear, usually thin and flat, indehiscent, not thickened or winged at the sutures.

Seeds : 1-4, reniform, flat compressed. 120 species have been found of *Dalbergia* in warm countries.

[A] Stamens 9, less commonly 10, monadelphous. Staminal tube slit along the upper side only.

I. Tall trees unarmed

a. Leaflets acuminate - *D. sissoo*

b. Leaflets obtuse - *D. latifolia*

II. Scandent shrubs

a. Leaflets 11-15 - *D. multiflora*

b. Leaflets 25-41 - *D. tamarindifolia*

[B] Stamens 10. Staminal tube slit on the upper and lower sides.

I. Trees

Standard 6 mm broad with a callosity at the base of the limb – *D. lanceolaria*

II. An erect shrub with spine-tipped branchlets - *D. spinosa*

III. A climbing shrub, leaflets 11-15 - *D. volubilis*

D. hupeana Hce. is used medicinally in China; *D. tamarindifolia* Roxb. in Indo-China; *D. ovovata* E. Mey. in South Africa.

Species – *Dalbergia sissoo* Roxb.

Habit : A fairly large, deciduous, handsome tree; reaching 18 m. high; young parts pubescent or tomentose; branches numerous, downy, grey and spreading.

Bark : Grey or light brown, somewhat reticulately longitudinally furrowed, exfoliating in narrow strips; young parts grey downy, inside light- brown, soon turning to dark-brown, very fibrous.

Heart wood : The heart wood is brown, mottled with darker longitudinal veins, hard and close grained, annual rings not distinctly marked; medullary rays very fine; pores uniformly distributed, joined by wavy white concentric bands; wt 45-55 lbs. per c.ft.

Leaves : Alternate, bifarious, imparipinnate; leaf-rhachis 2-4” long, zigzag, pubescent when young, Pale green.

- Petioles** : Terete, very downy when young;
- Stipules** : Lanceolate, caduceus.
- Leaflets** : 3-5, firm, 3.8-6.3 by 3-5.4 cm. (the terminal the largest and the lowest the smallest), distant, alternate, broad ovate or rhomboid, tough, slightly waved on the margin. suborbicular, conspicuously and abruptly acuminate, puberulous when young, soon glabrescent and shining when old, base narrowed or cuneate, lateral nerves about 5 on either half, rather in distinct, very slender, tertiaries prominent.
- Petiolules** : 3-6 mm. long.
- Flowers** : 0.2-0.3" long, yellowish white, scented, each shaped after the plan of a pea flower, sessile or nearly so, in axillary panicles shorter than the leaves and composed of several short subsecund spikes; rachis and branches of the panicle densely hairy; bracts linear-subulate hairy.
- Calyx** : Downy, about half the length of the flower. Standard with a long claw; 4-5 mm. long, hairy; teeth short, ciliate the 2 upper connate except at the tip, the lateral linear, obtuse, the lowest the longest, subacute.
- Corolla** : Pale yellow, 6-8 mm. long; standard 4 mm. broad, with a long claw, the limb obovate-orbicular.
- Stamens** : 9 in one bundle. The sheath of the filaments slit only at the top.
- Ovary** : Pubescent; ovules 2-4, style much shorter than ovary, stigma large, glandular
- Pods** : 3.8-10 by 0.6-1.3 cm. narrowed at the base into a long stalk which is twice as long as the calyx, thin, strap-shaped, linear lanceolate glabrous, pale brown when ripe. slightly reticulate. The pods do not burst open when ripe to free the seeds, but are scattered by wind and water; the thin outer covering of the pod soon decays and the seeds then germinate. In their wild state the trees are usually found growing on the banks of streams and rivers to which their pods have been carried by floods.
- Seeds** : 1-4, 0.25" long, kidney shaped, flat.

Dalbergia latifolia is also taken as Shinshapa somewhere.

***Dalbergia latifolia* Roxb.**

- Names** : Kala Shisham, Shisham, Sissu.
- Eng.** : Black wood, Indian Rose wood, Rose wood of southern Indian.
- Habit** : Arboreous, A large, deciduous, glabrous tree.
- Bark** : ash grey, exfoliating in thin long flakes.

- Wood** : handsome, light to dark purple, durable, it is also used as a timber tree.
- Leaves** : alternate, up to 4.5” long
- Leaflets** : 3-7, generally 5, alternate, orbicular or broadly ovate, emarginate; firm, upper side glabrous, dark green, under when young minutely pubescent, downy beneath.
- Flowers** : on short slender pedicles, small, whitish, fragrant, in lax short axillary panicles, branched and divaricating,
- Calyx** : segments oblong, more or less obtuse
- Stemens** : 9 or 10, all united into a sheath open on the upper side
- Gynoceium** : **Ovary** : stalked, about 5 ovuled, glabrous,
- Style** : slender, nearly as long as the ovary
- Stigma** : small
- Legume** : stalked, strap shaped, firm, oblong lanceolate, up to 3” long, 0.75” broad, usually 1-3 seeded.

Kushinshpa is another variety of Shinshapa which is mentioned in classics. According to Acharya P.V. Sharma (Dravyaguna Vigyana, part V), it may be *Dalbergia sissoides* Grah. Its heart wood is light in colour in comparison to *Dalbergia sissoo* Roxb.

***Dalbergia sissoides* Grah.**

Arboreous, glabrous

- Leaflets** : 5-7, alternate, elliptic-ovate, with a short bluntish acumination
- Flowers** : in axillary panicle, branched, lax, about half the length of the leaves; flowers on slender shortish pedicles;
- Calyx** : segments oval, obtuse.
- Stemens** : 9, all united into a sheath open on the upper side.
- Gynoceium** : **Ovary** : Stalked, 4-5 ovuled, glabrous.
- Style** : Straight, a little shorter

DISCUSSION

Material for the study was Shinshapa (*Dalbergia sissoo* Roxb.) stem bark and powder. Firstly plant was identified according to morphological characters. Plants were having pods indicating that it belongs to *leguminoceae* family. Flowers are papilionaceous and other patterns of corolla, calyx, stamens and ovary are indicating that the plant is of *Papilionaceae* family. Flowers were small, white, yellowish and in cluster, in a short axillary panicles with

spikes which is the characteristic of genera *Dalbergia*. Other Morphological characters supports that the plant is *Dalbergia sissoo* Roxb. That morphological characters are :

Macroscopic Study

Tree was app. 18m. high; branches numerous, bark was dark reddish brown and internally light brown and very fibrous. Bark was reticulately longitudinally furrowed, exfoliating in narrow strips. Heart wood was brown. Leaves alternate, imparipinnate, leaf-rhachis 2-4” long, zigzag, pale green. Petioles were terete. Stipules lanceolate. Leaflets 3-5, alternate, broad ovate, slightly waved on the margin. Suborbicular, abruptly acuminate, lateral nerves about 5 on either half. Flowers yellowish white, scented, sessile or nearly so, in axillary panicles shorter than the leaves and composed of several short subsecund spikes; rhachis and branches of the panicle densely hairy; bracts linear-subulate hairy. Calyx downy, about half the length of flower. Standard with a long claw; 4-5 mm. long, hairy; teeth short, ciliate the 2 upper connate except at the tip, the lateral linear, obtuse, the lowest the longest, subacute. Corolla pale yellow, with a long claw, the limb obovate-orbicular. Stamens 9 in one bundle. The sheath of the filaments slit only at the top. Ovary pubescent; ovules 2-4, style much shorter than ovary, stigma large, glandular. Pods narrowed at the base into a long stalk which is twice as long as the calyx, thin, strap-shaped, linear lanceolate glabrous, slightly reticulate. After proper identification, stem bark of *Dalbergia sissoo* Roxb. was collected from the different area.

Stem bark and powder were studied organoleptically, macroscopically and microscopically. Organoleptically, Colour of stem bark was dark reddish brown externally and light brown internally. While colour of powder was light brown. Odour of bark and powder was respectively. Taste of bark sample and powder same respectively. Bark was rough while powder was smooth in touch.

Reticulately longitudinally furrows, exfoliating in narrow strips were found in the bark macroscopically. Size of bark was 15-30 cm long, which cut into small pieces afterwards. Thickness varies from 0.4 to 1 cm. Shape was flat.

Microscopic Study

1. T. S. of stem bark

During microscopic study, it was found that rhytidoma with cork and phloem region were in the major portion of the bark, while cortex was narrower. Cork was 8-10 layered and just

below to the rhytedoma. Stone cells, few fibres, plenty of prismatic crystals, colouring materials and some sandy crystals were found in cork and rhytedoma region. Cortex was narrower and a few prismatic crystals of calcium oxalate and Stone cells in group of 2 to 3 or 4 together and starch grains were found in it. Phloem region occupies major portion of the bark and it consists plenty of prismatic crystals of calcium oxalate, starch grains, group of fibres, and medullary rays, which were mostly bisariate or triseriate and 'zigzag' in form.

CONCLUSION

Shinshapa tree was app. 18m. high; branches numerous, bark was dark reddish brown and internally light brown and very fibrous. Bark was reticulately longitudinally furrowed, exfoliating in narrow strips. Heart wood was brown Over all conclusion of macroscopic study of shinshapa stem bark is.

(i) Stem bark of *Dalbergia sissoo* Roxb.

Size : 30-60 cm. long, which had afterwards cut into small pieces 3-5 cm.

Thickness : 0.4 to 1 cm.

Shape : Long, Flat, Thick, Irregular

Colour : Outer Surface – dark reddish brown.

Inner surface – light brown

Texture : Rough, very fibrous inside.

Markings : Shallow, broad longitudinally furrowed, exfoliating in woody narrow strips and scales

MICROSCOPIC STUDY (*Dalbergia sissoo*)

(i) T. S. of stem bark of *Dalbergia sissoo* Roxb.

T. S. of stem bark shows major portion of the bark occupies cork with rhytedoma, a narrow region constitute cortex and more wide region occupies the phloem region.

Cork with rhytedoma

Stem bark consists of rhytedoma i.e. dead tissue which has not medicinal value. Just below the rhytedoma 8-10 layers of rectangular, thin walled, radially arranged cork cells are present. Stone cells, few fibres, plenty of large prismatic crystals, few sandy crystals and plenty of colouring material are present in rhytedoma and cork portion of the stem bark.

Cortex

Secondary cortex is very narrow, round or oval, thin walled, parenchymatous cells, a number of groups of sclerenchymatous cells, found scattered throughout secondary cortex. A few cortical cells contain prismatic crystals of calcium oxalate. Stone cells are very few and in group of 2 to 3 together in cortex. Starch grains are also present in cortex region.

Phloem

Major portion of the stem bark consists of phloem region. Secondary phloem very wide consisting of usual elements of thin walled cells and tangential strips of phloem fibres; collapsed, thin walled, parenchymatous cells present in tangential strips throughout the secondary phloem; most of phloem fibres and parenchyma cells contain prismatic crystals of calcium oxalate; phloem rays short, uni to triseriate, consisting of radially elongated, thin-walled, parenchymatous cells.

Sclerenchymatic Fibres

Group of fibres are widely distributed throughout the phloem and few groups are even found in the rhytidoma of the cork.

Medullary rays

Medullary rays are present between sclerenchymatic fibres in phloem region. They are mostly bisariate or triseriate and in 'zigzag' form.

Stone Cells

Small group mostly 2-3 or 4 stone cells are also found in small groups, particularly in the narrow region of the cortex and also few are found in the rhytidoma.

Crystals

Plenty of prismatic crystals of calcium oxalate are also found mostly around the group of fibres and they are also present in cork and cortex region. Sometimes they are in the form of crystal fibres.

Starch grains

Starch grains are present through out the cortex and phloem region, which gave bluish colour after stained with Iodine.

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