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Therapeutic Potentials of *Shirisha* (*Albizia lebbeck* Benth) – A Review

Review article

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Abstract

Albizia lebbeck Benth. is a large, erect, unarmed, deciduous, spreading tree belonging to the family Fabaceae (Formerly Leguminosae), member of the subfamily Mimosaceae. It is found throughout India, ascending to 900m in the Himalayas and also in the islands of Andaman. It contains saponins, macrocyclic alkaloids, phenolic glycosides and flavonoids. In *Ayurveda*, *Albizia lebbeck* Benth. is familiar as *Shirisha* and it has been attributed with properties like *Vishaghna* (anti-poisonous) and emphasized its efficacy in *Visarpa* (Erysipelas), *Hicca* (Hiccup), *Shwasa* (Breathlessness), *Kasa* (Cough) etc. Researches of recent past have also reported anti-inflammatory, anti-histaminic, anti-anaphylactic, anti-asthmatic, anti-microbial properties of the plant. Saponins isolated from the methanolic extract of bark and pod of *Albizia lebbeck* Benth. have found to possess anti-spermatogenic effect. The current review revealed that, the plant *Shirisha* has a number of potentials in therapeutic field.

Keywords: *Albizia lebbeck*, Shirisha, Vishaghna, Shwasa, Ayurveda.

Introduction

Albizia lebbeck Benth.(Figure1:a) is a large, erect, unarmed, deciduous, spreading tree belonging to the family Fabaceae (Formerly Leguminosae), member of the subfamily Mimosaceae.(1) It is found throughout India, ascending to 900m in the Himalayas and also in the Andmans.(2) In Hindi, the plant is commonly known as *Shirisha*. Other Vernacular names are

Sanskrit: *Barhapuspha*, *Bhandi*, *Kalinga*,
English: Parrot tree, East Indian walnut, Fry wood,
Urdu: *Darash*,
Gujrati: *Pilo sarashio*,
Telugu: *Dirisena*,
Kannada: *Bage mara*,
Tamil: *Vagie*,
Punjabi: *Sareehn*,
Marathi: *Chichola, Kala shiras*.

The word Albizzia has came from *Albizia* an Italian naturalist of the eighteenth century.(3) Bark (figure-1d) is dark brown to greenish black, rough, with longitudinal and transverse fissures on outer surface; inner surface whitish with fine longitudinal stations. The sapwood (figure-1b) is white or yellowish white and the heartwood (figure-1b) is dark brown, streaked with dark and white shades.

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Leaves bipinnate with 8-18 leaflets. Flowers (figure-1c) are stalked, greenish yellow. Flowering and fruiting season starts from April to June. Pods (figure-1e) yellowish brown with 6-10 seeds. Mature pods remain on the tree for long period and are available till May-July. The tree is a good substitute for *Teak* (*Tectona grandis* Linn) and *Sala* (*Shorea robusta* Gaertn.), The tree is very good nitrogen fixing plant. (4)

Figure 1

a: Whole plant

b: A- Bark, B-Sapwood, C-Heartwood

c: Compound leaf with inflorescence

d: Stembark;

e: Pod

Ayurvedic Pharmacology (_Dravya Guna_ and _Karma_) of _Albizia lebbeck_ (_Shirisha_)

Ayurvedic pharmacology is based on biophysical, experiential, inferential and intuitional mechanism. The action of *Dravya* (substance) is based on five mechanisms of action or attributes of a substance viz. *Rasa* (taste), *Guna* (property), *Vipaka* (metabolites), *Virya* (potency) and *Prabhava* (specific action); which have been depicted at Table-1.

Table 1: Ayurvedic Properties of *Albizia lebbeck* Benth. (5-6)

Rasa	***Guna***	***Virya***	***Vipaka***	***Prabhava***
Tikta, Kasaya, Madhura, Katu	*Laghu, Tikshna, Rukshna*	*Anushna*	*Katu*	*Tridosha shamaka, Vishaghna*

Table 2: *Karma* (Pharmacodynamics) and *Prayoga* (uses) of *Shirisha*.

Karma	Prayogas	Reference
Visarpaghna (Anti-Erysipelas)	*Shosha, Kasa, Vrana, Visha*	*Bhavaprakash Nighantu* (7)
Vishahara (Anti-Poisonous)	*Pama, Kushtha, Kandu, Twakdosh*	*Raja Nighantu* (8)
Raktastambhana (styptic), *Balya* (tonic)	*Arsha, shopha, visarpa, bhagna*	*Shodhala Nighantu* (9)
Tridosha shamana, Varnya	*Kustha, Kandu, Shwasa, Kasa, Vrana.*	*Kayaideva Nighantu*(10)
Tridosha shamana, Varnya	*Kustha, kandu, Shwasha, Kasa, Twaka dosha.*	*Dhanvantari Nighantu* (11)
Vishaghna,(anti-poisonous), *Vedana sthapana* (analgesic)	*Hicca, Shwasa, Visarpa, Sarpa Visha*	*Charaka Samhita* (12)
Shiro virechana, Vishahara, Pitta nashana	*Kustha, Arsha, Ashmari, Visha*	*Susruta Samhita* (13)

Therapeutic attributes of *Shirisha* in classics

Albizia lebbeck Benth has been attributed as par-excellence drug in cases of *Visha*(12). Its bark is used as *Lepa* (external medicament) in erysipelas.(14) *Albizia lebbeck* Benth. Seed is used in *Ardhavabhedaka* and *Unmada* in the form

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of *Nasya*.(15) *Swarasa* of *Shirisha Pushpa* is indicated in *Sarpa visha* (snake bite) with *Sobhanjana* (*Moringa olifera)*(16) and useful in *Hicca*, *Shwasa* along with *Pippli* (*Piper longum)* and *Maddhu*(17). *Panchshirisha Agada*, a preparation of 5 parts of *Albizia lebbeck* Benth. is recommended in the treatment of all types of poisonings.(18) *Amrita Ghrita*(19), *Gandhahasti Agada*(20), *Maha Gandhahasti Agada*(21) and *Shirisharishta*(22) are few compound formulations with *Shirisha* as a component, which have been indicated in cases of *Visha*.

Pharmacological properties of various parts of *Shirisha* in different dosage forms in *Brihatrayi*:

1. Charaka Samhita

	Part used	Dosage form	Disease	Reference
1.	*Beeja* (Seed)	*Shiro virechana (Nasya)*	*Shiraha shoola, Ardhavabhedaka, Kushtha*	*Ch. Su. 2/5*
		Nasya /Anjana	*Unmada*	*Ch. Chi. 9/64-65*
		Pralepa	*Arsha*	*Ch. Chi. 14/53*
		Nasya	*Shiro roga*	*Ch. Chi. 26/184*
		Nasya / Pana / Anjana	*Luta Visha*	*Ch. Chi. 23/200*
2.	*Twak* (Bark)	*Lepa*	*Visha*	*Ch. Su. 3/28*
		Lepa	*Kushtha*	*Ch. Chi. 7/96*
		Siddharthakadi yoga (lepa)	*Unmada*	*Ch. Chi. 9/70*
		Lepa	*Visarpa*	*Ch. Chi. 21/84*
		Amritghrita	*Visha*	*Ch. Chi. 23/242*
		Mulaka taila	*Pleeharoga / Shwasa / Kasa*	*Ch. Chi. 28/172*
3.	*Pushpa* (Flower)	*Swarasa*	*Hikka / Shwasa*	*Ch. Chi 17/114*
		Lepa	*Visarpa*	*Ch. Chi 21/90-91*
		Swarasa	*Visha*	*Ch. Chi 23/52*
		Mrita Sanjivani Agada	*Visha*	*Ch. Chi. 23/54*
		Nasya / Pana / Anjana	*Visha*	*Ch. Chi. 23/193*
		Gandhahasti Agada	*Visha*	*Ch. Chi. 23/71*
4.	*Phala* (Fruit)	*Lepa / Nasya / Pana*	*Visha*	*Ch. Chi. 23/53*
		Lepa	*Medhaka Visha*	*Ch. Chi 23/209*
5.	*Panchanga* (Whole Plant)	*Pana / Lepa*	*Visha*	*Ch. Chi 23/218*
		Maha Gadhahasti Agada	*Visha*	*Ch. Chi. 23/78*
6.	*Patra* (Leaf)	*Swarasa (Nasya)*	*Visha*	*Ch. Chi 23/49*
7.	*Sara* (Heart wood)	*Asava*	--	*Ch. Su. 25/49*
8.	***	*Lepa*	*Tvag dosha*	*Ch. Su. 3/29*
		Maha Kashaya	*Vishaghna*	*Ch. Su. 4/16*
		Maha Kashaya	*Vedana Sthapana*	*Ch. Su. 4/47*
		Agrya dravya	*Vishaghnanam*	*Ch. Su. 25/40*
		Kashaya Skanda	--	*Ch. Vi. 8/144*
		Shiro Virechana	--	*Ch. Vi. 8/151*

		Churna (*Lepa*)	*Kikkisa*	*Ch. Sha. 8/32*
		Kwatha	*Pittaja Prameha*	*Ch. Chi. 6/31*
		Churna (*Lepa*)	*Tvaga dosha, Dadru*	*Ch. Su. 3/4*

*** Part used is not mentioned in the classic.

2. *Sushruta Samhita*

1	*Beeja* (Seed)	*Pratisarana*	*Visha*	*Su. Kalp. 1/50*
		Churna	*Netra Vikara*	*Su. U. 12/28*
2	*Puspa* (Flower)	*Anjana*	*Netra Vikara*	*Su. U. 12/16, 12/31*
		Banshagatwadi agada(lepa,nasya,)	*Luta visha*	*Su. Kalp 5/79*
3	*Phala* (Fruit)	*Shiro virechana*	--	*Su. Su. 39/6*
		Churna	*Avasadana*	*Shu. Su. 37/33*
		Lepa	*Arsha*	*Su. Chi. 6/12*
4	*Panchanga* (Whole plant)	*Kwatha*	*Visha*	*Su. Kalp 5/81*
5	***	*Ghrita*	*Pittaja Ashmari*	*Su. Chi. 7/11*
		Lepa	*Dadru Nashaka*	*Su. Chi. 9/14*
		Vajrak taila	*Nadi Vrana*	*Su. Chi. 9/54*
		Maha Vajrak Taila	*Kushta*	*Su. Chi. 9/59*
		Kwatha	*Hasti meha*	*Su. Chi. 11/9*
		Dhanwantari Ghrita	*Prameha Pidaka*	*Su. Chi. 11/5*
		Lepa	*Shirah Shoola*	*Su. Kalp. 1/36*
		--	*Kushta*	*Su. Su. 38/12*
		Yavagu	*Visha*	*Su. Kalp. 2/45*
		--	*Sarpa Visha*	*Su. Kalp 5/18*

*** Part used is not mentioned in the classic.

3. *Asthanga Hridaya*

1	*Beeja* (Seed)	*Mukha Lepa*	*Vyanga*	*A H Su 22/19*
		Lepa	*Arsha*	*A H Chi 8/24*
2	*Puspa* (Flower)	*Anjana*	*Netra Vikara*	*A H U 11/44*
		Pishanjana	*Netra Vikara*	*A H U 15/31*
		Swarasa	*Shwasa*	*A H Chi 4/32*
		Lepa	*Visarpa*	*A H Chi 18/16*
3	*Twak* (Bark)	*Lepa*	*Kushta*	*A H Chi 19/63*
		Vajraka Taila	*Kushta*	*A H Chi 19/79*
4	*Patra* (Leaf)	*Swedana*	--	*A H Su 17/13*
5	***	*Swarasa*	*Shirah shula*	*A H Chi 20/26*
		Ghrita	*Ashmari*	*A H Chi 11/23*

*** Part used is not mentioned in the classic.

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Ethanobotanical, folk and tribal uses of *Albizia lebbeck* Benth:

Albizia lebbeck Benth. has a long history of use in Indian traditional medicine, particularly for the treatment of Asthma and allergic disorders. *Seeds* are astringent and have values in piles and diarrhea.

Bark has been used in *Ayurveda* for the treatment of bronchial asthma, leprosy, eczema, pruritus, paralysis, gum inflammation, anti-inflammatory agent and worm infestation.(23-27) Though, all the parts of the plant are prescribed in the treatment venomous bites; no part of the plant has antidotal value against either snake or scorpion.(28)

Phytochemical Study:

Leaf contains saponins, tanins and Two new tri-*O*-glycoside flavonols: kaempferol and quercetin3-*O*-α-rhamnopyranosyl (1'6)-α-glucopyranosyl (1'6)-α-galacto pyranosides.(29-30) Pods contains 3',5 dihydroxy4',7 dimethoxy flavone and N-benzoyl L Phenyl alaninol(30). The beans of the plants contain albiginc acid- a new triterpenoid sapogenin(31). Plant bark contain two saponin known as libbekenin A & B, Three Saponin albiziasaponins A, B and C.(32-34) Condensed tannins (7-11%) & d- catechin, libbecacidin, isomers of leucocyanidin, friedellin-3-one, acacic acid, Echinocystic acid and β- sitosterol. A saponin - lebbekenin C, on acid hydrolysis yielded echinocystic acid, glucose and rhamnose.(35-37) The heartwood contains Melanoxetin, d-pinitol, okanin & leucopelangonidin, a stereoisomer (-) melacacidin (7,8,3',4'- tetrahedroxyflavan-3,4-diol), lebbecacidin, two new compounds 2,3-cis-3,4-cis-3,Ω-methyl-melacacidin and 3'-O-methylmelonoxetin-isolated from heartwood(38). Root Saponin characterized as echynocystic acid-3-0-L-rhamnopyranosyl (1→5)- β- D-xylofuranolsyl (1→4)- β-D-glucopyranoside.(39-40) Flower contains Triterpene, saponin, lebbekanin, saponin glycosides, and crocetin lebbekanin-D,F,G&H, the flower on steam distillation gave 4.3% colorless sweet smelling oil and the residue gave lupiol.(41)

Analysis of seed (42):

Seeds are rich in proteins and can be included in animal diets.

Crude fibers	-4.2%
Nitrogen free extract	-45.3%
Crude protein	-39.5%
Ether extract	- 6.8%
Total ash	-4.2%
Moisture	- 8.2%
Pentose	-16.9%
Water soluble gum	-2.3%
Oil	-5.3%

Analysis of heartwood (43):

Ether extract	- 0.96%
Hot water extract	-14.4%
Lignin	-22.0%
Holocellulose	-76.9%
α-cellulose	-45.60%

Analysis of leaves (44-45)**:** Leaves are palatable, nutritious and can be used as fodder.

Dry matter	-36.8 to 44.2%
Crude protein	-20.1to 21.1%
Ether extract	-8.5 to 16.0%
Crude fibers	- 16.7 to 19.0%
Total ash	-10.1 to 10.4%
Total carbohydrate	-52.5 to 61.3%
Calcium	-3.6 to 4.3%
Phosphorus	-0.03 to 0.04%

Pharmacological contrive:

1. **Anti-asthmatic activity:** Clinical studies of stem bark decoction reported significant decrease in WBC, eosinophilic count, ESR, and 56% marked improvement (46). *Shrisharista* was given in 48 cases of bronchial asthma at a dose 40 ml per day for one month. The result indicated

that 36.59% patients got mild improvement, 43.90% patients got moderate improvement and 7.32% patients got marked improvement.(47) *Shireeshadi Ghana Vati* in a dose of 1 gm QID with water provided 40% showed marked improvement and 20% mild improvement in cases of Bronchial Asthma. No adverse reactions were reported.(48) Decoction of the flower in the dose of 50mg/kg body weight has significant action against histamine induced bronchospasm. The activity could be due to smooth muscle relaxation.(49)

2. **Effect on anaphylactic shock**: The decoction of the bark had a significant cromoglycate like action on the mast cells of albino rats. Studies indicate the anti-anaphylactic activity is due to inhibition of the synthesis antibodies and suppression of T-lymphocytes activity.(50) The crude extract of the seeds and a pure saponin fraction at a dose of 0.5 mg/ml had exhibited stabilizing effect on the mast cells in the mesentery and peritoneal fluid of rats subjected to anaphylaxis.(51)
3. **Pulmonary eosinophilia**: Preliminary screening in 35 cases of tropical pulmonary eosinophilia treated with extracts of *Shirisha pushpa* in a dose of 200 mg twice a day with water indicated 82% marked response, 12% good response and 6% poor response. No Adverse Effects were reported in the study.(52)
4. **Anti-tussive activity:** Shirishavaleha exhibited anti-tussive activity on sulphur dioxide induced cough in experimental animals. Result indicated significantly decreased cough episodes in comparison to control group.(53)
5. **Allergic conjunctivitis:** In a comparative clinical study, *Ghana satva* of *Shirisha* bark and *Shirisha Churna* capsules showed encouraging results in all kinds of allergic conjunctivitis.(54)
6. **Anti-fertility activity:** Methanolic extract of pod of *Shirisha* shown anti-spermatogenic activity by reduction in spermatocyte & spermatogonia count, reduction in sperm density & sperm motility and decreased size of testes, epididymis, and seminal vesicle and prostrate in male rats.(55) Oral administration of isolated saponin from bark of *Shirisha* in the dose of 50mg / kg body weight in male rats resulted in a significant decrease in weight of testes, epididymis, seminal vesicle & ventral prostate. No significant changes could be observed in hematological and biochemical parameters as well.(56) Saponins obtained from seeds at dose of 200 mg/kg inhibited copper-induced ovulation in 60% of rabbits and caused marked reduction in average number of bleeding points in the ovaries.(57) The ethanolic extract of pods and root at a concentration of 2% as well as the saponins, lebbekanin-E exhibited spermicidal activity in rats and human semen.(58-60)
7. **Anti-diarrheal activity:** Aqueous and methanolic extracts of *Shirisha* exhibited activity against E. coli & Salmonella species. While Petroleum ether & hexane extracts did not exhibit any activity. None of the extracts showed activity against Shigella & Candida sp.(61) It has also been shown moderate activity against V. cholerae, A.hydrophilis and B. subutilis.(62)
8. **Antimicrobial activity:** The Glycosides isolated from the stem bark exhibited antimicrobial activity against staphylococcus aureus, Pseudomonas aeruginosa, Trichophyton rubrum.(63)
9. **Anti-inflammatory activity**: Methanol extract of bark at the dose of 400mg/kg inhibited 36.68% ($p<0.001$) of edema at the end of 4 hr.(64) Anti-inflammatory effect of Shirishavaleha has been reported significant at the end of 6 hours (60.14%, $p<0.05$) in

comparison to control group (35.55%).(65) Aller-7, a botanical formulation of *Albizia lebbeck* Benth. along with six other plants exhibited potent activity against different inflammatory responses because of mast cell stabilization, lipoxygenase inhibition, hyaluronidase inhibition in number of in vitro models tested.(66)

10. **Analgesic activity:** The peripheral analgesic activity of *Shirisha* was measured by the acetic acid induced writhing test. The bark extract at 400mg/kg dose showed significant ($p<0.001$) reduction in the number of writhes with 52.4% of inhibition.(67) The central analgesic activity of the plant material was studied by measuring the drug induced changes in the sensitivity of the pre screened (Reaction time 2-4 sec) mice to heat stress applied to their tails by using a medicraft Analgesiometer-N (D'Amour and Smith 1941). The crude extract produced 61.48%($p<0.001$) elongation of tail flicking time 30 min after oral dose of 400mg/kg. The plant extract showed prolonged stress tolerance capacity in the mice, indicating the possible involvement of higher centres.(68) The bark administered in a dose of 250mg/kg i.p. showed analgesic activity being less than that of novalgin.(69)
11. **Cognitive behavior and Anti-anxiety Study:** Saponins containing n-butanolic fraction extracted from dried leaves inhibited baclofen-induced hypothermia and passivity in amnesic mice. The studies showed that n-butanolic fraction possesses anxiolytic activity and nootropic activity.(70-71)
12. **Immunomodulatory activity:** Shirishavaleha prepared from *Twak* (Bark) and *Sara* (Heartwood) has shown significant immunomodulatory activity with Heartwood in comparison to Bark.(72)

Conclusion:

The plant has been attributed with a number of activities in the classics. The multi-dimensional activities have been revalidated in recent times on several experimental models and even in well designed clinical trials. The review reveals anti-anaphylactic, anti- asthmatic, anti-diarrheal, anti-spermatogenic, anxiolytic, anti-inflammatory, anti-histaminic etc. activities of the plant in different forms. No study (of pre-clinical or clinical stages) reported any Adverse Reaction with the usage of the plant in crude form; which reveals the safety aspects of the plant.

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