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THERAPEUTIC AND PHARMACOLOGICAL IMPORTANCE OF SHAKHOTAKA (*Streblus asper* Lour.) W.S.R. TO FILARIAL ELEPHANTIASIS

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Abstracts: Filariasis (or philariasis) is a parasitic disease caused by an infection with *Wuchereria bancrofti* worms of the Filarioidea type. These are spread by night-biting *Culex quinquefasciatus* female mosquitoes. Ayurvedic texts have mentioned *Shakhotaka* (*Streblus asper* Lour.), its anti-filarial property in detail. As this is having *Laghu*, *Ruksha Guna*, *Tikta*, *Kashaya Rasa*, *Katu Vipaka*, *Ushna Virya*. By the virtue of above property this is *Vatakaphashamaka*. It is commonly known as Sand Paper Tree is a small rigid evergreen tree occurs naturally in the Himalayas from Himachal Pradesh to West Bengal and in the hills and plains of Assam and Tripura. *Shakhotaka* contains a number of bioactive chemicals, including Some nonprotoplasmic cell contents like alkaloid, tannin, sugar, starch, fat, protein, mucilage, lignin, cutin, react positively with different concentrations of acids, alkalies, salts and dyes. The drug *Shakhotaka* is an effective anti-inflammatory medicine and recommended particularly in treatment of filarial elephantiasis (*Shlipada*), fever, dysentery, diarrhoea, pyrrhoea, leucoderma, prameha as mentioned in classical texts of Indian medicine. The present review is therefore, an effort to give a detailed focus on its botanical details, phytochemistry, pharmacodynamics, etiopathogenesis, therapeutic importance and its pharmacological studies.

Keywords Ayurveda, *Shakhotaka*, *Streblus asper*, *Shothahara*, Filarial Elephantiasis, *Shlipada*.

Introduction: *Streblus asper* Lour (Family: Moraceae) is a small rigid evergreen tree commonly known as Sand Paper Tree, Siamese rough bush, Toothbrush tree, occurs naturally in the Himalayas from Himachal Pradesh to West Bengal and in the hills and plains of Assam and Tripura, ascending to an altitude of 450 meters. It also grows in the peninsular India up to 600 meters, especially in drier parts and in the Andamans. Generally it is found in drier regions of India. Filariasis (or philariasis) is a parasitic disease caused by an infection with *Wuchereria bancrofti* worms of the Filarioidea type^[1]. This disease belongs to the group of diseases called helminthiasis. The most spectacular symptom of lymphatic filariasis is elephantiasis—edema with thickening of the skin and underlying tissues—which was the first disease discovered to be transmitted by mosquito bites^[2]. Elephantiasis results when the parasites lodge in the lymphatic system. The drug *Shakhotaka* is an effective anti-inflammatory

medicine and recommended particularly in treatment of filarial elephantiasis (*Shlipada*) as mentioned in classical texts of Indian medicine. Accordingly the drug is useful in inflammatory conditions and blood disease. Bark is locally applied to swellings and ulcers. Seeds paste is prescribed to apply on lesions of leucoderma. Roots are orally given to snake-bite. Roots are useful in obesity. The decoction of bark is used in diarrhoea, dysentery and piles. Root are prescribed to be internally used in epilepsy. Sometimes the oral use of decoction of bark or root-bark obtained from *Shakhotaka* can cause nausea and vomiting, so it is necessary the consideration of human nature or constitution of body (*prakriti*) and posology (*matra*).

Shakhotaka was started right from the *Samhitas* up to recent research works to obtain thorough knowledge of drug. On comprehensive review of Ayurvedic classics it was found that *Shakhotaka* is described in *Sushruta Samhita*, *Sharangadhara Samhita*, *Nighantus* and

Chikitsagranthas. In *Sushruta Samhita*, it is described as oil cooked with *shakhotaka* juice is useful as snuff and purgative. Moreover, *madhuka-shara* and seeds of *shigru* or *apamarga* are used as pressed snuff^[3]. *Shakhotaka* is mentioned in *Nighantus* also. In *Bhavaprakash Nighantu*, it is described as the properties and synonyms of *shakhotaka*^[4]. In *Raj Nighantu*, it is described as the properties of *shakhotaka*^[5].

It is also mentioned in *Chikitsa Granthas* like *Chakradatta*, it is described as paste of *kiratatikta* mixed with two drops of the juice of *shakhotaka* bark and ghee in double quantity checks upward haemorrhage, cough and asthma(CD.9.24). *Shakhotakabimbadya tail* is used in *gandamala*^[6]. *Bhavamishra*, in his section *Bhavaprakash*, *madhyamakhand* mentions indication of *shakhotaka kwatha* in *shlipada*^[7]. Paste of *shakhotaka* bark pounded with sour gruel alleviates oedema caused by *vata*(VM.44.4). Oil cooked with *shakhotaka* bark and used as snuff alleviates *gandamala* and so does that processed with *bimbi*, *karavira* and *nirgundi*(VM.41.51). Decoction of *shakhotaka* bark mixed with cow's urine should be taken in order to alleviate filarial and obesity (SG.2.2.127;GN.4.2.24; BS.Shlipada.21). A few drops of *shakhotaka* latex mixed in fresh cow-milk should be taken. It alleviates even chronic *prameha* (SB.4.572). The latex of *shakhotaka* destroys *kushtha* (VD.16.116).

Shakhotaka at a Glance: A small rigid evergreen tree. Bark light-grey or greenish with faint ridges, rough when old, juice milky, twigs hairy, scabrid, brown, warty and uneven on the outer surface, light brown and fibrous on the inner surface. Leaves alternate, 2.5-10 cm. long, rhomboid elliptic, obovate or elliptic-oblong, acute, shortly or abruptly acuminate, more or less sinuate or crenate, scabrid on both surfaces but especially beneath lateral nerves 4-6 pairs, raised beneath, joined by intra-marginal hoops, petiole 1.3-5.8 mm. long, stipules rather longer than the petiole, obliquely lanceolate, acuminate.

Flowers dioecious axillary. Male flowers in globose pedunculate, heads 7.5 mm. diam, peduncles 1-4 together, 7.5-13 mm. long. Perianth campanulate, sepals 4 pubescent outside, imbricate in bud. Stamens 4, inflexed in bud, anthers reniform. Female flowers solitary inconspicuous, long peduncled, peduncles 1-4 together, 5-13 mm. long, bracts 2-3 below the perianth. Perianth closely embracing the ovary, sepals 4, enlarged in fruit. Ovary 1-celled ovule, pendulous, styles 2, very long, filiform connate

at the base. Fruits 1-seeded berry, loosely enclosed by the enlarged sepals, yellow when ripe, 5 mm. diameters.

Characteristics of Bark: Bark consisting of phloem, phellogen, phellogen and secondary phloem, moderately thickened and pitted sclerenchyma cells at the periphery of the phellogen, heavily thickened cell wall of phloem fibres differentiated into outer and inner coat enclosing a very narrow lumen, long narrow thickwalled bordered pitted cells associated with the phloem fibres and starch grains, solitary and clustered crystals of calcium oxalate present throughout the bark. It flowers in April and bears fruits during summers or May-June. As regards substitutes and adulterants, the leaves of *Ficus asperrima* Roxb. (*Kharapatra*) may be often mistaken for *Streblus asper* Lour, for its rough leaves. The trees of *Streblus asper* Lour, coppice well and they are good for hedges and other similar purposes. Several root suckers are produced which can be transplanted during the rains^[8].

Chemical Composition: Some nonprotoplasmic cell contents like alkaloid, tannin, sugar, starch, fat, protein, mucilage, lignin, cutin, react positively with different concentrations of acids, alkalis, salts and dyes. Analysis of the root-bark of *streblus asper* gave water extractive 9.53% alcoholic extractive 6.6%, ether extractive 2.8%, total ash 14.0% and acid-soluble ash 5.1%. Free sugars, tannins, potassium chloride are present. The root-bark as such as cardenolides. The total glycosides content in an Indian sample of the air dried root-bark was 0.14%. Ten cardenolide glycosides have been isolated from the ether and chloroform extracts of the root-bark of which six have been obtained in a crystalline form viz. Kantaloside asperoside, pyranoside, strebloside, hatroside, lucknoside. The four ether glycosides were obtained as amorphous powders. The air dried stem bark contains 0.028%, glycosides and also a-amyrin and lupol acetates, B-sitosterol and a-diol.

The leaves of *Shakhotaka* (*Streblus asper* Lour) contain B-sitosterol. They also gave a positive hemolysis test. The milky juice of the plant contains a milk-clotting enzyme and is commonly used like rennet to coagulate milk, however, a bitter flavor is reported in the curd. The chemical analysis plant drug isolated and characterized three new triterpenoids, friedelin, epifriedinol and taxasateryl acetate in addition to known alkaloids. Further investigations isolated a new cardiac glycoside vijaloside in

addition to well known cardenolide asperoside from the roots of *Shahkotaka*.

Chromatographic studies were conducted on leaves of *Shahkotaka* (*Streblus asper* Lour). Dried and milled leaves of plant were extracted with ethanol for 48 hours. The dark green extract was freed from solvent and poured into aqueous acetic (1%) with stirring and left overnight when a green gummy mass separated. The aqueous solution was filtered and

Pharmacodynamics^[10]

Rasa : Tikta, kashaya

Guna : Laghu, ruksha

Virya : Ushna

Vipaka : Katu

Doshakarma : Vatakaphashamaka

Doses of Juice 10-20 ml., Decoction 50-100

ml. Part used is roots, seeds, bark, latex, lea-

ves. Compound formulations are *Shahkotaka*

Ghana Vati, *Shahkotaka Kwatha*, *Shahkotaka*

Bimbadya Taila.

Etiopathogenesis^[11]

Kaphakara ahara-vihara
(Cold & humid Habitat)

→ Kapha-Pradhana
Tridoshprakopa

Tikta, Kashaya rasa
Laghu, ruksha guna
Ushna virya
Katu vipaka

↑
Shahkotaka

→ Doshon ki adhogati

↓
Rasa, rakta, mansa,
medodushti

↓
Vankshana, uru, janu,
jangha men awasthana

↓
Ghana shotha (Lymphoedema)

← Shlipada

Therapeutic Uses: The leaves of plant drug *Shahkotaka* are useful as galactogogus. A paste of leaves is applied to buboes and it is given to check excessive perspiration. An infusion of the leaves as taken as a substitute for tea. The twigs are chewed to make brushes for cleaning teeth and to cure pyrrhoea. The poultice of the roots is applied to ulcers, sinuses, swellings and boils. The powdered root is recommended in dysentery. The decoction of the roots is considered to be given in syphilis. Decoction of the bark is used in fever, dysentery and diarrhoea. Bark is also applied to boils as disinfectant agent.

The latex possesses astringent and antiseptic properties and it is applied to sore heals, chopped hands and glandular swellings. It is considered useful to apply on the head as a sedative in the treatment of neuralgia.

the filtrate gave negative test for alkaloids. The residue was dried, dissolved in benzene and chromatographed over alumina using petroleum ether and benzene successively as eluents. The petroleum ether eluates yielded only a yellow oil while benzene the final purification was achieved by this process. The substances responded the Lichermann Burchard test for sterile^[9].

The seeds are useful in epitaxis, piles and diarrhoea. Externally the paste of seeds is applied in leucoderma. The sweet berries of *Shahkotaka* are edible. Tender leaves are lopped for cattle and elephants as a fodder. The leaves are utilized as a substitute for sand paper for polishing wood, ivory articles, horns and cleaning utensils. The wood chips mixed with tobacco are used for making Burmese cheroots. It is a host plant for the lac-insect.

The plant drug is reported to be useful in cases of cancer, cholera, colic, diarrhoea and dysentery. The leaves extract is used in eye complaint and menorrhagia. The latex is also suggested to use in the pneumonia and the bark is used as stomachic. The bark is used as a remedy in urinary complaints. The fruits are eaten in different parts in country by rural

peoples. Fresh stem bark for medicinal purpose may be collected during the spring.

The drug *Shakhotaka* is an effective anti-inflammatory medicine and recommended particularly in treatment of filarial elephantiasis (*Shlipada*) as mentioned in classical texts of Indian medicine. Accordingly the drug is useful in inflammatory conditions and blood disease. Bark is locally applied to swellings and ulcers. Seeds paste is prescribed to apply on lesions of leucoderma. Roots are orally given to snake-bite. Roots are useful in obesity. The decoction of bark is used in diarrhoea, dysentery and piles. Root are prescribed to be internally used in epilepsy. Sometimes the oral use of decoction of bark or root-bark obtained from *Shakhotaka* can cause nausea and vomiting, so necessary consideration of human nature or constitution of body (*prakriti*) and posology (*matra*).

The drug is generally useful in the diseases caused due to provoked *vata* and *kapha*. The drug is astringent and carminative. The latex of drug (*Shakhotaka payah*) is prescribed to eradicate leprosy (*kustha*). Paste of bark of drug tree pounded with sour gruel is used to alleviate oedema caused by *vata* (*vatajanya shotha*). In treatment of *Prameha*, the drops of latex of plant drug mixed in fresh cow-milk are prescribed for oral use. Decoction of bark of the plant drug mixed with cow's urine has been recommended for use in cases of filarial (*shlipada*) and obesity (*medoroga*). In treatment of *Gandamala-apachi*, the oil is cooked *Shakhotaka* bark and same is used as snuff. The juice of bark is useful in intrinsic haemorrhage (*raktapitta*)^[12].

Pharmacological Studies

Antifilarial Activity: The crude aqueous extract of the stem bark of *S. asper* revealed significant macrofilaricidal activity against *Litomosoides carinii* and *Brugia malayi* in rodents^[13]. *Streblus asper* has been used in the preparation of a few formulations also. *Shakhotaka Ghana Vati* prepared from its stem bark was found to be useful in filariasis^[14]. A series of extraneous investigations involving hundreds of patients infested with filarial parasites have also established its efficacy against filariasis^[15]. The effect of aqueous and alcoholic extract of *S. asper* was also studied on the spontaneous movements of the whole worm and nerve-muscle preparation of *Setaria cervi*, the bovine filarial parasite, and on the survival of microfilariae *in vitro*^[16]. The *in vitro* effects of asperoside and strebloside on *S. cervi* females were also studied^[17]. It was found that

asperoside and strebloside interfere with the glutathione metabolism of the adult *S. cervi*, which cause disturbance in various vital activities of the parasites that ultimately results in the death of the parasites^[18]. A preliminary study of *S. asper* (*shakhotak*) as an antilymphoedematous agent was carried out by Baranwal *et al*^[19].

Cardiotonic Activity: The total ethanolic extract of the root bark of *S. asper* was found to indicate an interesting activity on blood pressure, isolated frog heart, isolated rabbit intestine and guinea pig uterus^[20].

Anticancer Activity: *Streblus asper* has been reported to possess anticancer activity^[21].

Antimicrobial Activity: Ethanol extracts from the sticks and leaves of *S. asper* have been shown to inhibit the growth of *Streptococcus mutans*^[22].

For Oral Hygiene: A single blind and crossover design study was also carried out to study the effect of the mouthrinse containing *S. asper* leaf extract on gingivitis and plaque formation^[23].

Against Anaerobic Bacteria: *In vitro* study was also carried out to determine the antibacterial effects of leaf extract of *S. asper* against the six anaerobic bacteria^[24].

Anti-Allergic Activity: *Streblus asper* showed promising anti-allergic activity in experimental models^[25].

Conclusion: On comprehensive review of Ayurvedic classics it was found that *Shakhotaka* is described in *Sushruta Samhita*, *Sharangadhara Samhita*. Some synonyms of *shakhotaka* like *Kausika*, *Pitaphalaka*, *Bhutavasa*, *Yukavasa*, *Kharacchada*, *Bhutavrksa*, *Gavaksa*, *Ganaksi*, *Ruksapatra*, *Sankhinivasa* described in various *Nighantu*. *Shakhotaka* (*Streblus asper* Lour.) Family: Moraceae is commonly known as Sand Paper Tree, having an anti-filarial property. As this is having *Laghu*, *Ruksha Guna*, *Tikta*, *Kashaya Rasa*, *Katu Vipaka*, *Ushna Virya*. By the virtue of above property this is *Vatakaphashamaka*. The drug *Shakhotaka* is an effective anti-inflammatory medicine and recommended particularly in treatment of filarial elephantiasis (*Shlipada*), fever, dysentery, diarrhea, pyrrhoea, leucoderma, prameha as mentioned in classical texts of Indian medicine.

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