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SHRINGATAKA: A PHARMACOLOGICAL REVIEW

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ABSTRACT

Many food items that we consume on our daily basis possess high therapeutic benefits, *Shringataka* commonly known as *Singhada* is one of those. Ancient texts have numerous evidences of *Shringataka* utility. People consider it as a delicious fruit and prepare nutritious meals for their fasting. It is widely used in treating anorexia, diarrhoea, dysentery, hematemesis, dysuria, abortion. *Shringataka* have various therapeutic values like analgesic activity, anti-diabetic activity, anti-ulcer activity, nootropic activity, neuroprotective activity, immune-modulatory activity, anti-fungal activity, anti-bacterial activity. This review is carrying out to sum up the classical knowledge and pharmacological actions of *Trapa natans bispinosa* (Roxb.) for further exploration on clinical aspects.

KEYWORDS: *Shringataka, Singhada, Trapa natans bispinosa* (Roxb.).

INTRODUCTION

Ayurveda science consider our food to be more potent than medicine to maintain a healthy or diseased state as each and every individual is more comfortable in consuming food regularly despite of taking medicines. Therefore, *Acharya Kashyapa* quoted '*mahabhesaja*' term for *ahara dravya*.[1] *Ahara* is *rasa* dominant and *Aushadha* is *virya* dominant this also makes food to be more interesting over medicines. Worldwide the Ayurvedic products market size reached US$ 4.5 Bn in year 2019 and expected to gain US$ 14.9 Bn upto 2026[2] this data highlights growing trust, resilience, demand of global population and it will definitely open doors for Ayurvedic entrepreneurs in the global markets. Hence, by discovering classical pharmacological aspects related to food items like *Shringataka* one can easily incorporate that knowledge for creating an effective and healthy ways to meet up the primary goals of Ayurveda i.e. maintenance of healthy state and treating diseased ones.[3] We can find

description of *Shringataka* i.e. *Trapa natans bispinosa* (Roxb.) in *Brihattrayees, Nighantus, Bhaishjyaratnavalli* and many more classical texts. In Latin, *Trapa* means an ancient weapon *kalkitrapa* with four spikes; *bispinosa* indicates having two spines. It is being commercially cultivated in Africa, Indonesia, Srilanka, Pakistan. There fruits are abundantly found in Uttar Pradesh, Bihar, Kashmir, Assam, Orissa in the month of October to March. This review circumscribes Botanical description, Classical review, Pharmacological properties related to Shringataka.

MATERIAL AND METHODS

The Literary evidences are collected from various Ayurvedic classical texts like *Samhitas (Charak Samhita, Susruta Samhita, Astanga Hridya), Nighantus, Chikitsa grantha (Bhaisajya ratnavalli*) and published articles from different search engine like Research gate, Pubmed, Google scholar by using the key words- *Shringataka, Singhada, Trapa Natans Bispinosa(Roxb.)* etc.

Botanical Description

Trapa Natans Bispinosa (Roxb.) is an annual floating herb that is commonly found in ponds and lakes of freshwater. The leaves are rhomboid is shape with red veins on it and have serrated margins, 6-9 cm broad, stalk of leaves is 12-18 cm long and brownish in colour. The flowers are auxiliary, white in colour and have one soft peduncle. Its fruits are obovoid-triangular in shape with 2 cm diameter have two spines, one seed inside having unequal cotyledons, outer coat is dark green and inner pulp is white in colour. The stem is spongy in nature and extends upto 5 metres from base to upper surface of water.[4]

Taxonomical Classification

Kingdom: Plantae

Phylum: Magnoliophyta

Class: Magnoliospida

Subclass: Rosidae

Order: Myrtales

Family: Trapaceae

Genus: Trapa

Subject: *Trapa natans bispinosa* Roxb.

Classical Description [Table: 1,2].

Table 1: Literary Synonyms of *Shringataka.*

Basis of Synonyms	Synonyms	Meaning
Habitat	*Jalaphala, Jalavalli, Ambukanda*	Found in water
Structure	*Shringataka, Shringruho, Shringkanda, Shringamulo, Vishadi, Trikona, Trikantaka, Trika*	Fruit resembles triangular shape, Thorns like horn structure found on its fruit

Table 2: Classification of *Shringataka* in Literature.

Literature	Name	Varga/Gana	Reference
Samhita	*Charak Samhita*[5]	*Madhura Skandha*	Ca.Vi.8/139
	Sushruta Samhita[6]	*Madhura Varga*	Su.Su.42/18
Nighantu	*Abhidhanratnamala*[7]	*Swadu Skandha*	A.R.M.N.1/55
	Abhidhanmanjari[8]	*Shaka Varga*	A.M.5/803
		Ekartha Varga	A.M.3/6
	Bhavaprakash Nighantu[9]	*Phala Varga*	B.P.N.7/77
		Kritanna Varga	B.P.N.12/88
	Dravyaguna Samgraha[10]	*Shaka Varga*	D.G.S.3/41
	Kaiyadeva Nighantu[11]	*Ausadhi Varga*	K.N.1/1620-1621
	Madhav Dravyaguna[12]	*Phala Varga*	M.D.G.21/43
	Madanpal Nighantu[13]	*Shaka Varga*	M.P.N.7/89-90
	Raja Nighantu[14]	*Shatavahadi Varga*	R.N.4/41-42
		Mulakadi Varga	R.N.7/45-46
	Siddhamantra[15]	*Pittaghana Dravya*	S.M.2/37-39
	Shodhala Nighantu[16]	*Guduchiyadi Varga*	S.N.1/165
		Karviradi Varga	S.N.1/36-46
	Soshruta Nighantu[17]	*Vidarigandhadi Gana*	So.N.2/13-33

Pharmacological Property

Shringataka (Trapa bispinosa natans Roxb.) constitutes *rasa madhura* and *kashaya*, *guna guru* and *sara*, *virya shita*, *vipaka madhura*. It possess *Tridoshahara* effect (mitigate *Vata, Pitta and Kapha dosha*). It comprise therapeutic activities such as *vrishya* (aphrodisiac), *balya* (enhance strength), *shukrala* (enhance sperm quantity and quality), *dahaprashmana* (burning sensation), *mutrala* (diuretic), *ruchiprada* (appetiser), *vishtambhi* (absorbent), *trishnanigrahana* (polydipsia). It is indicated in various ailments like *Raktapitta* (Bleeding disorders), *Grahani* (IBS), *Prameha* (Diabetes Mellitus), *Shosha* (Tuberculosis), *Atisara* (Diarrhoea), *Shopha* (Oedema).[Table 3]

Shrigataka encompasses ample quantity of minerals like Sodium, Potassium, Calcium, Zinc and Vitamin B (including B1, B2, B5, B6), A,E,C. Alkaloids presence in these plants act as

Anaesthetic, Anti-cholinergic and Spasmolytic agents. Flavonoids plays major role in preventing Platelet aggregation.

Table 3: Pharmacological Properties of *Shringataka* as described in *Nighantu.*

Nighantu/Samhita	*Rasa*	*Guna*	*Virya*	*Vipaka*	*Karma*	*Doshaghanta*
Bhavprakash Nighantu[18]	*Swadu*	*Guru*	*Shita*	-	*Vrishya*(aphrodisiac), *Deepan*(stimulate digestive fire), *Grahi*(absorbent), *Sukrala*(enhance sperm quality and quantity), *Sleshmala*(increase *kapha*), *Raktapittahara*(promote stasis of blood)	*Vata-Pittahara*
Raja Nighantu[19]	-	*Laghu, Sara*	-	-	*Raktapittahara*(promote blood stasis), *Vrishyatama*(aphrodisiac), *Shramahara*(antifatigue), *Shophara*(diuretic), *Ruchiprada*(enhance appetite), *Mehandardya*(correct penile dysfunction) *Tapahara*(manage burning sensations of)	*Tridoshahara*
Shodhala Nighantu[16]	*Madhura, Kashaya*	*Guru*	-	-	*Vrishya*(aphrodisiac), *Jivan*(nutritive), *Mehahara*(anti-diabetic), *Vatala*(increase vata)	*Pittashamaka, Kaphahara*
Sushruta Samhita[20]	-	*Guru*	*Shita*	-	*Vishtambhi*(absorbent, useful in conditions like IBS)	-

Table 4: Formulations of *Shringataka.*

Ayurvedic text	Indication	Dose form	No.	Textual Reference
Charak Samhita	*Nastashukra*, *Kshataksheena* (Chest Injury), *Dourbalya* (General debility), *Kasa* (Cough), *Hikka* (Hiccough), *Putrada* (Fertility), *Vami*(Vomitting), *Yoniroga* (Gyanecological disorders), *Mutramyapham* (Urinary Tract Infections)	*Amritaprash ghrita* (Medicated ghee)	2	Ca.Ci.11/35
	Paittika Mutrakrichra (Urinary Tract Infections)	*Kwatha* (Decoction)	8	Ca.Ci.26/50
Sushruta Samhita	*Stanyajanana* (Galactogogue)	*Ahara* (Diet)		Su.Sa.10/34
	Raktasrava in *garbhini* (Placenta Previa or Implantation bleeding)	*Kwatha* (Decoction) with milk		Su.Sa.10/61
	Garbhasravahara in seventh	*Kwatha* (Decoction) with milk		Su.Sa.10/65

	month (Placental Abruption)			
	Asthi Bhagna (Fractures)	*Gandha taila* (Oil)		Su.Ci.3/61
	Vatika Vatarakta (Gout)	*Kwatha* (Decoction)		Su.Ci.5/7
	Prameha (Diabetes Mellitus)	*Kwatha* (Decoction) with *yavagu*		Su.Ci.11/10
	Visarpa (Erysipelas)	*Lepa* (Ointment)		Su.Ci.17/6
	Kshataja Trishna (Polydipsia)	*Kwatha*(Decoction)		Su.U.48/24
Bhaisajayar atnavalli	*Agnimandya* (Dyspepsia), *Sutikagadapha* (Post Natal Disorders), *Atisara* (Diarrhoea), *Grahani* (IBS)	*Saubhagyashunthipak* (Granule)	2	B.R.25/381
	Parinamashula (Duodenal Ulcers), *Amlapitta* (Gastritis), *Pradara* (Leucorrhoea), *Mutrasangapaha* (Urinary difficulties)	*Pugarasayana/khanda* (Granule)		B.R.30/196

Pharmacological Activity

Analgesic Activity

T.bispinosa roots at dose of 200-400mg/kg was evaluated against Pentazocine(standard drug) at a dose of 30mg/kg on adult Swiss albino mice and evaluated by tail flick, tail immersion method. Both doses of methanolic extract showed significant analgesic activity ($P<0.01$). In tail flick method after 45 minutes 200mg/kg extract showed significant results ($P<0.01$) and for tail immersion significant results were observed after 30 minutes interval.[21]

Antidiabetic Activity

T.bispinosa fruit peels at dose of METN orally 100-200mg/kg were evaluated for 15 days on wistar rats in which Normoglycemic and Diabetic rats (induced by Streptozotocin single dose through intraperitoneally). Significant results ($P<0.001$) were obtained, Hypoglycaemic effect observed in normoglycemic and antidiabetic activity in diabetic (induced) rats.[22]

Antiulcer Activity

T.bispinosa fruits 50% ethanolic extract at two doses by using the models of pyloric ligation and aspirin plus pyloric ligation in wistar rats exhibit Antiulcer activity due to transformed state of mucosa of stomach and rise in total carbohydrate content.[23]

Neurological Activity

T.bispinosa at doses of 250/500mg/kg (p.o) of hydro-alcoholic extract in laboratory animal exhibit reduction in transfer latency, enhanced differentiating index for recalling objects. In addition it also mitigate latency memory, due to augmented cholinergic function.[24]

Nootropic Activity

T.bispinosa hydro-alcoholic extract at doses of 250 and 500mg/kg in mice enhanced Passive Avoidance Response (PAS), object distinguish and Transfer Latency (TL).[25]

Neuroprotective Activity

T.bispinosa hydro-alcoholic extract at dose of 500mg/kg (p.o) in female albino mice in which aging induced in 15 days by using 0.5mL 5%D-galactose. Reduction in fluorescence product in cerebral cortex is noted along with rise in inhibited lipid per-oxidation, restored glutathione peroxidise and catalase activity of cerebral cortex.[26]

Immuno-modulation Activity

T.bispinosa fruit's aqueous extract estimated in rats against sheep RBC's as an antigen. TBAE oral administration enhanced immune-modulation response. Significant increase ($P<0.05$) noted by gain in mean foot pad thickness after an interval of 2 days and production of Humoral as well as Cellular Antibody Response.[26]

Anti-fungal and Anti-microbial Activity

T.bispinosa fruit varieties ethanolic and petroleum extract found to perform antifungal activity but the wild variety found more potent as compared to green and red variety of the same plant. It also showed significant Cytotoxic activity and antimicrobial effect against gram-negative, gram-positive microbes.[27]

Anti-bacterial Activity

T.bispinosa two varieties (i.e. red and green) fruit methanol extract by disc diffusion method were evaluated. The green variety exhibits maximum antibacterial activity against Shigellasonnei and Staphylococcus aureus (concentration of 600mg Kanamycin). The red ones exhibit high antibacterial activity against Bacillus subtilis (concentration of 600 micron).[27]

DISCUSSION

Shringataka is recognized as *Trapa bispinosa* Roxb. or *Trapa natans* that is widely used in India as fruit and nutritious meal. Despite this it also possess abundance of medicinal properties. In Ayurvedic texts, *rasa* of *Shringataka* is described as *madhura* but in *Shodhala Nighantu* it is documented as *madhura* along with *kashaya rasa*. The obvious reasons could be explained for *madhura* and *kashaya rasa* could be explained by the presence of high sugar

content i.e. *Madhura rasa* in initial tender fruiting but in later stages fruit get matured and sugar content convert into starch that produces *kashaya rasa*. *Guna* of *Shringataka* is mentioned as *guru* but in *Raja Nighantu* it is described as *laghu*, *sara* and in API as *guru*, *laghu*. The probable reason behind the presence of the contrasting properties *guru*, *laghu* together in *Shringataka* due to effect of *kala* (time), *avastha* (state) and *rasa*, initially it is *madhura rasatmak* that exhibit *guruta* but when it attains maturity *kashaya rasatmakta* develops due to transformation of *guru* property into *laghu*. *Virya* is described as *shita* for *Shringataka*. *Vipaka* is documented as *madhura* in API. The indications are broadly seen for internal administration in conditions like *kshata/ kshya* (i.e. Debility due to chronic diseases such as Tuberculosis, Irritable Bowel Disease, Anaemia, Jaundice, Bleeding disorders like Haemorrhoids etc.), *daha* (i.e. Increase in body temperature in conditions like Urinary tract infections, Tuberculosis etc.), *stambhana* (i.e. Reduction in excessive bodily secretions like sputum, mucus or haemostasis in ailments like Pulmonary tuberculosis, Irritable Bowel Syndrome, Implantation bleeding etc.). Numerous therapeutic effects have been documented for *Shringataka* (*Trapa bispinosa* Roxb.) such as Analgesic activity, Antidiabetic activity, Anti-Ulcer activity, Nootropic activity, Neuroprotective activity, Immuno-modulator activity, Anti-microbial activity in Experimental or In-Vitro study.

CONCLUSION

Shringataka is the abundant source for many nutritious elements that contributes toward its pharmacological and medicinal importance. It is the key ingredient to prepare many beneficial formulations as mentioned in the Ayurveda treatise. The active or principle components responsible for executing various therapeutic activities are *madhura-kashaya rasa*, *guru-laghu guna*, *shita virya*, *madhura vipaka* that alleviates *pitta dosha*. On thorough review of all properties of as described in literatures, *Shringataka* should be incorporated in retrieving from chronic diseases like *Rajyakshma*, *Grahani*, *Pandu*, *Kamala* etc. in form of medications or meals. For the maintenance of good health one must adopt nutritive, easily available solutions *Shringataka* can be one of the potent drug. Hence, clinical studies should be conducted to explore the textual indications.

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