**Trapa bispinosa** Roxb.: An Ethnopharmacological Review

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**ABSTRACT**

Water chestnut (*Trapa bispinosa* Roxb.) commonly known as *Singhara* in India. It is an annual, floating-leaved aquatic plant of temperate and tropical freshwater wetlands, rivers, lakes, ponds and estuaries. Native to Eurasia and Africa, water chestnut has been widely gathered for its large nutritious fruits since the Neolithic. It is now a species of conservation concern in Europe and Russia. It has been used in traditional system of medicine like Unani and Ayurveda since centuries for many medical conditions like strangury, dysuria, polyuria, sexual debility, general debility, sore throat, lumbago, bilious affections and dysentery etc. Modern researches have supported its traditional uses and also explored other important properties such as Analgesic, antibiotic, antidiabetic, immunomodulatory, neuroprotective etc. This article is aimed to provide a brief traditional and ethnobotanical description of the plant.

**Keywords:** Ayurveda. Immunomodulatory. *Singhara.* *Trapa bispinosa.* Unani.
INTRODUCTION

Trapa bispinosa Roxb. is commonly known as Water chest nut which belongs to the family Trapaceae. It is an aquatic herb occurring throughout the greater parts of India in lakes, tanks and ponds. The plant is found in tropical, sub-tropical and temperate zone of the world (Anonymous 1976 and Anonymous 2003). It is commercially cultivated across different parts of India for its consumable seasonal fruit commonly known as Singhara which is a good source of nutrition having considerable amount of carbohydrate, protein and vitamins. Traditionally, the plant has been used in India for several important medicinal purposes. It has been used as nutritive, astringent, aphrodisiac, cooling, appetizer, tonic, anti-diarrhoeal etc. In Unani system of medicine it is being used in various diseases like sexual weakness, sore throat, bilious affections, bronchitis, tuberculosis, renal calculi and fatigue etc. (Ghani N 2002 and Abdul Hakeem M 2002) (Kabeeruddin M 2010). Recent experimental and clinical studies explored its Hepatoprotective (Kar D et al. 2004), Anti-microbial (Rahman MM et al. 2000), Anti-bacterial (Rahman MM 2001), Anti-tumor (Irikura T et al. 1972), Anti-oxidant (Song M et al. 2007) and Free radical scavenging activities (Kim B et al. 1997).

TAXONOMY

Kingdom : Plantae
Subkingdom : Tracheobointa
Division : Magnoliophyta
Class : Magnoliopsida
Subclass : Rosidae
Order : Myrtales
Family : Trapaceae
Genus : Trapa
Species : bispinosa (Itis 2012)

VERNACULAR NAMES

English: Water chest nut; Bengali: Paniphal; Persian: Singhara; Gujarati: Singora; Hindi: Simghara, Simghada; Kannada: Singara; Malayalam: Karimpolam, Vankottakkaya; Marathi: Shingade; Sanskrit: Smgtakah, Jalphala; Tamil: Chimmahara; Telugu: Kubjakamu; Urdu: Singhara. (Prajapati ND 2005; Ghani N 2002; Kabeeruddin M et al. 2010)

BOTANICAL DESCRIPTION

It is an annual aquatic floating herb found in lakes and ponds. Floating leaves are rhomboid in shape, 2 - 6.5 cm in diameter, dark green above and reddish purple beneath, broader than long, denticulate, dentate, serrate or incised with entire base,
apex acute, red and densely pubescent or villous beneath (Saxena HO et al. 1995) flowers are white (Ghani N 2002). Fruit is obovoid, triangular with two horns, one seeded, and green in fresh condition but after drying it becomes blackish; pulp of the fruit is whitish, sweet in taste (Kabeeruddin M 2010 and Saxena H O et al. 1995).

**Fig. 1 Fruits of Trapa bispinosa**

**Fig.2 Trapa bispinosa plant**

**PARTS USED**

Fresh and Dried fruits (Ghani N 2002; Kabeeruddin M 2010 and Saxena H O et al. 1995)

**USES IN UNANI MEDICINE**

Sexual debility, Spermatorrhea, General debility, Fatigue, Tuberculosis, Intermittent fevers, Dysentery, Dry cough, Bilious affections (Ghani N 2002 and Abdul Hakeem M 2002); Bleeding disorders, Anal fissure, Lumbago, Dental caries (Ghani N 2002) and Sore throat (Kabeeruddin M 2010).

**ETHNOBOTANICAL DESCRIPTION**

**Actions:** Aphrodisiac, Astringent, Appetizer, Anti-pyretic, Constipating, Diuretic, Haemostatic, Refrigerant, Nutritive, Anti-diarrhoeal, Tonic (Prajapati ND et al. 2005 and Asima Chatterjee 2010).

**Indications:** Dyspepsia, diarrhoea, dysentery, strangury, intermittent fevers, leprosy, pharyngitis, lumbago, bronchitis, sore throat, haemorrhage, generalised debility, leucorrhea, threatened abortion, dysuria, and inflammation (Prajapati N D et al. 2005; Asima Chatterjee 2010; Khare C P 2007).

**PHYTOCHEMICAL CONSTITUENTS**

Singhara contains many organic and inorganic constituents which are mentioned below:

**Organic constituents:** It contains Carbohydrates and Vitamins viz. Vitamin B-complex (thiamine, riboflavin, pantothenic acid, pyridoxine, nicotinic
Acid), Vitamin – C, Vitamin – A, D-
amylase and considerable amount of
phosphorylase (Khare C P 2007 and Singh
Gagan deep 2010).

**Inorganic constituents:** Acids, minerals,
calcium, phosphorus, iron, copper,
manganese, magnesium, sodium and
potassium (Khare CP 2007 and Singh
Gagan deep 2010). The physico-chemical
characteristics of *Trapa bispinosa* are
shown in Table-1 (Singh Gagan Deep
2010).

**Table 1: Physico-chemical characteristics of *Trapa bispinosa***

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Percentage (Wet basis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>81.12 ± 0.5</td>
</tr>
<tr>
<td>Total soluble solids (° Brix)</td>
<td>7.2 ± 0.2</td>
</tr>
<tr>
<td>Total acidity</td>
<td>0.142 ± 0.03</td>
</tr>
<tr>
<td>Crude lipids</td>
<td>0.36 ± 0.02</td>
</tr>
<tr>
<td>Total ash</td>
<td>1.33 ± 0.04</td>
</tr>
<tr>
<td>Crude fibre</td>
<td>0.72 ± 0.02</td>
</tr>
<tr>
<td>Total proteins</td>
<td>1.87 ± 0.03</td>
</tr>
<tr>
<td>Total sugars</td>
<td>5.63 ± 0.04</td>
</tr>
<tr>
<td>Reducing sugars</td>
<td>1.27 ± 0.02</td>
</tr>
</tbody>
</table>

**SCIENTIFIC REPORTS**

**Analgesic activity:**

Analgesic activity of the methanolic extract of the *T. bispinosa* root at a dose of 200mg/kg and 400mg/kg was evaluated against the standard drug pentazocine at a dose of 30mg/kg. Adult Swiss albino mice of either sex of six numbers in each group were undertaken for study and evaluated by tail flick and tail immersion method. The both doses of *T. bispinosa* roots methanolic extract were found to produce significant (p < 0.01) analgesic activity. In tail flick method, the extract at 200 mg/kg showed significant activity (P<0.01) after 45 minutes but in tail immersion method, the extract showed significant activity at all tested dose levels after 30 minutes interval. The results showed significant analgesic activity against stimuli (Anuj k Agrahari et al. 2010).

**Anti-bacterial activity:**

Antibacterial activities of the fruit extract of two varieties (green and red) of water chestnut by the disc diffusion method from methanol extract were studied. The extract
of red variety of water chestnut showed high antibacterial potential (31mm) against *Bacillus subtilis* with the concentration of 600 micron. On the other hand, green variety showed highest antibacterial activities (12mm) against both *Staphylococcus aureus* and *Shigella sonnei* with the concentration of 600 microgram Kanamycin used as standard. In this disc diffusion assay, the methanol extract of red variety was found to have a significant antibacterial efficiency than the extract of green variety of water chestnut. These findings pinpoint the efficiency of these extracts to inhibit microbial growth (Mohammad Razvy A et al. 2011).

**Antidiabetic activity:**
To evaluate the antidiabetic activity of methanol extract of *T. natans* fruit peels (METN) in Wistar rats, the effect of METN on oral glucose tolerance and its effect on normoglycemic rats were studied. Diabetes was induced in rats by single intraperitonial injection of streptozotocin. Three days after STZ induction, the hyperglycemic rats were treated with METN orally at the dose of 100 and 200 mg/kg body weight daily for 15 days. METN at the dose of 100 and 200 mg/kg orally significantly *(p < 0.001)* and dose dependently improved oral glucose tolerance, exhibited hypoglycaemic effect in normal rats and anti-diabetic activity in STZ-induced diabetic rats by reducing and normalizing the elevated fasting blood glucose levels as compared to those of STZ control group (Das Prashanto K et al. 2011).

**Anti-ulcer activity:**
The antiulcer activity of the fruits of *Trapa bispinosa* was studied on Wistar rats. The antiulcer activity of 50% ethanolic extract at two dose levels was evaluated by using pyloric ligation and aspirin plus pyloric ligation models. The tests extract revealed significant antiulcer activity, which might be due to increase in total carbohydrate content and alter state of mucosal barrier of the stomach. The results indicate that the ethanolic extract of fruits of *Trapa bispinosa* is endowed with potential antiulcer activity (Kar DM et al. 2010).

**Neuroprotective activity:**
Effect of hydroalcoholic extract of *Trapa bispinosa* was studied on fluorescence product and biochemical parameters like lipid peroxidation, catalase activity and glutathione peroxidase activity in brain of female albino mice. Ageing was accelerated by the treatment of 0.5 ml 5% D-galactose for 15 days. This resulted in increased fluorescence product, increase lipid peroxidation and decrease antioxidant enzyme like glutathione peroxidase and
catalase in cerebral cortex. After co-treatment with hydroalcoholic extract of *Trapa bispinosa* (500 mg/kg, p.o) there was decrease in fluorescence product in cerebral cortex. Moreover, *T. bispinosa* inhibited increase lipid peroxidation and restores glutathione peroxidase and catalase activity in cerebral cortex as compare to ageing accelerated control group (Ambikar DB et al. 2010).

**Immunomodulatory activity:**

In a study the immunomodulatory potential of aqueous extract of fruits of *T. bispinosa* (TBAE) was scrutinized in experimental animals. The immunomodulatory effect was assessed in rats against sheep red blood cells (SRBC) as antigen by studying cell-mediated delayed type hypersensitivity reaction (DTH), humoral immunity response and percent change in neutrophil count. Macrophage phagocytosis assay was carried out by carbon clearance method in mice. Oral administration of TBAE dose dependently increased Immunostimulatory response. Delayed type hypersensitivity reaction was found to be augmented significantly (p<0.05) by increasing the mean foot pad thickness at 48 hr and production of circulatory antibody titre (humoral antibody response) was significantly (p<0.05) increased in response to SRBC as an antigen. In addition, immunostimulation was counteracted by up regulating macrophage phagocytosis in response to carbon particles. Immunostimulatory property of TBAE further confirmed by elevated neutrophil counts significantly (p<0.01) compared to control values. The result of this study suggests that aqueous extract of fruits of *T. bispinosa* could stimulate the cellular and humoral response in animals (Ambikar D B et al. 2010).

**Neuropharmacological activity:**

The different doses (100, 250, 500 mg/kg, p.o) of hydroalcoholic extract of *Trapa bispinosa* were administered in laboratory animals. The effects of extract on various parameters like motor coordination, spontaneous Locomotor activity, object recognition, transfer latency, anxiolytic activity, and sodium nitrite induced respiratory arrest and hypoxic stress etc was studied. The *Trapa bispinosa* (250 & 500 mg/kg) found to decrease time required to occupy the central platform (transfer latency) in the elevated plus maze and to increase discrimination index in the object recognition test, indicating nootropic activity. *Trapa bispinosa* (250 & 500 mg/kg) showed significant increase in reaction time in hot plate analgesic activity. Moreover it also showed significant reduction in spontaneous
locomotory activity and latency memory which may be due to enhanced cholinergic function. It also showed significant analgesic activity (Vyawahare N.S et al. 2010).

**CONCLUSION**

The systematic review of Unani literature indicates that *Trapa bispinosa* has immense potential in the treatment of conditions such as Diarrhoea, strangury, dysuria, polyuria, sexual debility, general debility, sore throat, lumbago etc. The recent pharmacological studies reveal that this has an important Analgesic, antibiotic, anti-diabetic and immunomodulatory activities. The global interest toward traditional medicines is increasing, due to the safe and time tested remedies with lesser side effects. This review directs *Trapa bispinosa* as a potentially safe and effective plant that has immense medicinal values and benefits.

**REFERENCES**


Conflict of Interest statement
The Authors report no conflict of interest.