International Journal of Psychosocial Rehabilitation, Vol. 23, Issue 05,
2019 ISSN: 1475-7192

Trapa Bispinosa: Review on Nutritive & Medicinal Aspects

[1]Bhagaban Mohapatra, [2]Subhaprada Dash

Abstract--- *T. bispinosa belongs to family of trapaceae which is small herb with great medicinal properties. T. bispinosa is an essential ayurvedic medicinal plant that is used to treat problems related to gastointestine, speen, cancer, liver etc. its effectiveness is proved in numerous diseases such as diarrohea, dyspepsia, dysentery, leprosy, tiredness, inflammation, pharyngitis, bronchitis, haemorrhage, pitta, dipsia, burning sensation, urethrorrhea, weakness, fever, liver problem etc. It is perhaps due to phytochemical composition of T. bispinosa with higher mineral contents, ions (Calcium, potassium, sodium, Zinc) and vitamins along with saponins, alkaloids, flavonoids, phenols, H-donation. Nutritional and biochemical analysis of "T. bispinosa" in 100 grams of fruit demonstrates 22.35% and 72% carbohydrate, 4.5% protein, 11% moisture content, fibre. Chemical analysis showed that T.bispinosa is rich in citric acid that can be added to essential dietary supplements. Further analysis showed that it is also rich in Fe and Mn, K. This paper presents, medicinal, nutritious parameters, dietary, phytochemical,as well as pharmacological perspectives of Trapa bispinosa.*

Index Terms--- *Bronchitis, Medicinal, Nutrition, Pharmacology, T.bispinosa.*

I. INTRODUCTION

Trapa bispinosa also called as water chestnut is indeed a yearly, aquatic plant with floating-leaves found growing in lakes, lagoons, and erratic rivers. T. nutans is a floating herb that is from Trapaceae family.It involves flexuose base, ascends in water; and have multiple green roots which are equipped with the parts submerged in water [1]. It have alternating leaves which protrude at above portion of stem, it is 3-6 cm long with rhomboid shape and truncate base, mixture of purple and red at bottom with dilated petiole around apex.T.bispinosa is widely cultivated in India with a local name of water chestnut. They serve as food for living species globally apart from being essential in aquatic ecosystem[2].

It is raised in freshwater lakes across Asia and Africa, sometimes grown for requirement of edible fruit.The pharmaceutical values of entire herb as well as fruit is considered as a curing agent for numerous diseases in traditional medicine.Trapa bispinosa is annually cultivated aquatic plant distributed throughout the globe in "tropical, subtropical and temperate" areas. It is naturally raised in south Europe, as well as Africa. From Neolithic period it has been produced in Europe.it is widely consumed in diets by European folks because of its nutritional properties and also It is imported to Northern America in late 70's[3]. It has been found in lumbering streams, wetlands, lakes and lagoons and is widely grown in Asia. This prefers nutritional-rich water with pH ranging from 6.6 to 8.3 and CaCo3 alkalinity from

Department of Agriculture, Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar,
bhagabanmohapatra@soa.ac.in, subhapradadas@soa.ac.in

Received: September 2019 | Revised: October 2019 | Accepted: November 2019

11 to 130 mg / L.

Trapa bispinosa is used as decorative plant in Europen countries. Dispersal is restricted due to the enormous, floating nuts, while in northern states T.bispinosa persisted and expanded.In India T.bispinosa is called as singhara and most widely grown and consumed largely. The fruits of singhara are cooked or eaten as raw. When the fruit has been dried, it is ground to a flour called singhare ka atta that is used in many religious rituals and can be eaten in the traditional Indian festival "Navratri" as a Phalahar diet during the Hindu fasting days[4]–[6]. Dried singhara are consumed as flour commonly known as "singhare ka atta". Singhara flour is mainly consumed in fasting food during religious rituals.Singhara is a decent nutritional source with a significant amount of carbohydrates, proteins and vitamins.In natural waterbodies, the T.bispinosa also establishes a massive –scale root system. The roots contain chlorophyll pigment and carry out process of photosysnthesis by utilization of light energy from water.

Production of T.bispinosa entirely lies on photosysnthesis mechanism i.e. leaves expands on water surface in order to carry out photosysnthesis.Photosynthesis is mainly performed by two parameters, i) roots submerged in water, ii) leaves present in atmosphere.Leaf photosynthesis displayed C3 type phenotype while root photosynthesis found comparable to "submerged type (SUM)" exhibiting increased "phosphoenolpyruvate carboxylase (PEP Case)"activity and malate formation in root cells during night. Figure 1 represents the pictorial representation of T.bispinosa.

Fig. 1: *T.bispinosa*

Trapa bispinosa consists a large number of non-essential antioxidants, including flavonoids, flavones, maximum amount of phenols. flavonoids are basically rich in anti-oxidant properties and are widely found in tissues that include fruits, seeds, vegies, nuts, leaves in enormously higher concentrations[7], [8].Seed extraction of T.bispinosa showed

Received: September 2019 | Revised: October 2019 | Accepted: November 2019

availability of saponins, carbohydrates, lipids, sterols. Pericarp extraction of T. bispinosa demonstrated the availability of flavonoids, steroids, phenols, tannins. Table 1 represents the flavonoid and phenolic content of T.bispinosa extract.

Table 1: Flavonoid and phenolic content of T.bispinosa extract

Extract	Phenolic content (µg GAE/mg extract)	Flavonoids content (µg GAE/mg extract)
$(CH_3)_2CO$:DCM:MeOH	7.924±0.03:744±0.37	4±0.02:492±0.57

MINERAL COMPOSITION

Numerous organic & inorganic compositions are present in the *T.bispinosa*.

I.I. Inorganic components:

Minerals, Ca, P,Fe,Cu,Mn,Mg,Na, K and physical and chemical characterstics of T.bispinosa are illustrated in table 2 & 3 respectively·

Table 2: Mineral Composition of *T.bispinosa*

MINERALS	COMPOSITION
Calcium	366±0.3
Potassium	99±1.25
Sodium	37.5±0.35
Zinc	7±0.15
Barium	0.49±0.34
Chromium	0.1±0.03

Table 3: Physical & Chemical Characterstics of *T.bispinosa*

COMPONENTS	PERCENTAGE COMPOSITION
Moisture	82%
Total proteins	2%
Total ash	1.5%
Crude fibre	0.8%
Total acidity	0.15%
Total soluble solids	8%
Crude lipids	0.5%

Biochemical analysis of T.bispinosa fruit in 100 grams of fruit demonstrates 22.35% and 72% carbohydrate, 4.5% protein, 11% moisture content, fibre, with fat & ash contents of about 71%, 7.5%, 2.1% respectively[9], [10]. The mineral composition of seeds found was in the range of 0.1- 366 mg including calcium, potassium, sodium, zinc, barium, chromium with composition of 366±0.3, 99±1.25, 37.5±0.35,7±0.15,0.49±0.34,0.1±0.03.

I.II. Organic components:

T.bispinosa consists of numerous organic components which are illustrated in the table 4.

Received: September 2019 | Revised: October 2019 | Accepted: November 2019

Table 4: Organic Components of *T. bispinosa*

COMPONENTS	TYPES
Carbohydrates	• Amylase • D-amylase
Vitamins	• Vitamin B complex • Thiamine • Riboflavin • Pantothenic acid • Pyridoxine • Nicotinic acid
Phosphorylase	
Cycloeucalenol	
Ursolic acid	
2β,3α,23-trihydroxyurs-12-en-28-oic acid	

II. NUTRITIONAL PARAMETERS

Biochemical content of water chestnut fruits has been studied and it has been observed that water chestnut can be the excellent sources of carbohydrates, proteins and minerals essential for human consumption.

Nutritional content of *T.bispinosa* showed moisture content of 60.7%, ash content of 1.06%, reducing sugar content of 0.35%, total soluble sugar content of 0.1%, non-reducing sugar content of 0.6%, 8.8% starch, 0.9% lipid. 100 gm of water chestnut contains 0.3mg of protein that is water soluble, 60 µg of beta carotene, 1.3mg of vitamin C, and phenol content of 0.6 mg. mineral content of green variety of singhada lies in the range of 0.3%w/w to 7% w/w. The mineral content of red varities of singhada contains mineral content in the range of 0.5% w/w to 8.5% w/w. Presence of Cys, Arg, Pro, Gln, & Asn amino acids are present in both red & green varieties of *T.bispinosa* thereby signifying the importance of *T.bispinosa* human nutrition. Apart from this, *T,bispinosa* have different pharmacological activity on various species. Table 5 illustrates the pharmacological activity of *T,bispinosa* on different species.

Table 5: Pharmacological Activity of *T.Bispinosa* on Different Species

Species	Pharmacological properties
Rats	Immunomodulatory Anti-ulcer Analgesic Anti-diabetic
Fungi	Anti-fungal Anti-fungal peptides
Female swiss albino mice	Neuroprotective
In vitro methods	Anti-oxidant activity Anti-cancer activity Enzymatic activity
Bacteria	Anti-bacterial activity
Yeast	Physical & sensory properties of starch

Received: September 2019 | Revised: October 2019 | Accepted: November 2019

III. PHARMACEUTICAL ADVANTAGES

III.I. Pharmaceutical excipients

Strach from water chestnut is found of possess similar physiochemical and binding activities equivalent to standard starch. In contrast with Solanum tuberosum and corn starch, physiochemical property of T. bispinosa starch is evaluated. The shape of the granule observed is oval, and diameter of particle is 20–140 μm. Hydration and swelling response of theT.bispinosa is very similar to corn &Solanum tuberosum starch which make them effective pharmaceutical excipient to be used as a binding agent.

III.II. Stability of freeze thaw

The concentration of salt in the T.bispinosa plays crucial role in the increasing the stability of freeze Thaw. As the concentration of salt increases, stability of the freeze also increases i.e.gel becomes stable at lower temperature. Maximum stability is seen on adding NaCl at varying concentrations as NaCl is hydrophilic in nature which increases the holding capacity of starch for water thereby limiting expelling of water.

III.III. Prevents oxidation by metal chelation

T.bispinosa prevents oxidation reaction by chelating the iron from lipid peroxidation reaction thereby preventing oxidation by chelating iron and preventing formation of ferrous and ferrozoin components.

III.IV. Pharmaceutical starch

Starch isolated from T.bispinosa plays an essential role as pharmaceutical additives. The characterization of starch it is found to be crystalline nature and are found to be resistant against acid hydrolysis. Thus it proves that, Starch from T.bispinosa may be effectively used as pharmaceutical additives in formation of drug compound. Figure 2 shows pictorial representation of starch granules isolated from T.bispinosa.

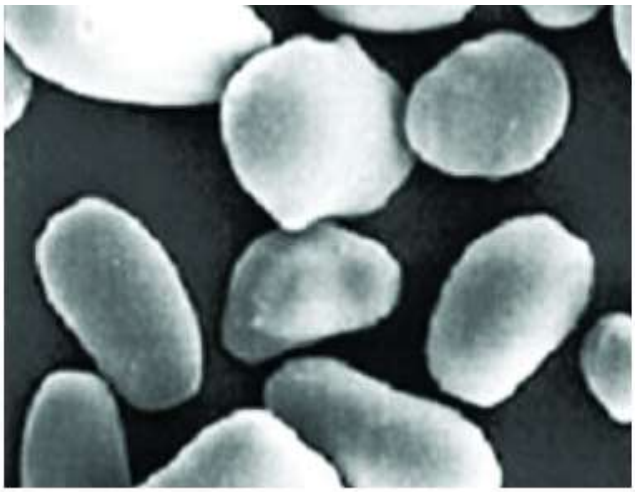

Figure 2: Starch granules extracted from *T.bispinosa*

CONCLUSION

The paper concludes that, T. bispinosa has enormous potential in treating diseases like diarrhoea, stranginess, excessive urination, polyuria, sexual weakness, general weakness, sore throat, and even liver problems. Recent therapeutic studies show that the plant possess important antimicrobial, antibiotic, analgesic, anti-inflammatory,

Received: September 2019 | Revised: October 2019 | Accepted: November 2019

antidiabetic, anti-cancerous activity.The medicinal properties of herbal plant is attracting wide range of people because of its safe, efficacious treatment and low side effects as compared to synthetic medicines. Thus, this review defines T.bispinosa as effective plant with enhanced anti-oxidant activity as well as potent pharmacological and nutritional value.

REFERENCES

[1] H. Yu and S. Shen, "Phenolic composition, antioxidant, antimicrobial and antiproliferative activities of water caltrop pericarps extract," LWT - Food Sci. Technol., 2015.
[2] P. Adkar, A. Dongare, S. Ambavade, and V. H. Bhaskar, "Trapa bispinosa Roxb.: A review on nutritional and pharmacological aspects," Advances in Pharmacological Sciences. 2014.
[3] A. Mewada et al., "Green synthesis of biocompatible carbon dots using aqueous extract of Trapa bispinosa peel," Mater. Sci. Eng. C, 2013.
[4] S. Imtiyaz, M. Anwar, S. Ali, M. Tariq, and S. Chaudhury, "Trapa bispinosa Roxb.: An Ethnopharmacological Review," Soushrutam.Com, 2013.
[5] H. Gao, J. Cai, W. Han, H. Huai, Y. Chen, and C. Wei, "Comparison of starches isolated from three different Trapa species," Food Hydrocoll., 2014.
[6] S. Pandey et al., " Rapid Biosynthesis of Silver Nanoparticles by Exploiting the Reducing Potential of Trapa bispinosa Peel Extract ," J. Nanosci., 2013.
[7] X. L. Li, X. R. Fan, H. J. Chu, W. Li, and Y. Y. Chen, "Genetic delimitation and population structure of three Trapa taxa from the Yangtze River, China," Aquat. Bot., 2017.
[8] R. Sarkar et al., "Structural studies of an antioxidant, immunoenhancing polysaccharide isolated from the kernel of trapa bispinosa fruit," J. Carbohydr. Chem., 2012.
[9] S. Mann, D. Gupta, V. Gupta, and R. K. Gupta, "Evaluation of nutritional, phytochemical and antioxidant potential of trapa bispinosa roxb. Fruits," Int. J. Pharm. Pharm. Sci., 2012.
[10] M. A. Hanif, H. N. Bhatti, M. S. Jamil, R. S. Anjum, A. Jamil, and M. M. Khan, "Antibacterial and antifungal activities of essential oils extracted from medicinal plants using CO2 supercritical fluid extraction technology," Asian J. Chem., 2010.

Received: September 2019 | Revised: October 2019 | Accepted: November 2019