# PHARMACOLOGICAL POTENTIAL OF *TRICHOSANTHES DIOICA* – AN EDIBLE PLANT

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**Abstract**

*Trichosanthes dioica* Roxb. (family: Cucurbitaceae), commonly known as "Sespadula" in English and "Parwal" in Hindi, is widely grown throughout India. Fruits of this plant are used as vegetable in Indian traditional food system from time immemorial. Besides fruits, other parts of the plant, such as the leaves and tender shoots, have also been used in the traditional system of medicine since ancient times. Pointed gourd has been used for overcoming problems like constipation, fever, skin infection, wounds and also improves appetite and digestion. The immature fruits are used as vegetable and as ingredients of soup, stew, curry, sweet, or eaten fried and as dorma with roe stuffing. The present review describes the morphological and pharmacological aspects of *Trichosanthes dioica* and summarizes the most interesting findings obtained in the preclinical and clinical research related to the plant.

**Key words:** *Trichosanthes dioica*, Pharmacology, Cucurbitaceae.

## Introduction

The Indian subcontinent represents one of the richest diverse genetic resources. Of the estimated 250,000 species of flowering plants at global level, about 3000 are regarded as food source; out of which only 200 species have been domesticated. Global diversity in vegetable crops is estimated to be about 400 species of which about 80 species of major and minor vegetables are reported to have originated in India. However, with the advent of cut and burn agriculture, green revolution/commercialized agriculture, the area development projects and the related activities of these diverse resources are declining at a fast pace. Overgrazing, deforestation and over exploitation of native resources under range situations have eroded the biodiversity from this unique ecosystem. Moreover, our traditional knowledge about these important indigenous plant species has also decreased in the younger generation influenced by urbanization. Indigenous plant species provide a variety of products like food, medicines, raw materials and are also an

important source of renewable energy. The Indian subcontinent had been one of the rich emporia of 2500 plant species used in indigenous treatment and food sources[1].

Pointed gourd (cucurbitaceae) is a dioecious perennial herbaceous vegetable. The crop is of Indo-Malayan origin and distribution and is extensively grown in eastern India[2] and to a lesser extent in other parts of South Asia[3].

*Trichosanthes dioica* Roxb. (family: Cucurbitaceae), commonly known as "Sespadula" in English and "Parwal" in Hindi, is widely grown throughout India[2]. Fruits of this plant are used as vegetable in Indian traditional food system from time immemorial. Besides fruits, other parts of the plant, such as the leaves and tender shoots, have also been used in the traditional system of medicine since ancient times[4-6]. Some specific medicinal properties have been identified, viz., hypocholesterolemic, hypoglyceridimic, and hypophospholipemic when shade-dried fruits were mixed in the food of nondiabetic animals[4, 7]. Most recently, its seeds and leaves have also been found as antidiabetic agents by our research group[8, 9]. It also serves as a rich source of vitamin C[4].

**Botany**

The plant is a perennial, dioecious, and grows as a vine (Fig. 1). Roots are tuberous with long taproot system. Vines are pencil thick in size with dark green cordate simple leaves. Flowers are tubular white with 16–19 days initiation to anthesis time for pistillate flowers and 10–14 days for staminate flowers. Stigma remains viable for approximately 14 hours and 40–70% of flowers set fruit. Based on shape, size and striation, fruits can be grouped into 4 categories: (1) long, dark green with white stripes, 10–13 cm long, (2) thick, dark green with very pale green stripes, 10–16 cm long, (3) roundish, dark green with white stripe, 5–8 cm long, and (4) tapering, green and striped, 5–8 cm long[6].

**Figure 1: *Trichosanthes dioica* plant.**

**Pharmacological Property**

**Anthelmintic**

The *in vitro* activities of defatted methanol (MeOH) extract of the leaves from *Trichosanthes dioica* Roxb. (Cucurbitaceae), and its ethyl acetate (EtOAc) and *n*-butanol (*n*-BuOH) fractions was evaluated against *Pheretima posthuma* (Annelida) and *Ascaridia galli* (Nematoda). All the extracts demonstrated concentration dependent paralytic and lethal effects on

*P. posthuma* and lethal effects on *A. galli*. The EtOAc fraction was found to be the most potent followed by the defatted MeOH extract and its *n*-BuOH fraction. *A. galli* was found to be more sensitive than *P. posthuma* against all tests extracts indicating *T. dioica* as an effective nematocide[10].

**Antihyperglycemic**

The study deals with the effect of a single oral dose of the aqueous extract of *Trichosanthes dioica* Roxb. (Cucurbitaceae) seeds in different diabetic animal models. Evaluation of the antihyperglycemic effect in normal, subdiabetic, and mild diabetic animal models is based on fasting blood glucose (FBG) and glucose tolerance test (GTT) studies. The graded doses of the extract, viz., 500, 750, 1000, and 1250 mg/kg body weight (b.w.), were administered orally. It was found that the blood glucose concentration decreased in a dose-dependent manner. The dose of 1000 mg/kg b.w. was found to be most effective with a maximum fall of 30.4% at 6 h during FBG studies in normal rats. However, the GTT studies showed the maximum reduction of 26.6% at 5 h in normal rats. Moreover, in case of sub diabetic and mild diabetic rats, the observed reduction in blood glucose levels was 32.8% and 35.9%, respectively, at 3 h during GTT. The data clearly reveal the significant antihyperglycemic profile of *Trichosanthes dioica* seeds[8].

**Antioxidant**

Antioxidants protect the body against oxidative stress by neutralizing free radicals. Plants contain rich amount of polyphenols which are very potent natural antioxidants. The study was designed to evaluate the relative contribution of different polyphenols such as total phenolics, flavonoids and flavonol contents and their antioxidants activities. For this purpose the total phenolics, flavonoids and flavonol contents of some medicinal plants were determined in the aqueous extracts of leaves of *Trichosenthes dioica*, fruits of *Moringa olifera* and *Ficus bengalensis* as well as seeds of *Emblica officinalis*. Total antioxidant activity of these extracts was monitored by Free Radical Absorbing Power (FRAP) assay. In this paper, those parts of the plants are used for the analysis of aforesaid parameters which are normally overlooked. The total phenolic content of *T. dioica* leaves was about two times more than that obtained from the fruits and seeds of *M. olifera* and *E. officinalis*, respectively. However, the aerial roots of *F. bengalensis* registered presence of least phenolic content. The aqueous preparation from *E. officinalis* exhibited total flavonoid content twice as high as that of the other three plants. The extract from seeds of *E. officinalis* was found to contain highest antioxidant activity as compared to the preparations from other plants. The high antioxidant activity and flavonoids contents in *E. officinalis* seeds indicated that it could be exploited

as an ingredient in developing a potential antioxidant supplement[11].

In another study, antioxidant activity of fruits of *Trichosanthes dioica* (Cucurbitaceae) was evaluated and compared with ascorbic acid (Standard). Anti-oxidant activity of aqueous extract of *Trichosanthes dioica* (TSD) fruits was studied for its free radical scavenging property in different in vitro methods as 1, 1 diphenyl-2- picryl hydrazyl, nitric oxide, reducing power assay and hydrogen peroxide radical method. Different concentrations of aqueous extract of TSD were prepared and evaluated by standard methods. The IC50 values of aqueous extract of TSD were compared with ascorbic acid (Standard) and it was noted that, the extract showed significant concentration dependent free radical scavenging property in all the methods. Results from the study showed that aqueous extract of TSD possess in vitro free radical scavenging activity. The findings could justify the inclusion of this plant in the management of antioxidant activity[12].

**Blood Sugar, Serum Lipids, Lipoproteins and Faecal Sterols:**

Effect of oral administration of 2 ml per day of suspension (in water) of alcoholic extract of whole fruit of *Trichosanthes dioica* (2%) (= 100 g fresh wt. = 7 g dry wt. = 1/15 g of alcoholic extract) with the help of catheter along with basal diet for four weeks have been studied in the normal albino rabbits. It was observed that this extract lowered the blood sugar, total cholesterol, low density lipoprotein cholesterol and triglyceride levels, and increased the high density lipoprotein cholesterol, phospholipid and faecal sterol levels. Such effects are manifested from the very first week of feeding and are statistically significant[13].

**Cholesterol-Lowering Activity**

This study was to examine the effects of single and repeated oral administration of the aqueous fruit extract of *Trichosanthes dioica* (TD) at a dose of 50 ml/kg b.w in normal and streptozotocin-induced diabetic rats. The aqueous fruit extracts of TD (50 ml/kg) were administered orally for 15 days, to normal and diabetic rats. The effect of the fruit extracts on cholesterol and triglycerides, were studied. The body weights of the rats were observed. The effect of the fruit extract was compared with vanadate, a reference drug. In normal rats, the aqueous fruit extract of TD induced significant decrease of plasma cholesterol and triglyceride concentrations 6hrs after a single oral administration ($P< 0.05$), and also in 2 weeks after repeated oral administrations ($p< 0.05$). TD treatment caused significant decrease of plasma cholesterol levels after a single administration ($p<0.01$), and after repeated ($p<0.01$) oral administrations. Significant increase of triglyceride levels was observed 6hrs after a single oral administration of the TD aqueous fruit extract ($p< 0.01$). One week after repeated oral administration of aqueous extract of TD, the plasma triglyceride levels were significantly decreased (p

<0.005). The decreasing trend continued even after 2 weeks (p <0.01). On the other hand, repeated oral administration of TD aqueous fruit extract, caused significant decrease of body weight after 2 weeks of treatment in both normal (p <0.001) and diabetic (p <0.01) rats. The study indicates that the aqueous fruit extract of TD exhibits cholesterol and body weight-lowering activities in both normal and hyperglycaemic rats[14].

**Antidiabetic**

In rats with streptozotocin induced severe diabetes mellitus, aqueous extract of *Trichosanthes dioica* fruits at a dose of 1000mg/kg body weight daily once for 28 days reduced the levels of fasting blood glucose, postprandial glucose, asparate amino transferase, alanine amino transferase, alkaline phosphatase, creatinine, urine sugar and urine protein where as total protein and body weight was increased. No toxic effect was observed during LD50[15].

The scientific evaluation of the antidiabetic efficacy of aqueous extract of *Trichosanthes dioica* fruits on streptozotocin-induced diabetic rats is being presented. The graded doses of the extract, viz., 500, 750, 1,000, and 1,250 mg/kg body weight (bw), were administered orally, and it was observed that the blood glucose concentration decreased in a dose-dependent manner. The dose of 1,000 mg/kg bw showed the maximum fall of 23.8% and 19.1% in blood glucose level (BGL) during fasting BGL and glucose tolerance test (GTT) studies, respectively, of nondiabetic rats. Whereas in the case of subdiabetic and mild diabetic models, the same dose showed reduction in BGL of 22.0% and 31.4% during GTT. The study also involves the first use of laser-induced breakdown spectroscopy as a sensitive analytical tool to detect the elemental profile responsible for the antidiabetic activity of aqueous extract of *T. dioica* fruits that exhibits the antidiabetic activity. High intensities of Ca, Mg, and Fe indicate large concentrations of these elements in the extract, since according to Boltzmann's distribution law, intensities are directly proportional to concentrations. The higher concentrations of these glycemic elements, viz. Ca, Mg, and Fe, are responsible for the antidiabetic potential of *T. dioica* as well as other plant already reported by our research group[16].

**Antipyretic**

Sudarshan churna is very potent Ayurvedic preparation, which is used traditionally as antimalarial and antipyretic formulation. *Swertia chirata* and *Trichosanthes dioica* is key ingredient in Sudarshan churna. The purpose of study was to evaluate antipyretic activity of Sudharshan churna. Aqueous extracts of Sudarshan churna was evaluated for antipyretic activity using two models including hyperpyrexia-induced in rats by brewer's yeast and another one hyperpyrexia induced in rabbits by Typhoid-Paratyphoid A, B vaccine. Like Paracetamol (100 mg/kg, p.o.), Sudarshan churna, showed significant

reduction in elevated body temperature at 200 mg/kg, p.o. On the basis of study, it was concluded that aqueous extract of Sudarshan churna has shown significant antipyretic activity[17].

**Glycemic property**

This study was to screen the glycemic attributes of an aqueous extract of *Trichosanthes dioica* leaves in normal as well as various diabetic models. The variable doses of 250, 500, and 750 mg/kg body weight (bw) of the extract were administered orally to normal and streptozotocin (STZ)-induced sub- and mild-diabetic rats in order to define its glycemic potential. The dose of 500 mg/kg bw was identified as the most effective dose which brings down the blood glucose level (BGL) by 32.9% ($P < 0.001$) at 6 h during fasting blood glucose (FBG) studies in normal rats. However, glucose tolerance test (GTT) showed the maximum reduction of 30.9% ($P < 0.001$) in BGL at 5 h in normal rats with the same dose, whereas the reduction observed was by 40.3% and 88.6% ($P < 0.001$) in sub- and mild-diabetic rats, respectively, at 3 h of glucose administration only. This evidence clearly indicates that the aqueous extract of *Trichosanthes dioica* leaves has good hypoglycemic potential along with a high anti-diabetic profile[9].

**Burn Wound Healing**

The methanolic extract of the plant was selected for assessment of healing potential in the form of simple ointment using full thickness burn wound model in rats. The effect produced by the extract ointment showed significant healing when compared with the control and standard groups. All parameters such as wound contraction, epithelialization period, hydroxyproline content, and histopathological studies were observed significant ($P<0.01$) in comparison to control group[18].

**Hepatoprotective**

The study was carried out to assess the potential of *Trichosanthes dioica* Roxb. (TD) as a hepatoprotective agent in ferrous sulphate (FeSO4) intoxicated rats. Liver damage was induced in Wistar rats by administering ferrous sulphate (30 mg/kg, p.o) on 10th day. Ethanolic and Aqueous extracts of TD at different doses (100, 200 and 400 mg/kg) and silymarin (100 mg/kg) were administered orally for 10 days. TD-200e showed decrease in the levels of AST ($p<0.01$), ALT, TB, ALP and increase in TP ($p<0.05$). TD-200a showed significant decrease in the levels of AST, ALT, TB, ALP and increase in TP levels. The groups treated with 400 mg/kg aqueous and ethanolic extract showed significant ($p<0.01$) reduction in AST, ALT, ALP, TB and increase in TP level. The pretreatment with TD extracts showed profound histopathological protection to liver cells as evident from histopathological studies. Hence it can be concluded that *Trichosanthes dioica* Roxb. has significant hepatoprotective activity[19].

## Conclusion

*Trichosanthes dioica* is a well-known plant used in the Indian system of medicine, besides which folklore medicine also claims its uses especially in diabetics and hepatic diseases, etc. *Trichosanthes dioica* fruit is cultivated in India, Japan, Sri Lanka, China, and Thailand for its vegetable use. Presently there is an increasing interest worldwide in herbal medicines accompanied by increased laboratory investigation into the pharmacological properties of the bioactive ingredients and their ability to treat various diseases. Numerous drugs have entered the international market through exploration of ethnopharmacology and traditional medicine. Although scientific studies have been carried out on a large number of Indian botanicals, a considerably smaller number of marketable drugs or phytochemical entities have entered the evidence-based therapeutics. Efforts are therefore needed to establish and validate evidence regarding safety and practices of Ayurvedic medicines.

## References


1. M. L. Chadha. Indigenous Vegetables of India with a Potential for Improving Livelihoods. International Symposium on Underutilized Plants for Food Security, Nutrition, Income and Sustainable Development 2009; 2: 1-8.
2. Chakravarthy, H.M., 1982. Fascicles of flora of India - 11 Cucurbitaceae. Botanical Survey of India, p. 136.
3. J.B. Mythili, Pious Thomas. Micropropagation of pointed gourd (*Trichosanthes dioica* Roxb.) Scientia Horticulturae 1999; 79: 87-90.
4. Sharma, G., and M.C. Pant. Effects of feeding *Trichosanthes dioica* (parval) on blood glucose, serum triglyceride, phospholipid, cholesterol, and high density lipoprotein-cholesterol levels in the normal albino rabbit. Current Sci. 1988; 57:1085–1087.
5. Sharma G, Sarkar A, Pachori SB, Pant MC. Biochemical evaluation of raw *Trichosanthes dioica* whole fruit and pulp in normal and mild-diabetic human volunteers in relation to lipid profile. *Ind Drug* 1989; 27: 24–28.
6. Singh, K. Pointed gourd (*Trichosanthes dioica Roxb.*). Indian Hort. 1989; 33: 35–38.
7. S.K. Mukharjee, Indian scenario (Abstract-11), 2–4 September, Varanasi, India (1996).
8. Prashant Kumar Rai a; Dolly Jaiswal a; Sandhya Diwakar b; Geeta Watal Antihyperglycemic Profile of *Trichosanthes dioica* Seeds in Experimental Models. Pharmaceutical Biology 2008; 46(5): 360–365.
9. Prashant Kumar Rai, Dolly Jaiswal, Rakesh Kumar Singh, Rajesh Kumar Gupta, and Geeta Watal. Glycemic Properties of *Trichosanthes dioica* Leaves. Pharmaceutical Biology 2008; 46(12): 894–899.

10. Sanjib Bhattacharya, Pallab Kanti Haldar, Ashoke Kumar Ghosh. *In vitro* effects of *Trichosanthes dioica* leaves on annelids and nematodes. Pharmacologyonline 2009; 2: 242-248.
11. Ratnesh K Sharma, Sanjukta Chatterji, Devendra K Rai, Shikha Mehta, Prashant K Rai, Rakesh K Singh, Geeta Watal and Bechan Sharma. Antioxidant activities and phenolic contents of the aqueous extracts of some Indian medicinal plants. Journal of Medicinal Plants Research 2009; Vol. 3(11): 944-948.
12. Yogesh Shivhare, Priya Singh, Rajak H., Patil U.K., Pawar R.S. Antioxidant potential of *Trichosanthes dioica* Roxb (fruits). Pharmacognosy Journal 2009; Vol 1(4): 258-262.
13. Govind Sherma and M.C. Pant. Influence of alcoholic extract of whole fruit of *Trichosanthes dioica* on blood sugar, serum lipids, lipoproteins and faecal sterols in normal albino rabbits. Indian Journal of Clinical Biochemistry 1992; 7: 53-56.
14. Sharmila Banu G, Kumar G, Rajasekara Pandian M. Cholesterol-Lowering Activity of the Aqueous Fruit Extract of *Trichosanthes dioica* Roxb (L.) in Normal and Streptozotocin Diabetic Rats. Journal of Clinical and Diagnostic Research. 2007; 1(6): 561-569.
15. Prashant Kumar Rai, Dolly Jaiswal, Devendra K. Rai, Bechan Sharma and Geeta Watal. Effect of water extract of *Trichosanthes dioica* fruits in streptozotocin induced diabetic rats. Indian Journal of Clinical Biochemistry 2008; 23 (4): 387-390.
16. Prashant Kumar Rai & Sanjukta Chatterji & Nilesh K. Rai & Awadhesh K. Rai & Dane Bicanic & Geeta Watal. The Glycemic Elemental Profile of *Trichosanthes dioica*: A LIBS-Based Study. Food Biophysics 2010; 5: 17–23.
17. Sushil Bhargava, Paridhi Bhargava, Surendra Saraf, Ravindra Pandey, Shiv Shankar Sukla and Rajesh Garg. Evaluation of antipyretic activity of sudarshan churna: an ayurvedic formulation J. Res. Educ. Indian Med. 2008; 11-14.
18. Yogesh Shivhare, Priya Singh and UK Patil. Healing Potential of *Trichosanthes dioica* Roxb on Burn Wounds. Research Journal of Pharmacology and Pharmacodynamics 2010; 02(02): 168-171.
19. Ghaisas MM, Tanwar MB, Ninave PB, Navghare VV, Takawale AR, Zope VS, Deshpande AD. Hepatoprotective activity of aqueous and ethanolic extract of *Trichosanthes dioica* roxb. in ferrous sulphate-induced liver injury. Pharmacologyonline 2008; 3: 127-135.