



REVIEW ARTICLE

PHARMACOGNOSY

TRICHOSANTHES DIOICA ROXB.: AN OVERVIEW**NITIN KUMAR**

Department of Pharmacognosy, Faculty of Pharmacy Babu Banarasi Das National Institute of Technology & Management Dr. Akhilesh Das Nagar, Faizabad Road, Lucknow 227 105 U.P (India)

**NITIN KUMAR**

Department of Pharmacognosy, Faculty of Pharmacy Babu Banarasi Das National Institute of Technology & Management Dr. Akhilesh Das Nagar, Faizabad Road, Lucknow 227 105 U.P (India)

*Corresponding author

ABSTRACT

Trichosanthes, a genus of family Cucurbitaceae is an annual or perennial herb distributed in tropical Asia and Australia. Pointed gourd (*Trichosanthes dioica* Roxb.) is known by a common name of *parwal* and cultivated mainly as a vegetable. Juice of leaves of *T. dioica* is used as tonic, febrifuge, in oedema, alopecia and in subacute cases of enlargement of liver. In Charaka Samhita leaves and fruits find mention for treating alcoholism and jaundice. A lot of pharmacological work has been scientifically carried out on various parts of *T. dioica* but some other traditionally important therapeutical uses are also remaining to proof till now scientifically. According to ayurveda leaves of the plant are used as antipyretic, diuretic, cardi tonic, laxative, antiulcer, etc. It is also used in skin disorder by some communities of Asia traditionally. The various chemical constituents present in *T. dioica* are vitamin A, vitamin C, tannins, saponins, tetra and pentacyclic triterpenes etc.

**KEYWORDS**

Trichosanthes dioica, Cucurbitacin, Diabetes, Hepatoprotective

INTRODUCTION

The plants of Cucurbitaceae family are classified into 110 genera & 640 species. The most important genera are *Cucurbita*, *Cucumis*, *Ecballium*, *Citrullus*, *Luffa*, *Bryonia*, *Momordica*, *Trichosanthes* (more than 30 species) ¹.

Trichosanthes, a genus of family Cucurbitaceae is an annual or perennial herb distributed in tropical Asia, Polynesia, & Australia. Over 20 species are recorded in India of which two namely *T. anguina* & *T. dioica* are cultivated as vegetable. Other important species found in the world are *T. palmata*, *T. cordata*, *T. nervifolia*, *T. cucumerina*, *T. wallichiana*, *T. cuspidata*, *T. incisa*, *T. laciniosa*, *T. kirilowii* etc ².



Figure 1
Leaves and fruits of Trichosanthes dioica

CLASSIFICATION:

Table 1
Botanical classification of Trichosanthes dioica.

Botanical Name	<i>Trichosanthes dioica</i>
Common Name	Pointed Gourd, Parwal
Kingdom	Plantae
Division	Magnoliophyta
Class:	Magnoliopsida
Order	Cucurbitales
Family	Cucurbitaceae
Genus	<i>Trichosanthes</i>
Species	<i>dioica</i>

**ETHNOPHARMACOLOGICAL USES:**

Pointed gourd (*Trichosanthes dioica*) is known by the name of *parwal*, *palwal*, *parmal*, *patol*, *potala* in different parts of India and Bangladesh and is one of the important vegetables of these regions³. The fruits and leaves are the edible parts of the plant which are cooked in various ways either alone or in combination with other vegetables or meats⁴. Juice of leaves of *T. dioica* is used as tonic, febrifuge & in subacute cases of enlargement of liver & spleen⁵. In Charaka Samhitha leaves & fruits used for treating alcoholism & jaundice. Leaves are used in odema and alopecia⁶. It is also used as antipyretic, diuretic, cardiogenic & laxative.

MORPHOLOGY:

The plant is a perennial, dioecious, and grows as a vine. Vines are pencil thick in size with dark green cordate, ovate, oblong, not lobed, rigid, leaves. Roots are tuberous with long tap root system. Flowers are tubular white. 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 categories⁴:

(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

(4) Tapering, green and striped, 5–8 cm long

CULTIVATION:

The pointed gourd is usually propagated through vine cuttings and root suckers. Seeds are not used in planting because of poor germination and inability to determine the sex of plants before flowering. As a result, crop established from seed may contain 50% nonfruiting male plants. Both pre-rooted and fresh vine cuttings are used for propagation. Vine cuttings made in the fall of previous year and rooted during winter. Fresh vines used for field planting should have 8–10 nodes per cutting. The distance between plants is kept between 1.5–2.0 m × 1.5–2.0 m. A female: male ratio of 9:1 is optimum for ensuring maximum fruit set⁷.

CHEMICAL CONSTITUENTS:

Earlier chemical study reveals that in addition to a number of tetra & pentacyclic triterpenes, the toxic bitter principles cucurbitacins (a group of often highly oxygenated tetracyclic compounds with a unique carbon skeleton & almost a carbonyl group in ring C) may be considered as a taxonomic character of Cucurbitaceae.

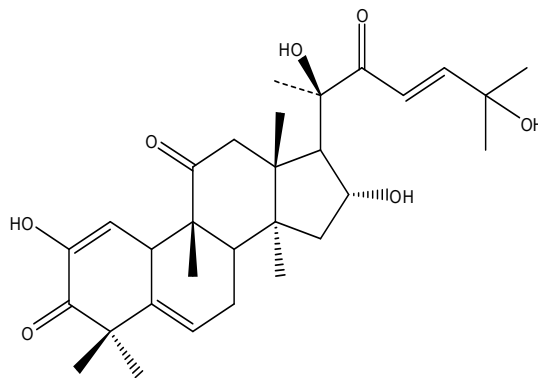


Figure 2
Cucurbitacin- j (Molecular formula- $C_{30}H_{42}O_7$)

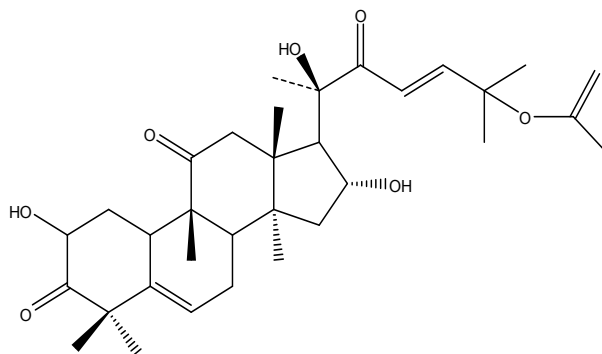


Figure 3
Cucurbitacin-B (Molecular formula- $C_{32}H_{46}O_8$)

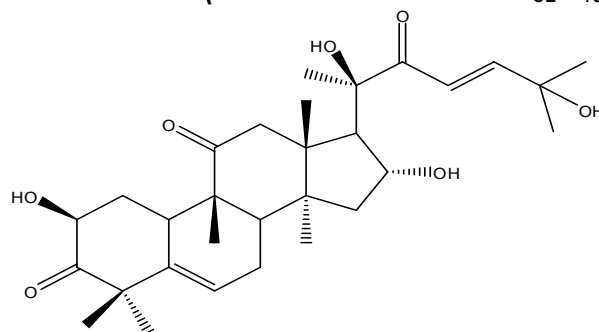


Figure 4
Cucurbitacin-D (Molecular formula- $C_{30}H_{44}O_7$)

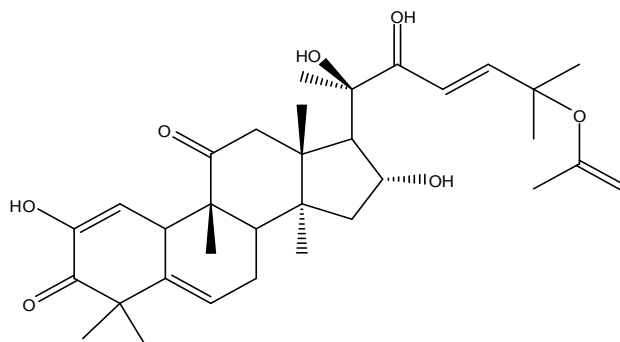


Figure 5
Cucurbitacin- E (Molecular formula- $C_{32}H_{44}O_8$)

Pointed gourd is rich in vitamins and contains 9.0 mg Mg, 2.6 mg Na, 83.0 mg K, 1.1 mg Cu, and 17.0 mg S per 100 g edible part⁸. The seeds of *Trichosanthes dioica* contain a large amount of peptides. The seed peptides have the unique property of being resistant to the action of silver nitrate, a sensitive reagent commonly used to stain proteins⁹. The various chemical constituents present in *T. dioica* are vitamin A, vitamin C, tannins, saponin¹⁰. Phytochemical evaluations of Aqueous and Ethanolic extracts have showed the presence of

saponins & tannins¹¹. The seed extract of *T. dioica* contains 7-oxidihydrokarounidol-3-benzoate as the most predominant component in the highly polar fraction of the nonsaponifiable lipid¹². Two main phytosterols present in *T. dioica* are namely, 24 α -ethylcholest-7-enol & 24 β -ethylcholest-7-enol¹³. Seeds of *T. dioica* also contain lectin, a carbohydrate (specifically galactose) binding protein which is homologous to Type-II ribosome inhibitory proteins (Type-II RIP). Sultan and Kenoth *et al.* (2004) have done



Purification, physicochemical characterization, saccharide specificity, and chemical modification of a Gal/GalNAc specific lectin from the seeds of *Trichosanthes dioica*¹⁴.

Kabir *et al.* (2000) evaluated that the seeds of *T. dioica* contain a large amount of peptides⁹. The seed peptides have the unique property of being resistant to the action of silver nitrate, a sensitive reagent commonly used to stain proteins. Ratnesh K Sharma *et al.* (2009) studied that the total phenolic content of *T. dioica* leaves is about two times more than that obtained from the fruits and seeds of *M. olifera* and *E. officinalis*, respectively¹⁵.

CLINICAL INVESTIGATION:¹⁶

Crude drug *T. dioica* is known to have antiulcerous effect in polyherbal preparation. Two formulations have been clinically investigated as given below:

- 1) Rai and Tripathi, (1968) showed that Patoladi kasaya a polyherbal formulation, consisted of 11 herbs viz., *Patola*, *Haritaki*, *Bibhitaka*, *Amalaki*, *Kutaki*, *Cirayata*, *Amrta*, *Pittapapada*, *Sunthi*, & *Bhrngaraja* exhibited complete improvement in 50% cases & partial improvement in 40% cases with peptic ulcer (10 patients case study).
- 2) Tripathi and Pathak, (1975) evaluated another Patoladi kasaya which consisted of only four herbs namely *Sunthi*, *Patola*, *Amrta*, *Kutaki* in the 33 case study of duodenal ulcer. It kept the patients symptoms/complication free when given in dose of 40 ml/day in two divided doses. It normalized both hyper & hypoacidity of these patient.

Aryavansha *et al.* (1981) studied the efficacy of single herb patola in 20 patients with duodenal ulcer. Effectivity of patola in duodenal ulcer was found 45% excellent response out of 20 cases.

PHARMACOLOGICAL PROPERTIES OF T. DIOICA ROXB.:

ANTIDIABETIC ACTIVITY:

Rai *et al.* (2008) showed 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⁻¹ body weight of the extract were administered orally to normal and streptozotocin (STZ) induced sub- and mild-diabetic rats in order to define its glycemic potential. This evidence clearly indicates that the aqueous extract of *Trichosanthes dioica* leaves has good hypoglycemic potential along with a high anti-diabetic profile¹⁷.

Rai *et al.* (2008) showed that in rats with streptozotocin induced severe diabetes mellitus, aqueous extract of *T. dioica* fruits dose of 1000mg/kg body weight daily once for 28 days reduced the levels of fasting blood glucose, postprandial glucose, aspartate 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. This study suggests that further detailed toxicity studies and mechanism of action of *T. dioica* would be useful for undertaking human trials¹⁸.

Chandrasekar *et al.* (1988) have reported that pointed gourd possesses the medicinal property of lowering blood sugar level in rats¹⁹.

HEPATOPOTECTIVE ACTIVITY:

Ghaisas *et al.* (2008) showed hepatoprotective activity of aqueous and ethanolic extract of *Trichosanthes dioica* (whole plant) in ferrous sulphate-induced liver injury. Ethanolic and Aqueous extracts of *Trichosanthes dioica* at different doses (100, 200 and 400 mg/kg) and silymarin (100 mg/kg) were administered orally for 10 days. The groups treated with 400 mg/kg aqueous and ethanolic extract showed significant reduction in AST, ALT, ALP level. The pretreatment with *Trichosanthes dioica* extracts showed profound histopathological protection to liver cells as evident from histopathological studies. Hence it can be concluded that *T. dioica* Roxb. has significant hepatoprotective activity¹¹.

CHOLESTEROL-LOWERING ACTIVITY:



Sharmila *et al.* (2007) observed cholesterol-lowering activity of the aqueous fruit extract of *Trichosanthes dioica* Roxb. in normal and streptozotocin diabetic rats²⁰.

Sharma & Pant *et al.* (1992) showed influence of alcoholic extract of whole fruit of *T. dioica* on blood sugar, serum lipids, lipoproteins and faecal sterols in normal albino rabbits. Effect of oral administration of 2 ml per day of suspension (in water) of alcoholic extract of whole fruit of *Trichosanthes dioica* (2%) with basal diet for four weeks was 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 levels²¹.

ANTI-INFLAMMATORY ACTIVITY:

Fulzul *et al.* (2001) found anti-inflammatory activity of polyherbal formulation "Jatyadi Ghrita", the ingredients of Jatyadi Ghrita are *Jasmine officinale*, *Azadirachta indica*, *Berberis aristata*, *Curcuma longa*, *Picrorrhiza kurroa*, *Rubia cordifolia*, *Trichosanthes dioica*, *Aristolochia indica*, *Hemidesmus indicus*, *Randio spinosa*, *Glycyrrhiza glabra* & Cow's ghee²².

IN SKIN DISORDER:

Bhujbal (1999) showed that polyherbal formulation including *T. dioica* is useful in skin

disorder. Fifty cases of various skin diseases were treated with decoction of a mixture of *Trichosanthes* & other herbal crude drugs in a dose of 20ml to 40 ml empty stomach with hot water & honey for 4 to 6 weeks. The drug was found to be useful and no side effect was observed²³.

ANTIFUNGAL ACTIVITY:

Hariti & Rathee *et al.* (1996) stated that the fixed oil of seeds of *Trichosanthes* species including *T. dioica* have antifungal property²⁴.

ANTIBACTERIAL ACTIVITY:

Hariti & Rathee *et al.* (1995) showed antibacterial activity of the unsaponifiable fraction of the fixed oil of *T. dioica* seeds against *Bacillus anthracis* & *Xanthomonas malracearum*²⁵.

Rai *et al.* (2010) reported the *in vitro* assessment of antimicrobial activity of different concentration of extract of different part of *Trichosanthes dioica*. Five clinical isolates of different bacterial strains were used and the disc diffusion method was opted. The results revealed that leaves, fruits and seeds of *Trichosanthes dioica* plant may be used as antibacterial agents. Though the leaves extract was active against all five strains, the highest inhibition was observed against *Mycobacterium smegmatis*. Thus the leaves extract could be used for tuberculosis treatment²⁶.

Table 2

Extent of Antimicrobial activity of *Trichosanthes dioica* against certain pathogens.

Leaves extract	<i>M. smegmatis</i> > <i>S. aureus</i> > <i>E. coli</i> > <i>K. pneumonia</i> & <i>P. aeruginosa</i>
Fruits extract	<i>S. aureus</i> > <i>K. pneumonia</i> > <i>E. coli</i> , <i>P. aeruginosa</i> & <i>M. smegmatis</i> (Nil)
Seeds extract	<i>S. aureus</i> > <i>E. coli</i> > <i>K. pneumonia</i> , <i>P. aeruginosa</i> & <i>M. smegmatis</i> (Nil)
Streptomycin	<i>E. coli</i> & <i>P. aeruginosa</i> > <i>S. aureus</i> > <i>K. pneumonia</i> & <i>M. smegmatis</i> (Nil)



ANTI-OXIDANT ACTIVITY:

Shivhare *et al.* (2010) evaluate the antioxidant activity of fruits of *Trichosanthes dioica* (Cucurbitaceae) and compared with ascorbic acid (Standard). Materials and Methods: 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. The findings could justify the inclusion of this plant in the management of antioxidant activity²⁷.

WOUND HEALING ACTIVITY:

Shivhare *et al.* (2010) reported a scientific evaluation for the wound healing potential of methanolic (MeOH) extract of *T. dioica* fruits²⁸.

Shivhare *et al.* (2010) studied methanolic extract of the plant *T. dioica* 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 provides significant healing when compared with the control and standard groups²⁹.

REFERENCES

1. Khare CP, Encyclopedia of Indian medicinal plants, Springer science business media: 458, (2007).
2. The Wealth of India, A Dictionary of Indian medicinal plant's raw material and industrial products, 289-290.
3. Kirtikar KR and Basu BD, Indian medicinal plant, 2nd Edn, Vol 5, oriental enterprises Dheradune: 1543-1544, (2001).
4. Singh BP and Wayne F. Whitehead Pointed gourd: Potential for temperate climates. J. Janick, 118: 27-35, (1999).
5. Nadkarni AK, Indian Materia Medica, 3rd Edn, Bombay popular prakashan Mumbai: 1236-1237, (1982).
6. Khare CP, Encyclopedia of Indian medicinal plants, Springer science business media: 458, (2007).
7. Maurya S, Standardization of male plant population in pointed gourd. Ann. Agr. Sci., 30: 1405-1411 (1985).
8. Singh K, Pointed gourd (*Trichosanthes dioica* Roxb.). Indian Hort, 33: 35-38, (1989).
9. Kabir S, The novel peptide composition of the seeds of *Trichosanthes dioica* Roxb. Cytobios, 103 (403): 121-31, (2000).
10. Chopra RN, Nayar SL, Chopra IC, Glossary of Indian Medicinal plants, CSIR, New Delhi, 2002, pp.340.

CONCLUSION

Trichosanthes dioica is an easily available plant. The fruit being an integral part of an average Indian diet, is consumed as vegetable. The plant belongs to family Cucurbitaceae, which has given us many important medicinal plants like *Momordica charantia*, *Citrullus colocynthis* etc. Hence it would not be wrong to state that still a lot has to be worked upon this important plant. Apart from this, old traditional texts like Charak Samhita mention the protective role of *Trichosanthes dioica* on important body organs like liver, spleen etc, many of which are now scientifically proven. Clinical investigation on peptic ulcer with polyherbal formulation, where *Trichosanthes dioica* is an integral part, has shown promising results. The authors perceive that *Trichosanthes dioica* may play a significant role in developing formulations for geriatric care as it contains almost all the properties of pharmaceutical care designed for the elderly i.e. antioxidant property, antidiabetic property, cholesterol lowering and hepatoprotective etc. In developing countries like India, one must fully explore this important medicinal plant which might provide us some important "leads" in near future.



11. Ghaisas MM, Tanwar MB, Ninave PB, Navghare VV, Deshpande T, Hepatoprotective activity of aqueous & ethanolic extract of *T. dioica* in ferrous sulphate induced liver injury. *Pharmacologyonline*, 3: 127-135, (2008).
12. Toshihiro A, Yumico K, Yoshimasa K, Kunio K, Thakur S, Tamura T, 7-oxodihydrokarounidiol-3-benzoate and other triterpenes from the seeds of Cucurbitaceae. *Phytochemistry*, 46 (7): 1261- 1266, (1997).
13. Kongton S, Chemical study of bioactive constituents from *Trichosanthes cucumerina* root and fruit juice, Mahidol University, 2003, pp. 80-85.
14. Ali N, Mohammed Sultan, Kenoth R, Swamy MJ, Purification, physicochemical characterization, saccharide specificity, and chemical modification of a Gal/GalNAc specific lectin from the seeds of *Trichosanthes dioica*. *Archives of Biochemistry and Biophysics*, 432: 212–221, (2004).
15. Sharma RK, Chatterji S, Rai DK, Mehta S, Rai PK, Singh RK, Watal G, Sharma B, Antioxidant activities and phenolic contents of the aqueous extracts of some Indian medicinal plants. *Journal of Medicinal Plants Research*, 3(11): 944-948, (2009).
16. Singh KP, Singh RH, Clinical investigation of importance of *T. dioica*. *Journal of research in ayurveda, siddha*, 6(2): 132-140, (1985).
17. Rai PK, Jaiswal D, Singh RK, Gupta RK, Watal G, Glycemic Properties of *Trichosanthes dioica* leaves. *Pharmaceutical biology*, 46(12): 894-899, (2008).
18. Rai DK, Rai PK, Jaiswal D, Sharma B, Watal G, Effect of water extract of *Trichosanthes dioica* fruits in streptozotocin induced diabetic rats. *Indian Journal of Clinical Biochemistry*, 23 (4): 387-390 (2008).
19. Chandrasekhar B, Mukherjee B, Mukherjee SK, Blood sugar lowering effect of *Trichosanthes dioica* Roxb. in experimental rat models. *Int J Cru Drug Res*, 26: 102–106, (1988).
20. Sharmila BG, Kumar G, Rajasekhara PM, Cholesterol-lowering activity of the aqueous fruit extract of *Trichosanthes dioica* in normal and streptozotocin diabetic rats. *J Clin Dia Res*, 1(4): 561-569, (2007).
21. Sharma G, Pant MC, Influence of alcoholic extract of whole fruit of *T. dioica* on blood sugar, serum lipids, lipoproteins & faecal sterols in normal albino rabbits. *Indian journal of clinical biochemistry*, 1: 53-56, (1992).
22. Fulzule SV, Satturwar D, Joshi SB, Studies on anti-inflammatory activity of a poly herbal formulation- *Jatydi Ghrita*. *Indian drugs*, 39(1): 42-44, (2001).
23. Bhujbal MM, Patoladi Quath in the management of skin disorder. *Deerghayu* 58:72-76, (1999).
24. Hariti M, Rathee PS, Antifungal activity of the unsaponifiable fraction of the fixed oil of *Trichosanthes* seeds. *Asian journal of chemistry*, 8(1): 180-182, (1996).
25. Hariti M, Rathee PS, Antibacterial activity of the unsaponifiable fraction of the fixed oil of *Trichosanthes* seeds. *Asian journal of chemistry*, 7 (4): 909-911, (1995).
26. Rai PK, Mehta S, Gupta RK and Watal G, A Novel Antimicrobial Agents *Trichosanthes dioica*. *International Journal of Pharma and Bio Sciences*, 1(3): 1-9, (2010).
27. Shivhare Y, Singh P, Rajak H, Patil UK, Pawar RS, Antioxidant potential of *Trichosanthes dioica* Roxb (fruits). *Phcog J*, 2(6): 107-111, (2010).
28. Shivhare Y, Singour P, Patil UK, and Pawar RS, Wound healing potential of methanolic extract of *Trichosanthes dioica* Roxb. (fruits) in rats. *Journal of Ethnopharmacology*, 127 (3): 614-619, (2010).
29. Shivhare Y, Singh P and Patil UK, Healing Potential of *Trichosanthes dioica* Roxb. on Burn Wounds. *Research journal of pharmacology and pharmacodynamics*, 2(2): 168-171, (2010).