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Review Article

DISTRIBUTION AND ANCIENT-RECENT MEDICINAL USES OF *TRICHOSANTHES* SPECIES

Saboo Shweta S [1], Thorat Priyanka[1], Tapadiya Ganesh G[2], Khadabadi S S[1]

[1] *Department of Pharmacognosy, Govt. College of Pharmacy, Aurangabad, India*
[2] *R. C. Patel Institute of Pharmaceutical Education & Research, Shirpur, India*
Corresponding Author: shweta.saboo1@gmail.com

Abstract
India, with its great biodiversity about 15% out of the 20,000 medicinal plants of the world, has a tremendous potential and advantage in the emerging field of herbal medicines. Medicinal plants are the main sources of chemical substances with potential therapeutic effects. A lot of compounds were characterized from plants which are now using in the treatment of many diseases. The use of medicinal plants for the treatment of many diseases is associated with folk medicine from different parts of the world. Naturally occurring compounds from plants, fungi and microbes are still used in pharmaceutical preparations in pure or extracted forms about three hundred species are used by 7800 medicinal drug manufacturing units in India which consume about 2000 tons of herbs annually. There are estimated to be more than 717,319 registered practitioners of Ayurveda, Siddha, Unani and Homeopathy in India in the recent years, the growing demand for herbal products has led to the extinction of many important herbs because the drugs have no or very less side effect. In many useful plants species one is *Trichosanthes* species is a little-exploited species with immense medicinal potential. Considering its importance, research is necessitated to explore the potential of this species.
Keywords: *Trichosanthes cucumerina, Trichosanthes kirilowii*, *Trichosanthes villosa, Trichosanthes tricuspidata,* medicinal plant, trichosanthin

1. Introduction

"According to the WHO, herbal medicine is the most lucrative type of traditional medicine which generates billions of dollars in terms of revenue annually. The WHO states that, traditional medicine can treat various infectious and chronic conditions: new anti-malarial drugs were developed from the discovery of chinchona, a plant used in China for almost 2000 years" [1].
It is estimated that at least 25% of all modern medicines are derived, either directly or indirectly, from medicinal plants, primarily through the application of modern technology to traditional knowledge[2]. The demand of medicinal plants is increasing day by day in both developing as well as developed countries as a result of recognition of the non-narcotic nature, lack of side effects and easily availability of many herbal drugs. Most often the medicinal plants are collected from the wild. The therapeutic potential of various herbal plants have need to be explore for its medicinal use. In this present paper we have attempted to briefly summarize the information available on the potency of *Trichosanthes* species because of its immense medicinal potential[3].

2. Present status of herbs in market

Between 70% and 95% of citizens in a majority of developing countries, especially those in Asia, Africa, Latin America and the Middle East, use traditional medicine, including traditional and herbal medicines for the management of health and as primary health care to address their health-care needs. In some industrialized nations, use of traditional medication is equally significant; Canada, France, Germany and Italy for instance, report that between 70% and 90% of their populations have used traditional medicines under the titles "complementary", "alternative", or "nonconventional"[2]. A survey completed by WHO's Roll Back Malaria programme showed that in Ghana, Mali, Nigeria and Zambia, around 60% of all febrile cases in children, presumably due to malaria, are treated at home with herbal medicine. Information compiled by UNAIDS revealed that approximately two thirds of

HIV/AIDS patients in a variety of developing countries seek symptomatic relief and manage opportunistic infections through the use of traditional medicines . In Brazil, a reported 89% of patients diagnosed with cancer use TM Traditional medicines products to treat their conditions. There is growing acceptance that traditional medicines are appropriate and effective in treatment or control of certain diseases [2].

Medicinal plants play a vital role for the development of new drugs. Almost 70% modern medicines in India are derived from natural products. Medicinal plants play a central role not only as traditional medicines but also as trade commodities, meeting the demand of distant markets. India has a very small share (1.6%) of this ever-growing global market. To compete with the growing market, there is urgency to expeditiously utilize and scientifically validate more medicinally useful plants[4].

India is a vast repository of medicinal plants that are used in traditional medical treatments. The various indigenous systems such as Siddha, Ayurveda, Unani and Allopathy use several plant species to treat different ailments. The uses of herbal medicine become popular due to the toxicity and side effects of allopathic medicines. This led to sudden increase in the number of herbal drug manufactures. Plants are important sources of medicines and presently about 25% of pharmaceutical prescriptions in the United States contain at least one plant-derived ingredient. In the last century, roughly 121 pharmaceutical products were formulated based on the traditional knowledge obtained from various sources. Medicinal plants play an important role in the development of potent therapeutic agents. During 1950-1970 approximately 100 plants based new drugs were introduced in the USA drug market including deserpidine, reseinnamine, reserpine, vinblastine and vincristine which are derived from higher plants[4].

3. Morphological study *of Trichosanthes* species

3.1 Trichosanthes cucumerina: It is a tropical or subtropical vine, raised for its strikingly long fruit, used as a vegetable, medicine and a lesser known use in crafting didgeridoos. Common names include snake gourd (var. *anguina*), serpent gourd, chichinga, and padwal. It is also known as chichindo in Nepali Formerly, the cultivated form was considered a distinct species, but it is nowadays regarded as mere variety of the wild ancestor, as they freely interbreed *Trichosanthes cucumerina* var. *anguina* (L.) Haines–cultivated variant. *Trichosanthes cucumerina* var. *Cucumerina*-wild variant[5].

3.2 Trichosanthes dioica: It is also known as the pointed gourd, parwal/parval (in Hindi) and "Paror" in Maithili. Colloquially, in India, it is often called *green potato*. It is widely cultivated in the eastern part of the India, particularly in Orissa, Assam, Bihar. It is a good source of carbohydrates, vitamin A, and vitamin C. It also contains trace elements (magnesium, potassium, copper, sulphur, and chlorine) which are needed in small quantities, for playing essential roles in human physiology. It is employed as an ingredients of soup, stew, curry, sweet, or eaten fried and as *potoler dorma* or *dolma* (dolma) with fish, roe or meat stuffing[6].

3.3 Trichosanthes kirilowii: It is a flowering plant from the family of Cucurbitaceae found particularly in Henan, Shandong, Hebei, Shanxi, and Shaanxi. It is one of the 50 fundamental herbs used in traditional Chinese medicine, where it shares the name *gualou* with the related *T. rosthornii*. It is known as Chinese cucumber in English[7].

***3.1 Trichosanthes tricuspidata*:** It known as *T. palmate* Roxb., *T. bracteata* Lamb., *T. pubera* Blume or *Modeccca bracteata,* belongs to the family Cucurbitaceae. In Hindi it is known as *Lal Indrayan*; in English, Redball snakegourd; in Malaya, *Kalayar*; in Marathi, *Kaundal*; in Telugu, *Avuduta*; in Thai, *Khe- Ka- Daeng* and in Nepal, *Indreni* [8].

3.5 Cucurbitaceae family: The family Cucurbitaceae (vine crops) consists of various squashes, melons, and gourds, including crops such as cucumber, pumpkins and watermelons. The family Cucurbitaceae lies within the class of dicotyledonous and in the division of anthophytha. It is known to many as the gourd or pumpkin family. They usually produce spiralling tendrils or modified shoots that wrap around adjacent objects and use them for support. That's why they are considered vine crops. Cucurbits usually are climbing plants with alternate, simple, palmately veined leaves. There are however some dioecious species [9].

4. Geographical distribution of *Trichosanthus* species

4.1 Habitat: A *Trichosanthes* species generally found at an altitude of 1200 to 2300 m. It ranges from eastern Himalayas in India and southern China through southern Japan, Malaysia, and tropical Australia. In India it is a large climber[3].

4.2 Distribution: Pantropical and subtropical a few representative in temperate to cooler climate often attaining a height of 9-10 meters.

4.3 Vegetative Characters: Plants are mostly annual or perennial with weak stem trailing or decumbent vines, usually climbing by means of tendrils and with plenty of juicy sap in the leaves and stems.

Root: Roots are taproot, branched and thickened due to the storage of food and water.

Stem: Stems are herbaceous in nature and climbing by means of tendrils.

Leaf: They are alternate, brood, and usually simple but often deeply lobed or divided and palmately veined, reticulate, petiole long and hollow. Tendrils may be simple or branched arising in the axil or opposite to the leaf at the node.

Flower: They are regular, unisexual, rarely bisexual, smaller or large showy, white or yellow [10].

5. Ancient uses of *Trichosanthes* species as medicine

***5.1 Trichosanthes cucumerina* (Snake gourd):** The plant including roots, leaves, fruits, seeds have medicinal properties. The root is used as a cure for bronchitis, headache and boils. Both root and fruit are considered to be cathartic. The fruit is used as an anthelmintic. The seeds are used for stomach disorders and are also considered as antifebrile and anthelmintic. Studies on the pharmacological profile have shown the presence of anti-inflammatory activity in the roots and tubers and antidiabetic activity in seeds. Chemically galactose specific lectin has been isolated from the seeds. The hot aqueous extract of *Trichosanthes cucumerina* exerts a significant protection against ethanol or indomethacin induced gastric damage. Increasing the protective mucus layer, as well as decreasing the acidity of the gastric juice and antihistamine activity are probable mechanisms by which the hot water extract mediates its gastroprotective actions [11].

***5.2 Trichosanthes dioica* (pointed gourd):** Interesting antimicrobial profile has been observed against *Staphylococcus aureus, Klebsiella pneumonia, Escherichia coli, Pseudomonas aeruginosa* and *Mycobacterium smegmatis* bacteria[12.] They are employed in treatment of epilepsy, alopecia, skin disease and diabetes mellitus [13.] According to Ayurveda, leaves of the plant are used as antipyretic, diuretic, cardiotonic, laxative, and antiulcer. Traditionally it is also used in skin disorder by some communities of Asia[14].

***5.3 Trichosanthes kirilowii* (Chinese cucumber):** The seeds o*f Trichosanthes kirilowii* have been used in Chinese medicine as an anti-inflammatory agent, a cough medicine and as an expectorant. Evaluation of the cytotoxic activity against human cancer cell lines exhibited cytotoxicity especially against a human renal cancer. The triterpenoids present in the plant are expected to be potential anti-tumor promoters[11]. In traditional Chinese medicine it is said to drain heat and generate fluids, clear and drain lung heat, transform phlegm, and moisten lung dryness, and resolve toxicity and expel pus. The fruit of the plant, clear heat and transform phlegm-heat, unbind the chest and dissipate nodules, and reduces abscesses and dissipate nodules[7]. Fruits rind can help to cure diseases of the heart and lungs. The tuber of plant displayed extreme inhibition of HIV [27], enhance immunity, lowering blood pressure, and tumor. In addition, *Trichosanthes* also has special green health care function. Therefore, in recent years, it is valued and demanded[29].

Proteins precipitated by acetone from an aqueous *extract of Trichosanthes kirilowii* root tubers contained abortifacient and erythroagglutinating activities[30].

***5.4 Trichosanthes tricuspidata* (Indrayan):** In Thai traditional medicine, the plant is used as a laxative, anthelmintic and in the treatment of migraine[11]. The root extract has shown antioxidant effect. In Ayurvedic medicines, the fruits are used in the treatment of asthma, ear ache and ozoena (intranasal crusting, atrophy and fetid odor). In the Unani system, the fruits are used as a carminative (an agent that relieves flatulence), a purgative, and as an abortifacient, to lessen inflammation, cure migraines, and reduce heat of the brain. It also employed in treatment for opthalmia (inflammation of the eye), leprosy (infectious disease caused by *Mycobacterium leprae*), epilepsy (episodic impairment or loss of consciousness, abnormal motor phenomenon) and rheumatism, (painful local inflammation of joints and muscles) as well as other uses. The seeds are emetic and a good purgative. In the Thai traditional system, the plant is used as an anti-fever remedy, a laxative, as an anthelmintic as well as in migraine treatments. The roots of the plant are used to treat lung diseases in cattle and for the treatment of diabetic carbuncles and headaches. The vaidyas, or practitioners of Ayurveda, also use the fruits in treating stomatitis. The oil extracted from the roots is used as a pain killer. In Bastar

District, Chhattisgarh, India, the plant is used for curing snakebite poisoning and the juice of the plant is applied externally for skin eruptions. In Nepal the roots are used to cure bleeding in chickens[2].

6. Chemical constituents of *Trichosanthes* species

***6.1 Trichosanthes cucumerina*:** It is rich in protein and vitamin C. The use of the pulp of ripe fruits as a substitute for tomato paste is the major use. The edible part of the immature fruit is 86 – 98% per 100g edible portions, it contains water 94g, protein (0.6g), fat (0.3g), carbohydrate (4g), fibre (0.8g), Ca (26mg), Fe (0.3mg), P (20mg), Vitamin B1(0.02mg), Vitamin B2 0.03ng, Niacin 0.3mg, Vitamin C (12mg). [15] The major active constituents of the drug are triterpenoid saponins viz, cucurbitacins. The plant is richly constituted with a series of chemical constituents like flavonoids, carotenoids, phenolic acids which makes the plant pharmacologically and therapeutically active[16].

***6.2 Trichosanthes dioica*:** Earlier chemical study reveals that in addition to a number of tetra and pentacyclic triterpenes, the toxic bitter principles cucurbitaceous (a group of often highly oxygenated tetracyclic compounds with a unique carbon skeleton and almost a carbonyl group in ring C) may be considered as a taxonomic character of Cucurbitaceae. Pointed gourd is rich in vitamins and contains Mg (9.0 mg), Na (2.6 mg), K (83.0 mg), Cu (1.1 mg), and S (17.0 mg) per 100 g edible part. 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 proteins. The various chemical constituents present in *T. dioica* are vitamin A, vitamin C, tannins, and saponins. Phytochemical evaluations of aqueous and ethanolic extracts have showed the presence of saponins and tannins. The seed extract of *T. dioica* contains oxidihydrokarounidol-3- benzoate as the most predominant component in the highly polar fraction of the non saponifiable lipid. Two main phytosterols present in *T. dioica* are namely, 24α- ethylcholest-7-enol and 24β-ethylcholest-7-enol. 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) [14].

***6.3 Trichosanthes kirilowii*:** The plant is a source of the toxic anti-HIV type I ribosome-inactiving lectin trichosanthin [7]. Several multi-florane triterpenoids have been isolated from the seed extract. The most predominant ones include karounidiol and its 3-O-benzoate derivative. These triterpenoids are expected to be potential anti-tumor promoters. Evaluation of the cytotoxic activity of karounidiol against human cancer cell lines [11].

6.4 Trichosanthes tricuspidata: It contains cucurbitane, hexanorcucurbitane and octanorcucurbitane glycosides from fruits of *Trichosanthes* tricuspidata[33.] Mohamed isolated a tetrahydroxy pentacyclic triterpene "trichotetrol" from the root extract of this vine. From the fruits o*f T. tricuspidata*, 14 cucurbitane glycosides were isolated such as cucurbitacin K, 2-O-β-glucopyranoside, a hexanorcucurbitane glucoside and octanorcucurbitane glucosides were isolated along with two known cucurbitane glucoside. An extract of the fruits of this plant was found to be cytotoxic in KB cells, and two new cucurbitacins were reported: tricuspidatin and 2-O-glucocucurbitacin J. Kaneda and Uchikoba reported a protease from the sarcocarp of the fruits of this plant.

The root of plant contains contains methyl palmitate, palmitic acid, suberic acid, α-spinasterol, stigmast-7-en-3-beta-ol, α-spinasterol 3-o-beta-D-glucopyranoside, stigmast-7-en-3-beta-ol-3-O-beta-D-glucopyranoside, glyceryl 1-palmitate, glyceryl 1-stearate, bryonolic acid, cucurbitacin B, isocucurbitacin B, 3-epi-isocucurbitacin B, 23,24-dihydrocucurbitacin D, isocucurbitacin D and D-glucose. It also contains more than 6 times more cucurbitacin than the roots o*f T. kirilowii* Maxim. var. *Japonicum* Kitam. Also three new cycloartane glycosides have been isolated and named cyclotricuspidosides A, B and C, from the leaf and stem parts[3].

7. Recent scientifically proved use of *Trichosanthes* species

7.1 Trichosanthes cucumerina

1. Anti-oxidant activity of *Trichosanthes cucumerina* by Ferric-reducing antioxidant power (FRAP) assay [17].
2. Anti-diabetes activity- "Trichosanthes *cucumerina* Linn improves glucose tolerance and tissue glycogen in non insulin dependent diabetes mellitus induced rats"[18].
3. *Trichosanthes* cucumerina used for the treatment of inflammation may not cause any histological aberration in the urinary bladder: by methanolic extracts of *Trichosanthes* cucumerina seeds on the weight of urinary bladder in adult male wistar rats[19].

4. Aqueous extract of *Trichosanthes cucumerina* prevent diabetic renal abnormalities: by oral administration of aqueous extract of *Trichosanthes cucumerina*[20].
5. Anxiolytic activity of ethanolic extracts from the leaves of *Trichosanthes cucumerina*[21].

7.2 Trichosanthes dioica

1. Anti- diabetic activity of *Trichosanthes Dioica* fuits investigated in streptozotocin induced diabetic rats[22].
2. Hypoglycemic effect of aquous extract of *Trichosanthes dioica* in normal and diabetic rats[13].
3. Anti-tuberculosis (leaves extract active against *Mycobacterium smegmatis*) and Anti-microbial activity, (leaves, fruits and seeds) of extracts by disc diffusion method[12].
4. Antitumor efficacy and amelioration of oxidative stress by *Trichosanthes dioica* root against Ehrlich ascites carcinoma in mice[23].
5. It has been reported that the presence of flavonoids and trace elements viz. Cu, K and Mg are responsible for antidiabetic activity of plants[24].
6. *In vitro* cytotoxic effect of *Trichosanthes dioica* root has been reported[25].
7. Antioxidant, antidiarrhoeal and cytotoxic activity of aerial parts of *Trichosanthes dioica* Roxb have been evaluated. Antioxidant activity using nitric oxide scavenging assay, castor oil-induced and magnesium sulphate-induced diarrhoea in mice were used to evaluate anti-diarrhoeal activity while Brine shrimp lethality bioassay was employed for cytotoxicity test[26].

7.3 Trichosanthes kirilowii

1. Purification, characterization and antitumor activity of a novel protein from *Trichosanthes kirilowii* Maxim: Trichosanthrip, a novel RIP with a lower molecular mass, was purified from collected 14 populations of wild *T. kirilowii*, and its characterization and antitumor activity was assayed. Trichosanthrip has a good future in cancer care with higher antitumor activity and lower side effect[27].
2. Genetic transformation of hairy roots in *Trichosanthes kirilowii* Maxim by Ti and Ri plasmids: Compared with the ordinary hairy roots, the double transformed hairy roots grow faster but retain similar protein contents[28].
3. Germplasm resources evaluation of different populations of *Trichosanthes kirilowii* Maxim posted by Tumor Research Center[29].
4. Proteins precipitated by acetone from an aqueous extract of *Trichosanthes kirilowii* root tubers contained abortifacient and erythroagglutinating activities[30].

7.4 Trichosanthes tricuspidata

1. Study has been carried out on *Trichosanthin* induced apoptosis of leukemia K562 cells[31].
2. Anti-oxidative effects of *Trichosanthes tricuspidata* root extract on sildenafil induced migraine in albino mice has been observed[32].
3. Anti-pyretic effect of *Trichosanthes tricuspidata* Linn on albino rats was investigated[33, 34].
4. Anti-inflammatory and analgesic activity of aqueous extract of *Trichosanthes bracteata* fruits in animal model was study[35].
5. Cytotoxic activity was investigated for extracts of *Trichosanthes tricuspidata* fruits in KB cells[36].

Conclusion

After the through literature we have found that *Trichosanthes* have tremendous medicinal properties such as anti-HIV, anxiolytic, anti-pyretic, anti-diarrhoeal, carminative, antioxidant, anti-diabetic, antibacterial, laxative, anthelmintic, anti-tuberculosis, and purgative. It is also employed as an abortifacient, diuretic, and cardiotonic agent. They also show strong anti-inflammatory, antitussive, cytotoxic, and expectorant properties. Apart from biological profile *Trichosanthes* posses many therapeutically important chemical constituents which required further research to explore the medicinal value of this species.

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