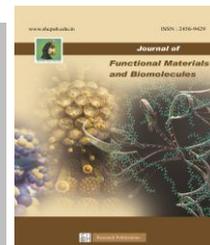




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## PHYTOCHEMISTRY AND PHARMACOLOGICAL POTENTIAL OF *TRICHOSANTHES CUCUMERINA*

Ahzam Basha, S.<sup>1</sup> and A. Poongothai<sup>1\*</sup>

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### Abstract

*Trichosanthes cucumerina* L., commonly known as snake gourd, is a tropical climber of the family Cucurbitaceae, widely distributed in Asia and Africa. It has long been used in Ayurveda, Siddha, and Unani medicine for treating ailments such as diabetes, fever, jaundice, respiratory disorders, and skin diseases. Phytochemical studies reveal the presence of alkaloids, flavonoids, cucurbitacins, glycosides, saponins, phenolics, and triterpenoids, which are linked to its broad pharmacological activities. Experimental findings have demonstrated antidiabetic, antioxidant, hepatoprotective, anticancer, antimicrobial, anti-inflammatory, and immunomodulatory properties of extracts derived from different parts of the plant. The fruit also provides important nutritional benefits, being rich in vitamins, minerals, and dietary fiber. Toxicological studies suggest that *T. cucumerina* is relatively safe at therapeutic doses, though higher concentrations may cause gastrointestinal irritation. Despite promising preclinical evidence, only limited clinical trials are available, indicating the need for standardized studies and advanced formulations. This review consolidates current knowledge on the ethnobotany, phytochemistry, pharmacology, and safety profile of *Trichosanthes cucumerina*, highlighting its role as a potential source for novel herbal drugs.

**Keywords:** *Trichosanthes cucumerina*, Snake gourd, Phytochemistry, Ethnomedicine.

### 1. Introduction

Medicinal plants remain vital in primary healthcare and are important sources of bioactive compounds.

*Trichosanthes cucumerina* L., belonging to the family

*Cucurbitaceae*, is an important medicinal and edible plant distributed across tropical Asia and Africa. In Ayurveda and Siddha, the fruits, seeds, and leaves are used for treating diabetes, helminthiasis, jaundice, skin infections, and fever. The presence of secondary metabolites such as *cucurbitacins*, flavonoids, and glycosides has been associated with its pharmacological activities [1].

### 2. BOTANICAL DESCRIPTION AND TAXONOMY

*Trichosanthes cucumerina* is an annual monoecious climbing herb that grows up to 5–6 meters with slender, green, 4-angled, slightly hairy stems bearing a disagreeable odor. Its roots are white and tuberous, while the simple, alternate leaves are scabrid, hairy, and palmately lobed (3–5 lobes) with a broad, heart-shaped base. The plant bears axillary, long-peduncled staminate inflorescences with clusters of 6–15 white, tubular, fringed flowers, whereas the pistillate flowers are solitary with hairy stigmas on a single-celled inferior ovary. The cylindrical, often twisted fruits are greenish-white when

\*Corresponding author: E-mail: [poongothai@shcpt.edu](mailto:poongothai@shcpt.edu)

<sup>1</sup>Department of Biochemistry, Sacred Heart College (Autonomous) Tirupattur-635 601, Tamil Nadu, India.

immature and turn deep crimson upon ripening. Seeds are greyish-brown, rugose, firm, and embedded in a soft, foetid red pulp [2]. The Fig.1.shows the *Trichosanthes cucumerina* as below,

**Kingdom:** Plantae; **Phylum:** Tracheophyta

**Class:** Magnoliopsida ; **Order:** Cucurbitales

**Family:** Cucurbitaceae; **Genus:** *Trichosanthes*

**Species:** *Trichosanthes cucumerina*



**Fig.1.** *Trichosanthes cucumerina*

### 3. TRADITIONAL USES

*Trichosanthes cucumerina* has long been recognized in traditional medicine and dietary practices across Asia and Africa. The immature fruits are consumed as a vegetable in curries, soups, and stews, while the ripe fruits are occasionally used for pickling. The roots, leaves, and seeds are utilized in folk remedies for treating digestive ailments, fever, cough, and respiratory disorders. Decoctions of the plant parts are used as a general health tonic and as a remedy for constipation, jaundice, and intestinal worms. In Ayurveda, the plant is described as bitter, cooling, and purgative, and it is often employed to balance pitta-related disorders [3].

### 4. ETHNOMEDICINAL USES

Ethnomedicinally, different parts of *Trichosanthes cucumerina* are used for treating a wide range of diseases. The fruits and leaves are applied for their antidiabetic, anti-inflammatory, and hepatoprotective effects [4]. The root extracts are traditionally administered for diarrhea, dysentery, and helminthic infections. The seeds are used in indigenous practices as a vermifuge and to alleviate fever. In Sri Lankan traditional medicine, the plant is prescribed for snake bites and skin eruptions, while in African ethnomedicine, it is valued for managing malaria, hypertension, and gastrointestinal disturbances. These wide-ranging uses highlight the importance of *Trichosanthes cucumerina* as a culturally significant medicinal plant [5].

### 5. PHYTOCHEMICALS

*Trichosanthes cucumerina* is a nutrient-dense plant. Proteins, fat, fiber, carbs, and vitamins A and E make up a large portion of its composition. The contents of flavonoids and total phenolics are 78.0% and 46.8%, respectively. Vitamins C and E are abundant in the fruit. 30.18% is the crude protein content. Potassium and phosphorus were the two most common mineral elements. Zinc, magnesium, and sodium are also present in rather significant concentrations. *Trichosanthes cucumerina* contains the following chemical constituents: sterols 2  $\beta$ -sitosterol, stigmasterol, cucurbitacin B, cucurbitacin E, isocucurbitacin B, 23,24-dihydroisocucurbitacin B, and 23,24-dihydrocucurbitacin E.

There are also trace amounts of chemicals such tannins, phytates, and oxalate [6].

## 6. Pharmacological Activities

### 6.1. Hepatoprotective activity

According to research, the hepatotoxic medication CCl<sub>4</sub> selectively damages liver cells and modifies the structure and function of the cell membrane as a result of metabolic activation. The cytoplasm of hepatic cells contains higher concentrations of the enzymes AST and ALT. The plasma's leaking results in the damage to hepatic cells, which raises the levels of hepatospecific enzymes in serum. The liver's ability to excrete bile is compromised due to the hepatotoxin's liver damage, which raises the blood's bile levels [7].

### 6.2. Cardioprotective activity

Arrhythmias are among the cardiotoxic symptoms brought on by doxorubicin, and 30–40% of individuals who receive a cumulative dose of 500 mg/mm<sup>2</sup> may develop irreversible cardiomyopathy as a result of longterm toxicity. DOX (doxorubicin) caused an increase in plasma enzyme activity. Although these enzymes are not unique to myocardial injury, a combination of them may indicate myocardial injury [8].

### 6.3. Gastroprotective activity

Ethanol is an ulcerogenic drug that damages the stomach mucosa by promoting irregularities in mucosal microcirculation, ischemia and the formation of free radicals, endothelin release, mast cell degranulation, suppression of prostaglandins, and a reduction in the synthesis of gastric mucus When prostaglandin synthesis

is inhibited by the nonsteroidal anti-inflammatory drug (NSAID) indomethacin, acid production rises and cytoprotective mucus creation falls, potentially leading to stomach ulcers [9]. *Trichosanthes cucumerina* possesses strong gastroprotective properties, including the capacity to considerably lessen the number and duration of stomach lesions brought on by 100% ethanol and indomethacin. A dose of hot water extract (HWE) at 750 mg/kg has gastroprotective effects similar to those of sucralfate and cimetidine [10].

### 6.4. Antidiabetic activity

In rats with NIDDM, an aqueous extract of *Trichosanthes cucumerina* considerably ( $P < 0.01$ ) reduced the increase in blood glucose levels. After 45 minutes, the diabetic animals' blood glucose levels rose, and two hours later, they were still high. Blood glucose levels in the group treated with *Trichosanthes, cucumerina*, peaked after 30 minutes and gradually decreased for up to two hours [11]. In diabetic mice, the medication considerably ( $P < 0.01$ ) reduced postprandial blood glucose levels. In comparison to NIDDM controls, we discovered that *Trichosanthes cucumerina* enhanced the amount of glycogen in insulin-dependent organs such the liver and skeletal muscle by 62% and 58.8%, respectively. *Trichosanthes cucumerina* therefore exhibits antidiabetic properties. In NIDDM patients, the medication increased oral glucose tolerance [12].

### 6.5. Antifertility activity

The Growth factors and steroids produced by the gonads, together with pituitary hormones, control certain aspects

of folliculogenesis. FSH secretion and follicular dynamics may be regulated by ovarian androgen and inhibin follicular secretion. The regulation of ovarian function is significantly influenced by the hypothalamopituitary unit [13]. In turn, the regulation of folliculogenesis is significantly influenced by these glycoprotein hormones. When intact rats were given a high dose of *Trichosanthes cucumerina* L. ethanol extract, their ovarian weight significantly decreased. This could be because the drug's estrogenic negative feedback mechanism inhibited the release of tropic pituitary gonadotropin [14].

#### 6.6. Anticancer activity

The Cucurbitacin B only radiosensitized MDA-MB-231 and MCF7:5C cells; SKBR-3 cells did not. Cucurbitacin B triggered G2/M arrest in her MDA-MB-231 and MCF7:5C cells, but not in SKBR-3 cells, according to flow cytometric measurement of DNA content. Furthermore, p21 expression was elevated prior to irradiation, according to real-time PCR and western blot analysis. Cell cycle arrest is believed to be caused by this. Consequently, the experimental treatment of breast cancer may benefit from the combination of cucurbitacin B and radiation [15].

#### 6.7. Antibacterial activity

Antibacterial elements found in *Trichosanthes cucumerina* work well against wound pathogens such *S. aureus*, *S. pyogenes*, *E. coli*, and *P. aerogins*. *E. coli* and *P. aeroginosa* were shown to be the most vulnerable to *Trichosanthes cucumerina* at a very low concentration (12.5 g/disc) of both extracts, with an inhibition zone larger than 9 mm. Plant secondary metabolites, including flavonoids,

alkaloids, tannins, saponins, and other aromatic compounds, act as defenses against a range of microorganisms, insects, and other herbivores [16].

#### 6.8. Anti-oxidant activity

Antioxidant activity was measured by comparing the ethanolic extract of *Trichosanthes cucumerina* with ascorbic acid as a standard. At a concentration of 150 ug mL, the maximum percentage inhibition was 86.2%, while at 50 ug mL, it was 62.9 and at 100 ug mL, it was 92.9% were respectively [17].

#### 6.9. Anti-inflammatory activity

*Trichosanthes cucumerina* reduced oedema in a carrageenan-induced paw oedema model in both the early and late phases of acute inflammation, which were mediated by the release of histamine and serotonin, neutrophil infiltration, eicosanoid release, free radical production, and other neutrophil-derived mediators [18]. It is known that the maximum levels of Cyclooxygenase-1 and Cyclooxygenase-2 expression occur in the early and late phases of paw oedema brought on by carrageenan, respectively. According to this, *Trichosanthes cucumerina* might suppress COX-1 as well as COX-2. The substantial gastroprotective effect of *Trichosanthes cucumerina* against stomach ulcers caused by ethanol or indomethacin suggests that the plant's COX-2 inhibitory activity outweighs its COX-1 inhibitory effect [19].

#### 6.10. Toxicity

There is no scientific evidence to support the public's and some medical professionals' view that herbal remedies are safe and mild. Compounds in plant extracts are

comparable to those in medications and share the same potential for serious adverse effects. The usefulness of any medication is based on both its therapeutic effectiveness and its absence of toxicity or adverse side effects. Investigating the acute and long-term adverse effects of *Trichosanthes cucumerina* aerial parts is essential [20].

## 7. CONCLUSION

*Trichosanthes cucumerina* L. is a valuable medicinal plant with a long history of traditional and ethnomedicinal use, particularly in Asian and African healthcare systems. Its diverse phytochemical constituents, including alkaloids, flavonoids, tannins, saponins, and triterpenoids, contribute to a wide range of pharmacological activities such as antidiabetic, anti-inflammatory, hepatoprotective, antimicrobial, and antioxidant effects. The documented traditional uses are now being validated by modern pharmacological investigations, highlighting the plant's therapeutic potential. However, despite promising experimental evidence, clinical studies remain limited, and comprehensive toxicological evaluations are required to ensure safety and efficacy. Future research should focus on isolating bioactive compounds, elucidating their mechanisms of action, and exploring their potential in drug development. Thus, *Trichosanthes cucumerina* represents a significant ethnopharmacological resource with promising applications in modern medicine.

**Conflict of Interest:** Nil

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