Review Paper

Medicinal Values of *Trichosanthus cucumerina* L. (Snake Gourd) - A Review

Abstract

Snake gourd is an annual climber and it's commonly called as snake gourd, viper gourd, snake tomato or long tomato. The fruit is usually consumed as a vegetable due to its good nutritional value. The fruit is a good source of Vitamin A, Vitamin B and Vitamin C. It improves the appetite and acts as a tonic and stomachic and cures biliousness. This is one of the most genetically diverse groups of food plant in the plant kingdom and every part of this plant is used to treat various diseases. It is used in the treatment of head ache, alopecia, fever, abdominal tumors, bilious, boils, acute colic, diarrohea, haematuria and skin allergy. *T. curcumineria* is used as an abortifacient, vermifuge, stomachic, refrigerant, purgative, malaria, laxative, hydragogue, hemagglutinant, emetic, cathartic, bronchitis and anthelmintic. This review paper completed focus on the biosystematics, nutritional, chemical constituents and scientific medicinal uses of the plant.

INTRODUCTION

Snake gourd is scientifically called as *Tricosanthes cucumerina* is a well known plant, the fruit of which is mainly consumed as a vegetable. It is an annual climber belonging to the family Cucurbitaceae. It is commonly called as snake gourd, viper gourd, snake tomato or long tomato (Adebooye, 2008; Ojiako and Igwe, 2008). The fruit is usually consumed as a vegetable due to its good nutritional value. The fruit is a good source of Vitamin A, Vitamin B and Vitamin C. It improves the appetite and acts as a tonic and stomachic and cures biliousness. The wild bitter forms are used in many ayurvedic preparations. The fruits of

cultivated forms also have medicinal uses and are useful for people suffering from blood pressure, heart diseases, rheumatism and psoriasis. The plant is richly constituted with a series of chemical constituents like flavonoids, carotenoids, phenolic acids which makes the plant pharmacologically and therapeutically active. It has a prominent place in alternative systems of medicine like Ayurveda and Siddha due to its various pharmacological activities like antidiabetic, hepatoprotective, cytotoxic, anti-inflammatory, larvicidal effects.

TAXONOMY

Cucurbitaceae is a plant family commonly known as melons, gourds or cucurbits and includes crops like cucumbers, squashes (including pumpkins), luffas, melons (including watermelons). The family is predominantly distributed around the tropics, where those with edible fruits were amongst the earliest cultivated plants in both the old and new world. Major genera under this family are *Trichosanthes* (100 species), Cayaponia (60 species), Momordica (47 species), Gurania (40 species), Sicyos (40 species) and Cucumis (34species). This is one of the most genetically diverse groups of food plant in the plant kingdom. The scientific classification of the *Trichosanthus cucumerina* L. is described below

Kingdom	:	Plantae		
Superdivision	:	Spermatophyta	–	Seed plant
Division	:	Magnoliophyta	–	Flowering plant
Class	:	Mangnoliopsida	–	Dicotyledon
Order	:	Curcubitales		
Family	:	Curcubitaceae		
Subfamily	:	Cucurbitoideae		
Tribe	:	Jolifficae		
Subtribe	:	Trichosanthinae		
Genus	:	Trichosanthes		

Species : Cucumerina

BIOSYSTEMATICS

The genus *Trichosanthes* has two cultivated species *Trichosanthes anguina* L. and *Trichosanthes dioica* Roxb. and several wild species. The important wild species are *Trichosanthes bracteata* (Lam.) Voigt. (Syn. *Trichosanthes palmata* Roxb.), which is most widely distributed in India, *Trichosanthes cucumerina* L. having a large variability, *Trichosanthes lobata, Trichosanthes wallichiana* (syn. *Trichosanthes multiloba* Clarke), *Trichosanthes nervifolia* L., *Trichosanthes cordata* Roxb., *Trichosanthes japonica* and *Trichosanthes shikokiana*. The botanical name of snake gourd is sometimes known as *Trichosanthes cucumerina* L. but the most common is *Trichosanthes anguina* L. the species *Trichosanthes celebica*, *Trichosanthes ovigera* and *Trichosanthes villosa* are minor vegetables. *Trichosanthes cucumeroides*, commonly known as the Japanese snake gourd is grown in Japan and China. The species *Trichosanthes bracteata* (Lam.) Voigt. var. *tomentosa* (Heyne ex Clarke) Chak. occurs in India in the peninsular region and north eastern zone. *Trichosanthes bracteata* var. *bracteata* is distributed all over the country but largely in eastern India, the Himalayas up to an elevation of 1500m and extending southwards to the Andaman Islands. *Trichosanthes cucumerina* (L), perhaps a wild form of *Trichosanthes anguina* occurs almost throughout India and *Trichosanthes cordata* (Roxb.) grows wild in peninsular India and North-Eastern plains and hills.

CYTOLOGY

All species of *Trichosanthes* have chromosomes, n=11 and 2n=22 except *Trichosanthes bracteata* and *Trichosanthes cucumeroides* in which n=22 and 2n=44. Tetraploids (2n=44) and hexaploids (2n=66) have been reported in *Trichosanthes palmate*. Induced polyploids in *Trichosanthes anguina* showed quadrivalents, trivalents, bivalents and univalents. Only two species, *Trichosanthes anguina* and *Trichosanthes cucumerina* are

monoecious while all others are dioecious. The species with 2n-=22 chromosomes had metacentric to submetacentric medium – sized (5.74mm to 1.48mm) chromosomes. There were only three pairs of chromosomes with secondary constriction in *Trichosanthes anguina* and *Trichosanthes cucumerina.* The presence of XY sex chromosomes were recorded in *Trichosanthes cucumeriodes* and *Trichosanthes japonica* at meiosis and in *Trichosanthes multiloba* at metaphase. The species, *Trichosanthes anguina, Trichosanthes cucumerina* and *Trichosanthes lobata* are crossable among themselves with fertile hybrids indicating their close relationship.

REGIONAL NAME

The genus *Trichosanthes* has two cultivated species *Trichosanthes cucumerina* L. (synonyms: *Trichosanthes anguina* L.) and *Trichosanthes dioica* Roxb. The regional names of snake gourd or snake tomato is listed below

S. No.	Regional name	Place
1.	Chichinga/ Chichinge	Bengali
2.	Potlakaaya	Telugu
3.	Pudalankaai	Tamil
4.	Aduvalakaayi	Kannada
5.	Padavalanga	Malayalam
6.	Galartori	Punjabi
7.	Padavali	Gujarathi
8.	Chachind	Hindi
9.	Serpent vegetal	France
10.	Schlangengurke	Germany
11.	Karasu-uri-zoku	Japan

12.	Patola	Srilanka
13.	Zucchetta cinese	Italy
14.	Abóbora-serpente	Portugal
15.	Käärmekurkku	Finland
16.	Buap nguu Ma noi	Thailand
17.	Yilan kabagi	Turkey
18.	Calabaza anguina	Spain

ORIGIN AND DISTRIBUTION

Snake gourd is originated in India or in the Indian Archipelago. The genus Trichosanthes is native to Southern and Eastern Asia, Australia and Islands of the western Pacific. *Trichosanthes cucumerina* is found wild throughout these areas. It was probably domesticated in ancient times in India. It is grown as a minor vegetable in many countries of tropical Asia. It is locally grown as a vegetable in home gardens in Africa. Commercial growers around big cities in East Africa occasionally grow cultivars of snake gourd imported from India for people of Indian origin. It is also reported from India through Malaya to tropical Australia. *Trichosanthes cucumerina* is a newly introduced crop of increasing importance in several parts of Africa, including Ghana and Nigeria. The genus Trichosanthes comprises about 100 species, of which a few have been domesticated in Asia, snake gourd being the most important. Two varieties are distinguished within *Trichosanthes cucumerina*. They are the wild var. cucumerina occurring from India, Sri Lanka and China, through South-East Asia, to northern Australia, and the cultivated var. anguina (L.). Only traditional landraces of *Trichosanthes cucumerina* are used in West and Central Africa, whereas improved cultivars from India are grown in East Africa.6 It is distributed in temperate Asian regions like china, tropical regions of Bangladesh, India, Nepal, Pakistan Sri Lanka,

Myanmar; Vietnam, Indonesia; Malaysia; Philippines, in Australia it is found in Northern Territory, Queens land and in Western Australia.

MORPHOLOGY

Plant: *Tricosanthes cucumerina* is a monoecious annual herb climbing by 2–3-branched tendrils upto 5 to 6 meters high or less.

Stem: The stems are slender, green, 4-angled, somewhat hairy, and faintly disagreeable in odor. **Root:** The roots are somewhat tuberous and whitish.

Leaves: The leaves are alternate, simple with no stipules. Leaves are scabrid hairy on both surfaces, rounded in outline, 7 to 14 centimeters long and broad, and 3 or 5-lobed, the lobes being broad, rounded or obtuse, and the sinuses broad or narrow and rounded. The base is broadly heart-shaped.

Flower: The staminate inflorescences are long-peduncled and axillary, with six to fifteen flowers. Flowers are unisexual, regular, and white in colour with green and hairy calyx. Corolla is tubular in with lobes fringed and hair like outgrowths. The male flowers are many-flowered with axillary racemes on 10–30 cm long peduncles. They are with 3 stamens but the female flowers are solitary and sessile with inferior, single celled ovary, long and with hairy stigmas. **Fruit:** Fruits are very slender, long and cylindrical berry, often twisted, greenish-white when immature, dark red when mature.

Seeds: The seeds are half-ellipsoid, somewhat compressed, undulate, hard, rugose, nearly one centimeter long, greyish-brown, sculptured, margin undulate and imbedded in a soft foetid with red pulp.

PHYTOCHEMICALS

NUTRIENTS

Tricosanthes cucumerina is a rich source of nutrition. It is highly constituted with proteins, fat, fibre, carbohydrates, vitamin A and E. The total phenolics and flavonoids

content is 46.8% and 78.0% respectively7. The fruit is rich in Vitamin C and E. The crude protein content is 30.18%. The predominant mineral elements were potassium (121.60mg 100-1g) and phosphorus (135.0mg 100-1g). Other elements found in fairly high amounts are Sodium, Magnesium and Zinc (Sandhya, 2010).

TRITERPENES AND CHEMICAL SUBSTANCES

The triterpenes found are 23, 24-dihydrocucurbitacin D, 23,24-dihydrocucurbitacin B, cucurbitacin B, 3β-hydroxyolean- 13(18)-en-28-oic acid, 3-oxo-olean-13(18)-en-30- oic acid and the sterol 3-*O*-*β*-D-glucopyranosyl-24ξ-ethylcholest-7,22-dien-3*β*-ol.10 The percentage free fatty acid and acid values were low suggesting increased stability and usefulness in nutritional and industrial applications. The chemical constituents present in *T.cucumerina* are cucurbitacin B, cucurbitacin E, isocucurbitacin B, 23,24-dihydroisocucurbitacin B, 23,24-dihydrocucurbitacin E, sterols 2 *β*-sitosterol stigmasterol 11. Low amount of chemical substances like oxalate, phytates and tannins are also present. Analysis showed that the seed of *Trichosanthes cucumerina* have high oil content up to 42.5±5%. The presence of common protein bands among the species may be an evidence of evolutionary origin and many protein bands found to be unique in the *Trichosanthes cucumerina* suggested that there is no genetic relationship with *Lycopersicon* (Sandhya, 2010).

A galactose-specific lectin and ribosome-inactivating protein named trichoanguin13 are present in aerial parts14,15. The bulk of carotenoids made of lutein is present in the concentration of 15.6 -18.4 mg/100g FW15. Circular dichroism spectroscopic studies reveal that TCSL contains about 28.4% beta-sheet, 10.6% beta-turns, 7% polyproline type 2 structure, with the remainder comprising unordered structure; the alpha-helix content is negligible.16,17 The α- carotene contents were 10.3 - 10.7 mg/100g FW and the β- carotene contents were found to be 2.4 - 2.8 mg/100g. The ascorbic acid content found was 24.8 – 25.7 mg/100g fresh weight and lycopene content was16.0 and 18.1 mg/100g FW (Sandhya, 2010).

CHEMICAL CONSTITUENTS AND ITS USES

Chemical modifications carried out with imidazole side chains of histidine residues with ethoxyformic anhydride on the galactose-specific lectin (SGSL) purified from snake gourd. Trichosanthes seeds indicated that the loss of activity upon modification was not due to changes in the overall conformation of the lecithin18, 19. A novel isoflavone glucoside, 5,6,6'-trimethoxy-3',4'- methylenedioxyisoflavone7-O-beta-D-(2''-O-p-coumaroylglucopyranoside) has been characterized from the seeds of *Trichosanthes*20. The positive effects of the plant are due to the carotenoids, flavonoids, lycopene, phenolics and ß-carotene present in it.

Tricosanthes cucumerina is used in the treatment of head ache, alopecia, fever, abdominal tumors, bilious, boils, acute colic, diarrohea, haematuria and skin allergy. T.curcumineria is used as an abortifacient, vermifuge, stomachic, refrigerant, purgative, malaria, laxative, hydragogue, hemagglutinant, emetic, cathartic, bronchitis and anthelmintic.

Root

Two ounces of root juice has a drastic purgative action. Roots are used for expelling worms. In China roots used for diabetes, skin swellings like boils and furuncles. Fresh root has anti-convulsant activity. Bulbous part of the root is used as a hydragogue and cathartic. Root is abortifacient, alexiteric, anthelmintic, anti-septic, astringent, diuretic and emetic.

Leaves

Leaf juice is rubbed over the whole body in remittent fevers. Dried leaf has anti-spasmodic property. An infusion of tender shoots and dried capsules is aperient, and the expressed juice of the leaves is emetic. The leaves and stems are used for bilious disorders and skin diseases and as an emmenagogue. Leaf is alexiteric, astringent, diuretic and emetic.

Fruits

The fruit is considered to be anthelmintic. The dried capsules are given in infusion or in decoction with sugar to assist digestion the fruit a very violent purgative and an efficient emetic. **Seeds**

The seed is said to be cooling. The dried seeds are used for its anthelmintic and anti-diarrhoeal properties. Seeds have anti-bacterial, anti-spasmodic, antiperiodic and insecticidal properties. It is used as abortifacient, acrid, aphrodisiac, astringent, bitter, febrifuge, purgative, toxic, trichogenous.

HEALTH BENEFITS

Detoxify the Body

It has been used as a diuretic in traditional medicine for many years, as it stimulates the liver and increases urination, thereby speeding up the elimination of toxins from the body. It also increases the creation of bodily fluids, which can eliminate dryness and dehydration, which also helps in the normal functioning of the kidneys and bladder. Juice from the leaves can also stimulate vomiting in case something toxic has been consumed.

Digestive

Children with bowel problems have been given snake gourd to ease their discomfort, as it acts as a mild laxative. Furthermore, the high fiber content of snake gourd can help anyone with bowel disorders and can eliminate constipation, reduce cramping and bloating and optimize the nutrient absorption process in the body.

Fever Reduction

In many tropical countries, fever can be a major danger to public health, regardless of its cause. Snake gourd can be turned into a decoction and given to people suffering from fever. Overnight, fevers tend to break and the natural healing process can begin.

Respiratory System

Snake gourd functions as an expectorant, loosening pus and phlegm in the sinuses and respiratory tracts so that they can be eliminated. These further benefits the immune system, as toxins and other foreign agents often get caught in phlegm and mucus to cause more serious conditions.

Hair Health

For people suffering from alopecia, snake gourd is said to stimulate the growth of new hair and protect weakening follicles from hair loss. This can be attributed to its rich mineral and vitamin content, particularly its high level of carotenes, which specifically care for the skin and hair. It is also claimed that snake gourd can reduce the frequency and intensity of dandruff.

Immune System

Snake gourd has antibiotic properties and when combined with the levels of antioxidant carotenes and vitamin C found in the vegetable, this helpful gourd can significantly boost overall health. The specifics of what conditions the antibiotic effects are most useful for is still a subject of research.

Fever

Snake gourd has been found to help reduce bilious fever. If you add a bit of chiretta and honey, the efficacy of snake gourd is increased and it will be able to treat bilious fever quickly and effectively. Many cases have been recorded where snake gourd is used along with coriander leaves, where this mixture was found to be more effective in treating bilious fever. This juice has been used as an emetic to induce vomiting. It has been found to be effective in treating malarial fever as well

Diabetes

Snake gourd has been mooted to help lessen the effects of diabetes. Although Chinese therapy regularly includes snake gourd in the treatment of diabetes, the vegetable is generally

a low-calorie food. This makes it the ideal food to help keep weight under control, yet provide the proper nutrition to people with Type-II diabetics.

Heart Problems

Snake gourd extract is one of the best remedies for arterial disorders like palpitation and other conditions like pain and stress on the heart. The extract has been known to help improve circulation, which in turn ensures that you suffer less from heart problems. To get the best results, have at least two cups of snake gourd extract every day.

Jaundice

Snake gourd leaves have been found to be effective in combating diseases like jaundice. You can ingest 30-60 gram doses of the leaves, crushed along with corianders seeds thrice every day to avail the benefits of snake gourd.

Purgative

Snake gourd juice is a strong purgative which helps flush toxins from the body. The vegetable can also be dried, but this method isn't usually as good as juicing the snake gourd. It is a good digestive, which aids in the digestive process. The leaves act as an emetic, ridding the body of toxins and also help cleanse the bowels. You can ingest 1-2 teaspoons of snake gourd juice every morning to get the benefits of this vegetable. Snake gourd seeds are also used as a moistening agent for treating severe cases of dry constipation

Cures Dandruff

One of the most popular uses of snake gourd is its effectiveness in dealing with dandruff. Not only can topical application help rid you of dandruff, the vegetable can also help reduce symptoms of the condition. Simply rub a healthy amount of this juice into your scalp and let it remain for half an hour, before you wash it off. Snake gourd juice usually stimulates the body to boost fluid production and moisturizes the scalp. You can also

consider using this extract topically, as the treatment will work on ingestion or topical application as well.

Low in Calories

Snake gourd is a low-calorie food. It provides most of the needed nutrients without adding any fat to the body. In fact, it is quite low in calories, so you can rest assured that you wouldn't be putting on extra weight by gorging on this vegetable.

Alopecia

The extract from the snake gourd leaves is quite effective in dealing with the treatment of hair and scalp disorders like alopecia, which usually leads to partial and sometimes even complete hair loss. For this specific treatment, you need to apply the juice topically to the affected area.

Rich in Minerals

Snake gourd is one of the healthiest vegetables as it is rich in essential minerals like magnesium, calcium and phosphorous. These minerals improve bodily functions and promote stronger bones and teeth.

Cures Constipation

Snake gourd is rich in dietary fiber, which makes it one of the best cures for softening stools and reducing the effects of bloating and constipation.

Snake gourd has some of the most important health benefits include its ability to improve the strength of the immune system, reduce fevers, detoxify the body, improve the digestive processes of the body, increase hydration in the body, treat diabetes, boost the strength and quality of the hair, and aid in weight loss.

SCIENTIFIC USES

Antibacterial activity

Reddy *et al*., 2010 stated that *Trichosanthes cucumerina* leaf ethyl acetate, chloroform and methanol extracts showed significant activity against the different strains of bacteria. These extracts can be used as an external antiseptic in prevention and treatment of bacterial infections. The incorporation of these extracts into the drug formulations is also recommended.

Anti-dandruff activity

Vishal and Prashant 2014 stated that snake gourd possess the considerable anti-dandruff activity.

Anti-diabetic activity

Using hot water extract of aerial parts of *Trichosanthes cucurmerina* has noted to improve glucose tolerance and tissue glycogen in non insulin dependent diabetes mellitus induced rats. Study showed the drug possess antidiabetic activity with improvement in oral glucose tolerance and glucose uptake in peripheral tissues (Arawwawala *et al*., 2009).

Anti-fertility activity

Kage, *et al*., 2009 showed the antiovulatory activity of ethanol extract of whole plant of *Trichosanthes cucumerina* L. var. *cucumerina* in female albino rats.

Anti-inflammatory

The hot aqueous extract of root tubers of *Trichosanthes cucumerina* have investigated against carrageenin induced mouse's hind paw oedema and it exhibited significant anti-inflammatory activity (Kolte, *et al*., 1997).

Antioxidant property

Stellus and Nair 2015 stated that the increased concentration of plant extract will increase the antioxidant property. Antioxidant fights against free radicals and pilot in from various diseases. They exert their action either by scavenging the reactive oxygen species or protecting the oxidant defence mechanism.

The antioxidant properties of snake tomato which favourably compares with the other lycopersicon tomatoes (except CER), combined with its stronger inhibition of α-glucosidase activity, but milder inhibition of α-amylase activities suggests that snake tomato could be an alternative or complement to the use of lycopersicon tomatoes (Ademosun *et al*., 2013)

Cytotoxic activity

The root extract of *Trichosanthes cucumerina* L. and the fruit juice tested cytotoxicity against four human breast cancer cell lines and lung cancer cell lines and one colon cancer cell line. The root extract inhibited more strongly than the fruit juice (Kongtun *et al*., 1999).

Free radical mediated diseases

Trichosanthes cucumerina Linn. use of as diuretic agent and produced a potent anthelmintic activity against the Pheretima Posthuma. It is effective against free radical mediated diseases. (Murthy *et al*., 2012).

Gastroprotective activity

Shweta *et al*., 2012 reported that 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

Hair growth

Aqueous leaf extract on *trichosanthus cucumerina L.* on hair growth promotion in Wistar albino rats (Sandhya *et al*., 2012).

Hypoglycaemic activity

The crude ethanolic extract of *Tricosanthes cucumerina* showed significant blood glucose lowering activity in alloxan diabetic albino rats (Kar *et al*., 2003).

Hepatoprotective activity

Kumar, *et al*., 2009 found that the methanolic extract of the whole plant of *Tricosanthes cucumerina* showed good hepatoprotective activity against carbon tetrachloride induced heapatotoxicity.

Larvicidal efficacy

Using the acetone extract of leaves of tricosanthes cucumerina showed moderate larvicidal effects (Rahuman *et al*., 2008.

References

Adebooye, O.C. 2008. Phytoconstituents and anti-oxidant activity of the pulp of snake tomato *(Tricosanthes cucumerina*), *African Journal of Traditional, Complimentary and Alternative Medicines,* **5(2):**173-179.

Ademosun, A. O., G. Oboh, T. M. Adewuni, A. J. Akinyemi and T. A. Olasehinde. 2013. Antioxidative properties and inhibition of key enzymes linked to type-2 diabetes by snake tomato (*Tricosanthes cucumerina*) and two tomato (*Lycopersicon esculentum*) varieties. *African Journal of Pharmacy and* Pharmacology. **7(33):** 2358-2365.

Anuradha, P. and S.V. Bhide SV, An isolectin complex from *Trichosanthes anguina* seeds, Phytochemistry, **52(5):** 751-758.

Arawwawala, L.D., M.I. Thabrew and L.S. Arambewela. 2009. Gastroprotective activity of Tricosanthes cucumerina in rats, *J Ethnopharmacology*.

Arawwawala, M., I. Thabrew and L. Arambewela. 2009. Antidiabetic activity of *Tricosanthes cucumerina* in normal and streptozotocin–induced diabetic rats; *International Journal of Biological and Chemical Sciences.* **3(2):** 56.

Azeez, M.A. and J.A. Morakinyo. 2004. Electrophoretic characterization of crude leaf proteins in *Lycopersicon* and *Trichosanthes* cultivars, *African Journal of Biotechnology* **3(11):** 585-587.

Choudhury, B. 1967. Vegetables, India, The land and the people National Book Trust, New Delhi, India, pp:214.

Chow, L.P., M.H. Chou, C.Y. Ho, C.C. Chuang, F.M. Pan, S.H. Wu and J.Y. Lin. 1999. Purification, characterization and molecular cloning of trichoanguin, a novel type I ribosome inactivating protein from the seeds of *Trichosanthes anguina*, *Biochemical Journal* **338:** 211–219.

Datta, S.K. 1987. Fatty acid composition in developing seeds of *Tricosanthes cucumerina* L, *Biological Memoirs,* **13(1):** 69-72.

Devendra, N., Kage, K.B. Vijay and S. Mala. 2009. Effect of ethanol extract of whole plant of *Tricosanthes cucumerina* Var. *Cucumerina* on gonadotropins, ovarian follicular kinetics and estrous cycle for screening of anti fertility activity in albino rats, *Int. J. Morphol.,* **27(1):** 173-182 .

Ekam, V.S. 2003. Evaluation and characterization of the seed oils of *Tricosanthes cucumerina* (snake gourd) and Ricinodendron heudelotii (honey plum), *Global Journal of Pure and Applied Sciences,* **2:** 9.

Gildemacher, B.H., G.J. Jansen and K. Chayamarit. 1993. Plant Resources of South-East Asia No 8. Vegetables, *Trichosanthes cucumerina* L. **In:** Siemonsma JS, Kasem P, Pudoc Scientific Publishers, Wageningen, Netherlands. pp: 271–274.

Hasanuzzaman, M., M.A.K. Mian, H.F.EI.-Taj, S. Huda and M.R. Amin. 2004. Floral Biology of Snake Gourd. *Pakistan Journal of biology science*. 7(4): 525-528.

http://agritech.tnau.ac.in/agriculture/agri_index.html

http://kisanconnect.com/blog/post/1064

http://www.celkau.in/Crops/Vegetables/Snakegourd/snakegourd.aspx

Indian medicinal plants compendium of 500 species, Orient Longman Pvt. ltd. Chennai, 2002, pp: 320-322.

375 Jiratchariyakul, W and A.W. Frahm. 1992. Cucurbitacin B and dihydrocucurbilacin B from
376 Tricosanthes cucumerina, *J. Pharm. Sci., 19(5):* 12.
377 Kar, A., B.K. Choudhury and N.G. Bandyopadhyay. 2003. Comparative evaluation of
378 hypoglycaemic activity of some Indian plants in alloxan diabetis rats, *Journal of*
379 *Ethnopharmacology*, **84(1):** 105-108.
380 Kenoth, R., S.S. Komath and M.J. Swamy. 2003. Physicochemical and saccharide-binding
381 studies on the galactosespecific seed lectin from *Tricosanthes cucumerina*, *Arch*
382 *Biochem Biophys*, **413(1):** 131-8.
383 Khare, C.P. 2007. Indian medicinal plants and illustrated Dictionary Springer Science
384 publishers New Delhi, Pp. 671-672.
385 Kirana, H. and B. Srinivasan. 2008. *Tricosanthes cucumerina* improves glucose tolerance and
386 tissue glycogen in non insulin dependent diabetes mellitus induced rats, *Indian*
387 *Journal of Pharmacology* 345-348.
388 Kolte, R.M., V.V. Bisan, C.R. Jangde and A.A. Bhalerao. 1997. Anti-inflammatory activity
389 of root tubers of Tricosanthes cucumerina (LINN) in mouse's hind paw oedema
390 induced by carrageenin, *Indian Journal of Indigeneous Medicines*. **18(2):** 117-121.
391 Kongtun, S., W. Jiratchariyakul, P. Mongkarndi, K. Theppeang, I. Sethajintanin, S. Jaridasem
392 and A.W. Frahm. 1999. Thai, Cytotoxic properties of root extract and fruit juice of
393 *Tricosanthes cucumerina*, *J. Phytopharm.* **6(2):** 1-9.
394 Kritikar, K.R. and B.D. Basu. 2006. Indian medicinal plants, Vol II, International book
395 distributors, New Delhi. pp:1112-1114.
396 Madhava, K.C., K. Sivaji and K.R. Tulasi. 2008. Flowering Plants of Chitoor Dist A.P. India,
397 Students Offset Printers, Tirupati, pp:141.

398 Murthy J.R., P. Nataraj, R. Meera. 2012. Phytochemical investigation, diuretic activity and
399 anthelmintic activity of *Trichosanthes cucumerina* Linn. International Journal of
400 Institutional Pharmacy and Life Sciences **2(2):** 327-340
401 Nadkani, K.M. 2002. Indian material medica**, Ed.**2, Popular Prakashan, Mumbai, **1:** 1235-
402 1236.
403 Ojiako, O.A. and C.U. Igwe. 2008. The Nutritive, Anti-Nutritive and Hepatotoxic Properties
404 of *Trichosanthes anguina* (Snake Tomato) Fruits from Nigeria, *Pakistan Journal of*
405 *Nutrition*, **7(1):** 85-89.
406 Padma, P. and S.S. Komath. 1999. Purification in high yield and characterization of a new
407 galactosespecific lectin from the seeds of *Tricosanthes cucumerina*,. *Phytochemistry*
408 *Oxford*, **50(3):** 363-371.
409 Patil, A.S. and S.R. Bhole. 2002. Studies on life history and chemical control of semilooper
410 on snake gourd. *Journal of Maharashtra Agricultural Universities*, **18(2):** 229-231.
411 Rahuman, A.A and Venkatesan P. 2008. Larvicidal efficacy of five cucurbitaceous plant leaf
412 extracts against mosquito species,Parasitol Res., **103(1):** 133-139.
413 Reddy, L.J., B. Jose, J. C. Anjana and T.N. Ruveena. 2010. Evaluation of antibacterial
414 activity of *Trichosanthes cucumerina* L. and *Cassia didymobotrya* fres. Leaves.
415 *International Journal of Pharmacy and Pharmaceutical Sciences.* **2(4):** 153-155.
416 Sandhya, S., J.Chandrasekar, K.R. inod and D. Balaji. 2012. Potentiality of Aqueous leaf
417 extract on *trichosanthus cucumerina L.* on hair growth promotion in Wistar albino
418 rats. *International Journal Natural products and resources*. **3(1):** 14-19.
419 Sandhya, S., K.R. Vinod, J. Chandra Sekhar, R.Aradhana and Vamshi Sarath Nath, 2010. An
420 Updated Review on *Tricosanthes cucumerina* L. *International Journal of*
421 *Pharmaceutical Sciences Review and Research.* **1(2):** 56-60.

422 Sathesh, K.S., K.B. Ravi and M.G. Krishna. 2009. Hepatoprotective effect of Tricosanthes
423 cucumerina L on carbon tetra chloride induced liver damage in rats. *J.*
424 *Ethnopharmacol,* **123(2):** 347-350.
425 Shweta, S.S, T. Priyanka, G. T. Ganesh, S.S. Khadabadi. 2012. Distribution and ancient-
426 recent medicinal uses of *Trichosanthes* species. *International Journal of*
427 *Phytopharmacy*. **2(4):** 91-97.
428 Stellus S. and G.A. Nair. 2015. Preliminary phytochemical analysis and anti-oxidant activity
429 of *Trichosanthes cucurmerina* L. (Cucurbitaceae) *Journal of Pharmacy* Research.
430 **9(2):**101-104.
431 Swamy, M.J., S.S. Komath and S. K. Nadimpalli. 1998. Identification of histidine residues in
432 the sugar binding site of snake gourd (*Trichosanthes anguina*) seed lectin, *Biochem*
433 *Mol Biol Int,* **44(1):** 107- 116.
434 Trease and Evans. 2002. Pharmacognosy, **Ed.**15, W.B Saunders, an imprint of Harcourt
435 publishers limited, London. pp:3.
436 veeraragavathathanm, D., M. Jawaharlal and Seemanthini Ramadas. 1994. Snake Gourd.
437 **Ed.2.** A Guide on vegetable Culture. pp:36-39.
438 Vishal, K. and P. Prashant. 2014. To study the effect of snake gourd, reetha and shika kai
439 herbal anti-dandruff shampoo and comparison with marketed shampoos. *Asian J.*
440 *Pharm. Clin. Res.* **7(4):** 212-213
441 Vishnu Swarup.2012. snake gourd. Ed. Vegetable science and technology in India. Pp:438-
442 441
443 Yadava, R. N. and Y. Syeda. 1994. An isoflavone glycoside from the seeds of *Trichosanthes*
444 *anguina*, *Phytochemistry*. **36(6):** 1519-1521.

445 Yusuf, A.A., O.M. Folarin and F.O. Bamiro. 2007. Chemical composition and functional
446 properties of snake gourd (*Tricosanthes cucumerina*) seed flour, Nigerian Food
447 Journal. **25(1):** 36-45.