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### “Gaduchi-The Best Ayurvedic Herb”

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*Tinospora cordifolia* is one of the constituents of several ayurvedic preparations used in general debility, dyspepsia, fever and urinary diseases. The stem is bitter, stomachic, diuretic, stimulates bile secretion, causes constipation, allays thirst, burning sensation, vomiting, enriches the blood and cures jaundice. The extract of its stem is useful in skin diseases. The root and stem of *T. cordifolia* are prescribed in combination with other drugs as an anti-dote to snake bite and scorpion sting. Dry barks of *T. cordifolia* has anti-spasmodic, anti-pyretic, anti-allergic, anti-inflammatory and anti-leprotic properties.

**Keyword:** *T. cordifolia*, Anti-Diabetic Anti-Oxidant Alternative Medicine Phytochemistry

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#### 1. Introduction

**Kingdom :** Plantae  
**Division :** Magnoliophyta  
**Class :** Magnoliopsida  
**Order :** Ranunculales  
**Family :** Menispermaceae  
**Genus :** *Tinospora*  
**Species :** *T. cordifolia*

*Tinospora cordifolia* (Willd.) Hook. f. and Thoms. (*Guduchi*) is a large, glabrous, deciduous climbing shrub belonging to the family Menispermaceae<sup>1,2</sup>. It is distributed throughout the tropical Indian subcontinent and China, ascending to an altitude of 300 m. In Hindi, the plant is commonly known as *Giloy*<sup>3</sup>, which is a Hindu mythological term that refers to the heavenly elixir that has saved celestial beings from old age and kept them eternally young. Other common names and synonyms are *Guduchi*, *Amrita*, *Amritavalli*, *Madhuparni*, *Guduchika*, *Chinnobhava*, *Vatsadani*, *Tantrika*, *Kundalini*, *Chakralakshanika* (Sanskrit),

*Gulanacha* (Bengali), *Gurcha* (Hindi), *Garo*, *Galac* (Gujarati), *Thippateega* (Telugu), *Amrutavalli* (Kannada), *Amrita*, *Gilo* (Kashmiri), *Chittamrutu* (Malayalam), *Gulvel* (Marathi), *Guluchi* (Oriya), *Gilo* (Punjabi), *Seendal*, *Seendil Kodi* (Tamil), *Siddhilata*, *Amarlata* (Assamese) Heartleaf Moonseed, *Tinospora* (English)<sup>4</sup>. *Guduchi*, the Sanskrit name, means one which protects the entire body. The term *amrita* is attributed to its ability to impart youthfulness, vitality and longevity. The stems of *T. cordifolia* are rather succulent with long filiform fleshy aerial roots from the branches. The bark is creamy white to gray, deeply left spirally the space in between being spotted with large rosette-like lenticels. The leaves are membranous and cordate. The flowers are small and yellow or greenish yellow. In axillary and terminal racemes or racemose panicles, the male flowers are clustered and female flowers are usually solitary. The drupes are ovoid, glossy, succulent, red and pea sized. The seeds are curved. Fruits are fleshy

and single seeded. Flowers grow during summer; and fruits, during winter<sup>[5,6]</sup>. Stem of the *T. cordifolia* appears in varying thicknesses, ranging from 0.6 to 5 cm in diameter; young stems are green with smooth surfaces and swelling at nodes, while the older ones show a light brown surface marked with warty protuberances due to circular lenticels; transversely smoothened surface shows a radial structure with conspicuous medullary rays traversing porous tissues; tastes bitter<sup>[4]</sup>.

Guduchi is widely used in veterinary folk medicine/ ayurvedic system of medicine for its general tonic, antiperiodic, anti-spasmodic, anti-inflammatory, antiarthritic, anti-allergic and anti-diabetic properties<sup>[7,8]</sup>. The plant is used in ayurvedic, "Rasayanas" to improve the immune system and the body resistance against infections. The root of this plant is known for its antistress, anti-leprotic and anti-malarial activities<sup>[8,9]</sup>. Authors investigated earlier one of the plants of the family Menispermaceae and found that the constituents and activities were similar to other reports<sup>[10,11]</sup>.

### 1.1 Chemical Composition

A variety of constituents have been isolated from different parts of *Tinospora cordifolia*. They belong to different classes such as alkaloids, diterpenoid lactones, steroids, glycosides aliphatic compounds, polysaccharides. Some constituents have been isolated from plant mainly they are tinosporone, tinosporic acid, cordifolisides A to E, syringen, berberine, giloin, gilenin, crude giloinin and, arabinogalactan polysaccharide, picrotene, bergenin, gilosterol, tinosporol, tinosporidine, sitosterol, cordifol, heptacosanol, octacosanol, tinosporide, columbin, chasmanthin, palmarin, palmatosides C and F, amritosides, cordioside, tinosponone, ecdysterone, makisterone A, hydroxyecdysone, magnoflorine, tembetarine, syringine, glucan polysaccharide, syringine apiosylglycoside, isocolumbin, palmatine, tetrahydropalmatine, jatrorrhizine respectively<sup>[13,14]</sup>.

### 1.2 Medicinal Properties

The stem of *Tinospora cordifolia* is one of the constituents of several ayurvedic preparations used in general debility, dyspepsia, fever and urinary diseases. The stem is bitter, stomachic, diuretic<sup>[15]</sup>, stimulates bile secretion, causes constipation, allays thirst, burning sensation, vomiting, enriches the blood and cures jaundice. The extract of its stem is useful in skin diseases<sup>[16,17]</sup>. The root and stem of *T. cordifolia* are prescribed in combination with other drugs as an anti-dote to snake bite and scorpion sting<sup>[47,48,49]</sup>. Dry barks of *T. cordifolia* has anti-spasmodic, antipyretic<sup>[18]</sup>, anti-allergic<sup>[19]</sup>, anti-inflammatory<sup>[20,21]</sup> and anti-leprotic<sup>[22]</sup> properties. The aqueous extract of the stem antagonizes the effect of agonists such as 5-hydroxytryptamine, histamine, bradykinin and prostaglandins E1 and E2 on the rabbit smooth muscle, relaxes the intestinal, uterine smooth muscle and inhibits the constrictor response of histamine and acetylcholine on smooth muscle. Intravenous exposure to aqueous extract of *T. cordifolia* in doses of 5.0, 10.0 and 15.0 mg/kg body<sup>[38]</sup> weight produces a temporary but marked fall in blood pressure and bradycardia in anaesthetized dogs. *T. cordifolia* is widely used in Indian ayurvedic medicine for treating diabetes mellitus<sup>[23,24]</sup>. Oral administration of an aqueous *T. cordifolia* root extract to alloxan diabetic rats caused a significant reduction in blood glucose and brain lipids. Though the aqueous extract at a dose of 400 mg/kg could elicit significant anti-hyperglycemic effect in different animal models, its effect was equivalent to only one unit/kg of insulin<sup>[25]</sup>.

It is reported that the daily administration of either alcoholic or aqueous extract of *T. cordifolia* decreases the blood glucose level and increases glucose tolerance in rodents<sup>[26,27]</sup>. Aqueous extract also caused a reduction in blood sugar in alloxan-induced hyperglycemia in rats and rabbits in the dose of 400 mg/kg. However, histological examination of pancreas has not revealed any evidence of regeneration of  $\beta$ -cells of islets of Langerhans and the possible mode of action of the plant is through glucose metabolism<sup>[28]</sup>. The aqueous extract has also

exhibited some inhibitory effect on adrenaline-induced hyperglycemia. Ethyl acetate extract of its roots has afforded a pyrrolidine derivative with hypoglycemic activity in rabbits<sup>[29-30]</sup>. Another study has also revealed significant hypoglycemic effect of extract of leaves in normal and alloxan diabetic rabbits. However, the extract had no significant effect on total lipid levels in normal or treated rabbits<sup>[31,32]</sup>.

*T. cordifolia* is reported to benefit the immune system in a variety of ways<sup>[50,33,34]</sup>. The alcoholic and aqueous extracts of *T. cordifolia* have been tested successfully for immuno-modulatory activity<sup>[35-36]</sup>. Pre-treatment with *T. cordifolia* was to impart protection against mortality induced by intra-abdominal sepsis following coecal ligation in rats. It has also significantly reduced the mortality from *E. coli* induced peritonitis in mice. In a clinical study, it has afforded protection in cholestatic patients against *E. coli* infection. These activities are not due to its anti-bacterial activity as shown by the negative in-vitro anti-bacterial activity of the plant extract<sup>[35,37]</sup>. It is reported that the treatment in rats had resulted in significant leucocytosis and predominant neutrophilia. It has been also observed that it stimulates the macrophages as evidenced by an increase in the number and % phagocytosis of *S.aureaus* by peritoneal macrophages in rats<sup>[38]</sup>. Other workers have also supported these observations. The phagocytic and Intra-cellular killing capacity of polymorphs in rats, tested at 3.5 h after *E. coli*. infection were significant<sup>[39,40]</sup>. The anti-stress and tonic property of the plant was clinically tested and it was found that it brought about good response in children with moderate degree of behaviour disorders and mental deficit. It has also significantly improved the I.Q. levels. The hepatoprotective action of *T. cordifolia* was reported in one of the experiment in which goats treated with *T. cordifolia* have shown significant clinical and hemato-biochemical improvement in CCl<sub>4</sub> induced hepatopathy. Extract of *T. cordifolia* has also exhibited *in vitro* inactivating property against Hepatitis B and E surface antigen in 48-72 h<sup>[41]</sup>.

The aqueous extract of *T. cordifolia* exerted a significant anti-inflammatory effect on cotton

pellet granuloma and formalin induced arthritis models. Its effect was comparable with Indomethacin and its mode of action appeared to resemble that of a non-steroidal anti-inflammatory agent. The dried stem of *T. cordifolia* produced significant anti-inflammatory effect in both acute and subacute models of inflammation. *T. cordifolia* was found to be more effective than acetylsalicylic acid in acute inflammation. But in subacute inflammation, the drug was inferior to Phenylbutazone<sup>[42]</sup>. In a clinical evaluation, a compound preparation 'Rumalaya' containing *T. cordifolia* was reported to significantly reduce the pain in patients suffering from rheumatoid arthritis<sup>1</sup>.

The aqueous extract of roots of *T. cordifolia* has shown the anti-oxidant action in alloxan diabetes rats. The administration of the extract of *T. cordifolia* roots (2.5, 50 mg/kg body weight) for 6 weeks resulted in a significant reduction of serum and tissue cholesterol, phospholipids and free fatty acids in alloxan diabetic rats<sup>[43]</sup> Jagetia *et al.*, have found that guduchi killed the HeLa cells very effectively *in vitro* and thus it indicates that guduchi needs attention as an anti-neoplastic agent<sup>[44]</sup>. In this study exposure of HeLa cells to 0, 5, 10, 25, 50 and 100 mg/ml of guduchi extract (methanol, aqueous and methylene chloride) resulted in a dose dependent but significant increase in cell killing when compared to non drug treated controls.<sup>[39]</sup> Ether extract of the stem distillate of aerial part of *T. cordifolia* has inhibited the *in vitro* growth of *Mycobacterium tuberculosis* at 1:50,000 dilution<sup>[45]</sup>. Its ethanolic extract has exhibited significant antipyretic activity in experimental rats. 'Septilin' syrup, a compound preparation containing *T. cordifolia* (7.82% in 5 ml of syrup) was found to elicit good clinical response in children suffering from upper respiratory tract infection and chronic otitis media<sup>[46]</sup>.

The Ayurveda literature reports that it can cause constipation, if taken regularly in high doses; it has no side effect and toxicity. Yet the safety and the potential indications in human beings have to be established using modern methods.

**Table 1:** Ayurvedic properties (*dravya-guna*) of *T. cordifolia* (*Guduchi*)<sup>[51,52]</sup>.

<i>Rasa</i>	<i>Guna</i>	<i>Virya</i>	<i>Vipaka</i>	<i>Prabhava</i>
<i>Tikta, Kasaya</i>	<i>Laghu, Guru, Snigdha</i>	<i>Ushna</i>	<i>Madhura</i>	<i>Vishaghna</i>
Bitter, Astringent	Light, Heavy, Unctuous	Hot potency	Neutral	Anti-toxic

**Rasa:** Taste appreciation of the substances by chemical receptors on tongue; sweet, sour, salt, bitter, pungent and astringent, **Guna:** Ten pairs of opposite or mirror image attributes; attribute or property of any substance, **Virya:** potency; ushna-hot, sheeta- cold, **Vipaka:** Intestinal digestion and tissue metabolism; madhura- neutral, amlaacidic, katu- alkaline, **Prabhava:** Specific action through specialized receptors

### 1.3 Cultivation of *Tinospora Cordifolia*

#### 1.3.1 Soil and Climate

It grows well in almost any type of soils and under varying climatic conditions.

#### 1.3.2 Nursery Raising and Planting

The plant is cultivated by stem cutting in the month of May-June. It requires some support preferably Neem and Mango trees, such plants are supposed to possess better medicinal values.

#### 1.3.3 Weeding and Hoeing

Periodical hoeing is done, both in the nursery and field as per requirement.

#### 1.4 Manures, Fertilizers and Pesticides

The medicinal plants have to be grown without chemical fertilizers and use of pesticides. Organic manures like, Farm Yard Manure (FYM), Vermi-Compost, Green Manure etc. may be used as per requirement of the species. To prevent diseases, bio-pesticides could be prepared (either single or mixture) from Neem (kernel, seeds & leaves), Chitrakmool, Dhatura, Cow's urine etc.

### 1.5 Irrigation

The field after plantation should be irrigated periodically as and when required weekly or fortnightly.

### 1.6 Harvesting/Post Harvesting Operation

Mature plants are collected, cut into small pieces and dried in shad.

**Yield-**Approximately 8-10 q. /ha

### 1.7 Macroscopical and Microscopical Study of *Tinospora Cordifolia* (Stem)

The drug occurs as long, cylindrical, glabrous, soft wooded pieces which show characteristic nodal swelling. The fresh stems are greenish with a smooth surface but the older stems have a brownish warty surface due to the presence of circular lenticels. Fracture is fibrous, taste bitter and odorless.

**Colour-** Pale green to brownish green

**Odour-** odourless

**Taste-** Intensely bitter

**Fracture-** Fibrous

Transverse Section of stem shows 2-3 layers of cork cells with brownish pigment followed by two layers of collenchymatous cortex & 4-6 layers of parenchymatous cortex consisting of circular to is diametric type of cells. 7-9 layers of lignified pericycle fibres forming a continuous circle of arches. Vascular bundles are 16-20 open & collateral, surrounded by pericycle fibres. It consists of:

- ⇒ Phloem-Appears like caps over metaxylem. Calcium oxalate crystals is also present. It Contains sieve tube, companion cells, phloem parenchyma.
- ⇒ Xylem - Appears as wedge shaped patches separated by multiseriate modularly rays.
- ⇒ Pitted xylem vessel in large number & tracheids, xylem parenchyma in less number.
- ⇒ Medullary rays 15-20 or more cells wide containing rounded, hemispherical, oblong, Ovoid starch grains.

⇒ Pith composed of large, thin walled parenchymatous cells with starch grains.

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