



Phytochemical Screening and Standardization Parameter of Giloy (*Tinospora Cardifolia*)

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DOI: <https://doi.org/10.55248/gengpi.4.823.50451>

ABSTRACT

Tinospora cordifolia has been widely used in traditional medicine systems for various purposes. It is reputed for its immunomodulatory, hepatoprotective, antidiabetic, analgesic, anti-inflammatory, and anti-arthritic properties. It has also been employed for its antimicrobial, antifungal, and antimalarial activities. These traditional uses have been supported by scientific investigations revealing the plant's diverse phytochemical composition, which includes alkaloids, terpenoids, flavonoids, glycosides, steroids, and phenolics. Additionally, it possesses hepatoprotective and antidiabetic properties, reduces inflammation, and displays antioxidant activity. The plant also exhibits anti-cancer effects by inducing apoptosis and inhibiting tumor growth.

Introduction

Tinospora cordifolia, also known as Guduchi, Giloy or Amrita, is a large, glabrous, deciduous, climbing shrub belonging to the family Menispermaceae. The stem structure is fibrous and the transverse section exhibits a yellowish wood with radially arranged wedge-shaped wood bundles containing large vessels, separated by narrow medullary rays. The bark is creamy white to grey, deeply left spirally and stem contains rosette-like lenticles. The leaves are membranous and cordate in shape. Flowers are in axillary position, 2-9 cm long raceme on leaflet branches, unisexual, small and yellow in color. Male flowers are clustered and female are usually solitary. The seeds are curved, and fruits are fleshy and single-seeded. Flowers grow during the summer and fruits during the winter. The stem is rather succulent with long filiform fleshy aerial roots from the branches. Its bark is grey-brown or creamy white in color, and it appears yellow or greenish-yellow when the plant is leafless. [1, 2]

Tinospora cordifolia has important medicinal values and has been used in traditional Ayurvedic medicine for ages. Potential medicinal properties reported by scientific research include anti-diabetic, antipyretic, antispasmodic, anti-inflammatory, anti-arthritic, antioxidant, and immunomodulatory effects. The stem and roots are an integral constituent of Ayurvedic medicine and are used in the treatment of fever, jaundice, chronic diarrhea, cancer, dysentery, and other diseases. The chemical constituents of *Tinospora cordifolia* have diverse pharmacological importance.

Common names: gurjo, heart-leaved moonseed, guduchi or giloy

Regional Names

Latin	T.cordifolia (wild.)
English	Gulantha /Indian tinospora
Sanskrit	Guduchi, Madhuparni, Amrita, Chinnaruha, Vatsadaani, Tantrika, Kundalini
Hindi	Giloya, Guduchi
Bengali	Gulantha
Telugu	Tippatiga
Tamil	Shindilakodi
Gujarati	Galo
Kannada	Amrita balli

Taxonomic Description:

Kingdom	Plantae
Subkingdom	Tracheophyta-vascular plants
Superdivision	Spermatophyta-seed bearing plant
Division	Magnoliophyta-flowering plant

Class	Magnoliopsida-dicotyledons
Subclass	Polypetalae
Order	Ranales
Genus	Tinospora
Species	T. Cordifolia
Family	Menispermaceae

Botanical Description:

Characteristic	Description
Plant Type	Climbing shrub
Stem	Large, glabrous, fibrous structure
Stem Transverse Section	Yellowish wood with radially arranged wedge-shaped wood bundles containing large vessels, separated by narrow medullary rays
Bark	Creamy white to grey, deeply fissured spirally
Stem Lenticels	Rosette-like lenticels
Leaves	Membranous, cordate shape
Flowers	Axillary position, 2-9 cm long raceme on leaflet branches, unisexual, small and yellow in color
Male Flowers	Clustered
Female Flowers	Usually solitary
Seeds	Curved
Fruits	Fleshy and single-seeded
Flowering Season	Summer
Fruiting Season	Winter
Family	Menispermaceae
Genus and Species	Tinospora cordifolia
Distribution	Found in tropical lowland regions

Habitat:

T. cordifolia prefers wide range of soil, acid to alkaline and it needs moderate level of soil moisture. Found throughout tropical India, and in South Asia, Indonesia, Philippines, Thailand, Myanmar, and China and in Srilanka worldwide (Spandana et al, 2013).

CHEMICAL CONSTITUENTS:

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 giloininand, arabinogalactan polysaccharide, picrotene, bergenin, gilosterol, tinosporol, tinosporidine, sitosterol, cordifol, heptacosanol, octacosonal, tinosporide, columbin, chasmanthin, palmarin, palmatosides C and F (Sharma et al 2010) .

Chemical constituents and uses of different parts of T. cordifolia:

Sr. no.	Parts Used	Chemical constituents	Uses
1.	Stem	Palmatine, 18- norclerodane glycoside, Furanoid diterpene glucoside, Tinocordiside, Tinocordifolioside, Cordioside, Cordifolioside A, Cordifolioside B, Syringin, Syringinapiosylglycoside, Palmatosides C, Cordifolioside C, Cordifolioside D,	Respiratory tract infections (Vedavathy et al, 1991). Skin diseases (Aiyer & Kolammal, 1963). Antidote to snake bite and scorpion sting (Nadkarni & Nadkarni, 1976). Enhance the immune response (Manjrekar et al, 2000). Anti carcinogenic property (Dikshit et al, 2000).
2.	Bark	Tinosporofuranol, Tinosporafurandiol, Tinosporaclerodanol and Tinosporaclerodanoid	Anti-inflammatory property (Rai & Gupta, 1967).
3.	Root	Sitosterol, Tembetarine, Magnoflorine, Jatrorrhizine,	Anti-oxidant activity (Desai et al, 2012).

		Choline, Tinosporin, Isocolumbin, Palmatine, Tetrahydropalmatine	
4.	Whole Plant	β -sitosterol, δ -sitosterol, 20 β - Hydroxy ecdysone, Furanolactone, Clerodane derivatives Tinosporon, Tinosporides, Jateorine, Columbin, Octacosanol, Heptacosanol	Antidote to snake bite and scorpion sting (Nadkarni et al, 1976). Analgesic and Neuropharmacological Activities (Hossain et al, 2009). Diabetes, Rheumatoid arthritis, Gout, Cancer, high cholesterol content (Upadhyay et al, 2010). Anti-asthmatic (Spelman et al, 2001).
5.	Aerial Part	Heptacosanol	Anti-stress activity (Singh et al, 2003).

HISTORY AND TRADITIONAL USES:

Uses in Indigenous Systems of Medicine:

The Ayurvedic drug Amrita is mentioned in various classical texts of Ayurvedic System of Medicine, viz. Charak, Sushruta and Ashtang Hridaya and other treatises like Bhava Prakash and Dhanvantari Nighantu under other various names, viz. Amritvalli, Chinnarruha, Chinnodebha, Amara and Vatsadani etc. (Sharma et al, 2001).

In Sushruta Samhita, it is mentioned under "Tikta-Saka Varga" and claimed to be useful in treating Maha-jvara (a kind of fever), Kustha (leprosy), Aruchi (anorexia) and Svasa (asthma). In other treatises i.e. Ashtang Hridaya and Charak Samhita, it has been indicated in diseases like Jvara (fever), Kamala (jaundice) and Vat Rakta (gout) etc.

In Bhava Prakash, it is considered as an astringent, diuretic, bitter tonic and potent aphrodisiac and curative against skin infections, jaundice, diabetes and chronic diarrhoea and dysentery. In Dhanvantari Nighantu, its medicinal properties are mentioned for cure of bleeding piles, promoting longevity, curing itching and erysipelas (Aiyer & Kolamall, 1963).

In Unani System, mostly "Sat Giloe" is incorporated in the preparations. "Arq Giloe" which is prepared from the fresh plant is considered as a febrifuge, while "Arq Maul Laham Mako-kashiwala" is a general tonic (Singh et al, 2004).

COMMERCIAL IMPORTANCE OF THE DRUG:

T. cordifolia pertinent to characterize the DNA fingerprinting for conservation and utilization of the plant genetic resources because it was helpful to know the genetic background of the medicinal plants having high commercial value, and also provides a major input into conservation biology.

T. cordifolia is a rich source of biologically active compounds, which would attract the attention of drug discovery groups to discover novel bioactive molecules for safer and effective treatment of various diseases and studies by HPTLC method has reported for the analysis of cordifolioside-A, both in 60% methanol extracts of *T. cordifolia* and in the available commercial formulations (Bhattacharyya & Bhattachary)

Preliminary Phytochemical Screening:

The following procedures were adapted to tests for the presence of various chemical constituents in extract.

S.NO	Phytochemical constituents	Aqueous extract	Methanol extract
1	Tannins Ferric chloride test	-	-
2	Alkaloids Dragendorff's test Wagner's test	+	+
3	Saponin Foam test	+	+
4	Flavonoids	+	+

	Shinoda test		
5	Carbohydrates Molish test	+	+
6	Steroids Liebermann test	+	+
7	Amino acids Ninhydrine test	+	+

Physiochemical parameters:

Dry form of *Tinospora Cordifolia* stem was grinded and analyzed by employing various physiochemical parameters like loss on drying, ash value, acid insoluble ash, water soluble ash, alcohol soluble extractive value and water soluble extractive value. Observations of physiochemical data are given in following table;

S.No	Parameters	Value observed
1	Loss on drying	7.25%
2	Total ash value	11.3±1.4%
3	Acid insoluble ash	1.9±0.7%
4	Water soluble ash value	17.5±0.3%
5	Alcohol soluble extractive value	0.857g
6	Water soluble extractive value	0.62g

PHARMACOLOGICAL ACTIVITIES:

Sr. No.	Biological property	Observation	Reference
1.	Antioxidant and free radical scavenging activity	The methanolic extract of <i>T. cordifolia</i> stem contains high amounts of phenolics, flavonoids, and alkaloids with moderate amounts of tannins and carbohydrates, which exhibit good total antioxidant activity and moderate free radical scavenging activities.	(Ghate et al, 2013).
2.	Antidiabetic activity	<i>T. cordifolia</i> was used in combination to treat diabetes, and several research studies confirmed that it causes a significant reduction in blood glucose levels.	(Singh, 2005).
3.	Renoprotective activity	Renoprotective activity	(Rahmatullah, 2010)
4.	Hepatoprotective activity	Tinosporine and tinosponone, identified in the stem and roots of <i>T. cordifolia</i> , are reported as hepatoprotective agents and have exhibited in vitro inactivating property against Hepatitis-B and E. A compound formulation having <i>T. cordifolia</i> has been observed to express hepatoprotective properties in adult goats of either sex.	
5.	Antibacterial activity	Both hot and cold methanol extracts of <i>T. cordifolia</i> stem contain significant antibacterial activity against all test bacterial strains of <i>Salmonella typhi</i> , <i>Pseudomonas aeruginosa</i> , <i>Staphylococcus aureus</i> , and <i>Shigella dysenteriae</i> . Ethanolic extracts exhibited significant antibacterial activity against <i>Escherichia coli</i> , <i>Proteus vulgaris</i> , and moderate activity was observed against <i>Enterobacter faecalis</i> .	(Singh & Singh, 2012). (Singh, 2005).
6.	Immunomodulatory activity	The aqueous extract of <i>T. cordifolia</i> has multifaceted immunomodulatory potential. The alcoholic and aqueous extracts of <i>T. cordifolia</i> have been tested successfully for adaptogenic and immunomodulatory activity.	potential (Upadhyay, 2011), (Rege et al, 1999)

7.	Wound healing activity	T. cordifolia is used in numerous Ayurvedic preparations having potent wound healing activity.	(Sinha et al, 2004).
8.	Antiviral activity	The leaves of T. cordifolia extracts show anti-HIV 1 activity. Extraction of important biologically-active phytochemicals from T. Cordifolia will certainly be helpful in treating and protecting various viral diseases in human beings.	(Mamidala et al, 2012).
9.	Improving cognition, concentration, and memory & cerebral ischemia	Due to the central antioxidant properties of T. cordifolia, having the important role in improving cognition, concentration, and memory, which provides potential benefits in Alzheimer's disease and attention-deficit-hyperactivity disorder. T. cordifolia prevents oxidative stress injury and cytokine regulation so it shows beneficial effects in improving cerebral ischemia.	(Mutalik & Mutalik, 2011).

MEDICINAL APPLICATIONS:

1. T. cordifolia is a good antioxidant; it is given with L-DOPA during Parkinson's disease. L-DOPA produces free radicals during the formation of dopamine. T. cordifolia neutralizes the side effect of drug (Srivastava et al, 2011).
2. Stem portion of T.cordifolia is used in general debility, dyspepsia, fever and urinary diseases (Singla, 2010).
3. The powder of root and stem of T.cordifolia is used along with milk for treatment of cancer (Bhatt & Sabnis, 1932).
4. Oral administration of the juice of stem with honey can also be used for treatment of asthma (Sinha et al, 2004).
5. The juice of the roots is very much effective in Urinary disorder (Meshram et al, 2013).
6. T. cardifolia has shown signification reduction in blood sugar level in both normal and Alloxan induced Diabetic mice. The extract of plant parts decreases the blood sugar level (Chattopadhyay, 1999). Guduchi is also used for soothing inflamed and injured mucous membranes in the digestive tract. It protects the stomach and duodenum by increasing the production of mucin (Meshram et al, 2013).
7. T. cordifolia is regarded as one of the best psychotropic drugs in India (Meshram et al, 2013).

Safety pharmacology: It is a common misconception that Ayurvedic medicines are always safe. In fact, they also pose serious health risks either in the form of adverse reactions or in the form of drug interactions. In a clinical study, T. cordifolia has been shown to be at a dose of 500 mg/d for a period of 21 days in healthy individuals.[80] It has also been shown not to exert any remarkable adverse effects on the cardiovascular system,[121,122] renal system,[112,122] central nervous system[39-40,45,121,123] and gastrointestinal system.[49,101,124]

Conclusion

Tinospora cordifolia is a valuable medicinal plant with a rich phytochemical composition and diverse therapeutic properties. Its traditional uses have been supported by scientific research, highlighting its potential in various disease conditions. Further studies are warranted to fully understand its mechanisms of action, optimize its formulations, and establish its safety and efficacy for widespread use.

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