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A SYSTEMATIC REVIEW ON- ETHNOMEDICINAL IMPORTANCE AND PHARMACOLOGICAL POTENTIAL OF *TINOSPORA CORDIFOLIA*

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ABSTRACT

The plant *Tinospora cordifolia* (Willd.), commonly known as Giloy or Guduchi, is used in Ayurvedic medicine. This plant has ethnomedicinal importance in the treatment of various chronic and acute diseases. This plant is a rich source of phytochemicals such as glucosides, alkaloids, flavonoids, diterpenoid lactones, steroids, polysaccharides, and phenolic compounds, which have a wide spectrum of ethnomedicinal and pharmacological potential. It also has immunomodulatory, antioxidant, anti-inflammatory, antidiabetic, nephroprotective, hepatoprotective, cardioprotective, neuroprotective, gastroprotective, anticancer, antiviral, and antimicrobial potentiality. The phytoactive components of *T. cordifolia* help the regulation of inflammatory pathways, oxidative stress, and various immune responses. This review summarizes the medicinal and pharmacological aspects of *T. cordifolia,* including phytochemical composition, traditional uses, medicinal importance, pharmacological activities, mechanisms of action, and future research perspectives of *T. cordifolia.*

Keywords: *Tinospora cordifolia*, Giloy, Guduchi, Ethnomedicinal

1 INTRODUCTION

The medicinal plant *Tinospora cordifolia* (Linn.) is a climbing plant that has been widely used in Ayurvedic and local forms of medicine. This plant, which is a shrubaceous deciduous plant with a height of three to four feet, is a member of the Menispermaceae family. *T. cordifolia,* commonly known as heart-leaved moonseed plant (English), Amrita Guduchi (Sanskrit), Giloe (Hindi), Gulancha (Bengali), Giloya (Hindi), Galo (Gujrati), and Teppatige (Telugu), is an important drug of the Indian system of medicine (Gupta et al., 2018). This plant is distributed throughout the tropical part of India from Kumaon to Assam, extending in the north through West Bengal, Bihar, Deccan, Konkan, Karnataka, and Kerala (Kaur et al., 2016). The stems of *T. cordifolia* are bitter-tasting and range in color from gray to brown to black. *T. cordifolia* is a succulent plant with long, fleshy, filiform aerial roots. The stem is cylindrical, 5-25 mm in diameter, soft, woody, and dry. According to Patanjali Yogapith, this plant is very effective in preventing swine flu, which has been declared an

epidemic worldwide. According to Mishra et al. (2014), *T. cordifolia* plants have anti-inflammatory, anti-apasmodic, carminative, digestive, and anti-stress as well as uses for diabetes, jaundice, urinary tract infections, fever, seminal weakness, skin diseases, and general debility.

2 PHYTOCHEMICALS OF *T. CORDIFOLIA*

Many aromatic and aliphatic phytochemical compounds, polysaccharids, glycosides, terpenoids, alkaloids, and steroids are among the phytochemical compounds found in *T. cordifolia* (Kumar et al., 2017). The plant *T. cordifolia* is the source of major phytochemicals like berberine, furanolactone, and other compounds like tinosporone, cordifolisides A to E, tinosporic acid, cordioside, giloin, picrotene, arabinogalactan polysaccharide, cordifol, gilosterol, bergenin, tinosporol, tinosporidine, sitosterol, octacosonal, tinosporide, palmarin, amritosides, tinosponone, palmatosides C and F, ecdysterone, makisterone A, tembetarine, magnoflorine, glucan, syringine, palmatine, isocolumbin, tetrahydropalmaitine, and jatrorrhizine (Kumar et al., 2017).

Table 1: Major phytochemicals in parts of *T. cordifolia,* representative active compounds, and their pharmacological activities

Parts of the *T. cordifolia*	Phytochemicals	Representative compounds	Pharmacological activities	References
Root and stem	Alkaloids	Berberine, Choline, Magnoflorine, Jatrorrhizine	Antimicrobial, Antioxidant, Antidiabetic	Upadhyay et al., 2010
Stem	Diterpenoid lactones	Cordifolide, Columbin, Tinosporon, Tinosporide	Hepatoprotective, Anti-inflammatory, Anticancer	Upadhyay et al., 2010; Kumar et al., 2020
Leaves	Flavonoids	Apigenin, Luteolin, Quercetin	Antimicrobial, Antioxidant	Tiwari et al., 2018; Kumar et al.,2020
Leaves and Stem	Glycosides	Cordioside, Cordifolioside A, Cordifolioside B	Antioxidant, Immunomodulatory	Sharma et al., 2012
Stem	Polysaccharides	Arabinogalactan polysaccharides	Wound healing activity, Immunomodulatory	Sharma et al., 2012; Kumar et al., 2020
Leaves and Stem	Phenolic compounds	Ferulic acid, Gallic acid, Ellagic acid	Anti-inflammatory, Free radical scavenging	Kumar et al.,2020
Stem	Steroids	Giloinsterol, Ecdysterone, β-Sitosterol	Cardioprotective, Anti-inflammatory	Kumar et al, 2020
Stem	Terpenoids	Clerodane diterpenes, and Sesquiterpenoids	Antimicrobial, Anti-inflammatory	Upadhyay et al., 2010

3 MEDICINAL AND PHARMACOLOGICAL ACTIVITIES OF *T. CORDIFOLIA*

T. cordifolia has various biological implications, including stimulating bile secretion through its bitter stomachic stem, which also relieves fever, reduces thirst, stops vomiting, and improves blood quality. It also has anti-inflammatory, diuretic, jaundice, skin, low fever, diabetes, urethral and vaginal discharges, as well as an enlarged spleen (Mishra et al., 2014). According to Kaur et al. (2016), *T. cordifolia* is utilised in a variety of preparations for immunosuppressive, anti-allergic, anti-inflammatory, hypoglycaemic, anticancerous, hepatoprotective, cardioprotective, wound- healing, and antihelminthic properties.

Some medicinal and pharmacological properties of this plant are as follows:

3.1 Anti-microbial activity

Extracts of T. cordifolia have antibacterial activities against E*. coli, Staphylococcus aureus, Klebsiella pneumonia, Proteus vulgaris, Shigella flexneri, Salmonella typhi, Salmonella paratyphi, Salmonella typhimurium, Pseudomonas aeruginesa, Enterobacter aerogene,* and *Serratia, marcesenses g*ram (+) bacteria (Deshmukh, 2017).The methanolic extract of T.

cordifolia has been reported to have potential antimicrobial activity (Deshmukh, 2017). The aqueous root extracts are used to cure leprosy (Choudhary et al., 2013). The anti-microbial activity of T. cordifolia was observed in leaf, stem, and root extracts against pathogenic microorganisms (Sandhu et al., 2013). The leaf and stem of T. cordifolia extracts exhibit inhibitory activity against several fungi and bacteria in laboratory studies, which indicates potential use as a source of anti-microbial properties (Siddiqui et al., 2025).Upadhay et al. (2011) have reported that aqueous extracts of *T. cordifolia* also inhibit both gram (+) and gram (-) bacteria, like *Klebsiella pneumonia, E. coli, M. luteus, S. pneumonia, S. aureus, B. cereus,* and *L. acidophilus*. However, the methanolic extract of T. cordifolia, from the whole plant, shows a significant dose-dependent antibacterial activity against gram (+) microbes (Gahlawat and Mazumdar, 2013), especially *V. cholera, Shigella dysenteriae, E. coli,* and gram (+) bacteria like *Bacillus sp. and S. aureus*.

3.2 Anti-oxidant activity

Tinospora cordifolia is a well-known medicinal plant which is used as an anti-oxidant component. It may be useful as a nutraceutical product in biological systems and as an antioxidant in food systems. Various extracts of *T. cordifolia*, including ethanolic, methanolic, and aqueous extracts, have been shown to exhibit anti-oxidant properties by George et al. (2016). In rats given alloxan-induced diabetes, the ethanolic extract boosted erythrocytes, lipid peroxide, and catalase activity while lowering superoxide dismutase and glutathione peroxide levels. Siddiqui et al. (2025) have reported that *T. cordifolia* has ethnochemicals like alkaloids, flavonoids, phenolics, and diterpenoids that scavenge reactive oxygen species, which reduce oxidative stress and protect cellular macromolecules from oxidative damage. However, methanolic leaf extracts of *T. cordifolia* decrease the level of the free radical species of diabetic rats and up-regulate the anti-oxidant enzyme (Sivakumar and Rajan, 2010), scavenging activity for free radicals. The ethanolic bark extracts of *T. cordifolia* have a greater capacity to scavenge free radicals than the methanol extracts (Neha et al., 2014). When compared to other solvents, the aqueous, ethanolic, and methanolic extracts of *T. cordifolia* exhibit strong potential anti-oxidant qualities as well as metal chelation and reducing power activities (Bhawya and Anilakumar, 2010). This plant can scavenge free radicals produced during aflatoxicosis in the biological system. *T. cordifolia* contains alkaloids such as tinosporin, choline, palmatine, isocolumbin, magnoflorine, and tetrahydropalmatine, which have protective effects against aflatoxin-induced nephrotoxicity (Gupta and Sharma, 2011).

3.3 Anti-diabetic activity

The stem extract of *T. cordifolia* is effectively consumed to cure diabetes by monitoring blood glucose. Srivastava et al. (20121) have reported that *T. cordifolia* has an anti-diabetic prospective which is specified using relieving oxidative stress, limiting gluconeogenesis, and augmenting insulin emancipation, as well as monitoring blood glucose levels. The oral treatment of *T. cordifolia* (100 and 200 mg/kg body weight) for 14 days mediates its anti-diabetic potential by mitigating oxidative stress, promoting insulin secretion, and also inhibiting (Sangeetha et al., 2011) gluconeogenesis and glycogenolysis. In the diabetic rat, the root extracts of *T. cordifolia* reduce the brain-mediated lipid level and down regulate the blood glucose and urinary glucose levels, emphasizing its lipid-lowering and anti-diabetic activity (Stanely et al., 2000). The leaf and stem extracts of *T. cordifolia* exhibit significant anti-diabetic activity by improving glucose homeostasis, enhancing insulin sensitivity, and protecting pancreatic β-cells (Singh and Chaudhuri, 2017; Kumar et al., 2020).

3.4 Anti-HIV activity

Patients with HIV have shown a notable improvement in immune system modulation after using *T. cordifolia* root extract (Promila et al., 2017). Due to its capacity to lower eosinophil counts, macrophage counts, B lymphocyte activation, haemoglobin levels, and polymorphonuclear leucocytes, extract *T. cordifolia* has been shown to have an immunomodulatory effect (Kalikae et al., 2008; Akhtar, 2010). The various preparations of this plant have been evaluated to determine its importance in treating HIV-positive patients by decreasing the patient's resistance to the retroviral regimen (Gupta et al., 2010). The preclinical evidence suggests promising antiviral activity, including potential anti-HIV effects; well-designed clinical trials are still required before therapeutic use can be recommended (Kumar et al., 2020; Dash and Verma, 2026).

3.5 Anti-toxic activity

The crude powder of *T. cordifolia* is used in the treatment of Parkinson's disease because it reduces the toxicities of L-DOPA therapy (Reddy and Reddy, 2015). The alkaloids of *T. cordifolia,* like tinosporine, palmetine, choline, isocolumbin, magnoflorine, and tetrahydropalmatine, showed protection activity against aflatoxin-induced nephrotoxicity. In albino male mice, extracts from leaves and stems have hepatoprotective properties against lead nitrate-induced toxicity, and an equivalent oral dosage of the extract prevents lead nitrate-induced liver damage (Sharma and Pandey, 2010).

3.6 Cardioprotective activity

The *Tinospora cordifolia* plant contains several phytochemicals like magnoflorine, berberine, palmatine, cordifoliosides, diterpenoid lactones, and tinosporide, which contribute to the protection of cardiac tissue from oxidative damage (Dash

and Verma, 2026). The alcoholic extract of *T. cordifolia* pretreatment in rats significantly reduced myocardial infarct size; lowered lipid peroxidation; restored endogenous antioxidant enzymes like catalase, superoxide dismutase, and reduced glutathione; and improved cardiac function (Sharma et al., 2005). Priya et al. (2017) have reported that *T. cordifolia* protects against cadmium-induced cardiotoxicity by reducing serum levels of cardiac injury markers such as lactate dehydrogenase and creatine kinase, which improves antioxidant defence systems and has myocardial architecture.

3.7 Immunomodulatory activity

The various parts of *T. cordifolia* have immunomodulatory activity by enhancing macrophage activation, stimulating phagocytosis, regulating cytokine production, and improving both innate and adaptive immune responses (Sharma et al., 2012; Dash and Verma, 2026). It's also improved humoral and cell-mediated immunity, which increases delayed-type hypersensitivity responses and enhances resistance against infections. These findings indicate its potential role as an immunorestorative and immunesupportive component (Kumar et al., 2024).

3.8 Anti-inflammatory activity

In Ayurveda, the *T. cordifolia* plants are extensively used for the cure of inflammatory diseases. Kumar et al. (2024) have studied that *T. cordifolia* leaf and stem extracts possess a significant anti-inflammatory activity by the modulation of multiple inflammatory signalling pathways. The phytochemicals of *T. cordifolia,* such as alkaloids (berberine and magnoflorine), lactones (tinosporide), steroids, glycosides, phenolic compounds, and polysaccharides, are active components and regulate oxidative stress and inflammatory mediators, thereby reducing inflammation in tissue (Kumar et al., 2024). The chloroform extract of *T. cordifolia* significantly suppresses the expression of cyclooxygenase-2, prostaglandin E_2, inducible nitric oxide synthase, tumour necrosis factor-α, interleukin-6, and interleukin-1β. It also inhibits the activation of p38 MAPK and NF-kB signalling pathways while preserving constitutive COX-1 activity, suggesting a safer anti-inflammatory activity (Philip et al., 2018). The various products of *T. cordifolia* leaf promote wound healing by regulating the inflammatory phase of tissue repair and reducing oxidative stress, and it's also accelerating tissue regeneration (Singh et al., 2025).

4 CONCLUSION

It is clear from the above review of the literature that the common medicinal plant *T. cordifolia* has a valuable source of phytochemical compounds with diverse ethnomedicinal and pharmacological properties. Future research should focus on standardization of various formulations and extracts, identification of active components, medicinal and pharmacokinetic evaluation, toxicity assessment, and multicenter clinical trials to establish its efficacy and safety in evidence-based medicine.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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