

REVIEW ARTICLE

A review on the ethnopharmacological and therapeutic aspects of *TINOSPORA CORDIFOLIA* THUNB.
 of menispermaceae family

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ABSTRACT

Tinospora cordifolia Thunb. commonly known as Guduchi is one of the most important medicinal herbaceous vine belonging to the family Menispermaceae which have relatively fewer documented medicinal plants compared to other families. *Menispermaceae* family is native to India's tropical regions, Myanmar and Srilanka, consisting of about 73 genera and about 320 species. Among them *Tinospora cordifolia* is well known for its medicinal value and therapeutic potentials. The whole plant is utilised in both traditional and modern medical system due to the presence of high alkaloid content in its stem and leaf parts. *T. cordifolia* is mostly distributed in India, China, Thailand, Myanmar, Philippines, Indonesia and Africa and typically thrive well in dry deciduous forests in an altitude up to 1000ft. This plant is renowned for its antioxidant, anti-inflammatory, anti-hyperglycaemic and immunomodulatory properties. Major phytochemical compounds including alkaloids, steroids, glycosides, diterpenoid lactones, sesquiterpenoids etc are present. *T. cordifolia* is widely used for the preparation of various herbal medicines and it is mentioned as 'Rasayana' in Ayurvedic medicine due to its power to rejuvenate and improve the immune system. Its plant parts are commonly used to treat diseases such as bronchitis, syphilis, ulcers, jaundice, piles, urinary tract infections, skin problems and liver diseases. This review aims to highlight the traditional and ethnopharmacological significance of *Tinospora cordifolia* in the current scenario of increasing demand for plant-based products for the treatment of chronic diseases worldwide.

Keywords: *Tinospora cordifolia*, ethnopharmacology, pharmacology, phytochemistry, therapeutic

1. INTRODUCTION

Using medicinal plants for healing is a therapeutic practice that is as old as humanity. There is copious evidence from a variety of sources (written papers, preserved monuments, and even original plant medicines) supporting the ancient human hunt for pharmaceuticals in nature. Due to the growing adoption of herbal healthcare methods, medicinal plants have become more significant in recent times. This is because of the existence of bioactive chemicals which gives them a wide range of pharmacological effects [1].

Tinospora cordifolia Thunb., is an evergreen perennial climber. This plant is a member of the family *Menispermaceae* and is deciduous and dioecious. In the Indian medical system, the herb is known as 'Rasayana' and holds great therapeutic significance. Modern medicine has acknowledged its effectiveness as well. *T. cordifolia* grows on a variety of tree species and is native to lower elevations in tropical regions of the Indian subcontinent. It

requires a moderate amount of soil moisture and prefers a wide range of soil types, from acidic to alkaline [2]. Growing on a variety of hedges and trees, *T. cordifolia* is a huge, widely spreading, glabrous, dioecious perennial deciduous climber. According to reports, it bears separate male and female blooms. When the stem is young, it has green succulent bark that is covered by a thin layer of brown bark. When the stem dries out and the bark separates from the wood, it is dotted with warty lenticels. Branches produce thin, pendulous, fleshy roots that are terete, striate, and have tubercled, pale, occasionally glossy, or glabrous bark [2].

India has long utilised medicinal herb, *Tinospora cordifolia* Thunb. in folkloric and Ayurvedic treatments. Due to the presence of several chemicals of pharmacological significance that fall into diverse classes, including steroids, sesquiterpenoid, glycosides, alkaloids, and phenolics, all parts of the plant are incredibly valuable. These substances are hepatoprotective,

immunomodulatory, anti-inflammatory, antipyretic, antidiabetic, and antioxidant due to their pharmacological characteristics [3].

T. cordifolia is used to treat several illnesses, including fever, dyspepsia, jaundice, asthma, diabetes, skin conditions, and persistent diarrhoea and dysentery. It is also essential in the management of helmenthiasis, rheumatoid arthritis, leprosy, and cardiac problems [4]. In traditional medicine, the root and stem parts are used as a counter measure against scorpion stings and snake bites. The stem is diuretic, bitter, stomachic, and increases bile secretions in addition to quelling thirst, enhancing blood quality, and treating jaundice. The stem juice helps with urethral and vaginal discharges, indigestion, and diabetes; while root and stem powder are used to treat cancer. In Ayurveda it is denoted as 'Amrita' for its usage for regeneration. Significant pharmacopoeias also have references related to this medicinal plant [4].

2. REVIEW OF LITERATURE

2.1. Ethnopharmacological aspects of *T. cordifolia*

T. cordifolia gained a significant attention since it is used in several regions of the nation in traditional and tribal medicine. The Baiga tribe, lives in Uttar Pradesh, produce paste from the stem of Guduchi (*T. cordifolia*). The medication was made and administered to treat fever [5]. *T. cordifolia* is used as a medicament by the seacoast fisherman and

tribal people of Bombay and its surrounding areas to cure fever, jaundice, chronic diarrhea, and dysentery [6]. The tribals of Bigwada, Rajasthan, and Jammu & Kashmir, use stem decoction orally to treat fever [7]. The herb is used on a daily basis by the tribal people of the Khedbrahma region of North Gujarat as food and medicine. For the treatment of cancer, the powdered root and stem bark of *T. cordifolia* were combined with milk [8]. The Gujjar and Backwal Muslim tribes of Rajouri, Jammu (Tawi) used the herb to treat bone fractures [9].

In the Dahanu forest section of Maharashtra, tribal races such as Agaris, Bhils, Dho-dias, Dublas, Khakar, Rimoshis, Thakurs, Vardaris, Vagharis, and Varlis utilize its stem decoction with cold or hot water (approximately 3-4 grams) in the morning on an empty stomach as a tonic for general weakness [10]. The inhabitants in Patiyala (Punjab) use two drops of the leaf juice to cure ear discomfort [11]. Tribals of Madhya Pradesh Harda District utilize this plant to treat fever, dysentery, diarrhea, piles, skin ailments, rheumatism, bronchitis, asthma, gynecological disorders, abortion, and snake bite [12].

2.2. Phytochemical constituents of *T. cordifolia*

Aerial and root parts of *T. cordifolia* have been reported to contain various phytochemical constituents. In the early 1900s, the plant was found to contain giloin, gilenin, and gilosterol, as well as bitter components such columbin, chasmanthin, and palmarin [13].

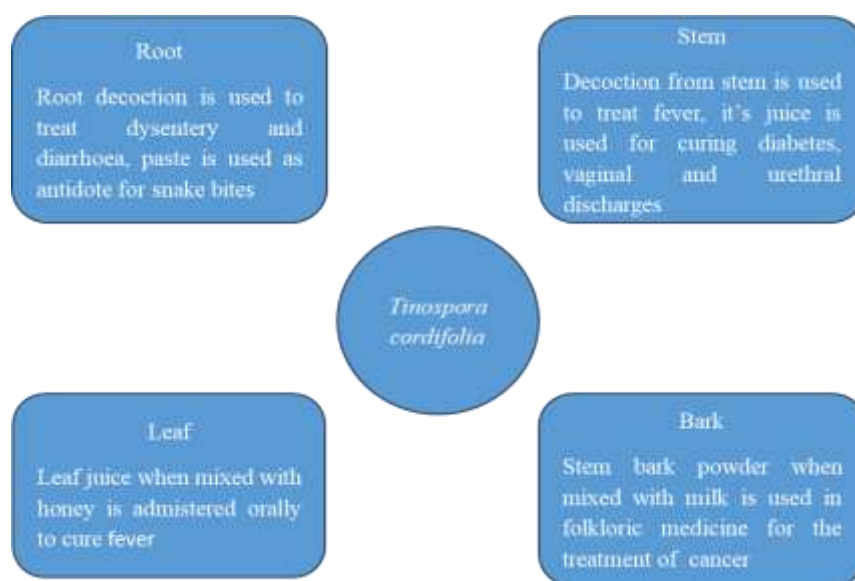


Figure 1. Schematic representation of traditional uses of *Tinospora cordifolia*

Table 1. Phytochemical constituents and the effects of major bioactive principles of *T. cordifolia*

Phytochemicals	Active principles	Effects in humans	Plant part	Reference
Alkaloids	Berberine	Anti-cancer	Stem, root	[14]
	Tinosporin	Neurological		[15]
	Palmatine	Infections		[16]
	Tembetarine	Inflammation,		[17]
Terpenoids	Tinosporide	Respiratory	Whole plant	[18]
	Furanoid-diterpene	Immunomodulatory		[19]
	Sesquiterpene	Anti-inflammatory		[20]
	Tinosporaside	Antipyretic, antidiabetic		[21]
Glycosides	Tinocordiside	Neurological	Stem	[22]
	18-norclerodane glucoside	Neurological		[23]
	Tinocordifolioside	Anticancer		[22]
	Palmatosides	activities.		[22]
Steroids	β -sitosterol	Immunomodulatory	Stem, aerial parts	[24]
	Ecdysterone	Anti-inflammatory		[25]
Aliphatic compounds	Heptacosanol	Anti-inflammatory	Whole plant	[26]
	Octacosanol	Antinociceptive		[27]
Diterpenoid lactones	Furanolactone	Vasorelaxant	Whole plant	[28]
	Clerodane derivatives	Norepinephrine induced		[29]

2.3. Pharmacological and therapeutic aspects of *T. cordifolia*

The alcoholic extract of *T. cordifolia* stem and leaf parts demonstrated substantial immunomodulatory effects. At a regular dose, the extract improved α -amylase activity and bone marrow cellularity in rats. According to the studies some substances, including 11-hydroxymustakone, N-methyl-2-pyrrolidone, N-formylannonain, cordifolioside A, magnoflorine, tinocordiside, and syringing, have shown immunomodulatory effects [30]. The aqueous extract of the stem section demonstrated anti-inflammatory effect in albino rats. When given orally, it greatly reduces the acute inflammatory response to carrageenin extract [31]. The effect of the whole plant extract against CCl₄ induced changes by causing hepato-cellular changes after protein formation or bioaction, resulted in an accelerated toxification. The plant's ability to reduce free radicals and suppress lipid peroxidation makes it a potential hepatoprotective agent [32].

Anti-cancerous benefits of *T. cordifolia* have largely been researched using animal models. TCE protects testes from sub-lethal gamma radiation by increasing body weight, tissue weight, testes-to-body weight ratio, and tubular diameter in male Swiss albino mice [33]. In pre-irradiated mice, TCE reduced radiation-induced lipid peroxidation and GSH levels in testes. Pre-treatment of HeLa cells with TCE reduces cell viability, increases LDH, and decreases GSH S-transferase activity [33]. The stem methanolic extract of *T. cordifolia* (200mg/kg, i.p. daily for 5 days) significantly enhanced white blood cell count in BALB/c mice ($P < 0.001$). It increased bone marrow cellularity ($18.16 \times 10^6/\text{femur}$) and α -esterase positive cells (1423/4000), indicating stem cell maturation. The extract also significantly increased humoral immune response by increasing the number of plaque-forming cells in the spleen (1575 PFC/106 spleen cells) and circulating antibody titre (256), as well as enhancing macrophage activation (129%) [34]. Aqueous, alcoholic and chloroform extracts of *T. cordifolia* leaf extract at concentrations of 50, 100, and 200 mg/kg body weight showed significant hypoglycemic effects in diabetic rabbits [35].

Oral treatment of aqueous root extract of *T. cordifolia* to alloxan-induced diabetic rats resulted in a considerable reduction in blood glucose and brain lipids. The root extract reduces hepatic glucose-6-phosphatase, serum acid phosphatase, alkaline phosphatase, and lactate dehydrogenase levels in

diabetic rats [36]. Another study demonstrated that crude ethanolic extract of *T. cordifolia* has hypoglycemic effect in alloxan-diabetic rats [37]. *T. cordifolia* plant decoction when effectively treated in carrageenin-induced hind paw oedema in rats, demonstrated potential anti-inflammatory properties [38]. The effectiveness of crude medication formulation incorporating *T. cordifolia* against *Entamoeba histolytica* was investigated. Crude extract of the plant inhibited enzyme levels of axenically cultured amoeba DNase, RNase, aldolase, alkaline phosphatase, acid phosphatase, α -amylase, and protease to variable degrees [39]. Aqueous root extract of the plant was further investigated for its hypolipidemic impact. After administering the extract at 2.5 and 5.0 g/kg body weight for 6 weeks, alloxan diabetic rats experienced significant reductions in serum and tissue cholesterol, phospholipids, and free fatty acid levels. The root extract at a dose of 5.0 g/kg body weight had the strongest hypolipidemic impact [40]. Water and ethanolic extracts of *T. cordifolia* stem prevented cyclophosphamide-induced immunosuppression. The ethanolic stem extract from the plant inhibited cyclophosphamide-induced anaemia. The water extract of the plant was shown to be more powerful than the other extract [41]. The medication was tested for its ability to prevent liver damage caused by the typical hepatotoxin, carbon tetra chloride in rats. *T. cordifolia* was found to prevent fibrous alterations and promote regeneration of parenchymal tissue, even though it exacerbated acute injury [42].

Pharmacological and clinical investigations of *T. cordifolia* was conducted to investigate its involvement in uraemia. In dogs, the water extract caused a temporary drop in blood pressure, bradycardia, and increased ventricular contraction force, as well as diuresis in rats. It drastically reduces blood urea levels in uremic dogs [43]. The non-hormonal medication minofil, combining *T. cordifolia* and other plant medicines, was evaluated clinically in post-menopausal women. Estriol was associated with breast soreness, nausea, and fluid retention by 22% (7 cases), but minofil had no adverse effects. Minofil is a cost-effective and side-effect-free alternative to HRT, which is still debated. It has a shorter treatment period and longer-lasting benefits [44]. Herbal mixtures along with *T. cordifolia* ingredients, has been shown to have anabolic properties. A study on the efficacy of adjuvant therapy with a multi-ingredient herbal preparation in tuberculosis patients on anti-

tubercular medications were found to be beneficial in both subjective (appetite, sense of well-being) and objective (weight, blood protein) parameters [45].

3. CONCLUSION

This review focuses on the botanical description and medicinal properties of *Tinospora cordifolia*. Scientists can use the plant's biodiversity and traditional medicinal value to identify pharmacologically active and therapeutic components for treating various ailments. It is determined that this miraculous herb has been traditionally used by numerous communities across the tribal regions of the world for the treatment of urinary, gastrointestinal, cutaneous, pulmonary, hepatic, gynaecological, inflammatory, and infectious disorders. Furthermore, traditional and local medicinal practitioners recognise the species' ability to heal allergies, tumours, and cancers. Almost all parts of the plant are being used to treat various ailments. In recent times, the old traditional practices are gradually declining extremely and under risk owing to rapid modernization, thus there is an urgent need for the documentation of such tribal species and aid to create novel ways to unlock their efficiency employed for human welfare for the future.

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