



# Phytopharmacological Perspectives of *Tinospora cordifolia* Chemical Constituents and Medicinal Properties

Kagne SS<sup>1\*</sup>, Uplanchiwar VP<sup>1</sup>, Thakare VM<sup>1</sup>, Mehta HD<sup>1</sup>, Bais AG<sup>2</sup>, Kathane KG<sup>1</sup>, Khiwansara KJ<sup>1</sup> and Guha SS<sup>1</sup>

<sup>1</sup>Nagpur College of Pharmacy, Wanadongri, Nagpur, India

<sup>2</sup>Priyadarshini JL College of Pharmacy, Nagpur, India

\*Corresponding author: Vaibhav P Uplanchiwar, Professor, Nagpur College of Pharmacy, India, Tel: +91 9039436908; Email: vaibhavuplanchiwar@gmail.com

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## Abstract

According to the World Health Organization, 80% of the world's population relies mostly on traditional remedies including the use of plant extracts or active components. India's mega-biodiversity and knowledge of rich historic traditional systems of medicine (Ayurveda, Siddha, Unani, Amchi, and local health traditions) give a solid foundation for the use of a wide range of plants in general healthcare and the treatment of common disorders. *Tinospora Cordifolia* is a Deciduous woody climbing shrub found in India, China, and Africa. It is a member of the Menispermaceae family. This plant's pharmacological importance stems mostly from its root, stem, and leaf. It contains a variety of photoactive chemicals, including alkaloids, steroids, glycosides, lactones, polysaccharides, and others. Practically every portion of the plant has immunomodulatory effects. It is a significant medicinal plant used in Ayurveda medicine to treat colds, fevers, diabetes, and even rheumatoid arthritis.

**Keywords:** *Tinospora Cordifolia*; Medicinal Plants; Guduchi; Medicinal; Ayurveda; Giloy

**Abbreviations:** TCE: *Tinospora Cordifolia*; PMN: Polymorphonuclear leucocytes, LPO: Lipid Peroxidation; EETC: Ethanolic Extract of *Tinospora Cordifolia*; GST: Glutathione S Transferase; GR: Glutathione Reductase; LPO: Lipid Peroxidation.

## Introduction

80% of people worldwide, according to the World Health Organization, rely mostly on conventional treatments, including those that use Pharmacological chemicals including phytochemical compounds. The gigantic of Indian, as well as understanding of rich historical traditional systems of medicine (Ayurveda, Siddha, Unani, Amchi, and local health traditions), give a firm framework for the application of

a varied variety of plants in healthcare and the cure for prevalent clinical maladies [1].

*Tinospora Cordifolia* is a shrub that's also frequently utilized in Ayurveda medicine. It belongs to the Menispermaceae class. The plant is a woody, glabrous climbing shrub native to India. It may additionally be found in Burma and Sri Lanka. It thrives in the tropics, may reach vast heights, and climbs massive tree stumps. The stem is gray or creamy white in color, spirally and vertically split, and interspersed with huge clover small bumps. The wood is white, soft, and porous, and when exposed to air, the freshly cut surface immediately turns yellow. The leaves are simple, overlapping, allowed to escape, long petiolate, and chordate in shape, with such a preferable option reticulate venation.

The branches sprout long thread-like aerial roots.

Flowers are unisexual and tiny. Male flowers grow in bunches, where as female blooms grow alone. Six sepals are arranged in two whorls of three each. Six obovate and membranous petals form two whorls. The aggregate fruit is red, juicy, and has numerous drupelets on a robust stem

with crimson sub terminal style scars [2]. Menispermaceae is a tropical plant family with around 70 genera and 450 species. It may be found all across India, as well as in areas of Sri Lanka, Bangladesh, and China [3]. In Ayurveda, the plant is known as Rasayana and is widely recognized for strengthening the immune system and the body's protection against certain invading Microorganisms [4] (Figure 1).



Figure 1: *Tinospora*.

### Common Name [5]

- **Latin:** *Tinospora cordifolia* (willd.) Hook.F. & homson
- **English:** Gulancha/ Indian *Tinospora*
- **Sanskrit:** Guduchi, Madhuparni, Amrita, Chinnaruha, Vatsadaani, Tantrika, Kundalini & chakralakshanika.
- **Hindi:** Giloya, Guduchi
- **Bengali:** Gulancha
- **Telugu:** Thippateega
- **Tamil:** Shindilakodi
- **Marathi:** Shindilakodi
- **Gujarathi:** Galo

### Classification [6]

- **Kingdom:** Plantae – Plants ;
- **Subkingdom:** Tracheophyta –Vascular Plants;
- **Super-division:** Spermatophyta-Seed bearing plants
- **Division:** Magnoliophyta-Flowering;
- **Class:** Magnoliopsia-Dicotyledons
- **Subclass:** Polypeptalae-Petals are free;
- **Series:** Thalamiflorae-Many stamens and flower hypogynous
- **Order:** Ranunculales
- **Family:** Menispermaceae
- **Tribe:** Tinosporeace
- **Genus:** *Tinospora* Species: *cordifolia*

### Chemical Constituents

*Tinospora Cordifolia* Alkaloids, diterpenoid, lactones, glycosides, steroids, sesquiterpenoid, phenolics, aliphatic chemicals, as well as polysaccharides are some of the constituents [7].

### Medicinal Properties of *Tinospora Cordifolia*

*Tinospora Cordifolia* Since it has biological activities also including anti-inflammatory, immunomodulatory, anti-oxidant, anti-diabetic, anti-periodic, anti-spasmodic, anti-neoplastic, anti-stress, anti-leprotic, anti-malarial, hepatoprotective, anti-allergic, and anti-arthritis activity, it is extensively utilized in conventional Ayurvedic medicine in the country of India [8].

*Tinospora Cordifolia* Fever, asthma, diabetes, dyspepsia, jaundice, urinary problems, skin diseases, and chronic diarrhoea and dysentery are all treated with this medication. It is additionally utilized to treatment heart disease, leprosy, helminthiasis, and rheumatoid arthritis [9].

- *T. cardifolia* snake bite but instead scorpion stem and root injuries sting antidote [10].
- The stem is Bitter, stomachic, diuretic, increasing bile formation, thirst-quenching, blood enrichment, as well

as healing jaundice [11].

- Plant stem juice can help Diabetes, dyspepsia, especially vaginal and urethral discharges are also possibilities are all symptoms [12].
- The bark of this plant possesses anti-allergic, anti-spasmodic, anti-pyretic, and anti-inflammatory properties and antileprotic properties [13].
- The Cancer being cured by combining root as well as stem powder with milk [14].
- The entire *T.cardifolia* plant It is utilized to treat pig scabies, diarrhea, urinary diseases, syphilis, skin issues, and bronchitis, in addition to being used to prolong life, boost immunity, and stimulate the immune system [15].
- The Usually combined with ghee but rather honey, dried fruit powder is used as a tonic and in the treatment of jaundice and rheumatism [16].
- This plant's Dry stem crude extract, which was poly saccharide in nature, displayed polyclonal B-cell mitogen activity, as well as active stem extract components increased their humoral response in mice. [17].
- Giloy (*T.cardifolia*) juice, a combination of Giloy herb and tulasi leaves, is used to treat monkey malaria [18].
- *T.cardifolia* Across both acute as well as subacute inflammation scenarios, stem aqueous extract shows anti-inflammatory action [19].
- It has It seems to have anti-allergic rhinitis characteristics. Allergic rhinitis is an atopy condition characterized by hypersensitivity towards pollens emitted by grass, weeds, trees, and dust, among other things [20].
- The aqueous extract of *T. cordifolia* stem has radioprotective action [21]. It is used to cure jaundice because it decreases body heat [22].
- This same presence of alkaloids throughout this plant's stem regulates blood sugar levels [23].
- It reduces radiation-induced tissue damage [24]. The herb is also used to cure eye problems and fractures [25].

## Pharmacological Activity

### Anti Diabetic Activity

*T. cordifolia* extracts have been shown in pharmacological investigations to have anti-diabetic properties in vivo. It is believed indicates alkaloids, tannins, cardiac glycosides, flavanoids, saponins, and steroids, among other physiologically active phytoconstituents produced from diverse portions of either the plant, mediate its anti-diabetic activity [26].

These chemicals have been reported to have several target actions in diabetes situations, allowing for possible Usage includes clinical and experimental research. Kannadhasan R and Venkataraman S investigated the

effectiveness of *Tinospora Cordifolia* (SETc) (1000mg/kg/p.o) on diabetic patients and discovered that it possesses antidiabetic activity as well as antiobese properties [27].

An increase in streptozotocin diabetic albino rats ethanolic extract of *Tinospora Cordifolia* leaves in two doses (200 and 400 mg/kg b.w.) During 10 and 30 days, it was given orally. In diabetic rats, TC has been shown to have a considerable anti-diabetic impact, with effectiveness ranging from 50% to 70% when compared to insulin [28]. Borapetoside C (5 mg/kg, i.p.) from *Tinospora crispa* decreased High plasma glucose levels in diabetic rats boosted glucose intake, delayed insulin emergence of resistance, as well as finally improved insulin sensitivity.

Borapetoside C's hypoglycemic activity may have been aided by the stimulation of insulin-induced IR-Akt-GLUT2 expression in the liver and the increase of insulin sensitivity [29]. Palmatine, jatrorrhizine, and magnoflorine, which are isoquinoline alkaloid rich fractions from stem, have been demonstrated both in vitro and in vivo to replicate insulin and release insulin [30]. Water, ethanol, and methanol extracts of the plant stimulated glucose absorption in Ehrlich ascites tumor cells [31].

### Anti Cancer Activity

*Tinospora Cordifolia* possesses anti-cancer efficacy that has been well shown in animal studies. This same anticancer activity of *Tinospora Cordifolia* alkaloid palmatine was successfully proven in a 7,12-dimethylbenz(a)anthracene DMBA-induced skin cancer model using mice utilizing response surface technique (RSM) [32]. A single injection of *Tinospora Cordifoliae* xtract at dosages of 200, 400, and 600 mg/kg dry weight, 24 hours before cyclophosphamide (at 50 mg/kg), decreased micronuclei generation in mouse bone marrow in a dose-dependent manner.

C57 Bl mice were administered a 50% methanolic extract of *Tinospora Cordifolia* at a dose of 750 mg/kg body weight for 30 days, which improved their life span and decreased tumor size considerably decreased when compared to controls [33].

Mishra R et al Using C6 glioma cells, researchers explored the anti-brain cancer potential of a 50% ethanolic extract of *Tinospora Cordifolia* (TCE). In C6 glioma cells, TCE, in a dose-dependent way, inhibited cell proliferation while promoted differentiation [34].

Manju Bala and colleagues *Tinospora Cordifolia* secondary metabolites KB (human oral squamous carcinoma), CHOK-1 (hamster ovary), HT-29 (human colon cancer), and SiHa

(human cervical cancer) cell lines, together with primary mice cells, were tested.

### Immunomodulatory Activity

*Tinospora Cordifolia* has a well-known immunomodulatory effect. It has been reported that the active substances Immunomodulatory and cytotoxic characteristics of 11-hydroxymustakone, N-methyl-2-pyrrolidone, N-formylannonain, cordifolioside A, magnoflorine, tinocordiside, and syringin [35].

*Tinospora Cordifolia* ethanolic extract (100 mg/Kg/p.o.) possesses immunomodulatory activity, according to the stem is validated by increasing the amount antioxidant enzymes, activating T and B cells, and generating antibodies, all of which have essential functions in immunity, along with boosting melatonin concentrations in the pineal gland and cytokine levels that play important roles in immunity, such as IL-2, IL-10, and TNF.

Aqueous *Tinospora Extracts* have also been demonstrated to have an effect on cytokine generation, mitogenicity, immunological effector cell stimulation, and activation [36].

PMN cells (polymorphonuclear leucocytes) are an important part of the host defensive system. *Tinospora Cordifolia* extracts activated PMN cells for phagocytosis of additional *Candida* cells utilizing with in vitro slide phagocytosis approach [37]. Oral treatment of *T cordifolia* alcoholic extract (100 mg/kg, p. o) resulted in a clear rise in foot pad thickness as well as a substantial increase in WBC counts and bone marrow cells, indicating a stimulatory impact on the hemopoetic system [38].

Bharti Umretia and colleagues According to the findings of the study, Guduchi Ghana (concentrated form of aqueous extract of Guduchi) prepared traditionally has a substantial immunostimulatory effect on the immune system [39].

### Anti Oxidant Activity

*Tinospora Cordifolia* has the potentially for application as that of an antioxidant in food systems and maybe as a nutraceutical in biological systems. *Tinospora Cordifolia* extracts in methanol, ethanol, and water demonstrated substantial antioxidant capability when especially in comparison to these other solvents, these include metal chelation and power activity reduction [40].

According to the findings, *Tinospora Cordifolia* stem methanol extracts taken orally improved erythrocyte

Catalase activity related membrane lipid peroxide. It moreover reduced the activities for superoxide dismutase and glutathione peroxidase in treated group diabetic rats [41]. *Tinosporacordifolia* potentially Scavenge free radicals induced by aflatoxicosis. Through the inclusion of alkaloids such as choline, tinosporin, isocolumbin, palmatine, tetrahydropalmatine, as well as magnoflorine, *Tinospora Cordifolia* provided protection towards aflatoxin-induced nephrotoxicity [42]. Neha Upadhyay et al According to the findings, *Tinospora Cordifolia* As compared to methanol extracts, Bark ethanol preparations seemed to have the highest free radical scavenging activity, as well as the highest phenolic content [43].

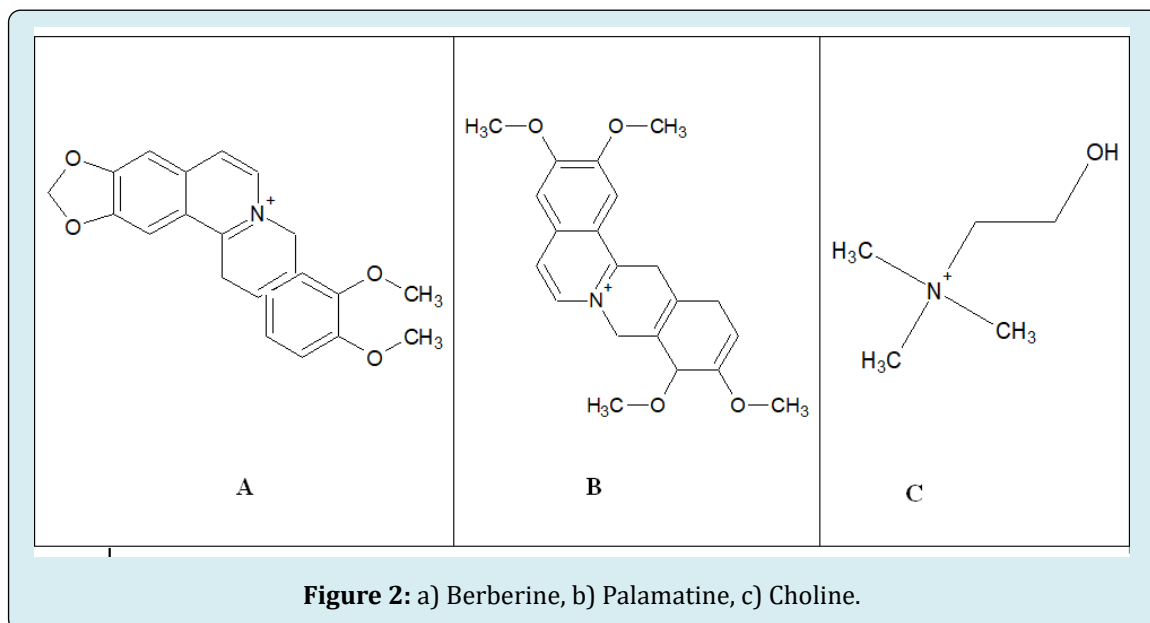
The treatment of an ethanolic extract of *Tinospora Cordifolia* (EETC) to male Wister albino rats with N-nitrosodiethylamine (DEN) caused liver cancer restored the levels of lipid peroxidation (LPO), enzymic and nonenzymic antioxidants to near normal [44].

### Anti Toxic Activity

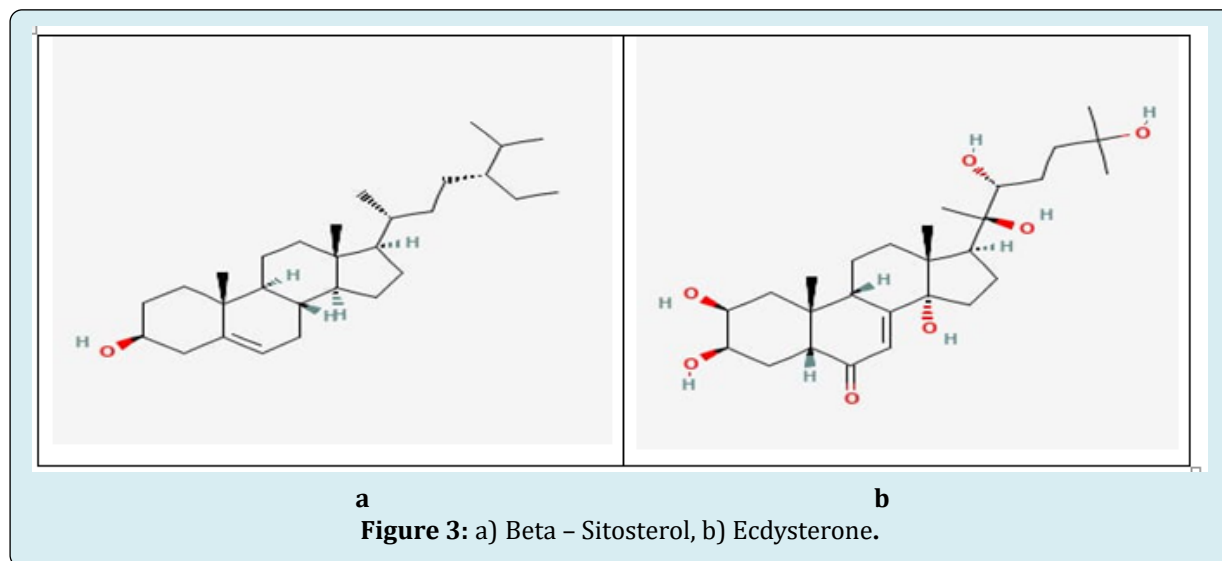
L-DOPA is considered the gold standard therapy for Parkinson's disease, however several studies have shown that it causes the death of surviving dopaminergic neurons in *Tinospora Cordifolia* crude powder co-administration protected dopaminergic neurons in the Brain as compared to a Mock operation control group. *Tinospora Cordifolia* crude powder treatment has been shown to reduce the toxicity of L-DOPA therapy for Parkinson's disease [45]. *Tinospora Cordifolia* alkaloids Aflatoxin-induced nephrotoxicity has been demonstrated to be protected by choline, tinosporine, isocolumbin, palmetine, tetrahydropalmatine, and magnoflorine.

*Tinospora Cordifolia* extracts have been demonstrated to scavenge free radicals generated during aflatoxicosis. It has protective benefits by reducing thiobarbituric acid, GSH, ascorbic acid, protein, and increasing the activity of anti-oxidant enzymes in the kidney such as SOD, CAT, GPx, Glutathione S-transferase (GST), and glutathione reductase (GR) [46] Cyclophosphamide, an anti-cancer medication, has just been found to decrease glutathione levels within both the bladder and the liver, while additionally decreasing levels of the cytokines interferon- and IL-2 while elevated numbers of the pro-inflammatory cytokine TNF-. This impact might be reversed with *Tinospora Cordifolia* medication, showing *Tinospora Cordifolia's* function in overcoming Cyclophosphamide-induced toxicities in cancer treatment [47]. (Figure 2-5).

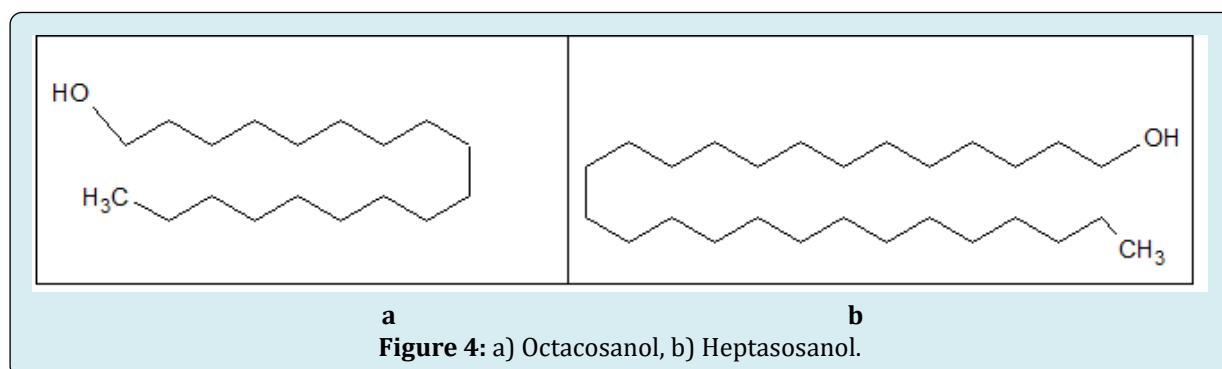
## Alkaloids



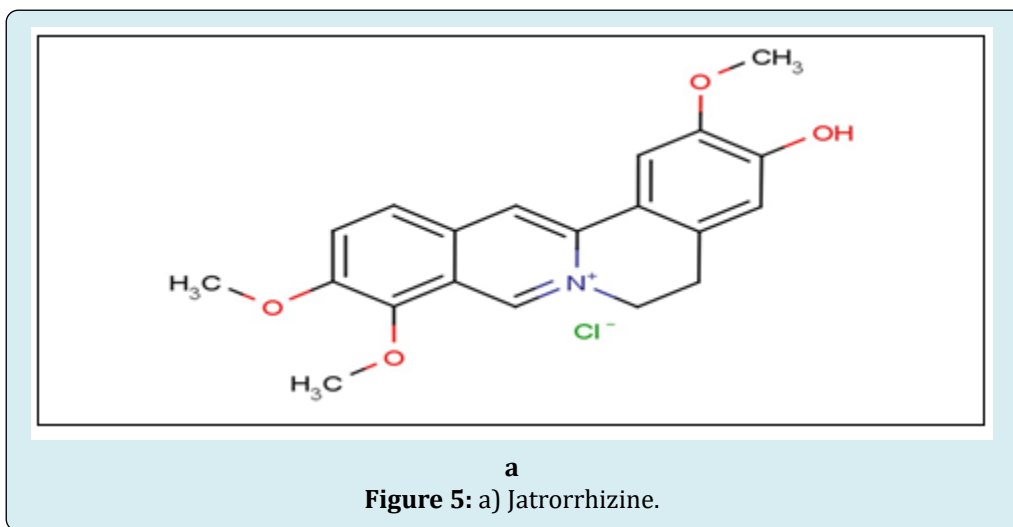
## Steroids



## Aliphatic Compounds



## Miscellaneous



## Discussion

*Tinospora Cordifolia*, often known as “Guduchi,” is a huge climber with several elongated branches. *Tinospora cordifolia* For millennia, it has been used to treat Fever, jaundice, chronic diarrhea, cancer, dysentery, bone fracture, pain, asthma, skin illness, deadly bug bite, snake bite, as well as eye disorders are all treated with it. *Tinospora cordifolia* extract components and biological activity have recently been discovered in investigations. Such qualities can be used to create novel formulations that are better and more promising than conventional ones. Although *Tinospora* is genetically heterogeneous and there have been reports of tissue culture-based multiplication, effective germplasm conservation measures.

The potential of a commercially significant medicinal plant with many biological functions that have not yet been realized. Significant research has really been carried out on the isolation and purification of active TC constituents that seem to be principally responsible for the treatment of numerous illnesses, as well as potential confirmation. It offers numerous health benefits to clients as a pharmaceutical agent. Nevertheless, since the crude variety of that kind of medicinal plant has a harsh and bitter flavor, future research should concentrate on the TC integrated product but also its diversification.

## Conclusion

The current review focuses on *Tinospora cordifolia*'s botanical description and therapeutic value. Because of its great bio-diversity and historic medicinal relevance, the plant opens up a new avenue of study for Researchers are striving to extract pharmacologically active and therapeutic constituents from either the plant in attempt to heal a

number of horrifying diseases. *Tinospora cordifolia*, a versatile medicinal plant, is a unique source of different chemicals with distinct chemical structures. Given that there has been minimal research on the biological activity and potential medicinal uses of these chemicals, further research is required before they may be used to treat diseases. To build modern pharmaceuticals from *Tinospora cordifolia* components, a drug-development initiative should be initiated.

The proposed review provides an overview on the traditional antidiabetic, anticancer, immunomodulatory, antioxidant, antibacterial, and antitoxic claims of *Tinospora Cordifolia*, as well as their support by modern research. In recent years, there has been a growing trend and interest in medicinal plant research. Over the past couple of decades, a significant amount of study has been conducted to better understand the chemistry of different sections of *Tinospora cordifolia*. While *Tinospora Cordifolia* has been used effectively in Ayurvedic medicine for millennia; nevertheless, further research and development work on *Tinospora Cordifolia* and its products is required for increased economic and therapeutic application. This review can be utilized to conduct additional research.

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