

## A PHARMACOLOGICAL AND CHEMICAL CONSTITUENTS REVIEW ON TINOSPORA CORDIFOLIA -A MEDICINAL HERB

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### ABSTRACT

*Tinospora cordifolia* (Giloy) is one of the essential and very prominent herbs that are traditionally used as a common ingredient in the different Folk, Ayurvedic, Unani and Siddha medicine systems. This plant's ceremonial medicinal importance is primarily because of the root, stem, and leaf. It consists of different compounds that are phytoactive, such as alkaloids, hormones, lactones, polysaccharides, glycosides, etc. In nearly all areas of the plant, immunotherapeutic effects are observed. It is one of the most significant medicinal plants used in the treatment of colds, fever, diabetes, and even rheumatoid arthritis in Ayurvedic medicine.

**KEYWORD:** *Tinospora cordifolia*, Giloy, pharmacological potential, phytochemicals, Medicinal properties.

### INTRODUCTION

The World Health Organisation (WHO) has estimated that up to 80 percent of people, including some medicinal plants, still rely mostly on herbal drugs for their prescriptions. Plants have been used as natural medicines ever since the dawn of human life. Recently, scholars have shown considerable interest in conventional medicinal plants developing novel prescription drugs. India, with its massive biodiversity and tremendous knowledge of ancient herbal medicine systems such as Ayurveda, Siddha, Unani, Amchiand, provides a solid base for the general healthcare usage of a wide range of species and the diseases of common people.<sup>[1]</sup>

Among the immense library of precious medicinal plants is *Tinospora cordifolia*, a deciduous scaling shrub belonging to the Menispermaceae family. The plant family Menispermeaceae consists of around 70 genera and 450 species distributed in tropical

climates. In India, and also in parts of Sri Lanka, Bangladesh and China<sup>[2]</sup>, it is present. The herb is known as Rasayana in Ayurveda that is very well known for building resistance to disease and defending the body from micro-organisms attacking it.<sup>[3-4]</sup>

Since time immemorial, *Tinospora cordifolia* has been an important drug in Indian medicinal systems and has been used in medicines. The medicine is well-known and is prescribed for fever, diabetes, dyspepsia, jaundice, urinary complications, skin conditions, chronic diarrhoea and dysentery. In the treatment of coronary disease, leprosy and helmenthiasis, it has also been shown to be effective. In fact, stem starch is digestive and nutritious and is used in a large range of diseases.<sup>[8]</sup>

In conventional medical regimens, *Tinospora cordifolia* is a well-known medicinal plant and recent research findings have emphasised the possible application of *Tinospora cordifolia* in modern medicine. The aim of the current study is to map the medicinal properties and possible possibilities of *Tinospora cordifolia* for further research into the production of effective therapeutic compounds.

### **Common names**

Latin : *Tinospora cordifolia*

English : Gulancha / Indian *Tinospora*

Sanskrit: Guduchi, Madhuparni, Amrita, Chinnaruha, Vatsadaani, Tantrika.

Hindi : Giloya, Guduchi

Bengali: Gulancha

Telugu: Thippateega

Tamil : Shindilakodi

Marathi: Shindilakodi

Gujarathi: Galo

Kannada: Amrita balli, Madhupa

### **Taxonomic classification**

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 hypogynou;

Order :Ranunculales;

Family :Menispermaceae-The Moonsee family;

Tribe :Tinosporeace;

Genus :Tinospora;

Species :cordifolia.

### **Distribution**

The plant is spread all over India's tropical and subtropical areas. It is native to areas such as India, Sri Lanka, China, Myanmar, Thailand, Indonesia, Malaysia, Vietnam, Bangladesh, South Africa and the Philippines.<sup>[5-6]</sup>

### **Growth Requirement**

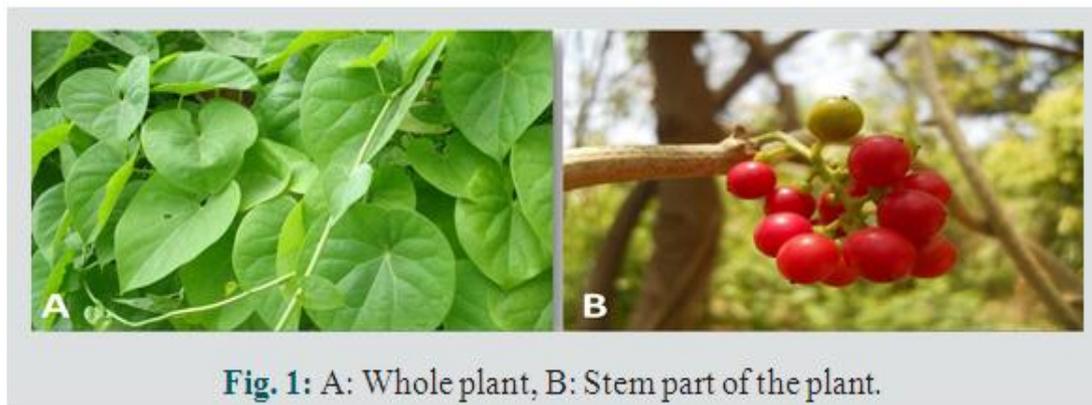
The plant is very rigid and can be cultivated in virtually all climates, but warm climates are favoured. Currently, planting takes place during the rainy season (July-August). It can be grown successfully in any number of soils. Medium black or red soil can be preferred for cultivation purposes.<sup>[7]</sup>

### **PLANT DESCRIPTION**

Guduchi is a large leaves are alternate, perennial, coniferous twine usually found with scrumptious stems and papery bark in India, Myanmar and Sri Lanka. It is endemic to the tropical area of India, growing to a temperature range of 25 to 45°C at an altitude of 500 meters.<sup>[9]</sup> Easy, heart-shaped and dark, bright green is the colour of the leaves. In contrast, the lamina is broadly ovate, alternate, stipulate, entire, 10-12 cm long and 8-15 cm thick with pleomorphic vascular bundles multi-coated.<sup>[10]</sup> The stem surface tends to be very long and 3-8 mm in diameter.<sup>[11-12]</sup>

Bark is succulent, with deep spotted clefts and large lenticels, similar to rosettes. Gray or creamy white is the colour of the bark. Broad, thread-like aerial stems emerge from the branches. White or light greyish brown is the colour of the long, dusty roots.<sup>[13]</sup> Flowers in the auxiliary and terminal racemes are uni-sexual, short and greenish purple. Male flowers are grouped, while in a single inflorescence, female flowers normally occur. In a flower there are six sepals, free in two series, three petals each, and six free and smaller petals than sepals, ovate and membranous.<sup>[14]</sup> Over the summer (March to June), flowers prosper, while fruits mature during the winter

(November). The fruits are orange-red, fleshy, 1-3 ovoid, flat, thick stalk droplets with a sub-terminal frighten-style aggregate.<sup>[15]</sup> Therefore, the family is known as the Moonseed family.<sup>[16]</sup> Moreover, the endocarp is variously ornamented “Fig. 1”.



**Fig. 1:** A: Whole plant, B: Stem part of the plant.

## HISTORY AND AYURVEDIC ASPECTS

The name of three elemental substances embedded in Indian scriptures known as the Vedas, such as Kapha, Vata and Pitta, is Ayurveda, a 5,000-year-old medicinal theory. Ashtang Hridaya and Sushrut, including Bhava Prakash and Dhanvantri Nighant, as per Ayurvedic text, viz., Charak and other treaties. More broadly recognised are Guduchi or Amrita, Amara, Amritvalli, Chinmarruha, Chinnodebha and Vatsadani, etc.<sup>[17-21]</sup> Historically, many diseases such as Svasa (asthma), Maha Jvara (fever), Aruci (anorexia) and Kustha (leprosy) have been treated in Sushurta Samhita under Tikta-SakaVarga.<sup>[20]</sup> In the sense of Ashtang Hridaya and Charak Samhita, there is also clear evidence for the treatment of different ailments, such as Jvara (fever), Vat Rakta (gout) and Kamala (jaundice).<sup>[19-21]</sup> In Bhavya Prakash, diuretic, astringent, bitter tonic and possible curative and aphrodisiac agents are deemed against jaundice, diabetes, chronic diarrhoea, dysentery and skin infections.<sup>[22]</sup> Bleeding pile cure, itching cure, erysipelas, and promotion of longevity have been seen in Dhanvantri Nighantu.<sup>[23]</sup> Deepanam (kindles digestive fire), Laghu (light), Dhatukrit (builds seven body tissues), Chakshushyam (good for the eyes), Bayasthaapankarakam (maintains vitality and youthfulness) and Medhayam (mind-rejuvenating) can also be seen as Guduchi.<sup>[24]</sup>

Guduchi was regarded as an important source of medicine such as tonic, diuretic and anti-periodic by European practitioners in India and was further included in the 1868 Bengal Pharmacopoeia.<sup>[25]</sup> A significant component of formulations used to treat various illnesses, such as urinary disease-related dyspepsia, fatigue, and fever, is found in the Ayurveda literature. Taila guduchi, vati sanjivani, avaleha kanta-kari, churna guduchyadi,

chyavnaprasha, ghrita guduchi, satva guduchi, taila guduchi brihat, guggulu amrita, amritashtaka churna, and many more are among the simple formulations drawn up. *Tinospora Cordifolia*, the most widely used herb in Ayurvedic medicine, has been primarily used as a remedial herb for individuals and tribals to cure various diseases. In Ayurveda, *Tinospora Cordifolia* is extremely essential for its many therapeutic properties, such as rejuvenating, immune-boosting, anti-rheumatic and detoxifying powers. Medicinal properties of *T.cordifolia* In medical medicine, *T.cordifolia* is now used to treat colds and flu, skin infections, liver disorders, immune disorders, gout, arthritis, and, most recently, chemotherapy to counteract adverse reactions.<sup>[24]</sup> So, it's obvious now that *T. Cordifolia*, seen by ancient tirthankaras in the Vedic period, is the most important herbal cure with a great potential to treat a variety of ailments (medicinal qualities).

### Nutritional composition

Pandey et al. (2016) observed that dehydrated Giloy has high amounts of 210 mg, 5.23 g, 22.55 mg, 52.295 g and 5.88 percent, respectively, of calcium, protein, iron, crude fibre and ash. They also observed that dehydrated Giloy had 18.28 mg percent anti-radical scavenging activity 19.75, polyphenols 12.2 mg, respectively, with a high flavonoid amount (Table 1).

Nutrients	Giloy ( <i>T.cordifolia</i> )	
	Fresh	Dehydrated
Moisture%	30-.35	9.64
Ash%	2.3	5.880
Carbohydrate (g)	3.34	7.53
Protein (g)	2.30	5.23
Fat(g)	0.36	1.05
Fiber (g)	11.321	52.295
Iron (mg)	5.87	22.55
Calcium (mg)	82.247	210
Vitamin C(mg)	56	16
Beta Carotene (□g)	303.7	428.5
Energy (Kcal)	88.64	240
Polyphenols (mg)	4.8	12.2
Flavonoids (mg)	6.7	18.28
%Anti-radical activity	11.07	19.75

### Pharmacognosy of *Tinospora Cordifolia*

**Stems** - Fleshy

**Roots** - long thread like, aerial, arise from branches.

**Bark** - Thin, greyish or creamy white in colour, when peeled fleshy stem is exposed.

**Leaves** - Cordate (heart shaped), membranous, juicy.

**Flowers** - Bloom during summer

**Male flower** - Small, yellow or green coloured occur in clusters.

**Female flower** - Occur singly.

**Fruits** - Pea shaped, fleshy, shiny turn red when boiled. Occur in winter

Seeds - curved, pea sized.

**Parts Used:** Stems, Roots

**Cultivation:** Soil And Climate: It grows well in almost any type of soils and under varying climatic conditions.

**Nursery raising and planting:** In the month of May-June, the plant is cultivated by stem cutting. Neem and Mango trees ideally need some help, certain plants are expected to possess stronger medicinal qualities.

**Weeding and Hoeing:** Periodical hoeing is done, both in the nursery and field as per requirement.

**Manures, Fertilisers and Pesticides:** Medicinal plants have to be cultivated without the need for pesticides and artificial fertilisers. Natural manures can be used by the species as needed, such as Farm Yard Manure (FYM), Vermi-Compost, Green Manure, etc. Bio-pesticides (either single or mixture) from Neem (kernel, seeds & leaves), Chitrakmool, Dhatura, Cow 's urine etc.) can be prepared in order to deter disease.

**Irrigation:** The field after plantation should be irrigated periodically as and when required Weekly or fortnightly.

**Harvesting/Post Harvesting Operation:** Mature plants are collected, cut into small pieces and dried in shad.

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

**Economics:** The rate for a kg. of dried stem ranges from Rs. 15-20. (YEAR-2001).

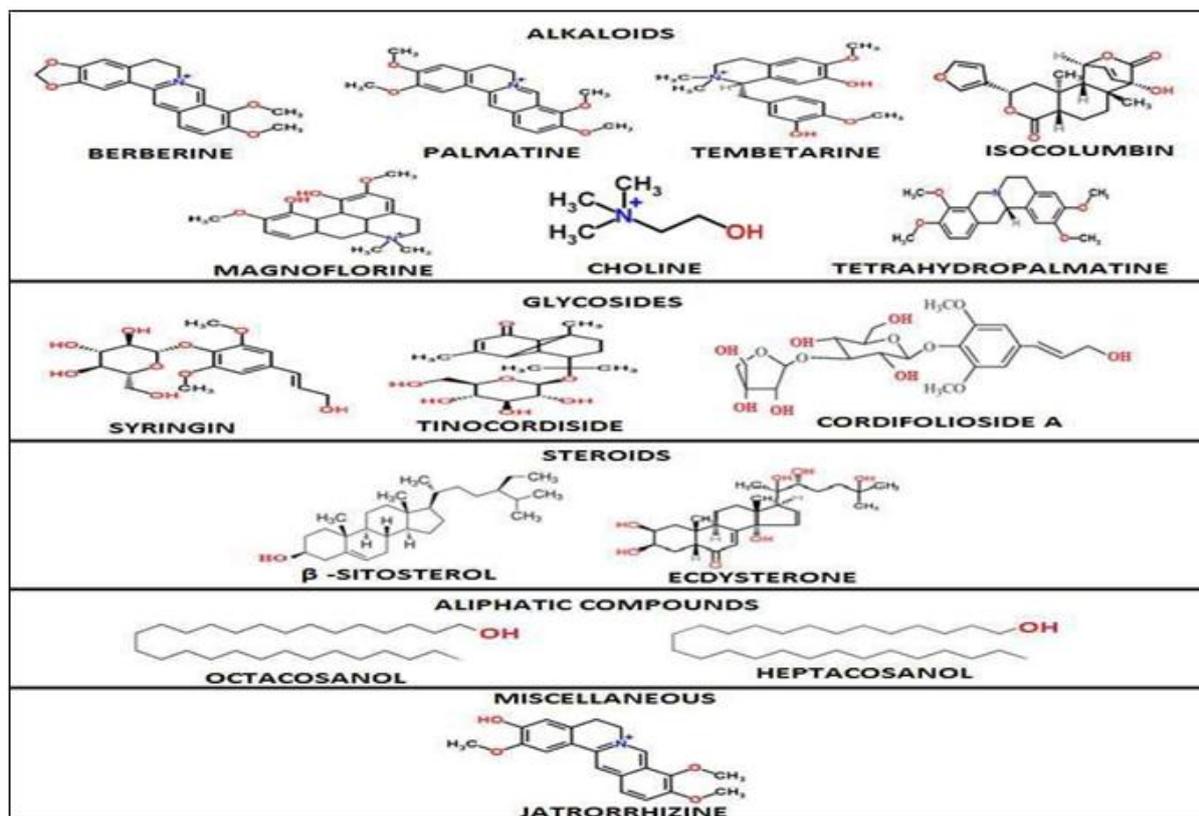
## CHEMICAL CONSTITUENTS

Mainly present in the fruit are alkaloids, glycosides, hormones, sesquiterpenoids, aliphatic compounds, essential oils, blends of fatty acids and polysaccharides. Gilosterol, berberine,

bitter giloinin, and non-glycoside giloinin are located in the alkaloids. The main phytoconstituents in *Tinospora cordifolia* are tinosporine, tinosporide, tinosporaside, cordifolide, cordifol, heptacosanol, clerodane furano diterpene, diterpenoid furanolactone, tinosporidine, columbine, and  $\beta$ -sitosterol. Records of Berberine, Palmatine, Tembatarine, Magniflorine, Choline and Tinosporin have been reported from its stem. The essential compound structure is seen in “fig. 2”.<sup>[26-29]</sup>

### Main chemicals present in *Tinospora Cordifolia* parts and their pharmacological potential

Phytochemicals Class	Compounds isolated	Plant Part	Pharmacological Potential in Human beings	References
Steroids	$\beta$ -sitosterol, $\delta$ -sitosterol, 20 $\beta$ -hydroxyecdysone, Ecdysterone, Makisterone A, Giloinsterol	Stem	Osteoporosis is caused by glucocorticoids in early inflammatory arthritis. Inducing cell cycle arrest and apoptosis via c-Myc suppression in the G2 / M process.	[30]
Alkaloids	Berberin, choline, tembatarine, magnoflorine, tinosporin, palmetin, isocolumbin, aporphine, jatrorrhizine, tetrahydropalmatine	Stem root	Antiviral, anti-cancer, ant diabetic, antiinflammatory, immunomodulatory	[31-34]
Diterpenoid Lactones	Furanolactone, clerodane derivatives, tinosporin, tinosporides, jateorine, columbin	Whole Plant	Vasorelaxant: relaxes norepinephrine induced contractions, inhibits calcium ion influx, anti-inflammatory, antimicrobial, antiviral.	[35-37]
Sesquiterpenoid	Tinocordifolin	Stem	Antiseptic	[38]
Glycosides	Tinocordiside, tinocordifolioside, cordioside, syringing, syringing-apiosylglycoside, pregnane glycoside palmatosides	Stem	Treatment of dementia, motor and cognitive deficits, spine and hypothalamus neuron loss, immunomodulator	[39- 40]
Others	Jatrorrhizine, cordifol, giloin, tinosporic acid	Roots, whole plant	Protease inhibitors for HIV	[41]



**Fig 2: Important phytochemicals from *T. cordifolia*.**

## PHARMACOLOGICAL ASPECTS

Since ancient times, *Tinospora Cordifolia* has been known as the most commonly used herb in the herbal medicine system for its spasmolytic, allergen-free and anti-diabetic properties. The immune system is strongly stimulated by the herb. This plant has many protective properties. His root portion is known for its antimalarial and stress-relieving effects, while his stem is used as a bitter stomach and diuretic. Biliary secretion is enhanced, blood is enriched, and jaundice is healed. The main biological processes of *Tinospora Cordifolia* are as follows.

### Anti-Cancer Activity

Numerous laboratory animal models were used to demonstrate the anti-cancer potency of guduchi plants. The radio protecting property is well defined by this plant because it considerably raises the weight of different tissues as well as body weight. Moreover, it also defends against gamma radiation (sub-lethal range) radiated from mouse testicles (Swiss Albino). When exposed to differing amounts of methylene chloride extracts, the cultured HeLa cells are exposed. In *Tinospora Cordifolia*, a dose-dependent increase in cell death or cell killing was recorded compared to untreated (control) cultured cells, such as 0,5,10,25,50 and 100  $\mu\text{g} / \text{ml}$ , respectively.<sup>[42]</sup>

By adding guduchi hexane extract to mice with Ehrlich ascites tumor, the proliferation of these tumour cells (G1 phase) is inhibited, which simultaneously enhances the expression of the 'Bax' gene (pro-apoptotic), leading primarily to apoptosis induced by caspase.<sup>[43]</sup> Guduchi was reported to have strong anti-tumor activity via a mouse model of two-stage skin carcinogenesis. This reflects a reduction in the weight and incidence of papillary tumours, while simultaneously raising the number of phase II enzymes in the patient population.<sup>[44]</sup>

*Tinospora Cordifolia* had an add-on effect on mice exposed to cultured Ehrlich cells when combined with  $\gamma$ -radiation due to a drop in the amount of Glutathione (GSH) that caused oxidative damage to these cancer cells.<sup>[45]</sup> In the researchers' skin cancer model, Guduchi extract has been shown to inhibit the degree of micronucleus development in bone marrow cells and thus improve the survival time in mice. Nonetheless, in comparison to cyclophosphamide, *T. cordifolia* has a combined effect on the inhibitory rate of the tumour and the percentage of survival, respectively.<sup>[46]</sup> The anti-cancer potential is precisely demonstrated in a Dimethylbenzanthracene-induced (DMBA) model of skin cancer conducted in mice (Swiss Albino). *T. cordifolia* Extract of an isolated active component of the palmatine plant *T. cordifolia*.<sup>[47]</sup> *Tinospora Cordifolia* has anti-neoplastic properties and, by reducing the rate of proliferation and differentiation, has a strong potential to treat brain tumours. As indicated, in C-6 glioma cells.<sup>[48]</sup>

Different types of tumour cells have been tested for the anti-cancer activity of guduchi-isolated secondary metabolites (such as magnoflorin, palmatin, jatrorrhizin, yangambin, etc.) and have been reported for the treatment of KB cells with 'palmatin' and 'yangambin', while tinocordiside has been reported for colon and oral cancer cells (KB).<sup>[49]</sup> In the other hand, some chemotherapeutic agents are synthetic by nature and, in the case of *T. cordifolia* herbs, have a range of harmful and severe toxic effects that are very limited. From *T. cordifolia*. It can also be considered a 'good medicine' for cancer disease treatment in terms of patient care.

### **Anti-diabetic activity**

Various isolated phytoconstituents from different sections of *Tinospora Cordifolia* are responsible for treating diabetes mellitus. Alkaloids, tannins, flavonoids, saponins, cardiac glycosides and steroids are among these phytochemicals.<sup>[50]</sup> It has the mystical ability to decrease the level of blood sugar in humans. Palmatine, jatrorrhizine and magnoflorine are present in the isoquinoline alkaloid rich stem fraction, exhibiting both in vitro (using rat

pancreatic  $\beta$ -cell line, RINm5F) and in vivo insulin-mimicking and insulin-releasing effects.<sup>[51]</sup> It is confirmed that another isoquinoline alkaloid 'berberin' is especially useful in the treatment of human diabetes. This decreases as effectively as metformin the amount of elevated glucose. Liver metabolism is also facilitated by inhibiting FOXO1, which combines mitochondrial activity with insulin signalling during insulin resistance and metabolic syndrome. It lowers blood sugar and cholesterol levels and regulates blood pressure by activating adenosine monophosphate-activated protein kinase.<sup>[52-55]</sup>

### **Immunomodulatory Activity**

*Tinospora cordifolia* is well known thanks to its immunomodulatory response. The active compounds 11-hydroxymustakone, N-methyl-2-pyrrolidone, N-formylannonine, cordifolioside A, magnoflorine, tinocordiside and syringin have been reported to have potential immunomodulatory and cytotoxic impact. The immunomodulatory activity of the ethanol extract of *Tinospora cordifolia* (100 mg / Kg / p.o) In the Vaibhav Aher et al study, changes in the concentration of antioxidant enzymes, increases in T and B cells and antibodies that play a major role in immunity, increases in the concentration of melatonin in the pineal gland, and increases in the quantity of cytokines such as IL-2, IL-10.<sup>[57]</sup> An integral aspect of the host defence mechanism is polymorphonuclear leukocyte (PMN) cells. *Tinospora cordifolia* extracts were able to activate the PMN cells by an in vitro slide technique of phagocytosis for the phagocytosis of added *Candida* cells.<sup>[58]</sup> Oral administration of *Tinospora cordifolia* alcoholic extract (100 mg / kg, p. o) revealed a significant increase in the thickness of the foot pad as well as a significant increase in the number of WBC and bone marrow cells, suggesting a significant stimulatory effect on the haemopoietic system, demonstrating direct immunomodulatory action.<sup>[59]</sup> Results suggest that classically prepared Guduchi Ghana (a distilled form of aqueous extract of Guduchi) has been shown to have a potent immunostimulatory effect on the immune system.<sup>[60]</sup> Bharti Umretia et al Study The impact of the formulated *Tinospora* lotion for Interleukin-1, Interleukin-6 and Interleukin-8 using blood serum samples was demonstrated in a randomised, controlled, concurrent, pilot clinical trial. Hyperkeratosis and inflammatory cell invasion in scabies have been avoided by down-regulation of Interleukin 1-, 6, and 8 levels in scabies. The modulation effect on the *Tinospora* lotion's interleukin levels reinforces its anti-scabies activity.<sup>[61]</sup>

### Anti-Oxidant Activity

*Tinospora cordifolia* has potential uses as an antioxidant in food systems and possibly as a nutraceutical in biological systems. Compared to other solvents, *Tinospora cordifolia* methanolic, ethanolic and water extracts have substantial antioxidant potential and often have metal chelation and decreased energy activity.<sup>[62]</sup> V Sivakumar et al Research Findings indicate that *Tinospora cordifolia* orally administered methanol stem extracts enhanced the function of lipid peroxide and catalase erythrocyte membrane. In alloxan-induced diabetic rats, the activity of superoxide dismutase, glutathione peroxidase, was also lowered.<sup>[63]</sup> *Tinospora cordifolia* provides the ability to scavenge free radicals produced during aflatoxicosis. *Tinospora cordifolia* has demonstrated safety against aflatoxin-induced nephrotoxicity due to the inclusion of alkaloids such as choline, tinosporin, isocolumbin, palmatine, tetrahydropalmatine, and magnoflorine.<sup>[64]</sup> The results of the Neha Upadhyay et al report indicate that *Tinospora cordifolia* bark ethanol extracts exhibited the highest activity of free radical scavenging compared to methanol extracts and that the highest phenolic content was also exhibited by ethanol extracts.<sup>[65]</sup> The administration of N-nitrosodiethylamine (DEN)-induced liver cancer with ethanolic extract *Tinospora cordifolia* (EETC) in male Wister albino rats reversed almost natural amounts of lipid peroxidation (LPO), enzyme and non-enzyme antioxidants.<sup>[66]</sup> A high 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity (IC<sub>50</sub>= 25±0,3 µg / mL) was observed in essential oil isolated from *Tinospora cordifolia* plants. A dose-dependent decrease in energy activity was also shown.<sup>[67]</sup>

The *tinospora cordifolia* leaves were collected with methanol and extracted into water with ethyl acetate and butanol. The antioxidant role of the free radical scavenging operation of the DPPH-tested extracts was found to be strongest with a 250 mg / ml concentration of methanol, followed by ethyl acetate, butanol and water, reducing electricity, phosphomolybdenum and metal chelating behavior.<sup>[68]</sup>

### Anti-Microbial Activity

The antibacterial role of *Tinospora cordifolia* extracts has been checked for *Escherichia coli*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Proteus vulgaris*, *Salmonella flexneri*, *Salmonella paratyphi*, *Salmonella typhimurium*, *Pseudomonas aeruginosa*, *Enterobacter aerogene*, and *Serratia marcescens* (Gram-positive bacteria).<sup>[69]</sup> Extracts from the *Tinospora cordifolia* Hook with aqueous, ethanol and acetone leaves and roots. On clinical isolates of urinary pathogens, F. Thoms showed optimum inhibitory activity against *Klebsiella*

pneumoniae and *Pseudomonas aeruginosa*.<sup>[70]</sup> Silver nanoparticles synthesised from the *Tinospora cordifolia* stem have very high antibacterial efficacy against *Pseudomonas aeruginosa* multidrug-resistant strains isolated from burn patients.<sup>[71]</sup> The active compound isolated from *Tinospora cordifolia* stem ethanol extract [(5R, 10R)-4R, 8R-Dihydroxy-2S, 3R:15, 16-diepoxylerod-13(16), 17, 12S, 18, 1S-dilactone] was found to be active against bacteria and fungi. *Enterococcus faecalis* (125 µg / ml) and *Bacillus subtilis* (200 µg / ml) had the lowest MIC values observed. The compound was also seen to be successful against fungi; *Trichophyton simii* (31.25 µg / ml), *Trichophyton rubrum* 57 (62.5 µg / ml), *Trichophyton rubrum* 296 (62.5 µg / ml) were considered to be the lowest minimum inhibitory concentration values.<sup>[72]</sup> Results of the Francesca Bonvicinia et al research suggest that *Tinospora cordifolia* constituents demonstrated higher inhibitory activity against reference microbial strains and clinical isolates of methicillin-resistant *Staphylococcus aureus* (MRSA) and *Klebsiella pneumoniae*-developing carbapenemase.<sup>[73]</sup>

### **Antiulcer Activity**

To investigate the antiulcer function, D. N. K. Sarma et al. used the ethanolic extracts of the roots. *Tinospora Cordifolia*, and it has been found that it causes a pronounced defensive action against ulceration caused by 8 h restriction tension, comparable to diazepam.<sup>[74]</sup>

### **Wound Healing Activity**

Umesh Jain et al. found that the methanolic extract has considerable wound healing activity supporting *Tinospora cordifolia*. The research indicated that *Tinospora cordifolia*'s methanolic extract has improved wound healing ability, which was obvious by the increased rate of wound contraction; decreased epithelialization time, increased deposition of collagen and increased wound healing ability.<sup>[75]</sup>

### **Anti-HIV Activity**

*Tinospora Cordifolia* has been researched to determine its importance in the treatment of HIV-positive patients by reducing patients' tolerance to the retroviral regimen. The anti-HIV production of *Tinospora Cordifolia* demonstrates its use in disease control by increasing the number of CD4 T cells in HIV positive patients and reducing the number of eosinophils (a type of WBC). The phagocytic and intracellular bactericidal function of *Tinospora Cordifolia* extract has been considerably increased. Also, *Tinospora cordifolia* has triggered peritoneal macrophages. Additionally, *Tinospora cordifolia* increases phagocytosis and intracellular killing properties. B-lymphocytes, polymorphic nuclear leukocytes, and macrophages are

strongly activated by *Tinospora Cordifolia*.<sup>[76-77]</sup>

### **Anti Allergic Activity**

The non allergic effect of *Tinospora cordifolia* has been studied. Important relief from sneezing, nasal discharge, nasal inflammation and nasal pruritus was observed in *Tinospora cordifolia* relative to placebo, with consistent changes in nasal smear and nasal mucosal examination.<sup>[78]</sup>

### **Anti-inflammatory Activity**

The Siddalingappa C M et al review has been written. At doses of 100 mg / kg, 200 mg / kg, 100 mg / kg and 5 mg / kg of diclofenac after 30 minutes, 60 minutes and 90 minutes, *Tinospora cordifolia* was seen to demonstrate a substantial increase in reaction time (pain threshold). In the same doses above, *Tinospora cordifolia* showed 32.63 percent, 36.63 percent and 40.5 percent inhibition of paw edoema at the end of three hours, respectively.<sup>[79]</sup>

### **CONCLUSION**

A robust medicinal herb, *Tinospora cordifolia* is an unusual source of various compound forms with complex chemical structures. On the biological activity and plausible medicinal uses of these compounds, relatively little work has been performed, and comprehensive research is therefore needed to maximise their therapeutic usefulness for disease control. To generate new medicines with compounds obtained from *Tinospora cordifolia*, a drug discovery programme should be pursued. The present analysis highlights *Tinospora cordifolia*'s classical antidiabetic, anti-cancer, immunomodulatory, antioxidant, antimicrobial, anti-toxic arguments and confirms their current examination. There has been an growing trend and appreciation in the study of medicinal plants over the past few years. In recent decades, a considerable amount of study has also been performed to examine the chemistry of various sections of *Tinospora cordifolia*. While *Tinospora cordifolia* has been successfully used in Ayurvedic medicine for decades, for greater economic and therapeutic use, systematic research and development work on *Tinospora cordifolia* and its properties should be undertaken.

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