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Review Article

**A COMPREHENSIVE REVIEW ON HERB: *TINOSPORA
CORDIFOLIA*****Madhavi M. N*, Khushbu Satarkar¹, Archana Pal², Satish B. Kosalge³***Associate Professor, ^{1,2}Research Scholars, ³Principal

Hi-Tech College of Pharmacy, Chandrapur, Maharashtra, India

Abstract:

A common plant in India is the herbaceous vine *Tinospora cordifolia*, sometimes known as the Giloy. The conventional Ayurvedic medical system makes extensive use of it. Plants have long been a rich source of medicines, dating back to the beginning of human civilization. This report discusses a survey of the component chemicals found in *Tinospora cordifolia* and their pharmacological properties. Immune suppression is a factor in the development of conditions such as obstructive jaundice, hepatic fibrosis, dyspepsia, urinary tract infections, fever, diabetes, anaemia, and inflammation. *T. cordifolia* has a wide range of chemicals that have cytotoxic and immunomodulatory properties, and they have been employed in traditional medical systems. This review aims to condense important information on chemical constituents, chemical structure, and pharmacokinetic activities such as anti-diabetic, anti-cancer, immunomodulatory, antiviral, antioxidant, antimicrobial, hepatoprotective, and their impact on cardiovascular and neurological disorders as well as rheumatoid arthritis.

Key Words: -*Tinospora cordifolia*, Guduchi, Menispermaceae, *Tinosporic acid*.

Corresponding author:**Mrs. Madhavi M N,**

Associate professor,

Hi-Tech college of pharmacy,

Padoli, Chandrapur, 442406,

Maharashtra, India.

Mail Id: madhumartha@gmail.com, khushbusatarkar8@gmail.com, archanafpal@gmail.com,

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INTRODUCTION:

According to estimates from the World Health Organization (WHO), up to 80% of people still rely mostly on conventional treatments like medicinal herbs. Plants have been used as natural remedies ever since human civilization began. India's immense biodiversity and extensive understanding of old traditional medical systems like Ayurveda, Siddha, Usnani, and Amchiand give a solid foundation for the use of many plants in general healthcare and common human illnesses. The Menispermaceae family includes the deciduous climbing shrub known as *Tinospora cordifolia* (willd). About 70 genera and 450 species of tropical plants make up the Menispermaceae plant family. In addition to Sri Lanka, Bangladesh, and China, it is present in all of India. The plant, known in Ayurveda as Rasayana, is well known for boosting the immune system and the body's defense against specific infectious microorganisms.^[1] Tinosporine, cordifolide, and syringin are three important phytochemicals found in giloy that have been demonstrated to be immunomodulatory, making them effective against coronaviruses by fostering immunity and viral prevention. It is an extraordinary old vine, also known as the "root of immortality. This study describes the chemistry, physiology, and therapeutic benefits of this heavenly herb in preventing a number of terrible diseases.^[2]

HISTORY:

The Ayurvedic medicine Guduchi, or Amrita, is described in several ancient Ayurvedic writings, including those by Charaka, Sushruta, and Ashtang Hridaya, as well as other treatises like Bhavprakash and Dhanvantari Nighantu, under a number of different names, including Amara, Amritavalli, Chhinnaruha, Chhinnodbheda, Vatsadani, etc. It is reported to be effective in curing Kushtha (leprosy), Mahajvara (a type of fever), Shwasa (asthma), and Aruchi (anorexia) in the Sushruta Samhita under the heading "Tikta-Shakavarga". It has been mentioned in other treatises, such as Charaka Samhita and Ashtang Hridaya, for ailments including Kamala (jaundice), Jvara (fever), and Vatarakta (gout), among others. According to Bhavprakash, it is a bitter tonic, astringent, diuretic, effective aphrodisiac, and a cure for skin diseases, jaundice, diabetes, chronic diarrhoea, and dysentery.

According to Dhanvantari Nighantu, its therapeutic benefits include treating erysipelas and itching as well as curing bleeding piles. According to the effective vegetable tonic, it exists. It is recommended for many conditions that cause debility since it is a rejuvenator. The fecula is nourishing in particular for diarrhea and is frequently used for cold fevers, seminal weakness, urinary affections, jaundice, skin conditions, different types of diabetes, and stomach irritability. Ayurvedic practitioners have a long-held notion that Guduchi Satwa made from Guduchi plants growing on Neem trees (*Azadirachta indica*) is more bitter and effective and also has some of Neem's healing properties. As a particular tonic, antiperiodic, and diuretic, the medicine also attracted the attention of European doctors in India; as a result, it was listed in the Bengal pharmacopoeia of 1868. Ayurvedic literature refers to *T. cordifolia* as a component of a number of chemical compositions used to treat urinary disorders, dyspepsia, fever, and generalized senility.^[3] There are numerous skin and health advantages to *Tinospora cordifolia* (Giloy). Even though we lack evidence, there are two stories that explain how this magical plant came into existence. The first is that it has been claimed that during the Samundra Manthan, a pot full of amrita emerged from the sea. Some people grabbed it and fled, but some drops of the amrita fell to the ground and took the form of a climbing shrub called Giloy. The second is that there is evidence that suggests that when Lord Rama visited Sri Lanka, the Ramayana war took place during this time.^[4]

OBJECTIVE:

Understanding the sporadic literature on the botanical and geographic description, traditional use, phytochemistry, and pharmacological qualities of *T. cordifolia* and the detailed on whole-body maintenance and diseases. Since Giloy is a plant, its active ingredients have fewer side effects; hence, the primary goal of this review is to study the medicinal applications in treatment of various diseases and disorders like osteoporosis, cancer, diabetes, and etc. with it. This plant's active ingredients have a wide range of pharmaceutical applications.^[5]

SYNONYMS:

Indian Languages Use Different Name for Giloy: -

Table No.: 1. Different synonyms of *T. cordifolia* [6]

S.No.	Language	Name
1.	Hindi	Giloy
2.	English	<i>Tinospora cordifolia</i>
3.	Sanskrit	Amrita
4.	Marathi	Gulvel, Giroli
5.	Persian	Gulbel
6.	Punjabi	Gilow
7.	Urdu	Gilo
8.	Kannada	Amrutaballi
9.	Gujarati	Galac, Garo
10.	Oriya	Guluchi
11.	Malayalam	Amritavalli, Chitamirth
12.	Nepalese	Gurjo

BIOLOGICAL SOURCE: -

It is obtained from *Tinospora cordifolia*, a climbing shrub belonging to family Menispermaceae.

Types of botanical species:

Three species have been recovered from India out of the 40 species that have been discovered throughout tropical regions like Africa, Southeast Asia, Indo-Malaya, and Australia.

- *Tinospora cordifolia*
- *Tinospora sinensis*

- *Tinospora crispa*.

Tinosporabakis Miers, *Tinosporarumphii* Boerl, and *T. malabarika* Miers are a few other species.^[7]

TAXONOMICAL CLASSIFICATION:

The Guduchi plant, an herbaceous vine that is a member of the Menispermaceae family, is typically found in deciduous and dry forests. The following list (Table.2) provides this medicinal herb's botanical classification:^[3]

Table No.:2. Taxonomical classification of *T. cordifolia* [8]

Kingdom	Plantae – plant
Subkingdom	Tracheobionta – Vascular plant
Super division	Spermatophyta-Seed bearing plant
Division	Magnoliophyta – Flowering
Class	Magnoliopsida – Dicotyledons
Sub-class	Polypetalae – Petals are free
Series	Thalamiflorae – Many stamens and flower hypogynous
Order	Ranunculales
Family	Menispermaceae – The Moonseed family
Tribe	Tinosporeae
Genus	<i>Tinospora</i>
Species	<i>T. cordifolia</i>

GEOGRAPHICAL DISTRIBUTION:

The plant grows throughout India's tropical areas, from Kumaon to Assam and from Myanmar, Bihar, and Konkan to Sri Lanka. It is a substantial climber that outgrows the tallest trees in forests and sends out aerial

roots that can extend for up to 10 meters, although they are not thicker than pack thread. The Sardar Bhagwan Singh PG Institute of Biomedical Sciences and Research is located in Balawala, Dehradun, Uttarakhand, India.^[9]

BOTANICAL DISCRPTION:

It is a sizable, climbing, glabrous, deciduous shrub. The structure of the stem is fibrous, and the transverse section reveals a yellow-type wood with radially oriented wedge-shaped wood bundles, including big vessels, separated by narrow medullary rays. The stem has rosette-like lenticels, and the bark is a deep left spiral that transitions from creamy white to gray. The membranous, cordate leaves have a form. Flowers are small, unisexual, yellow, and in an axillary position. They are 2–9 cm long. Female flowers are often solitary, whereas male blooms are grouped. Curved seeds are present. Fruits have a solitary seed and are meaty. Flowers bloom in the summer, while fruits ripen in the winter.^[10]

CULTIVATION PRACTICES:

Many different types of soil, from sandy to clay loam, are suitable for growing giloy. However, for it to flourish, the soil needs to be well-drained, moist, and full of organic matter. It develops in a variety of climatic situations. The crop is raised in rain-fed environments. Although it may be cultivated virtually anywhere, the plant favors a warm temperature and is quite stiff. The finest planting material for growing commercial crops is stem cuttings. Planting often takes place from July through August, when it rains. The direct sowing of the stem cuttings takes place in the field. Older stems with nodes are used to take cuttings. Within 24 hours of being taken from the mother plant, cuttings must be sown. They should be somewhat submerged in water while doing this. For planting, 1 hectare of land needs about 2500 cuttings. Using seeds is another way to grow the plant.

Raising wooden stakes or a trellis might provide the support the plant needs to flourish. For healthy twining growth, two to three hoeing and weeding are necessary. There haven't been any reports of a major disease or insect pest infestation in this crop. Harvesting occurs in the fall after the stem has grown to a diameter of over 2.5 cm. The base is still there for future growth. The stem needs to be broken up into little pieces and dried in the shade. Because the stem bark comes off even when touched, it is important to cut the stem with extreme caution because a peeled stem decomposes quickly. The plant produces between 10 and 15 q/ha of fresh woody stems that are reduced to 300 kg of dry weight in about two years.^[11]

MORPHOLOGICAL DESCRIPTION:

Different parts of the plants morphological characteristics discussed here.

Stem: - This plant has a long, filiform, fleshy, and rather damp stem that is ascending in nature. Branch-borne aerial roots appear. The dried stem is cylindrical, elongated, and slightly twisted (figure 1a). The thin, paper-like outer bark is brown to greyish in colour. Transverse sectioning of the stem reveals a structure like a wheel. Circular and noticeable lenticels are present. The stem powder has a distinctive odour and bitter flavour and ranges in colour from creamish brown to dark brown. In cases of urinary and digestive disorders, the stem is employed. The "Guduchi-satva" starch that is obtained from the stem is very beneficial for digestion and many ailments.^[1]

Root: - There are aerial roots, and they have a primary structure with a tetra to penta-arch (figure 1b). However, the cortex of the root is split into an inner parenchymatous zone and an exterior thick-walled zone.^[12]

Leaves: -The leaves are simple, alternating, and exstipulate, with long petioles that can reach a length of 15 cm (6 inches) and which are pulvinate both at the base and apex, with the basal petiole being longer and somewhat twisted halfway around (figure 1c). Heart-shaped leaves and scarlet fruit give this plant its common name, heart-leaved moonseed. The lamina is broadly oblong or ovate cordate, 10–20 cm (4–8 inches) long or 8–15 cm (3–6 inches) broad, deeply cordate at the base, seven-nerved, membranous, pubescent above, and whitish tomentose with a conspicuous reticulum beneath.^[13]

Fruits: -They are fleshy, orange-red in colour, aggregated in groups of 1-3, smooth, and devoid of drupelets on thick stalks through subterminal-style scars. Winter is the season when fruits grow (figure 1d).^[12]

Seed: -There have been reports of curved seeds in this species. Consequently, this family is also known as the moonseed family. Because seeds are curved, an embryo will naturally take on a curved shape as well. Additionally, the endocarp's many ornamentations offer significant taxonomic characteristics (figure 1e).^[12]

Flower: -Flowers have a greenish-yellow colour, are unisexual, and only appear when a plant has no leaves. Female flowers are seen in single inflorescences, while male flowers are grouped. Sepals come in two series of three, totalling six. The inner sepals are smaller than the outer ones. There are six free, membranous petals that are likewise smaller than the sepals. Flowering takes place from March to June (figure 1f).^[14]

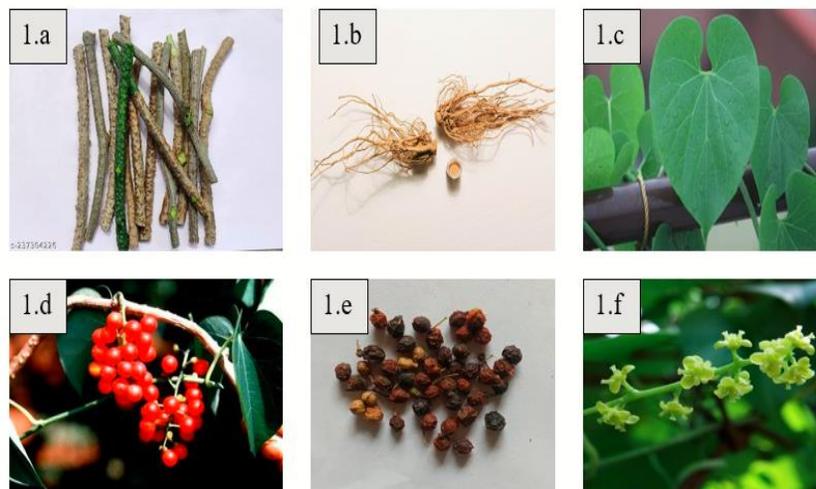


Figure. 1. Parts of *Tinospora cordifolia* Plant a. Stems, b. Roots, c. Leaves, d. Fruits, e. seeds, f. flowers

PHYTOCHEMISTRY:

The plant primarily contains alkaloids, glycosides, steroids, sesquiterpenoids, aliphatic components, essential oils, a mixture of fatty acids, and polysaccharides; almost all portions of the plant are employed in ayurvedic formulation, and fresh plant is more effective than dried plant.^[11] Four new and seven existing compounds were isolated during phytochemical analysis of the aerial portions of *Tinospora cordifolia* in methanol extract. Tinoscorside D, a new clerodane diterpene, tinoscorside C, and sinapyl 4-O-D apiofuranosyl-(16)-O--D-

glucopyranoside (tinoscorside A) are the four new aporphine alkaloids.^[12] The alkaloids contain gilosterol, berberine, bitter giloinin, and non-glycoside giloinin. The primary phytochemicals found in *Tinospora cordifolia* are tinosporine, tinosporide, tinosporaside, cordifolide, cordifol, heptacosanol, clerodane furano diterpene, diterpenoid furanolactone, tinosporidine, columbine, and b-sitosterol. From its stem, reports of berberine, palmatine, tembetarine, magnesium, choline, and tinosporin have been made.^[15]

Table No.3.: Chemical constituents of *T. cordifolia*^[16]

S. No.	Chemical Name	Active Principle	Parts in which present
1.	Alkaloids	Berberine, Palmatine, Tembetarine, Magnoflorine, Choline, Tinosporin, Isocolumbin, Palmatine, Tetrahydropalmatine, Magnoflorine.	Stem and Root
2.	Glycosides	Furanoidditerpeneglucoside Tinocordiside, Tinocordifolioside Cordioside, Cordifolioside A, Cordifolioside B, Syringin, Syringin apiosylglycoside, Palmatosides C31, Palmatosides F31, Cordifolioside A, Cordiofolioside B2, Cordifolioside C2, Cordifolioside D2, Cordifolioside E2.	Stem
3.	Diterpenoid Lactones	Clerodane derivatives Tinosporon, Tinosporides, Jateorine, Columbin.	Whole plant
4.	Steroids	b-sitosterol, d-sitosterol, b - hydroxyecdysone. Ecdysterone, Makisterone, Giloinsterol.	Stem and aerial plant.
5.	Sesquiterpenoid Aliphatic compound Miscellaneous compounds	Tinocordifolin. Octacosanol, Heptacosanol, Nonacosan-15-one 3, (a,4-dihydroxy-3- methoxy- benzyl)-4-(4-hydroxy-3 methoxy-benzyl)- tetrahydrofuran.	Whole plant

Tinospora cordifolia (stem aqueous extract) is present in trace amounts. Studying the elements *Tinospora cordifolia* is a medicinal plant that has long been used in India to treat a variety of illnesses, from the common cold to serious conditions like diabetes, hypertension, jaundice, rheumatism, and skin problems. The major and minor elements Cl, K, Ca, Ti, Cr, Mn, Fe, Co, Ni, Cu, Zn, Br, and Sr in them were identified and characterized using a 2-MeV proton beam. The abundance of Cl, K, and Ca in all leaf samples, as well as the noticeable amounts of Mn and high Zn content in *T. cordifolia* (20), Evidence and mechanisms of action related to trace element concentration.^[16]

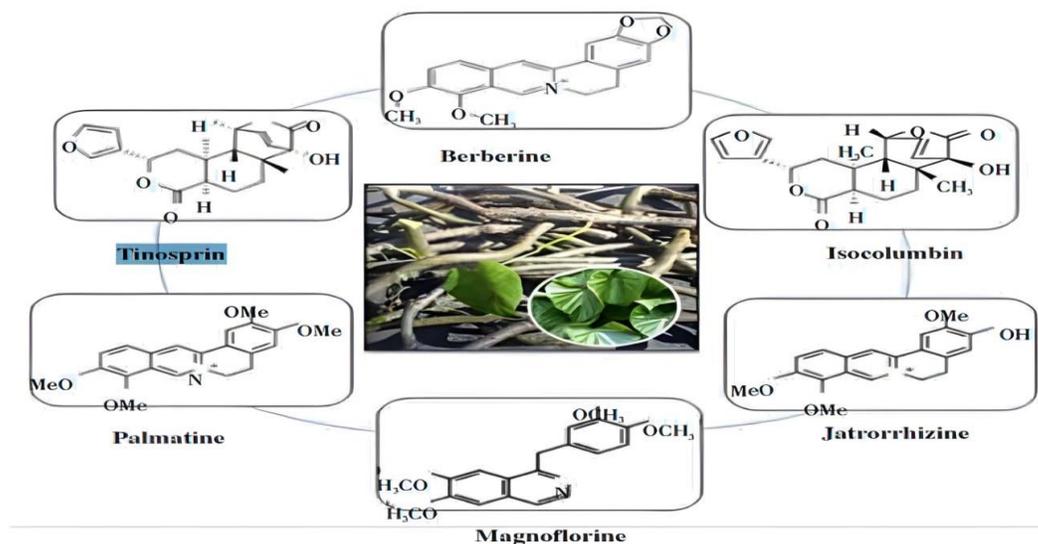


Figure .2. Phytochemicals of *T. cordifolia* ^[17]

Phytochemical Screening (Analysis): -

Stem extraction was used for the initial subjective phytochemical research. The measurement of secondary metabolites in *Tinospora cordifolia* using methanolic extraction, ethanolic extraction, chloroform extraction, and aqueous extraction. Table.4 ^[18]

Table No.4.: Phytochemical analysis of *T. cordifolia* ^[18]

S.No.	Phytochemical testing of secondary metabolites	General test	` <i>Tinospora cordifolia</i> Stem			
			EXTRACTION			
			Methanolic extract	Ethanolic extract	Chloroform extract	Aqueous extract
1	Tannins	FeCl ₃ (Ferric chloride) Test	-	-	-	-
2	Alkaloids	Dragondroff's test	-	-	+	+
		Mayer's test	-	-	-	-
		Wagner's test	+	+	+	+
3	Flavonoids	Shinoda test	+	+	+	+
4	Steroids	Liebermann-Burchard reaction	+	+	+	+
5	Cardiac glycosides	Keller-Kilianni test	+	+	+	+
6	Saponins	Frothing test	+	+	-	+

(+) indicates presence; (-) indicate absence.

NUTRITIONAL COMPOSITION:

According to Pandey et al. (2016), dehydrated Giloy has substantial amounts of calcium, protein, iron, crude fiber, and ash, with respective values of 210 mg, 5.23 g, 22.55 mg, 52.295 g, and 5.88%. Additionally, they discovered that

dehydrated Giloy possessed high levels of flavonoids (18.28 mg%), polyphenols (12.2 mg), and anti-radical scavenging activity (19.75). Nutritional composition given in Table.5 ^[19-20]

Table No.5.: Nutritional composition of T. cordifolia ^[19-20]

Nutrients	Giloy (T. cordifolia)	
	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 (µg)	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

SUBSTITUTES AND ADULTERANTS:

Specifically, *T. sinensis* (Lour.) Merrill (syn. *T. malaberic* Miers ex Hook. f. and *T. crispa* (Linn.) Miers ex Hook. f. & Thoms.) is substituted for or mixed with *T. cordifolia*. There are not many characteristics that can be used to distinguish between *T. sinensis* and *T. cordifolia*, despite the similarities in their microscopic characteristics. The following traits set them apart: Sclerenchymatous sheaths in the cortical sections of *T. cordifolia* dissolve into sporadic, irregular patches, whereas in *T. sinensis*, they are fragmented into parts that seal the vascular bundle and

endure even after additional secondary growth. While *T. cordifolia* lacks crystals, *T. sinensis* has a sizable calcium oxalate crystal inside the lumen of every cork cell. In comparison to *T. sinensis*, *T. cordifolia* has more mucilaginous cells. but there are more vascular strands in *T. sinensis* than in *T. cordifolia*; each strip of vascular strand in *T. cordifolia* has a well-developed xylem, but this is not the case in *T. sinensis*. When compared to *T. sinensis*, *T. cordifolia*'s pith is large and made up of cells with thin walls. *T. cordifolia* contains more starch than *T. sinensis* does.^[21]

EVALUATION:

Organoleptic characteristics: -

Table No.6.: Organoleptic characteristics of T. cordifolia ^[1]

Parameter	Raw (Fresh Guduchi stem)
Colour (Rupa)	Creamish brown
Taste (Rasa)	Bitter
Odour (Gandha)	Not specific (better smell after removing outer loose skin)

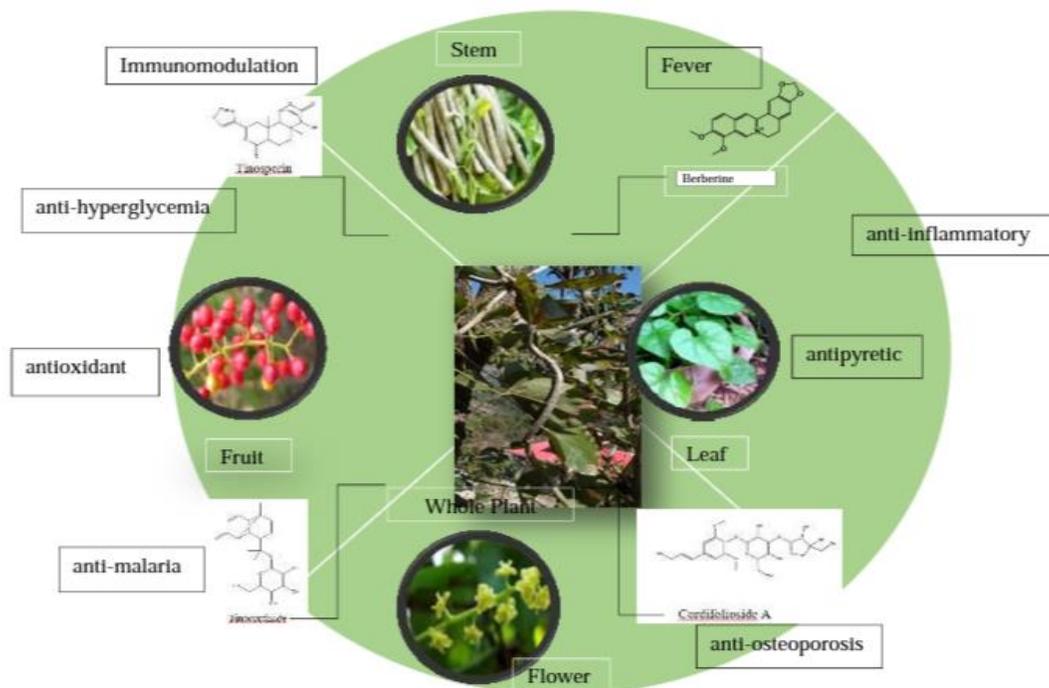
TLC Analysis: - In the modern era, TLC has been used as a crucial tool for the qualitative and quantitative phytochemical investigation of herbal medications and formulations. The TLC method was created to assess the levels of berberine and tinosporaside in the methanolic extract of the examined *T. cordifolia* parts, which included the leaf, stem, and aerial roots.^[1]

ANALYTICAL FINDINGS OF TINOSPORA CORDIFOLIA EXTRACT:

Table No.7.: Analytical finding of *T. cordifolia* ^[1]

S.No.	Test Parameters	Lot 1Te/14/1051	Lot 2 Kg 475	Lot 3 Kg 154	Lot 4 Kg173
1.	Loss On Drying at 105 °C (% w/w)	3.35	3.88	2.41	5.59
2.	Total Ash (% w/w)	11.82	6.42	6.43	6.68
3.	Acid Insoluble Ash (% w/w)	1.37	0.71	0.53	1.49
4.	Water Soluble Extractive on d/b (% w/w)	88.62	96.18	89.83	93.42
5.	50% Alcohol Soluble Extractive (% w/w)	81.68	83.05	81.26	86.72

MEDICINAL AND PHARMACOLOGICAL USES:

Figure.3. *T. cordifolia* is used traditionally to cure several diseases ^[5]

Anti-Diabetic Activity: - This plant's stem is typically used to treat diabetes by controlling blood glucose levels. According to reports, it functions as an anti-diabetic medication by inhibiting gluconeogenesis and glycogenolysis and explaining oxidative stress, which promotes insulin production.^[16]

Immunomodulatory System: - *T. cordifolia* is known for its safe reactivity to guidelines. Experts have archived this component. Numerous mixtures are predisposed to immunomodulatory and cytotoxic effects, including Syringin, cardioside A,

magnoside, N-methyl-2-pyrrolidone, and 11-hydroxymuscovone. These common mixtures are believed to enhance macrophage phagocytic growth, increase the production of nitric oxide by spleen cells, and create reactive oxygen species (ROS) in human neutrophils.^[22]

Anti-Toxic Activities: - The antioxidants included in aqueous extracts of Giloy can scavenge free radicals produced during aflatoxicosis. The Giloy extracts prevented lead nitrate-induced liver damage. Due to its capacity to increase levels of glutathione, ascorbic

acid, and proteins while decreasing concentrations of thiobarbituric acid reactive compounds (TBARS), *T. cordifolia* exhibits anti-toxic potential. Additionally, it improves the function of antioxidant enzymes found in the kidneys, including catalase, glutathione peroxidase, glutathione S transferase, and glutathione reductase. Additionally, *T. cordifolia* contains alkaloids such as isocolumbin, palmetin, tetrahydropalmatine, and magnoflorine that guard against aflatoxin-induced nephrotoxicity.^[18]

Anti-HIV Activities: - There is evidence that this plant's base concentrate lowers its overall resistance to HIV. The antagonist of this HIV influence was identified through the decrease in eosinophil count, activation of B lymphocytes, macrophages, haemoglobin levels, and polymorphonuclear leukocytes.^[22]

Anti-Cancer Activities: - *T. cordifolia* demonstrates anti-cancer efficacy, which is primarily demonstrated in animal models. Due to a significant increase in body weight, tissue weight, and tubular diameter, root extract from *T. cordifolia* has demonstrated radioprotective activity. Due to lipid peroxidation, the release of LDH, and a decrease in GST, *T. cordifolia* dichloromethane extracts exhibit cytotoxic effects. Root extract had a significant impact on radiation in pre-irradiating animals, caused an increase in lipid peroxidation, and caused GSH levels in the testes to fall.^[12]

Anti-Microbial Activities: - The *T. cordifolia* methanol concentration has been tested for microbiological contamination. against *Salmonella typhi*, *Shigella flexneri*, *Salmonella paratyphi*, *Salmonella typhimurium*, *Pseudomonas aeruginosa*, and *Enterobacter aeruginosa*. Against *Escherichia coli*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Proteus vulgaris*, and *Klebsiella*. Additionally, the removal of *T. cordifolia* has demonstrated improvements in mouse neutrophil phagocytosis, intracellular bacterial limitation, and antibacterial events.^[22]

Anti-Oxidant Activities: - The erythrocytes' membrane lipid peroxide and catalase activity are both increased, which increases the anti-oxidant activity of the methanolic stem extract.

Mental Disorder: - The entire plant and the leaf juice have historically been used to treat a variety of mental problems. One of the best psychotropic medications in India is thought to be this one.

Effect On Memory: - The use of *T. cordifolia*'s alcoholic and aqueous extracts to create retained memory indicates an improvement in learning and memory.

Against Dengue: - The Giloy capsule designed for Ayurveda is effective in treating dengue.

Hypolipidemic Effect: - It is well known that *Tinospora cordifolia* root extract lowers serum and tissue lipid levels.

Antistress Activity: - The *T. cordifolia* plant's ethanolic extract has anti-stress effects.^[7]

Anti-Allergic Activity: - There are anti-inflammatory, allergy-fighting, and anti-histaminic effects in the plant giloy. It aids in the treatment of eczema and psoriasis, as well as skin conditions like allergies and asthma. It also effectively treats fever, the flu, and colds.^[6]

Antiulcer Activity: - Using the ethanolic extracts of the roots of *T. cordifolia*, researchers found that the antiulcer activity significantly reduced the risk of ulceration.^[7]

Wound Healing Activity: - The objective of the current study was to assess the dexamethasone-suppressed healing profile of *T. cordifolia*'s alcoholic extract and its effects on wound healing. The increased tensile strength of *T. cordifolia* extract may be attributed to the enhancement of collagen production. The incision, excision, and dead space of the wound models were used to study the wound healing capabilities of the plant. *T. cordifolia* extract did not restore dexamethasone-suppressed wound healing.

Antipyretic Activity: - Traditional knowledge attributes *T. cordifolia*'s jwarahara effect (antipyretic activity) to it. The water-soluble portion of a 95 percent ethanolic extract of *T. cordifolia* was found to be effective as an antipyretic. Another investigation revealed the antipyretic effects of *T. cordifolia* stems that were hexane- and chloroform-soluble. According to numerous studies, *T. cordifolia* has anti-infective and antipyretic properties. Pre-treating rats with *T. cordifolia* prevented intra-abdominal sepsis-related mortality in rats after coecal ligation, and it significantly decreased mortality in mice due to *E. coli*-induced peritonitis.^[8]

Anti-Osteoporotic Effect: - The herb *Tinospora cordifolia* is effective in treating osteoporosis and osteoarthritis. This plant's alcoholic extract enhances

the differentiation of cells into the osteoblastic lineage, the mineralization of bone-like matrix, and osteoblast development.^[7]

SARS-coV2 (COVID-19): - Many chemical compounds found in *Tinospora cordifolia*, including berberine, coline, tetrahydropalmatine, and octacosanol, have been discovered to be efficient in regulating viral replication and suppressing the SARS-coV2 virus. According to molecular docking research, *T. cordifolia* (giloy) inhibits the SARS CoV-2 virus. The primary protease enzymes' 3CLpro targets I and II include berberine, sitosterol, octacosanol, tetrahydropalmitine, and choline. When compared to other inhibitors, the primary chemical components of *T. cordifolia*, such as berberine and sitosterol, are effective at inhibiting the SARS-CoV-2 protein. The components in the stem extract of *T. cordifolia* are effective inhibitors of 3CL protease activity and have positive effects on preventing viral reproduction and growth.^[13]

POSSIBLE SIDE-EFFECTS OF T. CORDIFOLIA:

Although taking Giloy is not known to cause any major negative effects, the following minor side effects should not be ignored:

Constipation: Giloy is renowned for its ability to aid digestion. But occasionally, it might result in constipation and gastrointestinal discomfort.

Reduction in blood sugar level: Unchecked use of Giloy, which is known to treat diabetes, can lower blood sugar levels too low. Consequently, diabetics should use it carefully.

Occurrence of auto-immune diseases: Increased signs of auto-immune conditions like lupus, rheumatoid arthritis, and multiple sclerosis may occur as Giloy boosts the immune system. Giloy usage should be avoided in such circumstances.^[13]

CONCLUSION:

Tinospora cordifolia (Giloy) has so many incredible features, many of which were mentioned above, that it is reasonable to suppose that it can be helpful in stopping the chain of viruses that propagate infection. This study discusses the analytical screening, pharmacological, and pharmacogenetic features. People have long believed that Ayurveda has the power to heal fatal illnesses on its own. These herbs support a healthy immune system, aid in the removal of viruses from the body, and provide efficient viral infection treatment. Along with other harmful effects,

they also work to prevent cancer, malaria, diabetes, hyperlipidaemia, bacteria, and other diseases. Discussions are addressed over its dispersion, chemical make-up, and cultivation methods. Future studies might concentrate on *Tinospora cordifolia* as a source of advantageous phytochemicals for the pharmaceutical sector.

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