



Tinospora Cordifolia (Giloy): A comprehensive review of its bioactive constituents and therapeutic potential

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Abstract

Tinospora Cordifolia Common name is *Giloy*. In Ayurvedic Texts, *Giloy* (*Tinospora Cordifolia*) have been known as the most potent and important Medicinal product. Ayurvedic herb *Giloy* is found throughout china and Indian. The current review focuses on the phytochemical composition of *Giloy* leaves and their immunomodulatory action highlighting specific pathway including NF-kB pathway. One of the beneficial Medicinal plant which can be consumed either raw or prepared. It is used to treat a variety of illness including chronic fever, dengue fever, allergic rhinitis, viral infections. *Giloy* has a few Secondary effects like Blockage, immune system issue. Varieties of bioactive phytochemical constituents isolated from the stem, root, and whole plant of *Giloy* have been identified. In the last two decades, the diverse pharmacological activities of *T. cordifolia* have been continuously studied. Due to its therapeutic efficacy in immune modulation, it could be effective in viral and other disease treatment as well. *Giloy* are also used in coronaviruses because *Giloy* built a strong immunity in human body against COVID-19. Also, association between *Guduchi* / *Giloy* and liver injury.

Keywords: *Giloy*, *Tinospora Cordifolia*, phytochemical constituents, cultivation and collection, pharmacological activities

Introduction

The world health organization reported that 80% of the world population relies chiefly on traditional medicines involving use of plant extracts or their active constituents. India with its mega- biodiversity and knowledge of rich traditional system of medicine. *Tinospora Cordifolia* is one of the most significant plants. In the present concentration on the counter oxidants and antimicrobial action of the watery, ethanol & chloroform separates from the stem and base of *Tinospora Cordifolia* was assessed by involving some *In-vitro* model. The *Tinospora Cordifolia* genus has 34 species. Many of which are used as traditional medicines in all over the world including Asia, Africa and Australia. It is a perennial dioecious plant with morphological characteristic of twinning branches, stem with papery bark, alternatively arranged heart shaped leaves, aerial roots, greenish-yellow tiny flowers etc. the diverse and important therapeutic application due to present of secondary metabolites such as alkaloids, terpenoids, Lignans, flavonoids etc ^[1, 2].

Synonyms ^[3]

Tipaa-teega (Telugu), Shindilakodi (Tamil), Gurcha (Hindi), Garo (Gujarati), Amritavalli (Sanskrit), *Guduchi* (Marathi), Guluchi (Oriya), Amratha balli (Kannada).

Biological Source ^[4]

Giloy is obtained from *Tinospora Cordifolia* Plant and which is a glabrous deciduous climbing shrub belonging to the family Menispermaceae.

Geographical Source ^[5]

India, Sri Lanka, Myanmar and China, North Africa, South Africa, Bangladesh, Southeast Asia. *Giloy* Found almost

throughout tropical India thriving up to elevation of around 1,000-1,200 meters above sea level. In india *Giloy* grow in Uttar Pradesh and uttharakhand.

Scientific Classification ^[5]

Kingdom: Plantae

Sub kingdom: Tracheophyta -vascular plants

Super Division: Spermatophyta – seed bearing plants

Division: Magnoliophyta – flowering

Class: Magnoliopsida

Sub: class – Polyetalae – petals are free

Order: Ranunculales

Family: Menispermaceae

Genus: *Tinospora*

Species: *T. cordifolia*.

Propogation ^[6]

Stem cutting is the best propagating material of this plant and mainly done in the month of June-July. Seeds also used for propagation of this plant, before sowing seeds are soaked in water for 24 hours for fast germinate.

The hydro primed seeds are sown in polybags during May-July. Germination takes place in 8-10 days with 80-90 per cent success.

In case of fresh seeds without any pre-soaking, only 30-35 per cent germination is obtained. The nursery duration for these plants is up to one and half months.

Semi hard wood cuttings of pencil thickness with 2-4 nodes are planted in June-July. It requires some support preferably neem and mango trees.

It is quite easy to propagate that even if a twig is placed on a branch of a tree, it establishes itself as a giant climber in a couple of years.

Cultivation and Collection

Giloy can grow in any type of soil, ranging from sandy to clay loam. It grows under varying climatic conditions. Stem cuttings are the best planting material for commercial crop production. Planting is usually done during the rainy season (July to August).

The stem cuttings are sown directly in the field. Nodes on mature stems are used to inhibit cuttings. Cutting should be sown within 24 hours of being removed from the mother plant.

About 2500 stem cuttings are recommended per hectare land for good crop growth. The optimum spacing is 3m × 3m for higher yield. It requires some support, preferably

nem and mango trees. Such plants are supposed to possess better medicinal values. Before plantation land is ploughed and made weed free. A basal dose of 10 tonnes FYM (farmyard manure) is recommended for higher yield and basal dose of 75 kg of nitrogen is also applied as basal dose. The field after plantation should be irrigated periodically as and when required. However, it is mainly grown as rain fed crop. As such no serious insect pest or diseases are reported in this crop.

Mature plant is collected, cut into small pieces and dried in shad. The plant yields about (10–15 q/ha) 1500 kg of fresh woody stem, reduced to 300 kg of dry weight per hectare in about two years [7, 8].



Plant Description

T. cordifolia also known as queen of all herbs, is a climbing shrub with a number of coiling branches. The whole plant has been divided into different parts i.e., stem, leaves, flowers, roots and fruits.

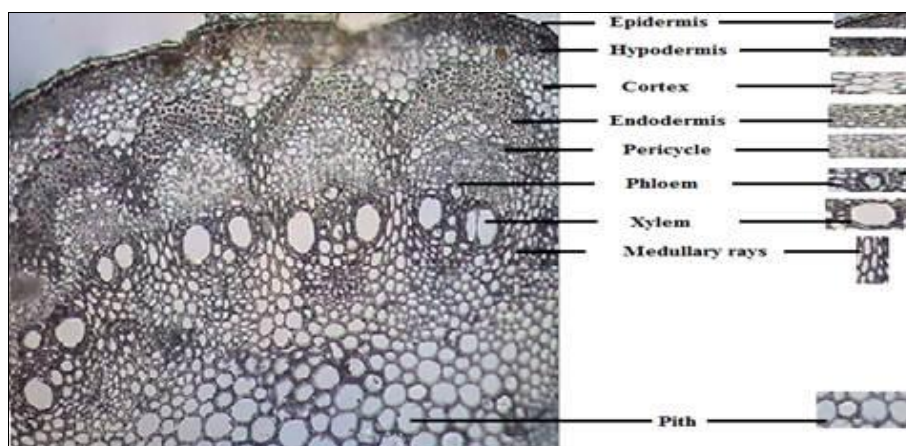
Leaves- Leaves of the *Guduchi* are simple, alternating, stipulate, long-petioled (2.5–7.0 cm), heart-shaped (partially twisted), 7-9-nerved, and deeply cordate (cuneate) at the base and halfway around. The lamina is membranous and is 8-15 cm in width and 10-20 cm in length. Adult leaves are yellowish-green to yellow in color, bitter, and have an ambiguous odor, whereas juvenile leaves are a vibrant green. Tiny, unisexual racemes appear when the plant is leafless, becoming a greenish yellow color. Male flowers

bloom in clusters, whereas female blossoms often grow alone. There are two sets of three sepals, for a total of six. Compared to the sepals, the outer ones are more delicate, independent, and membranous. From March through June, the summer months, the flowers blossom [9].

Stem- The *Guduchi* plant has a long, succulent, slender, juicy stem that grows upward and has aerial roots that grow out of it and into the earth. The stem twists in a helical pattern, and the bark is various shades of milky white and grey [10].

Root- long, cylindrical and fibrous. Aerial roots arise from the branches. Root of *Giloy* is proved to be effective in relieving bowel problems by being potent emetic agent [10].

Transverse Section of *Giloy* Stem



Transverse sections of *Guduchi* stems reveal the plant's cork, cortex, and vascular bundle. Cork is made up of two distinct types of cells, the outer layer being made up of thick-walled, compressed brownish cells and the inner layer

being made up of thin-walled, colorless, tangentially orientated cells. Lenticels induce cracks in the cork tissue. The cortex is thick and has many layers: the outer layer is made up of irregularly organized, tangentially elongated

chlorenchyamatous cells, while the inner layer is made up of polygonal cells laden with abundant starch granules. Ovoid and uncomplicated, starch grains have just a scattering of secretory cells across their cortices. A large number of crystals fibers, each carrying a single prism, are linked to lignified pericyclic threads. Vessel elements, tracheids, parenchyma, and fibers make up the xylem, whereas the phloem parenchyma includes calcium oxalate crystals. The cambium consists of one to two layers. The pith is predominantly made up of big thin-walled cells holding starch grains, and the pith of the vessel components is cylindrical in form and has a bordered pith. The medullary rays are 15–20 cells wide.

Phytochemical Constituents

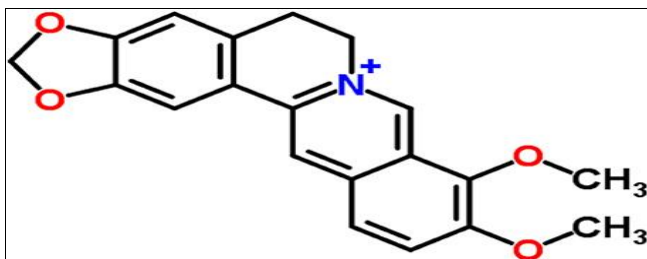
Giloy leaves are potent source of nutrients and essential elements. Leaves contains to high leaves of calcium, protein, iron, crude fibre and ash.

There are many chemical constituents present in *Giloy*. Following secndory metabolite present in *Giloy* such as alkaloids, glycosides, steroids, terpenoids and another aliphatic compound.

Alkaloids

The alkaloid in a plant is a crucial secondary metabolite. Berberine, Palmitate, Tinosporine, Magnoflorine, Jatrorrhizine, Choline, Tembetarine, Pycnanthine isocolumbin, aporphine, clearance derivatives [(5R, 10R)-4R-8R-dihydroxy-cleroda-13 (16), 14-dieno-17, 12S:18 they have biological properties Like Vasorelaxant, anti-inflammatory, anti-viral, anti-microbial, and anti-hypertensive activities [11].

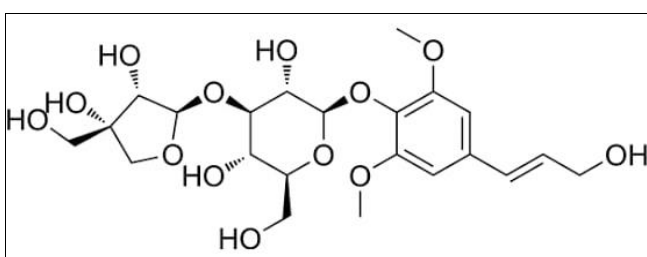
Structure of Berberine



Glycosides

Glycosides are present in the stem of *T. cordifolia*. The examples of glycosides are 18-norclerodane glucoside, Furanoid diterpene glucoside, Tinocordiside, Tinocordifolioside, Cordioside, Cordifolioside A, Cordifolioside B, Syringin, Syringin-apiosylglycoside, Palmatosides C, Palmatosides F, Cordifolioside A, Cordifolioside B, Cordifolioside C, Cordifolioside D, Cordifolioside E. It is used in immunomodulatory, perkinson`s, anti-oxidant etc [12].

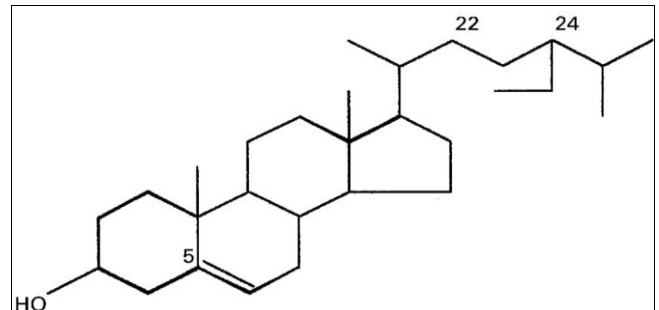
Structure of Cordifolioside A



Steroids

β -sitosterol, δ -sitosterol, Giloinsterol, stigmasterol, Ecdysterone, 20-hydroxyecdysone, ecdysterone, GiloinsterolEcdysterone, all are present in *Giloy*. This inhibit TNF- α IL-1 β , IL-6 and COX-2. Inflammatory arthritis, IgA neuropathy [13].

Structure of β -sitosterol



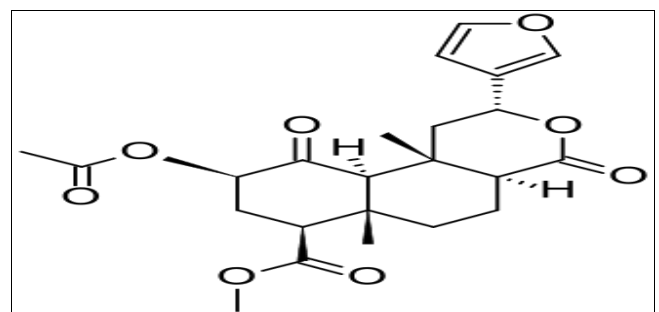
Aliphatic compounds

The entire *T. cordifolia* plant contains aliphatic compounds. Octacosanol it is having properties hypolipidemic (reduce cholesterol) and neuroprotective (support nerve function) and adaptogenic (enhance endurance and stress resistance), Nanocosan15-one dichloromethane, and Heptacosanol are the active components. They had anti-inflammatory and anti-nociceptive properties [14].

Terpenoids

The *Giloy* contain sesquiterpenoids they demonstrated an HIV protective effect. Tinosporide, Furanolactone diterpene, Furanolactone clerodane diterpene, furanoid diterpene, Tinosporaside, ecdysterone makisterone and several glucosides isolated as poly acetate, phenylpropene disaccharides cordifolioside A, B and C, cordifolioside D and E, Tinocordioside, cordioside, palmatosides C and F, Sesquiterpene glucoside tinocordifolioside, Sesquiterpene [15].

Structure of furanolactone



Pharmacological Activities

Giloy is a common climbing shrub that grows on other trees. In Ayurvedic medicine, *Giloy* is considered the queen of herbs and is traditionally used for centuries to treat various diseases including: Chronic fever, Flu, Cold, Hair loss, Arthritis Etc.

The stem of *Giloy* is widely known for its various properties, such as: Antioxidant, Antidiabetic, Antispasmodic, Antipyretic, Anti-allergic, Antihistress, Anti-inflammatory, Immunomodulatory, Antineoplastic etc [16].

Regulation of blood sugar level

Giloy stems are commonly used in traditional medicine to treat diabetes and act as Anti-diabetic agent. It has been suggested that in the process of antidiabetic properties it increases secretion of insulin, decreases gluconeogenesis and glycogenolysis, all of which have control blood glucose level. It has present alkaloids, tannin, cardiac glycoside, flavonoids, saponin, have been shown to have antidiabetic properties^[17].

Antioxidant

Anti-oxidant Activity The methanolic stem extracts of *Giloy* showed anti-oxidant activity when administered orally with the increase in lipid peroxide of erythrocytes membrane and catalase activity while the decrease of SOD and GPx activities in alloxan-induced diabetic rats. *Giloy* extract is regarded as an inhibitor of an enzyme, aldose reductase, as well as the actions of various anti-oxidants, which reduces the chemical toxicity caused by free radicals. The plant extract has profound free radical scavenging activities against Superoxide Anion (O⁻), Hydroxyl Radicals (OH), nitric oxide (NO) radicals, and peroxynitrite anion (ONOO⁻), as well as reduces the toxic side effects of an anti-cancer drug, Cyclophosphamide (CP), in mice due to the formation of free radicals. The protective effects of *Giloy* have been reported even with high anti-oxidant and enzyme levels in the fetal milieu. Besides this, *Giloy* plays an important role in removing free radicals produced during aflatoxicosis and protects the kidneys against the aflatoxin-induced toxicity due to the action of alkaloid compounds. This further leads to the increment of TBARS substances in the brain while the decrease of their levels in the heart of diabetic rats^[18].

Immunity Booster

T. cordifolia were reported to have beneficial effects on the immune system. Compound isolated from *T. cordifolia*, (1, 4)-alpha-D-glucan activates the immune system through the activation of macrophages via TLR6 signaling, NF-kappaB translocation, and cytokine production in RAW cells. The same isolate causes tachycardia, accompanied by hyperventilation, after intravenous administration in rats.

Taking *Giloy* might help boost your immune system against allergies, too. A study including 75 people with hay fever allergies found that *Giloy* helped alleviate their symptoms, including runny and stuffy nose.

Anti- cancer activity

Giloy is used as anti- cancer activity which exhibits that combat cancer. Root extract of *Giloy* has been redio-protective properties due to chemical composition. that elevates in body weight, tissue weight, and tubular diameter. Study was performed by Siddalingappa C M *et al.* it has It was observed that *Tinospora Cordifolia* showed clearly^[19]

Anti-Asthma Activities

Giloy has been traditionally to treat ailments such as bronchitis and chronic cough, cold, sneezing etc. Due to its powerful anti-inflammation and anti-oxidant properties. It pacifies the mucous membrane of the respiratory system. It is very effective in respiratory issue like asthma, cough, cold and tonsils. Chewing *Giloy* roots drinking *Giloy* root juice give symptomatic relief to the patients of asthma^[20].

Anti-HIV Activity

Giloy is an exceptionally viable spice in the treatment of HIV. -It supports the safe framework and helps in the creation of fresh blood cells. Kalikae *et al.*, showed that the root extract of *T. cordifolia* affects the immune system of HIV positive patient. Anti-HIV effects to reduce eosinophil count, stimulation of B lymphocytes^[21].

Antipyretic activity

T. cordifolia is traditionally recognised for its antipyretic activity. Antipyretic efficacy was found in the water-soluble fraction of a 95 per cent ethanolic extract of *T. cordifolia*. The hexane- and chloroform-soluble parts of *T. cordifolia* stems were found to exhibit antipyretic properties in another experiment. *T. cordifolia* has anti-infective and antipyretic effects, according to several research. In rats, pre-treatment with *T. cordifolia* protected them against mortality caused by intra-abdominal sepsis after coecal ligation, and dramatically reduced mortality caused by *E. coli*-induced peritonitis in mice^[22].

Improves Vision and reduces Signs of Angina

In several parts of India, *Giloy* plant is helps to boost up vision clarity. For this, boil *Giloy* powder in water, let it cool down and apply over the eyelids. This plant contains anti-aging properties that help reduce dark spots, pimples, fine lines and wrinkles. It provides flawless, glowing skin of an individual^[23].

Anti- Arthritis activity

Giloy contains anti-inflammatory and anti-arthritis properties that helps to treat arthritis and its several symptoms. For joint pain, the powder from *Giloy* stem. It can be used along with ginger to treat rheumatoid arthritis. *Tinospora Cordifolia* have been reported to affect the proliferation, differentiation and mineralization of bone like matrix on osteoblast model systems *in vitro* and hence finds potential application as anti-osteoporotic agent^[24].

Anti-Toxic potential

Free radicals generated during aflatoxicosis can be scavenged by the antioxidants present in aqueous extracts of *Giloy*. Lead nitrate induced liver damage was prohibited by the *Giloy* extracts^[38]. *T. cordifolia* shows anti-toxic potential due to its ability of lowering the concentration of thiobarbituric acid reactive substances (TBARS) and enhancing the level of glutathione, ascorbic acid and proteins. It also enhances the activities of antioxidant enzymes such as superoxide dismutase, catalase, glutathione peroxidase, glutathione S-transferase and glutathione reductase in kidneys. Moreover, the presence of alkaloids such as isocolumbin, palmetin, tetrahydropalmitine and magnoflorine in *T. cordifolia* protects against aflatoxin induced nephrotoxicity^[25].

Pregnancy and lactation

It's not that *Giloy* is known to cause any severe side effects during pregnancy and breastfeeding; there is limited information available about it. A great deal of caution is exercised when administering and prescribing the medication and treatment during this stage. Further research is required to gather information about its specific details. So, it is always advisable to avoid it and find an alternative solution. Stay on the safe side^[26].

Antistress-Activity

Ethanol extract of *T. cordifolia* at the dose of 100 mg/kg gives significant anti-stress activity in all parameters compared with standard drug diazepam (dose of 2.5 mg/kg). It acts as Medhya Rasayana or brain tonic by expanding mind power like memory and reliving. Reported that *Tinospora Cordifolia* has been studied for its anti-allergic effect and it was found that *T. cordifolia* provided significant relief from sneezing, nasal discharge, nasal congestion, and nasal pruritus compared with placebo with congruous improvements on examination of the nasal smears and nasal mucosa [27].

Anti-Anxiety

In comparison to the standard dose of diazepam, which is 2.5 mg/kg, the anti-anxiety effects of an ethanolic extract of *T. cordifolia*, which was administered at a dose of 100 mg/kg, were shown to be significantly more remarkable. The intelligence quotients of patients have been higher, according to clinical study. In the practice of Ayurvedic medicine, *T. cordifolia* has been utilised for centuries as a brain tonic, with the assumption that it may improve cognitive processes such as memory and recall [28].

Surgery

Giloy should be stopped around 2-3 weeks before your scheduled surgery date because it is known to cause sugar level alternation in the blood. It could interfere with the sugar level control during and after surgery.

Osteoprotective activity

Rats treated with *Tinospora Cordifolia* showed an osteoprotective effect, as the bone loss in tibiae was slower than that in controls. Serum osteocalcin and cross-laps levels were significantly reduced. This study demonstrates that extract of *Tinospora Cordifolia* has the potential for being used as anti-osteoporotic agent [29].

Conclusion

Tinospora Cordifolia most common name is *Giloy* belonging to the family Menispermaceae. *Giloy* is possess more potent and important activities in medicinal product. *Giloy* found throughout India and China. It has popular remedies in Ayurvedic and traditional system in treatment of wide range of ailments. The present review paper shows that all parts of *Giloy* are very preferable in medicine. *Tinospora Cordifolia* known as *Giloy* that introduction, biological source, geographical source, phytochemical constituent and all parts of *Giloy* and their benefits also given. Further research is necessary to interpret phytochemical and medicinal aspect of this plant. This widely use in corona virus also have potential source for the development of new drug in industry. *Giloy* most widely Use in anti-oxidant, anti-inflammatory, anti-cancer activities.

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