

“Review - on Versatility of *Tinospora cordifolia*”

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ABSTRACT :-

Traditional medical practises have employed *Tinospora cordifolia* (Gulvel) for a seemingly endless array of ailments. It frequently occurs alone or in conjunction with other chemicals. Its significant function in immune -modulation in diseases including diabetes mellitus, obstructive jaundice, and hepatic and splenic damage is supported by evidence from pharmacological trials. Additionally supported by data are its anti-oxidant, radioprotective, anti-hyperglycemic, anti-inflammatory, anti-ulcer, antispasmodic, and ability to dissolve urinary calculi qualities. It may be an antidepressant and improves thinking and memory. Benefits in infections, joint inflammation, and allergies are probably explained by immune-modulation, limiting oxidative damage, and reducing inflammation. The combination of several actions contributes to its antitubercular, cytotoxic, and toxin-protective properties. It is useful for enhancing the effects of other chemicals in the form of easy extraction The formulations, the applicability of supporting data, potential mechanisms of action, and hopes for the future are all covered in this review.

KEYWORDS:- Gudachi, phytochemistry, Menispermaceae, *Tinospora cordifolia*, pharmacological activities

I. INTRODUCTION:-

The tall, deciduous climbing shrub *Tinospora cordifolia*, also known as "Guduchu" in Sanskrit, is a member of the "menispermaceae" family and can be found at higher elevations^[1-3]. It is also known as *Cocculus cordifolius* Dec, *Menispermum cordifolium* Wild, and *Tinospora glabra* (N.Br.)Mere. It is a climber that is fleshy, robust, and deciduous that grows with the support of mango or beech trees^[4]. The leaves have a heart-shaped form. The milky white to grey tint of the succulent bark is speckled with lenticles and has deep clefts. It often is an indigenous plant from India and is also known to be found in the Far East, mainly in rain forests. It produces long, slender

aerial roots. It has a light grey papery bark on a stem that is about 6 cm in diameter. The leaves are widely oval or orbicular, 7.5–14 cm long, and 9–17 cm wide, with a deep heart-shaped base. Racemes of tiny greenish yellow flowers are seen. The outer layer of the 3+3 sepals in 7 blooms is modest, while the inner layer is huge. Six stamens are clearly visible^[5]. Its Hindi name, giloya, alludes to a divine elixir used to delay ageing and maintain youth indefinitely. Rejuvenator or adaptogen is described as one that protects the body from ailments by the Sanskrit name guduchi^[6]. The blossoming period extends throughout both the summer and the winter. a wide range of biologically active plant compounds, including alkaloids, steroids, diterpenoid lactones, aliphatics, and glycosides^[7]. have been isolated from the root, stem, and entire plant, among other plant body parts^[8]. This essay explores the medicinal implications of several guduchi (*Tinospora cordifolia*) formulations. The root, stem, and leaf of guduchi are the primary components used in formulations. The pharmacological activities of a medicine change and produce varied outcomes depending on the media employed to prepare these formulations, such as water in hima, kwatha, taila, and ghrita in sneh kalpanas, etc^[9]. It can be found in North Africa, West Africa, South Africa, Myanmar, Sri Lanka, Thailand, the Philippines, Indonesia, Malaysia, Borneo, Vietnam, and Bangladesh. Maharashtra, Gujarat, Madhya Pradesh, Himachal Pradesh, and a few more states in North and South India are among the states in India where it is in great abundance^[10,11,12,13]. The safety of *T. cordifolia* is recognised because it has no impact on bone marrow, blood lymphocytes, or DNA integrity, a feed supplement^[14]. In the context of chicken production, medicinal plants and their extracts are also noteworthy since they help animals' overall health and growth^[15]. In Indian Ayurvedic medicine, *T.cordifolia* has a well-established track record of efficacy in the treatment of metabolic diseases and diabetes^[16].

Pharmacognosy of Tinosopra cardifolia :-

- 1) Fleshy stems
- 2) Long aerial roots that resemble long threads grow from branches.
- 3) When the thin, fleshy stem-covered bark is peeled back, it is greyish or creamy white in colour.
- 4) Heart-shaped, membranous, juicy leaves.
- 5) Flowers: Summer is when they bloom.
 - a) Male flowers are small, clustered, and yellow or green in colour.
 - b) Female flower – Exists alone.
- 6) Fruits—Fleshy, glossy, pea-shaped fruits that turn crimson when boiling. happen in the winter
- 7) Curved, pea-sized seeds.
- 8) Used Parts: Stems and Roots
- 9) Geographical distribution: The plant grows in India's tropical regions from Kumaon to Assam, and from Myanmar, Bihar, Konkan, to Sri Lanka. It is a substantial climber that spreads over the tallest trees in the forests and sends out aerial roots that may reach a length of 10 metres, albeit they are not thicker than pack thread.
- 10) Cultivation: Soil And Climate: It thrives in a wide range of soil types and climatic settings.
- 11) Nursery rearing and planting: In the months of May and June, the plant is grown via stem cutting. Neem and mango trees are recommended as a form of support because they are said to have higher therapeutic qualities.
- 12) Hoeing and Weeding: Hoeing is done on a regular basis in both the field and the nursery depending on the situation.
- 13) Manures, Fertilizers, and Pesticides: No chemical fertilisers or pesticides may be used in the cultivation of medicinal plants. According to the needs of the species, organic manures such as Farm Yard Manure (FYM), Vermi-Compost, Green Manure, etc. Bio-pesticides could be made from

Neem (kernel, seeds, and leaves), Chitrakmool, Dhatura, cow's urine, etc. to prevent illnesses.

14) Irrigation: After planting, the land should be routinely watered as needed.

15) Harvesting and post-harvesting activities: Mature plants are gathered, fragmented, and dried in shade^[17].

Synonym:-

Amrita, Amritvalli, Madhuparni, Giloe, Guduchi, Kundalini are a few names in Indian languages, as as Giloya, Guduchi in Hindi, Ambarvel, Gharol, Gulvel in Marathi, Nimgilo, Gulancha, Palo in Bengali, Jivantik, Tippaatige in Telugu, and Shindilakodi in Tamil. According to the Indian Drugs and Cosmetics Act, Ambrithu, Gulvel is an ayurvedic medication (1940). It has been said that the stem, leaves, fruits, and seeds are helpful. It has an astringent, bitter, and pungent flavour^[18].

CHEMICAL CONSTITUENTS :-

Important components of Gulvel include tinosporine, tinosporaside, cordifolide, cordifol, and heptacosanol^[19]. Gulvel has a high fibre content (15.9%), enough protein (4.5%-11.2%), enough carbohydrates (61.66%), and a low fat content (3.1%). It contains 292.54 calories per 100 g of nutritional value. It contains significant amounts of potassium (0.845%), chromium (0.006%), iron (0.28%), and calcium (0.131%), all of which are crucial for a variety regulatory functions^[20]. Tinosporine, tinosporide, tinosporaside, cordifolide, cordifol, heptacosanol, clerodane furano diterpene, diterpenoid furanolactone tinosporidine, columbin, and b-sitosterol are among the major phytoconstituent in *Tinospora cordifolia*. Its stem has been reported to contain Berberine, Palmatine, Tembertaine, Magniflorine, Choline, and Tinosporin^[21,22,23,24].

Active component	Compound	References
Terpenoids	Tinosporide, Furanolactone diterpene, Furanolactone clerodane diterpene, Furanoid diterpene, Tinosporaside, ecdysterone makisterone, and several glucosides isolated as poly acetate, as well as the phenylpropene disaccharides cordifolioside A, B, and C, cordifolioside D, and E, Tinocardio	[25,26,27,28,29 ,30,31,32,33,34,35]

Alkaloids	jatrorrhizine, palmatine, beberine, tembeterine, and choline. They also include tinosporine (S), magnoflorine (S), beberine (S), and choline (S).	[36,37,38,39,40]
Lignans	3a, 4-(4-hydroxy-3-methoxybenzyl), (S), 4-(4-dihydroxy-3-methoxybenzyl),	[41]
Steroids	20a-hydroxyecdysone, giloinsterol, (S), β -sitosterol	[42,43,44,45]
Others	giloin, tinosporan and tinosporal acetates, tinosporidine, sinapic acid, heptacosanol, octacosanol, two phytoecdysones, and an immunologically active arabinogalactan.	[46,47,48,49,50]

Table 1.2 Some essential constituents of *Tinaspora cordifolia*



Fig 1.1 chemical constituents deserve pharmacological action



Fig 1.2 Tinospora cordifolia fruits

Phytochemistry :-

From *T. cordifolia*, various constituents have been isolated and clarified. These substances come from a variety of groups, including

sesquiterpenoids, glycosides, aliphatic compounds, phenolics, diterpenoid lactones, alkaloids, and steroids^[51].

Type of chemical	Active component and their distribution
Alkaloids	The following terms are used in this sentence: tinosporin (L), tinosporic acid (L) (W), berberine (s), palmitine (s)(R), tembatarine (S)(R), choline (S)(R), tinosporine (s)(R), isocolumbin (R), and tetrahydropalmatine (R).
Glycoside	18 Syringin (S), Syringin apiosyl glycodide (S), Palmayosides C and P, Nonderodane glycoside (S), Furanoid diterpene glycoside (S), Tinocordiside (S), Tinocordifoliside (S), Cordioside (S), Cordioside A, B, C, D, Syringin (S), Syringin apiosyl glycodide (S), Syring (S).
Diterpenoids lactones	Tinosporon columbin (S), clerodane derivatives (W), tinosporon (W), tinosporisides (W), jateorine (W), columbin (W), tinosporal, and tinosporide are some examples of diterpenoids.
Steroids	Sitosterol (S), hydroxyecdysone (S), makisterone A (S), giloinsterol (S), octacosanol (S), heptacosanol (S), nonacosan-15-one (S), and tetrahydrofuran (S)
Sesquiterpeniids	Einocordifolin (s)
Miscellaneous compound	Unrelated substances Jatrorrhizine (R), tinosporidin (W), cordifol, cordifellone, giloin, giloinin, and arabinogalactan are some examples of related compounds (S)

Table 1.3:- chemical composition of the Tinospora cordifolia herb

Letters in brackets indicate the part of the plant from which the chemical constituent has been isolated. S, stem; L, leaf; R, root; W, whole plant; O, other aerial p .

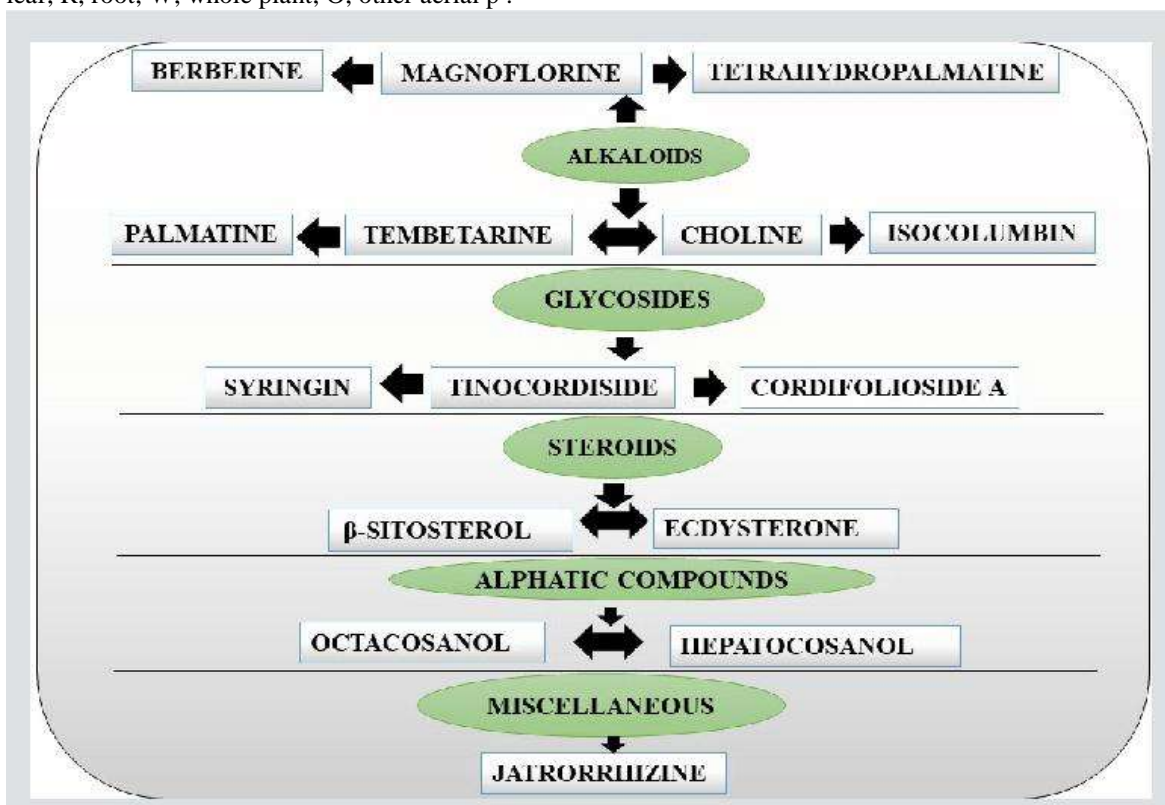


Fig 1.3:- phytoactive constituents of *Tinospora cordifolia*

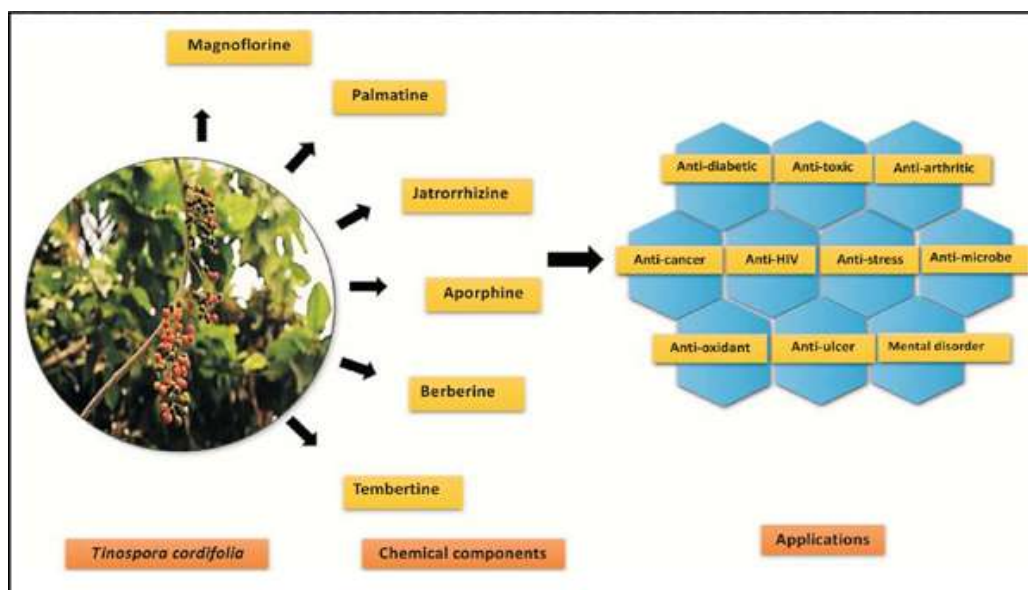


Fig 1.4:- *Tinospora cordifolia* :- Phytoche

II. RESULTS :-

A] *Tinospora cordifolia* is a plant with a wide genetic range.

Studies of the morphological and physiological traits of the plant, such as plant length, stem diameter, growth habit, floral morphology, flower colour, stomatal density, trichomal density, lenticels density, petiole length, plant biomass, and other traits of the plant, as well as diversity in the genetic components identified by markers, have revealed the diversity in the medicinal plant, which is of utmost importance for effective and efficient management of the disease. The use of markers for randomly amplified polymorphic DNA has been reported,^[52]

B] Pharmacological activities of *Tinospora cordifolia*

Antioxidant Activity :-

T. cordifolia extract was used to assess the oxidative status of the heart, liver, kidney, and brain; it was found that these extracts were superior to insulin and glibenclamide in terms of effectiveness. Additionally, *T. cordifolia* has been used to lessen ischemic brain damage by preventing the production of ROS, which then ameliorates oxidative stress-mediated cell injuries brought on by oxygen/glucose deprivation through direct effects and gene expression modulation^[53]. *Tinospora cordifolia*'s in-vitro antioxidant activity has been investigated by Anilakumar K R et al. In methanol, ethanol, and water extracts, *Tinospora cordifolia* was found to have good antioxidant activity. The stem's potential as a source of natural antioxidants or nutraceuticals to minimise oxidative stress and reap subsequent health benefits is suggested by the extracts' high reported antioxidant activity^[54]. The stemic ethanol extract increased the erythrocytes' membrane lipid peroxide, catalase activity, and decreased superoxide in a study by George et al. on the antioxidant activity of *T. cordifolia*'s methanolic, ethanolic, and water extracts. dismutase and glutathione peroxidase in rats with diabetes brought on by alloxan. Methanol leaf extracts showed antioxidant activity when partitioned in water with ethyl acetate and butanol at a concentration of 250 mg/ml. Methanol leaf extracts also had high levels of phosphomolybdenum and metal chelating activity^[55].

Immunomodulatory Activity :-

According to reports, they work by increasing human neutrophils' generation of

reactive oxygen species (ROS), macrophages' phagocytic activity,^[56]. These substances may have an anticancer effect because they can increase the production of nitric oxide by macrophages and splenocytes^[57]. Gulvel's protective effects on mice with peritonitis brought on by *Escherichia coli* indicated enhanced neutrophil phagocytic capabilities. Gulvel dramatically reduced the immunosuppression caused by cholestasis in rats, pointing to its potential usefulness as an immunomodulator in obstructive jaundice^[58,59].

Antidiabetic Activity:-

The aqueous and alcoholic extracts increased glucose tolerance and decreased fasting blood sugar, but after one month of treatment, things started to get worse. In rabbits treated with aqueous, alcoholic, and chloroform extracts of Gulvel leaves, significant hypoglycemic effects were seen. Blood sugar, brain lipids, hepatic glucose-6-phosphatase, serum acid phosphatase, alkaline phosphatase, and lactate dehydrogenase all significantly decreased by the aqueous root extract of Gulvel, while body weight, hemoglobin, and hepatic hexokinase levels^[60,61].

Anti-cancer Activity:-

The anti-cancer properties of *T. cordifolia* are 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 properties. *T. cordifolia* dichloromethane extracts exhibit cytotoxic effects as a result of lipid peroxidation, the release of LDH, and a decrease in GST. Root extract significantly impacted radiation in pre-irradiating animals, increased lipid peroxidation, and caused a decrease in GSH in the testes^[62].

Hepatoprotective Activity:-

Several polyherba preparations, many of which contain *T. cordifolia*, have been marketed recently for the treatment of various liver diseases. Additionally, *T. cordifolia* root extracts shown hepatoprotective qualities against pyrazinamide- and rifampicin-induced liver damage^[63].

Anti-inflammatory Activity:

Numerous animal studies using models of carrageenin-induced hind paw edoema, induced edoema and arthritis, adjuvant-induced arthritis, cotton pellet granuloma, and formalin-induced arthritis, as well as a clinical trial in rheumatoid

arthritis, demonstrated the anti-inflammatory action of Gulvel in acute and subacute inflammation^[64,65].

Anti- microbial activity:-

T. cordifolia's methanolic extract has been shown to be effective against microbial infection. *Escherichia coli*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Proteus vulgaris*, *Salmonella typhi*, *Shigella flexneri*, *Salmonella paratyphi*, *Salmonella typhimurium*, *Pseudomonas aeruginosa*, *Enterobacter aeruginosa*, and *Enterobacter aerogene* have all been tested for the anti-bacterial activity of *T. cordifolia* extract^[66].

Anti-arthritic, anti-osteoporotic effects :-

Tinospora cordifolia may be used as an anti-osteoporotic agent because it has been shown to impact osteoblast model systems' in vitro proliferation, differentiation, and mineralization of bone-like matrix. Alcoholic extract from *Tinospora cordifolia* has been demonstrated to increase the differentiation of cells into osteoblastic lineage, the mineralization of bone-like matrix, and the development of osteoblasts^[67].

Anti-allergic activities:-

There have been studies on the anti-allergic properties of *Tinospora cordifolia*. When compared to a placebo, *T cordifolia* significantly reduced nasal discharge, nasal obstruction, and nasal pruritus, and consistently improved nasal examination results .both nasal mucosa and smears^[68].

Anti-HIV activities:-

TCE's anti-HIV effects were demonstrated by a decrease in eosinophil count, activation of B lymphocytes, macrophages, and polymorphonuclear leucocytes, and an increase in haemoglobin percentage, demonstrating the drug's potential for use in the treatment of the illness^[69,70].

Anti-stress activity:

The plant extract has a mildly negative impact on mental and behavioural deficits. Clinical studies demonstrated that patients' I. Q. levels had improved. It functions as a *Medhya Rasayana*, or brain tonic, in Ayurveda by enhancing mental abilities including memory and recall^[71]

Traditional use:-

Increased phagocytosis, neutralising toxins, stimulating the growth of epithelial cells, and supposed positive effects in recurrent

infections, chronic fever, tuberculosis, malaria, diabetes, chronic otitis media, and as an adjuvant with antibiotics or nonsteroidal anti-inflammatory drugs are just a few immune-modulation-related claims^[72,73].

III. CONCLUSION:-

All types of life can benefit from a plant like *Tinospora cordifolia*, which serves a variety of functions. According to reports, plant extracts contain active substances in the form of alkaloids, glycosides, lactones, and steroids, as was already mentioned. All of these active substances have various immunomodulatory and physiological functions, highlighting the plant's wide range of adaptability. It is firmly believed that comprehensive information, such as that provided in this review, on the phytochemical and diverse biological features of the extracts, may give comprehensive proof for the use of this plant in various medicines. Future research could expand the usage of *Tinospora cordifolia*'s organic and aqueous extract as a source of beneficial phytochemical components for the pharmaceutical sector. The therapeutic value of *Tinospora cordifolia* has been confirmed by the pharmacological and clinical investigations included in the current review. Chemical components found in the plant suggest that it may someday act as a "lead" in the creation of new treatments for illnesses. Numerous positive effects include antioxidant, hepatoprotective, antimicrobial, antihyperglycemic, antipyretic, antihyperlipidemic, cardiovascular-protective, anti-inflammatory, osteoprotective, neuroprotective, antianxiety, analgesic, antidiarrheal, and antistress properties.

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