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Tinospora cordifolia: A review on its pharmacological activities and phytochemical constituents

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Abstract- *Tinospora cordifolia* commonly called Guduchi is a natural herbal shrub that belongs to menispermaceae family. It is found in India, Myanmar and Sri Lanka. This plant has various applications in traditional and folk medicine for treatment of many diseases such as jaundice, gout, diabetes, Skin diseases, cancer, fever, dysentery, cardiac diseases, Urinary problem etc. *T. cordifolia* is considered as an important herbal drug of Indian system of Medicine (ISM). In modern medicine, the plant has been evaluated and studied more profoundly and most recently the drug is implemented. This review brings together various properties and medicinal uses of *Tinospora cordifolia*, along with phytochemical and pharmacological reports.

Keywords : *Tinospora cordifolia*, Phytochemicals, Pharmacological

INTRODUCTION

Plant description-*Tinospora cordifolia* (Synonym: Tinosporasinesis) is also known as Guduchi/Amrita and its names in Latin: *Tinospora cordifolia* (wild), English: Tinospora Gulancha/Indian Tinospora, Hindi: Guloya. It belongs to the family Menispermaceae and is found in Myanmar, Sri Lanka, India and China.[1]

T. cordifolia is a large deciduous, extensively spreading climbing shrub with several coiled branches with a different type of morphology. The stem is of climbing in nature, filiform and fleshy.[2] It is native to tropical region of India ascending to an altitude of 500 metres in the range of 25 to 40°C. The leaves are simple heart shaped and dark bright in colour. Multicoated reticulate venation is found in lamina.[3] Bark is Succulent, with deep clefts spotted and large rosette-like lenticels. The colour of bark is white creamy or grey. Flowers are unisexual, small and greenish yellow on auxillary and terminal racemes. Flowers grow during summer (March to June) while fruits develop during the winter (November) fruits are orange-red in color, fleshy and smooth.

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METHODOLOGY

We have exhaustibly reviewed many published literature on recent developments in research of *T. cordifolia,* including original articles and papers as

secondary data from various search engine such as Pubmed, Pubmed Central Databases, Google Scholar, Crossref, WorldCat, Harvard library, Mendeley, Scilit, Cite factor, Shodhganga, Science Central, AYUSH Research Portal, Open J-Gate, Biblioteca were taken into consideration for the report. Medical advancements and the effects of *T. cordifolia* observed with different experiments were collected for the review purpose

Traditional use of *Tinospora cordifolia*-

Tinospora cordifolia has been used by many countries in flok medicine for treatment of various diseases such as fever, and urinary diseases.[4] In India, the plant is usually used by traditional practioners for the treatment of asthma, dysentery, arthritis, skin ulcer and weakness.[5] In dhanvantri Nighantu, it has been depicted for treatment of bleeding piles, curing itching and promiting longevity.[6] *T. cordifolia* is highly valuable in Ayurveda for its numerous medicinal properties like immune- modulation, anti-rheumatic, detoxifying and rejuvenating properties. *T. cordifolia* is recently applied in modern medicine for treatment of flu, cold and corona virus prevention. Therefore, it is clear that *T. cordifolia* is most important plant with a great potential of remedies of various diseases.

PHYTHOCHEMICAL CONSTITUENTS

T. cordifolia contains important phytochemical constituents that have been studied an proven to be effective and valuable therapeutic compounds. *T. cordifolia* (Guduchi) mainly consists of alkaloids, glycosides, steroids, mixture of fatty acids, phosphorous, proteins, polysaccharides, aliphatic compounds, lignans, terpenoids and essential oils.(Fig: 1.1)[7] The stem of *T. cordifolia* contains clerodane furano diterpene glucoside (amritoside A, B, C and D) and the structure has been established by different spectroscopic studies leaves of this plant are rich in protein (11.2%).[8-10]

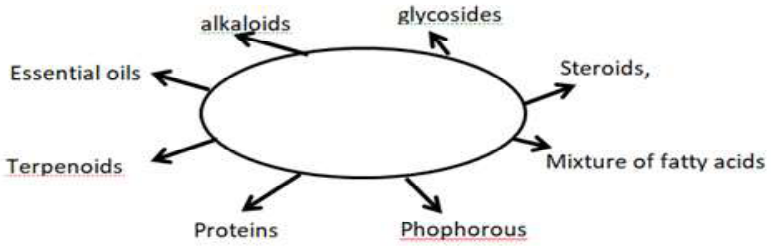

Fig: 1.1 Major Phytochemicals of *T. cordifolia*

Detailed chemical constitution of *T.cordifolia* is given in table 1.1

Sl. No.	Active Components	Compounds
1	Alkaloids (Tikta-Bitter Principle)	Berberine, Palmatine,Tembetarine, Magnoflorine, Choline, Tinosporin, Isocolumbin, Palmatine, Tetrahydropalmatine, Magnoflorine
2	Aliphatic compound	Octacosanol, Hetacosanol,
3	Diterpenoid lactones	Furanolactone, Clerodane derivatives and [(5R, 10R)- 4R-8R- dihydroxy-2S-3R:15,16-Diepoxy- cleroda- 13 (16), 14-dieno- 17, 12S: 18, 1S-dilactone] and Tinosporon, Tinosporides, and, Jateorides, and, Jateorine, columbin
4	Glycosides	18-norclerodane glucoside, Furanoidditerpeneglucoside, Tinocordiside, Tinocordifolioside, Cordioside, Cordifolioside A, Cordifolioside B, Syringin, Syringin-apiosylglycoside, Palmatosides C, Palmatosides F, Cordifoliside A, CordiofolisideB, Cordifoliside C, Cordifoliside D, Cordifoliside E
5	Steroids	β-sitosterol, δ-sitosterol, 20β- Hydroxyecdysone. Ecdysterone, Makisterone A, Giloinsterol.
6	Sesquiterpenoid	Tinocordifolin.
7	Terpenoids	Tinosporide, furanolactonediterpene, Furanolactoneclerodanediterpene, furanoid diterpene, Tinosporaside, furanoidditerpene, Tinosporaside, ecdysteronema kisterone and several glucosides isolated as poly acetate, Phenylpropene disaccharides cordifoliosid A, B and C, cordifoliside D and E, Tinocordioside, cordioside, palmatosides C and F Sesquiterpenetinocordifolin.
8	Others.	Giloin, Tinosporan acetate, Tinosporal acetate, Tinosporidine, Heptacosanol, Octacosanol, sinapic acid, tinosponone, two phytoceedysones and immunologicallyactivearabinogalactan.

I. Pharmocological activities of *T. cordifolia*

Antidiabetic activity- *T.cordifolia* has wide application against diabetes mellitus due to presence of active components such flavonoids, saponins, cardiac glycosides, tannins, steroids and alkaloid. Alkaloids have potential against diabetes because if stimulates insulin secretion and shows insulin mediated action.[11] The root extract of *T. cordifolia* showed an antihyperglycemic effect in the alloxan- induced diabetic model by decreasing its excess glucose level.[12] In a diabetic rat model *T. cordifolia* root extracts attenuated the brain mediated lipid level and down- regulated the blood glucose level showing its anti-diabetic and lipid- lowering activity.[13]

The stem extract of *T. cordifolia* is reported to have anti-diabetic potential by enhancing the insulin efficiency through its secretion from beta pancreatic cell the extract of Guduchi decreases the post meal increased glucose level by inhibiting glucosidase activities. The leaf extract of *T. cordifolia* has also found anti-diabetic potential when tested in Streptozotocin induced diabetic rat model[14].

Anti-stress activity- Ethanolic extract of Guduchi gives significant anti-stress activity when compared with drug diazepam. The clinical research showed that improved I.Q. level of patients.[15]

Antimodulatory activity–Guduchi is able to increase the response of immune cell highlighting it as a potent agent for the prophylaxis of immune susceptible diseases. GI-4 A, a polysaccharide present in the *T. cordifolia* increases the proliferation and differentiation of immune cells like T- Cell associated with the expression of the anti-apoptic gene.[16] Polymozphonuclear leucocyte (PMN) cells are important components of the immune system. Extract of guduchi stimulated the PMN cells for phagocytosis.[17] Aqueous extract of *T.cordifolia* stimulates cellular mitosis and activation of cytokine and immune effector cells.[18]

Anti-osteporotic activity- The ethanolic extract of *T.cordifolia* is found to increase the degree of proliferation and differentiation of the osteoblast cells Rats. It also takes part in the calcification process by producing minerals Beta Ecdysone or 20- hydroxyecdysone, a steroid found in *T. cordifolia* showed the prevention of osteoporosis.

Diuretic activity-T. cordifolia has been reported as useful in urinary trouble separately and in the form of various formulations in ayurved. In a specific study of rats and human volunteers Guduchi was found to have diuretic effect.[19]

Antileprotic activity: - *T. cordifolia* is also used for its anti-leprotic properties, along with wide use in other skin diseases.[20]

Gastrointestinal and anti-ulcer activity- Treatment with a formulation containing *T.cordifolia* has been shown to reduce ulcer index total capacity, with an increase in the pH of gastric fluid in pylorus-ligated rats and in the ethanol-induced gastric mucosal injury in rats.[21]

Hepatoprotective activity- Various Ayurvedic preparations of *T. cordifolia* are reported in Kamla (Jaundice). A clinical study has shown that guduchi plays an important role in normalisation of abnormal liver functions (ALT, AST).[22] The antihepatotoxic activity *T. cordifolia* normalising liver function by assaying SGPT, SGOT, Serum Alkaline Phosphatase and serum bilirubin.[23]

Antipyretic activity- Traditionally *T. cordifolia* is known for its antipyretic activity. The water- soluble fraction of 95% ethanolic extract of *T. cordifolia* has significant antipyretic activity[24]. In other experimental study, antipyretic effects have been reported in the hexane and chloroform soluble portions of *T. cordifolia* stem.[25]

Anti inflammatory Activities - The alcoholic extract of *T. cordifolia* has been found to exert anti-inflammatory action in models of acute and subacute inflammation.[26] *T. cordifolia* that grow on *Azadirachta indica* (neem) significantly inhibited acute inflammatory response evoked by carrageenin in a dose of 50mg/100g given orally and intraperitoneally.

The dried stem of *T. cordifolia* produced significant anti-inflammatory effect in both acute and subacute models of inflammation. *T. cordifolia* was found to be more effective that acetylsalicylic acid in acute inflammation, *T. cordifolia* was found to be more effective than acetylsalicylic acid in acute inflammation, although in subacute inflammation, the drug was inferior to phenylbutazone.[27]

Anti-allergic activity– *T. cordifolia* is traditionally used for the treatment of asthma, and the juice is also employed for the treatment of chronic coughs.[28] In a clinical study, 100% relief was reported from sneezing in 83% of the patients on treatment with *T.cordifolia*. Similarly, there was relief from nasal discharge was reported in 69%, form nasal obstructions 61% and from

nasal pruritus, in 71% in placebo group. The anti- allergic and bronchodilator properties of an aqueous extract of the stem evaluated on histamine-induced bronchospasm in guinea pigs, capillary permeability in mice and mast cell disruption in rats showed that it significantly decreased bronchospasm induced by 5% histamine aerosol, decreased capillary permeability and reduced the number of disrupted mast cell.[29,30]

CONCLUSION AND DISCUSSION

Tinospora cordifolia is an important medicinal shrub having various biologically active compounds including alkaloids, steroids, glycosides, sesquiterpenoids etc. these bioactive compounds have been reported to have a therapeutic potential. The various scientific studies that have been conducted on *T.cordifolia* states that it is effective against diseases like cancer, diabetes, infections, viral infections etc. it also have hypolipidemic effect, anti HIV potential, antiosteoporotic effects, antitoxic, effects, wound healing and parkinson's disease. By the above applications, *T.cordifolia* has been marketed by prominent companies. *T.cordifolia* now can be used for further research investigations in novel drug development.

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CONFLICT OF INTEREST

Authors declare no conflict of interest regarding publication or any other activity related to this article.

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