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A REVIEW ON THERAPUETIC POTENTIAL & PHYTOPHARMACOLOGY OF *TINOSPORA CORDIFOLIA*

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Abstract

Tinospora cordifolia linn. is a climbing deciduous herb having various medicinal properties. Which is distributed throughout India and other regions of world. Guduchi stands important role in ayurvedic health system. Presence of wide range of phytochemical constituents, it possess medicinal properties include antidiabetic, anticancer, analgesic, antimicrobial anti-inflammatory activity. This review paper provides information regarding phytochemical constituents, nutritional value and medicinal properties of *Tinospora cordifolia*.

Key words: *Tinospora cordifolia*, analgesic, antimicrobial anti-inflammatory activity.

Introduction

India is enriched with enormous biodiversity of medicinal plants. Around 70% of medicinal herbs found in eastern and western ghats tropical forests, vindhyas, chota nagpur plateau, aravalis and Himalayas. The large portion of world medicinal plant population plants important role in health care system and mainly dominant in developing country. Now a days, plants are not only exerting influence in health care but also provide hope as a source for future medicine. National health care programme is conducted by WHO to promote more exposure in herbal drugs because they are easily assessable about price to reach in common people and to considering herbal drugs are safer than synthetic chemical drugs (Dar *et al*., 2017). In china, Greece, Egypt and India the medicinal plants are considered as oldest sciences where commonly used as herbal drug, disinfectant and aromatic agent. In history of human life, treatment of diseases with medicinal plant be as a tool for the recovery from diseases and it became only the choice for the treatment.

The term "medicinal plant" indicates that the plants having medicinal properties in which the phytochemical constituents in the plant exerts direct and indirect therapeutic effect (Jamshidi *et al*., 2018).

In ancient medical history of ayurveda *Tinospora cordifolia* family menispermaceae is one of the most widely used shrub as medicine. Commonly it is known as guduchi, amritha valli. *Tinospora cordifolia* occupied with wide variety of bioactive principles and it is medically proven important plant (Pathan *et al*., 2017). *Tinospora cordifolia*, the versatile herbal drug is the distinctive source of constituents which is having antidiabetic, immunomodulatory, antioxidant, antimicrobial, antitoxic and anticancer activity. Number of investigations and research has been done on chemical constituents of guduchi. It also having potentiating activity on other substances in the form of shodhan–vidhi. "Guduchi" is the Sanskrit name which indicates that one protects from diseases. In hindu mythology, hindi name of *Tinospora cordifolia* is "giloya" believed to be that the heavenly elixir which prevents aging (Mutalik *et al*., 2011).

Morphological Features (Khatun *et al*., 2016) (Mani *et al*., 2015)

Amruthaballi is the large deciduous, widely spreading

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Table 1: Vernacular names of *Tinospora cordifolia Linn.*

Sanskrit	Guduchi, amrita, somavalli
Malayalam	Chittamruthu
Kannada	Amrutha balli
Hindi	Gurcha, giloe, gulancha
Marathi	Gula –vel
Bengali	Gulancha
Tamil	Seendal
Gujarati	Galo
Telugu	Teppatige
Urdu	Gilo
Kashmiri	Amrita, Gilo
Asamese	Siddhilata, Amarlata

climbing shrub having number of coiling branches.

STEM: Stem part of *Tinospora cordifolia* is rather tender, with long, fleshy, thin and climbing in nature.

LEAVES: Leaves are approximately 15 cm round long petioled, heart shaped, pulvinate, simple, alternate, lamina is found to be 10-20 cm long, ovate, membranous 7 nerved and at base deeply cordate.

FLOWER: It is yellowish green in colour. Flowers are simple, pedunculate arranged as pseudo racemes arising from the old branches.

ARIAL ROOTS: Characterised as terta-penta arch primary structure. Root cortex divided into externally thick wall and parenchymatous internally.

FRUITS: Mostly develop during winter season. Fruits are orange–red in colour with fleshy, aggregate, ovoid, smooth are orange-red in colour, fleshy, aggregate, drupelets on thick stalk having sub terminal style scars.

SEEDS: family is named as moon seed family seeds are found to be in curved shape

Vernacular Names (Kavya *et al.*, 2015) (Meshram *et al.*, 2013)

The Vernacular names of the plant is given in table 1.

Table 2: Taxonomical classification of *Tinospora cordifolia* Linn.

Kingdom :	Plantae
Subkingdom:	Tracheophyta
Superdivision:	Spermatophyta
Division:	Magnoliophyta
Class:	Mangnoliopsida
Subclass:	Polypetalae
Series:	Thalamiflorae
Order:	Ranales
Family:	Menispermaceae
Tribe:	Tinosporeae
Genus:	Tinospora
Species:	Cordifolia

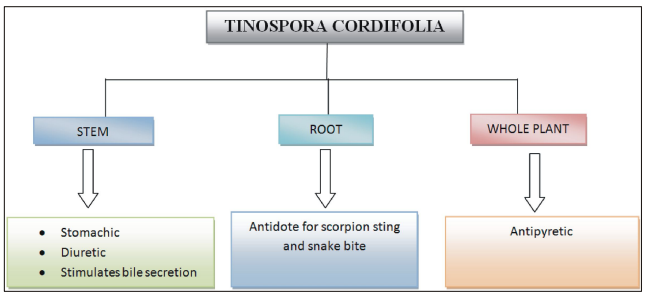
Taxonomical Classification (Bharati *et al.*, 2018)

The taxonomical classification of the plant is given in table 2.

Geographical Distribution

Guduchi is one of the famous traditional ayurvedic medicine, which is distributed all over the tropical region of India upto 1200m above the sea level from Kumaon to Assam. Northern region of India it covers a wider area through west Bengal, Bihar, Deccan, Konkan Karnataka, Kerala. *Tinospora cordifolia* also found in Bangladesh, China and Srilanka. South East Asian continent such as Malaysia and Indonesia also reported *Tinospora corifolia*.

Parts used



Potential Benefits of Tinospora Cordifolia (Bharati *et al.*, 2018)

Guduchi having wide range of nutritional value and possess great importance in health and diseases. Utility as food promotes the health and offers preventive and curative benefits. It is rich in carbohydrates and protein content helps in providing essential energy. Presence of trace elements makes *Tinospora cordifolia* as potassium and chromium supplement. People those who are diabetic takes *Tinospora cordifolia* as the part of diet which is benefiting by the action of chromium. Repletion of chromium improves glucose tolerance reverses abnormal increase in circulating insulin and glucogon. Potassium content also can reduce cardiac arrhythmias and support the cardiac functioning.

Traditional uses

Traditionally *Tinospora cordifolia* stem extract is used to take for jaundice, vermifuge and intestinal worms. For the treatment of rheumatism and jaundice dried fruit is taken along with ghee or honey. Combination with other drugs stem and root extract is used for snake bite and scorpion sting. Leaves are mainly used for ulcer irritation (Choudhary *et al.*, 2013)

On study, the survey conducted by the Ali ahmed *et al.*, on traditional ethnomedicinal uses of the *Tinospora cordifolia* at different areas of savar upazila. Information

Table 3: Traditional uses of *Tinospora cordifolia.*

Plant part	Traditional uses
Leaf juice	• For burning sensation • To treat ear pain (2-3 drops)
Stem juice	• Taken orally with honey for asthma treatment • Treatment of skin diseases
Stem paste	• To treat eczema • Treatment of fever • For various skin diseases • Treatment of leucorrhoea
Stem decoction	• Fever treatment
Old stem decoction	• For Periodic fever
Whole plant paste	• Cough treatment
Dried fruit powder	• As tonic along with ghee and honey
Root paste	• To treat leprosy
Root juice (warm)	• For fever
Root decoction	• Treatment of dysentry
Stem +root powder	• Treatment of cancer taken along with milk

collected from various registered Ayurvedic and Unani practitioners (Ali *et al*., 2015).

Phytochemistry

Wide variety of chemical constituents have been isolated from *Tinospora cordifolia*. which includes different classes such as alkaloids, steroids, diterpenoid lactones, polysaccharides, glycosides, phenolics, sesquiterpenoids and aliphatics compounds (Singh *et al*., 2003).

Rakesh maurya *et al*., conducted experiment on isolation of amritosides A, B, C and D clerodane furane diterpene glucosides from *Tinospora cordifolia* stem, ethanolic extract of stem which is soluble in n-BuOH over chromatographic silica gel eluted along with $CHCL_3$ –MeOH, obtain complex mixtures with 2 fractions. Spectroscopic studies are done to confirm the structure of compounds (Maurya *et al*., 2004).

Vijay D. gagan *et al*., performed isolation of cordifoliosides A, B, C: nonterpene furan glycosides from fresh stem ethanolic extract as polyacetates. On the basis of TLC and GC, hydrolysis of these glucosides afforded glucse is identified presence of OH and C=O is confirmed using IR spectroscopy. The angular methyl group, four acetyl methyl group, carbomethoxyl group $1\beta+2\alpha$ protons substituted furan ring and presences of acetylated sugar protons are also confirmed on the basis of spectroscopic methods (Gangan *et al*., 1994).

Kaur, G. *et al*., performed phytochemical investigation of *Tinospora cordifolia*. It is found to be that phytochemicaly *Tinospora cordifolia* is about their constituents on the basis of different in geographical locations and seasonal change. Hydroalcoholic and aqueous extract shows more chemical constituents than other extracts. Result of the study on the basis of various chemical test found to be that guduchi contains significant amount of alkaloids, glycosoideds, steroids, sesquiteroenoids, Aliphatic compounds, mixture of polysaccharides and fatty acids (Kaur, G. *et al*., 2014).

Pharmacological activity

• Antioxidant activity:

Antioxidant activity is mainly affecting through different mechanisms which includes superoxide anion scavenging assay, hydroxyl radical scavenging assay, DPPH radical scavenging and ABTS radical scavenging method. Chi, S. *et al*., evaluated antioxidant potential of various extract of *Tinospora cordifolia*. Methanolic extract of leaf and ethyl acetate extract of stem shows these activities. On further studies on leaf and stem powder of guduchi by DPPH method it is found to be that stem extract has lower retention of antioxidant activity comparing to leaf extract. Leaf and stem extract also provide significant protection towards plasmid DNA damage radical induced protein oxidation. Antioxidant protective property is mainly due to the presence of the phyochemicals such as polyphenols and tannins (Chi, S. *et al*., 2016).

Upadhyay, N. *et al*., conducted study on antioxidant potential and total phenolic content on stem of guduchi using *in Vitro* model. DPPH assay is used for the determination of scavenging activity of stem extract of *Tinospora cordifolia*. In this method it is shown that reduction of purple DPPH to yellow coloured diphenyl picrylhydrazine. Spectrophotometer is used for determining the absence of free radical. At 518 nm remaining DPPH showed maximum absorption Result of investigation shows that ethanolic stem extract having significant antioxidant activity along with phenolic content (Upadhyay, N. *et al*., 2013).

Viswanadha vijaya padma *et al*., conducted a study on antioxidant activity of methanolic stem extract against Cd- induced kidney dysfunction due to oxidative stress. Investigation concluded that the methanolic stem extract exerts action of decreasing protein carbonyl content, inhibition of lipid peroxidation, modulation of cellular antioxidant system and strengthing the membrane ATPase activity (Padma, V. *et al*., 2015).

Table 4: Chemical active constituents of *Tinospora cordifolia Linn*.

STEM	ALKALOIDS	• Berberine • Palmatine • Tembetarine • Magnoflorine
	GLYCOSIDES	• 18-norclerodane glucoside • Furanoid-diterpene glucoside • Tinocordiside • Tinocordifolioside • Cordioside • Cordifolioside A • Cordifolioside B • Cordifolioside C • Cordifolioside D • Cordifolioside E
	STEROIDS	• Ecdysterone • Makisterone A • Giloinsterol
	SESQUITERPINOIDS	• Tinocordifolin
AERIAL PART	STEROIDS	• β–sitosterol • ∞–sitosterol· • 20-β- hydroxyl ecdysone
ROOT	ALKALOIDS	• Choline • Tinosporine • Isocolumbin • Palmatine • Tetrahydropalmatine • Magnoflorine
	MISCELLANEOUS COMPOUNDS	• Jatrorrhizine
WHOLE PLANT	DITERPENOID LACTONES	• Furanolactone • Clerodane derivatives • Tinosporon • Tinosporides • Jateorine • Columbin
	ALIPHATIC COMPOUND	• Octacosanol • Heptacosanol • Nonacosan-15-one
	MISCELLANEOUS COMPOUNDS	• 3, (α, 4-dihydroxy-3-methoxy-benzyl)-4-(4-hydroxy-3-methoxy-benzyl)-tetrahydrofuran. • Tinosporidine • Cordifol • Cordifelone • N-trans-feruloyl tyramine as diacetate • Giloin • Giloinin • Tinosporic acd

• Immune-stimulant activity:

Sultan Alsuhaibani and Masood A. Khan performed study on immunostimulatory activity and investigation on therapeutic activity of *Tinospora cordifolia*: against salmonellasis. Anti salmonella activity of methanolic stem extract of *Tinospora cordifolia* is higher when compared to aqueous extract. Aqueous and methanolic extract treatment effects on immune system by stimulated secretion of pro inflammatory cytokines by macrophages. It was assessed by the levels of proinflammatoy

cytokines. Bacterial load in macrophages is highly reduced by treatment with methanolic extract as compared to aqueous extract. Investigation concluded that methanolic extract shows greater inhibitory action against *Salmonella typhimurium* infection found in macrophages and shows higher survival possibility in infected mice (Alsuhaibani, S. *et al*., 2017).

• Anti Microbial Activity:

Ethanolic extract of guduchi leaf shows maximum antibacterial activity against *Klebsiella pneumonia* and *Pseudomonas aeruginosa*. On comparison with ethanolic extract, chloroform extract of leaf having moderate activity and it exerts poor inhibitory action against E-coli. Ethanolic stem extract also exerts maximum inhibitory activity against *Klebsiella pneumonia* and except *Proteus vulgaris* it exerts moderate action towards other pathogens. *Proteus vulgaris* is resistant to all kind of extract. On study, aqueous, ethanolic and acetone extract of leaves and stem of guduchi is found to be effective against urinary pathogens. Both stem and leaf aqueous extract exhibit poor inhibitory action against all pathogens (Shanthi, V. *et al*., 2013).

• Anti Hiv Activity:

Jithendra Mittal, Madan Mohan Sharma and Amala Batra conduct a research on the various therapeutic activity of *Tinospora cordifolia*. Root extract of *Tinospora cordifolia* exert anti-HIV activity through different mechanism by reducing the level of polymorphonuclear leucocytes, haemoglobin and esinophil count, stimulating macrophages and B-lymphocytes. Study concluded that guduchi having significant anti-HIV activity (Kalikar, M. *et al*., 2008).

• Anti Clastogenicity Activity

Ethanolic stem extract of *Tinospora cordifolia* possess the anticlastogenic activity against arsenic induced genotoxiciy. The ethanolic stem extract having anti mutagenic potential as preventive herbal drug against chemical toxicity (Kattupalli, S. *et al*., 2019).

• Antidiabetic Activity:

Tinospora cordifolia mentioned as life style regimen for diabetics, which ensure better glyceamic control via extrapancreatic and intrapancreatic action. It possess multiple site of action such as liver, β-cells of pancreas, fat, L-cells of intestinal mucosa, fat and muscles. Usefulness by its potent *in-vitro* acetyl cholinesterase inhibitory activity. In diabetic patients, hyperglycaemia and hyperlipideamia is common. Treatment with aqueous root extract shows better reduction in serum and tissue cholesterol, free fatty acids and cholesterol (Sharma, R. *et al*., 2015).

Study conducted by Abhijith L.M. and Ravi K. Sori on antidiabetic activity of *Tinospora cordifolia* in alloxan induced diabetics in albino wistar rats, results shows that both low dose and high dose exhibit hypoglycaemic activity. In *in-vitro* rat lens, it is observed that 103 µg/ml of aqueous extract of guduchi exert aldose reductase inhibitory activity. Root extract shows significant reduction in serum lipid and glucose on 6 weeks oral administration in alloxan induced diabetic rat. Reduction in fasting blood sugar level in streptozotocin induced diabetic rats is observed in treatment with both aqueous and alcoholic extract of *Tinospora cordifolia* stem after 10-30 days in dose 200 and 400 mg/kg body weight and found to be greater efficacy compared with insulin (Meena, A.K. *et al*., 2010).

• Nephroprotective Activity:

Tinospora cordifolia extract exert nephroprotective activity against cyclophosphamide induced toxicity. On study, 5 days administration of *Tinospora cordifolia* extract of dose 200 mg/kg in cyclophosphamide induced nephrotoxicity in swiss albino mice model. From investigation it is found to be lowered level of urea, protein urine and nitrogen level in blood. Also, it increases the lowered level of cytokines IFN-IL-2 because of cylcophosphamide toxicity (Prithviraj *et al*., 2017).

• Anti Inflammatory Activity:

Aqueous extract of guduchi stem is effective against carrageenan and histamine induced rat edema. On study, conducted by Jacob, J. and B.K. Prakash on anti-inflammatory activity of *Tinospora cordifolia* methanolic extract by inhibition of COX and LOX enzyme due to the presence of alkaloids and flavanoids. Also found that LOX enzyme inhibition due to protoberberine. In future it may develop as a therapeutic agent with less side effects (Jacob, J. *et al*., 2013).

• Analgesic Activity:

Aqueous extract of guduchi exihibit the analgesic activity due to the presence of various phytochemical constituents. Sumanlata *et al.,* conducted a study on analgesic activity of aqueous extract in experimentally induced pain in albino rats. It shows effective action by central and peripheral mechanism in all 3 pain models like eddy's hot plate method, tail flick test, writhing method. *Tinospora cordifolia* is the better choice of drug comparing to NSAID which produce gastric irritation while guduchi exihibit gastroprotective activity (Sumanlata *et al*., 2019).

Crude extract contains aqueous extract of aerial parts

and stem of guduchi. The presence of any one of the phytochemical constituents like alkaloids glycosides, favanoid, steroids and terpenoids in the aqueous extract of aerial part is responsible for analgesic activity by PG synthesis inhibition (peripheral mechanism) and involving opoid receptor *via* central mechanism (Goel, B. *et al*., 2014).

• Antiameobic Activity:

The ethanolic extract of *Tinospora cordifolia* exert inhibitory activity against *Entameoba histolytica*. Treatment with crude extract at dose 800 mg/kg shows grater cure in hepatic ameobiasis (Joshi, G. *et al*., 2016).

• Radioprotective Activity:

Alcoholic stem extract of *Tinospora cordifolia* excert radioprotective activity. Harish Chandra goel *et al.,* investigated radioprotective activity of stem exract on the male mice treated with desired dose of gamma radiation delivered to whole body. On study, it is found to be that pre-administration of guduchi stem extract of dose 200mg/kg i.p exhibit radioprotective potential in terms of whole body survival, haematological parameter, spleen colony forming units, cell cycle progression and micronuclei induction (Goel, H.C. *et al*., 2004).

Conclusion

The present review mainly focused on the medicinal importance and potential of *Tinospora cordifolia linn*. over various diseases. *Tinospora cordifolia* possess established traditional medicinal values hence, this plant is worth for further investigation at molecular level beneficial for human kind.

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