Review Article

Informative Review on Pharmacognostic, Phytochemistry, Ethnopharmacological, and Phytopharmacological Actions of *Tinospora cordifolia*

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ABSTRACT

Herbal drugs are medicinally and therapeutically active. From ancient times, *Tinospora cordifolia* belongs to Menispermaceae. This plant generally contains tinosporine, hydroxy ecdysone, furanoid diterpene, tinosponone, terpenoids, sinapic acid, and aliphatic compounds. Major phytopharmacological actions are significantly reported are against Diabetes Mellitus (DM), SARS-CoV-2 syndrome, boost immunity, treat influenza, viral infection, lymphoma, anticancer, antipyretic, effective against several bacteria such as *Mycobacterium leprae, Mycobacterium tuberculosis*, *Neisseria gonorrhoeae* and having diverse variety beneficial properties. This review is an endeavor on many isolated chemical components from *T. cordifolia,* medicinal utilization of this plant against several disorders, ethnopharmacology, phytopharmacological actions.

Keywords: *Tinospora cordifolia*, Giloy, Menispermaceae, Ethnopharmacology, Phytochemical, Phytochemical analysis, Phytopharmacology.

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INTRODUCTION

Medicinally and therapeutically active plant i.e., *Tinospora cordifolia*, belongs to the family Menispermaceae. This plant is native to India. Menispermaceae is involved in the order Ranunculales. Leaves are simple and alternate, lamina are ovate. This plant has been utilized in several ailments, chronic disorders, normal flues, and viral infections. *T. cordifolia* has been utilized in the therapeutics of SARS-CoV-2 viral infection, treatment of leprosy, in the management of pyrexia, boost immunity, hypersensitivity reactions, sepsis, breast cancer, and treatment of several dermatological syndromes, jaundice, diabetes, and gout.[1] Several important Pharmacopoeias also enlist this plant in their formulary.[2] In modern investigations, this plant has been justified to alleviate the negative consequences of chemotherapy. Phytochemicals that are present in the plant have several major and intense phytopharmacological properties that ensure the treatment of chronic human disorder. This review generally focuses on the ethnopharmacological utilizations, phytochemical study along phytopharmacological investigations for supplementary advancement. There is a great promise for the development of novel drugs from *T. cordifolia* to treat many human syndromes as a result of its effectiveness and safety.

Taxonomic hierarchy

Kingdom- Plantae

Division- Magnoliophyta

Class- Magnoliopsida

Order- Ranunculales

Family- Menispermaceae

Genus- *Tinospora*

Species- *Tinospora cordifolia*

Binomial Name- *Tinospora cordifolia* (Thunb.) Miers

Common Name- Giloy

Vernacular Names of *T. cordifolia*

Assamese- Aamoi Lota

Bengali- Gulancha

English- Heart-leaved Moonseed

Gujrati- Galo

Hindi- Giloy

Kannada- Amara

Kannada- Madhupa

Malayalam- Amritavalli

Manipuri- Amrutvel

Manipuri- Ningthou kong-Lee

Mizo- Thei-Sawn-Tlung

Nepali- Gurjo

Odia- Gulancha

Punjabi- Galo

Rajasthani- Neemgiloy

Sanskrit- Guduchi

Tamil- Anantai

Telugu- Tippa Teega

Tulu-Amritha Buru

Urdu- Gilau

Pharmacognostic Interpretation of *T. cordifolia*

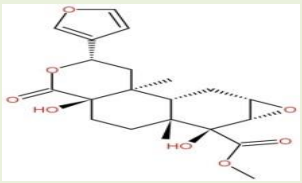
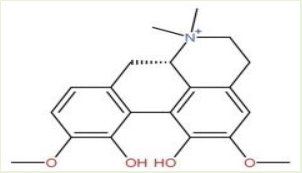
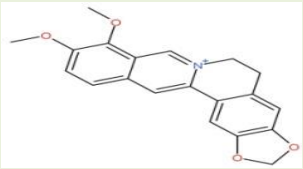
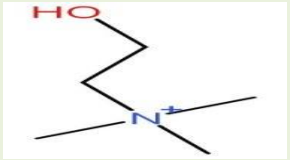
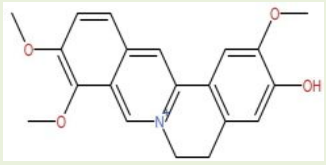
Climbing shrub which is huge deciduous, broadly spreading with a few snaked branches with an alternate sort of morphology having filiform stem white to dim in color.[3] Stem's powder seems to be creamish brown or dull brown, has severe taste, and is utilized in dyspepsia, pyrexia, and urinary illnesses.[4] Leaves of this plant are basic, substitute, long-petioled i.e. roughly 15 cm; round, pulvinate, heart-formed, bent to some degree, and most of the way around. Lamina is about 10–20 cm long and membranous.[5] Branches are yellowish to greenish in shade along with unisexual blossoms at axillary positions.[6] Its natural products are single-cultivated, natural products throughout the colder time of year and blossoms develop throughout the late spring.[7] The root is a string like aeronautical, some of the time constantly extending contact the ground[8], and aeronautical roots are portrayed by tetra to Penta curve essential design.[9] The seeds are bent in shape[10], and the endocarp is differently ornamented, which gives basic ordered characters.

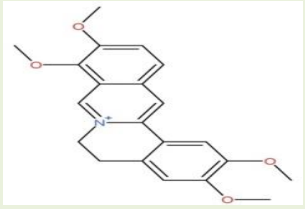
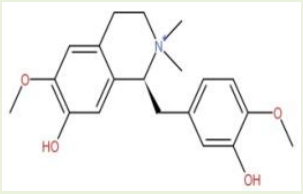
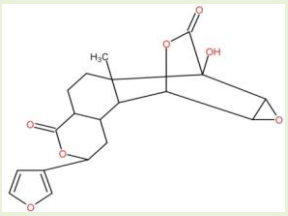
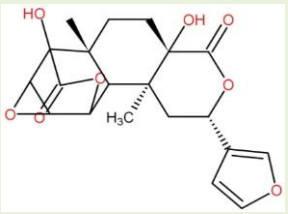
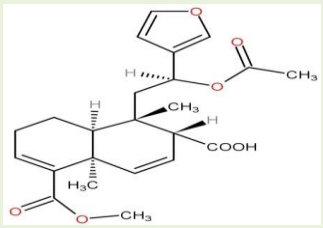
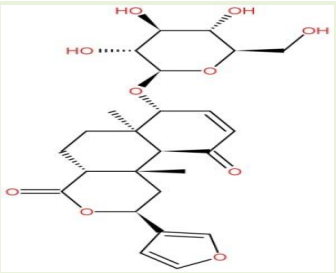
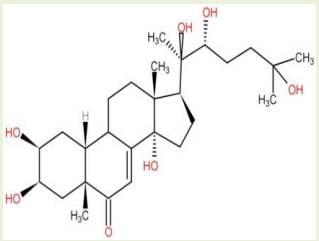
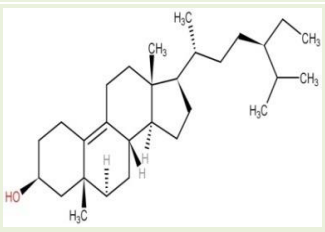
Figure 1: Stem of *T. cordifolia*

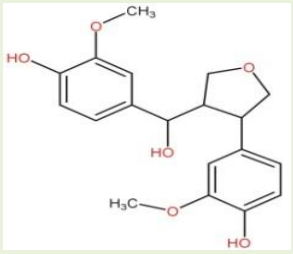
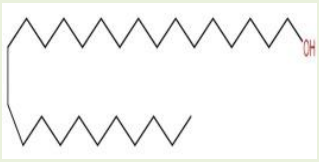
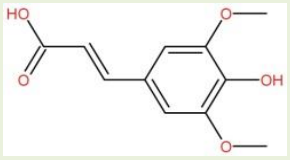
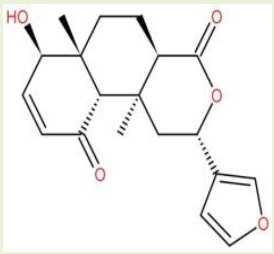
Phytochemistry

Different bioactive mixtures are isolated from this plant. This plant for the most part contains alkaloids, glycosides, terpenoids, phenolic compounds, diterpenoid lactones, steroids, lignans, and aliphatic compounds. These all substances alongside their structure are addressed and enrolled in table no. 1.

Table 1: Major Phytochemicals present in *T. cordifolia* accompanying structure

Major Phytoconstituents	Compound	Structure	PART	References
ALKALOID	Tinosporine		Aerial part, stem	1
ALKALOID	Magnoflorine		Stem	11
ALKALOID	Berberine		Aerial part, stem	12
ALKALOID	Choline		Stem	13
ALKALOID	Jatrorrhizine		Aerial part, stem	14

ALKALOID	palmatine,		Stem, root	12, 13,14
ALKALOID	Tembeterine		Stem	11,12,13,14
TERPENOIDS	Tinosporide		Stem	15
TERPENOIDS	Furanolactone clerodane diterpene		Whole plant	16,17,18
TERPENOIDS	Furanoid diterpene		Stem	19,20,21
GLYCOSIDES	Tinosporaside		Stem	21,22
STEROID	Hydroxy ecdysone		Aerial part	23,24
STEROID	ß-Sitosterol		Aerial part	14, 25

LIGNANS			Whole plant	26, 27
ALIPHATIC COMPOUNDS	Heptacosanol		Whole plant	14, 23, 25, 27, 28, 29
ALIPHATIC COMPOUNDS	Octacosanol		Whole plant	26
PHENYLPROPANOIDS	Sinapic acid		Whole plant	22, 23, 26
DITERPENOID LACTONES	Tinosponone		Whole plant	17,27,28,29

Phytochemical screening

The primer subjective phytochemical investigation was done via the usage of stem extraction.[30,31] Methanolic extraction, ethanolic extraction, chloroform extraction, and aqueous extraction was utilized for the determination of secondary metabolites in the *Tinospora cordifolia.*

Table 2: Phytochemical analysis

Serial Number	Phytochemical testing of secondary metabolites	General test	*Tinospora cordifolia* 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

Ethnopharmacological Utilization Of Heart-Leaved Moonseed

Tinospora has conventionally been used as a therapeutic remedy. This plant and their respective species have been utilized in the therapeutic of parasitic disorder, diarrhea, mucosal infection, pyrexia, mucosal ulceration, dermal disorders, respiratory tract infection, renal disorder, urinary tract infection, a gastrointestinal disorder involving inflammation of gastric region, flatulence, dyspepsia, and diabetes. "Giloy" is also effective in the management of cancer. *T. cordifolia* protects the hepatic regions from damage. As per Ayurveda, *T. cordifolia* itself possesses a bitter taste and pungency. Because of the presence of bitterness in the Tinospora plant, it possesses several metabolic activities. This plant accommodating and given to the patients who are suffering from enlarged spleen and piles. In the treatment of gout, it is admired to be given in combination form with several other therapeutically active herbs such as *Curcuma longa* (turmeric), *Zingiber officinalis* (ginger), *Commiphora mukul* (guggul). This plant can also be given in the treatment of thrombocytopenia, in combination with *Carica papaya* (Papaya). For the treatment of SARS-CoV-2 syndrome, *Tinospora cordifolia* with the combination of *Withania somnifera* (Ashwagandha), *Ocimum sanctum* (Basil). This whole plant is also utilized for providing relief from the pain originating from bone fractures. It is considered a general tonic.[1]

Table 3: Medicinal uses of *T. cordifolia*

S. No.	Medicinal utilization	References
i.	Anti-protozoal	32
ii.	Breast cancer	33
iii.	Sepsis	
iv.	*Mycobacterium tuberculosis*	
v.	Diabetic foot ulceration	34
vi.	Experimental amoebic liver abscess	35
vii.	Liver toxicity induced from the CCl_4	36
viii.	Pollinosis/ Hay Fever/ allergic rhinitis	37
ix.	Rheumatoid arthritis	38

Ethnopharmacological utilization of this plant is also enlisted in table no. 4 according to the part of the plant because each part contains their pharmacological properties and therapeutic effect due to the presence of diverse bioactive compounds in the *T. cordifolia.*

Table 4: Ethnopharmacological uses of *T. cordifolia*; treatment from different part of plant

S. No.	Plant Part	Ethnopharmacological utilization	Reference
A.	Leaves	Gout, *Helicobacter pylori* infection	39
B.	Fruit	Treatment of jaundice and rheumatism.	3
C.	Bark	Treat Hansen's disorder	40
		Hypersensitivity reactions	41,42
D.	Stem & root	Cancer, dysentery, diarrhea, periodic fever	43,44,45
		Act as antidote to scorpion sting; applicable only if given with combination of other therapeutically active herbs	46,47,48
		Assisting digestion, dermal disorder, bile liberation activates, act as diuretic, enriches the blood, cures obstructive jaundice	46
		Useful in diabetes, vaginal and urethral discharges low fevers and enlarged spleen	
E.	Whole plant	Jaundice	3
		Stimulate the immune system	49,50, 51

Phytopharmacological Actions

There are various actions determined from the *T. cordifolia*. Phytoconstituents present in this plant have their pharmacological actions that are regarded as phytopharmacological actions. Examples of such activities are elaborated as such antioxidant, hepatoprotective, neuroprotective, dermatological, diuretic, radioprotective, antioxidant, deal with various kind of hypersensitivity reactions, antimalarial, relief stress, treat dengue, effective in thrombocytopenia, mental disorders, dementia, depression, hepatotoxicity, splenic injury, treat ulceration, treat gonorrhea, obstructive jaundice, treat infections, SARS-CoV-2 syndrome infection, viral infection, flu and also effective, work against several pathogens such as *Mycobacterium leprae, Entamoeba histolytica, Mycobacterium tuberculosis, Aedes aegypti and Plasmodium species (Plasmodium malariae, Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale*) and many more effective pharmacological actions.

Table 5: Phytopharmacological activity reported by several phytochemicals present in the *T. cordifolia*

Phytochemical	Class	Part	Phytopharmacological activity	Reference
Palmatine	Alkaloid	Whole plant	Hepatoprotective activity	52
Berberine, choline, Tembetarine, Tinosporin		Aerial parts	Neuroprotective effect	53
Berberine		Stem	Antidyslipidemic activity	54
Furanolactone, Tinosporon	Diterpenoid lactone	Whole plant	Antimicrobial activity	55
Furanolactone, Tinosporin, Tinosporide, Jateorine, Columbin, Clerodane derivatives	Alkaloid and Terpenoids	Stem	Cardioprotective effect	56
Magnoflorine, Tinocordiside, Cordifolioside A		Stem	Anticancer activity	57

Market Formulations

^Ayurvedic medicine- Guduchi capsules; boost immunity

^Multiplate by Arishtha Pharmaceuticals; treat thrombocytopenia

^Divya Swasari Coronil Kit by Patanjali; treatment of SARS-CoV-2 syndrome

^Goutyhills by Isha Agro Developers Pvt. Ltd.; treatment of Gout

^Lord's *Tinospora cordifolia*- Mother Tincture (Homoeopathic) by Lord's Homoeopathic Laboratories; improve white blood cells count

CONCLUSION

From this review, we conclude that *T. cordifolia* regarded as excellence source for the treatment of diabetes, leprosy, pyrexia, boost immunity, possess activity against microbes, treat SARS-CoV-2 syndrome and many pathological conditions along with it is effective against several microbes, bacteria and deadly virus. Conventional utilization have been elaborated and evaluated by the modern pharmacology investigations. There is a great promise for the advancement of novel drugs from *T. cordifolia* to treat and cure many human ailments as the result of its accuracy, safety, effectiveness, and this plant could be the future research interest to explore the plant exhaustively.

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