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A Review on Medicinal properties of Tinospora cordifolia

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ABSTRACT :

Plants have been a major source of medicine from the beginning of human civilization. There is an increasing need for plant-based medications, health goods, pharmaceuticals, dietary supplements and cosmetics. Tinospora Cordifolia, a member of the Menispermaceae family, is a deciduous climbing plant that is widely distributed throughout the tropical and subtropical regions of world. It grows on China, Myanmar, Thailand, the Philippines, Indonesia, India, Sri Lanka, Malaysia, Vietnam, Bangladesh, and South Africa. The main phytochemical components of this plant are glycosides, alkaloids, aliphatic compounds, steroids, sesquiterpenoid, polysaccharides, diterpenoid lactones, and phenolics The herb contains alkaloid tinosporin, borapetoside F, borapetoside B, syringin, Berberine, Palmatine, Magnoflorine, Choline, Isocolumbin, Tetrahydropalmatine according to the phytochemical analysis. This plant has been revealed to exhibit an anti-diabetic, anti-HIV, immunomoduatory, anti-cancer, anti-anxiety, anti-osteoporotic, anti-hyperipidemic, wound Healing, anti-inflammatory and Antihelmintic properties..This review summarizes the morphological, Geographical, microscopical characteristics, phytoconstituents, pharmacological activities along with nutritional value, adverse effects, traditional uses of Tinospora cordifolia.

Keywords: Tinospora cordifolia, Guduchi, Climbing shrub, Anti-diabetic, Anti-inflammatory, Traditional herb

Introduction :

The World Health Organization describes traditional medicine as "the understanding, abilities, and procedures that depend on the concepts, opinions , and experiences which are indigenous for various cultures, and that are utilized in the maintaining health and also with prevention, detection, enhancement, or treatment of physical and mental illness".
The climate, atmosphere, and geographic place in which traditional medicine developed all have an impact on its beliefs and practices. However, the most common philosophy is a complete approach to life, balancing the mind, body, and environment, and emphasizing health over disease.

Traditional medical systems differ significantly, each with its own theory and procedures. Generally speaking, the primary focus is on the individual's general state instead of the specific ailment or disease from which the patient suffers, and the therapeutic application of herbal is an essential part of all traditional medical treatments. The Tinospora plant has considerable potential for diagnosing and treating many kinds of ailments. It is a medicinal plant that has been widely researched and used to cure a variety of ailments, among them but not limited to heart disease, diabetes, leprosy, arthritis of the joints, along with allergies[1].

Tinospora species include a variety of phytochemicals and remedies that can be utilized to treat a number of ailments. The Tinospora plant has several phytochemical components which are beneficial to its medicinal approach[2]. These components contain alkaloids, flavonoids, glycosides, aliphatic compounds, diterpenoid, vitamins, tannins, lactones, steroids, coumarins, lignans, triterpenes, as well as nucleosides. Although Tinospora plants are classified into three species, Cordifolia is the most essential due to its medicinal features and therapeutic activity[3]. Tinospora cordifolia has also been demonstrated to have immunomodulatory characteristics, making it an effective stress and anxiety treatment. The Tinospora cordifolia plant has the ability to reduce free radical formation, protecting membranes against radical-induced membrane damage. It is also useful in Dengue because it improves platelet count. In addition, it has numerous unknown health benefits as well as applications. Tinospora cordifolia extract has been used to treat autoimmune diseases. In a rat model of rheumatoid arthritis, it reduces the production of pro-inflammatory cytokines such as IL-6 and TNF-α[4]. Moreover, a range of Tinospora cordifolia extract fractions and components have been shown to have anticancer activity[5].

While there are many other ayurvedic medicinal plants, Tinospora cordifolia has the potential to be proved as a highly valuable plant with beneficial, ethnopharmacological, plant chemicals, and a variety of other properties. Previous studies have found that Tinospora cordifolia provides a wide range of therapeutic pharmacological characteristics, comprising anti-diabetic, anti-inflammatory, antiarthritic, antioxidant, hepatoprotective, cardioprotective, anti-allergic, as well as anti-stress abilities. To evaluate T. cordifolia's medicinal potential, more extensive research is needed to understand the regulatory processes. This thorough examination aims to provide an overview of T. cordifolia's numerous pharmacological actions[6].

Description :

Tinospora cordifolia, also known as Guduchi or Giloy, is a large climbing shrub along with greenish-yellowish flowers that develops at higher altitudes and is genetically variable.

Table 1. Scientific classification[7]

Kingdom	Plantae
Subkingdom	Tracheophyta
Infrakingdom	Streptophyta
Superdivision	Spermatophyta
Division	Magnoliophyta
Subdivision	Dicotiledons
Class	Magnoliopsida
Superorder	Polypetalae
Order	Ranunculales
Family	Menispermaceae
Genus	Tinospora
Species	Cordifolia

Table 2.Vernacular names[8]

English	Indian Tinospora, Gulancha
Sanskrit	Guduchi, Amrita, Tantrika, Madhuparni
Hindi	Giloya, Guduchi
Bengali	Gulancha
Marathi	Gulwel
Guajarati	Galo
Telugu	Thippateega
Tamil	Shindilakodi
Kannada	Amrita balli
Malayalam	Chittamrithu, Amruthu

Morphology :

It is a huge deciduous climbing shrub with long twisted branches. The **leaves** are simple, alternating, exstipulate, roundish, pulvinate, with long, alternating petioles up to 15 cm long. The basal petiole is longer and few twisted. The lamina is broadly oblong or oval cordate, 10-20 cm long or 8-15 cm broad, 7 nerved and profoundly cordate at the base, membranous, pubescent above, and whitish tomentose beneath. **Flowers** are unisexual, tiny on individual plants, and occur when the plant has no leaves. The axillary and terminal racemes are greenish yellow. Female flowers are normally solitary, while male flowers are grouped. **Sepals** are six free in two sets of three, with the outside ones being smaller than the inner. **Petals** are six oblong, membrane-bound, and smaller than sepals. **Fruits** consist of 13 ovoid smooth drupelets on a strong stem with crimson or orange-colored subterminal style scars[9].

Figure 1. Tinospora cordifolia whole plant

Figure 2. Tinospora cordifolia leaves

Figure 3. Tinospora cordifolia stems

Figure 4. Tinospora cordifolia roots

Figure 5. Tinospora cordifolia fruits

Figure 6. Tinospora cordifolia flowers

Figure 7. Tinospora cordifolia seeds

Microscopy :

Root :

Aerial roots are made up of tetrahedra, which are identical to plants' basic structure, the Penta-arch. The cortex is separated into an inner parenchymatous zone that contains cells that contain tannin and mucilage and an outside thick-walled zone that represents the velamen. Starch is abundant in the areal root's parenchyma.

Stem :

Transverse sections of Guduchi stems show the vascular bundle, cortex, and cork of the plant. Cork is composed of two types of cells: the outer layer is made up of thick-walled, compressed brownish cells, while the inner layer is made up of thin-walled, colorless, tangentially orientated cells. Lenticels cause fissures to form in cork tissue. The thick and multilayered cortex is composed of polygonal cells loaded with a profusion of starch granules in the inner layer and irregularly arranged, tangentially lengthened chlorenchyamatous cells in the outer layer. Starch grains are ovoid and simple, with only a sprinkling of secretory cells on their cortical surfaces. Numerous crystal fibers are connected to lignified pericyclic threads, each of which carries a single prism. The xylem is made up of vessel components, tracheids, parenchyma, and fibers, while calcium oxalate crystals are found in the phloem parenchyma.

The cambium is composed of one to two layers. The pith is cylindrical in shape and has a bordered pith. It is mostly composed of large, thin-walled cells that contain starch granules. Medullary rays range in width from 15 to 20 cells.

Leaf :

The middle cross section of a Guduchi leaf has a single, well-developed collateral vascular bundle, a large hump on the bottom, and a small convex on the top. Mesophyll is seen to be divided into palisade and spongy tissue in a dorsiventral cross-section of the lamina. The mesophyll has a palisade layer of thin-walled, differentiated columnar cells that occupy about half of its width. There are a wide range of palisade ratios, ranging 4 to 12. Close examination reveals that epidermal cells are angular and occur at a density of 1000 to 1500 mm^2, whereas cellular trichomes vary in size from 115 to 145 m in height and 32 to 42 m in depth. The dimensions of anomalocytic stomata are 200-600 mm^2, 36-54 m, and 18-36 m, respectively. Veins are complicated, with numerous primary veins branching off. The dorsal veins are abundant and plainly apparent. For every sixteen vein terminations, up to three vein islets are present. When examined in cross section, the petiole appears spherical. A broad central parenchymatous pith is present, along with three to four layers of fibrous pericycle, eight to ten vascular bundles grouped in a ring, a large zone of cortex, and only one layer of epidermis and one layer of endodermis[10].

Geography :

In India, the plant Tinospora cordifolia is found in both tropical and subtropical areas. It is native to areas of China, Myanmar, Thailand, the Philippines, Indonesia, India, Sri Lanka, Malaysia, Vietnam, Bangladesh, and South Africa[11].

Phyto-chemical Constituents :

A wide range of phytoconstituents have been isolated from Tinospora cordifolia plant. All phytoconstituents related to various drug categories are glycosides, alkaloids, aliphatic compounds, steroids, sesquiterpenoid, polysaccharides, diterpenoid lactones, and phenolics. The leaves of this plants are high in protein, and beneficial for phosphorus and calcium. The various phytoconstituents reported such as glycoside, alkaloids, bitter principles, crystalline components, etc. Columbin, chasmanthin, and palmarin are identified as bitter principles. The phytoconstituents have been isolated from T. cordifolia are alkaloid tinosporin, borapetoside F, borapetoside B, syringin, polypodine B [20,22]-acetonide, angelicoidenol2-O-β-D-apiofuranosyl-(1→6)-β D glucopyranoside, secoisolariciresinol-9'-ODglucopyranoside, and pinoresinol-di-O-glycoside[12].

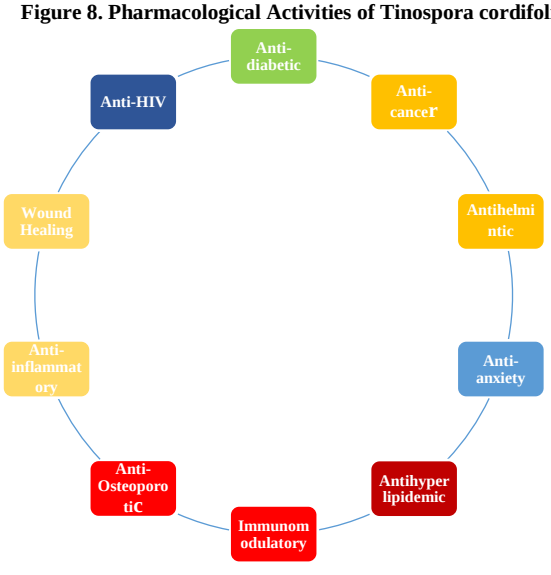
Table 2. Active constituents of T. cordifolia plant[13]

Compound	Active constituents	Parts of plant
Alkaloids	Berberine, Palmatine, Magnoflorine, Choline, Tinosporin, Isocolumbin, Tetrahydropalmatine	Stem and Root
Glycosides	Tinocordifolioside, Syringin, Palmatosides C, Palmatosides F, Cordioside	Stem
Steroids	B Sitosterol, Ecolysterone, Makisterone A, Giloinsterol	Aerial Part and Stem
Diterpenoid lactones	Tinosporides, Jateorine, Columbin, Tinosporin	Whole Plant
Sesquiterpenoid	Tinocordifolin	Stem
Aliphatic Compounds	Octacosanol, Heptacosanol	Whole Plant

Pharmacological Activity :

Tinospora Cordifolia possesses anti-diabetic, anti-HIV, immunomoduatory, anti-cancer, anti-anxiety, anti-osteoporotic, anti-hyperipidemic, wound Healing, anti-inflammatory, and Antihelmintic properties.

Figure 8. Pharmacological Activities of Tinospora cordifolia



a) Anti-diabetic activity

The stem of this kind of plant is commonly used to treat diabetes by controlling blood glucose levels. It has been proven that it functions as an anti-diabetic medication by decreasing oxidative stress, increasing insulin secretion through blocking gluconeogenes as well as glycogenolysis. The presence of Alkaloids, tannins, cardiacglycosides, flavonoids, saponins, steroids, and other compounds have been shown to exhibited to this plant species of anti-diabetic properties. The crude extract of stem present in in ethyl acetate, dichloromethane, chloroform, and hexane suppresses enzymes such as salivary, amylase, and glucosidase, that lead to rise in post-prandia glucose levels and showing potential actions towards diabetes mellitus disease[14].

b) Anti-cancer activity

The plant Tinospora cordifolia can possess anti-cancer properties. After administering 200, 400, or 600 milligrammes per kilogramme of dry weight of Tinospora cordifolia extract for 24 hours prior to intraperitoneal injection of cyclophosphamide (50 mg/kg), mice having preexisting micronuclei in their bone marrows were protected from the development of new ones. After administering a 50% methanolic extract of the Tinospora cordifolia plant for 30 days at a dose of 750 mg/kg body weight, it was discovered that C57 B1 mice with longer lifespans and decreasing size of tumors[15].

c) Antihelmintic activity

The stem extracts of Tinospora cordifolia stem were evaluated invitro against Eisenia foetida at concentrations of 10, 25, 50, and 100mg/ml to test their antihelmintic activity. The tme at which Worms death and paralyzed times were calculated. At 100 mg/ml, both the aqueous and ethanolic extracts outperformed the gold standard drug piperazine citrate (10 mg/ml) have better activity. The aqueous extract showed a longer time for death (15.83 0.60) but a shorter time for paralysis (9.16 0.30) compared to the ethanolic extract[16].

d) Anti-Anxiety activity

The anti-anxiety effects of a 100 mg/kg ethanolic extract of Tinospora cordifolia were demonstrated to be much larger than those of the standard dose of diazepam (2.5 mg/kg). Clinical studies have revealed that patients' IQs have risen. In Ayurvedic medicine, Tinospora cordifolia is widely used as a brain tonic, with the possibility that it may improve cognitive abilities such as memory and recall[17].

e) Antihyperlipidemic activity

The researchers investigated the hypolipidemic effect of an aqueous extract of the root on rats weighing 2.5 and 5.0 g/kg body weight on the sixth week,; this lead to lower tissue cholesterol, serum, phospholipids, and total fatty acid. The root extract produced a significant hypolipidemic effect when administered at a dose of 5.0 g/kg of body weight. The potential of T. cordifolia root extract to lower blood or tissue lipid levels in diabetic rats has not been examined previously[18].

f) Immunomodulatory activity

In a research studies, two isolated compounds from Tinospora cordifolia, syringin and cordiol, were found to suppress the in-vitro resistant hemolysis of sheep erythrocytes by serum of guinea pig. The C3-convertase's impairment in the standard complement pathway may be responsible for decreased immune system hemolysis. Tinospora cordifolia combinations lead to significant raises in guinea pig serum IgG antibodies. Cordiol, cordioside, and cordiofolioside-A prolonged the incubation time and induced macrophase. Various types of dynamic combinations and their immunomodulatory behaviour have been examined[19].

g) Anti-Osteoporotic activity

Tinospora cordifolia ethanol extract increases osteoblast development by promoting cell proliferation, differentiation into osteoblastic ancestry, and calcification of the bone-like trabecular matrix. Plant-derived ecdysteroids have been shown to possess anabolic and anti-osteoporotic actions in vertebrates. Animal studies have demonstrated that beta-ecdysone (Ecd) isolated from Tinospora cordifolia can remove osteoporosis and significantly increase joint ligament thickness. The isolated 20OH-Ecd from T. cordifolia has been associated with an anti-osteoporotic action, revealing that the plant may be effective in the prevention and treatment of osteoarthritis and osteoporosis[20].

h) Anti-inflammatory activity

Nonsteroidal anti-inflammatory drugs are commonly used to treat inflammation and fever. Herbal medications have been developed to fight the adverse effects of these man-made drugs. Tinospora cordifolia is widely used due to its numerous medicinal benefits. In addition to its analgesic and antipyretic properties, it may reduce inflammation and fever. Rat models of histamine- and carrageenan-induced paw edema were used to assess anti-inflammatory action, while the Brewer's yeast-induced pyrexia model was used to assess ante-pyretic activity. Tinospora cordifolia stem aqueous extract was administered to the animals at doses of 1.25, 2.5, and 5gm/kg. The aqueous extract of Tinospora cordifolia was discovered to exhibit potent anti-inflammatory and anti-pyretic properties comparable to those of the commonly used medications diclofenac and paracetamol[21].

i) Wound Healing

Studies found that dexamethasone decreased the alcoholic extract of Tinospora cordifolia's wound healing profile and its impact on wound healing. The Tinospora cordifolia extract's increased flexibility, which might be related to the collagen combination's maturation, enhanced the plant's ability to heal wounds. T. cordifolia extract did not reduce the adverse effects of dexamethasone on wound healing[22].

j) Anti-HIV activity

Tinospora cordifolia has been studied to determine its importance in treating HIV-positive patients by reducing the patient's resistance to retroviral therapy. Cordifolia's anti-HIV activity reveals its use in illness management by raising the number of CD4 T-cells and lowering the number of eosinophils, a kind of white blood cell, in HIV-positive individuals. The extract from Tinospora cordifolia exhibited noticeably higher intracellular bactericidal and

phagocytic activity. It also induced macrophages in the peritoneum. It also enhances the ability to destroy cells within cells and phagocytose. Macrophages, polymorph nuclear leucocytes, and lymphocytes are all markedly stimulated by Tinospora cordifolia[23].

Nutritional Value :

Tinospora cordifolia is herbal plant because of its significant amount of beneficial components. There are several micronutrients and macronutrients present. Gulvel contains a high fibre level (15.9%), sufficient amount of protein (4.5%-11.2%), enough carbohydrates (61.66%), and a low fat level (3.1%). It has 292.54 calories per 100 grams of nutritional value. It includes high levels of potassium (0.845%), chromium (0.006%), iron (0.28%), and calcium (0.131%), all of them are required for a range of physiological functions[24].

Traditional Uses :

- The locals of Jammu (J & K) and Bigwada (Rajasthan) administer an oral decoction of stem to treat fever.
- The locals of Bhuvneshwar (Orissa) administer an oral warm juice of the root to treat fever.
- The locals of Patiyala (Punjab) administer the juice or decoction of leaves orally with honey to treat fever.
- The locals of Dehrabara Kolaras, Sivpuri District in Madhya Pradesh administer a decoction of the stem orally in people with twak-roga (skin disease).
- The locals of Patiyala (Punjab) administer two drops of leaf juice of Guduchi (Tinospora sinensis) to treat Karna Shula (ear pain).
- The locals of Dhurala (Haryana) administer an mixture of Terminalia chebula (Haritaki), Tinospora cordifolia (Amrita), and Trachyspermum ammi (Ajwain) is taken orally once a day in the early morning with salt or decoction of this mixture in a dose of 50 ml for the treatment of Kasa (cough).
- Local women in Arjunpura (Rajasthan) administer a paste of Guduchi (Tinospora cordifolia) and 5 seeds of Krishna marich (Piper nigrum) orally once daily in the morning to treat rakta pradar (leucorrhoea).
- The tribes in Bombay and its surrounding areas, together with fishermen along the coast, use the herb Tinospora cordifolia to treat fever, jaundice, chronic diarrhea, and dysentery.
- The Gujjar and Backwal Muslim tribal people of Rajouri, Jammu (Tawi), utilized the herb to treat bone fractures.

In the case of Daha (burning sensation), the paste or juice of Amrita (Tinospora cordifolia) leaves with Sarsapa beeja churna (seed powder of Brassica campestris) is used locally[25].

Adverse Drug Reaction :

The adverse effects of Tinospora on humans are very less known. But large doses may result in adverse effects on the body. It may lower blood sugar levels; however, if you have diabetes, use it with caution. It may also rises autoimmune symptoms. It is also suggested to avoid taking Tinospora while pregnant and lactation[26].

Conclusion :

The present review mainly focuses on the pharmacognosy and pharmacological properties of the Tinospora Cordifolia. Alkaloids, steroids, glycosides, sesquiterpenoids, and other bioactive substances have been shown to have therapeutic potential in a variety of diseases. The whole plant, stem, powdered root and stem bark, aerial root and stem decoction, root juice, and leaf juice or paste have all been used traditionally to treat a variety of illnesses, including fever, jaundice, diarrhea, dysentery, and general debility. The different studies carried out on T. cordifolia have revealed that it is an extraordinary medicine and have little adverse effect on it. Overall, this present review shows anti-diabetic, anticancer, immunomodulatory, anti- HIV, anti-anti-inflammatory and wound Healing properties of Tinospora cordifolia, which have been used for future drug and further studies by research and development.

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