Tinospora cordifolia: A multipurpose plant

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Abstract: Plants have been an important source of medicine for humans since time immemorial. And today also we find there is increasing demand for medications, health products, food supplements, cosmetics, and many more obtained from natural sources as plants due to their fewer side effects compared to drugs. A review on the pharmacological activities of the plant named Tinospora cordifolia with its chemical constituents is given in the present review. Tinospora cordifolia, also known as "Amrita" (due to its detoxifying, rejuvenating, and immune-boosting properties) or "Guduchi," is the traditional and important Indian system of medicine, and its traces have been found in various classical texts. It has been widely investigated in treating metabolic and immune disorders, diabetes, heart disease, cancer, infectious disease, and many more. Till today, much research has been done on the activities of T. cordifolia, and some are still being carried out. It is effective in viral and other diseases due to immunomodulatory action. This paper presents a critical review of details about the plant constituents, its morphology, and its therapeutic effects, which can be used for further research.

Keywords: Tinospora cordifolia, Anti-diabetic, Immunomodulatory, Antineoplastic, Anti oxidant, Corona

INTRODUCTION

The importance of plants to human health began to arise in 1897, when Friedrich Bayer and Co. introduced aspirin to the world, and further digoxin, quinine, morphine, and other conventional drugs were discovered to be obtained from the plant. As per WHO, 70% of the world population relies on plant drugs other than synthetic drugs due to their less toxic effects.

Tinospora cordifolia (Guduchi) is also an important medical plant that is widely distributed in India, extending from the Himalayas down to the southern part of peninsular India.

It is a large, globrous, deciduous climbing shrub that belongs to the family of Menispermaceae. Different types of chemical constituents are reported to be found from these shrubs, which belong to different classes, such as alkaloids, diterpenoid lactones, glycosides, steroids, sequiterpenoids, phenolics, aliphatic compounds, and polysaccharides.

A total of 13 scientific plant species of the genus Tinospora were accepted as species names out of 34, and from that, three specific medicinal plant species of Tinospora (cordifolia, crispa, and sinesis) exist, especially in India. Out of the three, cordifolia has much more importance due to its medicinal properties.

GROWTH REQUIREMENT FOR THE PLANT

The plant is very rigid, and it can be grown in almost all climates but generally prefers a warm climate. Planting is usually done during the rainy season in the months of July to August. As it is a climber, it requires support for its growth. Fast-growing species such as Neem (Azadirachta indica), Jatropha (Jatropha curcas), and Moringa (Moringa oleifera) have been planted to provide support for their growth and development. Tinospora cordifolia growing with Neem (Azdirachta indica) is called NEEM GILOY. It has a chemical composition as similar as neem as well as giloy and shows better therapeutic properties than only giloy. It prefers medium black or red soil for its cultivation. It can be successfully grown in a large variety of soils, ranging from sandy to clay loam. However, the soil should be well drained with sufficient moisture and rich with organic matter for its growth and development.

MORPHOLOGICAL DESCRIPTION OF PLANT

It is perennial deciduous twine having succulent stems and papery bark which is widely found in India, Myanmar, Nepal and Sri Lanka.

Different parts of Tinospora cordifolia :-

A] Stem = It is succulent with fil form =, fleshy and climbing nature. The cork arises in sub-epidermal layers and give rise to 2 – 3 layers of the cork. Throughout the Parenchyma of the stem starch is present.

B]Root = It has arial roots, which are characterized by tetra- to penta-arch primary structure, and its cortex is divided into an outer, thick-walled and inner parenchymatous zone. Parenchyma of arial root contains starch grains, which are oval or elliptical in shape, mostly simple but sometimes as compounds containing 2 to 5 components.

C]Leaves = Leaves are simple, alternate, ex-stipulate, with a long petiole approximately 15 cm, round, pulvinate, heart-shaped, twisted partially, and half way around. Lamina is ovate, 10-20 cm long, 7 nerved and deeply cordate at base and membranous. Starch is present throughout the tissue.

D]Flowers = Flowers appear when a plant loses the leaf. They are unisexual, recemes, greenish yellow in color. Male flowers are clustered, and females are solitary inflorescences. Sepals are 6,3 each in 2 series. Inner ones are bigger than outer sepals. Petals are 6 as well smaller than sepals, obovate, free, and membranous.

E]Seed = Curved seeds are present.

F]Fruit = They are orange-red in colour, fleshy, aggregate of 1-3 and ovoid, smooth, druplets on thick stalk with sub terminal style scars. Fruit develops during winter.

THERAPEUTIC APPLICATIONS

Anti-diabetic

Tinospora cordifolia stems (TCS) are found to have potent antidiabetic activity, which reduces blood glucose levels. The extracts of TCS have some compounds that inhibit α-amylase and α-glucosidase enzymes and show anti-diabetic effects. A study was done on investigating the hypoglycemic effect of T. cordifolia (TCS) (methanol, hexane, and ethylacetate) on healthy and streptozotocin-induced diabetic rats for days to find its regenerative efficacy. And the result was the increased blood glucose in diabetic conditions is gradually reduced and almost nearer to normal after

90 days by the administration of TCS extracts, in which methanol extracts show better reduction. Tinospora cordifolia contains alkaloids; the isoquinoline alkaloid-rich factor from stem, including palmatine, iatrorrhizine, and magnoflorine, has been reported for insulin-mimicking and insulin-releasing effects both in vitro and in vivo. The root extract of this plant has also been reported to have anti-diabetic properties, which decrease the level of glycosylated hemoglobin, hydroperoxidase, and vitamin E. Oral administration of the leaf extracts of T. cordifolia has also found anti-diabetic potential when tested in a diabetic rat model (streptozotocin-induced diabetes) through different peripheral pathways such as glycogen storage and transportation of glucose to other mechanisms.

Immunomodulatory Activities

Various studies have proven T. cordifolia as an herb activating and modulating the immune system. TCS extracts contain compounds such as N-methyl1-2-pyrrolidine and 11-hydroxymustakone, Magnoflorine, and Tinocordiside that have immunomodulatory effects by enhancing reactive oxygen species (ROS) generation, which causes to augment the immune response. A novel (1,4)-α-D glucan from T.C. activities the immune system by alctivating macrophages via TLR6 signaling and NF-kB activation mechanisms, leading to cytokine and chemokine production. Immunoductatory protein obtained from the dry stem powder of T. c. is significant for augmenting the various immunological activities in the human body. In HIV-positive patients, T.C. extracts exhibit effects by increasing phagocytosis and intercellular killing capacity by increasing survival rate and polymorphonitear leucocyte function. According to some studies, the TCS methanolic extract administration increases the total WBC count in mice. It also increases bone marrow cellularity and α-esterase-positive cells in bone marrow, indicating increased maturation of stem cells. significantly increase in HIR as seen from the increase of plaque-forming cells in the spleen and enhance the macrophage activation.

Antineoplastic activity

Cancer is define as a group of diseases involving abnormal cell growth with the potential to invade or spread to other parts of the body. It is a leading cause of death worldwide with limited treatment options, often hampered by adverse effects and resistance to conventional therapies. Radiation, chemotherapy, and surgery are some of the current treatment modalities that have been linked to a high rate of morbidity. As a result, there is a lot of interest in the development of complementary therapies, such as medicinal plants. In the Tinospora genus, only Tinospora cordifolia has exhibited anti-carcinogenic properties and was therefore chosen as the topic of evaluation. The mechanism of action includes regulating cell proliferation, apoptosis, angiogenesis, and metastasis, as well as reducing oxidative stress. According to the research done on Tinospora cordifolia for oral cancer cells in a dose-dependent manner, TCE induced apoptosis in AW13316 cells in a concentration-dependent manner. Apoptosis was induced even at a low concentration of 5µg/ml. 24h treatment with Giloy induced a significant reduction in expression of EMT genes in a dose-dependent manner, although no effect was noted on metastatic genes respectively.

Antioxident Activity

In a living organism oxidation is natural process for the production of energy to fuel biological cycles, but in these process oxidative free radicals are formed which can cause damage to the body and contributes to oxidative stress. It can damage to DNA protein and lipids of the body, has major contribution to ageing and also to degenerative disease. To protect body and to eliminate and diminished the action of free radicals there is an antioxidant defense mechanism. T.c plant contains phenolic compounds, flavonoids which are secondary plant metabolites and are also the Natural Antioxidants, ehich can trap few radicals directly and scavenge them through a series of coupled reactions with them through a series of coupled reactions with antioxidant anzyme and also exhibit a wide range of biological effects, including antiaging, antimutagenicity and protective effects on stress oxidative. As per studies on T.C stem extracts it is found that ethanolic stem extract has better antioxidant activity then methanolic stem extract. T. cordifolia has significant and linear relationship between the antioxidant activity and phenolic content, which shows that it can also be used as source of antioxidant for pharmacological preparation.

Corona and Tinospora cordifolia

Corona virus (COVID-19) is an extremently contagious disease that transfers through inhaling droplets and by fomites due to personal contact. It is pneumonia characterized by fever, dry cough, and dyspnea, and its other symptoms include respiratory problems, neuralgia, headaches, skin rashes,

gastrointestinal troubles, and myculgia. Intially, there was no perfect medicine to treat Corona; treatment was done on the basis of symptoms. As there was no medicine available, people came with their traditional folk medicine, which involved several herbs and medications along with T. cordifolia (Wild), Mies ex Hook. F., and Thomas. It is an Ayurvedic immune-modulator medication with antioxidant, anti-inflammatory, immunomodulatory, anti-allergic, anti-cancer, and other effects. The Corona virus is responsible for damaging epithelial cells, induced oxidative stress, and damaged the tissue of the lungs, heart, and kidney, causing respiratory infection, ARDS, and thus death. But in contact with that, utilizing T. cordifolia enhances immunity and combines with the illness. It has high antioxidants, which help to neutralize free radicals and reduce inflammation. According to the studies, T. cordifolia cleanses the blood, eliminates toxins from the body, and successfully fights infection and virus. Major symptoms or health effect of COVID-19 is fever, which can be effectively reduced by drinking T. cordifolia juice. It gradually reduces many primary symptoms of COVID, such as breathing difficulties, coughs, and colds. The combination of berberine (a secondary metabolite of plants) and tinospone has reported activity to control viral replication and also work on the main protease of viruses.

REFERENCES

[1] Dr. Sumanlata, D. A. (n.d.). Evaluation of Anti-Inflammatory and Antipyretic Effect of Aqueous Extract of Tinospora Cordifolia in Rats. International Journal of Research and Review.

[2] Dsouza, M. (2016). Antioxidant and Anti-Inflammatory Activity of Tinospora cordifolia using In Vitro Model's . Journal of Chemical Biological and Physical Sources.

[3] Ganesh Chandra Jagetia, S. K. (2005). Evaluation of the Antineoplastic Activity of Guduchi (Tinospora cordifolia) in Enrich Carcinoma Bearing Mice. Biological and Pharmaceutical Bulletin-J- STAGE, 460-466.

[4] Geetanjali Upadhyay, L. M. (n.d.). Evaluation of Antioxidant Potential of stem and Leaf Extracts of Himalayan Tinospora cordifolia Hook.f and Thomson. the open Bioactive Compounds Journal.

[5] Jenny Jacob, P. K. (2013). Ayurvedic Herb, Tinospora cordifolia; Validation of Anti-Inflammatory and Immunomodulatory Activity by Effect on Inflammatory Mediators, TNS-alpha and Lipoxygenase isozymes. Journal Of Pharmcy Research.

[6] K.G.C Dissanyake, W. P. (2020). Immunomodulatory Efficiency Of Tinospora cordifolia Against Viral Infections. WOrld Journal OF Pharmaceutical And MEdicinal Research, 22-28.

[7] Kamble, L. H. (2015). Antidiabetic Potential and Idetification of Phytochemicals from Tinospora cordifolia. ResearchGate.

[8] M. Vijaya Kumnar, H. R. (2024). A Therapeutic Evaluation of Anticancer and Pharmacological Abilities on Tinospora codifolia; A Systemic Review. Uttar Pradesh Journal of Zoology, 1-8.

[9] Manisha Subedi, B. T. (2022). Tinospora Cordifolia(Gurjo) and its Potential Role to Combat with COVID-19 A Review. Janapriya Journal Of Interdisciplinary Studies.

[10] Manisha Subedi, B. T. (n.d.). Tinospora Cordifolia(Gurjo) and ITs Potential Roe to combact with COVID-19 A Review. Janapriya Journal OF Interdisc.

[11] Panja, A. K. (2021). Immunity - Building up Medical Capacity: An ayurvedic overview. International Journal of Ayurveda and Traditional Medicine, 1-4.

[12] Pitchai Daisy, D. P. (2009). Anti-diabetic properties of Tiniospora cordiflia stem extcts on streptozotocin-induced diabetic rats. African Journal of Pharmacy and Pharmacolgy.

[13] Prakash Kumar, J. J. (2011). Duakl Inhibition of Lipoxygenase by An Ayurvedic Herb, Tinospora cordifolia(WILD.): Possible Explanaion For Anti-Inflammatory Activity. Journal of Pharmacy Research.

[14] Ravindra B. malabadi, S. m. (n.d.). Tinospora cordifolia(Amruthballi):Medicinal plant with Aticancer activity. Magna Scientia Advanced Biology And Pharmacy .

[15] Ravindra Mishra, H. R. (2022). EVALUATION OF ANTI-INFLAMMATORY ACTIVITY OF H. ROSASINENSIS & T. CORDIFOLIA PLANTS. WORLD JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH, 239-246.

[16] Richa Singh, D. L. (2022). Potential role of tinospora cordifolia in management of COVID-19: A systematic review. International Journal of Health Sciences.

[17] Rohit Sharma, H. A. (2015). Antidiabetic claims of Tinospora cordiflia(Wild.)Miers;

Critical appraisal and role in therapy. Asain Pacific journal of Tropical Biomedicine .

[18] S. mathew, G. K. (1998). Immunomodulatory and antitumor activities of Tinospora cordifolia. ELSEVIER, 35-43.

[19] Sampark S. Thakkar, F. S. (2021). Magical bullets from anindigenous Indian medicinal plant Tinospora cordifolia; An in silico approach for the antidote of SARS-COV-2. Egyptian Journal of Petroleum.

[20] Shankargouda Patil, H. A. (2021). Tinospora cordifolia (Thunb.) Miers (Giloy) inhibits oral cancer cells in a dose-dependent manner by inducing apoptosis and attenuating epethelial-mesenchymal transition. Saudi Journal of Biological Sciences.

[21] Sharma, S. (2024, January). ResearchGate. Retrieved from ResearchGate: https://www.researchgate.net/publication/378699415

[22] Sheena Philip, G. T. (2018). Evaluation of the anti-inflammatory activity of Tinospora cordifolia (Willd.) Miers chloroform extract – a preclinical study . Journal of Pharmacy and Pharmacology .

[23] Showket Amhed Ganaie, R. K. (2013, January). ResearchGate. Retrieved from REsearchGate: https://www.researchgate.net/publication/265764596

[24] T. Naga Ravikiran, A. M. (2015). EXPLORATION OF ANTI-HYPERGLYCEMIC AND HYPOLIPIDEMIC ACTIVITIES OF ETHANOLIC EXTRACT OF TINOSPORA CARDIFOLIA (WILLD)HOOK WHOLE PLANT IN ALLOXAN INDUCED DIABETIC RATS. Journal of Drug Delivery and Therapeutics, 94-99.

[25] Upendra Sharma, M. B. (2012). Immunomodulatory active compounds from Tinospora cordifolia. Journal of Ethnopharmacolgy.

[26] Vidya H R, M. R. (2022). Immunomodulatory activity of TInospora cordifolia. Ip journal of Nutrition, Metabolism and Health Science.

[27] Vipul B. Chauhan, C. M. (2016). EVALUATION OF IN-VITRO ANTI-INFLAMMATORY ACTIVITY OF GLYCYRRHIZA GLABRA AND TINOSPORA CORDIFOLA. International Journal of Science, Environment And Technology, 4518-4521.