**Tinospora Cordifolia Linn: A brief information about the Tinospora cordifolia and its pharmacological action.**

 Siddharth Chandak, Sanket Sonawane, prathamesh Lonare, prof.Chinmay Kapile,Prof.Rahul Jagdale

Abstract:

 Many pharmacologically significant drugs are designed using bioactive chemicals of various kinds. A well-known medicinal plant in the Menispermaceae family, Tinospora cordifolia (Giloy) is a significant source of innovative medications and medical supplies. Giloy's importance as a great medicinal plant is demonstrated by its many therapeutic applications and medical qualities, as well as phytochemical study. It has been shown to have anti-inflammatory, anti-oxidant, anti-spasmodic, anti-allergic, anti-HIV, and anti-cancer effects. The plant's main stem promotes bile output, cures jaundice, is diuretic, bitter, and stomachic. This review paper emphasised T. cordifolia's pharmacological potential and the phytochemical that underlie its pharmacological actions

 INTRODUCTION:

 World Health Organization (WHO) estimate that 81% of people mainly depend on traditional remedies such as for curing Health or preventing ailments. According to Rana et al. (2012), Tinospora cordifolia is a big, deciduous shrub that climbs and is a member of the Menispermaceae family. Plants produce a wide variety of bioactive compounds, which makes them great sources of various kinds of medications.Common names for this plant include heart-leaved moonseed and giloy, and it is found in India, Burma, China, Myanmar, and Sri Lanka. Other synonymous and common names are Guduchi, Amrita, Guduchika, Chinnobhava, Vatsadani, Kundalini, Gulancha (Bengali), Gurcha (Hindi), Gala (Gujarat), Amrutavalli (Kannada), Gilo (Punjab), Seendal, Seendil Kodi (Tamil) and Amarlata (Assamese) (Narayana, 2008)Researchers worldwide have recently become very interested in Tinospora cordifolia due to its reported medicinal qualities, which include anti-inflammatory, anti-arthritic, anti-periodic, anti-oxidant, anti-allergic, hepatoprotective, immunomodulatory, and anti-neoplasticism activities (Soham and Shyamasree, 2012) [24]. Alkaloids, steroids, diterpenoid lactones, and glycosides are among the many active substances that have been identified from various plant components, including the stem, root, and entire plant (Upadhyay et al., 2010).Since the Covid-19 epidemic, tinospora has consistently attracted increased attention from researchers worldwide due to its use as a home cure for preventing a variety of illnesses and problems as well as a herbal medicine in primary healthcare. Applications for medicinal plants, like Tinospora, are numerous and include pharmacological, phytochemical, and clinical research. On the other hand, the reverse approach uses a contemporary research methodology called "reverse pharmacology" to validate scientific findings.Tinospora species offer a wide variety of phytochemicals and treatment methods for a number of illnesses. The presence of phytochemical elements such alkaloids, flavonoids, glycosides, aliphatic compounds, diterpenoid, vitamins, tannins, lactones, steroids, coumarins, lignans, triterpenes, and nucleosides is thought to be responsible for the Tinospora plant's therapeutic action.

**Morphology Of Tinospora cordifolia:**

 Tinospora cordifolia consist a many physical components such as stem,leaves,roots,flowers,fruits etc.

* **STEM:**

It can scale big trees and has a juicy,meaty stem.The stem diameter can vary from 0.6 to 5cm and the bark is creamy white to grey. Older stems feature warty protuberances and are light brown,whilst younger stem are smooth and green.

* **LEAVES:**

Tinospora cordifolia has simple,alternating,heart-shaped leaves with along petioles that can reach a length of 15 cm.

* **Shape:**

 The leaves of giloy is longer and partially twisted while the apex and base of the leaves are roundish.

* **Size:**

 The size of leaves of giloy is 10-20cm in diameter.

* **Texture:**

 When young he leaves are membrane like but as the age they turn leathery.

* **FLOWER:**

 Tinospora cordifolia flowers are small,yellow and unisexual

* Male flower:Grouped in axillary racemes
* Female flower:Solitary
* Flowering season:May-June

 Native to India’s tropical and subtropical climates,Tinospora cordifolia is a climbing shrub wih greenish yellow flowers.

* **FRUITS**:

A crimson,succulent,ovoid drupe around the size of a large pea fruit of Tinospora cordifolia. When mature,the fruit has a red colour. The fruit has a smooth,oval shape.

**SEEDS**

The seed of giloy are curved and pea sized.

* **ROOTS:**

The roots of giloy are thread-like and aerial it may touch ground sometimes.The aerial cortex is separated into an exterior thick-walled zone.Mucilage and tannin containing cells are seen in the inner zone.The dried aerial roots have a creamy white or light grey-brown colour.The dried aerial roots are odourless and have a little fracture.The taste of the dried aerial roots is mild bitter.

**Plan Descripion:**

 Up to 1.2 km above sea level, the huge deciduous, glabrous perennial plant Tinospora is widely distributed across India, particularly in the tropical regions. China, Sri Lanka, Bangladesh, Pakistan, and Burma are among the neighbouring Nations where it can be found. Warm climates are ideal for growing Tinospora plants. Red or medium-black soil is ideal for Tinospora cultivation. Additionally, it may be cultivated effectively in a wide range of soil types, including clay loam and sandy soils. But for it to flourish, the soil needs to be rich in organic matter, well-drained, and moist enough. Common names for T. cordifolia include heart-leaved moonseed, Guduchi, Giloy, and Amrita. It is believed to be a holy drink and a sweet drink of God Indra. Another species of Tinospora is T. crispa, a woody, tall, and completely hairless climber that grows as a tiny herb called locally as Faridbel. This herb grows widely throughout India's temperate and tropical regions. The third species—T. sinensis/malabarica, commonly referred to as the Malabar gulbel—has heterosexual blooms, long, oval-cordate leaves that are larger than those of T. cordifolia, a huge annual climber, and aerial roots from branches.

**Pharmacological Ethnology:**

 Traditional medicinal systems, especially those in the South Asian region, have long valued T.cordifolia ethnopharmacologically. Stem of T.cordifolia is primarily utilised as a diuretic, thermogenic, astringent, bitter, stomachic, and allaying of thirst, vomiting, and burning sensations. It also nourishes the blood, stimulates bile production, avoids constipation and jaundice, and more. Additionally, its stem has been regarded as an indigenous source of medications with antipyretic, anti-diabetic, immunomodulatory, and anti-hepatotoxic properties. Skin conditions may be effectively treated using T.cordifolia stem extract. The plant's root, another crucial component, has anti-ulcer and anti-stress properties. The stem and root of T.cordifolia are used as an antidote for snakebite as well as scorpion sting, together with other medications. T.cordifolia's dry bark contains anti-inflammatory, anti-allergic, anti-pyretic, and anti-spasmodic properties. On the basis of a number of published research, T. cordifolia has a wide range of applications in Ayurvedic medicine. T.cordifolia is well known for its ability to modulate the immune system. It is utilised to strengthen the body's defences naturally and is frequently advised to strengthen the immune system. It has long been used to treat bacterial and viral infections as well as other forms of fever.It is thought to strengthen the body's defences against infections and lessen the symptoms of fever. The plant's antioxidant and anti-inflammatory qualities are well-known. It is used to combat oxidative stress in the body and to relieve inflammation-related ailments including arthritis. T.cordifolia is used to increase overall digestive wellbeing, decrease acidity, and enhance digestion. Additionally, it promotes liver health.

Phytoconstituents of Tinospora cordifolia:

 A variety crucial chemical components, such as alkaloids, glycosides, steroids, flavonoids, phenols, tannins, terpenoids, polysaccharides, essential oils, and a mix of fatty acids, have been identified in T. cordifolia and isolated during initial screening. Active phytochemical elements such b-sitosterol, clerodane furano diterpene, columbin, tinosporine, tinosporide, tinosporaside, cordifolide, cordifol, heptacosanol, and furano diterpene are derived from these essential fundamental phytoconstituents of T. cordifolia .A few key chemical components are listed in Table A, even though the structures of the main active phytochemical compounds are shown in a number of articles. Each of these phytoconstituents has been linked to various illness disorders and has unique biological activities and significance. The plant material of T.cordifolia is throughly removed in a variety of ways such as hydro-alcoholic, n-hexane, ethanol, methanol, aqueous, chloroform, and ethyl acetate. To discover the key phytoconstituents present in the sample, a number of analytical methods are applied to various T. cordifolia plant extracts.

**Pharmacological Action Of Tinospora cordifolia:**

 T.cordifolia has been the emphasis of in-depth scientific research with pharmaceutical significance worldwide throughout the past 20 years. Numerous studies have documented the anti-diabetic, anti-inflammatory, antioxidant, immunomodulatory, anticancer, antimicrobial, anti-allergic, and many other properties of the Tinospora plant. The pharmacological effects of T. cordifolia plants may target several ailments because of the phytochemical chemicals they contain, including alkaloids, phenolics, diterpenoid, glycosides, aliphatic compounds, and steroids. The majority of research in pharmacology relies on physiologically active chemicals and crude extracts from plants. We have highlighted T. cordifolia's diverse pharmacological effects in this article.

**Anti-Diabetic:**

 In traditional Indian folk medicine, stems of Tinospora cordifolia are frequently utilised to cure diabetes by regulating blood glucose levels. According to certain hypotheses, it has anti-diabetic effects via lowering oxidative stress (OS), raising insulin secretion, and lowering glycogenolysis and gluconeogenesis, all of which support in controlling blood sugar levels. It has been proven that the main phytoconstituents of Tinospora cordifolia, such as alkaloids, tannins, cardiac glycosides, flavonoids, saponins, and steroids, have anti-diabetic effects. The isoquinoline alkaloid-rich fraction from the stem, which includes palmatine, jatrorrhizine, and magnoflorine, has been demonstrated to have insulin-mimicking and insulin-releasing properties both in vitro and in vivo. When taken orally, root extracts have been demonstrated to inhibit OS markers, raise insulin production, and decrease blood glucose levels. Studies conducted in vitro have demonstrated the initiation and restoration of cellular defence antioxidant markers, including glutathione peroxidase (GPx), glutathione (GSH), and superoxide dismutase (SOD), as well as the inhibition of fructose 1, 6-diphosphatase and glucose 6-phosphatase and the restoration of the liver's glycogen content. The root extract was shown to lower levels of ceruloplasmin, hydroperoxides, vitamin E, plasma thiobarbituric acid reactive chemicals, and glycosylated haemoglobin in diabetic rats.

**Immunomodulatory:**

 Magnoflorine, tinocordioside, 11-hydroxymuskatone, cordifolioside A, N-methyl-2-pyrrolidone, and N-formylannonain are among the phytoconstituents that were isolated from T. cordifolia and demonstrated cytotoxic and immunomodulatory properties . The phagocytic function of macrophages was improved by isolated phytoconstituents, which also improved the production of nitric oxide (NO) by stimulating splenocytes and the capacity of neutrophil immune cells to produce reactive oxygen species (ROS).According to Ayurveda, Tinospora cordifolia possesses the following qualities: vrishya (aphrodisiac), vayah-sthapana (anti-aging), rasayana (rejuvenating), balsa (tonic), aayushyaprada (extension of life), and chakshusya (useful in eye disorders). The immunomodulatory properties of T. cordifolia's alcoholic and aqueous extracts have been thoroughly studied, and positive effects on the immune system have been documented. As determined by sodium dodecyl sulfate-polyacrylamide gel electrophoresis, concurrent administration of G1-4A/PPI (partially purified immunomodulator) from T. cordifolia significantly decreased protein breakdown during photosensitisation.

 **Ani-Cancer Activiy:**

 Cancer is the second most common cause of mortality worldwide. There have been evidence of T. cordifolia's anticancer efficacy against a variety of malignancies and tumours. According to previous studies, T. cordifolia extract inhibits the expression of the anti-apoptotic B-cell lymphoma-extra-large protein (Bcl-xL) and the G1/S phase-specific protein cyclin D1, which stops cells in the G0/G1 and G2/M phases. This supports the extract's anti-proliferative and apoptosis-inducing properties.Male Swiss albino mice were also shown to have a radioprotective function. Male mice's testes are protected from the damaging effects of sub-lethal gamma radiation by T. cordifolia extract. In rats with diethylnitrosamine (DEN)-induced hepatocellular carcinoma (HCC), a T. cordifolia isolate called a diterpenoid has been shown to have chemopreventive potential by reducing antioxidant activities through sodium dismutase (SOD), catalase (CAT), and detoxification enzymes like GSH and GPx. This, in turn, increases the activities of hepatic markers like serum glutamic oxaloacetic transaminase (SGOT), serum glutamic pyruvate transaminase (SGPT), and LDH, while lowering serum transaminase levels, confirming its anti-tumor effect.Vinblastine, vincristine, vindesine, etoposide, teniposide, paclitaxel, docetaxel, camptotecin, and irinotecan are among the many treatments that use plant-derived compounds [88]. It has been reported that the terpenoids and alkaloids (Magnoflorine, Palmatine, Tinocordiside, and Cordifolioside A) that were separated from T. cordifolia have anticancer properties. T. cordifolia has been the subject of numerous further in-vitro and in-vivo anti-cancer investigations.

 **Anti-Allergic:**

 Asthma has long been treated using T. cordifolia, and the juice is also used to cure continuous coughs. Through its anti-histaminic properties, T. cordifolia aqueous extract lowers mast-mediated allergic responses in rats. Additionally, there have been reports of a reduction in allergic rhinitis symptoms such as sneezing, nasal discharge, nasal obstruction, and nasal pruritus. In vitro and in vivo allergic reactions were mediated by the aqueous extract of T. cordifolia stem on mast cells. In a rat model, T. cordifolia dramatically reduced the cutaneous anaphylactic reaction triggered by histamine as well as the contraction of the guinea-pig ileum caused by histamine. It dramatically reduced the intracellular calcium levels of activated mast cells and prevented the release of TNF-α in rat peritoneal mast cells triggered by antidinitrophenyl (DNP) IgE. T. cordifolia may be helpful in treating both acute and chronic allergy diseases, according to all of these results. According to the current review, as compared to commercially available anti-allergenics, T.cordifolia extract offers a unique chance to cure allergic illnesses with negligible or no adverse effects.

**Anti-Oxidant Activity**:

 Since they prevent ROS from damaging cells and lessen their negative effects, antioxidants are essential for regular physiological processes. Using 1-diphenyl-2-picrylhydrazyl (DPPH), total flavonol and phenolic phytocompounds extracted from the T. cordifolia plant formulation demonstrated strong antioxidant activity [111]. Gamma-glutamylcysteine ligase gene expression and GSH levels have been shown to rise in response to T. cordifolia. Additionally, it demonstrated potent free radical scavenging capabilities.

 **Anti-Microbial Activity:**

 Methanol extracts from Tinospora cordifolia are useful in the battle against microbial diseases. Extracts from Tinospora cordifolia were tested for their antibacterial properties against Gram-positive bacteria, including Salmonella typhi, Shigella flexneri, Salmonella paratyphi, Salmonella typhimurium, Pseudomonas aeruginosa, Enterobacter aerogene, Escherichia coli, Staphylococcus aureus, Klebsiella pneumonia, Proteus vulgaris, and Serratia marcescens.In mouse models, TCE has been demonstrated to increase neutrophil phagocytic and intracellular bactericidal capabilities as well as facilitate bacterial clearance. TCE has been demonstrated to have immunostimulant effects on macrophages. Intra-mammary infusion of hydro-methanolic extracts of Tinospora cordifolia treatment boosted polymorphonuclear cell phagocytic activity in preclinical mastitis in cows.

**Anti-HIV Agent**:

 TCE has been shown to increase the effectiveness of treatment by lowering the recurrent resistance of HIV. TCE has a promising role in managing HIV, as evidenced by its anti-HIV effects, which included a drop in the eosinophil count, activation of B lymphocytes, macrophages, and polymorphonuclear leucocytes, and a decrease in the haemoglobin percentage.

**Anti-Arthritic Activity:**

 Chronic inflammation in the synovial membrane of afflicted joints is a hallmark of arthritis, which ultimately results in a loss of everyday function because of persistent pain and exhaustion. Rheumatic arthritis (RA), which affects about 1% of the population, is more common in women than in men. Tinospora cordifolia and Zingiber officinale have been used in traditional medicine to treat rheumatoid arthritis in either single or combined formulations. Tinospora cordifolia may be utilised as an anti-osteoporotic agent because it has been demonstrated to prevent bone-like matrix from proliferating, differentiating, and mineralising in osteoblast model systems in vitro. It has been shown that alcoholic extract from Tinospora cordifolia promotes osteoblast proliferation, cell differentiation into the osteoblastic lineage, and the mineralisation of bone-like matrix.

**Anti-Pyretic Activity**:

 T. cordifolia's jwarahara action, or antipyretic function, has long been acknowledged. A 95% ethanolic extract of T. cordifolia was discovered to have antipyretic properties in its water-soluble fraction. In another experiment, it was discovered that the stems of T. cordifolia exhibited antipyretic qualities after being dissolved in hexane and chloroform. According to multiple studies, T. cordifolia has anti-infective and antipyretic properties. Rats exposed to T. cordifolia prior to coecal ligation were protected against intra-abdominal sepsis-induced mortality, and mice treated with E. coli-induced peritonitis saw significantly lower mortality rates.

 **Anti-Osteoporotic Activity**:

 Osteoporotic is a condition in which the thickness of one tissue is decrease which results in the easily breakdown of bones. A 25 μg/ml dose of T. cordifolia promoted osteoblast development, enhanced cell differentiation into osteoblastic lineage, and boosted the mineralisation of bone-like matrix in both osteoblast model systems. Research on cell morphology made it abundantly evident that following treatment with the extract, there was a rise in the number of cells and no negative change in their morphology.

 **Anti-Stress Activity:**

 A variety of mood disorders, including anxiety, cognitive dysfunction, and motor coordination impairments, are brought on by sleep deprivation (SD).examined the impact on lacking in sleep mice of a 50% ethanolic stem extract of T. cordifolia [139]. When tested for anxiety and cognitive functioning using elevated plus maze (EPM) and novel object recognition (NOR), mice treated with T. cordifolia extract exhibited better behavioural responses than those who were sleep deprived.

 **Other Medical Utilization Of Tinospora cordifolia:**

 Studies on T. cordifolia have shown positive effects on conditions like leprosy, ulcers, depression, diarrhoea, asthma, and infertility in addition to these pharmacological actions. In rats, the methanolic extracts from T. cordifolia leaves prevented thrombin-induced platelet activation.

 In the clinical trial stage, T. cordifolia, an incredible herb, targets the coronavirus target site when combined with other medical herbs. The therapeutic potential of medicinal herbs, such as T. cordifolia, W. sominfera (ashwagandha), and O. sanctum (tulsi), among others, in preventing coronavirus disease has been demonstrated in a number of studies. Recent research on W. sominifera and T. cordifolia revealed immunomodulatory activity against COVID-19 in vivo. T. cordifolia plant aqueous extracts have an impact on effector strengthen the body's defences against the fatal illness, a person experiencing coronavirus symptoms takes "kadha," or a decoction, of T. cordifolia and O. sanctum along with Piper nigrum (black pepper), Curcuma longa (turmeric), and Zingiber officinale (ginger).

**Conclusion:**

 From the above information Tinospora cordifolia has a beneficial role in the ayurveda as well as in the allopathic medicinal science and pharmacotherapeuics.Due to increase in the disease ayurvedic and natural remedies plays crucial role in ensuring the healthy lives of humans. The miraculous truth is that herbal medicine has less side effects than other standard treatment techniques and exhibits effective treatment in terms of either short-term or long-term medication. Herbal medication is helpful and protective against a number of illnesses. This appropriate method of using herbal medication helps to improve compatibility with the human body and strengthen the immune system in addition to treating the illness site. The miraculous truth is that herbal medicine has less side effects than other standard treatment techniques and exhibits effective treatment in terms of either short-term or long-term medication. Herbal medication is helpful and protective against a number of illnesses. This appropriate method of using herbal medication helps to improve compatibility with the human body and strengthen the immune system in addition to treating the illness site. . The miraculous truth is that herbal medicine has less side effects than other standard treatment techniques and exhibits effective treatment in terms of either short-term or long-term medication. Herbal medication is helpful and protective against a number of illnesses. The T. cordifolia plant may be a "leader in the traditional system of medicine" for the creation of new disease-fighting drugs in the years to come, according to the existence of chemical ingredients.

**References:**

1) S. Kirti, N.P. Mishra, J. Singh, S.P.S. Khanuja, Tinospora cordifolia (Guduchi), a reservoir plant for therapeutic applications: a review, Ind J Traditional Knowledge 3 (2004) 257–270.

2) W. Ahmad, I. Jantan, S.N.A. Bukhari, Tinospora crispa (L.) Hook. f. & Thomson: a review of its ethnobotanical, phytochemical, and pharmacological aspects, Front. Pharmacol.

3) P.K. Gupta, P. Chakraborty, S. Kumar, P.K. Singh, M.G. Rajan, K.B. Sainis, S. Kulkarni, G1-4A, a polysaccharide from Tinospora cordifolia inhibits the survival of

Mycobacterium tuberculosis by modulating host immune responses in TLR4 dependent manner, PLoS One 11 (2016) e0154725, https://doi.org/10.1371/

journal.pone.0154725.eCollection.2016.

4) A. Palmieri, L. Scapoli, A. Iapichino, L. Mercolini, M. Mandrone, F. Poli, A.B. Giann, C. Baserga, M. Martinelli, Berberine and Tinospora cordifolia exert a

potential anticancer effect on colon cancer cells by acting on specific pathways, Int. J. Immunopathol. Pharmacol. 33 (2019), https://doi.org/10.1177/

5) L. Pan, C. Terrazas, C.M. Lezama-Davila, N. Rege, J.C. Gallucci, A.R. Satoskar, A.D. Kinghorn, A. Cordifolide, A sulfur-containing clerodane diterpene glycoside

from Tinospora cordifolia, Org. Lett. 14 (8) (2012) 2118–2121,

6) R. Raghu, D. Sharma, R. Ramakrishnan, S. Khanam, G.J. Chintalwar, K.B. Sainis, Molecular events in the activation of B cells and macrophages by a non-

microbial TLR4 agonist, G1-4A from Tinospora cordifolia, Immunol. Lett. 123 (2009) 60–71.

7) A.K. Sharma, S. Kumar, A.K. Pandey, Free reducing, antiradical and cytotoxic activities of Tinospora cordifolia stem extracts, Biochem. Anal. Biochem. 3 (2014)

8) A. Chopra, M. Saluja, G. Tillu, S. Sarmukkaddam, A. Venugopalan, G. Narsimulu, R. Handa, V. Sumantran, A. Raut, L. Bichile, K. Joshi, B. Patwardhan, Ayurvedic medicine offers a good alternative to glucosamine and celecoxib in the treatment of symptomatic knee osteoarthritis: a randomized, double-blind, controlled equivalence drug trial, Rheumatology 52 (2013) 1408–1417, https://doi.org/10.1093/rheumatology/kes414. Epub 2013 Jan 30.

9) E-paper, What Ayurveda Has to Offer in Fight against Coronavirus, IANS News, 2020,

10) S. Akhtar, Use of Tinospora cordifolia in HIV infection, Indian J. Pharmacol. 42 (2010) 57–63.

11) hratoxin A treated mice, J. Ethnopharmacol. 58 (1997) 15–20.P.V. Leyon, G. Kuttan, Inhibitory effect of a polysaccharide from Tinospora cordifolia on experimental metastasis, J. Ethnopharmacol. 90 (2004) 233–237,