IJPPR
INTERNATIONAL JOURNAL OF PHARMACY & PHARMACEUTICAL RESEARCH
An official Publication of Human Journals
ISSN 2349-7203
HUMAN

TINOSPORA CORDIFOLIA

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ABSTRACT

Tinospora cordifolia is a popular plant that has number of beneficial effects mentioned in Ayurvedic system and used traditionally with combination with other drugs or sometimes used alone to get desired effect. Tinospora cordifolia in Ayurvedic medicines is quoted to treat fever, skin problems, immunomodulatory, anti-stress, treatment of jaundice, in diabetes as anti-diabetic agent, hepatoprotective, anti-oxidant, anti-arthritis, anti-periodic and anti-neoplastic agents. Our current study in this review encompasses active component in plant Usage of these active compound in the treatment on various medical conditions. The future scope of review remains in exploiting biochemical and signalling pathway affected by isolating the compound from Tinospora cordifolia so as to enable more research as well as effective formulation in disease eradication.

Keywords*:* - Ayurvedic, Tinospora cordifolia, Herbal, Plant, Herbs, Research, medicinal use.

INTRODUCTION

Number of herbal products has given crucial, life-saving medicinal compound used in armamentarium of modern medicines. Herbal product system is also known as botanical medicine or phytomedicine. In early twentieth century, herbal medicinal system was only medication system. The demand of allopathic drugs increased due to its fast therapeutic actions which lead to little decrease in use of herbal medicines. Despite of it, use of herbal products continues to spread all over the world by the people and achieved success to mitigate many healthrelated problem. It has known to be a system with less side effects and better compatibility with human body. It is estimated that up to eighty percent of world population that is, four billion people living in developed as well as developing country rely on herbal drug as a primary source of healthcare and it is known to be integral part ofculture communities and medicinal system.

The plant Tinospora cordifolia belongs to the family of Menispermaceae which is genetically enormous shrub. The flowers of shrub are greenish yellow in colour. The colour of stem is gray, creamy white; the cleft is spiral and longitudinal in nature. The space is spotted between large rosette like lenticels, leaves are simple, alternate, exstipulate, long petiolate, chordate in shape which shows multi-coat reticulate ventilation. Flowers of Tinospora cordifolia are small in size and unisexual. Male flower are in cluster and female flower are solitary. Fruits are aggregated and red in colour, fleshy with many drupelets on thick stalk which style scars, scarlet in colour sub terminally. Tinospora cordifolia is commonly found in higher altitudes of 300m in regions like Indian subcontinents, Myanmar, Sri Lanka, Bangladesh and China. Tinospora cordifolia includes different names they are: Gulvel, Giloe (English); Foon kan thang (Malaya); Makabuhay (Philippines); Brotowali, Andawali, Putrawali, Daun gade (Indonesia); and Boraphet, Wan kab hoi yai (Thailand). Some names of Tinospra cordifolia in Indian lingual are : Amrita, Amritavalli, Madhuparni, Giloe, Guduchi, Kundalini(Sanskrit); Giloya, guduchi (Hindi); Ambarvel, Gharol, Gulvel (Marathi); Nimgilo, Gulancha, Palo (Bengali); Jivantik, Tippaatig (Telugu); Shindilakodi (Tamil); Ambrithu, Chittamrutu (Malayalam); Gilo, Batindu, Garham,Ga (Punjabi); Galo, Galonovelo (Gujarati); Ambritaballi, Uganiballi (Kannada); Amarlata, Siddhilata (Assamese); Amrita, Gilo (Kashmiri); Gulancha, Gurcha (Kumaon); Harajora, Harajuri, Harjora (Mundari);Guluchi, Gulochi (Oriya) . In various Ayurvedic text Tinospora cordifolia is mentioned to treat Vatarakta (gouty arthritis), Daha (burning sensation), rheumatoid arthritis, gout and many

more. This article intends to provide overview on the compounds of Tinospora cordifolia which shows number of medicinal properties.

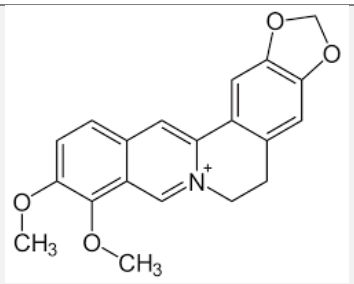
Fig : *Tinospora Cardifolia*

Phytochemistry of Tinospora cordifolia:

The numbers of chemical constituents are obtained from Tinospora cordifolia. The leaves of this plant are rich in phosphorous, protein (11.2%) and calcium. Each chemical constituent are roughly classified into alkaloids (Berberine, Tinosporin); glycoside (cordifolioside A, palmatosides C), diterpenoid (octucosanol), steroid (makisterone A, giloinsteron) .

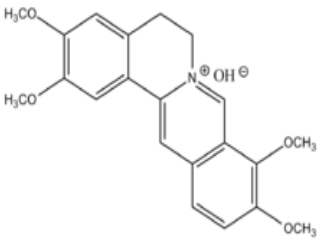
In the stem of Tinospora cordifolia chemical constituent like choline, magniflorine, tembertarine and palmatine are obtained. The major phytoconstituent includes Tinosporaside, cordifolide, cordifol, heptacosanol, clerodane furano diterpenoid and b-sitosterol.

The aqueous fraction of Tinospora cordifolia is a rearranged cadinane sesquiterpene named

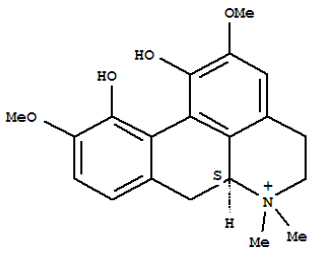
PHYTOCHEMICALS	**STRUCTURE**
BERBERINA	

tinocordiside which consist of tricyclic skeleton with a cyclobutane ring.

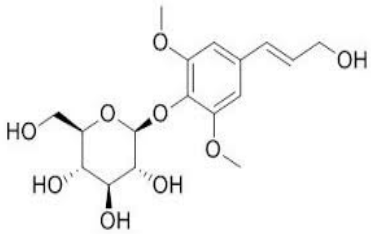
PALMATINA



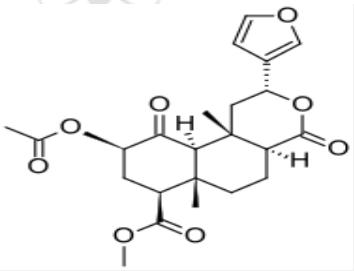
MAGNOFLORINE



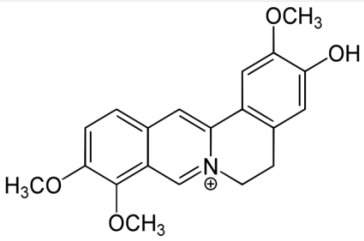
SYRINGIN



FURANOLACTONE



JATRORRHIZINE



The new chemical compound clerodane furano diterpene with the molecular formula C20H20O8, has been isolated from the stem of the Tinospora cordifolia.

Another new daucane type of sesquiterpene, tinocordifolin, has been extracted from the stem of the plant. Tinocordifolin is new sesquiterpene together with tinocordifolioside, N-trans-feruloyl tyramine.

Compounds and its nutrimental value

The crucial components of Gulvel are Tinosporine, tinosporaside, cordifolide, cordifol and hepatacosanol . In stem alkaloid major content are Barberine and palmatine. The different type of glucoside which are present in Tinospora cordifolia are 18-norclerodane glucoside, sesquiterpenes like tinocordioside, tinocordifolioside, tinocordifolin,tinosponone, cordioside, cordifolisides and syringene are also present. Immunologically active compounds like arabinogalactan and (1,4)-alpha-D-glucan.

The crude values for food constituent in Tinospora cordifolia includes high fibre that is 15.9%, sufficient amount of protein (4.5% to 11.2%) , good amount of carbohydrate (61.66%) and low portion of fat (3.1%). Dietary value of the plant is 292.54 calories per 100 gram. Tinospora cordifolia is rich in the ingredient of potassium that is 0.845% (Regulatory function of nerve impulse), high chromium value (0.006%) (Regulatory of carbohydrate utilization and pathophysiological reduction in Diabetes mellitus), sufficient amount of iron that is 0.28% (Hematopoietic functions), and good content of calcium (0.131%) (Regulatory function of blood coagulation, nervous, cardiovascular and the musculoskeletal systems.

Traditional uses or claimed

In Vedic and ayurvedic scriptures Tinospora cordifolia is described comprehensively regarding its utilization. The plant is referred as Guduchi or Amrita in Sanskrit text which means use of this medicinal shrub in the rejuvenating and retainment of youth and life expectancy of the patient. The most claimed and common uses include deility, fatigue, old age, hematinic, adaptogen, rejuvenator and tonic bleeding piles.

Immunomodulation related claims include increase in phagocytosis, neutralizing toxins, stimulating growth of epithelial cells which is supposed to give beneficial effect in recurrect infections, chronic fever, malaria, diabetes, chronic ear-throat-nose infection with combination of drugs with include anti-microbial, non-steroidal anti-inflammatory and to relieve from iching. It also helps to reduce inflammation, pain and fever related claims include rheumatoid arthritis and gout which include the symptom of pain and fever.

It also shows the anti-oxidant property which helps in alleviating degenerative process in case of diabetes. Tinospora cordifolia also claims to be useful as medium of “shodhan- vidhi” that is to increase the effect of other substances like Guggul.

Medicinal and therapeutic properties

Tinospora cordifolia is known to have many medicinal properties which are used traditionally against various diseases. The plant is titled for its potent aphrodisiac nature and its nature of rejuvenating.

1. **Immune-modulation**:

The Gulvel chemical constituent syringin and cordial are isolated as it shows the inhibition of C3-convertase in complement pathway, increase in humoral and cell-mediated immunity, growth in IgG antibodies, and expansion of colony forming units that is granulocyte-macrophages. Leukocytosis and enhanced neutrophil function is caused by macrophage by cordioside, cordiofolioside and cordiol isolated from Gulvel. It shows protective effect against Escherichia coli induced peritonitis in mice which reflected neutrophils improved phagocytic capacities. Gulvel shows significant immunosuppressant of cholestasis in rats, suggesting its role in obstructive jaundice as in role of immune-modulator. Arabinogalactan 25 and the novel (1, 4)-alpha-D-glucan which are immunological active constituents derived from the plant Gulvel was responsible for activation of immune system through macrophage activation through the (TLR6) tall like receptor-6, cytokine production and translocation of nuclear factor kappa B (NF-kappa-B). Elevation of interleukin-2 (IL-2) shows the property of antiangiogenic activity and tissue inhibitor of metalloprotease-1 (TIMP-1).

Liver damage can be caused by immuno-modulatory effect due to tuberculosis and its related anti-tuberculosis drugs, likewise, in case of cancer anti-cancer drugs and in malaria too. Immune-modulation property is claimed as it is used for bone marrow stimulant, haematinic, tonic or rejuvenator and shows long term effect in general debility and old age due to additional effect that is anti-oxidant property. It is used to prevent and treat recurrent infection of ear-nose-throat and in treatment of symptomatic pruritus which is related to immune-modulation property.

2. **Osteoprotection**:

In case of tibia it slows the process of bone loss when treated with Gulvel , showing good osteoprotective activity when demonstrated on rat. The two significant levels of serum osteocalcin and cross-laps were reduced. The Tinospora cordifolia extract ecdysteroids have been reported to have protein anabolic and anti-osteoporotic effect in mammals. It is also reported to have significant increase in thickness of joint cartilage which leads to oestrogenic in mesenchymal stem cells. It also gives relief from osteoporosis in animal model. From

Tinospora cordifolia 20-OH-β-Ecd is been isolated for its osteoporotic effects. Thus, it is suggested to be used as an anti- osteoporotic agent.

3. **Seizures and convulsion**:

In rats, when compared with phenytoin, ethanolic extract from the Gulvel represented more inhibition of electroshock seizures with percentage of 61.1% 47. When tested on mice it also showed another report which lack of anti-convulsing effect.

4. **Parkinson`s disease**:

According to Birla et al. report Tinospora cordifolia shows great effect against Parkinson disease. The aqueous extract of 1-methyl-4-phenyl-1, 2, 3, 6-tetra hydropyridine (MPTP) shows anti-inflammatory activity which is intoxicated in Parkinsonian mouse model. The extract of Tinospora cordifolia target MPTP-intoxicate mice and also protect dopaminergic neurons by suppressing neuroinflammation in MPTP-induced in Parkinsonian mouse model.

5. **Anti-cancer activity**:

The plant Gulvel shows anti-cancer property especially on animal model. In mice model, the extracted compound of Tinospora cordifolia that is palmatine classified in group of alkaloid, when observed using response surface methodology (RSM) it clearly indicated that 7, 12-dimethylbenz(a)anthracene DMBA has anti-cancer property. In bone marrow of mice, prevention of micronucleus formation was observed when a single application of Tinospora cordifolia extracted dose was given in 200, 400 and 600 mg/kg dry weight, 24 hours prior the i.p. administration of cyclophosphamide (at the 50 mg/kg), in a dose dependent manner. The methanolic extract of Tinospora cordifolia when received 50% that is 750 mg/kg body weight for 30 days it delineated increase in life span and tumour size was significantly reduced as compared to the control in C57 B1 mice. The anti-brain cancer potential at 50% of Tinospora cordifolia extract ethanol using C6 glioma cells was investigated in Mishra R et study. Tinospora cordifolia is known to show significant effect to decrease cell proliferation in dose dependent manner and differentiation was induced in C6 glioma cells. Eight secondary metabolites from Tinospora cordifolia was evaluted against four different human cancer cell lines, against KB (human oral squamous carcinoma), CHOK-1 (hamster ovary), HT-29 (human colon cancer) and murine primary cells were evaluated in Manju Bala et study respectively. The KB and CHOK-1 cells was found to active against all extract and fraction whereas, pure form of palmatine among all pure molecules was found to be active against KB and HT-29; yangambin against KB cells and tinocordiside against KB. In MCF-7 cells, two molecules from hexane and methanol fraction (T1 and T2) from the plant Tinospora

cordifolia, as compared to T2, T1 was used in the treatment to suppress proliferation, migration and invasion of MCF-7 cells. T1 down regulated the epithelial-mesenchymal transition related genes, Twist and Snail, with increased in transcription of E-cadherin.

6. **Snake bite and scorpion bite**:

The use against snake bite and scorpion bite is mentioned in text due to its ability to remove endogenous and exogenous toxin. The mechanisms are more similar to the action of immune-modulation and anti-oxidant activity.

7. **Bronchial asthma**:

The stem of tinospora cordifolia in aqueous extract was benefial in guinea pigs, to decrease bronchospasm in case of mice to decrease capillary permeability and reduced the number of disrupted mast cell in rats. Mechanism in case of allergies and bronchial asthma is similar to the response of immune-modulator.

8. **Wound healing**:

Shanbhag T et al., the present study was based on two significant part that was evolution of Tinospora cordifolia extract alcohol on wound healing profile and its result on the dexamethasone suppressed healing. Different wound models like incision, excision and dead space were used to investigate property of wound healing , potentially the plant Gulvel was successful to increase the tensile strength may be imputed to increase of collagen synthesis. The chemical constituent of Tinospora cordifolia is unable to reverse dexamethasome suppressed wound healing.

9. **Inflammation, pain and fever**:

The aqueous and alcoholic extracted of Tinospora cordifolia studies animal extensively in acute and subacute inflammation which uses model of carrageenin-induced hind paw edema, induced edema, arthritis, adjuvant induced arthritis , cotton pellet granuloma, formalin-induced arthritis and in rheumatoid arthritis clinical trial it showed anti-inflammatory effect. Effect of indomethacin and mechanism of action of non-steroidal anti-inflammatory drug show similar property to chemical constituent of Tinospora cordifolia was suggested.

Randall-Semite assay in rats and acetic acid induced writing test on mice which showed fundamental peripheral analgesic activity of chemical constituent which was extracted from Tinospora cordifolia. Analgesic effect of morphine was demostrated but central analgesic effect was not observed on hot plate test and tail clipon rats. On experimental evalution on rats, the chemical compound of Tinospora cordifolia that is hexane soluble preparation and chloroform soluble portions showed anti-pyretic activity.

These allexperimental study represents anti-inflammatory activity of Tinospora cordifolia which shows similar mechanism of action of non-steroidal anti-inflammatory drugs. It is also claimed to be used for rheumatoid arthritis and gout which has number of evidances.

10. **Anti-microbial activity**:

The Tinospora cordifolia has anti-bacterial property which has been assayed against many gram-positive bacteria like Eschericha coli, Straphylococcus aurens, Klebsiella pneumoniae, Proteus vulgaris, Salmonella typhi, Shigella flexneri, Salmonella paratyphi, Salmonella typhimurium, Pseudomonas aeruginosa, Enterobacter aerogene and Serratis marcesenses. The chemical compounds which were isolated from stem and leaves of Tinospora cordifolia that is ethanol, aqueous and Acetone showed maximum inhibitory activity against urinary pathogens which were clinically isolated, the study was carried out by Hook. F. The study conducted by Thomas represented highest inhibitory activity against Klebsiella pneumoniae and Psedomonas aeruginosa. Good anti-bacterial property is also found from silver nanoparticles which are isolated from Gulvel, that acts against bacteria Psudomonas aeruginosa which were isolated from burn patient.

11. **Anti-oxidant** :

In plant Tinospora cordifolia, phenolic part shows anti-oxidant property. Its major role is to prevent the chemical reaction oxidation and the stress associated with infection was suggested with reference to the compound catalase, glutathione-s-transferase, glutathione peroxidase, glutathione reductase, superoxide dismutase and polyphenoloxidase.

Marketed formulation of Tinospora cordifolia:

Tinospora cordifolia is obtained in various dosage form example, syrups and tablets. Gulvel constituent is found in number of Ayurvedic medicaments like Amritarishta, Amrtottara kvatha churna, Guduci taila, Guduchyadi churna, Guduchyadi-kwatha, Gudduchi Sattva and Chinnodbhavadi kvatha churna. Some examples related to the dosage of drugs and strength include: In case of recurrent infection, to increase phagocytosis, chronic ear-nose throat infection, stimulating growth of epithial cell 600 mg tablet is given twice, daily. 500mg tablet is used as immunomodulator in infection, effective in tuberculosis, malaria, diabetes and used in case of inflammation combined with nonsteroidal anti-inflammatory drugs. In rheumatoid arthritis 200mg of tablet is given in combination twice daily. In haematinic, immune-modulator chronic fever and infectious disease 300 mg tablet is recommended twice daily, in form of powder 3-6 g is given and in form of decoction 20-30 gram is given as per Indian Pharmacopoeia. In case of general debility, fatigue, and old age and to be used as

immunostimulant 37.5 mg content of Tinospora cordifolia is used. 50 mg of dose is used as antacid. In menstrual disorder 250 mg of dose is given with the combination of other drug. In condition of Diabetes tablet of 500 mg is given twice daily and dose of 100 mg of tablet is advice as 1 tablet twice. Some references have been by tribals that uses Tinospora cordifolia for medicinal purposes: In Bangladesh the tribe name Garo uses Gulvel for treatment of chicken pox, rheumatism and helminthiasis. In India Korkus is used in Melghat and some part of Maharashtra for the treatment of fever, polyuria and fever. A Gond tribal in Kukrakhappa that is in Madhya Pradesh it is used to treat fever in malaria and typhoid.

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