WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 10, Issue 6, 1734-1747. Review Article ISSN 2277– 7105

TINOSPORA CORDIFOLIA-AN IMMUNOMODULATORY DRUG IN AYURVEDA FOR PREVENTION AND TREATMENT OF COVID-19 AND DIVERSE PHARMACOLOGICAL IMPORTANCE

Shubham P. Varpe*, Vishal S. Balme*, Prathamesh B. Kadu*, Vaibhav D. Andhale, Rushikesh A. Kuldharan, Mahesh S. Sadgir

Research Scholar: B. Pharm Ashvin College of Pharmacy Manchi Hill, Ashvi bk.

Article Received on
21 April 2021,

Revised on 11 May 2021,
Accepted on 31 May 2021

DOI: 10.20959/wjpr20216-20676

***Corresponding Author**
Shubham P. Varpe,
Vishal S. Balme,
Prathamesh B. Kadu
Research Scholar: B. Pharm Ashvin College of Pharmacy Manchi Hill, Ashvi bk.

ABSTRACT

Tinospora cordifolia is a deciduous woody climbing shrub distributed throughout india, china, Africa. It belong to the family Menispermaceae. Since the beginning of human cultivation, medicinal plant have been used by mankind for its therapeutics value. Tinospora cordifolia is a widely used shrub in flok and Ayurvedic system of medicine over india. A variety of constituents have been isolated from of different parts of tinospora cordifolia. They belongs classes such as alkaloids, diterpenoids lactones, steroid, glycosides, aliphatic compound and polysaccharides. Tinospora cordifolia is the best remedy for children suffering from upper respiratory tract infection. The aqueous extract of tinospora cordifolia significantly lowered the serum cholesterol and moves the HDL cholestrol level to basic value. It also possesses antioxidant, anti-hyperglycemia, anti-neoplastic and also it show hepatoprotective properties. It is considered an essential herbal plant of Indian system of medicine(ISM) and has been usedin the treatment of fever, urinary problem, dysentery, skin desease leprosy diabetesand many more deasease. Though almost all of its parts are usedin traditional system of medicines, leaves, stem, roots are the most importantpart which are used medicinally. The present review aims to summarize the information concerning the chemical constituents and medicinal aspect of the tinospora cordifolia.

KEYWORD: Tinospora cordifolia, medicinal plant, medicinal properties, herbal drug, drug, antioxidant, chemical constituents.

INTRODUCTION

The World Health Organization (WHO) estimated that upto 80% of people still realy mainly on traditional remedies such as medicinal plant for their medicines.[1] Among the vast library of important medicinal plants, tinospora cordifolia (willd) is a deciduous climbing shrub which belongs to the family Menispermaceae. The plant is designated as Rasayana in Ayurveda and is very well known for building up to the immune system and body's defence aginst definite infecting Micro-organism.[2] Tinospora cordifolia is known by different name in various different language in India viz, Tippa-teega (Telugu), Guduchi (Marathi), Guluchi (Oriya).[3] Plant are utilized as therapeutics agent since time immemorial in both organized (Ayurveda, Unani) and Unorganised (flok, tribal, native forms).

The plant family Menispermeaceae consist of about 70 genus and 450 species that are found in tropical low land region. It is act as antiperiodic, alterative and diuretic. Watery extract of the plant is used as febrifuge and is called 'indian quinine'.[4]

Fig. 1: Whole plant of *T.cordifolia.*

Common name[5]

Latin : Tinospora cordifolia
English : Guluncha/ Indian tinospora
Sanskrit : Guduchi, Amrita
Hindi : Guduchi
Bengali : Guluncha
Telugu : Tippatiga
Marathi : Shindilakodi
Gujarati : Galo
Kannada : Amrita balli

Taxonomical classification

Kingdom : Plantae

Subkingdom : Tracheophyta-Vascular plants

Super-division : Spermatophyta-Seed bearing plants;

Divivsion : Magnoliopsia-Flowering;

Class : Mangnoliopsia-Dicotiledons

Subclass : Polypeptalae-Petal are free;

Series : Thalamiflorae-Many stamens and flower hypogynous

Order :Ranunculales

Family : Menispermaceae-The moonsee family

Tribe : Tinosporeace

Genus : Tinospora

Species : Cordifolia

Distrubution

The plant is distributed throughout the tropical and subtropical region india. It is indigenous to areas of India, Sri Lanka, China, Myanmar, Thailand, Philippines, Indonessia, Malaysia, Vietnam, Bangladesh, and south Africa.[6,7]

Growth requirement

The plant is very rigid and it can be grown almost all climate but prefer warm climate. Planting is usually done during rainy season (july-august).[8] It can be successfully grown in all variety of solid.

Pharmacognostic description: The stem of plant is filiform, fleshy and climbing in nature; bark is white to gray.[9] Powder of stem is creamish brown or dark brown, characteristic odor, bitter tasteand use in dyspepsia, fever, and urinary diseases. The starch obtained from the stem known as "Guduchi-satva."[10] Leaves of plant are simple, alternate, long –petioled, round, pulvinate, heart-shaped, and twisted partially and halfway around.

Some of the essential constituents of T. cordifolia

Active components	Compound
Terpenoids	Tinosporide, Fluranolactone diterpene, furonide diterpine, Tinosporaside, cardifolioside A, B and C, D sesquiterpene tinocordifolin.[10]
Alkoloids	Tinosporine, Magnoflorine, Bebirine, Choline, jatrorrhizine, palmatin[11,12]
Liganans	3(a,4-dihydroxy-3methoxybenzyl)-4-4(hydroxyl-3 methoxybenzyl).[13]
Steroids	Giloinsterol, 20a-Hydroxy ecdysone.[14]
Other	Giloin, sinapic acid, Heptacosamal.

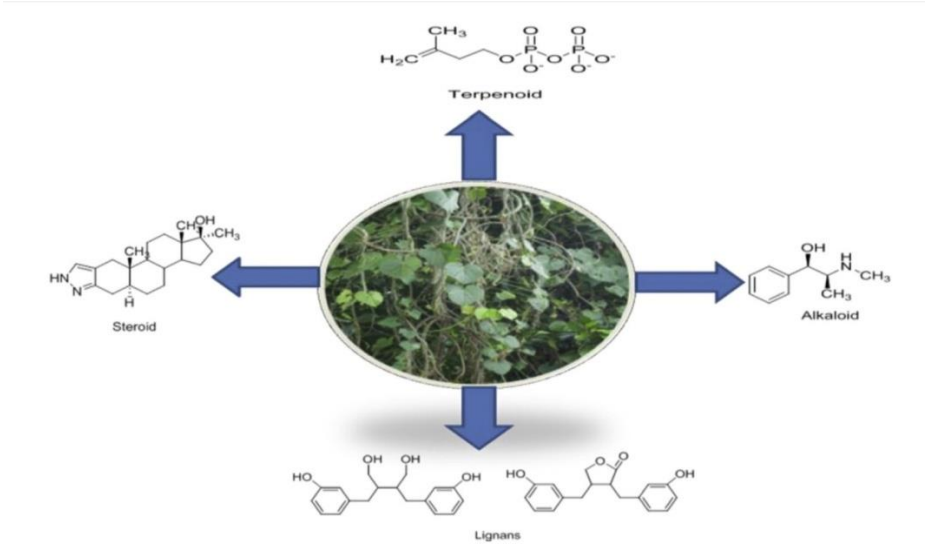

Fig. 2: Major constituents of tinospora cordifolia.

Botanical description

It has two varieties

1. Tinospora cordifolia Miers (Menispermum cordifolium willd).
2. T. cinesis: (T.malabarica(Lam) Meirs).

1. Tinospora cordifolia Miers (Menispermum cordifolium willd).

Leaves- Membranous, glabrous, 5-10 cm long, cordate; petiole2.5-7 cm.

Flower- In racemes of about 5 cm; axillary, terminal or from the old wood, pale yellowish white in colour.

Fruits- Carpel, dorsally convex, ventrally flat, size of large pea.

2. T. cinesis: (T. malabarica (Lam) Meirs)

It is a large climber with 2 cm. diameter stem, old branches are smooth and shining, more or less watery light coloured papery bark, young parts covered with whitish hair.

Leaves- Membranous, sparingly pubscent above broadly ovate-cordate, 7.5-23 cm long, petiole 6-12 cm. long, striate.

Flowers- Arranged in pseudo racemes arising from the old branches, simple pedunculate, yellowish green coloured.

Fruit- Drupes 1-3, scarled or orange colure

Uses of part of T. cordifolia

S. no	Part used	Chemical constituents	Uses
1	Stem	Berberine, palmatin,18-norclerodane glucoside, furonoid diterpene glucoside, tinocordiside	Respiratory tract infection, Skin deasease Anti-hyperglycemia property
2	Bark	Tinosporofuranal, Tinosporoafurandiol, Tinosporaclerodanol	Anti-inflamantory
3	Root	Sisosterol,choline, tinosporin, palmatine	Anti-neoplastic, Anti-oxidant.

(a)Leaves of *Tinospora cordifolia*

(b)Stem of *Tinospora cordifolia*

(c)Aerial root of *Tinospora cordifolia*

(d)Fruits, Flowers of *Tinospora cordifolia*

(e)Seeds of *Tinospora cordifolia*

Fig. 3: All part of T. cordifolia.

Phytoactive compounds of *tinospora carifolia*

Tinospora cordifolia constitute different classes of phytoactive compounds such as steroids, alkaloids, glycosides, diterpenoid lactones, sesquiterpenoid, aliphatic compounds, Miscellaneous compound and polysaccharides.

Class	Chemical constituents	Activity	Plant part
Alkaloids	Berberine, Magnoflorine, CholinePalmatin, Tembetarine, Tinosporine, Isocolumbin, Aporphine alkaloids, Jatrorrhizine, Tetrahydropalmatine	Anti-viral infections Neurological, Immunomodulatoryanti-diabetes, Anticancer	Stem & Root
Steroids	20 δ -Hydroxyecdysone, δ- sitosterol, β –sitosterol, GiloinsterolEcdysterone, Makisterone A	Inhibits TNF-α, IL-1 β, IL-6 and COX-2. inflammatory arthritis, IgA neuropathy	Shoot
Glycosides	Tinocordiside, Tinocordifolioside, Cordioside, 18-norclerodane glucoside, CordifoliosideSyringin, Syringinapiosylglycoside, Furanoidditerpene Glucoside, Palmatosides, Cordifolioside A, B, C, D and E, Pregnane glycoside.	anticancer activities Treats neurological disorders like ALS, Parkinsons, Dementia	Stem
Diterpenoid lactones	Furanolactone, Tinosporon, Tinosporides, Columbin, Clerodane derivatives, Jateorine	anti-inflammatory, anti-microbial, anti-viral. Anti hypertensive, VasorelaxantInduce	Whole plant

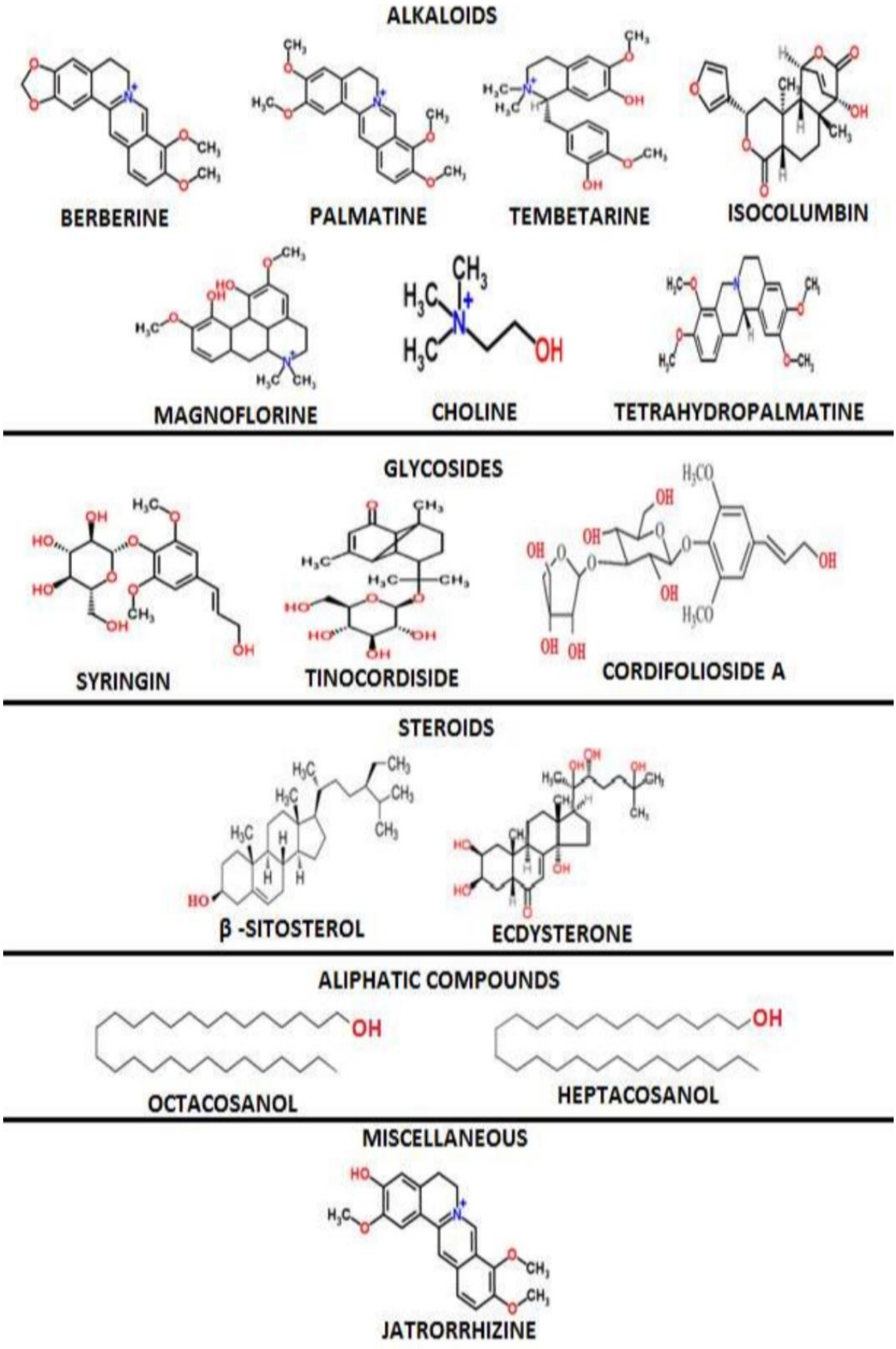

Fig. 4: Some phytoactive compounds from *tinospora cordifolia*.

Chemical constituents

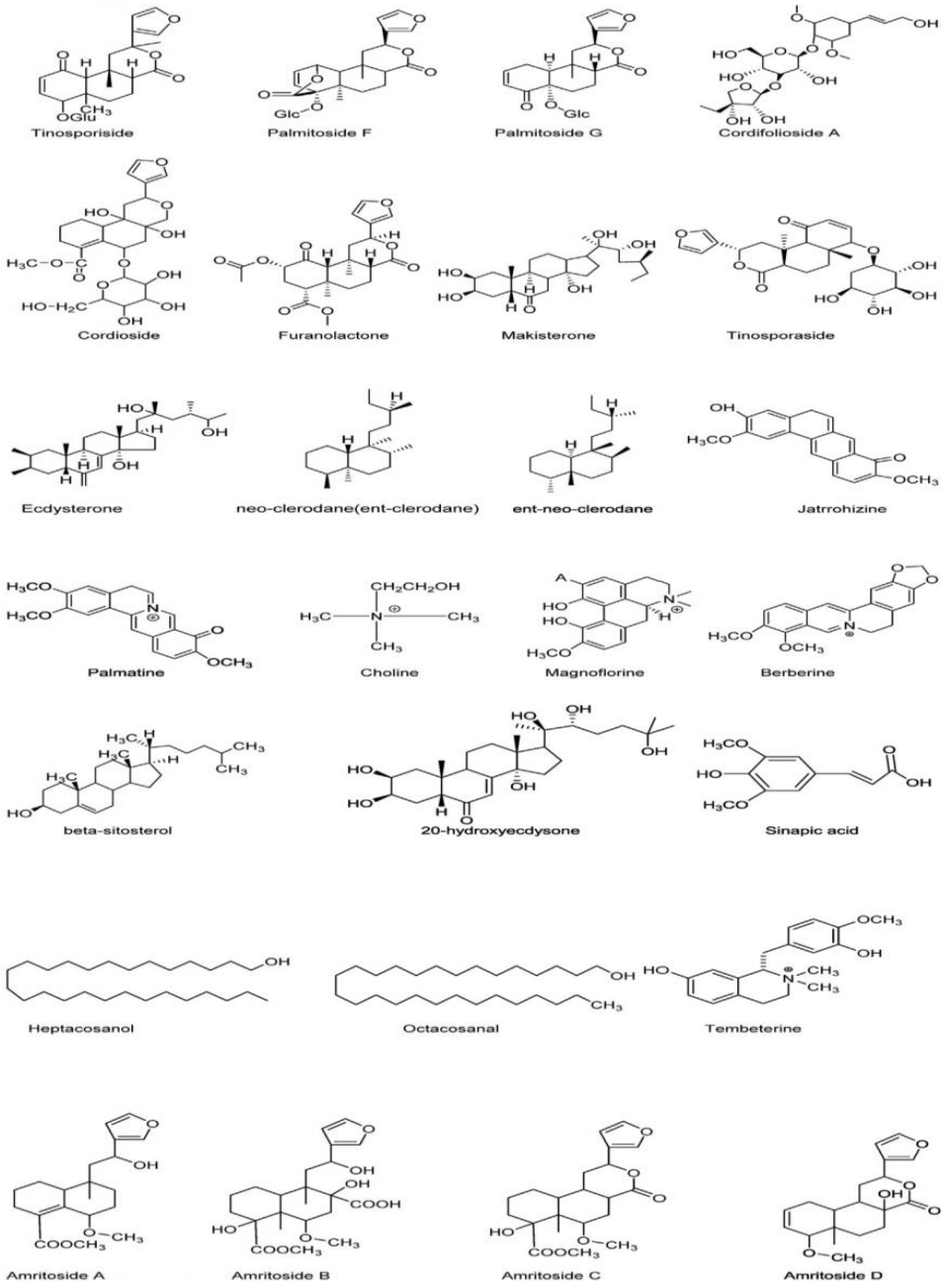

Fig. 5: Structure of the chemical constituent of T. cordifolia.

Pharmacological activity/medicinal use

Anti-diabetics activity

The anti-diabetics activities is due to alkaloid (Magnoflorine, palmetine,Jatrorrhizine), tannins, cardiac glycosides, flavonoids, saponins, etc.[15] the activity of the enzyme inhibited hypoglysomic action in diabetics animal and normal animal. In diabetic rat model, T. cordifolia root extract of guduchi attenuated the brain mediated lipid level and down-regulated the blood glucose and urinary glucose level emphazing its anti-diabtics and lipid-

lowering activity.[16] Oral administration of an aqueous T.cordifolia root extract to alloxan diabetic rat caused a significant reduction in blood glucose and brain lipids.[17]

Anti-cancer activity

Tinospora cordifolia shows anti-cancer activity, this activity, this activity is mostly shown in animal models.[18] Dichloromethane extract of TC shows cytotoxic effect owing to lipid peroxidation and release of LDH and decline in GST. The extract indicates the anticancer potential in 7,12-dimethylbenz(a)antracene DMBA induced skin cancer model in mice[19]. Two molecule from the plant and methanol fractions (T1 and T2) from the plant Tinospora Cordifolia show that in MCF-7cells T1 tratment significantly suppressed the proliferation, migration and invasion of MCF-7cells when copared to that of T2.

Immunomodulatory activity

Tinospora cordifolia is well known for its immunomodulatory response. Active compound 11-hydroxymustakone, N-methyl-2-pyrrolidone, N-formylannonain and syringing as been reported to have potential Immunomodulatory and cytotoxic effect.[20] Immunomodulatory activity of t. cordifolia ethanolic extract (100 mg/kg/p.o.) stem through altering the concentration of antioxidant enzymes, increasing T and B cells and antibody which play and important role in imunity, enhancing the concentration of melaltonin in pineal gland and increasing the level of cytokines like IL-2,IL-10 and which play an important role in immunity. These natural compound have been reported to improve the phagocytic activity of macrophages, enhancement in nitric acid production by stimulation of splenocyte.[21]

Anti-oxidant activity

The T. cordifolia has potential application in food system as an antioxidant and probably in biological system as a nutraceutical. Methanolic, ethanolic and water extracts of Tinospora cordifolia showed significant antioxidant potential compared to other solvents and also possess metal chelation and reducing power activity.[22] Methanolic extract of stem of T. cordifolia has been reported to anti-oxidant activity, by increasing the erythrocytes membrane lipid peroxide and catalase activity. It also decreases the activity of SOD, GPx in alloxan induced diabetic rats.[23,24]

Anti-microbial activity

Antimicrobial activity of the T. cordifolia with different solvents on different micro-organism, showed good antifungal and antibacterial activity. Silver nanoparticles from the

stem of T. cordifolia, which possess antibacterial activity against the different strains of bacterias.[25] The anti-bacterial activity of Tinospora cordifolia extracts has been assayed against Escherichia coli, Staphylococcus aureus, Klebsiella pneumonia Proteus vulgaris, Salmonella typhi, Shigella flexneri, Salmonella paratyphi, Salmonella typhimurium, Pseudomonas aeruginosa, Enterobacter aerogene, and Serratia marcesenses (Gram-positive bacteria).[26] The active compound [(5R, 10R)-4R, 8R-Dihydroxy-2S, 3R:15, 16-diepoxycleroda-13(16), 17, 12S, 18, 1S-dilactone] was isolated from ethanol extract of Tinospora cordifolia stem showed activity against bacteria and fungi..

Anti-toxic activity

The extract to scavenge free radicals generated during aflatoxicosis. It showed protective effects of T. cordifolia on thiobarbituric acid reactive substances (TBARS) levels and increase the level of GSH, ascorbic acid, protein, and the activities of anti-oxidant enzymes viz., Superoxide Dismutase (SOD), Catalase (CAT), GPx enzyme, Glutathione S-transferase (GST) and glutathione reductase (GR) in kidney. The alkaloids such as choline, tinosporin, isocolumbin, palmatine, tetrahydropalmatine, and magnoflorine present in the plant of T. cordifolia showed protection against aflatoxin-induced nephrotoxicity.

Anti pyritic activity

Studies have shown insignificant antipyretic effects in the hexane and chloroform soluble fractions of the stem of Tinospora cordifolia.[27]

Anti –inflammatory activity

The water extract of the stem of *Tinospora cordifolia* has been checked for anti-inflammatory activity in albino rats. It has significantly inhibited acute inflammatory response evoked by carrageenin when administered orally and intraperitoneally.[28]

Memory enhancing activity

Studies have shown that Giloy helps in cognitive enhancement by immunostimulation and synthesis of acetylcholine. Thus contributing in increased choline level which shows that it has memory enhancing property for learning and memory in normal and memorydeficits animals.[29]

Anti-HIV potential

The root extract of T. cordifolia affects the immune system of HIV positive patient. The stem extract of Tinospora macrophages, level of hemoglobin, and polymorphonuclear leucocytes.[30]

Hepatic disorders

In clinical studies 20 patients of infective hepatitis were selected on the basis of clinical and biochemical findings. Four tablets (500mg each) thrice in a day, orally with fresh water were given to the patient for 4 weeks. Comparison between before and after treatment of those patients (N=20) were showed that drug *T. cordifolia* (*Guduchi*) played an important role in relieving the symptoms as well as normalization of altered liver function test.[31,32]

Ayurvedic properties and pharmacological effect

According to Ayurveda literature Guduchi is Tikta (bitter), Kasaya (astringent) in Rasa (taste), Guru (heavy) and Snigdha (unctuous) in Guna (properties), Ushna (hot) in Virya (potency) and Madhura (sweet) in Vipaka (metabolism). But Kaiydevnighantu has mentioned Laghu (light) Guna (properties) in Guduchi.[33] Guduchi Sattva is claimed to be a potent tonic and rejuvenator. It is useful in fevers, diarrhoea, urinary tract infections, jaundice, skin diseases, irritable bowel syndrome and defects of semen morphology & spermatogenesis.[34]

Therapeutic uses

1. Juice of *Guduchi* is highy useful to cure irregular fever.[35] Decoction of *Guduchi* mixed with honey can be taken in the morning to cure jaundice. Decoction of *Guduchi* can also be given in case of Vomiting.
2. Guduchi svarasa (juice) and Satavari svaras in equal parts (10 ml each) are mixed together and given along with Guda (jaggery) in Vataj jvara .
3. Ghrita and oil cooked with juice and paste of Guduchi, Triphala, Vasa, Draksha and Bala alleviates chronic fever.
4. Decoction prepared with Guduchi, Parpat and Amalaki (500ml-100ml) may be administered in case of Pittajjvara.[36]
5. In the diseases due to vatadosa it is given with Ghrita, in Pitta dosa with Sarkara and Kaphadosa with Madhu.[37]
6. Guduchi juice works well with cow's milk or lodhra in leucorrhea and with cumin seeds in burning sensation due to *Pitta*. In menorrhagia caused by Vata, juice of Guduchi is highly beneficial.[38]

CONCLUSION

In spite of the overwhelming influences and our dependence on modern medicines and tremendous advances in synthetic drugs, a large segment of the world population still likes drugs of plants origin. Of the 2, 50, 000 higher plant species on earth, more than 80, 000 are medicinal. Tinospora cordifolia, the versatile medicinal plant is the unique source of various types of compounds having diverse chemical structure. Very little work has been done on the biological activity and plausible medicinal applications of these compounds and hence extensive investigation is needed to exploit their therapeutic utility to combat diseases. A drugdevelopment their therapeutic utility to combat diseases. Present review spotlights the classical antidiabetic, anticancer, immunomodulatory, antioxidant, antimicrobial, antitoxic claims of contemporary researches. This review can be used for further research as well as clinical purpose.

REFERENCE

1. C. bharathi, A. Harinatha, Reddy, G. Nageshwari, B. Srilaxmi, M. Soumya, D.S.Vanisri, B. Venkatappa; A Review on medicinal properties of tinospora cordifolia; International journal of scientific research and review, 2018.
2. CP. Khare; Indian Medicinal plant a illustrated Dictionary,springer science and business media, 2007.
3. N.M.Reddy, Rajashekhar Reddy; Tinospora cordifolia cgemical constituents and medicinal properties; Scholars Academic journal of pharmacy, 2015.
4. Bhopendra mani tripathi, D.C. singh, suresh chaubey, Gangadep kour, rishi arya;A critical review on guduchi and its medicinal properties; International journal of Ayurved and pharma research, 2015.
5. U.spandana, shaik liakhat ali, T. niramala, m.santhi, SD sipai, babu; A review on tinospora cordifolia; International Journal of current pharmaceutical review & research, 2013.
6. Abhimanyu Sharma, Asmita gupta, Sakshi singh, Amlabatra, Tinospora cordifolia (Willd) Hook. f & Thomson; A plant with economics potential; journal of chemical and pharmaceutical research, 2010.
7. K. sinha, NP.mishra, J.singh, sps.khanuga,Tinospora cordifolia (Guduchi); a reservoir plant for therapeutic application; Indian journal of traditional knowledge, 2004.
8. S.chaudhari, N. shaikh; guduchi-the best ayurvedic herb; the pharma innovation journal, 2013.

9. A.K. Upadhya, K. kumar, A. kumar, H.S,mishra,; Tinospora cordifolia (willd) hook.f. & thomous. Validation of the ayurvedic pharmacology through experimental & clinical studies; International journal ayurvedic research, 2010; 1.
10. Priyanka Sharma, bharat p.dwivedee, dheeraj bisht, ashutosh k. dash, Deepak kumar; the chemical constituents and diverse pharmacological importance of tinospora cordifolia, Heliyon (Elsevier), 2019.
11. N. choudhary, M.B. siddiqui, s.azmat, s.khatoon; Tinospora cordifolia: ethanobotany, phytopharmacology and phytochemistry aspect, IJSPR, 2013; 4.
12. V. R. mahajan, C.I. jolly, k.m.kundnani; a new hypoglycemic agent from T.cordifolia; Indian drug, 1985; 23.
13. J.B. hanuman, A.K.mishra, B. sabata,; a natural phenolic ligans from T. cordofolia miers; journal chem. Soc, 986.
14. A.R. kidwai, K.C. salooja, V.N. Sharma, S. siddiqui; chemical examination of T. cordifolia; journal of science research, 1949.
15. Anonymous, the Ayurvedic pharmacopoeia of India. Part 1. first ed. Vol 1, Department of AYUSH, Ministry of health and FW, New Delhi, 2001.
16. M.M. Shivananajappa, M. Muralidhara; Abrogation of material and fetal oxidative stress in the streptozotocin-induced diabetic rat by dietry supplement of T. cordifolia; Phytomedicine, 2011; 18.
17. Stanely M, Prince P, Menon VP: Antioxidant action of Tinospora cordifolia root extract in alloxan diabetic rats; Phytother research, 2001.
18. Jagetia GC, Rao SK; Evaluation of the antineoplastic activity of guduchi (Tinospora cordifolia) in ehrlich ascites carcinoma bearing mice; Biol pharma bull, 2006.
19. Ali H Dixot S; Extraction optimization of Tinospora Cordifolia and assessment of the anticancer activity of its alkaloid palmtine; scientific world journal, 2013.
20. Sharma U, Bala M, Kumar N, Singh B, Munshi RK, Bhalerao S; Immunomodulatory active compound from T. cordifolia; J Ethnopharmacol, 2012.
21. Upadhyay PR, Sharma v, anita kv,; assessment of the multifaceted Immunomodulatory potential of the aqueous extract T. cordifolia; Research journal chem. Sci, 2011.
22. Bhawya D, Anilakumar KR; In Vitro Antioxidant Potency of Tinospora cordifolia (gulancha) in Sequential Extracts. International Journal of Pharmaceutical & Biological Archives, 2010.
23. Stanely P, Menon VP; Hypoglycaemic and hypolipidemic action of alcohol extract of Tinospora cordifolia roots in chemical induced diabetes in rats; Phytother Res, 2003.

24. Stanely P, Menon VP; Antioxidant action of Tinospora cordifolia root extract in alloxan diabetic rats; Phytother Res, 2001.
25. V.duraipanduyan, S.ignacimuthu, k.balakrishna, N.A. Aaharabi;Antimicrobial activity of T. cordifolia; an ethnomedicinal plant; Asean J. trad; knowlwdge, 2012; 7.
26. Narayanan AS, Raja SS, Ponmurugan K, Kandekar SC, Natarajaseenivasan K, Maripandi A, Mandeel QA; Antibacterial activity of selected medicinal plants against multiple antibiotic resistant uropathogens; Benef Microbes, 2011.
27. Ikram M, Khattak SG, Gilani SN. (Antipyretic studies on some indigenous Pakistani medicinal plants: II). J Ethnopharmacol, 1987.
28. Pendse VK, Dadhich AP, Mathur PN, Bal MS, Madam BR; (Anti-inflammatory, immunosuppressive and some related pharmacological actions of the water extract of Neem Giloe (Tinospora cordifolia)- A preliminary report); Indian J Pharm, 1977.
29. Lannert H, Hoyer S. (Intracerebroventricular administration of streptozotocin causes long-term diminutions in learning and memory abilities and in cerebral energy metabolism in adult rats). Behavioral Neuroscience, 1998.
30. Rege N, Bapat R D, Koti R, Desai N K & Dahanukar S, Immunotherapy with Tinospora cordifolia: A new lead in the management of obstructive jaundice by Tinospora cordifolia, Indian J Gastroenterol, 1993; 12.
31. Prakash S. & Rai N.P., Role of Tinospora cordifolia (Willd.) Miers (Guduchi) in the treatment of infective hepatitis, J Res Ayurv Siddha, 1996; 17: (1-2).
32. Prakash S. & Rai N.P; Role of Tinospora cordifolia (Willd.) Miers (Guduchi) in the treatment of infective hepatitis:J Res Ayurv Siddha, 1996; 17.
33. Prince PS, Menon VP: Antioxidant activity of Tinospora cordifolia roots in experimental diabetes: J Ethnopharmacol, 1999.
34. Sharma Priyavrata, Kaiyadave Nighantu, Chaukhambha Orientalia, Varanasi, 5.
35. Charaka Samhita of Agnivesha, Pt. Kashinatha Shastri, Edited by Dr. Gangasahaya Pandeya, Part 2, Varanasi: Chaukhamba Sanskrit Sansthan, Reprint, 2006.
36. Vaidhya Ravidutt shastri, Harit samhita, Chaukhambha Sanskrit series office: Varanasi.
37. Shri Bhava Mishra, Bhava Prakasha Chikitsa, Comm. Prof. K.C. Chunekar, Edited by Late Dr. G.S. Pandey, Chaukhambhabharati academy, Varanasi.