



A REVIEW STUDY ON PHARMACOLOGICAL ACTIVITY OF TINOSPORA CARDIFOLIA

¹Dev Prakash Dahiya, ¹Chinu Kumari, ¹Dinesh Kumar Thakur*, ¹Akanksha sharma, ²Bhopesh kumar, ²Munish Choudhary, ²Anita kumari , ²Utsav Pathak.

¹School of Pharmacy Abhilashi University, Chail-Chowk, Himachal Pradesh ,175028

¹abhilashi college of pharmacy , Nerchowk Mandi Himachal Pradesh ,175008

Abstract: *Tinospora Cardifolia* (Menispermaceae) is an Ayurvedic medicinal plant distributed throughout the Indian subcontinent and China. The whole plant is used in folk and the Ayurvedic system of medicine alone and in combination with other plants. Due to its commercial importance *T. Cardifolia* has been of intense research interest for the last four decades with the isolation of diverse compounds such as alkaloids diterpenoids phenolics steroids aliphatic compound and polysaccharides along with discovery of a wide spectrum of Pharmacological properties like immunomodulation anticancer hepatoprotective and hypoglycemic. Although pharmacological activities of extract and compounds of *T. Cardifolia* have been studied both *in vitro* and *in vivo* only a few mechanisms of action have been explored. In the present review the pharmacological activities of compounds and different extracts of *T. Cardifolia* are highlighted along with those of the marketed products. This compilation of the extensive literature of *T. Cardifolia* here will be referral point of clinical study and the development of standardized phytomedicine in healthcare.

I. INTRODUCTION

Herbal remedies were the first medicines used by the humans due to many pharmacologically active secondary metabolites produced by the plants. These medications are commonly used in all medical settings to make its essential for primary care. Understanding how herbal medicines are sourced processed and standardized which can help the providers guide patient who are trying to choose the most clinically effective and affordable treatments. *Tinospora Cardifolia*, also known as Guduchi or Giloy [1,2], is a widely used medicinal plant in traditional Ayurvedic medicine. It has been revered for centuries in India for its versatile medicinal properties.

The seeds are curved. Fruits are fleshy and single seeded. Flowers grow during summer and fruits grow during winter. [3,4] *Tinospora Cardifolia* belongs to the Menispermaceae [5,6] family and is native to the tropical

regions of India, Myanmar, and Sri Lanka. In recent years, there has been a surge of scientific interest in this plant, leading to numerous studies that explore its pharmacological activities. This article aims to provide a comprehensive review of the pharmacological activity of *Tinospora Cardifolia*. [7]

In Ayurveda it has been used for its Rasayana Deepana Jwaranashana Tridosha Shamaka properties. It is also an immunomodulator which is useful for stress hyperlipidemia pyrexia. The primary objective of this study was to evaluate the effect of *Tinospora Cardifolia* on physical performance and secondary objective were to evaluate the muscle power maximal oxygen consumption and sympathetic activity in comparison with placebo when subjected to the physical stress. [8,9] Identification and characterization of the metabolites including alkaloids sesquiterpenes and phytoecdysteroids were performing using various techniques. [10]

II. Description of the plant

The plant has a vigorous growth habit, with long, slender, and twining stems that can reach up to 30 meters in length. [11,12] The stems are usually green or brownish and have a slightly rough texture. The leaves of *Tinospora Cardifolia* are heart-shaped or cordate, hence the name "Cardifolia," and are arranged alternately along the stems. [13,14] The leaves are medium to large in size, with prominent veins and a smooth surface. They have a glossy appearance and vary in color from light green to dark green. One of the distinguishing features of *Tinospora Cardifolia* is its ability to climb and cling to various surfaces using aerial roots.

These roots emerge from the stem nodes and provide support as the plant grows and spreads. The plant can often be seen climbing on trees, walls, and other structures in its natural habitat. *Tinospora Cardifolia* blooms during the summer season, producing small, yellowish-green flowers in clusters. The flowers are unisexual, and both male and female flowers are found on the same plant. Although the flowers are not particularly showy, they have a sweet fragrance and attract bees and other pollinators. After pollination, the female flowers develop into small, fleshy, berry-like fruits.

These fruits are ovalshaped and turn bright red when they ripen. [15] Each fruit contains one or two seeds, which are dispersed by birds and animals that consume them. The real treasure of *Tinospora Cardifolia* lies in its medicinal properties. Almost every part of the plant, including the stems, leaves, and roots, is used for therapeutic purposes. It is considered an adaptogen, which means it helps the body adapt to various stressors and strengthens the immune system. In Ayurvedic medicine, *Tinospora Cardifolia* is known for its detoxifying, rejuvenating, and immunomodulatory effects. Apart from its medicinal uses, *Tinospora Cardifolia* is also valued in traditional cuisine for its bitter taste. It is sometimes used in preparations like herbal teas, decoctions, and tonic formulations. [16] Additionally, the stem of *Tinospora Cardifolia* is often used in making garlands and wreaths during religious ceremonies and festivals in India. In recent years, *Tinospora Cardifolia* has gained attention from researchers worldwide, and scientific studies have started to validate its traditional uses. [17] However, it's important to consult with a healthcare professional or an Ayurvedic practitioner before using *Tinospora Cardifolia* or any other herbal remedy for medicinal purposes.

Classification:

1. **Kingdom** – Plantae
2. **Division** – Magnoliophyto
3. **Class** – Magnoliopsida
4. **Order** – Ranunculales
5. **Family** – Menispermaceae
6. **Genus** – Tinospora
7. **Species** – Tinospora Cardifolia

Synonyms

1. **English-** Gulancha Tinospora Moon seed heart leaved
2. **Hindi-** Giloe Gurach
3. **Kannada-** Amrutaballi Ugani Balli
4. **Malayalam-** Amrita Sittamrytu
5. **Marathi-** Gulaveli Chittamrutu Ambarvel Gulavela
6. **Oriya-** Gulochi Gulancha
7. **Bengali-** Giloe Gulancha
8. **Telugu-** Tippa Teega
9. **Tamil-** Amrida Valli Silam Pattigai
10. **Gujrati-** Gado Gulo
11. **Sikkim-** Gurjo
12. **Arab-** Gulanch.

CULTIVATION AND COLLECTION

Tinospora is distributed toward topical regions of India that are located 1200 m above sea level from Kumaon to Assam. In India, it is easily available in Bihar, West Bengal, Kerala, and Karnataka. It commonly grows in deciduous and dries a forest which grows over hedges and small tree [18].

This herb prefers growing in large variety of soils but prefers red soil or medium black soil [19]. The soil should be well drained with sufficient organic matter and moisture as required. It can be propagated by seeds and vegetable cutting, but viability of seeds is very less and seeds germination is major problems related with clonal propagation. [20]

The plant is very rigid and can be grown in subtropical and tropical climate but mainly in warm and rainy climate. It does not tolerate high rainfall and waterlogged conditions. As Tinospora is a climber, it requires

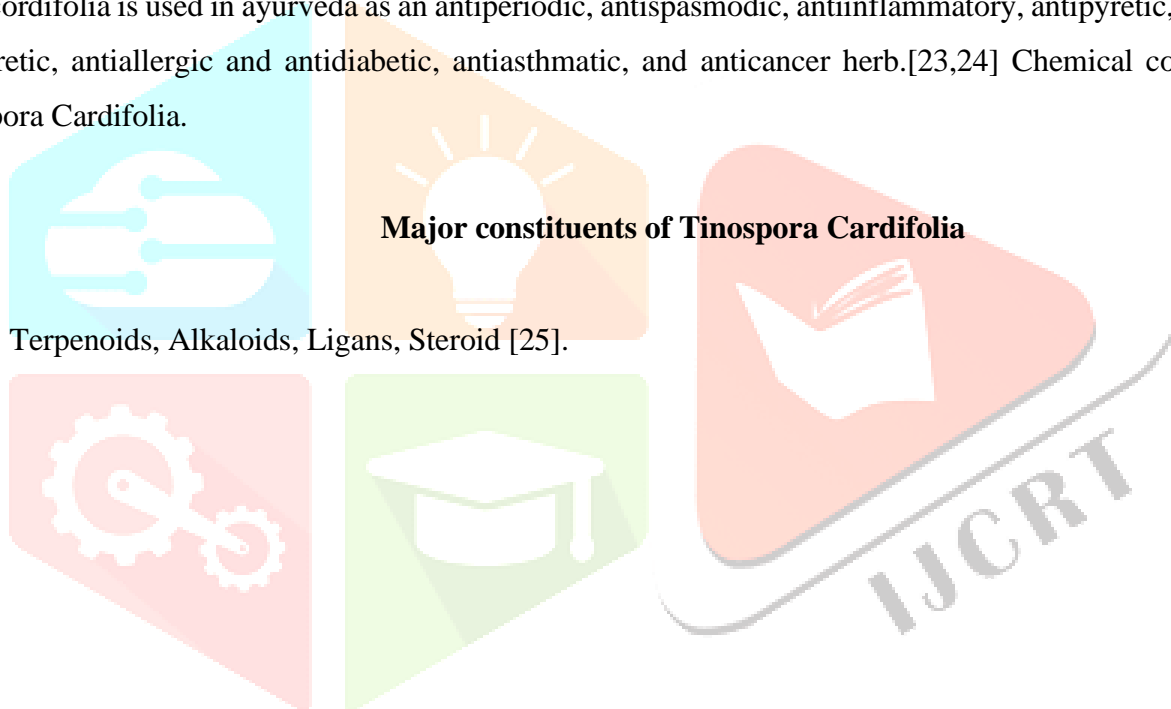
support for its growth (fast-growing species such as neem, jatropa, and moringa). For example, T. cordifolia growing with neem (Azadirachta indica) is called as NEEM GILOY.

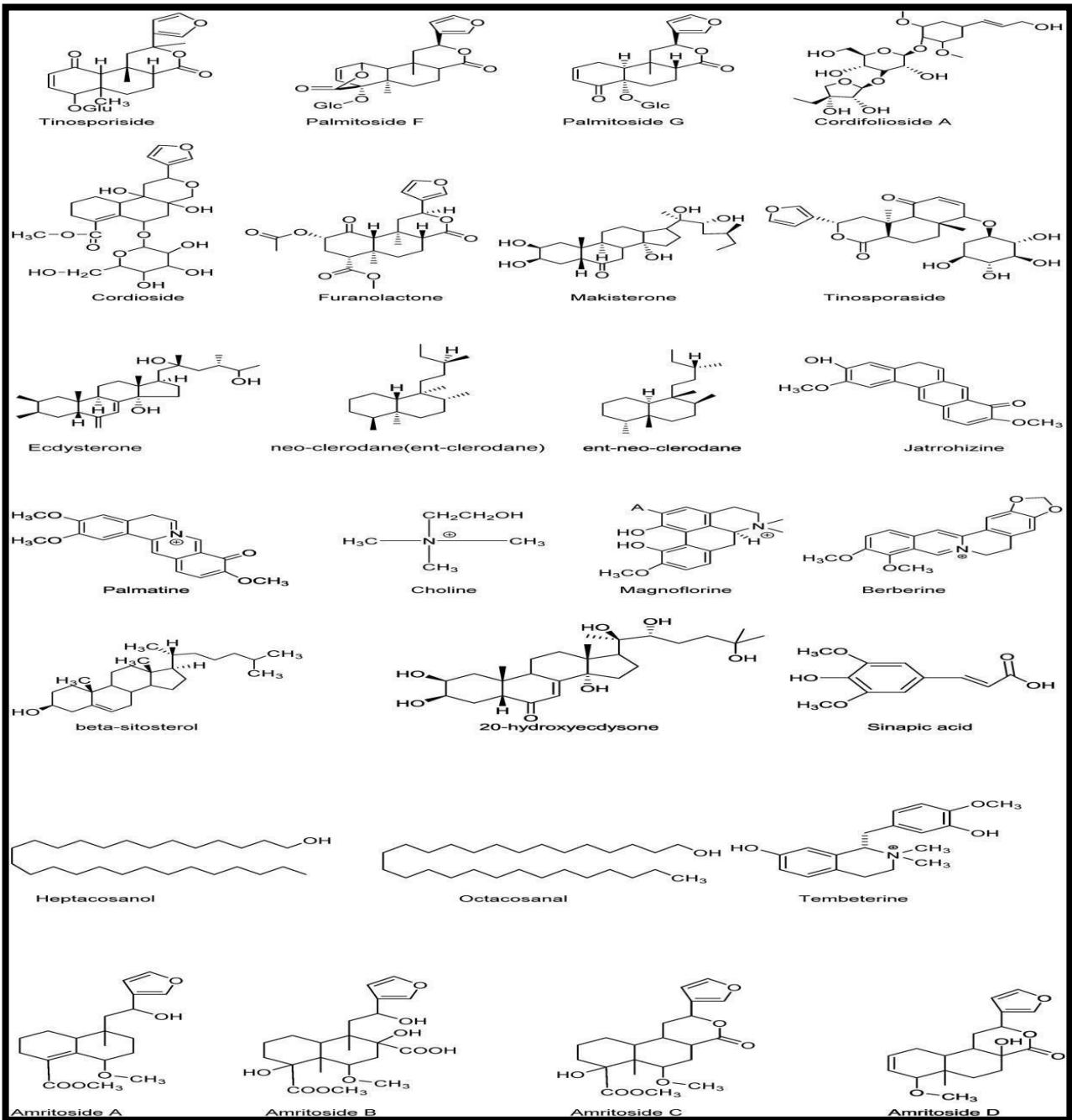
CHEMICAL CONSTITUENTS

Columbin, tinosporaside, jatrorhizine, palmatine, berberine, tembeterine, tinocordifolioside, phenylpropene disaccharides, choline, tinosporic acid, tinosporal, tinosporon, tinosporine, sitosterol (beta form), tinocordiside, magniflorine are the therapeutically active chemical constituents present in Tinospora[21,22]

MEDICINAL PROPERTIES

T. cordifolia is used in ayurveda as an antiperiodic, antispasmodic, antiinflammatory, antipyretic, antiarthritic, antipyretic, antiallergic and antidiabetic, antiasthmatic, and anticancer herb.[23,24] Chemical constituents of Tinospora Cardifolia.





III. Pharmacological Activity or properties of *Tinospora*

Cardifolia:

1. Immunomodulatory Activity:

Tinospora Cardifolia has potent immunomodulatory properties, making it an invaluable herb for enhancing the body's immune system. [26] Several studies have reported its ability to stimulate the production of immune cells such as lymphocytes and macrophages. [27] The plant also possesses antioxidant activity, which helps in reducing oxidative stress and strengthening the immune response. These immunomodulatory effects make *Tinospora Cardifolia* beneficial in combating various infections and autoimmune diseases.

2. Antimicrobial Activity:

The plant exhibits significant antimicrobial properties against a broad spectrum of microorganisms. Studies have shown its effectiveness against bacteria, viruses, and fungi. [28] *Tinospora Cardifolia* extracts have demonstrated antibacterial activity against common pathogens such as *Staphylococcus aureus*, *Escherichia coli*, and *Salmonella typhi*. Additionally, it has antiviral effects against certain viruses, including dengue, influenza, and herpes simplex virus. [29] These antimicrobial properties highlight the potential of *Tinospora Cardifolia* in the development of new therapeutic agents.

3. Anti-inflammatory Activity:

Tinospora Cardifolia possesses potent anti-inflammatory properties, which can be attributed to the presence of various bioactive compounds such as alkaloids, flavonoids, and terpenoids. [30] These compounds inhibit the release of pro-inflammatory mediators and suppress inflammatory pathways, thus reducing inflammation in the body. Several studies have indicated its effectiveness in conditions like rheumatoid arthritis, asthma, and colitis. [31] The anti-inflammatory activity of *Tinospora Cardifolia* offers promising prospects for the development of natural anti-inflammatory drugs.

4. Antioxidant Activity:

The plant is rich in antioxidants, which help combat oxidative stress and free radical damage in the body [32]. Oxidative stress is implicated in the development of various diseases, including cardiovascular disorders, neurodegenerative diseases, and cancer. [33] *Tinospora Cardifolia* scavenges free radicals, enhances antioxidant enzyme activity, and prevents lipid peroxidation. These actions contribute to its protective effects against oxidative damage and its potential in preventing or managing oxidative stress-related conditions.

5. Hepatoprotective Activity:

Tinospora cordifolia has a long history of use in traditional medicine for liver ailments. Scientific studies have confirmed its hepatoprotective activity.[34]The plant helps protect the liver from toxic substances, including drugs, chemicals, and alcohol. It aids in the regeneration of liver cells, enhances liver function, and reduces liver damage markers.[35] *Tinospora cordifolia*'s hepatoprotective properties make it a promising natural remedy for liver disorders and a potential adjuvant therapy alongside conventional treatments[36].

6. Antidiabetic activity:

The anti-diabetic activities is due to alkaloids (Magnoflorine, Palmetine, Jatrorrhizine), tannins, cardiac glycosides, flavonoids, saponins, etc. [37] The crude extract of the stem in ethyl acetate, dichloromethane (CDM),chloroform and hexane was studied for inhibition of the alphaglucosidase enzyme. The activity of the enzyme inhibited hypoglycemic action in diabetic animal and normal animals [38]. The aqueous extract was studied in the rats, without the addition of *Tinospora cordifolia* extract increase in glucose by 21.3%, insulin by 51.5%, triglycerides by 54.12%, and glucose-insulin index by 59.8 when plant containing extract was given. [39]

7. Antistress activity:

Ethanol extract of *T. Cardifolia* at the dose of 100 mg/kg gives significant anti-stress activity in all parameters compared with standard drug diazepam (dose of 2.5 mg/kg).[40] The plant extract gives a moderate degree of behavior disorders and mental deficit response. The clinical research showed the improved I. Q level of patients. In Ayurveda, it acts as *Medhya Rasayana* or brain tonic by increasing mind power like memory and recollection.[41]

8. Hepatic disorder:

Protective Effects of *Tinospora Cardifolia* water extract (TCE) on Hepatic and Gastrointestinal Toxicity was reported by Sharma et al., a significant increase in the levels of gamma-glutamyl transferase, aspartate transaminase, alanine transaminase, Triglyceride, Cholesterol, HDL and LDL ($P < 0.05$) in alcoholic sample whereas their level get downregulated after TCE intervention, patients showed the normalized liver function of *T. Cardifolia* stand to relieve the symptoms .[42- 43]

9. Anticancer activity:

The anticancer activity of *T. cordifolia* palmatine extract in animal models, alkaloid using response surface methodology (RSM).[44-45] The extract indicates the anticancer potential in 7,12dimethylbenz(a)anthracene

DMBA induced skin cancer model in mice [46]. Rahul et al., prepared the extract of 200, 400, 600 mg/kg dry weight in a dose depend upon manners. 50% methanolic extract of cordifolia to C57 BI mice for 30 days at a dose of 750 mg/kg body weight the tumor size reduced life span [47]. Mishra et al., showed the anti-brain cancer potential, 50% ethanolic extract of *T. cordifolia* (TCE) using C6 glioma cells significantly induced differentiation in C6 glioma cells, and reduced cell proliferation.[48]

10. Anti-HIV potential:

Kalika et al., showed that the root extract of *T. cordifolia* affects the immune system of HIV positive patient. The stem extract of *Tinospora cordifolia* reduces the ability of eosinophil count, stimulation of B lymphocytes, macrophages, level of hemoglobin, and polymorphonuclear leucocytes.[49-50]

11. Parkinson's disease:

Birla et al., reported *T. cordifolia* extract is highly attractive against the Parkinsonism.[51] They observed the anti-inflammatory activity of aqueous extract in 1-methyl-4-phenyl-1,2,3,6-tetra hydroxy pyridine (MPTP)-intoxicated [52-53] Parkinsonian mouse model. The extract reversed the behavior of the target MPTP-intoxicated mice and it suggests that *T. cordifolia* protected dopaminergic neurons by suppressing neuroinflammation in MPTP-induced Parkinsonian mouse model.[54-55]

IV. CONCLUSION:

Tinospora cordifolia, or Guduchi, is a remarkable medicinal plant with a wide range of pharmacological activities. Its immunomodulatory, antimicrobial, anti-inflammatory, antioxidant, and hepatoprotective properties have been extensively studied and validated. As a natural and traditional remedy, *Tinospora cordifolia* holds great potential for the development of new therapeutic agents and can complement existing treatments for various diseases. However, further research is necessary to fully understand its mechanisms of action.

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