



Review Article

All Rounder Of Ayurveda-Tinospora Cordifolia

Shital Devkar*, Suvarna Deshmukh¹, Sourabh Patil², Shreyash Koli³, Prachi Khochage⁴, Nilesh Chougule⁵

^{1,2,3} Student Ashokrao Mane Institute of Pharmacy, Ambap, Kolhapur 416112, Maharashtra, India

⁴Assistant Professor Ashokrao Mane Institute of Pharmacy, Ambap, Kolhapur 416112, Maharashtra, India

⁵Principle Ashokrao Mane Institute of Pharmacy, Ambap, Kolhapur 416112, Maharashtra, India.

ARTICLE INFO

Received: 15 Dec 2023

Accepted: 19 Dec 2023

Published: 23 Dec 2023

Keywords:

Giloy, Guduchi, Ayurveda, Nector

DOI:

10.5281/zenodo.10423831

ABSTRACT

Ayurvedic traditional medicine frequently employs the medicinal herb *Tinospora cordifolia*. Having a multiple therapeutical activity which is used in treatment of various disorders. It's another names are Amrita and Guduchi. Amrita means the drink of god that bestows immortality. So the giloy is also known as Nector of god. The family of giloy is Menispermaceae. In traditional indian medicinal system it is imperative plant. Giloy contains chemical constituents that are Alkaloid, Terpenoids, Lignans, Steroids, which shows pharmacological activity. The element of giloy used in Siddha, Unani, Ayurvedic medicinal system. This review article is on the therapeutical properties, collection, cultivation, harvesting, chemical constituents of giloy which analysed for future research

INTRODUCTION

Plants have been utilised as medical sources since ancient times. We are favoured by nature with plants that can support a stable, disease-free lifestyle. *Tinospora cordifolia* or giloy is a plant with numerous therapeutic applications that is highly valued in traditional medicine. Giloy is widely used either on its own or in combination with other botanicals due to its many health advantages. Giloy is frequently referred to as the "herb of longevity" due to its purported capacity to foster robust health and longevity. They have been

linked to improving memory, promoting fertility, and treating a number of illnesses, including diabetes, cancer, infections, fever, and problems related to ageing [1]. In 20th century herbal medicines are used as analgesic or antibiotic. Increases popularity of the allopathic medicines due to high bioavailability and this will causes lost popularity of the herbal medicines. Common names are Guduchi, Amrita, Amritalata, Amritavalli, Chinnaruhaa, Madhuparni, vatsaadani, Tantrika, kundalini, Guduuchika. In ancient book Agrasangraha in which *Tinospora*

*Corresponding Author: Shital Devkar

Address: Ashokrao Mane Institute of Pharmacy, Ambap, Kolhapur 416112, Maharashtra, India

Email ✉: shitaldevkar6@gmail.com

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.



cordifolia plant is introduced by Acharya Charaka and Acharya Vagbhata. They are useful in the immune system of the body and carry out various functions related to that. Giloy is a climbing shrub which is native of India and found in tropical regions like Australia, Africa, China, Thailand, Myanmar, Philippines, Indonesia, Malaysia, Bangladesh, Sri Lanka. Giloy is an immunomodulatory herbal plant very beneficial for people but due to lack of knowledge about administration related to it will cause harmful effects instead of beneficial effects. Herbal medicine is also known as botanical medicine or phytomedicine. As compared with allopathic medicines, the herbal medicines are more compatible, more effective, and have less side effect properties; they are widely used in now a day. The giloy plant reveals numerous activities. That's why the name is given to the giloy plant NECTOR OF LIFE. One amazing plant in the Menispermaceae family also referred to as the moonseed family is the giloy. It is indigenous to tropical Asia and can survive at elevations as low as 300 metres and as high as 600 metres in subtropical regions. Because of the plant's complex chemical makeup, the whole plant is used in many different medical systems. The large size and smooth, deciduous climbing vines of this plant are its defining features. The roots are fleshy, thread-like, and frequently grow aerially, whereas the stems are succulent. The tiny, greenish-yellow flowers are accompanied by heart-shaped, membranous leaves. The Giloy plant's bark typically has a watery appearance and is gray-brown in colour [2]. *Tinospora cordifolia* is the prime part of the Indian Ayurvedic Medicinal System. In Ayurveda, foods and nutrition are classified in different ways dealing with vegetables. They are subdivided into Fruit, phala shaka, leaves, patra shaka, tubers, kanda shaka. Giloy belongs under vatsadani mentioned in one among the patra shaka. In ancient times, leaves are used as vegetable. Research on

pharmacology is essential to the advancement of traditional medicines, which are essential to the world's medical supply chain. Many chemical components, such as sesquiterpenoids, glycosides, aliphatic compounds, polysaccharides, steroids, and phenolics, are present in traditional medicines like the giloy plant. Many illnesses, including jaundice, urinary tract issues, skin issues, diabetes, anaemia, inflammation, allergies, helminthiasis, heart disease, leprosy, and rheumatoid arthritis, have historically been treated with giloy. Additionally, it has a reputation for boosting the immune system and displaying traits like antiperiodicity and radioprotection. Additional research on the pharmacological properties of conventional medications, such as giloy, could advance the field significantly and result in the creation of novel treatment alternatives [3].

Synonym of *Tinospora Cordifolia* [5]

Menispermum tuberculatum
Menispermum verrucosum
Cocculus villosus
Cocculus crispum
Tinospora tuberculata
Menispermum crispum Linn
Tinospora gibbericaulis Handel-Mazzetti
Tinospora mastersii Diels
Tinospora rumphii Boerlage
Tinospora thorelii Gagnepain
Menispermum rimosum Blanco
Tinospora rumphii
Tinospora crispa

MEDICALLY USED SPECIES OF *TINOSPORA CORDIFOLIA*

Species	Country
<i>Tinospora Crispa</i> Miers	Indo-China
<i>Tinospora Malabarika</i> Miers	Indo-China
Senegal	<i>Tinospora Bakis</i> Miers
Indo-China	<i>Tinospora Cordifolia</i> Miers
Java	<i>Tinospora Rumphii</i> Boerl



MORPHOLOGICAL CHARACTERISTICS [6,7]

• Leaves

Giloy have greenish coloured heart shaped(cordate), membranous and juicy with groovy notch at the base leaves are present. That are resembles betel leaves. The leaves are normally 5–10 cm in size and 7–90 nerved, with the occasional 12 by 10 cm measurement. Their distinctive features include a prominent basal nerve and a cordate shape with broad sinuses. Which is more or less cupidate, microscopical glistening glands are in beneath which is reticulately veined. Leaves are roundish and pulvinate. Lamina are broadly ovate and acute.

• Flower

Flower are yellow in colour and having size less than 2mm. Giloy plant contain two types of flower that are male flower and female flower. The female flowers of this plant stand in solitude, each bearing its own individuality, while the male flowers gather together in axillary racemes, forming clusters that exude a communal and vibrant presence. In summer season flower are grows. It contain petals and sepals. Total 6 sepals are present in which 3 are smaller and 3 are larger. Smaller one are in outer and larger is in inner. Smaller sepals are ovate- oblong and acute. Larger are membranous, concave, broadly elliptical and yellow. Size is 3-4mm. Petals are also 6 having 2mm in size. In young state stamen are claw cunate. Lamina is triquetrous or subtrilobed and reflexed at apex.

• Fruit

Fruits are raddish in colour and rounded in shape. They are present in grouped like grapes and single seeded. In winter season fruits are arises. They are three shortly stalked subglobose, drupes. They become scarlet when ripened. Fruit juice is used in various disease condition like urinary tract infection, liver disease and in heart related issues.

It having detoxification peroperty so used asto remove body toxins and to improve the immunity.

• Stem

Stem is fleshy, grooved and corky which contains branches send to down slender pendulous roots with tuberded pale. Taste is bitter. Stem contains high nutrition and alkaloid contain so it is considered as highly effective. The verse from Charak Samhita states that giloy is known to be a bitter herb. Because it raises insulin levels in the body, it is used to treat diabetes. It is also used to treat gastrointestinal issues. It reduses the constipation, acidity and bloating. Bark is papery and containing large rostte like lenticWhich is Creamy white to gray in colour. Stem having various properties like antimicrobial, anti-inflammatory, amti-oxidant and anti-diabetic activity.

Leaves



Flower



Fruits



Stem



Bark



Fig. 1 Tinospora Cordifolia Plant Parts

Seeds

It is for this reason that the family is called the moonseed family: the embryo and the seeds have a curved shape. The endocarpus is an important taxonomic feature, and it is adorned irregularly. Consuming giloy seeds is a natural, risk-free treatment that has minimal side effects.

- **Roots**

The roots are long and appear to be branching like threads. They are somewhat square, aerial, and have a creamy white colour that turns yellow when

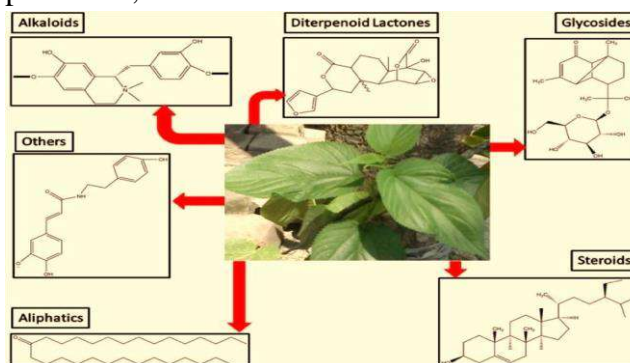
cut. They occasionally extend continuously and come into contact with the ground. Their primary structure, which can range from tetra to pentarch, is what defines them. The cortex consists of a dual-layered composition: an inner zone composed of parenchyma and an outer robust enclosure.

TAXONOMICAL CLASSIFICATION [7, 8]

Kingdom	Plantae – Plants
Subkingdom	Tracheophyta - Vascular plants
Super-Division	Spermatophyta - Seed bearing plants
Division	Magnoliophyta – Flowering
Class	Magnoliopsida – Dicotyledons
Subclass	Polypetalae - Petals are free
Series	Thalamiflorae - Many stamens and flower hypogynous
Family	Menispermaceae - The moonseed family
Order	Ranales
Tribe	Tinosporaceae
Genus	Tinospora

CHEMICAL CONSTITUENTS [9]

The compound known as giloy is made up of a wide range of chemical components, such as furanolactone, tinosporaridine, columbin, tinosporaside, tinosporine, tinosporide, cordifolide, beta-sitosterol, cordifol, hepatacosanol, clerodane furano diterpene and diterpenoid. The leaf of this herb contains proteins, calcium, and phosphorus. Amritoside A, B, C and D are glucosides found in the stem. Giloy contains three types of alkaloids: bitter giloinin, non-glycoside gilosterol, and berberine. The stem also contains choline, tinosporine, magniflorine, palmatine, and tembertarine.



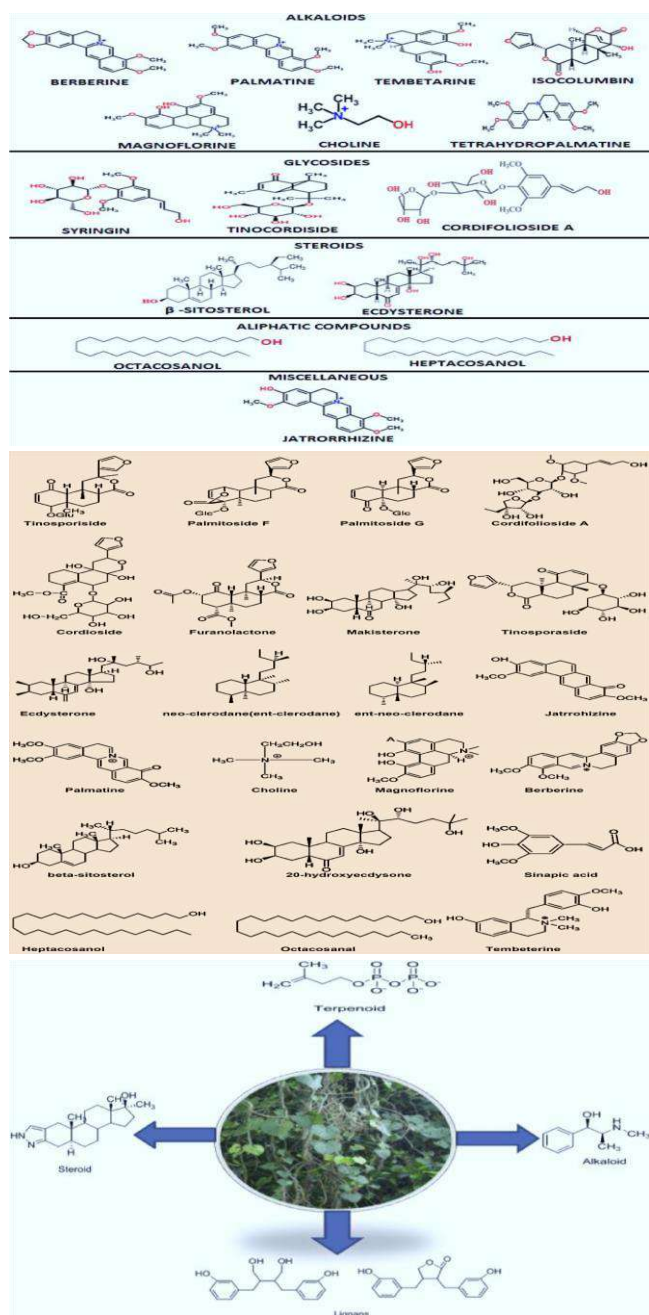


Fig. 2 Chemical Constituents in Giloy

MEDICINAL PROPERTIES

Giloy is used in Ayurvedic medicinal system because of it is a one type of medicinal harbal plant. It having more therapeutical value and used in treatment various disorders like gout , jaundice and tuberculosis. It plays important role in reproductive system , blood and fat. Few of them are used in scientific evidances[10]. The plant giloy, a versatile herb in traditional Ayurvedic medicine, has several medicinal uses. The root of

giloy is a main ingredient in many Ayurvedic formulas that are used to treat fever, dyspepsia, debility, and urinary tract infections. In addition to having an unpleasant taste, it also has the ability to stimulate bile secretion, diuretic effects, burn sensation relief, vomiting relief, allergy relief, quench thirst, blood enrichment, and treat jaundice. In addition, it exhibits anti-hyperglycemic and anti-carcinogenic properties and is applied to cutaneous and respiratory disorders. The antidote for scorpion stings and snakebite is giloy root, which is frequently taken in conjunction with other medications. It also has antineoplastic and antioxidant qualities. Giloy leaves are taken orally in fever cases; usually, they are taken as a juice or decoction with honey. Giloy bark has antileprotic, antispasmodic, antipyretic, and antiallergic properties. Furthermore, research using male albino rats with diabetes has shown that the Giloy root aqueous extract has antioxidant properties. Giloy is also used in neuropharmacological applications, for antidiabetic qualities and for treatment of rheumatoid arthritis [11]. Over the different system giloy shows positive activity. In Ayurveda giloy is one rasayana which used in-toto action. In-toto means overall or whole plant [12].

Active constituents and their therapeutical activity:-[13]

Active Constituents	Source	Therapeutical Activity
Alkaloids	Stem, Root	Anticancer,
Glycosides	Stem	Neurological
Diterpenoid	Whole plant	Antidiabetic
Steroids	Stem Arial parts	Treatment
Aliphatic Compound	Whole plant	disorder like perkinsons
Others	Root	Vasorelaxant, Antiinflammatory, Antimicrobial, Antihypertensive, Antiviral

Immunomodulator

To enhance activity of immune system the methanol, chloroform, n-butane extract of *Tinospora crispa* is demonstrated. In autoimmune diseases or cancer or immunological disorder the *Tinospora cordifolia* is used to enhance the immunity. The anti-inflammatory activity produced by cytokines activation in *T. crispa* extract. This compound *T. crispa* and *T. cordifolia* which enhance the immunological activity which are potent in nature towards the effect on the immune system [14]. G1-4A is a non-microbial TLR4 agonist that is produced by this plant. B-cells and macrophages both have the receptor. G1-4A stimulation of lymphocytes causes macrophages to become activated and B-cells to proliferate. In mice, an increase in the number of T-cells, B-cells and macrophages within the cell population leads to spleen enlargement. Moreover, the heightened synthesis of anti-apoptotic genes supports cell survival [15]. Many substances have been shown to have cytotoxic and immunomodulatory properties. These substances include 11-hydroxymuskatone, cordifolioside A, magnoflorine, N-formylannonian, and cordifolioside A. It has been shown that these organic compounds increase splenocyte production and augment macrophage phagocytic activity to increase nitric oxide production [16].

Hepatic Protective Activity

Tinospora cordifolia treatment significantly improved the hemato-biochemical and clinical outcomes of CCl₄induced hepatopathy in goats in a clinical trial, demonstrating the hepatoprotective qualities of the herb. Furthermore, it has been shown that *Tinospora cordifolia* extract can inactivate hepatitis B and E in vitro; for the surface antigen, this can be done in 48–72 hours [17]. In the ayurvedic medical system, giloy also known as guduchi holds high value as a medicinal herb. The name Amrita denotes its capacity to bestow upon its users longevity, vitality and youthfulness. In

contemporary medicine, characteristics like hepatoprotective effects, adaptogenic qualities, immunomodulatory activities, and anti-fibrotic qualities are well known. The active ingredient in tinosporin is immunosuppression, which it corrects to address the immunosuppression brought on by compromised hepatic function. Kupffer cells are a consequence of liver injury and play a major role in this correction. It seems that *Tinospora cordifolia* modifies the word "clearance" to mean "clearing" or "removal" which has a greater overall impact on Kupffer cell activation and its anti-fibrotic effect. The clearance test most likely relates to the capacity of Kupffer cells to eliminate toxic substances or injured cells from the liver in the context of the study you mentioned. As a result, fibrosis is reduced and liver function is enhanced as *Tinospora cordifolia* appears to improve Kupffer cells' capacity to clear or eliminate these compounds [18].

Neuroprotective Effect

Due to its neuroprotective qualities, *tinospora cordifolia* may be able to avert age-related neurological conditions like Alzheimer's disease. Furthermore, research is being done to find out how *Tinospora cordifolia* affects Parkinson's disease. Neuroinflammation is the main factor causing Parkinson's disease to progress. Native to India and neighboring tropical regions *tinospora cordifolia* belongs to the Menispermaceae family and is characterized as a creeping herb. It has historically been used to treat ailments like fever, pain, inflammation, asthma, epilepsy and cognitive decline. Other advantageous properties of *Tinospora cordifolia* include neuroprotection, metal ion chelation, removal free radical scavenging and increased antioxidant activity [19].

Against AIDS Activity

Tinospora cordifolia suggests potential advantages for people with autoimmune diseases and HIV. Studies on the effects of *Tinospora cordifolia*,



popularly referred to as giloy, in relation to HIV have been carried out. Giloy stimulates the immune system. According to Kalikae et al., the concentration of giloy in the roots boosts HIV-positive patients' immune systems and improves their general health. Haemoglobin levels, polymorphonuclear leukocytes, B lymphocyte and macrophage stimulation, eosinophil count reduction and protein levels are all affected by *Tinospora cordifolia* stem extract. These outcomes greatly enhance *Tinospora cordifolia*'s anti-HIV properties [20].

Wound Healing Activity

Effective wound healing is facilitated by the use of a methanolic extract of *Tinospora cordifolia*. The evidence for this encompasses higher collagen deposition, higher granulation tissue cell tensile strength, a higher percentage of wound contraction and a shorter epithelialization time frame.

Antistress Activity

Tinospora cordifolia has a major impact on stress management and the enhancement of normal brain function. Giloy root has long been utilised for its ability to reduce stress. Research on Giloy's anti-stress effects has concentrated on how the herb affects brain neurotransmitters in stressed rats. Supporting evidence is provided by the results, which show that stress-induced biochemical changes in an experimental rat model specifically, norepinephrine, dopamine and 5-hydroxytryptamine levels normalize. One of the ingredients in a polyherbal formulation is *Tinospora cordifolia*. It has been demonstrated that mice treated with an ethanolic root extract of *Tinospora cordifolia* exhibit higher concentrations of 5-hydroxyindolacetic acid (5-HIAA). This herbal remedy's extract has been used in studies on its antidepressant activity in rat and mouse models [21].

Radio Protective Activity

Tinospora cordifolia is believed to play a crucial role in radioprotection by engaging in various

processes such as scavenging free radicals, preventing lipid peroxidation, blocking calcium channels, enhancing DNA repair and stimulating stem cell proliferation. Using various experimental techniques, a number of the aforementioned traits or activities have been noted in *Tinospora cordifolia*. In experimental animals, studies evaluating radioprotective effectiveness have encompassed examinations of genotoxicity, cell proliferation, hematological parameters and full-body survival [22].

Antifeedant activity

Either the whole plant or a chloroform extract of *Tinospora cordifolia* is utilized to assess its antifeedant activity. A beneficial natural source of anti-feedants is *tinospora cordifolia*. It is active against a number of important field pests of agricultural lepidoptera, such as *Plutella xylostella*, *Spodoptera litura*, *Helicoverpa armigera* and *Earias vittella*. Out of all the extracts that were tested, the hexane extract shows the least amount of anti-feedant activity, whereas the methanolic extract shows a significant amount of activity. *Tinospora cordifolia* is known to produce anti-feedant effects, which are attributed to compounds such as 8-hydroxy columbin, tinosporide, timocordin and columbin [23].

Antioxidant Activity

Tinospora cordifolia, when assessed against various solvents, displayed remarkable antioxidant potential in food systems as well as nutraceutical applications. Methanolic, ethanolic and water extracts exhibited significant antioxidant capabilities and demonstrated activities associated with metal chelation and power reduction [24]. The oral administration of *Tinospora cordifolia* was found, in a study conducted by V. Sivakumar et al., to decrease lipid peroxide and catalase levels in erythrocyte membranes. Moreover, in rats with alloxan-induced diabetes, it reduced the activities of superoxide dismutase and glutathione peroxidase [25]. *Tinospora cordifolia* is effective

in combating free radicals produced by aflatoxicosis. It contains alkaloids such as cholin, tinosporin, isocolumbin, palmatine, tetrahydropalmatine and magnoflorine, which offer protection against aflatoxin-induced nephrotoxicity [26]. In research conducted by Neha Upadhyay and colleagues, the bark ethanol extract of *Tinospora cordifolia* exhibited the highest levels of free ethanol extracts. Additionally, it showcased a higher phenolic content and demonstrated superior efficacy in scavenging free radicals compared to the methanol extract [27]. In a study using N-nitrosodiethylamine (DEN) to induce liver cancer in male Wistar albino rats, the ethanolic extract of *Tinospora cordifolia* (EETC) effectively reversed lipid peroxidation (LPO) levels and restored enzymic and nonenzymic antioxidants to nearly normal levels [28].

Antilarvicidal Activity

When applied to *Spodoptera litura* larvae, the chemical compound cholone cordifolia [1-(2',3',4'-trihydroxyphenyl)-3-(4'-methoxyphenyl)-propen-1-one] demonstrated insect growth regulatory activity [29].

Antitumor Activity

Tinospora cordifolia contains chemical compounds called clerodane diterpenes that are cytotoxic to tumour cells. Much in vitro and in vivo research is currently being done to investigate *Tinospora cordifolia*'s antitumor properties. *Tinospora cordifolia*'s cytotoxicity and capacity to trigger apoptosis, which is the fundamental mechanism of its antitumor activity, are the main subjects of research. The efficacy of epoxy clerodane diterpenes against diethylnitrosamine-induced hepatocellular carcinoma has been regularly investigated. These studies' findings suggest that these diterpenes improve carcinogen metabolic activation blocking and encourage carcinogen detoxification. Alkaloids and other chemical components of the plant have been found

to have remarkable antitumor properties, offering high efficacy, improved tolerance and few side effects, according to recent studies. Rheumatoid arthritis was acknowledged to be treated with *Tinospora cordifolia* and *Zingiber officinale* in single or combination formulations in ancient Indian medicine. Current research findings support the potent activity of fungi toxins against cancer cell lines. Other pharmacological activities of *Tinospora cordifolia* have been observed, and Cordifolio Side A, one of its constituents, has been isolated. *Tinospora cordifolia* or TC has the capacity to exhibit both in vitro cytoprotective properties and in vivo radioprotective effects. IL and GM-CSF1 levels are elevated, apoptosis is decreased, and radiation-induced decreases in cell adhesion and spreading are mitigated. These qualities help explain its remarkable radioprotective effectiveness [30].

Antifertility Activity

The creation of innovative medications that control fertility and are sourced from medicinal plants presents a bright future. *Tinospora cordifolia* commonly known as "Neem-Giloy" is a traditional plant renowned for its multifaceted applications. The root of *Tinospora cordifolia* is utilized in treating diabetes induced by alloxan. As part of the pharmacological screening for the crude drug, the investigation into the methanolic extract of *Tinospora cordifolia* aims to assess its immunomodulatory and potentiating activities. Type-2 diabetes has been treated with a variety of species. Numerous analyses are currently being carried out to investigate the potential antifertility properties of stem extract from *Tinospora cordifolia* [31].

Antimalarial Activity

Plant extracts from *Tinospora cordifolia* have a variety of pharmacological properties, such as lowering blood sugar, depressing the central nervous system, and encouraging muscle relaxation. The plant's roots are especially



abundant in therapeutic qualities. From the Centuries, *Tinospora cordifolia* has been used to treat a number of illnesses, including malaria, coughing and leprosy from the Centuries. It is also used to treat dysentery, relieve indigestion-related stomachaches, treat skin conditions, shrink the spleen and encourage diuresis. In these situations, *Tinospora cordifolia* (TC) decoction is used. TC also called Giloy, is a succulent shrub that climbs smoothly and has broad, ovate leaves with a short, acuminate shape. Its bark is dotted with grey. The fruits are tiny and reddish, resembling peas, and the flowers are sort of green. Starch is found in the roots of *Tinospora cordifolia* and is used to treat dysentery and chronic diarrhoea. A solution of TC and olive oil is used to treat pimples. Furthermore, *Tinospora cordifolia* root powder is used to treat a number of medical conditions, such as ulcers, cough, chronic fever, dyspepsia, general weakness, splenomegaly, piles, leprosy, blood pressure imbalances, hiccups, snake bites, headaches, whooping cough, skin disorders and visceral obstructions. It is also used as a tonic and emetic.

For the preparation of *Tinospora cordifolia* extract following procedure is used

1. Firstly stem of TC wash with distilled water and air dried it.
2. Weighed and then chopped into tiny pieces; the ethanol content was uniform.
3. After filtering, this material is centrifuged for ten minutes at 2000 rpm.
4. The supernatant was dried by air.
5. Plant extract was created using the concentrated solid residue.
6. Weigh the extract and store it at 4 degrees Celsius until needed [32].

Antidiabetic And Hypoglycemic Activity

Tinospora cordifolia, frequently used in the treatment of diabetes mellitus, exhibits various beneficial effects. The aqueous root extract of this plant has been found to lower both brain lipid

levels and blood glucose levels in diabetic rats. Moreover, it encourages increases in total hemoglobin, body weight and hepatic hexokinase activity. In diabetic rats, the root extract of *Tinospora cordifolia* demonstrates hypoglycemic and hyperlipidemic effects, contributing to the reduction of alkaline phosphatase serum acid phosphatase, lactate hepatic glucose-6-phosphatase, dehydrogenase levels. Additionally, the extract aids in preventing and lowering body weight. Alcoholic, chloroform and aqueous leaf extracts of *Tinospora cordifolia* are administered at varying dosages (200, 100 and 50 mg/kg) to normalize body weight and alleviate alloxan-induced diabetic conditions. *Tinospora cordifolia* is a component of the Ayurvedic formulation Transina (TR). Studies on other medications have also shown its hypoglycemic effects and its ability to increase superoxide dismutase activity in pancreatic islet cells [33]. The substances found in Guduchi possess antidiabetic qualities due to components such as saponins, flavonoids, tannins, alkaloids, cardiac glycosides and steroids. They are now useful for both clinical and experimental research because of these qualities. It has been reported that alkaloids derived from Guduchi mediate the actions of insulin in a manner similar to that of insulin [34]. Furthermore, high levels of GSH and other reactive species brought on by gestational diabetes can be dangerous for the mother and the developing foetus. *Tinospora cordifolia*, when given daily to streptozocin induced diabetic pregnant rats, has been shown to have a protective effect by lowering oxidative stress and consequently, the risk of disease and birth defects [35]. Research has indicated that preparations made from guduchi roots can successfully lower brain mediated lipid levels in diabetic rats, which in turn lowers blood sugar and urine glucose levels. This demonstrates the plant's effectiveness in lowering cholesterol and treating diabetes [36]. Moreover, studies on the stem



extract of *T. cordifolia* have demonstrated its antidiabetic effects, which operate via a number of pathways. It stimulates several anti-diabetic processes, such as increased insulin secretion from beta pancreatic cells, decreased glucose synthesis and increased glycogenesis [37].

Anticancer Activity

In animal models, *Tinospora cordifolia* (TC) usually shows anticancer properties. The significant increases in tubular diameter, body weight and tissue weight were caused by the TC root extract, indicating a potential role for the extract in radioprotection. Dichloromethane extract of TC causes a decrease in GST (glutathione-S-transferases), the release of LDH (lactate dehydrogenase) and cytotoxicity, which is linked to lipid peroxidation. The findings show that the root extract dramatically reduces the increase in lipid peroxidation and the drop in GSH (glutathione) levels in the testes brought on by radiation in pre-irradiated mice [38]. Of the eleven ingredients in the proprietary herbal blend, *tinospora cordifolia* accounts for 17–23% and has been developed for cancer treatment. After one month of treatment, a patient with pulmonary epidermoid carcinomas experienced a complete cessation of hemoptysis and chest pain with a daily dosage of 450–480 mg of gelatinous capsules derived from TDS, along with an improvement in appetite. The same formulation worked well as a tumor-static treatment for a patient with third-stage pulmonary epidermoid carcinomas who had previously responded to other therapies [39].

Additionally, it has been demonstrated that the furanolactone diterpenoid columbin has proven to have preventive effects against colon cancer in humans [40]. Octacosanol, an antiangiogenic compound found in this plant, stops cancer from growing and spreading [41].

Activity And Their Extract [42]

Sr.No	Extract	Activity
1	Root extract	Ameliorative Effect

2	Alcohol extract	Cardioprotective effect
3	Aqueous extract	Hepatoprotective activity
4	Stem extract	Hypoglycemic activity
5	Aerial parts or Ethanol extract	Neuroprotective activity
6	Whole plant or Ethanol and aqueous extract	Antiulcer activity
7	Whole plant or Ethanol and aqueous extract	Antidiarrhoeal activity
8	Whole plant	Analgesic activity
9	Aqueous or Ethanol extract	Aphrodisiac property
10	Whole plant	Immunomodulatory activity
11	Stem extract	Antidyslipidemic activity
12		Antifeedant activity
13	Whole plant	Antioxidant activity
14	Stem or Aqueous extract	Antiinflammatory activity
15	Whole plant	Gastroprotective activity
16	Ethanol extract	Nootropic activity
17	Stem extract	Radioprotective activity and Cytoprotective activity

Cardiovascular Activity

Tinospora cordifolia (TC) aqueous and ethanolic extracts show a dose-dependent negative chronotropic and ionotropic effect [43]. Pre-administration of the methanolic extract of TC suggests a reduction in isoprenaline-induced myocardial infarction (MI) based on the current study's findings. TC has the potential to be cardioprotective because of its ability to stabilise the membrane and strengthen the myocardial membrane. Potassium supplementation is used to lower and even prevent cardiac arrhythmias [44]. After exposing heart tissues to various doses of *tinospora cordifolia* in a previous study, an experimental model of cardiac ischemia-reperfusion (I/R) injury demonstrated a dose-

dependent decrease in serum lipid peroxide levels and infarct size [45].

Nootropic Activity

In ayurveda *tinospora cordifolia* is called "Medhya Rasayana" and is used as "Brahma". Traditional medical systems have acknowledged the memory-enhancing benefits of TC. The three key components of memory and learning in Ayurveda are "dhi" (learning), "dhuti" (retention) and "smriti" (recall). This substance has neuropsychopharmacological qualities that help with learning and memory. A randomised, double-blind, placebo-controlled study conducted by Bairy in 2004 demonstrated that verbal learning could be enhanced over a 21-day period by the pure aqueous extract of TC. One important finding is that children's IQ levels have improved and behavioural and mental disorders have moderately decreased [46]. *Tinospora cordifolia* is used as a strong immunosuppressive agent, cognitive enhancer, and treatment for neurodegenerative diseases. One medicine that suppresses the immune system is cyclosporine. Studies using alcoholic and watery extracts of TC have verified its ability to improve rats' memory. In this study, cyclosporine was given following the administration of the alcoholic and aqueous extracts [47].

Anti-inflammatory Activity

Rat studies using carrageenan-induced hind paw edoema revealed that *tinospora cordifolia* decoction was a useful anti-inflammatory in this condition. This study also looked at how TC stem extract affected rat agonist-induced smooth muscle contraction, including histamine, 5-HT, bradykinin, prostaglandins E1, KCL, cholinomimetics and F2alpha. Doses ranging from 100 to 600 micrograms/milligram were administered during the experiment. The antagonistic action of TC was investigated because various autocoids are involved in the pathophysiology of clinical joint inflammation. It

was discovered that *Tinospora cordifolia* enhanced the reaction brought on by NA (nor-adrenaline), and this mechanism may have something to do with TC's ability to block TC uptake or its suppression of COMT (Catechol-Omethyltransferase) metabolism. Monoamine oxidase, or MAO is thought to be responsible for the 5-HT response's potentiation [48]. The water soluble stem extract of *tinospora cordifolia* has shown antiinflammatory properties in albino rats. It dramatically decreased the acute inflammatory response brought on by intraperitoneal carrageenin when taken orally [49]. Siddalingappa C. M. and colleagues carried out the study. *Tinospora cordifolia* administration at doses after 30-, 60- and 90-minutes results in a significant increase in the pain threshold (reaction time). The doses that were used were 100 mg/kg, 200 mg/kg and 100 mg/kg plus 5 mg/kg of diclofenac. Using the same doses as previously mentioned, *Tinospora cordifolia* showed a reduction in paw edoema after three hours of 32.63%, 36.63% and 40.5% [50].

Antipyretic Action

Due to its anti-inflammatory properties, *Tinospora cordifolia*, also referred to as Guduchi, is used to treat fever, inflammation, edoema caused by carrageenan and pain. Its ability to inhibit the production of proinflammatory cytokines, like tumour necrosis factor-alpha (TNF- α), explains why it functions so well as an antiinflammatory. Furthermore, *Tinospora cordifolia* analgesic effects are implied by the way it acts on the central and peripheral nervous systems. It also exhibits fever-fighting antipyretic properties. The anticancer medication cyclophosphamide is known to increase the proinflammatory cytokine TNF-alpha while downregulating the cytokines IL-2 and interferon-gamma. Remarkably, *Tinospora cordifolia* treatment has been demonstrated to effectively counteract this effect, resulting in a more advantageous cytokine profile [51].



Allergic Rhinitis Activity

A combination's antihistaminic and anti-inflammatory qualities were investigated in in-vitro experiments and the findings indicated that the combination is just as effective as cetirizine. Additionally, this study showed a significant decrease in all allergic rhinitis symptoms. Correlations between these results and clinical findings, such as leukocyte count and nasal smear cytology, were discovered. Additionally, the study found that *Tinospora cordifolia* was well tolerated [52].

Anti-Toxin activity

Tinospora cordifolia modulates different hormone and mineral levels, exhibiting a protective effect. Cyclophosphamide, an anticancer medication, is reported to reduce glutathione levels in the bladder and liver. This reduction leads to decreased levels of pro-inflammatory cytokines such as IL-2, TNF-Alpha and increased levels of interferon. It has been demonstrated that *Tinospora cordifolia* can reverse this effect, suggesting that the plant may be able to offset the toxic effects of cyclophosphamide used in cancer treatment [53]. Exposure of Swiss albino mice to lead nitrate results in a reduction in the number of erythrocytes and leukocytes in blood serum. In these circumstances, *Tinospora cordifolia* leaf and stem extract is used to lessen or reverse the effects of lead-induced haematological toxicity [54]. Concurrent administration of *tinospora cordifolia* crude powder, alongside the gold standard drug for treating Parkinson's disease. L-DOPA, has demonstrated protection of dopaminergic neurons in comparison to the sham-operated control group. Nevertheless, despite L-DOPA's status as the gold standard, several investigations have indicated its potential to cause degeneration in the surviving dopaminergic neurons of the central nervous system [55].

Anti-microbial Activity

Studies have demonstrated the potent antibacterial properties of silver nanoparticles, which are generated in the stem of *Tinospora cordifolia*, against *Pseudomonas aeruginosa*. *Pseudomonas aeruginosa* is commonly found in burn injury patients [56]. *Tincturia cordifolia* extract has been tested against a wide range of bacterial strains, including *E. coli*, *Pseudomonas*, *Salmonella typhi*, *Klebsiella pneumoniae* and others. These tests outcomes show that it has the power to prevent these bacteria from growing. The results of this experiment demonstrate *Tinospora cordifolia*'s potency as an antibacterial agent [57]. Additionally, it has been shown that *Tinospora cordifolia* stem extract is effective against *Bacillus subtilis* and *Enterococcus faecalis*. Moreover, it demonstrates antifungal activity against fungi such as *Trichophyton rubrum* and *simii* [58]. Granulocyte activity is increased in bovine models to induce mammary inflammation. *Tinospora cordifolia* hydroalcoholic extract is used in these kinds of situations. Further, *Tinospora cordifolia* functions as an antimicrobial agent in mastitis cases, which are brought on by *Staphylococcus aureus* infection [59]. *Tinospora cordifolia* stem and leaf extracts exhibit the highest inhibitory activity against clinical urinary pathogens, including *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*. Urinary tract infections can be prevented by applying this extract [60]. Carbapenemase enzymes catalyse the hydrolysis of beta-lactam antibiotics, resulting in the antibiotics ineffectiveness. Thus, *Tinospora cordifolia* exhibits a much higher inhibition rate than the reference microbial strain when tested against bacteria that produce carbapenemase enzymes and penicillinase-resistant beta-lactam antibiotics [61]. *Tinospora cordifolia* evaluates the microbial infectivity of the plant and inhibits the development of antibiotic resistance by urinary pathogens [62].

Anti-Osteoporotic Activity

In both human and rat models, *Tinospora cordifolia*'s alcoholic extract can enhance the osteoblast cells' degree of proliferation and differentiation. It also has anti-osteoporotic qualities. These bone-forming cells are in charge of preserving bone mineralization, which is sometimes referred to as the calcification process and is made possible by *Tinospora cordifolia* [63]. *Tinospora cordifolia* is known to yield beta-ecdysone (Ecd) or 20-hydroxyecdysone as steroids. By promoting muscle tissue development in a mouse model using mesenchymal stem cells, these steroids can effectively lower the incidence of osteoporosis [64].

Aphrodisiac Activity

Stem extracts from *Tinospora cordifolia*, both hydroalcoholic and aqueous, were utilised to analyse steroids, gums, sugars, glycosides, alkaloids, mucilage, fats and saponins. At lower concentrations, the aphrodisiac properties of the aqueous and hydroalcoholic extracts of *Tinospora cordifolia* stem (400 mg/kg body weight and 200 mg/kg body weight, respectively) are observed. The highest aphrodisiac activity in male Wistar albino rats was observed at 400 mg/kg body weight [65].

Hypolipidemic Activity

An aqueous extract from the roots, at doses of 2.5 and 5.0 g/kg body weight, demonstrated hypolipidemic effects in the sixth week of the rats lives. In rats with diabetes brought on by alloxan, this led to a decrease in serum phospholipids, free fatty acids and tissue cholesterol. The strongest hypolipidemic effect was observed at a dosage of 5.0 g/kg body weight from the root extract. Reduced serum lipid levels reduce the risk of vascular diseases, but elevated serum lipid levels in diabetes are suggestive of coronary heart disease. There has never been any prior research on *Tinospora cordifolia* root extract's capacity to reduce tissue or serum lipid levels in diabetic mice [66].

Radiation Therapy

A study that was published in "EvidenceBased Complementary and Alternative Medicine" suggests that giloy may help mitigate the side effects of radiation therapy. The detrimental effects of radiation therapy on male testicles were investigated in this study, which employed adult male mice as subjects. Compared to mice that did not receive giloy treatment, male mice that received both giloy treatment and radiation exposure exhibited fewer side effects and fewer testicular lesions. Evidence from this study suggests that giloy may help men receiving radiation therapy avoid infertility and related issues [67].

Ulcer Protective Activity

The antiulcer properties of ethanol extracts made from *Tinospora cordifolia* roots were assessed, and it was discovered that these extracts significantly provided protection. Comparable to the effects of diazepam, they were successful in preventing the formation of ulcers caused by an 8-hour restraint stress [68].

Against Dengue Activity

It has been demonstrated that the dengue treatment capsule made with Giloy is effective. Within the field of Ayurvedic medicine, it is very advantageous [69].

Effect On Memory

Furthermore, it has been shown that *Tinospora cordifolia* mitigates the memory deficits caused by cyclosporine and enhances learning and memory in healthy rats. Both the alcoholic and aqueous extracts of *Tinospora cordifolia* showed improvements in learning and memory, as evidenced by increased learning scores and improved memory retention in the Hebb-Williams maze [70].

Use In Parkinson's Disease

In light of parkinsonism, the precise *Tinospora cordifolia* concentration reported by Birla et al. is highly appealing. Using 1-methyl-4-phenyl-



1,2,3,6-tetrahydropyridine (MPTP) intoxicated parkinsonian mouse models, they saw the anti-inflammatory effects of watery concentrate. The objective behavioural abnormalities in MPTP-intoxicated mice were reversed by treatment, and the findings indicated that *Tinospora cordifolia* protected dopaminergic neurons in MPTP-induced parkinsonism by reversing neuroinflammation [71].

Anti-Anxiety Action

Clinical assessments revealed that patients' cognitive capacities improved after using preparations containing *Tinospora cordifolia*. This herbal remedy is believed to enhance cognitive functions like memory, recall and is used as a brain tonic in ayurvedic medicine. Sarma et al. discovered that, in contrast to the typical dosage of 2.5 mg/kg of diazepam, a 100 mg/kg ethanolic extract of *Tinospora cordifolia* exhibits strong anxiolytic effects [72].

CONCLUSION

A multipurpose plant is a valuable resource for a wide variety of organisms. Glycosides, alkaloids, lactones and steroids are a few of the active ingredients in plant extracts. More investigation is needed to comprehend how these active ingredients impact the connections between the structure and function of living systems. *Amrita*, or *Tinospora cordifolia*, is a well known plant, especially in traditional medicine. Among the pharmacological species that are used for commercial purposes, it is one of the most commonly used substances. They have several of health advantages like antioxidant, hepatoprotective, antimicrobial, antipyretics, antihyperlipidemic, cardiovascular, neuroprotective, antianxiety, analgesic, antidiarrheal, anti-stress and antihyperglycemic properties. Clinical experiments and biological research on *Tinospora cordifolia* point to the plant's low risk of adverse effects and great medicinal efficacy. Commercially significant as a

health supplement and a stockpile for possible medication development in serious illnesses where present treatment have limited therapeutical potential. To support its therapeutic usage and acceptance, more clinical trial should be undertaken using current understanding. *Tinospora cordifolia* is also said to have benefits when combined with other substances, rather than just being used alone. For the improvement of human wellbeing, its effects are seen when combined with other botanicals or medications.

REFERENCES

1. Shuddhi Ayurveda, "Giloy-a review", International Journal of current Research, Vol.13, Issue 01, January2021, Page no.15779-15785.
2. Dr.Dattu D. Karande, "Giloy (*Tinospora cordifolia*)-a review for its hepatoprotective effects, safety profile and terms and conditions for medicinal use", Journal of Emerging technologies and Innovative research, Vol.8, Issue 10, October-2021, Page no.b271-b276.
3. Priyanka sharma, Bharat P. Dwivedee, Dheeraj Bisht, Ashutosh K. Dash, Deepak kumar, "The chemical constituents and diverse pharmacological importance of *Tinospora cordifolia*", Heliyon, Vol.5, Issue 9, September -2019.
4. Technial Dossier on Guduchi (*Tinospora Cordifolia*), Ministry of ayush, Government of India, New Delhi, 2022.
5. *Tinospora Cordifolia (Giloy)* for socioeconomic empowerment NMPB Ministry of AYUSH Sponsered, Govt. College of pharmacy, Amravati-Maharashtra India, 2020.
6. Manoj kumar Sarangi, Shasank Soni, "A Review on Giloy- The Magic Herb", Inventi Rapid:Planta activa, Vol.2013, Issue 2, March-2013, Page no.1-4.



7. Ratnesh Singh, "A Review Artical on Phytochemistry and pharmacological Activity of *Tinospora Cordifolia*", *International Journal of Pharmacy And Pharmaceutical Research Human Journal*, Vol.19, Issue 1, August-2020, Page no.253-274.
8. Kavya B, Kavya N, Ramarao V and Venkateshwarlu G, " *Tinospora cordifolia* (Willd.) Miers: Nutritional Ethnomedical and Therapeutic utility, *International Journal of Research Ayurveda Phrama*, Vol.6, Issue 2, March-April-2015, Page no.195-198.
9. C. Bharathi, A. Harinatha Reddy, G. Nageswari, B. Sri Lakshmi, M. Soumya, D.S.Vanisri, B. Venkatappa, "A Review on Medicinal Properties of *Tinospora Cordifolia*", *International Journal Of Scientific Research and Review*, Vol.7, Issue 12, 2018, Page no.585.
10. Rakesh Maurya and Sukhdev S handa, "Phytochemistry", Vol.49, Issue 1343, 1998.
11. Amandeep Singh, Nisha A Bhatt, Abhineskar Sagar, Amartya Kumar, Abhay Goswami, "Medicinal Uses of Giloy: A Review", *European Journal of Molecular and Clinical Medicine*, Vol.08, Issue 04, 2021.
12. Tiwari M, Dwivedi UN, Kakkar P., "Tinospora cordifolia Extract Modulates COX-2, iNOS, ICAM-1, Pro-inflammatory cytokines and redox status in murine model of asthma", *J Ethnopharmacol*, Vol.153, Issue 2, 2014, Page no.326-337.
13. Charu Saxena, Geeta Rawat, " *Tinospora Cordifoia* (Giloy)- Therapeutic uses and Impartance:A review", *Current Research in Pharmaceutical Sciences*, Vol.09, Issue 03, 2019, Page no.42-45.
14. Patel Nidhi, Ptel Swati, Krishnakumurti R, "Indian *Tinospora* Species: Ntural Immunomodulator and therapeutic agents", *Internatinal journal of pharmaceutical biological and chemical sciences*, Vol.2, Issue 2, April-Jun 2013, Page no.1-9.
15. Raghu R, Sharma D, Ramakrishnan R, Khanam S, Chintalwar GJ, Sainis KB, "Mlecular envents in the activation of B-cells and macrphages by a non-microbial TLR4 agonist G1-4A from *Tinospora Cordifolia*, *Immunol Lett*, Vol.123, Issue 1, 2009, Page no.60-71.
16. Sharma P, Parmar J, Sharma P, Verma P, Goyal Pk, "Radiation Induced testicular injury and its amelioration by *Tinospora Cordifolia* (An indian medicinal Plant) extract, *Evidence based comp altern Meb*, 2012, Page no.643-647.
17. Md. Moniruzzaman Khan, M. Sa'dul Haque, Md. Saiful Islam Chowdhury, "Medicinal use of the unique plant *Tinospora cordifolia*: Evidence from the traditional medicinal and recent research", *Asian Journal if medical and Biological Research*, Vol.2, Issue 4 , 2016, Page no.508-512.
18. Giby Abraham, " We want to protecting have used in Ayurveda", *Global J Res. Med. Plants and Indigen. Med.* Vol.3, Issue 7, July 2014, Page no.303-311.
19. Hareram Birla, Surya Pratap Singh, "Neuroprotective role of medicinal herbs (*Tinospora Cordifolia*) in the parkinson disease", *general of biological engineering research and review*, Vol.4, Jan-June 2017, Page no.31.
20. Kalikaer, M.V., Thawani, V.R., Varadpande, U.K., Santakke, S.D., Singh, R.P., Khiyani, R.K., "Immunomodulatory effect of *Tinospora Cordifolia* Extracts in HIV Positive Patients" , *Indian Journal of pharmacology*, Vol.40, Page no.107-110.
21. Amarjeet Singh, Bimlesh Kumar, "Comparative antidiarrheal and antiulcer effect on the aqueous and ethanolic stem bark extract of *Tinospora Cordifolia* in rats, *journal*

- of Advanced pharmaceutical technology and research, Vol.5, Issue 3, Jun-Sep 2014, Page no.122-126.
22. Harish Chandra Goyal, Madhubala, Paban K Agrawal, Ruchi Dogra, "Radioprotective Potential of herbal extract of *Tinospora Cordifolia*, Journal of radiation Research, Vol.45, Issue 57-64, 2004, Page no.122-126.
 23. Sowjanya Kattupali, Spandana Uppuluri, vaishnavi Vesta, "The multi activity herbaceous vine-*Tinospora Cordifolia*", Asian Journal of pharmaceutical and clinical research, Vol.12, Issue 3, 2019, Page no.1-4.
 24. Bhawya D, Anilakumar KR, "In-vitro Antioxidant Potency of *Tinospora Cordifolia* (Gulancha) in Sequential Extract", International Journal of Pharmaceutical and biological Archives, Vol.1, Issue 5, 2010, Page no.448-456.
 25. Sivakumar V, Rajan MS, "Antioxidant Effect of *Tinospora Cordifolia* extract in Alloxan-Induced diabetic rats", Indian J Pharm Sci, Vol. 72, Issue 6, 2010, Page no.795-800.
 26. Gupta R, Shrama V, "Ameliorative Effect of *Tinospora Cordifolia* Root Extract on Histopathological and Biochemical changes induced by Aflatoxin-b(1) in mice kidney", Toxicol Int, Vol.18, Issue 2, 2011, Page no.94-98.
 27. Neha Upadhyay, Showkat A Ganie, Rajneesh K Agnihotri, Rajendra Sharma, "Free Radical Scavenging activity of *Tinospora Cordifolia* (Willd.) Miers", Journal of Pharmacognocoy and Phytochemistry, Vol.3, Issue 2, 2014, Page no.63-69.
 28. Jayaparkash R, Ramesh V, Sasikala C, "Antioxidant Activity of ethanolic extract of *Tinospora Cordifolia* on N-nitrosodiethylamine (diethylnitrosamine) induced liver cancer in male winster albino rats", J. Pharm Bioall Sci, Vol.7, 2015, Page no.40-50.
 29. Shakil NA, Saxena DB, "Isolation and sturcture of *Tinospora Cordifolin*, a novel insecticidal oxygenated chalcone, from the stem of *Tinospora Cordifolia* Miers", Natural Product Communications, Vol.1, 2006, Page no.553-556.
 30. Deepika Singh, Prabir Ke chaudhari, "Chemistry and pharmacology of *tinospora cordifolia*" Natural Product communication, Vol.12, 2001, Page no.299-308.
 31. RS Gupta, Rakhi Sharma, "A Review on medicinal plants exhibiting antifertility activity in males", Natural Product radiance, Vol.5, Issue 5, 2006, Page no.389-410.
 32. Vikram Singh, H. S. Banyal, "Antimalarial effect of *Tinospora Cordifolia* (Willd.) Hook. F. and THOMS and *Cissampelos pareira* L. On Plasmodium Berghei", Current Science, Vol.101, Issue 10, Nov 2011, Page no.1356-1358.
 33. S.K. Dwivedi, Enespa, "Hillsborough *Cordifolia* with reference to biological and microbial properties", International Journal of Current Microbiology and Applied Sciences, Vol.5, 2016, Page no.446-465.
 34. Patel MB, Mishra S, "Hypoglycemic activity of alkaloidal fraction of *Tinospora Cordifolia*", Phytomedicine, Vol.18, Issue 12, 2011, Page no.1045-1052.
 35. Shivananjappa MM, "Abrogation Of maternal and fetal oxidative stress in the streptozotocin-induced diabetic rat by dietary supplements of *tinospora corddifolia*", Nutrition, Vol.28, Issue 5, 2012, Page no.581587.
 36. Stanely P, Prince M, Menon VP, "Hypoglycemic and other related actions of *Tinospora cordifolia* roots in alloxan-induced diabetic rats", J Ethnopharmacol, Vol.70, Issue 1, 2000, Page no.9-15.
 37. Sangeetha MK, Raghavendran HR, Gayathri V, Vasanthi HR, " *Tinospora Cordifolia* attenuates oxidative stress and distorted

- carbohydrate metabolism in experimentally induced type 2 diabetes in rats”, *J Nat Med*, Vol.65, Issue 3-4, 2011, Page no.544-550.
38. Syed Ismail Jabiullah, Jainendra Kumar battineni, Vasudha Bakshi, Narender Boggula, “*Tinospora Cordifolia* a medicinal plant: A Review”, *Journal of Medicinal Plants Studies*, Vol.6, Issue 6, 2018, Page no.226-230.
39. Yoggeta, Deepika Bhatia, Sheetal Rani, “*Tinospora Cordifolia*: A Literature Review on therapeutic uses and pharmacological actions”, *Journal of Pharmaceutical Research International*, Vol.33, Issue 57A, 2021, Page no.330-343.
40. Kohno H, maeda M, Tanino M, Tsukio Y, Ueda N, Wada K, Mori H, Tanaka T, “A Bitter diterpenoid furanolactone columbin from *calumbae radix* inhibits azoxymethane-induced rat colon carcinogenesis”, *Cancer Letters*, Vol.183, 2002, Page no.131-139.
41. Thippeswamy G, Sheela ML, Salimath BP, “Octacosanol isolated from *Tinospora Cordifolia* Downregulates VEGF gene expression by inhibiting nuclear translocation of NF- κ B and its DNA binding activity”, *Eur J Pharmacol*, Vol.588, Issue 2, 2008, Page no.141-150.
42. Deepika Singh, Prabir K Chaudhari, “Chemistry and pharmacology of *Tinospora cordifolia*”, *Natural Product Communications*, Vol.12, 2017, Page no.299-308.
43. Pal Neha, Maya Datt Joshi, Yashwant Singh, Narendra Paratap Singh, “Review article of *tinospora cordifolia*”, *World general of Pharmaceutical Research*, Vol.9, Issue 2, Page no. 604-620.
44. Vijaya Nirmala R., Abhinaya R., “Any effect of cardioprotective activity in various medicinal plants: A Review”, *International Journal of current pharmaceutical research*, Vol.11, Issue 2, 2019, Page no.2-3.
45. Pritika Devi, “Role of *Tinospora Cordifolia* in metabolic health disorders: An updated review”, *Himalayan Journal of Health Science*, Vol.6, Issue 1, 2021, Page no.6-14.
46. Madhav Mutalik, Mutalik Maitreyee, “*Tinospora Cordifolia*: role in depression, cognition and memory”, *Australian journal of medicinal herbalism*, Vol.23, Issue 4, 2011, Page no.168-171.
47. Yanshi Rahal, Anshu Rahal, “*Giloy (Tinospora Cordifolia)*: A medicinal herb for livestock and poultry”, *International Journal of current Advanced Research*, Vol.8, Issue 04, April-2019, Page no.18523-18526.
48. Suman PS Khanuja, “*Tinospora Cordifolia (Guduchi)*: A reservoir plant for the therapeutical application: A Review article”, *Indian Journal of traditional knowledge*, Vol.3, Issue 3, August 2004, Page no.251-267.
49. Pendse VK, Dadhich AP, Mathur PN, Bal MS, Madam BR, “Anti-inflammatory, immunosuppressive and some related Pharmacological actions of the water extract of neem giloy (*Tinspora cordifolia*)- A preliminary report”, *Indian J Pharm*, Vol.9, 1977, Page no.221-224.
50. Siddalingappa C M, Rajesh T, Kudagi B L, krishnakanth K, Sujit T R, “Evaluation of Analgesic and Antiinflammatory activities of *tinospora cordifolia*”, *International Journal of Basic medical Science*, Vol.3, Issue 5, 2012.
51. Muhammad Saeed, Muhammad Naveed, Ihsanullah kakar, Ifayat Ullah, Fawwad Ahmad, Muhammad
52. Sharif, Asif Javaid, Mubasher Rauf, Moamed E., Abd El-Hack, Mervat A., Abdel-Latif, YY, Sun Chao, “Using *Guduchi (Tinospora cordifolia)* as an eco-friendly feed supplement

- in human and poultry nutrition” , Poultry Science, 2020, Page no.801-809.
53. Sumit Sharma, “Unproven/Alternative methods for treating allergic rhinitis”, Global general of otolaryngology, Vol.3, Issue 1, Jan-2017, Page no.08-09.
54. Hamsa T P, Kuttan G, “Tinospora cordifolia ameliorates urotoxic effect of cyclophosphamide by modulating GSH and Cytokine levels”, Exp Toxicol pathol, Vol.64, Issue 4, 2012, page no.307-314.
55. Sharma V, Pandey D, “Protective role of tinospora cordifolia against lead-induced hepatotoxicity”, Toxicol International, Vol.17, Issue 1, 2010, Page no.12.
56. Shanish Antony A, Partha Deb Roy, Vadivelan R, Jaysankar K, Vikram M, Nandini S, Sundeep M, Elango
57. K, Suresh B, “Amelioration of CNS toxicities of L-Dopa in experimental models of parkinson’s disease by concurrent treatment with tinospora cordifolia” , Hygeia J D Med, Vol.2, Issue 1, 2010, Page no.28-37.
58. Singh K, Panghal M, Kadyan S, Chaudhary U, Yadav JP, “Antibacterial activity of synthesized silver nanoparticles from Tinospora Cordifolia against multidrug resistant strains of Pseudomonas aeruginosa isolated from burn patients” , J Nanomed Nanotechnol, Vol.5, Issue 2, 2014, Page no.1-6.
59. Jayachandran R, Xavier TF, Anand SP, “Antibacterial activity of stem extracts of Tinospora cordifolia (Willd.) Hook. F and Thomson” , Ancient Sci Life, Vol.23, Issue 1, 2003, Page no.40-43.
60. Duraipandiyan V, Ignacimuthu S, Balakrishna K, AL-Harbi NA, “Antimicrobial activity of Tinospora cordifolia: an ethno medicinal plant”, Asian J Tradit Med., Vol.7, Issue 2, 2012, Page no.59-65.
61. Purandare H, Supe A, “Immunomodulatory role of tinospora cordifolia as an adjuvant in surgical treatment of diabetic foot ulcers: A prospective randomized controlled study”, Indian J Med Sci., Vol.61, Issue 6, 2007, Page no.347-355.
62. Shanthi V, Nelson R, “Antibacterial activity of tinospora cordifolia (Willd) Hook F Thoms on urinary tract pathogens”, Int J Curr Microbial app Sci., Vol.2, Issue 6, 2013, Page no.190-400.
63. Bonvicini F, Mandrone M, Antognoni F, Poli F, Angela Gentilomi G, “Ethanol extracts of Tinospora Cordifolia and Alstonia scholaris show antimicrobial activity towards clinical isoaltes of methicillin-resistant and carbapenemase producing bacteria” , Nat Prod Res., Vol.28, Issue 18, 2014, Page no.1438-1445.
64. Narayanan A, Raja S, Ponmurugan K, Kandekar S, Natarajaseenivasan K, Maripandi A, et al , “Antibacterial activity of selected medicinal plants against multiple antibiotic resistant uropathogens: a study from kolli hills, Tamil nadu” , Indian Benef Microbes, Vol.2, Issue 3, 2011, Page no.235-243.
65. Abiramasundari G, Sumalatha KR, Sreepriya M, “Effects of Tinospora cordifolia (Menispermaceae) on the proliferation, osteogenic differentiation and mineralization of osteoblast model systems in vitro” , J Ethnopharmacol, Vol.141, Issue 1, 2012, Page no.474-480.
66. Kapur P, Wuttke W, Jarry H, Seidlova-Wuttke D, “Beneficial effects of Beta-Ecdysone on the joint epiphyseal cartilage tissue and trabecular bone in ovariectomized rats”, Phytomedicine, Vol.17, Issue 5, 2010, Page no.350-500.
67. J. A. Wani, R. N. Achur, R. K. Nema, “Phytochemical Screening and aphordisiac activity of asparagus racemosus”,

- International Journal of Pharmaceutical Science and Drug Research, Vol.3, 2011, Page no.112115.
68. P. P. M. Stanely, V. P. Menon, G. Gunasekharam, "Hypolipidaemic action of *Tinospora cordifolia* roots in alloxan induced diabetic rats" , *J. Ethnopharmacol*, Vol.64, 1999, Page no.53-57.
69. Priyanka Sharma, Jyoti Parmar, Priyanka Sharma, Preeti Verma, P K Goyal, "Radiation-induced Testicular injury and its amelioration by *Tinospora cordifolia* (An Indian Medicinal Plant) Extract evidence based complementary and alternative medicine", Vol.2011, 2011, Page no.1-9.
70. D N K Sarma, R L Khosa, J P N Chansauria, M Sahai, "Antiulcer activity of *Tinospora cordifolia* Miers and *Centella asiatica* Linn extracts", *Phytotherapy Research*, Vol.9, Issue 8, 1995, Page no.589-590.
71. Herbal Remedies for Dengue, Planet ayurveda – Holistic healing through herbs.
72. Avnish K Upadhyay, Kaushal Kumar, Arvind Kumar, Hari S Mishra, "Tinospora cordifolia (Willd.) Hook. F. and Thoms (Guduchi)- validation of the ayurvedic pharmacology through experimental and clinical studies" , *Int J Ayurveda Res.*, Vol.1, Issue 2, Apr-Jun 2010, Page no.112-121.
73. Birla H Rai, S. N. Singh, S. S. Zahra, W. Rawat, A. Tiwari, N. Singh, R. K. Pathak A., Singh S. P., "Tinospora Cordifolia suppresses Neuroinflammation in Parkinsonian Mouse Model" , *Neuromolecular Medicine*, Vol.21, 2019, Page no.42-53.
74. Baghel P, "Plant of versatile Properties of *Tinospora cordifolia* (Guduchi)" , *International Journal of Agriculture Innovations and Research*, Vol.5, 2017, Page no.751-753.

HOW TO CITE: Shital Devkar*, Suvarna Deshmukh, Sourabh Patil, Shreeyash Koli, Prachi Khochage, Nilesh Chougule, All Rounder Of Ayurveda-Tinospora Cordifolia, *Int. J. in Pharm. Sci.*, 2023, Vol 1, Issue 12, 580-598. <https://doi.org/10.5281/zenodo.10423831>

