



A Review on Medicinal Properties of *Tinospora cordifolia* (Giloy)-The Magic Herb

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Review Article

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ABSTRACT

Since the advent of human civilization, plants have been rich sources of medications. A survey of constituent compounds present in *Tinospora cordifolia* and their pharmacological activities is discussed in this paper, since there has been a developing interest for plant based drugs, wellbeing items, drugs, foods supplements, makeup and so on in the present era. *Tinospora cordifolia* is a standard restorative plant which is used in a couple of standard meds to fix various contaminations. It is regularly known by the names *Amrita* and *Guduchi* and falls in the group *Menispermaceae*. It has been used in the treatment of a lot of illnesses like skin sickness infection, diabetes, fever, urinary issue, and diarrhea and is viewed as one of the most fundamental herbal plant in the *Indian system of medicines (ISM)*. An attempt is made in the current review to explore the pharmacological & phytochemistry effectiveness of *T.cordifolia*.

Keywords: *Giloy; diabetes; guduchi; therapeutic; Tinospora cordifolia; medicinal.*

1. INTRODUCTION

Homegrown medicine probably addresses the main areas of customary medicine everywhere in the world. In order to promote the use of natural

medicines and determine their appearance as hotspots for new medicines, it is essential to study therapeutic plants in a way that enhances the infamy of parables [1]. Long time. Conventional types of drugs exist and are still

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present in many countries of the world that recall India's sub-mainland countries such as India, Pakistan and Bangladesh [2]. The work shows that the restoration and utilization of plants is about as old as 4000-5000 BC. In addition, the Chinese were the first to use normal natural placement as a medicine [3].

India is rich in biodiversity of restorative plants. Among them, *Tinospora cordifolia* has a wide range of bioactivity criteria, as evidenced by the importance of recovery, but has not yet been widely and logically considered [4,5]. Healing plants have been used as natural medicine. This practice has existed since prehistoric times.

Our motherland is rich in biodiversity of restored plants. Among them, *Tinospora cordifolia* has a wide range of bioactivity criteria, as evidenced by the importance of recovery, but has not yet been widely and logically considered [4,5]. Therapeutic plants have been used as a natural medicine. This practice has existed since ancient times.

Guduchi (Tinosporacordifolia) is one of the most widely used and undisputed spices in Ayurvedic medicine. There is a place where there is a parsnip branch. The World Health Organization (WHO) revealed that 80% of residents mainly rely on traditional medicines, such as removing plants and using their dynamic ingredients [6]. It contains *berberine*, *cassia gum* and bitterness. It appears as an acyclic, alternative, diuretic. The water-like concentrate of this plant is used as an antipyretic and is called "*Indian Quinine*". Implantation from the roots and stems is an important energy source for disease weakness, indigestion and intermittent fever [7].

1.1 Morphology of Plant

Tinospora cordifolia is a fascinating, blissful, treed mountaineering shrub near India. It thrives well in the tropics, consistently achieves amazing height, and climbs tremendous wood capacity plots. The stems are slightly smooth white, spirally isolated in the vertical direction, and the space between them is dotted with huge rosettes such as lenticels. Wood is white, fragile, and porous, and recently cut surfaces expect a yellow shade when exposed to air. The leaves are transparent, substituting, prescriptive, long petioles, live chordates, and good-looking multi-layered reticular veins. A long thread like a root in the air comes out of the branch. The flowers are almost empty and unilateral. Men's flowers are gathered and women's flowers are single.

The six sepals organized in two spirals are oval and membranous. All regular items are red, with a thick tail with various nuclei, sub-terminal style scars, and a red tint [8,9].

1.2 Everyday Names

Guduchi (Tinosporacordifolia) is classified "*gurcha, giloe, gulancha*" in Hindi, "*guduchi, amrita, somavalli*" in Sanskrit, and "*gula-vel*" in Marathi. It is notable. "*Grancha*" in Bengali, "*seendal*" in Tamil, and "*gilo*" in Urdu [7]. Plant *Tinosporacordifolia* (Wild.) Miers ex Hook. F. also, Thomas. It is called *Guduchi* in light of the fact that it shields the body from disease. It's anything but a rope-like (tantra) perpetual climber (*Amta, AmurtaValari*), moving in a round design (*Kundari, Mandari*). It is delivered from the stem (*Kandodhbhava*) and recuperated in the wake of cutting (*Chinnaruha*).

A roundabout design can be seen at the crossing point of the stem (*Cakralaksanika*). Its leaves appear to be loaded with nectar (*Maduparni*) and can be eaten by calves (*Vazzadani*). The seed is *Chandrasahsa*, which is the reason of the name of repression.

Guduchi is an amazing medication that helps fever (*Jvarnasini*) and the well known *Rasayana (Jivanti, Dhara, Rasayana, Vayastha, Vayasya)*. It improves strength and significance (*Soma*), checks for poisonous substances (*Visagni*), and forestalls disarray (*Guduchi, Vasaria*) [10].

1.3 Traditional References

At VEDA, *SounakiyaAtharvaveda* and *Panini UpadhiBhojavrttaSayana* showed that *Guduchi* was kept in each house to keep away from snakes and scorpions. CHARAK requested *Vayahsthapana, Dahaprasamana, Trishnanigraha, Triptighna, Stanya-shodhana and Agryadravyas* (primary medications) with the attributes of *Grahi, Vatahara, Dipaniya, Kapha-Raktahara and Vibandhahara*. He further understood that it was phenomenal contrasted with other *MedhyaRasayanas* (mind supplements) [11]. *SUSHRUTA* is referenced by *Guducyadi, Patoladi, ValliPanchmula, Kakolyadi and Aragvadhigana* [12] *AstangaSamgraha* is referenced by *Guducyadi, Patoladi, Aragvadhadi* [13]. The portrayal of *Guduchican* be found in pretty much every *nighantu*. *Dhanvantarinighantu, Bhavaprakashnighantu* and *Raja nighantu* portrayed it under *Guducya di Varga*. *Sodararemembered* it for *Osadivalga*.

1.4 Botanic Discription

Guduchi grows into deciduous trees throughout India, similar to dry backing. It's supposed to move a ridiculous tree. There are two assortments.

- a. *T. cinensis*: (*T. malabarica* (Lam.) Miers)
- b. *Tinosporacordifolia* Miers
(*Menispermumcordifolium* Willd.)
- c. *T. cinensis* (*T. malabarica* (Lam.) Miers)

It's anything but an immense 2cm mountain dweller. Estimation stems, old branches are smooth and sparkling, genuinely warty light shades of paper bark, young regions covered with whitish hair. Leaf-Membrane-like, marginally juvenile on top, broadly appreciated for coordination 8-23.5 cm long and 5.5-13 cm petioles. Long, streaks.

Flowers: Organized with pseudoracemes emerging from old branches, straight, pedunculated, yellow-green shades.

Fruits: Drupe 1-3, red or orange [14].

- (a) *Tinosporacordifolia*Miers
(*Menispermumcordifolium*Willd.)

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1.5 Antiquity and Customary Utilizations

The Ayurvedic drug *Guduchi* or *Amrita* is referred to in various texts of the Ayurvedic drug arrangement: *Charaka*, *Sushruta*, *Ashtan Fridaya*, and various other names such as *Baba Prakash* and *Danvantri Nigantu*. *Transactions: Amara*, *Amritovali*, *Chinmalhuha*, *Chinnodeva*, *Vazadani* on, [15-20]. In *Sushurta Samhita*, referred to under *Tikta-Saka Varga*, *kustha* (illness), *Maha Jvara* (fever), *Svasa* (asthma) , *Aruci* (loss of appetite) has been professed to be useful in the treatment [21]. Various arrangements, such as *Charak Samhita* and *Ashtang Hridaya*, have been demonstrated with infectious diseases such as *Kamala* (jaundice), *bellows* (fever), and *batracta* (gout) [17,19]. In *Bhavya Prakash*, it is considered a severe tonic,

astringent, diuretic, expected love portion, and a remedy for skin contamination, jaundice, diabetes, persistent loosening of the intestines, and dysentery [20].

In *Dhanvantri Nighantu*, its therapeutic properties are referenced in drainage heap modification, longevity extension, and alleviation of tingling and erysipelas [22]. It is described as an intense vegetable tonic. Among Ayurvedic experts, what *Guduchi Satoba* obtained from the *Guduchi* plant growing on the *Neem tree* (*Azadirachtaindica*) is becoming more and more rigorous and more robust, as well as strengthening the ideal of *Neem's* recovery. It has been said [23]. The drug attracted the attention of European experts in India due to its specific tonic, anti-periodicity, and its diuretic effect, and was remembered in the 1868 Bengal Pharmacopoeia. *Tinospora cordifolia*, written by Ayurveda, is mentioned as a component of some details utilized in weakness, dyspepsia, fever, and urinary disorders. Some of the important plans are *Guduchya di churna*, *Guduchi taila*, *Sanjavani vati*, *Kanta-Kari avaleha*, *Chavanaprasha*, *Guduchi satva*, *Guduchu ghrita*, *Amrita guggulu*, *Brihat guduchi taila*, *amritash takachurna*.

2. REQUIREMENTS FOR GROWTH

The plant is truly firm, it will in general fill practically all conditions, however will in general be warm. Planting is normally done during the blustery season (July to August). Since it's anything but a climber, it is anxious to help its development. Quickly developing species, for example, *Neem* (*Azadirachtaindica*), (*Moringaoleifera*) and (*Jatropha curcas*) have been planted to help their development. *T.cordifolia* created with *Neem* (*Azadirachtaindica*) is named *NEEM GILOY*, and its material plan is tantamount to *Neem* and *Giloy*, and it shows better healing properties [24,25].

T. cordifolia will in general fill in medium dull or red soil. *Giloy* can likewise viably fill an assortment of soils, from sandy to sloppy dirt. By the by, the essential earth around has depleted sufficient water and is wealthy in regular substances required for development.

3. CONSTRAINTS ON GROWTH

T. cordifolia can be created from supplement cutting and seeds. In any case, both of these techniques are imprudent for the production of

gigantic extensions and issues in the typical dispersion procedures. The sanity of seeds is poor, and defenseless fruiting and seed germination are the primary issues of its clonal spread. Moreover, plant etchings are not appropriate in light of low effectiveness and their further advancement is additionally influenced by climatic conditions. Considering the necessities of development, plant tissue culture methodology might be a sensible system to make a tremendous reach in a more modest reality.

4. PLANT THREATS

Because of the rise of tremendous remedial properties, this plant has been over-abused by drug associations, and social people are minimalistically treated, bringing about outrageous shortage of this plant, which can't address the present issues. Because of its allure, *T. cordifolia* has been recorded in 29 helpful plants that are exceptionally moved in the Indian agroclimatic zone 8 (Rajasthan, UP and M.P.) recorded by the National Council of Medicinal Plants in New Delhi of the Government of India. This plant was likewise recorded by the NMPB in New Delhi, India in a huge exchange among 178 helpful plant species [25]. Subsequently, the plant has been assigned as a survey article to uncover or scholastically comprehend and update them about morphology, development necessities, the variety of its material mixtures, helpful properties, drug projects, the finish date of different points of view of investigation work, Different assessment things perceived by numerous monetary foundations, and so on.

5. BIOLOGICAL IMPORTANCE OF *T. Cordifolia*

The main biological events of *Tinospora cordifolia* brief in the following manner.

5.1 Anti-Diabetic Actions

The stems of this plant are usually used to treat diabetes by controlling glucose levels [26]. There are still irregularities in the treatment of diabetes drugs, and no oxidative pressure factors have been found, and insulin is persistently delivered by restraining gluconeogenesis and *glycogenolysis*. Because of alkaloids (*magnolia*, *palmitine*, *jatrorrhizine*) [27], tannins, cardiovascular glycosides, flavonoids, saponins, steroids, and so forth [28], the counter diabetic properties presented by this plant species are credited to this. The rough amassing of stems in

ethyl corrosive consumption takes away, dichloromethane, chloroform, and hexane hinders the fate of manufactured substances that can reach out with *salivation*, *amylase*, and *glucosidase* after dinners.

Blood glucose levels and expectant exercise showing diabetic illnesses [29]. The root concentrate of this plant is likewise considered to have ominous properties for diabetes, diminishing the substance of *glycosylated hemoglobin*, *hydroperoxidase* and supplement E [30].

5.2 Immunomodulatory Actions

T. cordifolia is known for its safe guideline reaction. This element has been archived by specialists [31-33]. A wide assortment of blends are inclined to immunomodulatory and cytotoxic impacts, including 11-hydroxymuscovone, N-methyl-2-pyrrolidone, N-formylglycine, cardioside A, magnonoside, cardioside and syringin [34].

These normal blends are thought to improve the phagocytic development of macrophages, increment the destructive creation of nitric corrosive by invigorating spleen cells [35] and produce responsive oxygen (ROS) in human neutrophils [36].

5.3 Anti-toxic Actions

Taking into account the presence of specialists in harmful tumors, the fluid concentrate of this plant has been displayed to have search action and can battle free extremists created during *Aspergillus flavus* harming [37,38]. More alkaloids, like *choline*, *tinospirin*, *iscolumbin*, *palmitine*, *tetrahydropalmitine*, and *magnolin* from magnolia heart, end up being impervious to nephrotoxicity brought about by aflatoxin [37]. What's more, *T. cordifolia* diminishes the gathering of *thiobarbital* destructive receptive substances (TBARS) and increments glutathione (GSH), ascorbic corrosive corrosives, proteins, and anticancer synthetic substances known as superoxide dismutase (SOD), The activity of catalase shows defensive impact (CAT), glutathione S-transferase (GST), glutathione peroxidase, and glutathione reductase (GR) in the kidney [37]. By and by, the shoot and tail concentrates of *T. cordifolia* have been thought to show hepatoprotective impacts against lead nitrate-initiated poisonousness in male pale-cleaned human mice. Basically, the oral piece of plant separates doesn't permit lead nitrate to cause liver harm [39-40].

5.4 Anti-HIV Actions

The foundation concentrate of this plant has been shown to reduce its general barrier to HIV [41]. Through the reduction of eosinophil count, the stimulation of B lymphocytes, macrophages, the levels of hemoglobin and polymorphonuclear leukocytes, the enemy of this HIV influence was discovered [41,42].

5.5 Anti-Cancer Actions

T. cordifolia is hairless, dazzling wood climbing shrub near India. It thrived in the tropics, reliably completed amazing heights and climbed the extreme compartments of big trees. The stems are weak and smooth white, spirally and longitudinally completely disconnected, with huge rosette-like lenticels in the space between them. The wood is white, delicate and permeable. When exposed to air, the surface of the later cut is expected to appear yellowish. The leaves are clear, alternate, without stipules, long petioles, notochord-like, with a perfect and healthy appearance, multi-coated mesh veins. A long rope like a root in the air grows from the branch. There are basically no flowers, and they are unisexual. The male flower is social, and the female flower is single. Six sepals are juxtaposed in two spirals, which are oval and membranous. Common things that are hard and fast are red, with different small drupes on the thick tail, with subterminal scars and red shades [8,9].

5.6. Anti-Microbial Actions

The methanol concentrate of *T. cordifolia* has been represented against microbial contamination [43]. Against *Escherichia coli*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Proteus vulgaris*, *Salmonella typhi*, *Shigella flexneri*, *Salmonella paratyphi*, *Salmonella typhimurium*, *Pseudomonas aeruginosa*, *Enterobacter aerugin* [44]. In addition, *T. cordifolia* remove has represented the transformation of anti-bacterial events and the improvement of mouse neutrophil phagocytosis and intracellular bacterial restriction [45].

5.7 Anti-Oxidant Actions

By dragging out the improvement of red platelet film lipid peroxides and catalase, the methanol concentrate of *T. cordifolia* stems has been displayed to represent a danger to oxidative action. It additionally diminished the rate of SOD and GPx in alloxan-initiated diabetic rodents [46-

47]. The concentrate of *T. cordifolia* has shown its free and continuous expulsion attributes [48]. The leaf concentrate of *T. cordifolia* gives a clarification that a α -glucosidase inhibitor, portrayed as a *saponin*, was discovered to be a comparative oxidant and the fundamental foe of the reformist development and advancement of hydroxyl bunches [49]. Because of the presence of alkaloids, it has shown affirmation of nephrotoxicity brought about by *aflatoxin* [37]. *T. cordifolia* fluid concentrate has radioprotective turns of events, recharging the determination of mice against the sub-damaging piece of gamma radiation [40,48].

6. CONCLUSION AND FUTURE PROSPECTS

The custom of collecting plants and plant-based prescriptions have begun in one era, and then to the following era. Plants collected from various sources exhibit completely unique characteristics in terms of useful qualities. In the new years, the neighbourhood medicine industry in India has improved more fundamentally. Therefore, people's interest in beneficial plants has greatly expanded. According to the latest measures, there are approximately 8,000 pharmacies in the Indian medical system in the country, which are busy solving human problems [50]. To be sure, the raw materials of these pharmacies are basically concentrated on the color tone every year. So far, creating deals has been achieved by cutting trees from standard climates or cutting trees/twigs/leaves with clear accusations or illegally. This plant type has great prospective and it has been unreasonably ruined by human activities. Therefore, saving it is a devastating need. Plant tissue culture structure is an optional framework for the rapid spread of the plant, used to confirm and update freely disposable things.

Convincing endophytes are standard and are various microbes that live in plant skins, but they are usually asymptomatic. These step-by-step plans build knowledge in the living tissues of the host plant and proceed in a mixture of subordination from production to almost non-pathogenic [8,51,52]. In view of their huge supporting species as heterotrophs and symbionts, they integrate a wide range of different fields. The ongoing abuse of endophytes Some metabolites (mainly and right-handed) are currently at the forefront of biotechnology, close to various animal colonies. It was found that the endophytes are related to *T. cordifolia* [50]. The basic idea related to the daily achievements of these creatures in nature is their

metabolism and biochemical classification. This allows the collection and misuse of the fascinating conditions of various animals. Endophytic parasites may produce large quantities of substances expected to be used in current treatments, agribusinesses, and industry [53].

Recently, plant diversity has also been used by experts to deliver nanoparticles. The green mixing movement has been introduced for the use of plants to kill good metal nanoparticles. This method of mixing nanoparticles is coordinated, unpretentious and dominant [54-58]. These nanoparticles identify important components in drug delivery, error-free, imaging and identification, quality transformation, counterfeit implants, tissue planning, and the antimicrobial activity of now stable materials. In this way, we have the opportunity to benefit from plants. From now to the foreseeable future, the arena of tissue culture needs further evaluation to progress the completion rate, subnuclear examination of any interiorvariationover meandering restoration measures, and evaluation of social events of parasitic endophytes to find specific plant cells In the hybrid plant cell approach, as well as the nanobiotechnology field through the drug transport structure of nanoparticles to manage various desolate challenges emerging problems.

NOTE

The study highlights the efficacy of "Ayurved" which is an ancient tradition, used in some parts of India. This ancient concept should be carefully evaluated in the light of modern medical science and can be utilized partially if found suitable.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Kaur R, Kaur H. The antimicrobial activity of essential oil & plant extracts of *Woodfordia fruticosa*. Archives of

- Applied Science & Research. 2010; 2:302-9.
2. Kaur R, Kumar S, Sharma AK. Medicinal plants for the treatment of sexual transmitted diseases. International Journal of Pharmaceutical Innovations. 2012;2:13-23.
3. Meena AK, Singh A, Panda P. *Tinospora cordifolia*: Its bioactivities & evaluation of physicochemical properties. International Journal of Pharmacognosy & Phytochemical Reseach. 2010;2:50-55.
4. Balandrin MF, Klocke JA, Wurtele ES, Bollinger WH. Natural Plant Chemicals: Sources of Industrial and Medicinal Materials. Science. 1985;228: 1154-1160.
5. Briskin DP. Medicinal Plants and Phytomedicines, Linking Plant Biochemistry and Physiology to Human Health. American Society of Plant Physiology. 2000;124:507-514.
6. Jayachandran R, Xavier TF, Anand SP. Antibacterial activity of stem extracts of *Tinospora cordifolia* (willd.) Hook. F. and Thoms. Anc Sci Life. 2003;22:40-43.
7. Nadkarni's KM. Indian Materia Medica, Revised and enlarged by A. K. Nadkarni. 1221;1.
8. Kirtikar KR, Basu BD. Indian Medicinal Plants Vol.2 (Lalit Mohan basu, Leader Road, Allahabad). 1933;77.
9. Badar VA, Thawani VR, Wakode PT et al. Efficacy of *Tinospora cordifolia* in allergic rhinitis. J Ethnopharmacol. 2005;96:445-449.
10. Sharma Priya Vrat, Namarupajnanam, Chaukhambha Visavabharti Prakashan Varanasi. 2011;75.
11. Gorakhnath Shastri, Agnivesh, CarakSamhita, part I, sutrasthana, Sadvirechanasatasritiya, adhyaya 4/50, 41, 29, 11, 18 and Yajjyapurushiyaaadhyaya 25/40 Chaukhambha Bharti Academy, Varanasi.
12. Ambikaduttshastri, susrutsamhita part, I, sutrasthana, Dravyasamgrahniya adhyaya. 38\6, 33, 35, 50.
13. Raviduttripathi, Astangsamgraha, Vividhganasamgrahniya adhyaya, 16/9, 10, 11.
14. Sastry JLN, Dravyaguna Vijnana, Forward by Prof. K.C. Chunekar, Chaukhambha Orientalia. 2:35.
15. Mitra R, Raghunandan K Anonymous, Pharmacognosy of Indigenous Drugs

- (Central Council for Research in Ayurveda & Siddha, New Delhi). 1982;1:321.
16. Sharma PC., Yelne MB, Dennis TJ. Data base on medicinal plants used in ayurveda, (Documentation & Publication Division, Central Council for Research in Ayurveda & Siddha, New Delhi). 2001;III:256.
 17. Charka, Charaka Samhita, Part I & II, (Hindi commentary by Pandey & Chaturvedi), Edited by Rajeshwar Datta Shastri, (Chaukhambha Vidyabhawan, Varanasi); 1961.
 18. Sushruta, Sushruta Samhita, commentary by Dalhana, Edited by Jadavji Trikamji Acharya, (Chaukhambha Orientalia, Varanasi & Delhi); 1992.
 19. Vaagbhata, Ashtanghridayam, Commentary by Arunadatta & Hemaadri, collected by Kunt & Narvare and Edited by Paradkara, (Chaukhambha Orientalia, Varanasi & Delhi); 1982.
 20. Misra B. Bhava Prakash Nighantu, (Hindi commentary by K C Chuneekar), (Chowkhamba Vidya Bhavan, Varanasi). 1969;1:269.
 21. Pendse GP, Bhatt SK. Chemical Examination of some Indian Medicinal Plants. *Tinospora cordifolia*, *Solanum xanthocarpum* & *Fumaria officinalis*, Indian Journal of Medicinal Research. 1932;20:653.
 22. Aiyer KN, Kolammal M. Pharmacognosy of Ayurvedic Drugs of Kerala, (Central Research Institute Trivendrum). 1963;1:28.
 23. Watt G. A Dictionary of Economic Products of India, , Reprinted edition, (Periodical Experts, Delhi). 1972;6(pt 4):63.
 24. Daniel M. Medicinal Plants: Chemistry and Properties. Science Publication. 2006;2:24-36.
 25. Chaudhari S, Shaikh N. Gaduchi-the best ayurvedic herb. The Pharma Innovation Journal. 2013;2(4):97-102.
 26. Sangeetha MK, Balaji 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. 2011;65:544-550.
 27. Patel MB, Mishra S. Hypoglycemic activity of alkaloidal fraction of *Tinosporacordifolia*. Phytomedicine. 2011;18:1045-1052.
 28. Zinjarde SS, Bhargava SY, Kumar AR. Potent α -amylase inhibitory activity of Indian Ayurvedic medicinal plants. BMC Complement Altern Med. 2011;11:1.
 29. Chougale AD, Ghadyale VA, Panaskar SN, Arvindekar AU. Alpha glycosidase inhibition by stem extract of *Tinosporacordifolia*. J Enzyme Inhib Med Chem. 2009;24:998-1001.
 30. Umamaheswari S, Mainzen PPS. Antihyperglycaemic effects of 'Ilogen-Excel' an ayurvedic herbal formulation in streptozotocin induced diabetes mellitus. Acta pol Pharma. 2007;64:53-61.
 31. Tripathi YB, Sharma M, Manickam. Rubia 5 din, a new antioxidant from rubiacordifolia. Ind J Biochem Biophy. 1997;34:302-306.
 32. Bishayi B, Roychowdhury S, Ghosh S, Sengupta M. Hepatoprotective properties of a *Tinospora cordifolia* in CCl4 intoxicated mature albino rats. J Toxic Sci. 2002;27:139-146.
 33. Subramanian M, Chintawar GJ, Chattopadhyay S. Antioxidant properties of *Tinospora cordifolia* polysaccharide against iron-mediated lipid damage and gamma-ray induced protein damage. Redox Rep. 2002;7:137-143.
 34. Sharma P, Parmar J, Sharma P, Verma P, Goyal PK. Radiation- induced testicular injury and its amelioration by *T. cordifolia* (An Indian Medicinal plant) extract. Evid based comp altern Med. 2012;643-647.
 35. Upadhyay PR, Sharma V, Anita KV. Assessment of the multifaceted immunomodulatory potential of the aqueous extract of *Tinospora cordifolia*. Res J Chem Sci. 2011;1:71-79.
 36. More P, Pai K. *In vitro* NADH-oxidase and myeloperoxidase activity of macrophages after *Tinospora cordifolia* (guduchi) treatment. Immuno Pharma Immuno toxic. 2010;34:368-372.
 37. Gupta R, Sharma V. Ameliorative effects of *Tinospora cordifolia* root extract on histopathological and biochemical changes induced by aflatoxin-b (1) in mice kidney. Toxicol Int. 2011;18:94-98.
 38. Jagetia GC, Rao SK. Evaluation of the antineoplastic activity of guduchi (*Tinospora cordifolia*) in ehrlich ascites

- carcinoma bearing mice. Biol Pharm Bull. 2006;29:460-466.
39. Sharma V, Pandey D. Protective role of *Tinospora cordifolia* against lead induced hepatotoxicity. Toxic Int 2010; 17:12-17.
 40. Sharma V, Pandey D. Beneficial effects of *Tinospora cordifolia* on blood profiles in male mice Exposed to Lead Toxic Int. 2010;17:12-17.
 41. Kalikae MV, Thawani VR, Varadpande UK, Santakke SD, Singh RP, Khiyani RK,. Immunomodulatory effect of *T. cordifolia* extract in HIV positive patients. Ind J Pharmacol 2008; 40:107-110.
 42. Akhtar S. Use of *T. cordifolia* in HIV infection. Ind J Pharmacol. 2010;42:57-63.
 43. Narayanan AS, Raja SS, Ponmurugan K, Kandekar SC, Maripandi A. Antibacterial activity of selected medicinal plant against multiple antibiotic resistant uropathogens: A study from Kolli Hills, Tamilnadu, India. Benef Microbes 2011; 2:235-243.
 44. Ambekar DH, Khante BS, Chandak BR, Titare AS, Baralkar SS, Aghadte SN. Screening of antibacterial potential of some medicinal plants from Melghat forest in India. Afr J Trad Comp Altern Med. 2009;6:228-232.
 45. Sengupta S, Mukherjee A, Goswami R, Basu S. Hypoglycemic activity of the antioxidant saponarin, characterized as alpha-glucosidase inhibitor present in *Tinospora cordifolia*. J Enzyme Inhib Med Chem. 2009;24:684-690.
 46. Stanely P, Menon VP. Hypoglycaemic and hypolipidemic action of alcohol extract of *Tinospora cordifolia* roots in chemical induced diabetes in rats. Phytother Res. 2003;17:410-413.
 47. Stanely P, Menon VP. Antioxidant action of *Tinospora cordifolia* root extract in alloxandabetic rats, Phytother Res. 2001;15:213-218.
 48. Kapur P, Wuttke W, Jarry H. Beneficial effects of beta-ecdysone on the joint epiphyseal cartilage tissue and trabecular bone in ovariectomized rats. Phytomedicine. 2010;17:350-355.
 49. Maridass M, De-Britto AJ. Origins of Plant Derived Medicines. Ethno botanical Leaflets. 2008;12:373-387.
 50. Diwanay S, Chitre D, Patwardhan B. Immunoprotection by botanical drug on experimental metastasis. J Ethanopharmacol. 2004;90:223-237.
 51. Tan RX, Zou WX. Endophytes: a rich source of functional metabolites. Nat Prod Rep 2001;18:448-459.
 52. Strobel G, Daisy B. Bioprospecting for Microbial Endophytes and Their Natural Products. Microbio Mol Biol Rev. 2003;67:4491-502.
 53. Gaiero JR, Mc-Call CA, Thompson KA, Day NJ, Best AS, Dunfield KE. Inside the root micro biome: Bacterial root endophytes and plant growth promotion. Am J Bot. 2013;100(9):1738-1750.
 54. Singh A, Sharma MM, Batra A. Synthesis of gold nanoparticles using Chick pea leaf extract using green chemistry. J of Optoelectronics and Biomed Maters. 2013;5(2):27–32.
 55. Singh A, Jain D, Upadhyay MK, Khandelwal N, Verma HN. Green Synthesis of Silver Nanoparticles using *Argemonemexicana* Leaf Extract and Evaluation of their Antimicrobial Activities. Dig J of Nanomater and Biostr. 2010;5(2):483-489.
 56. Thirumurugan T, Kaur K. Biological Synthesis and Characterization of Gold Nanoparticles from Pomegranate. Int J of Future Biotech. 2013;2(2):1-11.
 57. Asghari G, Varshosaz J, Shahbazi N. Synthesis of silver nanoparticle using *Portulaca oleracea* L. extracts. Nanomedicine Journal. 2014;1(2):94-99.
 58. Pasca RD, Mocanu A, Cobzac SC, Petean I, Horovitz O, Cotisel MT. Biogenic Syntheses of Gold Nanoparticles Using Plant Extracts. Partic Sci and Tech An Int J. 2014;32(2):131-137.

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