



Guduchi: Its Medicinal Properties

Prajwala B¹, Raghu N¹, Gopnath TS² and Basalingappa KM^{1*}

Abstract

In Ayurvedic medicine Guduchi is considered to be one of the three Amrit plants. Amrit means nectar of gods; such are the qualities of this climber plant that in Sanskrit it is named as "Amritavalli". Botanical name of Guduchi is *Tinospora cordifolia*. Guduchi is a well-documented in Ayurveda literature. It is used in multiple drug formulations. Ayurvedic practice without this herb may not be possible. It is useful in the promotion and restoration of health and in the treatment and curing of many diseases and known as Panacea (remedy) for all the diseases and disorders. Scientific studies also evaluate and confirm the insight beneficial properties of this medicinal herb like cardio protective, hepatoprotective, anti-inflammatory, analgesic effect, confirms the Ayurvedic views of Guduchi as Rasayana and immunity booster. The present review involves the medicinal properties of Guduchi and its uses in Ayurveda.

Keywords

Guduchi; *Tinospora cordifolia*; Ayurveda; Rasayana

Introduction

Since prehistoric times medicinal plants have been discovered and used in traditional medicinal practices. Chemical compounds synthesized from plants fight against insects, fungi, bacteria and diseases. Medicinal plants are readily available, nontoxic and cheaper than modern medicine hence it is widely used in non-industrialized societies. 3,00,000 of plant species acclaimed worldwide, among that only 5% have been investigated scientifically for their medicinal purpose [1]. Herbal products are gaining popularity in the Indian market due to side effects of synthetic products. Guduchi is one such plant which is the most highly revered herb in Ayurveda medicine. The name Guduchi comes from Sanskrit word that means "imperishable". This herb is also known by different names across the sub-continent of India: Guduchi, Amrit in Sanskrit, Tippa teega in Telugu, Shindilakodi in Tamil, Amruthaballi in Kannada, Giloy in Hindi, Garo in Gujarati, Gulvel in Marathi, Chittamrutu in Malayalam. Guduchi is a shrub native to India, it belongs to Menispermaceae family consist of about 70 genus and 450 species that are found in low tropical regions [2]. It is a well-known medicinal plant in Indian Ayurveda Pharmacy. During last two decades the drug has been subjected extensive phytochemical, pharmacological and clinical investigations [3]. Guduchi is used as an important ingredient in Ayurvedic medicine

for the treatment of fever, liver and spleen disorder, bleeding disease, burning sensation of heat, aphrodisiac treatment and oligospermia. Its roots, stems, leaves have all been used medicinally for thousands of years in Ayurveda tradition. In India Guduchi caught attention of European Physician as a specific tonic and it was included in the Bengal Pharmacopoeia of 1868 [4]. Ayurvedic literature quotes Guduchi as constituents of several compound preparations, used in fever, urinary diseases, dyspepsia, and general debility [5]. In Ayurveda Guduchi is known as Medhya Rasayana which means learning and memory enhancer because in children it has improved their IQ level, its root can be used for its anti-stress activity, dried stem of Guduchi has significant anti-inflammatory effect, it has revealed the hepatoprotective action in goats [6]. This herb is a well-established preventive agent against H1N1 flu and it is reported to possess anti-HIV property [7]. It is an excellent drug which is a good remedy for various diseases of humans and animals yet the safety and the potential indications in human beings and animals have to be established using modern techniques [8]. Guduchi is the best remedy for children suffering from upper respiratory tract infection [2]. Guduchi is used in Panchakarma other procedures and it can be used for both external and internal therapeutic purposes under various formulations [7]. This herb is mentioned as Tridosha Shamaka and a Rasayana plant and also known as adaptogen because it builds energy and general vitality and increases the resistance of the body to physical, chemical and biological stress [9]. Rasayana (rejuvenation therapy), one of the most essential branches of Ayurveda, Rasayana drug act essentially on nutrition dynamics and rejuvenate the body and psyche [10]. Guduchi is considered as potent herb for the treatment of Hiccups by traditional healers of Bagalkot district, Karnataka and also this herb will prevent the iron deficiency anaemia, dizziness, fatigue, weakness, dyspnoea, neuropsychiatric manifestation of chronic hypocalcaemia by providing sufficient iron and calcium [11]. Extract of this herb prevent polyuria, renal hypertrophy improve renal damage. Alcoholic extract of Guduchi has antihyperglycemic activity and aqueous extract has antidiabetic activity [12]. The medicinal uses of Guduchi are well documented in Charaka Samhita, Sushruta Samhita and Ashtang Hrudaya. In Sushruta Samhita, Guduchi is traditionally claimed for the treatment of diseases like Svasa - Asthma, Aruci - Anorexia, Maha jwara - Fever, Kustha - Leprosy and in Ashtang Hrudaya there is an evidence for Kamala-jaundice, Vat Rakta gout [13]. In Charaka Samhita this herb is said to possess Sangrahika and Vibandhaprashamana properties [7]. In different parts of the country Guduchi finds a special mention in tribal and folk medicine [14]. Hence it is clear that Guduchi is the most important medicinal plant considered by the ancient rishis in Vedic times with great medicinal qualities of curing number of diseases.

Botanical description

Botanical name of Guduchi is *Tinospora cordifolia*, it is a large deciduous climbing shrub belonging to Menispermaceae family, and this family is a rich source of alkaloids and terpenes. This plant contains 70 genera and 450 species [15]. This herb is commonly known as Heart leaf moonseed because the leaves of Guduchi are heart shaped, individualized, slimy, simple, alternate, membranous and cordate [16]. Wood is porous soft and white in colour. Flowers are greenish which are unisexual and bloom in summer. Female flowers

*Corresponding author: Kanthesh M Basalingppa, Department of Molecular Biology, Faculty of Life Sciences, JSS Academy of Higher Education & Research, Mysuru, Karnataka, India, Tel: +91 9482046281; E-mail: kantheshmb@jssuni.edu.in

Received: June 12, 2019 Accepted: August 30, 2019 Published: September 05, 2019

occur singly and male flowers are small yellow or green coloured occur in clusters, sepals and petals are six in number [17]. Fruits are orangish colouring found in aggregate of 1-3 drupes with scarlet. Roots are seen in both underground and aerial form [18]. Stem is rather succulent with long; fleshy in nature, bark is creamy white to grey [19]. Guduchi belongs to different classes of constituents such as alkaloids, glycosides, protein, steroids, polysaccharides, aliphatic compound, essential oil, phosphorous [13], sesquiterpenoid, tannin, saponin, terpenoids, amino acid [20,21].

The major phytoconstituent in Guduchi include are such as berberine, tembatarine, choline, aporphine alkaloid, tinosporine, jatrorrhizine, furanolactone, tinosporon, tinosporides, columbin, tinocordiside, tinocordifolioside, cordifolioside A, B, C, D and E, cordifolioside syringin, syringin apiosylglycoside, jateorine, palmatosides, β -sitosterol, δ -sitosterol, furanoid diterpene glucoside, makisterone A, giloinsterol, tinocordifolin, pregnane glycoside, ecdysterone, octacosanol, tetrahydroplamatine [19], heptacosanol, nonacosan, tetrahydrofuran, gilonin, giloinsterol/jateorine, 18-norclerodane glucoside [22].

Nutritional composition

Medicinal properties of Guduchi are mainly due to the presence of micro nutrients, macro nutrients and phytochemicals. Every parts of the plant like leaves, stem, fruits and roots are being used since ancient times and are rich in nutraceuticals. One of the studies concluded that Guduchi stems are a potential source of nutrition and minerals for human as well as animals [23]. Bitter starch of the plant known as Guduchi satva obtained from stem is highly nutritive and digestive and it is used to treat number of diseases [21] and it also reported to possess rich nutrients like fat, protein, dietary fibres, calcium etc. [7].

By analysing Tables 1 and 2 it can be concluded that Guduchi is a rich source of nutrition for body building and boosting the immune response. Calcium and phosphorous are good for the formation of bones and teeth. Iron plays pivotal role in erythropoietin and oxygen transport.

Medicinal uses of Guduchi

According to Ayurveda Guduchi increases the diminished Dosh or Dhatu and reduces the increased Dosh, so it brings balance of

Table 1: Taxonomical classification.

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Rannunculaceae
Family	Menispermeaceae
Genus	Tinospora
Species	Cordifolia [20]

Table 2: Nutrients in Guduchi leaves [24].

Nutrients	Concentration (%)
Carbohydrate	65.31
Moisture	7.78
Protein	8.74
Fat	2.80
Fibre	8.25
Ash	7.12
Iron	1.53
Calcium	0.11
Vitamin C	1.24

Tridosha (Vata, Pitta, Kapha) in the body and helps in preventing all types of diseases (Tables 3 and 4).

Pilonidal sinus: It is also called Saccrococcygeal fistula and Pilonidal abscess or cyst. Arogya Rasayan is a herbo-mineral composition (tablet) made-up of 15 ingredients used to treat Pilonidal Sinus. Stem powder of Guduchi is one of the ingredients in Arogya Rasayan. Guduchijuice with turmeric paste is beneficial for removing skin debris, pus and dirt particles. It boosts the healing process of wound and treats Pilonidal Sinus [24-29].

Thrombo cytopenia: Thrombocytopenia is a disorder in which there is an abnormally lower amount of platelets or platelet count gets lower than normal number of platelets in blood. Dengue is one of the main causes of Thrombocytopenia. Many Ayurvedacharyas and Ayurvedic literature have quoted the use of Guduchi in Dengue. Guduchi is able to cure Dengue fever and increase platelet in significant manner and lowers down the body temperature. In one of the studies Guduchi has increased the platelet count significantly in Busulfan induced thrombocytopenia rabbits [30]. Dengue fever can be correlated with Vishamjwar in Ayurveda. 40ml of Guduchi Kwat from morning to evening in the dengue haemorrhagic fever showed improvement in the platelet count, it helps in lowering the temperature and relieving the maculopapular rash with no side effects [31].

Alzheimer’s disease: Alzheimer’s disease is an irreversible, progressive brain disorder that slowly destroys memory and thinking skills and eventually the ability to carry out the simplest tasks. Ayurvedic drugs can help in the management of Alzheimer’s by providing Medhya (Intellect promoting) effect to improve the memory of the patients. Drugs mentioned as Medhya will improve cognitive function and can be used successfully in cases of Alzheimer’s disease. The four Medhya rasayana are Guduchi (Tinospora cordifolia), Mandukaparni (Centellaasiatica), Shankapushpi (Convolvulus pluricaulis), Madhuyashti (Glycyrrhiza glabra). One of the experimental studies undertaken with the objective of studying the effect of Guduchi on learning and memory in normal rats and on cyclosporine-induced memory deficits, Guduchi extracts enhanced cognition in normal rats as were seen in behavioural tests-HebbWilliam maze and the passive avoidance tasks. Hence Guduchi have the potential to provide a significant improvement in memory and learning capacity of the patients suffering from Alzheimer’s disease [32].

Buerger’s disease: It is also known as Smoker’s disease. It is a rare disease of the arteries and veins in the arms and legs. The common cause of disease is smoking, so called as smoker’s disease. In Ayurveda the disease is not mentioned as it is but the feature can be correlated with the Strotodushi lakshanas like Sanga (obliteration) and Srianam granthi (thrombus). Vitiation of blood in the vessels is also a feature of this disease hence Raktavaha strotodushti is also involved. Treatment included leech therapy, Guduchi swaras orally and til taila dhara

Table 3: Nutrients in Guduchi stem [11].

Nutrients	Concentration (%)
Carbohydrate	61.66
Protein	4.5-11.2
Fat	3.1
Iron	0.28
Potassium	0.845
Chromium	0.0060
Calcium	0.131

Table 4: Medicinal parts of Guduchi and its uses.

Sl. No	Plant part	Medicinal uses
1.	Root	Root of Guduchi having anti-oxidant activity and it will reduce tissue cholesterol, phospholipid and free fatty acids [25]. Root is used for visceral obstruction; its water extract is used in leprosy [26]. Resistance against HIV [19]. Prevent diabetic cataract and weight loss in diabetic patients [7]. Hypoglycaemic activity - root of this herb decreases blood glucose level, brain lipid level and increases total haemoglobin [27]. Roots of the herb is very thin and strong, in Sushruta root is used for suturing surgical wound, because of this strong root there is no chances of wound rupture and Guduchi having potent wound healing property.
2.	Stem	Combination of root and stem extract with other drug are prescribed as anti-dote to snake bite and scorpion sting [25]. Juice of the stem with honey is better for the treatment of Asthma [4]. Stem is used as an ingredient for Ayurvedic preparations to treat general debility, UTI, fever, dyspepsia [28]. Useful in skin diseases, jaundice, its juice is useful in diabetes, vaginal and urethral discharges, low fever and enlarged spleen [15].
3.	Leaves	Leaves are extensively used in the treatment of fever, urinary tract disorder, diabetes, anaemia, asthma, cardiac disorder, bacterial infection [16].
4.	Fruit	Combination of dried or powdered fruit with honey is used as tonic for the treatment of rheumatism and jaundice [15].
5.	Bark	Anti-pyretic, anti-allergic, anti-spasmodic, anti-leprotic [15].

Note: Guduchi itself means “one which protects our body” and an Amrita means the nectar that confers immortality”. Every part of the plant has therapeutic values.

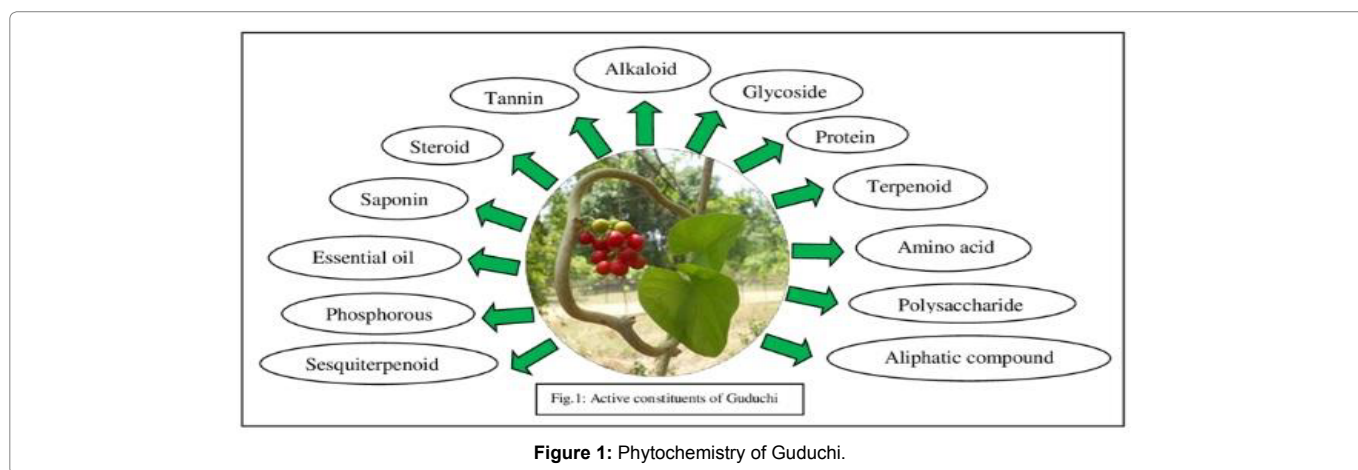


Figure 1: Phytochemistry of Guduchi.

locally. The result of this regime gave complete relief to the patient without any complications and was cost effective and also minimizes the chances of surgical interventional procedures [33].

HIV: Human Immunodeficiency Virus-(HIV) and Acquired Immune Deficiency Syndrome-(AIDS) are the global public health issue. Without treatment HIV infection is likely developed into AIDS. It has been observed that polyherbal formulations of Guduchi possess favourable effect in patient with HIV infection [34]. A toxicity study was conducted on crude extracts using peripheral mononuclear blood cells (PBMCs) isolated from whole blood. Guduchi leaves extract showed moderate cytotoxic activities against PBMCs. In HIV-1 reverse transcriptase assay Guduchi extract showed good inhibitory effect which was near that of reference drug. Leaves of Guduchi extract showed anti-HIV activity, isolating bioactive phytochemicals from this plant will be helpful in protecting and treating various viral diseases [1].

Hyperuricemia: Hyperuricemia is a condition of presence of excessive amount of uric acid in urine. Increased uric acid level in urine can contribute to kidney stones. Uricosuric activity of *Tinospora cordifolia* extract was tested in hyperuricemia induced in Albino Wistar rat using potassium oxonate. *Tinospora cordifolia* extract showed increased excretion of uric acid and decreased the

elevated serum uric acid levels induced due to potassium oxonate. *Tinospora cordifolia* extract showed potent uricosuric action [35].

Gout: Gout is a form of inflammatory arthritis that develops in some people who have high levels of uric acid crystals in the blood. This disorder is characterized by hyperuricemia, deposition of uric acid crystals in and around of joints and soft tissues. In Ayurveda classics clinical features of gout comes under the purview of Vatarakta. Vatarakta is one of the unique disorders in among Vatavyadhi - a group of nervous disorder [36]. Combine effect of stem extract of Guduchi and Trapusha (cucumber) juice was tested in the management of Vatarakta. After the course of effect of 12 weeks maximum number of patients showed normal serum uric acid level and remarkable relief in signs and symptoms of Vatarakta [37].

Leprosy: Leprosy is a chronic infectious disease which produces various granulomatous lesions in the skin, mucous membrane and the peripheral nervous system. Swarasa (juice) of Guduchi stem twice a day will help to develop immune system of body. In Ayurveda Guduchi is used for its Kushtahara (anti-leprotic) properties along with wide use in Kandu and Visarpa - types of skin disorder [27]. In Sushruta Samhita, it is mentioned under “Tikta Saka Varga” and it is claimed to be useful in treating Kushta or leprosy [4].

Poultry feed supplement: To enhance the productivity of eggs and meat in poultry farming it is needed for cheaper feed supplement which improve the overall weight gain of the birds and their feed conversion efficiency within short period of time. One of the studies was carried out with the objective of increase in total body weight gain and feed conversion ratio after the oral administration of *Tinospora cordifolia* stem extracts mixed with their feed mash in different preparations. *Tinospora cordifolia* stem extracts significantly increased the average body weight gain and overall feed conversion efficiency in the birds [38]. Guduchi showed better growth performance of birds in terms of body weight gain, improved FCR and resulted in better metabolizability and it can be effectively replace the antibiotic growth promoter in broiler ration [39].

Helminthiasis: Helmenthiasis is also known as worm infection. It is a macroparasitic disease of humans and other animals in which part of a body is infected with parasitic worms, known as helminths. *Tinospora cordifolia* is traditionally used as an anthelmintic agent. The anthelmintic property of *Tinospora cordifolia* extract was evaluated using *Pherithema posthuma* as an experimental model. Ethanol extract of *Tinospora cordifolia* showed significant anthelmintic activity against *Pherithema posthuma*. Ethanol extract also proved to be efficient than standard drug [40]. Chloroform extract of stem of *Tinospora cordifolia* showed anthelmintic activity against *Eisenia fetida* [41].

Low productivity of buffaloes: Low productivity of buffaloes is primarily due to poor genetic potential, inadequate supply of nutrients and unscientific approach in feeding, hence there is a need to adopt scientific feeding strategies. In Ayurveda, Guduchi is commonly known as Rasayana plant, it is widely used in veterinary folk. The animals under treatment group were fed dried Guduchi stem powder by mixing it in small amount of concentrate 120g/day for a period of 72days after calving. Supplementation of Guduchi increased 10% of milk production and milk quality in terms of reducing somatic cell count. It also enhanced 5% of dry matter intake of lactating Murrah buffaloes [42].

Crossbred cow's peripartum: Crossbred periparturient cow is highly susceptible to various diseases that effectively reduce its reproductive performance postpartum. Supplementation of Guduchi was performed to explore the possibilities of enhancing the reproductive performance of crossbred cow. There was no significant change in peripartum plasma total estrogens and PGFM levels but increases the total leukocyte, lymphocyte, neutrophil count and neutrophil lymphocyte ratio [43].

Vegetative propagation: A study was conducted to standardize the size of the cuttings and auxin requirements for vegetative propagation of *Tinospora cordifolia*. Variation in rooting ability of *Tinospora cordifolia* germplasm was collected from different geographical location was also tested. *Tinospora cordifolia* rooted well without any hormone treatment with 96% rooting. It also enabled the suggestion of reliable conditions for vegetative propagation of this species, making the spread and cultivation more successful [44].

Osteoporosis: Osteoporosis is a bone disease it happens when bone density decreases and the body stops producing as much bone as it did before. In Ayurveda it can be correlated with the *Asthi kshaya* on the basis of Pathophysiology and symptoms. Various therapeutic measures are recommended in the classical texts of Ayurveda for the management of this condition. 11 different drugs

mentioned in classical texts of Ayurveda texts are reported for their anti-osteoporotic activities in different clinical and experimental studies. Guduchi is one of the reported medicinal plants in clinical Ayurveda texts for its anti-osteoporotic activity. Effect of ethanolic extract of Guduchi was tested on the proliferation, differentiation and mineralization of bone like matrix on human osteoblast like cells MG-63 and primary osteoblast cells isolated from femur of rats. Cell morphology studies clearly indicated the increase in the cell number and absence of adverse effect in cell morphology on treatment with extract. Ethanolic extract stimulated the proliferation of osteoblast [45].

Toxicology: In an acute toxicity study leaves and stem of Guduchi did not show any side effects and mortality of Swiss mice even at the highest dose level [46]. It has not been mentioned to be a highly toxic substance [47]. Guduchi is considered being safe in dosage mentioned. No conspicuous information on toxicity is available so far [7]. It has no side effects and toxicity and no adverse reaction has been noted [48].

Discussion

There are many Ayurvedic Rasayana herbs, among those Guduchi holds most prominent place [49]. Guduchi is known as "rejuvenate herb" because of its medicinal properties. It is a multipurpose plant used to treat number of diseases. Apart from above mentioned properties Guduchi having anti-bacterial, anti-cancer, anti-tumour, anti-oxidant, anti-allergic, antispasmodic, anti-arthritis, anti-neoplastic, anti-inflammatory, anti-stress activities [49]. This herb is able to cure jaundice, cold, fever, etc. It is extensively used to treat gastrointestinal, neuropathies, diabetes, hyperlipidemia and other disorders [50]. Piles problem can be controlled by eating this plant with milk [51]. Different extracts of Guduchi contains growth regulatory active principles [52]. Guduchi has reported to have immunostimulant properties on macrophages [53]. Guduchi have effect on both the sexual arousal and sexual performance of the biological systems and these drugs have stimulatory effect on the copulatory behaviour [18]. According to Patanjali yogapith Guduchi is very effective in preventing swine flu that has been declared epidemic worldwide [54]. Ayurvedic doctors and some of the health experts suggest Guduchi for sexually transmitted disease like gonorrhoea [26]. Guduchi significantly reduces pain and morning stiffness in rheumatoid arthritis [48]. It might be help in improving the clarity of vision. It is a very good Vajikara (aphrodisiac) herb, regular use of this herb will helps to detoxify male reproductive system and rejuvenate it. Due to its adaptogenic and aphrodisiac property Guduchi helps to increase sperm count, sperm motility and erection time [55]. Guduchi heals a bowel affected with constipation, intestinal bleeding and haemorrhoids. It can be used in the case of snakebite and scorpion bite due to its ability to its ability to remove exogenous and endogenous toxins [47]. Apart from medicinal values or biological roles Guduchi is recommended to use drinking water treatment process, its biomass has been proven as suitable and low cost adsorbent to reduce fluoride into standard permissible limit. Thus Guduchi also protects against water contamination [7].

Conclusion

Guduchi is one of the most valued herbs in Ayurvedic collection. Every part of the plant is used for healing. Guduchi is renowned as a powerful healing herb, also aptly named the Divine nectar. It makes for an essential ingredient in many kind of refreshing tonic, it has

a long list of medicinal uses mainly supports the immune system, skin, liver, spleen, stomach, blood, intestine and also used to treat chemotherapeutic side effects. The importance of this wonderful herb is gaining importance day by day as more and more people start knowing the uses of Guduchi. There is no wonder that this Ayurvedic herb is also known as “Queen of all herbs”.

References

1. Estari M, Venkanna L, Reddy AS (2012) In vitro anti-HIV activity of crude extracts from *tinospora cordifolia*. *BMC Infect Dis* 12: P10.
2. Spandana U, Ali SL, Nirmala T, Shanthy M, Babu SDS (2013) A review on *tinospora cordifolia*. *Int J Curr Pharm Res* 4: 61-68.
3. Nagaprasanthi C, Khan RP, Chand GK, Aleemuddin MA, Begum RG (2012) In vitro antimicrobial activity of *Tinospora cordifolia* and its phytochemical screening. *Int J Pharmtech Res* 4: 1004-1008.
4. Sinha K, Mishra NP, Singh J, Khanuja SPS (2004) *Tinospora cordifolia* (Guduchi) a reservoir plant for therapeutic applications: A review. *Indian J Traditional Knowledge* 3: 257-270.
5. Krishna K, Jigar B, Jagruti P (2008) Guduchi (*Tinospora cordifolia*): Biological and Medicinal properties, a review. *The Internet J Alternative Medicine* 6: 1-8.
6. Upadhyay AK, Kumar K, Kumar A, Mishra HS (2010) *Tinospora cordifolia* (Willd) Hook.f.Thoms (Guduchi)-validation of the Ayurvedic pharmacology through experimental and clinical studies. *Int J Ayurveda Res* 1: 112-121.
7. Sharma R, Amin H, Galib R, Prajapati PK (2014) Therapeutic vistas of guduchi (*Tinospora cordifolia*): A medico- historical memoir. *J Res Educ* 1-16.
8. Sankhala LN, Tripathi SM, Bhavsar SK, Thakar AM (2012) Evaluation of effect of *Tinospora cordifolia* extract on humoral and cell mediated immunity in Acephate intoxicated mice. *Veterinary practitioner* 13: 168-170.
9. Salve BA, Tripathi RK, Petare AU, Raut AKA, Rege NN (2015) Effect of *tinospora cordifolia* on physical and cardiovascular performance induced by physical stress in healthy human volunteers. *AYU* 36: 265-270.
10. Rawat N, Roushan R (2018) Guduchi: A potential drug in Ayurveda. *World J Pharm Res* 7: 355-361.
11. Kavya B, Kavya N, Ramarao V, Venkateshwarlu G (2015) *Tinospora cordifolia* (Willd) Miers; Nutritional, ethnomedical and therapeutic utility. *Int J Ayurveda Res* 6: 195-198.
12. Upadhyay S, Bora M, Kawlani L, Mukherjee K, Hazra J (2018) Comprehensive pharmacology review of Guduchi [*Tinospora cordifolia* (Willd.) Miers]. *Journal of Drug Research in Ayurvedic Sciences* 3: 48-52.
13. Tiwari P, Nayak P, Prusty SK, Sahu PK (2018) Phytochemistry and pharmacology of *tinospora cordifolia*: A review. *Sys Rev Pharm* 9: 70-78.
14. Gupta BM, Ahmed KKM, Gupta R (2018) Global research on *tinospora cordifolia* (Medicinal plant) with special reference to India: A scientometric assessment publications output during 2001-2016. *International Journal of Pharmacognosy & Chinese Medicine* 2: 000141.
15. Joshi BC, Uniyal S (2017) Pharmacognostical review of *tinospora cordifolia*. *Inventi Rapid Planta Activa* 1: 1-10.
16. Tripathi BM, Singh DC, Chaubey S, Kour G, Arya R (2017) A critical review of *tinospora cordifolia* (Guduchi). *Int J Curr Res* 9: 55006-55009.
17. George M, Joseph L, Mathew M (2016) *Tinospora cordifolia* a pharmacological update. *The Pharma Innovation Journal* 5: 108-111.
18. Kumar DV, Geethanjali B, Basalingappa KM, Avinash KO, Kumar JR (2017) *Tinospora cordifolia*: the antimicrobial property of the leaves of amruthaballi. *J Bacteriology & Mycology* 5: 363-371.
19. Mittal J, Sharma MM, Batra A (2014) *Tinospora cordifolia*: a multipurpose medicinal plant a review. *J Med Plants Res* 2: 32-47.
20. Meshram A, Bhagyawant SS, Goutham S, Shrivastava N (2013) Potential role of *tinospora cordifolia* pharmaceuticals. *World J Pharm Res* 2: 4615-4625.
21. Pradhan D, Ojha V, Pandey AK (2013) Phytochemical analysis of *tinospora cordifolia* (Willd.) Miers Ex Hook. F. & Thoms stem of varied thickness. *Int J Pharm Sci Rev Res* 4: 3051-3056.
22. Bhan M (2016) *Tinospora cordifolia*-phytochemical and pharmacological evaluation. *Int J Sci Res* 1: 08-11.
23. Rahal A, Prakash A, Verma AK, Kumar V, Roy D, et al. (2014) Proximate and elemental analysis of *Tinospora cordifolia* stem. *Pak J Biol Sci* 17: 744-747.
24. Chauhan ES, Aishwarya J (2017) Nutraceutical analysis of *Tinospora cordifolia* dried leaves powder. *Imperial Journal of Interdisciplinary Research* 3: 1300-1302.
25. Singh SS, Pandey SC, Srivastava S, Gupta VS, Patro B, et al. (2003) Chemistry and Medicinal properties of *Tinospora cordifolia* (Guduchi). *Indian J Pharmacol* 35: 83-91.
26. Pandey M, Chikara SK, Vyas MK, Sharma R, Thakur GS, et al. (2012) *Tinospora cordifolia*: A climbing shrub in health care management. *Anc Sci Life* 3: 612-628.
27. Khan M, Haque MS, Chowdhury SS (2016) Medicinal use of unique plant *Tinospora cordifolia*: evidence from the traditional medicine and recent research. *Asian Journal of Medical and Biological Research* 2: 508-512.
28. Bansal D, Bhasin P, Punia A, Sehrawat AR (2012) Evaluation of antimicrobial activity and phytochemical screening of extracts of *Tinospora cordifolia* against some pathogenic microbes. *J Pharm Res* 5: 127-129.
29. Bhuyan C, Dudhamal T (2017) Clinical effect of kshara khurma in the management of nadivrana with special reference to Pilonidal Sinus (PNS) and review of literature. *Indian J Ancient Medicine and Yoga* 10: 13-18.
30. Chauhan DS, Latha S, Sharma RK, Jindal M, Gupta AK, et al. (2016) Evaluation of role of *Tinospora cordifolia* (T. Cord) in experimentally induced (Busulfan induced) Thrombocytopenia in rabbits. *Indian J Res* 5: 96-99.
31. Shinde DL (2017) A single case study: Guduchi Kwath(*Tinospora cordifolia*) in dengue fever. *Int J Appl Res* 3: 375-377.
32. Dileepkumar KJ, Shreevatsa S, Hiremath B, Pujari S (2015) Alzheimer's disease: An Ayurvedic Perspective. *Journal of Ayurveda and Holistic Medicine* 2: 36-41.
33. Saroj SJ, Kasle S, Giri S (2017) Ayurvedic management of Tao (Buerger's) disease: A case study. *Eur J Pharm Med Res* 4: 495-497.
34. Singh G, Saxena RK (2017) Medicinal properties of *Tinospora cordifolia* (Guduchi). *International Journal of Advance Research, Ideas and Innovations in Technology* 3: 227-231.
35. Shah PA, Shah GB (2015) Uricosuric activity of *Tinospora cordifolia*. *Bangladesh Journal Pharmacology* 10: 884-890.
36. Kumar KA, Kumar MS (2014) Herbal approach towards Vatarakta (Gout), a metabolic syndrome: A review. *International Journal of Ayurveda and Pharmaceutical Chemistry* 1: 22-43.
37. Huded S, Gummadi SV, Sankh K, Asha HN, Ashwini HS, et al. (2013) Evaluation of Guduchi yoga in the management of Vatarakta (Gouty Arthritis): A clinical study. *International Journal of Research of Ayurveda Pharmacy* 4: 688-692.
38. Bhardwaj U, Tiwari BK, Prasad A, Ganguly S (2011) Use of *Tinospora cordifolia* as poultry feed supplement. *An International J Biomedical and Life Science Research* 1: 18-22.
39. Singh S, Maan NS, Raana V, BS Tewatia, Sheoran N, et al. (2018) Effect of dietary inclusion of Giloy (*Tinospora cordifolia*) stem powder on growth performance and metabolizability in broilers. *Journal of Entomology and Zoology Studies* 6: 36-40.
40. Reddy MR, Reddy KT, Vedamurthy AB, Krishna V, Hoskeri HJ (2011) A study of anthelmintic activity of *Tinospora cordifolia* extracts. *Int J Pharm Pharm Sci* 3: 78-80.
41. Pawar SD, Patil YB, Premchandani LA, Borse SL, Borse LB, et al. (2014) Study of anti-helminthic activity of chloroform extract of *Tinospora cordifolia*. *World J Pharm Pharm Sci* 3: 2253-2268.
42. Mir NA, Kumar P, Rather SA, Sheikh FA, Wani SA (2015) Effect of supplementation of *tinospora cordifolia* on lactation parameters in early lactating murrah buffaloes. *Buffalo bulletin* 34: 63-67.
43. Mallik S, Prakash BS (2011) Effects of supplementation of *tinospora cordifolia* to crossbred cow's peripartum. *Anim Reprod Sci* 123:5-13.

44. Warriar RR, Singh BG, Anandalakshmi R, Sivakumar V, Kumar AM, et al. (2007) Vegetative propagation of *Tinospora cordifolia*-A folkloric and Ayurvedic medicinal plant. *Biomed* 2: 131-137.
45. Shubhashree MN, Naik R, Doddamani SH, Bhat S (2018) An update review of single herbal drugs in the management of Osteoporosis. *International Journal of Complementary & Alternative Medicine* 11: 82-86.
46. Pingale SS (2011) Acute toxicity study for *Tinospora cordifolia*. *Int J Research in Ayurveda & Pharmacy* 2: 1571-1573.
47. Mutalik M, Mutalik M (2011) *Tinospora cordifolia*: role in depression, cognition and memory. *Australian Journal of Medical Herbalism* 23: 168-173.
48. Khatun H, Kundu S, Ahmed KMMM (2016) Guduchi (*Tinospora cordifolia* (Wild), A traditional Indian herbs and its medicinal importance-An Ayurvedic approach with contemporary view. *International Journal of Ayurvedic and Herbal Medicine* 6: 2260-2267.
49. Priti A, Rani S (2017) Phytochemical screening, antibacterial and antioxidant activity of leaves extract of *tinospora cordifolia*. *J Pharm Res* 11: 991-995.
50. Kamble N, Puranik DB, Salojoa MK (2017) Preliminary phytochemical screening of aqueous extracts of *tinospora cordifolia* leaves and stem. *International journal of innovative science engineering & technology* 4: 54-60.
51. Mishra P, Jamdar P, Desai S, Patel D, Meshram D (2014) phytochemical analysis and assessment of in vitro antibacterial activity of *tinospora cordifolia*. *International Journal of Current Microbiology and Applied Sciences* 3: 224-234.
52. Dwivedi SK, Enepsa A (2016) *Tinospora cordifolia* with reference to biological and microbial properties. *International Journal of Current Microbiology and Applied Sciences* 5: 446-465.
53. Kumar ABS, Basalingappa KM, Kumar JR, Karthikeyan M, Gnanasekaran A, et al. (2017) preliminary phytochemical analysis of methanolic extract of *tinospora cordifolia* and its anti-bacterial action on *E.coli* cell division. *Journal of Drug and Medicine* 9: 52-60.
54. Kaur G, Prabhakar PK, Lal UR, Suttee A (2016) Phytochemical and biological analysis of *tinospora cordifolia*. *International Journal of Toxicological and Pharmacological Research* 8: 297-305.
55. Vikesh GS (2013) A review on Guduchi through Ayurvedic texts. *International Ayurvedic Medical Journal* 1: 1-7.

Author Affiliations

Top

¹*Division of Molecular Biology, Faculty of Life Sciences, JSS Academy of Higher Education & Research, SS Nagara, Mysuru-570015, India*

²*Division of Biotechnology, Faculty of Life Sciences, JSS Academy of Higher Education & Research, SS Nagara, Mysuru-570015, India*

Submit your next manuscript and get advantages of SciTechnol submissions

- ❖ 80 Journals
- ❖ 21 Day rapid review process
- ❖ 3000 Editorial team
- ❖ 5 Million readers
- ❖ More than 5000 
- ❖ Quality and quick review processing through Editorial Manager System

Submit your next manuscript at • www.scitechnol.com/submission