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AN OVERVIEW ON GUDUCHI; *TINOSPORA CORDIFOLIA*; MIERS WITH SPECIAL REFERENCE TO AYURVEDIC AND MODERN ASPECT

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ABSTRACT

Tinospora cordifolia, Miers commonly known as *Guduchi*, which is one of the most widely used herb in various Ayurvedic medicines. Now a days, Ayurvedic herbs are popular all over the world. The demand of Ayurvedic medicines is increasing progressively due to their efficacy, lesser side effects. Some of the Ayurvedic herbs are much popular in community. *Guduchi* is one of them. It is climbing shrub. According to Ayurveda taste of *Guduchi* is bitter, pungent and systringent. In *Charak Samhita* and *Ashtang Hridya*, it has been indicated in diseases like *Jwara*, *Vatarakta* and *Kamala*. The research article on *Tinospora cordifolia* include pharmacological activities like immunomodulatory activity, anti-microbial activity, anti-oxidant activity, anticancer activity, anti-allergic activity. The review article include information on habitat, cultivation and propagation, phytochemical constituents, pharmacological activities, traditional uses and the therapeutic uses of *Tinospora cordifolia*. *Guduchi* is used in India by various tribes in daily diet.

KEYWORDS: *Guduchi*, *Tinospora cordifolia*, Phytochemical, Pharmacological.

INTRODUCTION

Ayurveda is a traditional system of Indian medicine used over thousands of years for healing and well being of body. Treatments in *Ayurveda* are given to cure the body. *Guduchi* is one of the medicinal plants having tremendous effects on various diseases. *Tinospora cordifolia* is the latin name of *Guduchi*. It belongs to the family Menispermiaceae. *Tinospora cordifolia* is a climbing shrub. It is frequently used as domestic folk medicine for headaches, cold, fever, pharyngitis, diarrhoea and rheumatid arthritis treatment. Modern researches demonstrated that Tinospora species possess Anti cancer[1,2,3], Anti microbial[4,5], Anti allergic activity.[6,7,8,9] It consists of tinosporine, cordifolide, cordifol, tinosporide[10]. Its stem is used in Ayurvedic preperations to treat fever, dyspepsia, urinary disorders. Tinospora cordifolia is prescribed in *Ayurveda* as a *Rasayana*.

AYURVEDIC CLASSIFICATION

According to different Samhitas / Nighantus

***Charak Samhita*[11] –** *Vayasthapan gana, Dahaprashaman gana, Trisna nigrahan gana, Stanyashodhan gana* (Ch.Su.4)

***Sushrut Samhita*[12] –** *Guduchyadi varga, Patoladi varga, Aragvadhadi varga, Kakolyadi varga, Vallipanchmool* (Su.su.38)

***Ashtang Hridya*[13]–** *Shaka varga, Padmakadi gana, Patoladi gana, Guduchyadi gana, Aragwadhadi gana, Shyamadi gana.*

***Dhanwantari Nighantu*[14], *Raj Nighantu*[15], *Bhavaprakash Nighantu*[16], *Shaligram Nighantu*[17], *Nighantu Adarsha*[18] -** *Guduchyadi varga*

***Madanpal Nighantu*[19] –** *Abhayadi varga*

***Kaiyadeva Nighantu*[20] –** *Aushadhi varga*

Sr.No.	Nighantu	Number of types	Types
1	*Dhanwantari Nighantu*[14]	2	*Padma Guduchi (Tinospora sinensis)* Kanda Guduchi
2	*Kaiyadeva Nighantu*[20]	2	*Guduchi* *Pinda Guduchi*
3	*Raj Nighantu*[15]	2	*Guduchi* *Kanda Guduchi*

Types of Guduchi

Different species

1. Tinospora cordifolia
2. Tinospora malabarica

3. Tinospora crispa

L.N. = *Tinospora Cordifolia*

Taxonomical classification of *Tinospora Cordifolia*[21]

Kingdom - Plantae

Subkingdom - Tracheobionta

Division - Magnoliophyta

Class - Magnoliopsida

Subclass - Rannunculidae

Order - Rannunculales

Family - Menispermaceae

Genus - Tinospora

Species - Cordifolia

***Nirukti*[18]**

Amruta – Na mrutam asyaha

Vatsadani – Vatstyahi adyate, ad bhakshane

Chhinnaruha – Chhinna api rohati

Guduchi – Gud rakshane

Tantrika – Tantrayati ya sa, Tantri kutumbdharane, Tantrayate dharayati ayu

Madhuparni – Madhumayani parnani asyaha

Amrutavallari – na mariyate lata asuya

Kundali – Kundalakaren vardhate

Mandali – Mandalakaren vardhamana

Chakralakshanika – Kansachhede chakren lakshayate

Chandrahasa – Chandrakarani Shubhra beejam yasyaha

Rasayani – Rasayan vat

Jeevanti - Jeevayati iti

Vayasya – Vayase ayusha hita, Ayushayet yah athaha

Jwaranashini – Jware hitwat

Vishalya – Vigat shalyam asyaha

Som – Somaparadhana

***Paryay* of *Guduchi*[14,19,20,16,15]**

	Dhanwantari Nighantu	***Madanpal Nighantu***	***Kaiyadeva Nighantu***	***Bhavprakash Nighantu***	***Raj Nighantu***
Amruta	-	+	+	+	+
Amrutakand	+	-	-	-	-
Amrutlata	-	-	+	-	+
Amrutsambhava	-	-	-	-	+
Amrutavalli	+	-	-	-	+
Amrutvallari	-	+	-	+	-
Bahuchhinna	+	-	-	-	-
Bhishagjita	+	-	-	-	-
Bhishakpriya	-	-	-	-	+
Chakralakshana	+	+	+	-	-
Chakralakshanika	-	-	-	+	-
Chandrahasa	+	+	+	+	+
Chhinnangi	+	-	-	-	-
Chhinna	+	+	+	+	+
Chhinnaruha	+	+	+	+	+
Chhinodbhava	+	+	+	+	+
Devanirmita	+	-	-	+	-
Dhara	+	-	+	+	-
Guduchika	+	-	-	-	-
Jivanti	+	+	-	+	-
Jivantika	-	-	-	-	+
Jwaranashini	+	-	-	-	-
Jwarahar	-	-	-	-	+
Kandarohini	+	-	+	-	-
Kandodbhava kanda	+	-	-	-	-
Kanya	+	-	-	-	-
Kundali	+	+	+	+	+
Madhuparni	+	-	+	+	+
Mandali	+	-	-	+	-
Mrittika	+	-	-	-	-
Nagakumari	+	-	-	-	-
Nagakumarika	-	-	-	-	+
Pindamruta	+	-	+	-	-
Rasayani	+	-	-	+	+
Satrupa	-	-	+	-	-
Saumya	+	-	-	-	-
Somalatika	-	-	-	-	+
Somavalli	+	-	-	+	-
Soma	-	-	+	+	-
Surakruta	-	-	-	-	+
Syama	-	-	-	-	+
Tantrika	-	-	-	+	-
Vatsadani	+	+	+	+	+
Vayastha	+	+	+	+	+
Vishalya	+	-	-	+	+

Vara	-	-	+	-	+
Total					

Vernacular names[22]

Language	Name
English	Gulancha/Indian tinospora
Hindi	*Giloe, Gurach*
Assamese	*Amarlata*
Marathi	*Ambarvel, Gulavela*
Bengali	*Giloe, Gulancha*
Panjabi	*Batindu*
Gujarati	*Gado, Gulo*
Oriya	*Gulochi, Gulancha*
Kannada	*Amrutha balli, Uganiballi*
Malyalam	*Amrytu, Chittamrutu*
Tamil	*Amrida valli*
Telugu	*Tippa teega*
Kashmiri	*Amrita, Gilo*
Urdu	*Gilo, Gilo khushk*
Persian	*Gul-bel*
Arabic	*Gilo*
Tibetan	*Sle tras, sle tres*

Raspanchak

Sanhita/Nighantu	***Ras***	***Vipak***	***Veerya***	***Guna***
Charak[11]	*Tikta,Katu,Kashay*	*Madhur*	*Ushna*	*Guru*
Sushrut[12]	*Tikta*	*Guru*	*Ushna*	*Guru*
Ashtang Hridya[13]	*Tikta*	*Katu*	*Sheeta*	-
Nighantu Adarsha[18]	*Katu*	*Madhur*	*Ushna*	*Guru*
Dhanwantari Nighantu[14]	*Tikta, Kashay*	-	*Ushna*	*Guru*
Bhavaprakash Nighantu[16]	*Katu,Tikta,Kashay*	*Madhur*	*Ushna*	*Laghu*
Rajnighantu[15]	*Tikta,Kashay*	*Madhur*	*Ushna*	*Guru*
Madanpal Nighantu[19]	*Katu,Kashay*	*Madhur*	*Ushna*	*Laghu*
Shaligram Nighantu[17]	*Tikta,Kashay*	*Madhur*	*Ushna*	*Guru*
Kaiyadev Nighantu[20]	*Tikta,katu,kashay*	*Madhur*	*Ushna*	*Guru*

Panchabhautik Sanghatan

Ras/Vipak	***Prithvi***	***Jal***	***Tej***	***Vayu***	***Akash***
Tikta	-	-	-	+	+
Katu	-	-	+	+	-
Kashay	+	-	-	+	-
Madhur	+	+	-	-	-

Conclusion– *Vayu mahabhutadhikya* is there in *Guduchi rasa*.

In *panchbhautik sanghatan*,

- Due to *tikta rasa (Vayu + Akash) Guduchi* is *jwarahara, kaphahara, medohara, amahara, kushthahara, pramehahara*.

- Due to *katu rasa (Vayu + Tej) Guduchi* is *dipaneeya, amahara, kandughna*.

- Due to *kashay rasa (Prithvi + Vayu) Guduchi* is *kandughna, amahara, krimighna, Kushthahara*.

- Due to *Madhur vipaka (Prithvi + Jal) Guduchi* is *balya, hridya, vatahara, vatapittahara, rasayani, vayasthapaniya*.

***Karmas* of *Guduchi* :**[11,12,14,20,15,16,17]

Karma	***Ch.S.***	***Su.S.***	***A.S.***	***DN***	***KN***	***RN***	***BPN***	***Sha.N***
Vatahara	+	+	+	-	-	+	-	+
Amahara	-	-	-	-	-	-	-	+
Sangrahi	+	-	-	+	+	-	+	+
Hridya	-	-	-	-	+	-	-	+
Balya	+	+	+	+	+	-	+	+
Vanhikrita	-	-	-	-	+	-	-	-
Vatapittahara	+	+	+	-	-	-	-	-
Ayushya	-	-	-	+	-	-	-	+
Medya	-	-	-	+	-	-	-	-
Medohara	-	+	+	+	-	-	-	+
Pittahara	+	+	+	+	-	-	-	-
Vataraktahara		-	-	+	+	-	+	+
Dipaneeya	+	+	+	-	-	-	+	+
Rasayani	+	+	+	-	+	-	-	+
Tridoshahara	-	+	+	+	-	-	+	+
Vayasthapaniya	+	-	-	-	-	-	-	-
Raktadoshahara	-	+	+	-	-	+	-	+

Rogaghnata

Charaka[11]*– Trishnanigrahana* (alleaviates thirst), *Dahaprashamana* (reduces burning sensation), *Jwarahara* (decreases fever), *Kushthahara* (useful in skin diseases).

Sushruta[12]*– Pramehahara* (control diabetes), *Kandughna* (reduces itching), *Dahaprashamana*(reduces burning sensation), *Kushthahara*(useful in skin diseases), *Chhardighna* (reduces vomiting), *Jwarahara* (decreases fever).

Ashtang hridya[13] *– Pramehahara* (control diabetes), *Kandughna* (reduces itching)

Dhanwantari Nighantu[14] *– Kamalahara*(useful in jaundice), *Kandughna*(reduces itching), *Visarpaghna*(useful in herpes), *Kushthahara*(useful in skin diseases), *Krimighna*(destroys parasites), *Raktarshaghna*(useful in bleeding piles), *Panduhara*(useful in anaemia), *Jwarahara*(decreases fever).

Kaiyadev Nighantu[20] – *Pramehahara*(control diabetes), *Trishnanigrahana*(alleaviates thirst), *Visarpaghna*(useful in herpes).

Rajnighantu[15] – *Pramehahara*(control diabetes), *Dahaprashamana*(reduces burning sensation), *Bhramahara*(reduces giddiness), *Chhardighna* (reduces vomiting), *Panduhara*(useful in anaemia), *Jwarahara*(decreases fever).

Bhavprakash Nighantu[16] – *Kamalahara*(useful in jaundice), *Pramehahara*(control diabetes), *Kasahara*(reduces cough), *Dahaprashaman*a(reduces burning sensation), *Kushthahara*(useful in skin diseases), *Krimighna*(destroys parasites), *Chhardighna*(reduces vomiting), *Panduhara*(useful in anaemia), *Jwarahara*(decreases fever).

Shaligram Nighantu[17] - *Kamalahara*(usefulinjaundice), *Pramehahara*(control diabetes), *Kandughna*(reduces itching), *Kasahara*(reduces cough), *Jwarahara*(decreases fever), *Panduhara*(useful in anaemia), *Chhardighna*(reduces vomiting).

***Swaroop*[23]**

Bahuvarshayu Lata

Patra – Ekantar, Hridyakruti, Harit

Pushpa – Laghu, Peet, Gucchakar

Phala – Laghu, Raktavarni

Kanda – Chhede Chakrakar

Morphology

External morphology[24]

Guduchi is glabrous, climbing shrub. Older stems are upto 2 cm in diameter and have corky bark. Aerial roots arise from nodal scars of branches.

Stem and branches are specked with white verticle lenticles. Bark is grey, warty, papery, thin and peels off easily.

Leaves are 5-15 cm, ovate and acute. They are membranous when young but become more or less leathery with age.

Floral characteristics: Flowers are yellow and less than 2 mm in size, drooping from the axils of the leaves or naked stem.

Female flowers are solitary while male flowers are grouped in axillary racemes.

Fruit is an ovoid and succulent drupe, lustrous, red and size of large pea having single seed. Seed reniform.

In May-June flowering occurs while fruiting in September-October.

Internal Morphology[25]

Transverse section of stem shows outer most layer of cork, differentiating into outer zone of thick walled brownish and compressed cells, inner zone of thin walled colourless, tangentially arranged 3-4 rows of cells, cork broken at some places due to opening of lenticles, followed by 5 or more rows of secondary cortex of which the cells of outer rows smaller than the inner one, just within the opening of lenticles, groups of sclereids consisting

of 2-10 cells found in secondary cortex region, outer zone of cortex consists of 3-5 rows of irregularly arranged, tangentially elongated chlorenchymatous cells, cortical cells situated towards inner side, polygonal in shape and filled with plenty of starch grains, simple, ovoid or irregularly ovoid-elliptical, occasionally compound of 2-4 components, several secretory cells, found scatteredin the cortex, pericyclic fibres lignified with wide lumen and pointed ends, associated with a large number of crystal fibres containing a single prism in each chamber, vascular zone composed of 10-12 or more wedge-shaped strips of xylem, externally surrounded by semi-circular strips of phloem, alternating, with wide medullary rays, phloem consists of sieve tube, companion cells and phloem parenchyma of polygonal or tangentially elongated cells, some of them contain crystal of calcium oxalate, cambium composed of one to two layers of tangentially elongated cells in each vascular bundle, xylem consists of vessels, tracheids, parenchyma and fibres, in primary xylem, vessels comparatively narrow devoid of tyloses, secondary xylem elements thick walled, lignified, vessels cylindrical in shape bearing bordered pits on their walls some large vessels possess several tyloses and often contain transverse septa, medullary rays 15-20 or more cells wide containing rounded, hemispherical, oblong, ovoid with faintly marked concentric striations and central hilum appearing like a point, starch grains of 5.5-11.20 micron in diameter and 6-11.28 micron in length, pith composed of large, thin walled cells mostly containing starch.

Habitat[26]

Tinospora cordifolia is a climbing shrub found in tropical areas of India.It climbs numerous types of trees. It grows in dry and deciduous forests elevation up to 1000ft. It prefers acid to alkaline soil. It needs moderate moisture level of soil.

Cultivation and Propagation[27]

Medium black soil or red soil is best for cultivation of *Tinospora cordifolia*. The plant is cultivated by stem cutting in the month of May or June. It requires some support preferably *Neem* or *Mango*. The field should be irrigated periodically as and when required weekly or periodically after plantation. *Tinospora cordifolia* can be propagated by vegetable cutting and also seeds. Vegetable cutting is best way. The cuttings of 6 to 8 inch length long, small finger thickness stem having two nodes are used. The cuttings are dipped by quick dip method in 2500 ppm of IBA and get greater success of rooting. This may be planted in polybags fiiled with mud, sand and dry cow dungin the ratio 1:1:1. The rooting of cuttings takes 4 to 5 weeks. After that, it is ready for planting into main field. *Tinospora cordifolia* is climber,

proper training structures like wires are required. The first harvest can be made by plucking the leaves without damaging the vines. These leaves are then spread on clean dry floor for drying.

Traditional Uses[28]

- *Guduchi* juice is used in Diabetes with honey as diuretic.
- *Guduchi* juice is used in chronic fever or chronic cough with *Pippali*.
- *Guduchi* juice is also used in snakebite as antidote.
- *Guduchi* sattva is used in chronic diarrhoea,fever,headache,dysentery,urinary diseases and nutrient for debility.
- The tribals of Mumbai and its neighbouring areas also fisherman along the sea coast use *Guduchi* in the treatment of jaundice,fever,dysentery and chronic diarrhoea.
- The tribals of Khedbrahma region of Gujarat use *Guduchi* in their daily life as food and medicine. They use powder of stem bark and root with milk in the treatment of cancer.In diarrhoea and dysentry decoction of root is used.In the treatment of periodic fever decoction of old stem is preferred.
- The people of Jammu and Bigwada(Rajasthan) use decoction of stem of *Guduchi* for the treatment of fever.
- The people of Patiyala(Panjab) use juice or decoction of leaves of *Guduchi* with honey in fever.
- The muslim tribals of Rajouri, Jammu(Tawi) used the plant in bone fracture.
- The tribal races viz. Agaris, Bhills, Vagharis, Thakurs and Varlis in Dahanu forest division of Maharashtra use the decoction of stem of *Guduchi* with cold or hot water in morning in an empty stomach as a tonic in general debility.
- In Bihar, Banka inhabitants dyed shirt of child in juice of *Guduchi* and worn in Balashosha.
- In daha paste or juice of *Amrita* leaves and sarshapa beeja is applied locally.
- In kasa powder of *Haritaki*, *Amalaki* and *Ajwain* in equal quantity is administersd orally once daily in morning.
- The people of Patiyala, in *karnashoola* dropped two drops of leaf juice of *Guduchi* in the ear.
- The local women of Arjunpura (Rajasthan) administered paste of *Guduchi* and five seeds of *krishna marich* orally once daily in morning.

- Inhabitants of Badala (U.P.) take the stem juice orally with honey for the treatment of shwasa (asthma).
- The people of Dehraba,Sivpuri,Kolaras in district of M.P. use decoction of stem orally in case of *twak roga*.

Part use[23]

Root, stem and leaves are used in Ayurvedic medicine.

Chemical constituent of *Tinospora cordifolia*[10]

TYPE	Active principal	Parts in which present
Alkaloids	Berberine, Palmatine, Tinosporin, Choline, Magnoflorine	Stem and root
Glycosides	Tinocordiside, Tinocordifolioside, Cordifolioside B, Syringin, Palmatosides C31	Stem
Diterpenoid Lactones	Clerodane derivatives Tinosporon, Tinosporides, Jateorine, Columbin	Whole plant
Steroids	b-sitosterol,d-sitosterol, b-hydroxyecdysone, Ecdysterone, Makisterone, Giloinsterol	Stem and aerial plant
Sequiterpenoid Aliphatic compound Miscellaneous comp.	Tinocordifolin, Octacosanol, Heptacosanol, Nonacosan-15-one 3	Whole plant

Matra[18]

Churna - ¼ - ½ *tola*, *Kwath* - 4 *tole*, Amrutasatva - 5 – 15 *ratti*, *Amrutadyarishta* - ½ - ½ ounce २ times

Sanshamani vati - 10,50 upto 100 according to patient's strength

Doses

In powder form – 3-6 gm of the drug

In decoction form – 20-30 gm of the drug

Formulations

Amruta satva, Sanshamani vati, Amrutadyarishta, Guduchyadi kwath, Guduchi him, Amrutaghrut, Guduchyadi raskriya

PHARMACOLOGICAL ACTIVITIES[29]

In history of traditional medicine use of *Tinospora cordifolia* has revealed it to have pharmacological value as Hypoglycemic, hepatoprotective, anti inflammatory, anti oxidant, immune modular activity, antitumour activity.

1.Immunomodulatory activity

Isolated chemical compounds of *Guduchi* such as cordifolioside A and syringin are reported as immunomodulating agent in the clinical study[30].The stem of *Guduchi* alters the level of enzymes like catalase and stimulates lymphocyte cells maintaining the immune strength,thus proving the immune-protective role of *Guduchi*[31].A clinical showed that, lotion of *Tinospora cordifolia* causes a decline in the level of interleukin i.e. IL-1 and IL-6 in scabies animal model.It inhibits infiltration of inflammatory cells and hyperkeratosis into scabietic gash,showing its anti scabies activity[32].Aqueous extract of *Guduchi* induces cellular mitosis,stimulates the production and activation of cytokine and immune effector cells[33].*Tinospora cordifolia* is able to increase the response of immune cell as well as neutrophil activity highlighting it as a potent agent for the prophylaxis of immune susceptible diseases[34].Oral administration of alcoholic extract of *Tinospora cordifolia* (100 mg/kg) initiates an increase in foot pad thickness as well as white blood cell count and bone marrow cell indicating a stimulatory effect on haemopoetic system which shows a potent immunomodulatory action.[35] A classical preparation of an aqueous extract of *Guduchi* named as *Ghana* in Ayurveda when tested on edema rat model, it reduced the edematogenic agents and thus has a potent immunostimulatory action.[36]

2. Anti-microbial activity

A study highlighted that silver nanoparticles synthesized from the stem of *Tinospora cordifolia* possess good antibacterial activity against the bacteria named Pseudomonas aeruginosa found in the patient suffering from burn injury[4].An active chemical compound found from the stem of *Tinospora cordifolia* as reported,found to be effective against bacteria like E.faecalis and B.subtilis and fungus like T.Simii and T.rubrum.[5]

The stem and leaves of *Guduchi* showed maximum inhibitory activity against the clinical urinary pathogens such as Klebsiella pneumoniae and Pseudomonas aeruginosa. Thus, it prevents the urinary tract infections.[37] *Tinospora cordifolia* has also found its importance by decreasing the resistance to different antibiotic therapy by the urinary pathogens and thus check the microbial infectivity.[38]

3. Anti-oxidant activity

Various extracts of *Guduchi* exhibits an anti-oxidant potential by scavenging the free radicals and other reactive species respectively.[39] A clinical research has reported that the extract of *Tinospora cordifolia* shows anti-oxidant effect by raising the GSH level and reducing the expression of inducible nitric oxide synthase gene,it is also useful in cataract treatment by inhibiting the enzyme aldol reductase.[40,41]

The plant derived arabinogalactan, the polysaccharide compound shows a protection against free radicals in rat model indicating its anti-oxidant action.[42] In Ayurvedic medicine, Pepticare a herbomineral formulation which includes *Tinospora cordifolia* has also been reported to possess potent anti-oxidant effect in rat model.[43]

4. Anti-toxin activity

Tinospora cordifolia has reported to reverse the toxicity caused by aflatoxin in kidney(Swiss albino mice) where, it substantially elevates the enzyme activities and hormone level and decrease the reactive oxygen species. This anti-toxin activity is brought by the alkaloids of this *Guduchi.*[44] This plant extract when given orally has also reported to counter the toxic effects caused by lead nitrate in mice liver.[45]

5. Anti-Cancer Activity

Various experiment on animal models have been taken to show the anti-cancer activity of *Guduchi*. The radio protective property is well characterized by this plant as it considerably increases the weight of various tissues as well as weight of body. The cultured HeLa cells when exposed to different concentration of methylene chloride extracts of *Guduchi* such as 0, 5,10, 25, 50 and 100 microgram/ml; it showed an increase in cell death as compared to untreated cultured cell(control) in dose dependent manner.[1]

An extract of the isolated active constituent palmatine of plant *Guduchi* clearly indicates the anti-cancer potential in a Dimethylbenzanthracene induced (DMBA) skin cancer model conducted in mice(Swiss Albino).[2]

The anti-cancer activity of secondary metabolite (such as plamatine, yangambin magnoflorine, jatrorrhizine etc.) isolated from Tinospora cordifolia were tested in different type of tumor cells and among them ‘palmatine’ and ‘yangambin’ reported to treat KB cells while tinocordiside for colon cancer cell and oral cancerous cell (KB) respectively[2].Most of the chemotherapeutic agents are synthetic by nature and have number of adverse as well as

severe toxic effects which is very minimal in case of *Guduchi*.So,it can be considered as a 'safe drug' for treating cancer disease as far as patient health is concerned.

1.Evaluation of in vitro anticancer activity of *Tinospora cordifolia* (stem) against breast cancer cells[3]

The methanolic extract of stem of *Tinospora cordifolia* was evaluated for inhibition of cell proliferation and migration of human breast cancer cell line **MDA-MB-231**.MTT-based cytotoxicity assay was used to assess the effect of methanolic extract of stem of *Tinospora cordifolia* was evaluated for inhibition of cell proliferation and migration of human breast cancer cell line MDA-MB-231.MTT-based cytotoxicity assay was used to assess the effect of methanolic extract of stem of *Tinospora cordifolia* against proliferation of human breast cancer cell line.Wound healing migration assay was used to assess the effects on the migration ability of human breast cancer cells.Methanolic extract of *Tinospora cordifolia* showed significant anticancer activity against MDA-MB-231.MTT-based cytotoxicity assay was used to assess the effect of methanolic extract of stem of *Tinospora cordifolia* against proliferation of human breast cancer cell line.Wound healing migration assay was used to assess the effects on the migration ability of human breast cancer cells.Methanolic extract of *Tinospora cordifolia* showed significant anticancer activity against MDA-MB-231 human breast cancer cell line.

2. Effect of *Tinospora cordifolia* on MCF-7 cell morphology[46]

The cells were treated with three different doses of extract of *Tinospora cordifolia* 200 microgram/ml,400microgram/ml and 600microgram/ml. Aqueous and hydro alcoholic extracts of *Guduchi* are used.Both extracts show degenerative changes in the cell in dose dependent manner with maximum effect noticed at the dose of 600 microgram/ml.This findings suggest that the extracts of *Guduchi* have potential for acting as antiproliferative agent in mammary tumor.

3.Tinospora cordifolia induces cell cycle arrest in Human oral squamous cell carcinoma cells[47]

The extract of *Tinospora cordifolia* induce inhibition of proliferation of KB cells was associated with arrest of G0/G1 phase of cell cycle.The effect of extract of *Tinospora cordifolia* in the growth of KB cells without altering the growth of normal peripheral blood mononuclear cells indicates that *Tinospora cordifolia* has different effect on normal and malignant cells hence, it may have therapeutic potential in cancer.

4. *Tinospora cordifolia* an Augmenting agent for quality of life in cancer[48]: Surgery, chemotherapy and radiotherapy are major approach of cancer reatment and excess reactive oxygen species molecule is generated during chemotherapy. Chemotherapy depresses the immunity inviting infection with alterted cognitive function. *Tinospora cordifolia* having free radical scavenging capacity,decreases oxidative stress increasing glutathione and other anti-oxidant enzyme and down regulate the pro-inflammatory cytokines. It stimulates helper T cellular immune, innate immune response and develops antigen specific immunity also increase the acetylcholine which is responsible for enhancing the cognitive function.

Additionally, it inhibits cell proliferation,differentiation and induced apoptosis that prevent anti-tumor activity. Thus,we can assume that impaired quality of life due to chemotherapy in cancer will be well adjusted by *Tinospora cordifolia* and also have anti-tumor activity.

5. Assessment of free radical scavenging and anti-proliferative activities of *Tinospora cordifolia* in cervical carcinoma HeLa cell line[49]

The study shown that the ethanol extract of *Tinospora cordifolia* shown significant anti proliferative activity in HeLa(cervical carcinoma) cell line. Hence, it can be concluded that *Tinospora cordifolia* has potential to be established as a chemo-preventive option for cancer.

6. Anti-allergic activity

Guduchi is used for the treatment of *shwasa* and *kasa*. It is traditionally used for treatment of asthma and the juice is employed for the treatment of chronic coughs.[6] In a clinical study, 100% relief was reported from sneezing in 83% of the patients on treatment with *Tinospora cordifolia*. Similarly there was relief from nasal discharge was reported in 69%; from nasal pruritis in 71% and from from nasal obstructions 61%. In placebo group, there was relief from sneezing only in 21% patients; from nasal discharge in 16.2%; from nasal pruritis in 12% and from nasal obstruction in 17%. Thus, *Guduchi* significantly decreased all symptoms of allergic rhinitis and was well tolerated.[7] The anti-allergic and bronchodilator properties of an aqueous extract of the stem of *Guduchi* evaluated on histamine-induced bronchospasm in guinea pigs, capillary permeability in mice and mast cell disruption in rats showed that it significantly decreased bronchospasm induced by 5% histamine aerosol, decreased capillary permeability and reduced the number of disrupted mast cells.[8,9]

7. Antipyretic and Anti-infective activity

Traditionally *Guduchi* is known for its *jwarahara* activity. The water soluble fraction of 95% ethanolic extract of *Tinospora cordifolia* plant has shown significant antipyretic activity.[50] Pre-treatment with *Tinospora cordifolia* was shown to impart protection against mortality induced by intra-abdominal sepsis following coecal ligation in rats and significantly reduced mortality from induced by E.coli-induced peritonitis in mice.[51]

8. Hepato-protective activity

Various Ayurvedic preparations of *Guduchi* are indicated in *pandu*(anaemia) and *kamla*(jaundice). A clinical study has shown that *Guduchi* plays an important role in normalization of altered liver functions.[52] *Tinospora cordifolia* prevents antitubercular drugs[53,54] and bile salts[55] induced hepatic damage and obstructive jaundice.[56] The extract has also exhibited in vitro inactivating property against hepatitis B and E surface antigens in 48 to 72 hours.[57]

9. Cardioprotective activity

Bhavprakash Nighantu and *Shaligram Nighantu* describe Guduchi to have *hrudya* (cardioprotective) properties and is useful in *hridroga* (cardiac disorders). A dose dependent reduction in infarct size and in serum and heart lipid peroxide levels were observed with prior treatment with *Tinospora cordifolia* in ischemia reperfusion-induced myocardial infarction in rats.[58] Administration of the extract of *Tinospora cordifolia* roots (2.5 and 5.0 g/kg body weight) for 6 weeks resulted in a significant reduction in serum and tissue cholesterol, phospholipids and free fatty acids in alloxan diabetic rats.[59]

10. Anti-leprotic activity

Guduchi is used for its *kushthahara* (anti-leprotic) properties,along with wide use in *kandu* and *visarpa* and has been shown to exert anti-leprotic activity in a combination formulations.[60]

11. Gastrointestinal and Anti-ulcer activity

Ayurvedic properties of *Guduchi* include *sangrahani*, *arshahara*, *aruchinashak*, *dipana*, *chhardihara*, *trisnahara* and *hikkahara*. Treatment with formulation containing *Tinospora cordifolia* has been shown to reduce ulcer index total acidity with an increase in the pH of gastric fluid in pylorus-ligated rats and in the ethanol-induced gastric mucosal injury in rats.[61]

CONCLUSION

The scientific research on *Tinospora cordifolia* suggests a huge biological potential of this plant.It represents a class of hebal drug with very strong traditional or conceptual base as well as strong experimental base for its use.It has great medicinal potential to cure several diseases including cancer. *Tinospora cordifolia* can be a potential dietary component which can help in prevention of different diseases. In various *Sanhita* and *nighantus* most of common indications found are for *jwara*(fever), *kushtha*(skin diseases), *chhardi*(vomiting), *prameha*(diabetes), *kamala*(jaundice), *pandu*(anaemia) etc. Research study on *T.cordifolia* provide scientific validation for activities like anti-cancerous, antidiabetic, antipyretic, anti-allergic, anti-microbial. The utility of *Guduchi* leaves in diet is advisable and is highly beneficial. Also it is strong immunomodulator.

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