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Review article

Medicinal properties and *in-vitro* propagation of *tinospora cordifolia*

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ABSTRACT

Tinospora cordifolia is a widely used medicinal plant. It is a very important medicinal plant of the India and other countries. Many chemical constituents have been isolated from stem, leaf and root of T. cordifolia such as berberine, glionin, giloin, cordioside, amritoside, tinosponon, sitosterol etc. Many researchers have been working on anti-microbial, anti-malarial, anti-allergic, anti- bacterial, anti-cancer activities of T. cordifolia and some researchers have been also worked on in -vitro propagation of T. cordifolia, because the "National Medicinal Plant Conservation Board" has prioritized this plant species for sustainable utilization, cultivation and trade. Some biotechnological techniques can help for the same. This article has given more awareness about this plant.

Keywords: *Tinospora cordifolia, In-vitro* propagation, Phytochemicals, Conservation strategies.

INTRODUCTION

Medicinal plants play an important role in our life they are the only source of treatment for many diseases of India. India is a center of diversity and origin of many crop and medicinal plants. India possesses 20,000 species of higher plants, one third of it is endemic and 500 species having medicinal properties. Demand of Ayurvedic products is increasing now-a-days because they are not cost effective and side effects of these medicines are also nil. Medicinal plants are the main source of these Ayurvedic medicines but, they are rapidly lost from their natural habitats due to some environmental and economic reasons.

Tinospora cordifolia (Willd.) Miers. Ex Hook. F. Thomas. A. belonging to the family manispermaceae is a large glabrous, deciduous climbing shrub. This family consists of 70 genera and 450 species. That is found in the tropical lowland region. The plant is distributed throughout the tropical region of India to 1200 m. above sea level from Kumaou to Assam, in north extending through West Bengal, Bihar, Karnataka and Kerala. In center of India (Madhya Pradesh) it is found in dry forest, commonly growing over hedge and Neem trees. Common names of *T.cordifolia* are giloya, guduchi, gurvel, amrita, amritavalli, madhuparni, guduchika, tantrika, gulancha, gurcha, garo, gilo, seendal, siddhilata, heartleaf moon seed (4, 47). It is categorized as "Rasayna" in the traditional Indian system of medicine "Ayurveda" [1].

Botanical description

Tinospora Cordifolia is a large, glabrous, deciduous, climbing shrub and a perennial plant of weak and fleshy stem found throughout the India. The stem structure is fibrous and the transverse section exhibits a yellowish wood with radially arranged wedge shaped wood bundles, containing large vessels, separated by narrow medullary rays. The bark is creamy white to gray, deeply left spirally, leaves simple, alternate ex-stipulate, long petioles up to 15 cm long, roundish, pulvinate, both at the base and twisted partially and half way around . The aerial roots that arise from the stem are thread like. The leaves are heart shaped and smooth, flowers unisexual, small on separate plants and appearing when plant leafless, greenish yellow on axillary and terminal racemes, male flowers clustered, female usually solitary, fruit aggregate of 1-3 ovoid smooth drupelets on thick stalk with sub terminal style scars, scarlet or orange coloured. Flowers grow during the summer and fruits during the winter [2].

Figurer 1: *Tinospora cordifolia*

Figure 2: Leaves of *T. cordifolia*

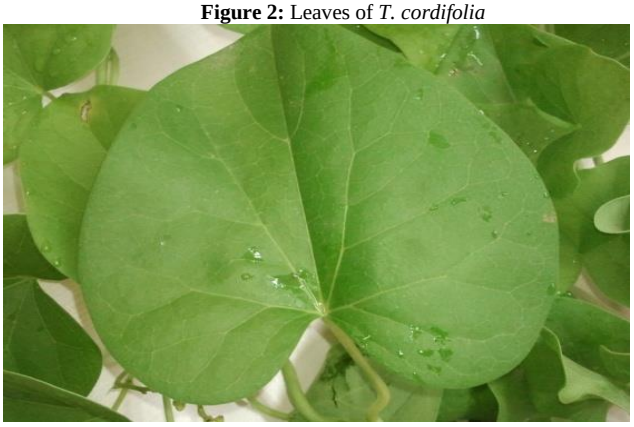

Figure 3: Stems of *T. cordifolia*

Distribution

T. cordifolia is distributed throughout the tropical region of India up to 1,200 m above sea level. It is distributed from Kumaon to Assam, in north extending through West Bengal, Bihar, Deccan, Konkan, Karnataka and Kerala. It thrives in the tropical regions in forest and other habitats.

Medicinal properties of *tinospora cordifolia*

Guduchi is widely used in veterinary, folk and Ayurvedic system of medicine for its general tonic, anti-periodic, anti-inflammatory, and anti-arthritic, anti- diabetic, anti-allergic, neuroprotective, antioxidant, antineoplastic, chemopreventive, radioprotective, antipyretic, and antifertility activities.

It is generally prescribed in general debility, diabetes, fever, jaundice, skin diseases, rheumatism, urinary diseases, dyspepsia, gout, gonorrhea and leucorrhoea. A decoction of the stems, leaves and roots are used to treat fever, cholera, diabetes, rheumatism and snake bites, an infusion of the stem is drunk as a vermifuge, A decoction of the stem is used for washing sore eyes and syphilitic sores. The stem is registered in the Thailand pharmacopoeia, and commonly use in hospitals to treat diabetes. The root of this plant is known for its anti-stress, anti-malarial, anti-leprotic activities [3].

The literature survey of *T. cordifolia* has shown that this plant species have several pharmacological activities. Action of aqueous and ethanolic extract of the plant when administered to alloxan induced diabetic rats caused a dose dependent reduction in blood glucose levels, similar to glibenclamide and insulin. Gupta *et al*. reported that the daily administration of either alcoholic or aqueous extract of *T. cordifolia* decrease the blood glucose level and increase glucose tolerance in gnawing animals. Ethayle acetate extract of its roots has afforded a pyrrolidine derivative with hypoglycemic activity in rabbits [4].

Hot methanol extract of *T. cordifolia* root showed more significant activity against all tested bacterial organisms than that of the cold methanol extracts. These reports open the possibility of isolating clinically effective antibacterial compounds.

The alcoholic and aqueous extract of *T. cordifolia* has been reported for immune-modulatory activities. According to Desai *et al*., dry stem crude extract of *T. cordifolia* contained a polyclonal B-cell mitogen, G1-4A which is a polysaccharide in nature. Dry stem crude extract as well as G1-4A increase humoral immune response in mice [5].

Jagetia *et al*. and Jagetia and Rao investigated that methanolic, aqueous and a methaylene chloride extract of *T. cordifolia* showed a dose dependent cytotoxic effect on Hela- cultured cells when compared with non-drug treated controls So results are demonstrated that Guduchi is also an anti-neoplastic agent.

Moreover, extensive work has been carried out on many other aspects of pharmacological activities of *T. cordifolia* that involved its adaptogenic activity on a variety of biological, physical and chemical stressors on different animal models. So, these reports reveal that the *T. cordifolia* is a useful and important medicinal plant because of its multiple medicinal uses.

The World Health Organization (WHO) has estimated that 80% of world population in developing countries depending primarily on herbal medicine for their basic health care, but some important medicinal plants are disappear from their natural habitat due to some environmental and economic reasons. *T. cordifolia* is one of them, it is an over exploited medicinal plant, it grows wild in the forest and other areas and there is no organized propagation information available so far, conventional vegetative propagation of this plant has limited potential for large scale propagation of elite plants.

Tissue culture remains one of the most basic biotechnological

techniques with its varied and vast applications. The technique has contributed tremendously in the safeguarding, improvement and distribution of important plant species, especially the vegetatively propagated plants. The plants resulting from *in-vitro* regeneration technique can eliminate difficulties in mechanization and improve productivity through somaclonal variation.

In-vitro* propagation of *tinospora cordifolia

Reddy *et al.,* reported a plant regeneration protocol through somatic embryogenesis from leaf explants obtained from seedling parts and Nakano *et al.,* found that the NAA (α-Naphthaleneacetic acid) and 2,4-D (2,4-Dichlorophenoxoxyacetic acid) along could initiate callusing from stem, leaf and nodal segments but, callus may grow slowly, when Kinetin along with auxins considerably increased callus growth.

Raghu *et al.,* developed a protocol for rapid clonal propagation of *Tinospora cordifolia*, through *in vitro* culture of mature nodal explants. Shoots were initiated on both Murashige and Skoog (MS) medium and woody plant medium (WPM) supplemented with 2.32 µM kinetin (KIN). Of the two basal media tested, WPM was found to be superior to MS medium for the induction of multiple shoots. Elongated shoots were rooted in half-strength MS medium supplemented with 2.85 µM indole-3-acetic acid (IAA). Rooted plantlets were successfully transferred to sand and established with 80% survival.

Gururaj *et al.,* reported a micropropagation protocol of *T. cordifolia* using a nodal portion of the stem as explants. They have observed the influence of IBA (Indole-3-butyric acid) and combination of 2,4-D and kinetin on shoot proliferation from nodal explants of *T. cordifolia* that is further supported by similar reports in *Mentha piperata* (Ravishankar and Venkataraman, 1988). Among different cytokinins (2-isopentenyladenine, kinetin, benzyl adenine) used for shoot proliferation from nodal explants, only benzyl adenine and kinetin showed response. Callus formation was common from the base of explants at lower concentrations of BA (benzyl adenine) but at higher concentrations, BA (8.87-13.31 mM) induced a single shoot from nodal explant.

Tabassum and Nag carried out *in vitro* study of *Tinospora cordifolia*. The nodal explants of the plant, after surface sterilization with 70% ethanol for one minute and 0.1% mercuric chloride ($MgCl_2$) for five minutes, were cultured in a nutrient medium containing Murashige and Skoog's salts, vitamins, sucrose and various concentrations and combinations of BAP(6-benzyl amino purine) and NAA (α-naphthaleneacetic-acid). The nodal segments exhibited basal callusing after two weeks and emergence of shoots from the axillary bud after three weeks. The emerging shoots were sub-cultured in a fresh medium with NAA (1 ppm) and BAP (2 ppm). After two weeks of first sub-culture, shoots emerged from the single shoot along with root. The sub-culture of the callus on medium containing BAP (2 ppm) and NAA (1 ppm) resulted only in shoot differentiation.

Singh *et al.,* showed growth response of explants of *T. cordifolia* on different culture media after 2-3 weeks of primary culture. Explants showed callus formation from nodal, inter-nodal and leaf explants when planted on the medium containing the combination of BAP and NAA. In the hormone-free basal medium and the medium containing Kinetin, no response was shown by nodal and inter-nodal explants. The shoot and root induction from cultured explants were remarkably influenced by the type and concentration of hormones.

Khalilsaraie *et al*., explained indirect somatic embryogenesis from mature leaves of *T. cordifolia*. This is the first report of antimicrobial activity of aqueous extract of leaf induced callus in *T. cordifolia* [7].

Khanapurkar *et al.,* investigated that the nodal and inter nodal segment from healthy grown plants were used as explants shoot proliferation was observed in MS medium containing BA 5.0 and 1.0 kinetin half strength MS media supplemented with 0.4 mg/l naphthalene acetic acid (NAA) showed the best results for rooting with the average rooting response of 40 % .

Sarma *et al.,* reported a callus induction protocol from different plant parts like young leaves, mature leaves, axillary buds and shoot nodes in murashige and Skoog's media supplemented with 4.4 µm of 6- benzyl amino purine (BAP) showed the best results.

Choudhary *et al.,* investigated that formation of multiple shoots in high frequency was achieved in nodal explants culture. Murashige and Skoog's basal medium with the combination of benzyl amino purine (2 mg/l), kinetin (4 mg/l) and thidiazuron (0.20 mg/l) gave maximum shoots per explants within 30 days of inoculation.

CONCLUSION

Tinospora cordifolia is an adaptogenic and rejuvenating property medicinal plant but this plant disappearing fastly from their natural habitats due to over exploitation. We can save this plant through biotechnological approaches and improve the quality of the plant through secondary metabolites production. Plant tissue culture technique is the best for the mass production and for improvement in productivity of this plant. Thus it can be used as a source for developing new drugs and commercialization..

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