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T.cordifolia: A medicinal plant

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Abstract
Tinospora cordifolia (TC) is a medicinal plant containing several nutritional properties. It is used as a therapeutic plant for treatment of fever, diarrhea, oral ulcer, diabetes, digestive disorder, urinary infections; jaundice and skin diseases etc. It is mainly used in Ayurveda and considered as a natural remedy for curing of various diseases. Giloy (*T.cordifolia*) is rich in nutritional and therapeutic values. It is consumed by the people in the form of decoction in cure certain ailments. The plant is well known for its phyto-chemical constituents.

Keywords: *T.cordifolia*, Giloy, Root extract, value added products

Introduction
Giloy is botanically known as *Tinospora cordifolia* (Wild) Miers ex hook.F. & Thoms. Belongs to family Menispermaceae is a medicinal plant. India is known for medicinal plants since ancient times. Among them Giloy is one of the most commercially exploited plant in our Indian system (Singh and Warrior, 2004) [26] and known as important constituent for many Ayurveda formulation for treating several diseases (Singh *et al*., 2006) [27]. In India medicinal plants are used as natural medicine since prehistoric times. Different parts of plants are used for medicinal purposes like crude extract due to presence of natural chemical constituents (Balandrin *et al*. 1985) [4]. *T.cordifolia* is used for the treatment of many health problems like diarrhea, jaundice, fever, diabetes, urinary issues, skin sicknesses etc.
It is found in India, China, Burma and Sri Lanka (Singh *et al*. 1984) [25]. It is a climber and mostly grows in warm climate. Neem, Jatropha and Moringa are used to provide support for its growth (Chaudhari and Shaikh, 2013) [5]. It is mostly cultivated in medium black or red soil but can also be grow in various types of soils which consist of sufficient moisture and organic rich material (Mittal *et al.* 2014) [14].
The exploration of active compounds in plant due to their biological function in disease control get interest in plant. The active compounds present in plant like alkaloids, steroids, diterpenoid lactones, aliphatics and glycosides have been confined from roots, stem and whole plant (Soham and Shyamasree, 2012) [30].
Its fresh juice from stems and leaves is used as tonic for body pain (Soudamini *et al*. 2005) and also for treatment of asthma when consume orally with honey (Sinha *et al*. 2004) [29]. It regulating many disorders such as anti-oxidant, anti-hyperglycemic, anti-hyper lipidemia, hepato protective, cardiovascular protective, neuro protective, osteo protective, radio protective, anti-anxiety, adaptogenic agent, analgesic, anti-diarrheal, anti-ulcer, anti-microbial and anti-cancer agent (Dhama *et al.*; 2017) [6]
In Ayurveda *T.cordifolia* is consume in various dose forms like *Kalka* (paste of fresh stem), *Churna* (powdered dry stem), *Swaras* (juice from fresh stem), *Kwatha* (hot water extract from ground dried stem), *Arishta* (Stable processed formulation from a decoction of *T.cordifolia* containing self-generated alcohol) etc. (Panchabhai *et al.* 2008) [17]. Alcoholic extract obtained from the dried ripe fruits of *T.cordifolia* are good for immune modulatory activities (Aher and Wahi, 2010) [2].

Botanical Discription
Botanical name of Giloy is *Tinospora cordifolia* (Wild) Miers ex hook.F. & Thoms. It belongs to family Menispermaceae. It is a huge, globrous; deciduous broadly spreading climbing bush with a few stretched twinning branches. The stem of *T.cordifolia* is delicious with long

Fili form, physical airborne roots from the branches. The bark is rich white to dark, the leaves are straight forward, interchange, extirpate, long petioles upto 15cm long, roundish, pulvinate, both at the base and peak with the Basel one longer and curved in part and most of the way around. Lamina extensively applaud or praise cordite, 10-12 cm long or 8-10 cm broad,7 nerved and profoundly cordate at base, membranous, pubescent above, whitish tomentose with a noticeable reticulum underneath. The blossoms unisexual, little on isolated plants and showing up when plant is leafless, greenish yellow on axillary and terminal racemes.

Nutritional Composition

Giloy have high nutritional value containing 292.54 calories. (Nile and Khobragade, 2009). (Table 1) (Table 2)

Table 1: Mineral elements present in Giloy

Mineral elements	Amount
Potassium	0.845%
Iron	0.28%
Calcium	0.131%
Chromium	0.006%

Table 2: Nutrients present in Giloy

Nutrients	Amount
Protein	4.5-11.2%
Carbohydrate	61.66%
Low fat	3.1%
Ash	12.4%

Natural products and their biological activities

Active compounds or natural products isolated from *T.cordifolia* have many biological functions or activities which are given as follows:

Table 3: Natural components present in Giloy plant

Active components/ natural components	Plant part	Biological activity (in human being)	Reference
Alkaloids	Root, stem	Anti-diabetes, immunomodulatory, Anti-viral functions, inflammation	Upadhaya. *et al.* (2010) [35], Rout(2006) [21], Patel. *et al.* (2009) [20], Gupta and Sharma (2011) [7], Jagetia and Rao(2006) [8], Patel and Mishra(2011) [19]
Steroids	Shoot	IgA neuropathy, induced cell cycle arrest in G2, M phase and apoptosis through c-Myc suppression, inhibit TNF-α, IL-6 and COX-2	Lv. *et al.* (2012) [11], Mckeown. *et al.* (2012) [13], Sundarraj. *et al.* (2012) [33]
Sesquiterpenoid	Stem	Antiseptic	Maurya and Handa (1998) [12]
Others	Root, whole plant	Protease inhibitors for HIV and drug resistant HIV	Kim. *et al.*(2008) [10], Mukherjee. *Et al.* (2010) [15]

Properties

Osteoprotective activity

During the experiment done on the mouse it is found that *Tinospora cordifolia* extract prevent the bone loss and also protect the animal from experimental estrogen deficiency induced by ovariectomy. It is concluded that *T.cordifolia* can be used for the treatment of bone fractures and inflammatory bone diseases in Indian ethnomedicine. *T.cordifolia* positively regulates the remodeling of bone and favored osteogenesis *in vitro*. (Abiramasundari *et al*. 2017) [1]

Anti-diabetic activity

T.cordifolia also acts as an anti-diabetic agent and is used for the treatment of diabetes mellitus. The anti-diabetic activity of *T.cordifolia* is due to presence of tannins, flavonoids, alkaloids, cardiac glycosides etc. (Anonymous, 2001) [3]. The leaf extract of plant is tested at different doses in alloxan-diabetic rabbit and it shows hypoglycemic effect positively (Wadood *et al.*, 1992) [38].

Anti- HIV activity

Kalikae *et al*. (2008) [9] reported that the stem extract of *T.cordifolia* reduces the ability of eosinophil count, stimulation of ß-lymphocytes, macrophages, level of haemoglobin and polymorphonuclear Leucocytes.

Immunomodulatory activity

Sharma *et al*. (2011) [7] and Upadhyay *et al*. (2011) said that a large variety of compounds which are responsible for immunomodulatory and cytotoxic effect are 11-hydroxymuskatone, N-methyl-2-pyrrolidone, Nformylannonain, cordifolioside A, magnoflorine, tinocordioside and syringin. These natural compounds have been showed to improve the phagocytic activity of macrophages, enhancement in nitric acid production by stimulation of splenocyte.

Anti-oxidant activity

Gupta and Sharma (2011) [24] stated that the T.cordifolia has the ability to scavenge free radical produced by aflatoxicosis. It showed protection against aflatoxin-induced nephrotoxicity due to the presence of alkaloids such as a choline, tinosporin, isocolumbin, palmatine, tetrahydropalmatine and magnoflorin.

(a)

(b)

(c)

Fig 1: (a) Giloy plant (b) Giloy stem (c) Giloy dried stem

Uses

Value added product

Sood, (2016) [31] from Hyderabad, India studied reported that prepared product has great nutritional value and can be organoleptically acceptable to the consumers. Giloy which contain high medicinal value can also be used for preparation of ready to eat and healthy products.

Sharma *et al.* (2013) [24] from Karnataka, India reported that nutritional and medicinal properties of cookies can be improved by incorporation of dried *Tinospora cordifolia* leaf powder. Nutritional value of cookies is increased 0 to 7.5% by increase in iron, calcium, dietary fiber, protein, anti-oxidant activity and ß-carotene by addition of Giloy dry leaves powder.

Sarala *et al.* (2012) [22] stated that spray dried powder sample from leaf and stem of *T.cordifolia*has high solubility. *T.cordifolia* not only contains various benefits and medicinal properties but can also be used in powder form for formulation of various health benefit food products.

Nile reported that medicinal plants *G.sylvester*, *T.glaberrima*, *T.cordifolia*on dry matter basis have good nutritive value and can be used as food, fodder and livestock. It is good for younger and anemic people as it contains sufficient protein, carbohydrate with low fat and high fiber.

(a)

(b)

Fig 2: Giloy products (a) Giloy juice (b) Giloy powder

Medicinal uses of *Tinospora cordifolia*

- The juice of *Tinospora cordifolia* is beneficial for diabetes, dyspesia, vaginal and uretheral discharges (Singla *et al.*; 2010) [28].
- The combination of giloy herb and tulsi leaves used against monkey malaria (Vashist *et al.*; 2011) [37].
- In the presence of alkaloid in stem helps to regulate the blood sugar level (Patel and Mishra, 2011) [19]
- The damage tissue produce by radiation prevented by *Tinospora cordifolia* (Pandey *et al.*; 2012) [18].
- The powder of the stem is creamish brown or dark brown and its characteristics is odor, bitter taste and used for dyspepsia, fever and urinary diseases (Tiwari *et al.;* 2018) [34].

Conclusion

T.cordifolia is believed to be a medicinal plant which contains good nutritional value. It is mainly used in extract form for treatments since ancient times. For making it more easily consumable a study was done to evaluate the nutritional value of Giloy plant. It may be concluded that various Giloy based products like juice, cookies, RTS etc are attempt to make and it is found that addition of Giloy enhances nutritional and medicinal value of the prepared products. Slight amount of Giloy powder gradually increases nutritional value and utility value of cookies.

T.cordifolia based products comprises more nutritional value as compare to other artificial food products. Sensory attributes of products may decrease but are acceptable and can be ignore. Therefore, *T.cordifolia* may be used not only as a medicinal remedy but can also be used as value added product which enhances food quality and its nutritional value. It can be used for fortification of various food products which contain less nutritive value.

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