TINOSPORA CORDIFOLIA ON IMMUNOMODULATORY ACTIVITY IN DIFFERENT DISEASES

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Abstract: Owing to the fact that plants have been accepted as an important part of traditional medicine due to their miraculous phytoconstituents. *Tinospora cordifolia* (Guduchi/ Giloy is an herb which has pharmacological functions and medicinal qualities because it contains several components like terpenes, glycosides, alkaloids, flavonoids and steroids. Therefore, this is the main reason it is texted as "Amrita" in old textbook. It belongs to family Menispermaceae. This herb is used in the treatment of fever, urinary problem, dysentery, skin diseases leprosy, diabetes, and many more diseases. The latest analysis shows its pharmacological value as antioxidant, antimicrobial activity, antibacterial activity, antifungal activity, anti-diabetic activity, anti- stress activity, hypolipidemic effect, hepatic disorder, anticancer, anti HIV potential, anti-osteoporotic effects, wound healing, and immunomodulation activity. In Hindu mythology, it is also known as "the nectar of immortality." and the "heavenly elixir" that defends the body from various diseases. This medicinal plant is now being examined more rapidly for diverse pharmacological activities. The plant is a wide, widely spreading, deciduous climbing shrub with a particular type of morphology and multiple coiled branches.

Keywords- Tinospora coridifolia, Immunomodulator, Herb, Metabolism enhancer, Anti hyperglycaemic, Endocrine system modulation

INTRODUCTION

Attention is growing these days towards creative food that have high nutritional property that helps in mutating good health while providing better nutrition, the main factor responsible for worldwide growth of the nutraceutical market. It is a desk-bound lifestyle responsible for triggering different diseases like arthritis, obesity which leads to increase in cardiovascular disorders and increase chance of diabetes, etc. The World Health Organisation (WHO) reports that therapeutic plants as" plants in which any of its ingredients contains compounds which can be useful for treatment purpose or precursor for making of drug and therefore, a number of individuals in growing nations (70-80%) are projected to be focused on the traditional form of medicine. From *Tinospora cordifolia*, commonly referred to as Giloy or Guduchi, is a juicy shrub climbing, belonging to the family *Menispermaceae*. In Hindu mythology, it is also known as "the nectar of immortality." and the "heavenly elixir" that defends the body from various diseases. The stem shows immunomodulatory, hepato-protective, anti-allergic, anti-neoplastic, anti-infective, diabetes and diuretic action. Furthermore, due to some external and internal agent that disrupts the haemostasis of body and people become sick. For prevention and fighting against these agent's, immune system plays important role. If there is a decline in its ability to do so, the body suffers from diverse disorder. Orthodox methods of preventing and treating sickness or other bodily pain, the plants are again becoming famous and were once overlooked for the chemotherapeutic substances. Therefore, medicinal plants are now being examined more rapidly. Several studies have assisted strong prophylactic and medicinal uses, applications, advantages of several herbs to fight both common and sophisticated illnesses disorder. Moreover, in an experimental analysis, it was found that several variables determining the therapeutic action of particular a herb. A female plant has more therapeutic value than male when crop is harvested in late summer or in winter, as well it possesses more antioxidant property and immunomodulation. For antidiabetic action plant need to be harvested in monsoon season. Its formulation is made in various ways and in various medium which has numerous pharmacological properties.

Talia (with oil preparation) shows more immune stimulating operation. Ghrita (ghee preparation) has an anti-stress action, accompanied by additional immunosuppression intervention [1]. Experimentally, the herb is further known to be healthy for use in animals as it has not been reported mutagenic impact on the living organism in various studies as it possess least DNA disruption in peripheral blood lymphocyte [2].

Pharmacognostic description

It is a wide, widely spreading, deciduous climbing shrub with a particular type of morphology, multiple coiled branches. The stem of the plant is naturally filiform, fleshy and climbing; the bark is white to grey [3]. The stem powder is creamy brown or dark brown, having bitter taste, is used in dyspepsia, fever and urinary infections [4]. The starch collected from stem part is known as Guduchi-satva is easily digestive and very nutritional. The plant leaves are simple long-peeled (about 15 cm); round, pulvanized, partially and halfway around bent. Ovate lamina, 10-20 cm long, seven at the base and membranous nerves and strongly cordate. Flowers are unisexual, axillary, 2-9 cm long

branches of leaflets and greenish-yellow in colour, generally male flowers are present in cluster and female ones in isolation [5]. Its fruits are single-seeded. Flowers grow during summer season and fruits during winter season. Thread-like, aerial, the root is squairsh in, hitting the ground, often constantly lengthening [6], tetra to penta arch main structure characterises aerial roots [3]. The seeds are curved [1], and the endocarp is ornamented in different ways, offering important taxonomic characteristics.

Chemical constituents

Chemical elements of the substance *Tinospora Cordifolia* belongs to various groups such as alkaloids, glycosides, hormones, aliphatic compounds, phenolics, polysaccharides [7], the leaves have high protein content (11.2%). The stem part includes the glucoside clerodane furono diterpene, lycopene and berberin.

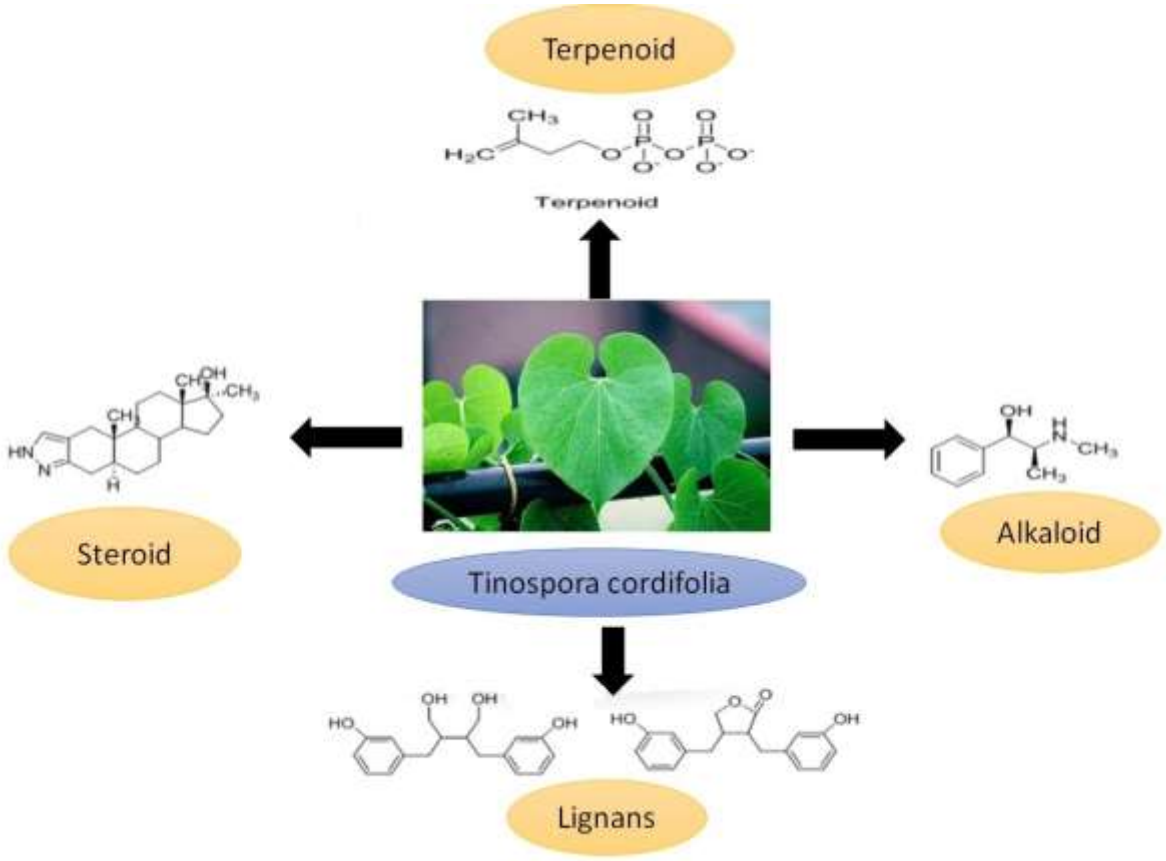

Figure.1. Major constituent of *Tinospora cordifolia*: terpenoid, alkaloid, lignans, steroids [1]

Parts of plant used for various diseases:

Stem: Dyspepsia, fever, and urinary diseases, anti-fungal and anti-bacterial activity [1][8], anti-diabetic respiratory infection.

Aerial parts of stem: Anti-anxiety activity. [3][4]

Leaves: Methanolic leave extract show antioxidant effect.

Roots: Phenolic extract show the anti-oxidant and antimicrobial, anti-hyperglycaemic effect.

Stem and roots: Anti-oxidant and antimicrobial cancer property.

An entire portion of the plant: Snakebite cure and scorpion sting, act as analgesic and used in diabetes, rheumatoid arthritis, gout, cancer, elevated levels of cholesterol, antipyretic, radio protective and anti-leprotic.

Medicinal importance of *Tinospora coridifolia*

- **IMMUNOMODULATORY ACTION:** Immunomodulatory action is seen because of non-specific immune mechanism stimulation [9]. The association with immunomodulatory intervention, a polysaccharide component is attributable as monomer groups, high in glucose, fructose, and arabinose. Other active immunomodulatory components that are present are: 11-hydroxymustakone, N-methyl-2-pyrrolidone, and N-formylannonine, cordifolioside A, tinocordiside, magnoflorine, and syringing [10,11]. In the present review the immunomodulatory behaviour of multiple forms of *Tinospora cordifolia* stem fractions and extracts were assessed. Studies of the phagocytic role of polymorphonuclear neutrophils (PMN) of *Tinospora cordifolia*, were also evaluated. Using this herb with cisplatin in the murine model, for the treatment of visceral leishmaniasis, instead of Th2 (T helper cell 2), it confirms the answer to type Th1(T helper cell 1) as well as also improved the adverse outcome of cisplatin [12]. Giving therapy along with this herb raises NADH-oxidase activity, NADPH-oxidase and myeloperoxidase that lead to activation of macrophages [13]. In CCl_4-intoxicated rats, in which macrophage function was attenuated (reduced bacteria-killing capability, reduction phagocytosis and reduction in the development of NO,etc.) is restored by the

administration of this extract of the plant [14]. The protein of an immunomodulatory (ImP) is a single strand, acidic protein without glycans (weighing approx. 25kDa) which exist in stem but doesn't exist in leaf, contributing to the proliferation of lymphocytes and activation of macrophages [15]. G1-4A functions as a non-microbial TLR4 agonist obtained from this herb. This receptor exists in macrophages and B lymphocytes in stimulation with G1-4A contributing to activation of macrophage and B cell proliferation. When administered in rat contribute to rise in spleen size because of rise in celluarility of macrophage, T cell, B cell. Cell survival is also improved because increase in anti-apoptotic expression gene [16]. It is one of the "Bala compound" elements as when provided to babies, resulting in increased immunoglobulin synthesis [17]. The mammary gland of its hydro-methanolic extract improve immunity by causing rise in IL-8, phagocytic activity and lysosomal enzyme production in milk. Moreover, when used in antiretroviral treatment, better findings have been obtained against HIV infection by using this herb. Drug resistance like problem can be tackled by using ghuduchi plant.

- **IMPROVES METABOLISM:** People with Body Mass Index (BMI) above 25 are considered as overweight. Therefore, a need for healthy weight control required to match amount of energy taken as compare to amount of energy consumed. *Tinospora cordifolia* has been evaluated for improving metabolism and hence beneficial in obesity. Adipose tissue produces the hormones adiponectin as well as leptin which is important for the regulation of different physiologic parameters. The low level of leptin stimulates food consumption, drives the body towards storage of energy and modulates neuroendocrine as well as immune system. The average amount of leptin decreases appetite, in which the body. The unusually high concentration of leptin in obese individuals are due to consequence of insulin resistance, such as type 2 diabetes, Adiponectin is formed then secreted by adipocytes inside blood [18]. In obesity, adiponectin decreases and increases in weight loss [19].There has been a composition filed for patenting, by Chatterje, which lowers the leptin-to adiponectin ratio and facilitates weight loss in patients with obesity / overweight issues [10]. Gymnemic and Boswellic acids are included in the synthesis. Acetyl-keto-boswellic acidfrom *Tinospora cordifolia* has improved lipolysis by up-regulating lipolytic enzymes, adipocyte triglyceride lipase and hormone-sensitive lipase with pentacyclic triterpenoid and by perilipin expression reduction [20]. Glucose in the stomach gymnemic acids are influenced by absorption [21]. Furthermore, they attached with tongue receptors further inhibit the consumption of glucose.[22]. It is also recognised that pancreatic cells are stimulated to secrete insulin and lower glucose levels in type 2 diabetic patients [23]. Therefore, the different constituents of *Tinospora cordifolia* have been found to improve metabolism.
- **ENDOCRINE SYSTEM MODULATORY PROPERTIES:** Guduchi also possess little hypoglycaemic and antihyperglycemic. It causes increase in the level of glucose-6-phosphate in liver [24,25]. From methanolic extract of this plant polysaccharide has been obtained that have B cell regeneration property when given to Wister diabetic rats [26]. Its stem extracts improve the cell's glucose absorption, such as adipocytes, glucose transporter GLUT1 myocytes, and GLUT3 [27,28,29]. Besides these, it helps in decreasing the postprandial hyperglycemia by acting on pancreatic amylase, therefore, considered an effective plant to tackle type 2 diabetes [30]. Extract of stem helps in inhibition of anenzyme alpha-glucoside that in a non-competitive way, breaks down complex sugar into glucose [31,32]. It also helps in reducing risk of long term damage of diabetes on other organs specifically due to the anti-oxidant effect of the plant [33,34].
- **ANTI-OXIDANT PROPERTIES:** *Tinospora cordifolia's* antioxidant property is attributable through the polysaccharide of arabinogalactan and phenolic compounds (epicatechin) [35]. The N-nitrosodiethylamine, obtained from this plant's ethanol extract is able to recover a normal level of lipid peroxidation, enzymatic and non-enzymatic antioxidants [36]. The leaf extract of this plant has more antioxidant property as compare to its powders stem extract [37]. Furthermore, root extract of *Tinospora cordifolia* protects against nephrotoxicity caused by aflatoxin as it leads to increase in oxidative stress by increasing the level of lipid peroxidation and decline in enzymatic and nonenzymetic antioxidant [38].
- **ANTI-PARASITIC PROPERTY:** *T. cordifolia* reduces oxidative stress by altering lipid peroxidation as well as enzymatic and nonenzymatic antioxidants in aflatoxin treated animals and are found to be very effective in treating scabies when compared with permethrin treatment [39]. Silver nanoparticles made from aqueous leaf extract of *T. cordifolia* are more effective in case of malaria parasite larvae as well as pediculicides [40,41]. Aqueous extract of *T. Cordifolia* at 250 mg/ml against pheretima demonstrated its substantial anthelminthic behaviour [42]. Moreover, antihelminth activity of chloroform extract of *T. cordifolia* stem is also demonstrated in *E. Foetidaas*, calculated in terms of the period of paralysis as well as the time of death, and were comparable with the outcome of Albendazole prescription (10 mg/ml) . *Berghei plasmodium* infection is fatal to white Swiss albino mice as they died due to contamination during the week of infection, and plasmodium dissemination was also prevented by alcoholic extract of *Tinospora cordifolia* [43].
- **ANTI-CANCER PROPERTIES:** The anti-cancer property on breast cancer cells have being observed in various studies because it attenuated the elevated levels of intracellular ROS and reduced the potential of colony forming units. Both become altered owing to an increase in apoptosis in breast cancer cells as well as pro and anti-apoptotic

genes. Primarily, this impact is attributed to the components of rutin and quercetin present in herb [43]. Alkaloid extracted from the herb, palmatine, may results into tumour size reduction by restoring glutathione (GSH) levels, as well as reducing superoxide dismutase (SOD) and catalase [44]. G1-4A may induce dendritic bone marrow cells that activate cytotoxic T cell which, further, can destroy cancer cells [45][46]. The ethanolic extract may decrease growth of cancer stem cell (cells that contain more number of ABC transporter), therefore, reduce use of chemotherapy by overcoming their hurdles [47]. The epoxy clerodanediterpene (ECD) part of gloy can prevent carcinoma and human MCF-7 breast cancer mediated by chemically induced hepatocellular [48,49]. In cancer cells, ECD induces apoptosis in regulating Cdkn2A, p53 and mdm2 expressions gene [49] obtained from gloy. Furthermore, octacosanol is reported to be main anti-angiogenic agent which decrease the expansion as well as metastasis of tumours [50]. In neuroblastoma, healing benefit is attributed of its potential for senescence and pro-apoptotic induction pathways, therefore, reducing the signals of anti-apoptosis[51]. Tumour-dependent thymus regression occurs in T cell lymphoma, and could be avoided by dealing with this herb extract. Thymus homeostasis in T cell lymphoma can be preserved by increasing the growth of thymocytes by enhancing thymus cytokine synthesis, such as IL-2 and IL-2 IFN-and modulating-retardant thymocyte apoptosis by caspase pathway. Further, it is safe to use the plant extract in cancers due to its potential to combine with chemotherapeutic agents, to suppress CYP3A4, that is important enzyme that gives adjuvant effect for their metabolism, therefore, it can assist the reduction of dosage of certain chemotherapeutic agents. Side effects on ordinary cells also reduced [52]. It also avoids toxicity caused by anti-cancer drugs by modulating GSH and pro-inflammatory cytokine levels TNF-alfa [53]. An herbal composition of different plants comprising eleven parts and few constituents of including *T. coridifolia* for the treatment of cancer have been patented. Around 17 to 23 percent from *T. coridifolia* composition when given in 450mg- 480mg in gelatinous capsule form, three times daily to a patient of with squamous cell lung carcinoma (refused to gain standard therapies) improvement was observed. After some time of treatment, full cessation of haemoptysis as well as chest pain improved, appetite and ambulatory gains have been observed in lung carcinoma patient.

- **ANTI-HYPERLIPIDAEMIC PROPERTY**: In the case of the Guduchi "swrasa" curbs hyperlipidaemia via reducing oxidative tension, chronic alcohol consumption and by stimulating the receptors of dopamine, leading to an increase in protein kinase A and cAMP [54]. When diabetes was induced by alloxan, oral administration of guduchi roots decreased the glucose content in the urine along with reduction in cholesterol in blood and serum in the various experimental models. It's aqueous extract also showed an antihyperglycemic effect. In a rat model, it was seen that, it leads to decline in sugar level in blood thus increase glucose tolerance and prevent a decrease in body mass [55]. Treatment with alloxan caused a rise in lipid content, peroxide, superoxide dismutase and catalase activity within liver, whereas, level of glutathione has decreased. Guduchi reduced/ restored, liver peroxidase enzyme and glutathione [4].
- **CARDIOVASCULAR PROTECTIVE PROPERTY:** By decreasing endothelial swelling which increases vascular health [56], this plant can also be used to alter disrupted lipid metabolism because of alcohol intake. By inhibiting cholesterol and glucuronides, they modulate lipid metabolism [57]. It provides defence against cardiotoxicity caused by cadmium by controlling the concentrations of different enzymes of serum markers such as kinases as well as by preserving the rate of lactate dehydrogenase, to antioxidants (dismutase superoxide, catalase, glutathione, glutathione peroxidase and S-transferase-glutathione) along with glycoproteins (hexose, hexamine, sialic acid, fucose) [58]. Moreover, atrial and ventricular functions become normalise by this herb which altered in chloride-induced arrhythmia or fibrillation [59]. It can protect the heart because of its anti -oxidant behaviour, where oxidative stress is main reason for injury [60].

. ADAPTOGENIC PROPERTY: Adaptogens are agents that helps living being counteract the conditions of physical, chemical and biological stress by non-specific resistance generation and avoids gastric-induced mucosal damage from cold immobilisation, macrophages being known to have a important part in gastric-defence. The same mechanism is prevented by blocking macrophages recruitment. In control mice increase in dosage leads to apoptosis with medicinal dose of (100-200 mg / kg) causes malignant cells apoptosis protect apoptosis bone marrow [61][62]. Experimentally, the herb is further known to be healthy for use in animals as it has not been reported mutagenic impact on the living organism in various studies as it possesses least DNA disruption in peripheral blood lymphocyte

- **ANTI-ANXIETY PROPERTY:** Sleep depletion induces insomnia along with other mood disturbances have shown to cured in acute sleep deprived rats after administration of 50% ethanolic extract of *T. cordifolia*. It leads to decrease in CD11b/c, MHC-1 expression profile and inflammatory marker like cytokines [63] by reducing activity of monoamine oxidase and rise in level of monoamine in brain *T. cordifolia* also acts as anti-depressant. *T. cordifolia*, when given along with honey or ghee, antidepressant and antianxiolytic effect was observed in Swiss albino mice.
- **HEPATOPROTECTIVE PROPERTY:** In mice, the hepatoprotective function of *T. cordifolia* has been observed in the paracetamol induced hepatotoxicity [64]. Oxidative stress caused by post hepatic cholestasis, which has also been found to be healed by using this plant. Furthermore, liver injury induced by carbon tetrachloride can be treated

by this herb, which help by decreasing level of enzymes like aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphate (ALP) and total bilirubin (TBL) During hepatopathy caused by carbon tetrachloride in goat, it has been observed that animal treated with this plant extract shown major therapeutic and hemato-biochemical enhancement. This plant extract leads to inactivation of hepatitis B and E surface antigen. [65]. Moreover, lead-induced liver injury could also be treated with *Tinospora* plant [66]. In addition, an analysis revealed, that the extract from *T. coridifolia* is critical for treatment for adverse liver functions as well as immune activity due to carbon tetrachloride (CCl_4) induced ttoxicity [66]. A different research reveals that extract obtained from *T. coridifolia* is main hepatoprotective agent due to its antioxidant and free radical scavenger quality along with hepatic reconstruction properties.

- **NEPHROPROTECTIVE PROPERTY:** Because of their anti-inflammatory, antioxidant and immunomodulatory activity, Guduchi also able to provide comfort from nephrotic syndrome. The sodium nitrite used in meat as a preservative and is found to be toxic for the kidneys because of oxidative strain it creates. This plant extract contributes to a decline in urea and creatinine levels [67]. DRDC / AY / 8080 (tablet) and DRDC / AY8081 (syrup), two herbal formulations, which contain *coridifolia* extract ar reported to help in preventing kidney stone [68] as well as nephrotic syndrome, a serious renal disease condition, caused by dysfunction of T-lymphocyte along with alteration in effect of vascular permeability which leads to change podocyte activity.
- **OSTEOPROTECTIVE PROPERTY:** This plant was used in the traditional Indian medicinal therapies for the management of fractures. Its alcoholic extract was found to result in increase in collagen accumulation, which leads to osteocalcin development and increases expression of osteogenic genes [69]. Furthermore, it also offers knee relief from osteoarthritis is comparable with glucosamine and celecoxib [70]. This cause growth in bone mineralization, stimulates the growth of osteoblast and enhancement of osteoblast lineage cell differentiation [71]. It is also known that the extract of *T. coridifolia* show prostimulatory impact on humans *in-vitro* osteoblast cells and collagen accumulation in the bone matrix as well as in osteogenic gene expression [69,71].
- **NEUROPROTECTIVE PROPERTY:** Furthermore, in intracerebral injection of 6-hydroxy dopamine (6-OHDA) for Parkinson's disease induction in a laboratory rat model, ethanolic extracts of *T. coridifolia* provided neuroprotection through increase in dopamine level, further helping in restoring locomotor activity in treated groups [72]. Moreover, by giving it's aqueous ethanolic extract it showed antipsychotic effect in amphetamine challenged rat resulting in decrease in hyperactivity as well as locomotor movement. This herb also provides a beneficial influence on kids facing emotional deficiency as well as personality impairment leading to better memory learning [73,74].

Table.1 Various Patents showing the Medicinal Importance of *T. cordifolia*

S. no	Title of Patent	Patent No.	Inventors	Description of Patent	Publication Date	Status	References
1	Composition of eleven herbals for treating cancer	US6780441	Solanki, R.	Treating squamous cell carcinomas, tumours and other metastatic states in particular lung cancer	August 24, 2004	Grant	[75]
2	Preparation for weight loss management	US8936817	Chatterji, A.K	Reduce leptin-to adiponectin ratio in the patient's blood serum	January 20, 2015	Grant	[76]
3	Herbal composition for effective treatment of aids, preparation thereof and method for treatment of aids patient	WO2005030232	Ayare, S.	Reduce HIV viral load, strengthen immune system and CD4 Count	April 7, 2005	Application	[77]

4	A synergistic herbal composition useful for the management odiabetes	WO2015189858	Nautiyal, C.S., Rao, C.V., Ojha, S.K., Rawat, A.K.S., Mani, D., Pal, A., Kumar, D.	For treatment of both type II and type I diabetes	December 17, 2015	Application	[78]
5	Use of Tinospora extract in the treatment of immune system modulated disorders	CA2432488	De, S.N.J., Yeole, R., Jha, R., Bagchi, S	Increase phagocytosis by polymorphonuclear leukocytes and used as adjuvant therapy to conventional antibiotic therapy, chemotherapeutic therapies and against chronic osteomyelitis, cancer, diabetes and respiratory disorders	July 11, 2002	Application	[79]
6	Use of parts of the natural plant Tinospora	WO1991008750	Krüger, C.	To augment cancer diseases	June 27, 1991	Application	[80]
7	Composition containing Tinospora coridifolia and process for obtaining same	US20060045923	Hingorani, L., Thawani, V.	For treatment of seasonal, perennial, or sporadic allergies	March 2, 2006	Application	[81]
8	Herbal extract for renal disorders	US7914824	Acharya, V.N., Mukhopadhyay, T., Piramal, S.A	For the treatment of renal disorders such as nephrotic syndrome and chronic recurrent urinary tract infections	March 29, 2011	Grant	[76]
9	Materials and methods for immune system stimulation	EP1781708	Nair, P.K.R., Melnick, S.J., Ramachandran, C.	An -D-glycanno cytotoxicimmunostimulatory polysaccharide mediate Th1-type specific immune response	February 16, 2011	Grant	[80]
10	Anti-allergic herbal formulation	US7344739	Pushpangadan, P., Rao, C.V., Rawat, A.K.S., Ojha, S.K., Reddy, G.D.	The release of histamine is tremendously decreased	March 18, 2008	Grant	[82]
11	Herbal formulation as memory enhancer in	US7429397	Pushpangadan, P., Rao, C.V., Kishore, K., Kartik, R.,	Treatment of senile and presenile dementia and memory enhancer	September 30, 2008	Application	[83]

	Alzheimer condition		Gupta, Y.K., Govindarajan, R.				
12	Composition comprising chitin and tinosporin for use in the treatment of viral diseases	WO2011135578	Balar, C., Nakum, A	Treatment of HIV, HTLV selectively inhibit virus from targeting T-helper cells and prevent receptor mediated entry	November 3, 2011	Application	[84]
13	A herbal composition for inflammatory disorders	WO2011080579	Paramesh, R., Babu, U.V., Saxena, E.	A herbal composition comprising blend of extract of Tinosporacoridifolia, Zingiberofficinal, Commiphorawightii, Boswelliaserrata and Curcuma longa for inflammatory disorders	July 7, 2011	Application	[85]
14	Tinosporasinensis pain-relieving tincture	CN10452445	Kuàngxcái,	Pain-relieving tincture containing 29 pure herbal Chinese medicine in 75% alcohol	April 22, 2015	Application	[80]
15	A herbal formulation to treat coccidiosis	WO2012131731	Oinam, I.D.	For the treatment of coccidiosis in poultry	October 4, 2012	Application	[86]

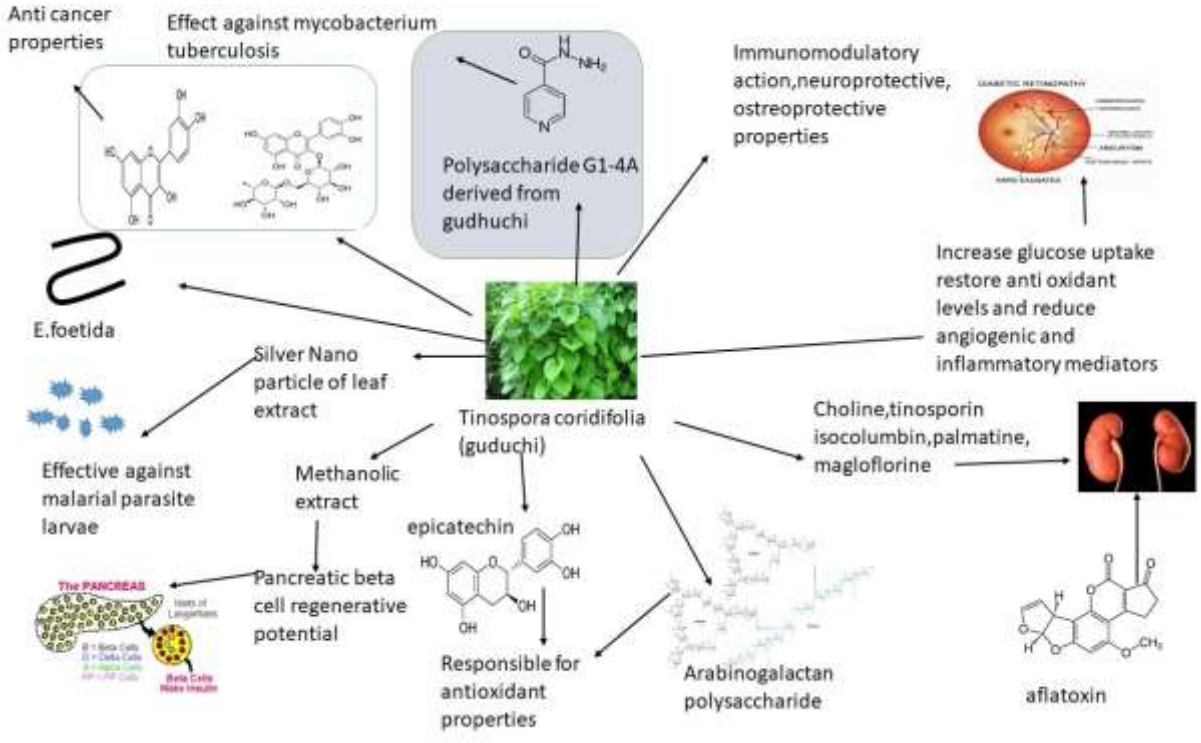

Figure.2 An overview on medicinal and beneficial health application of *T.cordifolia* [80]

Conclusion

T. cordifolia is a curative herb with compounds of different bioactive constituents including alkaloids, hormones and glycosides, which makes it effective against various disease, however, its anti-oxidant activity is main element for

success of this plant. The present review highlighted its various beneficial effect on immunomodulatory activity, antioxidant, anti-parasite activity, anticancer properties, cardiovascular protective action, antianxiety, hepatoprotective, nephroprotective, oesteoprotective and neuroprotective properties. The plant is being used effectively in ancient-era Ayurvedic medicine system as well. However, further research is required to carried out on this plant to know more therapeutic properties of this plant. Moreover, *Tinospora cordifolia* may act as a better alternative to synthetic drugs to treat various ailments.

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