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An Overview of Tinospora Cordifolia's Chemical Constituents and Pharmacological Properties

Kale G. D, Kamble H. V, Andhale A. K

Loknete, Shri Dadapatil Pharate College of Pharmacy, Mandavgan Pharata, Maharashtra, India

ABSTRACT

Plants have been used medicinally since the earliest times of human civilization. The demand for Chinese herbs, health products, and cosmetics is at a high level. Examples include pharmaceuticals, dietary supplements, cosmetics, and other similar products. Summary Chemical constituents of Tinospora cordifolia found throughout the plant This page describes their pharmacological effects. Tinospora cordifolia is an Ayurvedic shrub with a long history of use. Medicine. Tinospora cordifolia has been shown to include chemical compounds such as alkaloids, terpenoids, lignans, steroids, and others, which help determine the phytochemical and pharmacological effects of the plant. Antioxidant activity, antimicrobial activity, antibacterial activity, antifungal activity, antidiabetic activity, antidepressant activity, acid-reducing effect, liver dysfunction, anti-blocking activity HIV tumor, anti-inflammatory, antibacterial, curative, anti-proliferative, and immunomodulatory for infections and systemic diseases are among the pharmacologically important diseases. mention. enabled in this review. This article provides an overview of the chemical compounds found in different parts of the Tinospora cordifolia plant, along with their pharmacological effects. In Ayurvedic medicine, Tinospora cordifolia is a common shrub. Although several review articles on this plant have been published, it is always planned to include all the latest information on its pharmacological and phytochemical activities. Tinospora cordifolia is a useful plant for all living things. It belongs to the plant family Menispermaceae. It contains severalchemical substances with physiological effects.

KEYWORD: *Tinospora cordifolia has Antioxidant activity, antimicrobial activity, antibacterial activity, antifungal activity, antidiabetic activity, antidepressant activity, acid-reducing effect, liver dysfunction, anti-blocking activity HIV tumor, anti-inflammatory, antibacterial, curative, anti-proliferative, and immunomodulatory for infections and systemic diseases are among the pharmacologically important diseases*

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INTRODUCTION

The World Health Organization announced this. 80 percent of the world's population is predominantly dependent on traditional means of subsistence. Plant extract-containing drugs or their active use Ingredient. With an abundance of biodiversity familiarity with the rich ancient conventional system of Medicine (Ayurveda, Siddha, Unani, Amchi, and Traditional Chinese Medicine) [1]

Tinospora cordifolia is one of the most used and undisputed herbs in Ayurveda. medicine. It belongs to the family Menispermaceae. These are hairless, juicy, woody vine shrubs typical of India. It can also be found in Burma and Sri Lanka. It thrives well in the tropics and often reaches large heights. Climb the trunk of a tall tree. The stems aregrayor creamy white, and the deep, spirally torn gaps are vertically scattered lenticels like large rosettes. The wood is white, soft, and porous, and the freshly cut surface quickly turns yellow in the air [2]. The leaves are simple, alternating, normative, long-stem, winding,

showing multi-layered mesh veins. Long thread-like aerial roots stick out from the branches. The flowers are small and unisex. Male flowers are dense. Lady flower is lonely. 6 sepals placed in 23 swirls each. Six petals are arranged in two spirals, which are oval and membranous. Cumulative fruit red, fleshy, many drupes on thick stems, finally stigma, scarlet.

Tinospora cordifolia is an important medicine used in the Indian medical system, and subsequent medicines are ancient. The medicines are the well-known Indian bitter fever, diabetes, indigestion, jaundice, urinary problems, skin diseases, chronic diarrhea, dysentery. Again, treatments for heart disease, leprosy, and hermeneutic. Starch derived from stems is very nutritious. Used in many diseases of the digestive system [3]. Tinospora cordifolia is known With medicinal plants of traditional healing system Recent scientific research emphasizes the possibilities of Use of Tinospora cordifolia in modern medicine. This review is intended to document the drug Characteristics of Tinospora cordifolia and its potential Prospects for further scientific research for the Development of effective therapeutic compounds [4].

Since the beginning of human civilization, medicinal plants have been used by humans to cure diseases. reviews. Nature has been the source of medicine for thousands of years and countless 4,444 modern medicines have been isolated from natural sources. Traditional medicine remains the most affordable and accessible health resource in the primary health care system of resource-poor communities in India. A significant proportion of interest persists in finding nutrients from plant materials to replace synthetic drugs to overcome their side effects and also for economic reasons [5]. Tinospora cordifolia is a shrub widely used in systems of folk and Ayurvedic medicine. on India. Although almost all of its parts are used in traditional systems of medicine, the leaves, stems, and roots are the most used. Important parts for medical use. Tinospora cordifolia is a versatile resource for all life forms. It belongs to the family Menispermaceae. It contains many different chemicals that affect the body. This review is to summarize information regarding the chemical composition and medicinal aspects of the plant Tinospora cordifolia [6].

Botanical description-

It is a tall, widely distributed, deciduous, climbing shrub with many different lengths of branches. The leaves are alternate, simple, pointed with a petiole 15 cm long. length Long (6 in.) Round and ribbed, both base and top long longer and partially and half twisted. It gets its name from the heart-shaped moon seed by Its heart-shaped red leaves and fruit [7].

The plates are broad ovoid or large ovoid, 10–20 cm (4–8 in) long or 8–15 cm (3–6 in) wide, seven veins and many veins at the base, membranous, hairy above. Silky, grayish-white with a prominent grid underneath. The flowers of the plant are unisexual, small on separate plants, and appear when the plant is grown leafless, axillary yellow, and male flowers while the male flowers are grouped, but the female flowers are usually solitary [8]. Plants have six sepals in two triplets of each. Smaller outside than inside. While it has six petals that are smaller than the sepals, ovate, and membranous. Fruit gathered in clusters 13. They have medicinal plant smooth ovoid on the thick stem with bright red or orange ovoid scars [9].

Morphology-

Tinospora cordifolia is a succulent climbing woody plant found in the Indian subcontinent. In the tropics, he thrives, frequently reaching high heights and climbing huge trees. The stems are creamy grey and white, deeply cut lengthwise and spirally, and have gaps. The space between the large asterisks is speckled like peas [10].

Vegetable wood that is white, soft, and spongy. When exposed to air, a freshly sliced surface turns yellow. The leaves have a chord-shaped with layered mesh, simple, alternating, pyramidal, long petioles shielding. Long threads that resemble aerial roots protrude from the branches. The flowers are beautiful. Unisex and small. Male flowers appear in clusters, whereas female flowers are single. There are six sepals. They are ovoid and membranous and are organized in two helices. The fake fruit is predominantly crimson. meaty with vivid crimson contents on a thick stem [11]

Figure 1: Tinospora cordifolia (a) Plant habit, (b) A view of the stem with staminate and pistillate flowers

AYURVEDICPHARMACOLOGY *(DRAVYAGUNA-KARMA)* OF *T. CORDIFOLIA (GUDUCHI)*

Ayurvedic pharmacology is based on biophysics, experience, reasoning, and visualization mechanisms. The gesture of substances is based on five mechanisms of action or properties of a substance, namely rasa (forced evaluation of a substance by chemoreceptors on the tongue - Six tastes described namely sweet (madhura), sour (amla), salty (lavaṇa), bitter (tikta), pungent (kaṭu) and astringent (kaṣāya), guna (10 pairs opposite or mirror image properties; attribute or attribute of any substance), vipaka(digestion of the intestinal tract and tissues) metabolism; neutral madhura, amla acid, alkaline katu),virya(power; hot ushna, cold sheets) and prabhav (specifically acting through specialized receptors). All these mechanisms are related to the action of drugs of a physiological nature [12].

Karma is action related to activity or performance. It's the final effect of drugs. Properties, action (pharmacodynamics), and uses (indications) of T. cordifolia. In the classical texts of Ayurveda, Charak, Sushruta, and AshtangSangraha and other treatises like Bhava Prakash and DhanvantariNighantu, etc., T. cordifolia is believed to be useful in the treatment of leprosy, fever, asthma, loss of appetite, jaundice, gout, skin infections, diabetes, chronic diarrhea, dysentery, etc [13].

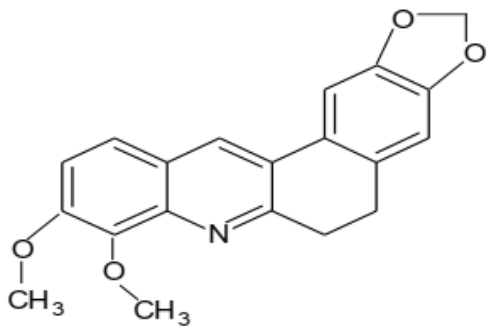
Table no. 1- Karma (action - pharmacodynamics) and prayoga (uses) of T. cordifolia

Sr. No	Karma *(Action - Pharmacodynamics)*	Prayoga *(Uses- Indication)*	*References*
1	Rasayana, Sangrahi, Balya, Agnidipana, Tridoshshamaka	Daha, Meha, Kasa, Pandu, Kamla, Kushta, Vatarakta, Jwara, Krimi, Prameha, Swas, Arsha, Kricch, Hridroga	[14]
2	Vata-Pitta-Kaphanashak, Trishnanashaka, Agnideepaka	Jwara, Chardi, Daha	[15]
3	Sarah, Vatahara, Agnideepana, ShlesmShonit- Prashamana	Vivandha	[16]
4	Tridoshnashaka, Vishaghni, Jwara-bhootaghni	Jwara, Daha, Kamla, Vatarakta	[17]
5	Sangrahi, Vrishya, Balya, Rasayana, Dipana, Chakshusya, Vayah-Sthapana, Medhya, Tridoshanashaka	Kushta, Krimi, Chardi, Daha, Vatarakta, Pandu, Jwara, Kamla, Meha, Trishna, Kasa	[18]
6	Grahi, Balya, Rasayana, Dipana, Hriddhya, Aayushyaprada, Chakshusya, Tridoshaghna	Jwara, Chardi, Kamla, Daha, Trisha, Bhrama, Pandu, Prameha, Kasa, Kushta, Krimi, Vatarakta, Kandu, Meda, Visarpa, Aruchi, Hikka, Arsha, Mutrakriccha, Pradera, Somroga	[19]
7	Pitta-Kaphapaha	VatajaGranthi, VatajaGalganda	[20]

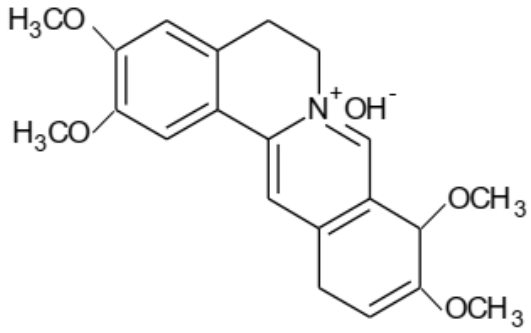
Photoactive compounds in Tinospora carifolia-

Alkaloids:

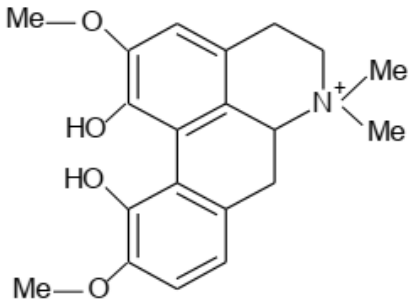
Thirteen alkaloids of isoquinoline and aporphineskeletons, amine, and amide were reported of which main alkaloids were protoberberine alkaloids berberine, palmatine, jatrorrhizine, magnoflorine, and cozy dine [21].



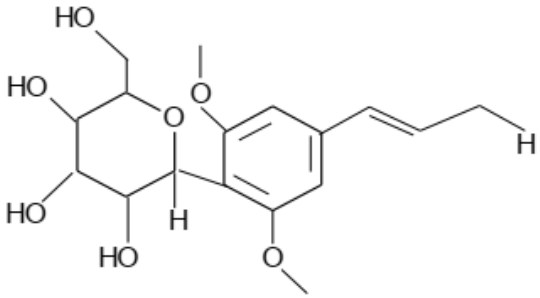
BERBERINE



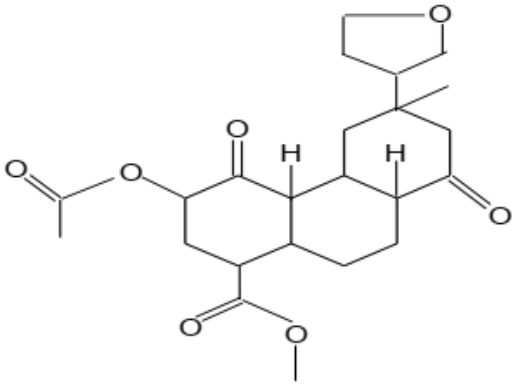
PALMATINE



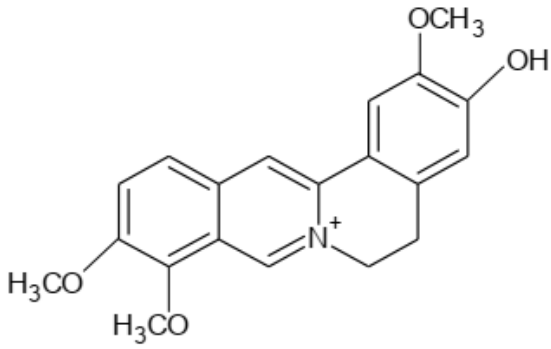
MAGNOFLORINE



SYRINGIN



FURANOLACTONE



JATRORRHIZINE

Fig.2: chemical constituents isolated from *Tinospora cordifolia*

Terpenoids:

Thirty-two diterpenoids and their glycosides of clerodane and norclerodane skeleton, one monoterpenoids, five sesquiterpenoids, and one triterpenoid cycloeuphordenol were isolated from T. cordifolia. A bicyclic diterpenoid (C21H24O7) from the whole plant was tentatively identified as tinosporin [22].

Phenolics:

Four phenylpropanoids, two flavonoids, three lignans, and two benzenoidderivativeshave been isolated from T. cordifolia [23].

Steroids:

Four steroids along with δ-sitosteroland2,3,14,20,22,25-hexahydroxyl-5-cholest-7-en-6-one have beenreported [24].

Sr. No	Class	Chemical constituents	Activity	Plant part	Reference
1	Alkaloids	Berberine, Magnoflorine, CholinePalmatin, Tembetarine, Tinosporine, Isocolumbin, Aporphinealkaloids, Jatrorrhizine, Tetrahydropalmatine	Anti-viral infections Neurological, Immunomodulatory anti diabetes, Anticancer	Stem & Root	[25]
2	Steroids	20 δ -Hydroxyecdysone, δsitosterol, β–sitosterol, GiloinsterolEcdysterone,	Inhibits TNFα, IL-1 β, IL-6and COX2. Inflammatory arthritis, IgAneuropathy	Shoot	[26]
3	Glycosides	Tinocordiside, Tinocordifolioside, Cordioside, 18-norclerodane glucoside, CordifoliosideSyringin, Syringinapiosylglycoside, Furanoidditerpene Glucoside, Palmatosides, Cordifolioside A, B, C, D and E, Pregnane glycoside.	anticancer activities Treatneurological disorders likeALS, arkinsons, Dementia	Stem	[27]
4	Diterpenoid lactones	Furanolactone, Tinosporon, Tinosporides, Columbin, Clerodane derivatives, Jateorine	Anti-inflammatory, anti-microbial, anti-viral. Antihypertensive, Vasorelaxant Induce apoptosis in leukemia by activating caspase-3and bax inhibits BCL-2.	Whole plant	[28]
5	Sesquiterpenoid	Tinocordifolin.	Antiseptic	Stem	[29]
6	Aliphatic compounds.	Heptacosanol, Octacosanol, Nonacosan-15-one dichloromethane	anti-inflammatory, Protection against 6-hydroxyl dopamine induced park insonisms in rats	Whole plant	[30]

Pharmacological activities-

Different pharmacological activities of T. cordifolia has been reported by the researcher, which has been described:

Anti-Diabetic Activity-

Pharmacological studies have demonstrated in vivo Antidiabetic potential of different extracts of T. cordifolia. It has been reported to mediate its antidiabetic capacity through a multitude of biologically active agents. phytoconstituents isolated from different plant parts, including alkaloids, tannins, cardiac glycosides, flavonoids, saponins, and steroids. These compounds are reported to include different targets activities in the state of diabetes, thus allowing potential applications in experimental and clinical search [31].

Research byKannadhasan R and Venkataraman S reported that 30 days of sediment extraction treatment of Tinospora cordifolia (SETc) (1000mg/kg/p.o) perDiabetic subjects have demonstrated efficacy establish antidiabetic activity with an antiobesity body built. Ethanolic extract of Tinospora cordifolia leaves at different dosages (200 and 400 mg/kg BW) taken orally for 10 days and 30 days in Diabetic albino mice with streptozotocin. It is displayed TC has significant antidiabetic activity in diabetic patients animals and has 50% to 70% efficiency compared to insulin. The stem is rich inisoquinolinealkaloids, includingpalmatine, jatrorrhizine and magnoflorin have been reported for insulin-mimicking and insulin-releasing effects both in vitro and in vivo. in Ehrlich Ascites tumor cell models, water, ethanol, and methanol Herbal extracts have been shown to stimulate glucose uptakeactive [32].

The protective effect of Tinospora Cordifolia root extract has been reported in the presence of higher levels of antioxidant molecules and enzymes. Tinospora cordifolia root extract isa Significant counterweight to diabetesOxidative stress in the mother's liver by reducing levels of malondialdehyde and reactive oxygen species and increased levels of glutathione and total thiols Oral treatment of Tinospora cordifolia (100 and 200 mg/kg body

weight) for 14 days mediates its antidiabetic potential by attenuating oxidative stress[33].

Anti-Cancer Activity-

Tinospora cordifolia showed potential antitumor activity, which was mainly shown in animal models. Thepalmatine alkaloid extract from Tinospora cordifolia using the reactive surface method (RSM) clearly showed the antitumor potential of 7.12 skin cancer induced by thedimethylbenz mouse model (a) anthracene DMBA [13]. A single application of Tinospora cordifolia extract at doses of 200, 400, and 600 mg/kg dry weight 24 h [34].

Administration of cyclophosphamide (at a dose of 50 mg/kg), significantly inhibitedmicronucleus formation in the bone marrow of rats, in a dose-dependent manner. C57 Bl mice that received 50% methanolic extract of Tinospora cordifolia at a dose of 750 mg/kg body weight for 30 days showed an increase in lifespan and a significantly reduced tumor size compared with controls.Brain cancer potential study for Tinospora cordifolia (TCE) 50% ethanolic extract using C6 glioma cells [35].

TCE significantly decreased cell proliferation in a dose-dependent manner and induced differentiation in C6 glioma. Eight secondary metabolites of Tinospora cordifolia against four different human cancer cell lines, KB (human oral squamous cell carcinoma), CHOK1 (ovarian robbery), HT29 (human colon cancer), and SiHa (human cervical cancer), and primary cells respectively. All extracts and fractions were active against KB and CHOK1 cells while in pure form palmitin was shown to be active against KB and HT29; tinocordiside against KB and CHOK1; yangambin against KB cells. Two hexane and methanol fractions (T1 and T2) from Tinospora cordifolia plants showed that in MCF7 cells, treatment T1 significantly prevented the proliferation and migration of MCF7 cells. compared with T2. genes, Twist and Snail, are involved in epithelial-mesenchymal transition and are regulated by T1 with increased transcription of E-cadherin [36].

Immunomodulatory Activity-

Tinospora cordifolia is famous for its immunomodulatory response. Active compoundshydroxymustakone, N-methyl2pyrrolidone, N-formylannonaine,cordifolioside A, magnoflorine, tinocordiside, and syringe have been reported to have potential immunomodulatory and cytotoxic effects. Research by Vaibhav Aherand colleagues confirm Immunomodulatory activity of Tinospora cordifolia ethanolic extract (100 mg/Kg/p.o.) from the root quamodify the concentration of antioxidant enzymes, increased T and B cells and antibodies that play a role important role in immunity, improve melatonin levels in the pineal gland and increased levels of cytokines such as IL2, IL10, and TNFα plays an important role in immunity [36].

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The results of the study show that Guduchi Ghana (a concentrated form of water extract byGuduchi) prepared by classic pop-outhas a significant immunostimulatory action on the immune system. A randomized, controlled trialIn parallel, a pilot clinical study demonstrated the effects of Tinospora lotion formula for Interleukin1, Interleukin6 and Interleukin8 use serum sample. Down-regulation of interleukins 1, 6, and 8 The extent of scabies penetration inhibits hyperkeratosis and infiltration of inflammatory cells into the scab.The corrective effect of Tinospora lotion on interleukin levels reinforces its anti-scabies activity [38].

Hypoglycemic activity-

Phosphatase, alkaline and lactate dehydrogenase and weight gain, total Hemoglobin and liver hexokinase in alloxanized diabetic rats [39]

Anti-toxin activity-

Guduchihasthe potential ability to scavenge free radicals and show a protective effect by regulating different levels of hormones and minerals. T. cordifolia has been reported to have aflatoxin-induced reverse toxicity in the kidney (Swiss albino rat) where, it significantly increased the hormone (such as glutathione) and enzymatic activities (such as catalase, glutathione reductase); and reduced reactive oxygen species (ROS). And this antiproliferative activity is essentially provided by the alkaloids of plants. Lead nitrate toxicity in Swiss albino rats

showed reduced value on the number of red blood cells and white blood cells in the serum [40].

However, Guduchi leaf and stem extracts were effective against these modified by overcoming lead toxicity compared withValue. Extracts of this herbal plant, when used orally, have also been reported against the toxic effects of lead nitrate in rats (Swiss albino) Liver. Research shows decreased levels of enzymes such as glutamic pyruvic transaminase (GPT) or alanine aminotransferase (ALT) and aspartate aminotransferase (AST) and an increase in the enzyme responsible to scavenge free radicals such as catalase [41].

T.cordifolia found importance in overcoming cyclophosphamide-induced toxicity by significantly elevating reduced levels of GSH, cytokines and gradual reduction of inflammatory cytokines (tumor necrosis factor) Levels in bladder and liver cells prevent damage confirms its antitoxic activity [42].

Anti-HIV activity-

T. cordifolia has been evaluated for its importance in the treatment of HIV-positive patients by reducing the patient's resistance to retrovirus regimen.104 Anti-HIV activity of T. cordifolia shows its application in disease management by increasing the number of CD4 and T cells decreased number of eosinophils (a type of white blood cell) in HIV-positive patients [43].

T. cordifolia extract showed significant improvement in phagocytosis and intracellular bactericidal activity. T. cordifolia also stimulates the peritoneum macrophages. In addition, T. cordifolia increases phagocytosis and the property of intracellular destruction. BILLION cordifolia significantly stimulate dB lymphocytes, polymer phonuclear leukocytes, and macrophages [44].

Anti-stress and tonic property-

The anti-stress and tonic property of the plant was clinically tested and it was found that it brought about a good response in children with a moderate degree of behavior disorders and mental deficit. It has also significantly improved the I.Q. levels [45].

Anti-inflammatory-

The alcoholic extract of Tinospora cordifolia has been found to exert anti-inflammatory actions in models of acute and sub acute inflammation [46].

Antineoplastic activity-

Intraperitoneal administration of an alcoholic extract of Tinospora cordifolia to mice with Dalton's lymphoma (DL) increased macrophage capabilities such asphagocytosis. Interleukin-1 (IL-1) antigen-presenting capacity and secretion, tumor necrosis factor (TNF)and RNI, as well as decreased tumor growth and prolonged lifetime the tumor-carrying host [47].

Conclusion-

Tinospora cordifolia, a multi-purpose medicine Plants are the sole source of species compounds with diverse chemical structures. Very little work has been done on biological activity and Possible medical applications of these compounds and therefore a thorough investigation is needed to exploit their therapeutic use in fighting disease. A drug development program should be in place to develop modern drugs with isolated compounds of Tinospora cordifolia. This review highlights classical anti-diabetic, anti-cancer, immunomodulatory, antioxidant, antibacterial, and anti-toxin claims Tinospora cordifolia and their confirmation by contemporary research. In some years, there are has been a growing trend and awareness in research on medicinal plants. Quite a large amount of research has been done in the past several decades of chemical discoveries by the parts of Tinospora cordifolia. While Tinospora cordifolia has been used successfully in Ayurvedic medicine for centuries, extensive research and development work should be done on Tinospora cordifolia and its products for better economic performance and therapeutic use. This review can be used to further research as well as a clinical goal

Conflicts of interest-

There are no conflicts of interest and disclosures regarding the manuscript

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