



Review Article

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Glinus lotoides (Ciru-Ceruppadai): An overview

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ABSTRACT

Glinus lotoides. Linn is an ancient herb of India, generally known as Ciru-Ceruppadai, belonging to the family Molluginaceae. The natural plant resources and nature-derived chemical moieties are gaining the global demand to provide holistic health care to the Mankind. There is an indispensable need to explore the herbal resources to produce newer generation of drugs with great potential and minimal adverse effects in highly illness susceptible living environment. *Glinus lotoides* L. herb is reported to contain hopane type saponins, tri-terpenoid saponins, sapogenins like mollugogenins, flavonoids vicenin 1 & 2, and also has nutritional value. It has demonstrated several pharmacological activity including anti-helminthic activity, anti-spasmodic activity, wound healing property, anti-tumor activity, molluscicidal activity, geno-toxicity and bio-pesticidal activity. This review summarizes on pharmacognostical account of various plant parts, phytochemical constituents, and different pharmacological investigations carried out on the plant.

Keywords: *Glinus lotoides* L., pharmacognostic features, phytochemistry, Analytical parameter, pharmacological activity.

INTRODUCTION

The Mankind uses herbs as medicine from time of his existence and evolution. The most of the plants are used as food, which made the man to realise its health benefits and began to use it as remedies in various ailments. There is no system of medicine in the whole world that does not have traces of herbs as its source directly or either derived or pharmacologically modified for credits of its alleviating potential. The concept of reverse pharmacology, itself happened shows the need of herbal potentials to be explored for herbs and its sources which are very potent, generally safe, and highly valuable as lead molecules in Pharma industry, which needs to be exploited in this world of newly originating and spreading infections that threatens human existence. One such plant is *Glinus lotoides* which is widely spread through the tropics and subtropics, especially in Africa, Asia, Australia and South Europe. *Glinus lotoides* L. syn. *Mollugo hirta* Thunb, *Mollugo lotoides*, a spreading annual herb, hairy with white flowers distributed in warmer parts of India in plains & also on hills up to 800m. The tender young leaves are used as edible food.

Classification (1)

Kingdom	: Plantae
(Unranked)	: Angiosperms
(Unranked)	: Eudicots
(Unranked)	: Core eudicots
Order	: Caryophyllales
Family	: Molluginaceae(Carpet weed family)
Genus	: <i>Glinus</i>
Species	: <i>Lotooides</i>
Binomial name	: <i>Glinus lotoides</i> Linn.

Vernacular Names**Indian local names(2)**

Tamil	: Ciru-Ceruppadi, Ceruppati, Sirooseroopadi
Hindi	: Gandhi-buti, Bakada, Dholakani, Hata
Kannada	: Chandrakaasi Soppu
Sanskrit	: Ushandi, Bhissata, Okharadi
Bengali	: Duserasag
Marathi	: Kotrak, Kadi-bhaji
Telugu	: Chandrasri kooraa, Thella poraku
Punjabi	: Gandibuti, Poprang
Malayalam	: Kodak
Gujarati	: Gholo okhrad, meetho okhrad

Foreign Names(3)

English	: Lotus sweet juice, Damascisa
Ethiopia	: Mettere
Arabic	: Moghua, Moghera
Chinese	: Xing su cao

Habit& Botanical description(4)

Lotus Sweet juice is an annual prostrate herb up to 40 cm long, with various parts woolly. Leaves are 0.6-2.0 cm long, 0.5-1.8 cm broad, round or more or less wedge-shaped, often with a sharp point at the tip, stalk 2-8 mm long. Flowers are borne in stalk less clusters of 5-6, in leaf axils. Flower stalks are up to 1.5 mm long, sepals 4-4.5 mm long, up to 7 mm in fruit, persistent, ovate to ovate-oblong. Fertile stamens are 12. Stigmas are 5, linear, about 1 mm long, persistent. Capsule is round or oblong, about 6 mm long, membranous, enclosed in the sepals. Seeds are many, less than mm long. Flowering: February-May. . The inflorescences a tight cluster of five to ten small flowers. Each flower has five woolly sepals and no petals. The fruit is an oval capsule about four millimetres long.

Habitat(5)

Woodlands, mixed Savannah woodland, Grassland, riverine forest, river banks, dry stream beds, sandy soils and roadsides.

Folklore (6)

- In Punjab, herb is given as purgation in abdominal diseases.
- In Sindh, dried plant prescribed by for diarrhoea. As local application in skin ailments and pruritus.
- In Ethiopia, seeds of *Glinus lotoides* used in treatment of tapeworm infestation.

Others

Fodder: Used as fodder for goats.

USES:

This plant is found in seasonally inundated land and has many traditional uses in cultures across its large native range, as medicine and as food. Young leaves and stems of *Glinus lotoides* are used as a vegetable in some tropical countries. The plant is considered useful in abdominal disorders. The tender shoots are eaten as potherb.(Kirt & Basu; Flora of British India part 2,662) Indigenously, *Glinus lotoides* serves a variety of medicinal purposes. It is used as an antiseptic, an anthelmintic, as a treatment for diarrhea and bilious attacks, and as a purgative for curing boils, wounds and pain in general. The juice of the plant is also sometimes given to weak children for strength (Hamed et al., Phytochemistry (1996) 43: 183-188). Used in Africa for treatment of diabetes & skin ailments.(El-Hamidi. 1967.) The use of *Glinus lotoides* to treat cancer has not yet been reported *Glinus lotoides* is native to Eurasia and Africa and has become widespread in tropical, subtropical, and warm-temperate areas worldwide. Several varieties have been described, but their delimitations are unclear and need further investigation. The vernacular name "damascisa" is applied to this species, as well as several other plants, which are used in Africa for treatment of diabetes and skin ailments (A. El-Hamidi et al. 1967Flora of N. America). In India, the species is used as treatment for diarrhea, boils, and abdominal diseases, as well as weakness in children (K. R. Kirtikar and B. D. Basu 1935). Antihelmintic properties are reported for *G. lotoides* from several African studies (B. Abegaz and B. Teclle 1980; G. Broberg 1980).

Nutritional value: (7)

The amount of protein, carbohydrate, fat, ash, moisture, sugar profile and fatty acids support the nutritional value of the seeds also contains Vitamin E, Selenium, and Calcium.

Siddha system of medicine: (8)

Parts used: Whole plant

Suvai: kaarpu

Thanmai: veppam

Pirivu: kaarpu

Action: stimulant, anti-syphilitic.

Therapeutic uses: (9)

Cures vata diseases, gunmam, soolai, mandham, mega noigal (syphilis), leucorrhoea, kapha diseases

Dose: Powder 2 to 3 g. twice or thrice a day.(10)

It is mentioned as one of the Rasayana (rejuvenative) drug in Siddha medicine by Siddhar Bogar in his work Bogar Karpa Vithi.(11)

Preliminary Phytochemical analysis of crude extract (12)

The different solvent extracts were analysed for the presence of various phytochemicals.

Table No: 1

S. No	Solvent extract	Alk	Ster	Sap	Tan	Flav	Anthroq	Terp	Coum	Quin
1	Hexane	-	-	+	-	-	+	-	+	-
2	Chloroform	+	+	-	-	+	-	+	-	+
3	Ethyl acetate	+	-	-	+	+	+	+	+	-
4	Petroleum ether	+	+	-		-		-		-

Note: Alk-alkaloids, Ster-Steroids, Sap -Saponins, Tan- Tannins, Flav- Flavonoids, Anthroq- Anthroquinones, Terp –Terpenoids, Coumarins, Quin-Quinones
(+) Present (-) Absent

Pharmacognostic study(13)

Description:

Root: Taproots well developed, stout fleshy, long, cream in colour, odour & taste not characteristic.

Stem: Spreading, much elongated, villous, bearing white flowers in axillary fascicles; odour nil & not characteristic.

Leaf: Leaves opposite, more than two at nodes, 1-2 cm in width & 0.5 to 1.5 cm in length & densely villous on both sides, obovate or sub-orbiculate, very obtuse at the apex, cuneate at the base, petioles 6 to 10 mm. long, slender, hairy, vein inconspicuous, odour nil & taste not characteristic.

Microscopic:

Root: Transverse section shows circular outline; epidermis single layer of thick walled cells; four to five layers of thin-walled parenchymatous cortex; stele showing anomalous secondary growth consisting of successive rings of alternate xylem & phloem, xylem consists of solitary wide circular thick-walled vessels; thin –walled parenchyma present in between the successive rings; starch grains present; pith absent.

Stem:

Cuticle present, epidermis single layered barrel shaped cells; a few cells shows papillary growth; cortex consists of 4 or 5 layers of loosely packed parenchyma; some contains druses; 2 Or 3 layers of stone cells alternating with sclenchymatous fibres forms the pericycle; stele shows phloem & many solitary circular vessels amidst thick-walled parenchyma; pith large; parenchymatous; starch grains present; a few cells contain druses of calcium oxalate.

Leaf:

Petiole: Transversr section circular in outline; epidermal cells thin walled with cuticle; epidermal outgrowths of stellate hair mostly dichotomously branched, with a 3 or 4 celled stalk; cortical region parenchymatous with intercellular spaces; a few cells contain druses; vascular strand single, deeply are shaped with many radial files of 2 tp 5 xylem elements; phloem present on the abaxial side of the xylem strands; a few layer of ground tissue with smaller cells surround the vascular area.

Midrib:

Transverse section of midrib shows abaxial side slightly curved; epidermal cells single-layer, barrel shaped; cuticle present; palisade parenchyma continuous with lamina, two layered followed by 3 to 5 layers loosely arranged

spongy parenchyma, some cells contain druses; single vascular strand are shaped; xylem elements in radial groups; phloem present on the abaxial side of the xylem strands.

Lamina:

Dorsi-ventral; epidermis single layered; cuticle present, 2 layers of palisade parenchyma followed by loosely arranged spongy parenchyma, some cells contain druses; lower epidermis shows stellate hairs dichotomously branched with a four or three celled stalk; in surface view abaxial epidermal cell walls sinuous & adaxial slightly wavy, stomata anomocytic; stomatal numbers 23 to 25 /mm². For adnaxial epidermis; stomatal index 43 to 45 for adaxial epidermis; palisade ratio 2 to 4; vein islet number 4 or 5.

Analytical Parameter:

Powder:

Greyish green; no characteristic odour & taste; shows stellate hairs and druses, fibres, vessels, fragments of leaf with anomocytic stomata, starch grains measuring up to 5µm in diameter & elongated pitted stone cells length upto 150µm with narrow lumen.

Identity, purity & strength:

Foreign matter-not >2%

Total ash-not >12%

Acid-insoluble ash-not >1%

Alcohol-soluble extractive-not <8%

Water-soluble extractive-<23%

Fixed oil extractive-< 3%

Thin layer chromatography study:

T.L.C. of chloroform extract on aluminium plate precoated with silica gel 'G' 60 F254(Merck, 0.2 mm thickness) using Toluene; Ethyl acetate (9:1) as mobile phase, shows under UV (254 nm), eight spots at Rf 0.10, 0.17, 0.24, 0.29, 0.46, 0.54, 0.61 & 0.71 (all green).

Under UV (366nm), seven spots appear at Rf 0.20 (pink), 0.32(blue), 0.37(pink), 0.41(dark pink), 0.49(blue), 0.54(pink), & 0.59(dark pink). On exposure to iodine vapour, spots appear at Rf 0.24, 0.65, 0.69 (all brown). On dipping the plate in vanillin sulphuric acid reagent & on heating at 105°C until the colour develops, eleven spots appear at Rf 0.11(green), 0.18(green), 0.29, 0.35(both grey), 0.45, 0.53 (both grey), 0.59(green), 0.74, 0.80 & 0.98(all grey).

Biological activity of Glinus lotoides (14)

The extraction of various using various concentrations of methanol as solvent of saponin-containing extracts from the seeds of Glinus lotoides analysed. crude dry extracts of 60% methanol (extract A), 70% methanol (extract B) and 80% methanol (extract C) were studied. The average particle sizes (X50) of extracts A, B and C were found to be 68.4, 92.1 and 68.5 microm, respectively.

Phytochemical Analysis(15)

The total flavonoids and saponins of the seeds of Glinus lotoides in the crude extracts is quantified by reversed-phase high-performance liquid chromatographic (RP-HPLC) methods with UV detection. The saponins were analyzed after acid hydrolysis in 3 M HCl at 100 °C for 1 h. Vicienin-2 and mollugogenol B were isolated. New sapogenins-Mollugogenols C& E-along with Mollugogenols A &B isolated; beta and gamma sitosterol glucosides & Oleanolic acid isolated; a new triterpene glycoside-molligocin A-isolated & characterized as Mollugogenol a-3:Mollugogenol7 isolated and its structure determined; structure of Mollugogenol D elucidated; stereostructures of Mollugogenols A & E established.- Study yielded Stidmollugogenol-F, a new triterpenoid saponin – 3β,16β,22-trihydroxyisohopane.

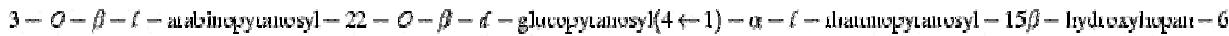
Seeds contain protein, carbohydrate, fat, ash, moisture, sugar profile, fatty acids.

Hopane-type saponins from the seeds of Glinus lotoides (16)

Four new hopane-type saponins, glinusides F,G,H and I (1-4), and the known Succulentoside B(5) as well as the two known flavones 5,7,4- trihydroxy flavone-6,8-di-C-Sophoroside (Vitexin-2 o-glucoside) were isolated from the seeds of Glinus lotoides.

Triterpenoidal saponin glycosides from *Glinus lotoides* var. *Dictamnoides*(17)

Three triterpenoidal saponins (glinusides A, B and C) were isolated from the *n*-butanol fraction of *Glinus lotoides* var. *dictamnoides*, their structures being determined by means of spectroscopic methods as



^{one}
 $\text{3} = \text{O} - \beta - \text{l} - \text{arabinopyranosyl} - 15 - \text{O} - \beta - \text{d} - \text{glucopyranosyl} - 22\beta - \text{hydroxyheptan} - 6 - \text{one}$
and
 $\text{3} = \text{O} - \beta - \text{d} - \text{glucopyranosyl}(4 \leftarrow 1) - \beta - \text{l} - \text{arabinopyranosyl} - 22\beta - \text{hydroxyheptan} - 6 - \text{one}$
respectively.

Pre-clinical study:

Acute Toxicity study: (18)

Methanolic extract of seeds of *G. lotoides* as single-dose toxicity study suggested the LD50 of the crude extract of *Glinus lotoides* might be greater than or equal to 5000 mg/kg. In repeated dose toxicity study of 250, 500 and 1000 mg/kg, no mortality was observed when administered per day for 28 days. Various doses of crude extract of *G. lotoides* were used in single dose toxicity test. There were no significant differences in body weight, no differences in most hematological parameters examined, and no histopathological changes were observed.

Anti-helminthic activity:(19)

In Ethiopia, seeds of the plant is used for its taenicidal activity. Extract of seeds was evaluated for invivo anthelminthic activity in albino mice infested with *Hymenolepsis nana* worms. Results showed the seed extract to be active in both single and multiple doses, although more effective in multiple doses.

Anti-spasmodic activity (20)

The plant seems to possess antispasmodic and ecbolic properties, since it relaxes the intestinal movements and stimulates the uterine musculature. It does not affect the blood pressure or respiratory movements.

Anti-Ulcerogenic activity (21)

The study showed that ,dose dependent anti-ulcerogenic effect against aspirin induced ulcer in rats. As overall trend 300mg/kg is the most effective dose. The effect of methanolic extract of *G. lotoides* on gastric acid secretion (pH). Showed that acid suppression in presence of 2 microgram/ml at doses 400 & 200 microgram/kg. At 400 microgram/kg it showed significant reduction in the incidence of ulceration. The results indicated that *G. lotoides* acted through H2 receptor blocking activity as it blocked the histamine effect in contracting rat uterus & guinea pig atrium. Thus the anti-secretory mechanism of methanolic extract of *G. lotoides* may account for anti-ulcerogenic activity.

Molluscicidal effects of *Glinus lotoides* fruits(22)

The aqueous & ethyl acetate crude extracts of *Glinus lotoides* fruits possess molluscicidal properties against the intermediate snail host, *B. pfeifferi*. The aqueous extract also showed in vitro cercaricidal property against *S. mansoni* cercariae.

Wound healing activity (23)

The chloroform extract of *Glinus lotoides* has two main constituents flavonoids and glycosides which can be attributed to the wound healing activity. The chloroform extract of *Glinus lotoides* showed the best activity against *Bacillus subtilis*, *staphylococcus aureus*. The inhibitory effect of chloroform extract of *Glinus lotoides* when compared with the antibiotics showed similar extent of activity. Flavonoids, glycosides are known to promote wound healing process mainly attributed to their astringent and anti-microbial property.

Chemo-protective activity (24)

The seeds of *G. lotoides* were found to contain nutritional compounds of well-established chemopreventive activity, including vitamin E, folic acid, selenium and calcium. Nutritional benefits of this herb is already known.

Anti-tumor activity (25)

Two antiproliferative triterpenoid saponins bearing *N*-acetylglucosamine were facilely synthesized. Antitumor activity was preliminarily investigated ($IC_{50} = 2.74 \mu\text{M}$ against HeLa cell). Repeatability, limits of detection (LOD)

and limits of quantification (LOQ). Repeatability (inter- and intra-day, $n = 6$ and 9, respectively) showed less than 2% relative standard deviation (RSD). The LOD and LOQ were found to be 0.075 and 0.225 mg/mL, respectively, for vicenin-2 and 0.027 and 0.082 mg/100 mL, respectively, for mollugogenol B.

In an another prospective study, the antitumour activity of the methanolic extract of *Glinus lotoides* (MGL) has been evaluated against Dalton's ascitic lymphoma (DAL) in Swiss albino mice. A significant enhancement of mean survival time of tumour bearing mice and peritoneal cell count in normal mice was observed with respect to the control group. When these MGL treated animals underwent i.p. inoculation with DAL cells, tumour cell growth was found to be inhibited. After 14 d of inoculation, MGL is able to reverse the changes in the haemotological parameters, protein and packed cellular volume consequent to tumour inoculation.

Anti-Cancer activity(26)

Methanol and n-hexane extracts showed differential growth inhibitory responses in carcinoma cell lines. The extracts induced significant apoptosis in the cancer cells. The methanol and n-hexane extracts showed differential growth inhibitory responses in carcinoma cell lines (Calu-3 IC₅₀)=29.7 and 79.8 µg/mL and Caco-2 IC₅₀)=69.7 and 74.6 µg/mL, respectively) as compared to normal cell lines (MDCK IC₅₀)=106.1 and 131.1 µg/mL and IEC-6 IC₅₀)=134.0 and 128.5 µg/mL, respectively). In addition, these extracts induced significant apoptosis in the cancer cells ($p<0.05$) at 100 µg/mL.

Anti-oxidant activity (27)

The hydrophilic oxygen radical absorption capacity (ORAC) value was found to be 123 µM Trolox Equiv./g, indicating the antioxidant activity of the plant. The hydrophilic oxygen radical absorption capacity (ORAC) value was found to be 123 µM Trolox Equiv/g, indicating the antioxidant activity of the plant.

Bio-pesticidal activity(28)

Two diets were used (rice & millet flour) as experimental media to compare the ovicidal activity of *Glinus lotoides*. Out of three different solvent extracts, the ethyl acetate extract exhibited maximum inhibition on egg hatchability, followed by chloroform extract & the hexane extract brought least ovicidal activity.

Anti-mutagenic activity:

The crude extract of seeds from *Glinus lotoides* contains high levels of the closely related C-glucoside, two flavonoids namely, Vicenin-1 & 2 and O-glucoside. These flavonoids were found both in the non-genotoxic & genotoxic fractions of the extract & shown to possess anti-mutagenic properties in bacterial assays conducted in the presence of mammalian metabolic enzymes (Choi et al,1994; Miyazawa & Hisama,2003),but a number of studies have also provided evidence for dual biological activities (anti-mutagenic /pro-mutagenic and anti-oxidant/pro-oxidant activities) (Skibola & Smith,2000; Halliwell,2007).

Pharmacological activity:

Genotoxicity /DNA damaging effect(29)

Study evaluated the potential genotoxicity of *G. lotoides* crude extracts. Fractions containing hopane-type saponins exhibited pronounced DNA damaging effect without affecting the viability of the cells.

CONCLUSION

Glinus lotoides L., is a herb, used in Siddha system of medicine as grinding juice in making of Parpam (silasathu parpam) and chenduram drugs (9). This plant is yet to be identified for its anti-oxidant property as mentioned in Siddha literature Bogar karpavidhi. In the current scenario of great thrusts towards herbal drug exploration ,yet to be studied plants resources are much more left behind as this simple herb. Let us explore the extravaganza and essence of herbal world.

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