

Phytochemical and ethno-pharmacological properties of *Desmodium triflorum*: A Review

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Abstract

Desmodium triflorum is a well-known Sri Lankan medicinal plant which is in folkloric use. Recent pharmacological studies have established its antioxidant, anti-inflammatory, anti-convulsant and analgesic activities. The plant is rich in alkaloids. The review depicts out on the folkloric uses along with pharmacological and biological activities of the extracts of *D. triflorum*. Habitat and distribution of the plant and the nature of compounds isolated are also reviewed.

Keywords: *Desmodium triflorum*, folkloric use, diabetes, medicinal plant, alkaloids, anti-inflammatory

Introduction

Herbal medicines are still the mainstay of treating diseases of more than half of the world population mainly in the developing countries.¹ *D. triflorum*, which is commonly known as “three-flowered beggar weed” is a dicotyledon.² It has been in folkloric use for many years.³ Roots, leaves and the whole plant are used in Ayurvedic medicine for various treatment purposes.⁴ Roots are

reported as carminative, tonic and diuretic. Leaves are antiseptic, antidiarrhoeal and galactogogue.⁵ The whole plant of *D. triflorum* is known to have expectorant, cooling and galactogogue properties.⁴ Faeces of wild rabbits those who have eaten the plant have been used for treatment purposes in folkloric medicine.⁶

Hedysarum triflorum is a synonymous Latin binominal for *D. triflorum*. Heen Undupiyaliya (Sinhala), Sirupullati (Tamil), Kudaliya and Jaiyalabhir (Hindi), Hansapadi, Tripadi and Amlana (Sanskrit) are vernacular names which have been used by different ethnic groups to identify this plant.⁴

Botanical description

D. triflorum is a very small, 15-45 cm long, perennial herb. It possesses numerous, long, slender, prostrate branches which are trailing and rooting at the nodes, clothed with white spreading hairs.⁴ Leaves are small, alternate, stipulate, trifoliate, rachis less than 1.2 cm, stipules ovate, acuminate and persistent.⁷ Leaflets are membranous, oval or ovate, base cuneate, truncate or imarginate or

rarely rounded with glabrous above and adpressed hairy beneath.⁸

Flowers are small, white or pink coloured. They are bisexual, irregular, 1-5 fascicled in the axil of leaves, bracteoles minute. These contain five sepals fused into a companulate calyx 3-4 mm long with few bristly hairs, segments long and setaceous. Five petals are there consisting of one broadly obovate, standard, two wing petals and two fused keel petals. A flower contains ten stamens-diadelphous, superior ovary with marginal ovules, unilocular. Flowering is observed from June to October.⁹

Fruit is a legume, 0.8 -1.2 cm long, nearly straight, not indented on dorsal, slightly so on ventral margin, 2-4 joints, as long as broad, reticulate and glabrous. Fruits contain blackish brown seeds.⁷

Taxonomy

Kingdom: Plantae

Division: Magnoliophyta

Class: Magnolippsida

Order: Fabales

Family: Fabaceae

Genus: Desmodium/Hedysarum

Species: triflorum (Lin.)¹⁰

Habitat and distribution

D. triflorum is a common weed that occurs throughout the tropics including India, Sri Lanka, Philippine islands, Myanmar, China, Hong Kong, Malaysia, North Australia and New Caledonia. The plant is seen on a wide

range of soils, and most commonly in dry, disturbed sites near the coast and on dry slopes, lava flows, open grassy lands, in lawns, pastures, waste places and along road sides.^{4,11} It is an abundant constituent of turf in Sri Lanka, specially in low country up to 200 feet or more.⁷

Phytochemistry

Preliminary phytochemical screening of extracts of *D. triflorum* has revealed the presence of alkaloids, flavonoids, proteins, phytosterols, saponins and tannins.^{6,12}

It contains significant amounts of alkaloids including hypaphorine, N,N-dimethyltryptophan, betaine, choline, N,N-dimethyltryptamine oxide. Beta phenethylamine is a minor constituent of its alkaloidal fraction. Phytochemical investigations has showed that the leaves of *D. triflorum* have a total alkaloid content of 0.01–0.15% and the roots have a total alkaloid content of 0.01–0.018% .¹³

It is reported that roots, leaves and stems contain tyramine, hypaphorine, 5-indole-3-alkylamines, Indole-3-acetic acid, trigonelline, stachydrine, betaine, choline and N,N-dimethyltryptophan. Additionally leaves are reported to contain fucosterol, vitexin and 2-O-beta-D-xylosylvitexin. Roots contain pinitol, vitexin and isovitexin in addition.^{4,14,15}

Traditional uses and ethnopharmacology

Roots and leaves of *D. triflorum* and the whole plant is used in traditional medicine.^{4,8}

In Sri Lanka, powder of the air dried *D. triflorum* is used to prepare a beverage which is used to relieve flatulence. This powder along with fenugreek powder is dissolved in hot water to prepare a beverage which is then strained and drunk for relieving diabetic thirst.⁶ Additionally *D. triflorum* is given as porridge to treat diabetes.¹⁶

A decoction of the plant is used as a cure for dysentery and diarrhoea in Java and Philippine islands while in Malaysia a decoction of the root is given for stomachache. The roots are used for cough, asthma, and also applied to wounds and abscesses.¹³

Leaves of *D. triflorum* are chewed and the sap is swallowed to relieve dry mouth.⁶ They are used both internally and externally for snake-bite poisoning, particularly that of the Russell's viper.⁹

Leaves are grounded in cow's milk and given to children for relieving diarrhoea due to indigestion. As well as it is given in the morning for its galactagogue activity, and in convulsion.^{4,5} Leaves are grounded into a paste with cinnamon bark and roasted in gingelly oil are applied on chronic ulcers to promote healing.⁹

Fecal materials of rabbits moistened with the extract of leaves of *D. triflorum* are applied on oedematous places of the patient to promote healing. Juice of the fresh plant is applied to abscesses and wounds for quick healing.⁴

D. heterophyllum (MahaUndupiyaliya) which is similar in pharmacological

properties is used to replace *D. triflorum* in the absence of it.⁶

Pharmacological properties

Various biological activities of *D. triflorum* have been reported in different researches. It is revealed that *D. triflorum* expresses antioxidant, anti-inflammatory, anti-convulsant and analgesic properties.^{17,18,19}

Ten *Desmodium* species including *D. triflorum* have been evaluated for antioxidant activity using DPPH (Diphenylpicrylhydrazyl) free radical scavenging activity, ABTS (2,2'-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid) radical monocation scavenging activity and ferric-reducing antioxidant power. Total phenolic content of the crude extracts of *D. triflorum* and other *Desmodium* species has also been investigated. This study indicated that the antioxidant activity of *D. triflorum* was related to its phenolic components. Furthermore vitexin has been isolated from *D. triflorum*. The reducing power has been expressed as 41.30 ± 1.38 μg of ascorbate equivalent per mg dry weight of the extract.¹⁷

According to Lai et al., (2010), a study was conducted to evaluate the antioxidant and anti-proliferative activities of the crude extract and fractions of *D. triflorum*. Its anti-proliferative activity was investigated using MTT [3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide] method. The total phenolic content of the crude extract was equivalent to 36.60 ± 0.1 mg catechin and the total flavonoid content was equivalent to 45.6 ± 0.6 mg rutin per gram. According to the study, *D. triflorum* was a

potent antioxidant medicinal plant and the ethyl acetate fraction exhibited the highest antioxidant activity among the tested fractions.¹⁸

According to Lai et al.,(2009), the analgesic effects of methanol extract of *D. triflorum* (MDT) was evaluated using acetic acid-induced writhing response and formalin test. Anti-inflammatory effect of MDT was investigated by carrageenan-induced paw oedema in mice. In the analgesic test, at concentrations of 0.5 and 1.0 g/kg body weight MDT decreased the acetic acid-induced writhing response and the licking time on the late phase in the formalin test. In the anti-inflammatory test, MDT (0.5 and 1.0 g/kg) decreased the paw edema at the 3rd, 4th, 5th and 6th hours after carrageenan administration. Methanolic extract of *D. triflorum* increased the activities of superoxide dismutase (SOD) and glutathione reductase (GRd) in liver tissues. The anti-inflammatory mechanisms of MDT was thought to be related to the decreases in the levels of malondialdehyde and nitric oxide in the inflamed paw via increasing the activities of SOD, glutathione peroxidase and GRd in the liver. As well as decreasing the levels of interleukin-1beta and tumour necrosis factor on the tissues of inflamed paw of mice.¹⁹

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