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Review

An ethnomedicinal, phytochemical and pharmacological profile of *Desmodium gangeticum* (L.) DC. and *Desmodium adscendens* (Sw.) DC.

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ABSTRACT

Ethnopharmacological relevance: Desmodium gangeticum (L.) DC. and *Desmodium adscendens* (Sw.) DC. are two important and well explored species of genus *Desmodium* (Fabaceae (alt. Leguminosae) subfamily: Faboideae). *Desmodium gangeticum* is used as a tonic, febrifuge, digestive, anticatarrhal, antiemitic, in inflammatory conditions of chest and in various other inflammatory conditions in the Ayurvedic System of Medicine while *Desmodium adscendens* is widely used for the treatment of asthma in Ghana, Africa.
Aim of the review: The aim of this review is to provide comprehensive information on the botany, traditional uses, phytochemistry, pharmacological research and toxicology of *Desmodium gangeticum* and *Desmodium adscendens* to explore their therapeutic potential and future research opportunities.
Materials and methods: All the available information on *Desmodium gangeticum* and *Desmodium adscendens* was collected via electronic search (using Pubmed, SciFinder, Scirus, Google Scholar, JCCC@INSTIRC and Web of Science) and a library search for articles published in peer-reviewed journals.
Results: About 25 different species of *Desmodium* including *Desmodium gangeticum* and *Desmodium adscendens* are used ethnomedicinally all over the world. Phytochemical research on *Desmodium gangeticum* and *Desmodium adscendens* has led to the isolation of alkaloids, pterocarpans, phospholipids, sterols, flavones and flavonoid glycosides from *Desmodium gangeticum* and triterpenoid saponins, phenylethylamines and indole-3-alkyl amines from *Desmodium adscendens*. Crude extracts, fractions and isolated components of *Desmodium gangeticum* and *Desmodium adscendens* showed a wide spectrum of *in vitro* and *in vivo* pharmacological activities like antileishmanial, immunomodulatory, antiasthmatic, smooth muscle relaxant, anti-inflammatory, anti-ulcer, cardio-protective, antidiabetic, antiamnesic, antiviral, antioxidant and hepatoprotective activities.
Conclusions: Desmodium gangeticum and *Desmodium adscendens* have emerged as a good source of traditional medicine. *Desmodium gangeticum* possesses the ability to scavenge the free radicals generated during ischaemia and ischaemia reperfusion thereby preserving the mitochondrial respiratory enzymes that eventually lead to cardio-protection and has potential prophylactic and therapeutic efficacy against *Leishmania* infection. *Desmodium adscendens* is useful against chronic bronchitis and asthma. However, there is a need to search for individual secondary metabolites responsible for these actions and study their mode of actions, bioavailability, pharmacokinetics and physiological pathways in sufficient detail. The promising results should be further substantiated by clinical trials.

Contents

Abbreviations: AA, arachidonic acid; ABTS, 2,2′-azino-bis(3-ethylbenzthiazoline-6-sulphonic acid); AChE, acetylcholinesterase; AL, alcohol; ALP, alkaline phosphatase; ASP, aspirin; BST, brine shrimp lethality bioassay; CAT, catalase; ChTX, charybdotoxin; CNS, central nervous system; COX, cyclooxygenase; CPK, creatinine phosphokinase; CRU, cold restraint induced ulcer; DHS-1, dehydrosoyasaponin 1; DPPH, 2,2-diphenyl-1-picrylhydrazyl; $FeSO_4$, ferrous sulphate; GPX, glutathione peroxidase; GR, glutathione reductase; GSH, glutathione; H_2O_2, hydrogen peroxide; HOCl, hypochlorous acid; HST, histamine; IR, ischemic repurfusion; KA, kainic acid; LDH, lactate dehydrogenase; LH, luteinizing hormone; LPO, lipid peroxidation; LTD4, leukotriene D_4; ME, maximal electroshock; MI, myocardial infarction; NADPH, nicotinamide adenine dinucleotide phosphate; NO, nitric oxide; OA, ovalbumin; PG, prostaglandin; PL, pyloric ligation; PTZ, pentylenetetrazole; ROS, reactive oxygen species; SGOT, serum glutamate oxaloacetate transaminase; SGPT, serum glutamate pyruvate transaminase; SOD, superoxide dismutase; TBARS, thiobarbituric acid reactive substances; VL, visceral leishmaniasis.

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1. Introduction

Desmodium gangeticum (L.) DC. and *Desmodium adscendens* (Sw.) DC. (Fabaceae (alt. Leguminosae) subfamily: Faboideae) are two important species belonging to the genus *Desmodium* which have been used extensively as traditional medicines in India and Africa, respectively over a long period of time and their uses have been well documented.

Desmodium gangeticum, commonly known as 'Salpan', 'Salpani' in Hindi and 'Shalparni' in Sanskrit, is used in Ayurveda, Siddha and Unani systems of medicine either as a single drug or in combination with other drugs. It is a bitter tonic, febrifuge, digestive, anticatarrhal, antiemitic, used in inflammatory conditions of chest and in various other inflammatory conditions which are due to 'vata' disorder. The roots have been used as expectorant and in snake bite and scorpion sting (Chopra et al., 1956; Nadkarni, 1976). It is an ingredient of Ayurvedic preparations like 'Dashmoolarishta' and 'Dashmoolakwaath' recommended for post-natal care to avoid secondary complications.

The other important *Desmodium* species is *Desmodium adscendens* which is used in the treatment of asthma in Ghana, Africa (Ampofo, 1977). In Mato Grosso, the plant is known as "amores do campo" or "carrapichinho" and in São Paulo and Rio Grande do Sul as "pega-pega". In Brazil it is easily found in the Northeast, Center West and Southeast regions (Pio Corrêa, 1984).

Desmodium gangeticum and *Desmodium adscendens* are known to contain molecules of therapeutic importance. In the last few decades, several studies have been carried out on these two medicinal plants that also provide evidence in favour of their conventional uses. The purpose of this review is to provide comprehensive information on the botany, traditional uses, phytochemistry, pharmacological research and toxicology of *Desmodium gangeticum* and *Desmodium adscendens* to explore their therapeutic potential, highlight the lacunae in our present knowledge and evaluate future research opportunities.

2. Botanical description

The genus *Desmodium* is represented by nearly 450 species distributed in the tropical and subtropical countries throughout the world, except in Europe and New Zealand, of which about 20–25 species are found in India (Ambasta, 1986).

Desmodium gangeticum is a perennial erect or ascending prostrate undershrub, 60–130 cm high with somewhat angular branches, pubescent or glabrous. Leaves simple, variable, ovate-oblong or rounded, 3–14 cm × 2–7 cm, acute to acuminate, glabrous above, pubescent beneath; petioles 1–2.5 cm long. Flowers purplish or white, 4–7 cm long in 10–30 cm long terminal and axillary racemes often combined to panicles. Calyx 4–5 cm long, pubescent. Vessilum 5–6 cm long, keel incurred. Pods sub falcate curved, 6–8 jointed, upper suture straight or without indent, lower deeply indented, hooked-hairy. The taproot is poorly developed and lateral roots are very strong, light yellow in colour and smooth in texture (Iyer, 1953; Duthie, 1994). Its flowering–fruiting season is during the months of March to December. It is found distributed throughout the warmer parts of India, tropics of Africa to Indomalaysia (Gaur, 1999).

Desmodium adscendens is herbaceous, stems slender angular, leaflets ovate-oblong acute subrepand bracts minute setaceous, joints small as long as broad. Stem erect, clothed when young with fine short spreading grey hairs. Stipules large, lanceolate, acuminate, not amplexical; petiole 1–1.5 in.; leaflet membraneous or subcoriacous, green and smooth above, grey clothed with short adpressed hairs beneath; end one 2–4 in. long; narrowed gradually to a point. Racemes copious, lax, lateral and terminal, the latter reaching a foot long, usually simple; pedicle 1/4 to 3/8 in., ascending or spreading. Calyx 1/16 in.; teeth lanceolate, longer than the tube. Corolla 3 times calyx. Pod 1/2 to 3/4 in. long, under 1/8 in. broad, glabrescent, 4–6 jointed; upper suture distinctly indented (Hooker, 1879).

3. Traditional medicinal uses and ethnopharmacology

Table 1 lists the traditional uses, local names, methods of administration and the induced effects that have been reported for *Desmodium gangeticum* and *Desmodium adscendens* along with sixteen other *Desmodium* species used by the local people and ethnic groups in the different parts of the world. Ethnobotanical uses of ten *Desmodium* species, reported to possess medicinal value in India, have been enumerated in Table 2.

4. Phytochemical constituents

Chemical investigations have revealed the presence of isoflavones, isoflavanones, C-glucosyl flavonoids, pterocarpans,