PHARMACOLOGICAL ACTIVITIES OF DESMODIUM GANGETICUM: AN OVERVIEW

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ABSTRACT
In our country has a great wealth of various naturally occurring Ayurvedic medicinal plants which have broadly pharmacological activities. A number of Ayurvedic medicinal plants are used for treating various disease. Desmodium gangeticum belonging to family Papilionaceae (Fabaceae) is an important plant found throughout India especially in Saurashtra reason. It is main contain of Dashamoola for pitta mitigates. In Ayurveda several action of Desmodium gangeticum mention in singal form as well as mulitpal compound. So the present review summarized its plants characteristics with their pharmacological activities.

Keywords: Pharmacological activities, Desmodium gangeticum.

INTRODUCTION
According to the WHO more than 80% of the world’s population relies on traditional herbal medicine for their primary health care. In recent time there has been a marked shift towards herbal cures because of the pronounced cumulative and irreversible reactions of modern drugs. However, due to over population, urbanization and continuous exploitation of these herbal reserves, the natural resources along with their related traditional knowledge are depleting day by day. As we know that India, with its mega-biodiversity and knowledge-rich ancient traditional systems of medicine viz. Ayurveda, Siddha, Unani and local health traditions, provides a strong base for the utilization of a large number of plants in general healthcare of the people. In allopathic medication showing severe side effects, it is important to look always a new herbal remedy for treating diseases. Based on the reported data, we are trying to give a brief review on Desmodium gangeticum belonging to the family Papilionaceae (Fabaceae) for the public interest to implement in daily life. So in this review, the literature tells us about various pharmacological properties.
Desmodium gangeticum which is commonly known as Salvan (Gujrati), Shalpan (Hindi) and Flax weed (English). It is a stout herb or under shrub, up to 1 m. high, Stems is angled, more or less hairy. Leaves are 1-foliolate, stipules is scarious, up to 8 mm. long. Leaflets- membranous, 7-15x3-7 cm, ovate-oblong or broadly ovate, acute or acuminate, rounded at the base. Flowers is in large terminal and axillary racemes, usually in small fascicles on a slender rachis; bracts subulate, up to 4 mm., calyx- 2 mm. long, hairy, corolla: - 4-5 mm. long, purple, violet, blue, lilac, or whight, these colours appearing at the same time on the same plant.Pods are slightly falcate, up to 18 mm. long; joints 6-8, longer then broad, slightly hairy with minute hooked hairs.Local names (in saurashtra): Salvan, Ekpani-pandadiyo. Flowring (in saurashtra): May to August. Fruiting (in saurashtra): Onwards to Octomber. Occurrence (in saurashtra): Barde Hills, Rozy near Jamnagar, Willingdon Dam near Junagadh, Girnar forest, Sasan Gir forest .

The plant of Desmodium gangeticum is bitter, sweet, thermogenic, nerveine tonic, aphrodisiac, demulcent, anthelmintic, cardiac tonic, febrifuge, anti-inflammatory, diuretic, haemostatic, rejuvenating, and useful in neuromuscular and ophthalmic disorders, loss of appetite, flatulence, diarrhea, dysentery, nausea, piles, helminthiasis. It is used in angina pain, cardiac disorders, tuberculosis, cough, seminal weakness, urinary disorders, fever, debility and gout. The root of desmodium gangaticum is one of the constituent of famous Ayurvedic preparation Dasmoola kvatha which is antipyretic and bitter tonic. It is reported to be beneficial in treatment of typhoid fever, biliousness and also diuretic and aphrodisiac.

Vernacular Names :
Bengal :- Salpani, Shalpani, Chhalani.
Eng :–Flax weed, Flix weed.
Gujrati :- Salvan, shalvan, sameravo, pandadiyo.
Hindi :- Shalpan, Salvan, sarivan, Gauri, Sar, Salpani, Dinth.
Kannad :- Kadangaa, Maru, Nabiylabune, Nariyalavona, bhui, Shevara.
Konkani :- Salvan.
Malayayam :- Orila, Pullati.
Marathi :- Salvan, Ranbhal.
Mundari :- Oterai
Oriya :– Salopornni, Sharpni.
Punjab :– Shalpurni, Samer, Sarivan.
Sanskrit :– Vidarigandha, Anshumati, Shalparni, Shaliparni, Somya
Santhal :– Tandi Bhedi Janetet.
Siddha :– Pulladi, Sirupulladi, Moovilai (Root)
Tamil :– Orila, Pulladi, Pullati.
Telugu :– Gitanaram, Kolaka ponna.
Tulu :– Kolakuponna, Gitanaram.
Urdu :– Sharpani.

**Distribution**

Common species on lower hills and plains throughout India, ascending to 1500 m in the Himalayas. It is frequently found in outer Himalaya. Punjab, in forest and west lend of Bihar and Orissa, Palghat in M.P., in open and westland forests of rajasthan, forest of Ganjam to Godavari, W. Ghats from South Canara to Travancore and Madras.

**Parts Used:** Root, Whole plant.

**Chemical Constituents:**


Fungus-inclulated leaflets:- isoflavonoid phytoalexin- desmocarpin together with genistein, 2-hydroxygenistein, dalbergioden, diphysolone and kievitone.

**Stem:** Flavones glucoside, 4-5,7-trihydroxy-8-prenylflavone-4’-0-alpha-L-rhamnopyranosyl-(1 to 6)-beta-D-glucopyranoside.

Aerial parts:- Twelve alkaloids of four stctural types (carboxylated and decarboxylated tryptamine, β- carbolines and β-phenylethylamines).

**Seeds:** 5 phospholipids.

**Toxicoloy:**
The aqueous extract of root was found to be nontoxic in acute toxicity studies. Gangetin-a pterocarpene from hexane extract of root is nontoxic up to a oral dose of 7 gm/kg in mice.

Therapeutic Evolution:
A classical herbal preparation, Shalparnyadi churna, consisting of Desmodium gangaticum (L) DC, Zingiber officinaie Rosc., Angle marmelos (L) Correa ex Roxb., Coriandrum sativum Linn. and Sida cordifolia Linn. was subjected to clinical trial on 15 patients of irritable bowel syndrome in doses of 3 gm T-D-S for 30 days. It is reported that the results showed positive response in all 15 patients.

Formulation and Preparations :
Shalparnyadi kvatha, chyavanaprasha, Dashamoolarishta, Chitrakaharitaki, Mahanarayana taila, Brahachchhagaladya ghrita, Dashamoola taila, mooshikadya taila, Vayuchchhaya surendra taila, Vyaghri taila.

Trade and Commerce :
Retail market price- Root- Rs. 30/- per kg. (1999)

Substitutes and Adulterants :
In Kerala Pseudarhria viscid (Linn) Wright & Arn. is used as substitute for Desmodium gangaticum. Some other texa viz., Desmodium polycarpum DC., Uraria lagopoides DC., Uraria hamosa Wall., Flemingia paniculata Wall. And Flemingia stricta Roxb. are used as Shaliparni in different parts of the country.

Agro Technique
Land Preparation-Ploughing to ensure proper aeration, 8 – 10 cartloads of cow dung / acre. Beds are prepared of 3 X 8 foot.
Transplanting - Plants are transplanted after 30 – 40 days.
Watering - Regular watering is needed.
Propagation -8 – 10 kg seeds / acre are sufficient. Seeds are sown on raised beds, which are covered with leaves or grass to protect from sunlight. Seeds sprout in 10 – 12 days provided regular watering is done. After 30 – 40 days plants are ready for transplanting.
Harvesting - The roots are dug up at the end of the growing season. If possible, they should be pulled up in one piece. They are then cut at the root collar level and washed or mechanically cleaned of any adhering soil. Entire roots are dried in the shade.

Simple Processing - The roots are dried in the shade. When sufficiently dry, these roots are coarsely ground and stored either in airtight containers or kept free from moisture.

Taxonomic Position:
- Kingdom: Plantae – Plants
- Subkingdom: Tracheobionta – Vascular plants
- Superdivision: Spermatophyta – Seed plants
- Division: Magnoliophyta – Flowering plants
- Class: Magnoliopsida – Dicotyledons
- Subclass: Rosidae
- Order: Fabales
- Family: Fabaceae – Pea family
- Genus: Desmodium Desv. – ticktrefoil
- Species: Desmodium gangeticum (L.) DC.

AIMS AND OBJECTIVES
To review the various Pharmacological activities of Desmodium gangeticum. Main aim is to prove the action which mention in Ayurveda by modern parameters or investigation.

MATERIALS AND METHODS
Available Ayurvedic Literatures were studied for better understanding of Desmodium gangeticum. Information regarding Desmodium gangeticum drugs from various National and International journals, Ayurvedic texts and also electronic search (using Pubmed, SciFinder, Scirus, Google Scholar, JCCCNSTIRC and Web of Science) was also used for availability and necessity for comprehensive understanding of the subject.

PHARMACOLOGICAL ACTIVITIES OF DESMODIUM GANGETICUM
Anti-inflammatory activity:
R. Govindarajan et al. (2007) studied the flavonoid and alkaloid fractions of Desmodium gangeticum were evaluated for anti-inflammatory activities in carrageenan-induced
inflamed rats with the aim of studying the promising fraction for inhibitory action on ferrous sulphate induced lipid peroxidation, superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPX) and total reduced glutathione in liver and spleen homogenates of inflamed rats.

Anshu Rathi et al. (2004) studied the water decoction of root and aerial parts of Desmodium gangeticum was examined for anti-inflammatory activity in experimental animals. There was a significant increase in analgesio-meter-induced force equivalent to 6.56–67.66% protection and 22.18–73.83% protection in acetic acid-induced writhing.

D. Ghosh and A. Anandakumar (1983) reported the Gangetin isolated from the hexane extract of the root of the plant Desmodium gangeticum. The compound showed significant anti-inflammatory activity in the exudative and the proliferative phases of inflammation in the doses of 50 and 100 mg/kg orally in albino rats.

Shivani Ghildiya et al. (2013) Laghupanchamula denotes combinations of roots of five herbs. However, in Ayurvedic classics besides four common herbs viz. Kantakari, Brihati, Shaliparni, and Prinshniparni, the fifth one is either Gokshura (Laghupanchamula with Gokshura LPG) or Eranda (Laghupanchamula with Eranda LPE), and both formulations have been documented to have shothahara (anti-inflammatory) action. The present study was undertaken to compare the anti-inflammatory activity of 50% ethanolic extract of LPG and LPE in rats and safety in mice. LPG and LPE significantly reduced acute and sub-acute inflammation, and showed effective and similar anti-inflammatory activity.

Anti-nociceptive activity:
Anshu Rathi et al. (2004) studied the water decoction of root and aerial parts of Desmodium gangeticum was examined for anti-nociceptive activity in experimental animals. The result establishes the traditional use of water decoction of Desmodium gangeticum codified in Indian System of Medicine.

Analgesic activities:
D. Ghosh and A. Anandakumar (1983) reported the Gangetin isolated from the hexane extract of the root of the plant Desmodium gangeticum. The compound showed significant analgesic activity in albino rats.
Anti-amnesic activities:  
Joshi Hanumanthachar and Parle Milind (2007) studied the effectiveness of aqueous extract of Desmodium gangeticum in attenuating scopolamine-induced amnesia in mice. It increased mice brain acetylcholine content and decreased acetyl cholinesterase activity in a similar manner to the standard cerebro-protective drug piracetam. Hence, aqueous extract of D. gangeticum can be used to delay the onset and reduce the severity of the symptoms of dementia and Alzheimer’s disease.

Anti-oxidant activity:  
R. Govindarajan et al. (2006) studied the total alcoholic extract of Desmodium gangeticum, which exhibited significant anti-inflammatory activity, was evaluated for the possible mode of action by studying its antioxidant potential in adjuvant-induced arthritic rats.

Prakash Veerul et al. (2009) studied some medicinal plant extracts for antioxidant activity and after ending of study he was consulted the methanolic crude extracts of Desmodium gangeticum found to be the strongest antioxidant, followed in descending order by Amaranthus caudatus, Solanum nigrum, Piper longum, Eclipta alba and Ocimum sanctum.

Gino A Kurian et al. (2009) reported the effect of aqueous extract of Desmodium gangeticum root in different antioxidant models and experimentally induced ischemic reperfusion in an isolated rat heart. The rats were divided into three groups namely control, reperfusion control, and drug treated. The above results suggest that the aqueous extract of DG root exhibit potential free radical scavenging effect that can reduce the oxidative stress exhibited by IRI.

Jen-Chieh Tsai et al. (2009) studied antioxidant activities and phenolic components of the crude extracts of 10 Desmodium species from Taiwan. In this study, DPPH free radical scavenging activity, ABTS radical monocation scavenging activity, ferric-reducing antioxidant power (FRAP) and reducing power of the 10 Desmodium species were evaluated for their antioxidant activities.

Anti-pyretic activity:
Zhan-Zhou Zhu et al. (2006) studied the petroleum ether fraction (PEF) from the ethanol extract of *Desmodium gangeticum*, which finding significantly antipyretic activities in mice.

**Anti-diabetic activity:**

Govindarajan R. et al. (2007) studied the evaluating the insulin secretion and antidiabetic activity of *Desmodium gangeticum*. Treatment of diabetic rats with aerial parts of D. gangeticum extract (DG, 100 and 250mg/kg body weight) for 3 weeks showed a significant reduction in blood glucose. D. gangeticum extract caused a significant increase in insulin secretion from MIN6 cells grown as monolayers and as pseudoislets, indicating that the antidiabetic activity may be as a result of increased insulin secretion. It also had a role on the lipid profile of the rats by causing reductions in cholesterol and triglycerides and increasing the HDL significantly.

**Cardiovascular activity:**

G A Kurian et al. (2010) studied effects of ethyl acetate extract of *Desmodium gangeticum* root on myocardial ischemia reperfusion injury in rat hearts.

G. A. Kurian et al. (2008) studied to evaluate the effect of a methanol extract of *Desmodium gangeticum* (L) DC (Fabaceae) (DG) on lipid per-oxidation and antioxidants in mitochondria and tissue homogenates of normal, ischaemic and ischaemia-reperfused rats. The results of our study showed that DG possesses the ability to scavenge the free radicals generated during ischaemia and ischaemia reperfusion and thereby preserves the mitochondrial respiratory enzymes that eventually lead to cardio protection.

G. A. Kurian and Jose Paddikkala (2012) studied mimetic action of herbal extract *Desmodium gangeticum* (DG) roots on ischemia reperfusion injury. The Results with physiological parameters like left ventricular developed pressure, end diastolic pressure and working index of isolated rat heart showed significant recovery in DG root extract administrated rat heart. So they Conclusions DG methanol root extract provides myocardial protection towards IRI by stimulating muscarinic receptors.

M. M. Shabi and L. Upadhyaya (2012) studied the effect of *Desmodium gangeticum* on lysosomal hydrolases, phosphatases and electrolytes in mechanically induced myocardial ischemic injury in rats. They concluded that alteration in these enzyme activities may
lead change in the electrolytes such as sodium, potassium and calcium content in the heart during ischemic reperfusion injury.

Sankar et al. (2013) studied Cardiac hypertrophy occurs in response to increased workload, such as hypertension or valvular heart disease. Oxidative stress has been implicated in cardiac hypertrophy and in its transition to heart failure. The methanolic root extract was analyzed for total phenolic content and tested for antioxidant potential. The results demonstrated potent free radical scavenging activity of DG. Cell line studies showed significant increase in ROS generation, and permeability transition pore opening in ISO-treated cells. This study is the first documentation of the modulatory effect of DG on cardiac hypertrophy.

Anti-ulcer activity:
Dharmani P et al. (2005) reported anti-ulcerogenic property of ethanolic extract of Desmodium gangeticum against cold restraint (CRU, 2 hr cold restraint stress), aspirin (ASP, 150 mg/kg orally), alcohol (AL, absolute alcohol 1 ml/200gm) and pyloric ligation (PL, 4 hr pylorus ligation) induced gastric ulcer models in Sprague Dawley rats, and histamine (HST, 0.25 mg/kg) induced duodenal ulcer in guinea pigs. Treatment with DG showed increase in mucin secretion by 56.17%, whereas OMZ showed 12.45% increase. Anti-ulcer effect of DG may be due to its cytoprotective effect along with antisecretory activity and could act as a potent therapeutic agent against peptic ulcer disease.

Ayyavu Mahesh et al. (2005) studied the ethanolic root extract of Desmodium gangeticum in various acute and chronic ulcer mouse models. Oral administration of root extract, significantly decrease the ulcer index and lesion number in a dose dependent manner against ethanol induced acute gastric ulcer in mice. In gastric ulcerated animal that received high dose of 150 mg/kg, the mucosa showed no ulceration with slight focal congestion and the glands appeared normal. The highest dose (150 mg/kg) of the extract provoked a marked increase in protein and glutathione levels, when compare to control. Our results indicate that the possess gastroprotective activity and increasing regeneration of damaged gastric mucosa and thus safe for human use.

CNS activity:
Alzheimer's disease: M Obulesu and D. Muralidhara Rao (2011) studied the extracts of plants and their effect on the amelioration of AD symptoms have been extensively.
paper summarizes the mechanisms like acetylcholinesterase (AChE) inhibition, modification of monoamines, antiamyloid aggregation effect, and antioxidant activity which are actively entailed in the process of amelioration of AD symptoms.

Jabbar S et al. (2001) studied aqueous extract of Desmodium gangeticum and showed severe anti-writhing activity in the acetic acid-induced abdominal writhing assay. It exhibited moderate central nervous system depressant activity in the spontaneous motor activity, hole cross, and open field tests and hole board tests. The effects of this extract on locomotion were compared with some standard CNS drugs.

Antibacterial activity
Krishnasamy Karthikeyan et al. (2001) studied Antibacterial activity of D. gangeticum was tested with various solvents viz., methanol, ethanol, chloroform and aqueous extract against various bacterial pathogens such as Klebsiella pneumoniae, Escherichia coli, Salmonella typhi, Streptococcus mutants and Pseudomonas aeruginosa. Antibiotic sensitivity assay was performed with amoxicillin, kanamycin, tetracyclin, ciprofloxacin and penicillin. The Result Of the selected several extract, the methanolic extract showed maximum zone of inhibition against S. mutants and minimum zone of inhibition was observed with aqueous extract against P. aeruginosa. In addition the antibiotic sensitivity was observed with kanamycin, tetracyclin, ciprofloxacin against all bacterias. So Conclusions is that The methonalic extract of D. gangeticum be able to use as potential antibacterial source for various infective pathogens.

Wound Healing Activity
V. Jain, V. Prasad and R.S. Pandey (2006) studied aqueous extract of Desmodium gangeticum for its wound healing potential on different experimental models of wounds in rats. The aqueous extract of aerial part of DG, in powdered form was incorporated in ointment (10% w/w dried powder in simple ointment base) and was evaluated for wound-healing potential in an excision, incision and dead space wound model in rats. The DG ointment showed significant responses in all three-wound types tested when compared with the control group. The effect produced by the DG ointment, in terms of wound contracting ability, wound closure time, tensile strength of the wound, regeneration of tissues at wound site were comparable to those of a standard drug povidone iodine ointment.
Miscellaneous activities:
Subha Rastogi et al. (2011) studied 25 different species of Desmodium genus including Desmodium gangeticum used ethnomedicinally all over the world. Phytochemical research on Desmodium gangeticum has led to the isolation of alkaloids, pterocarpans, phospholipids, sterols, flavones and flavonoid glycosides from Desmodium gangeticum. Crude extracts, fractions and isolated components of Desmodium gangeticum showed a wide spectrum of in vitro and in vivopharmacological activities like antileishmanial, immunomodulatory, antiasthmatic, smooth muscle relaxant, anti-inflammatory, anti-ulcer, cardio-protective, antidiabetic, antiamnesic, antiviral, antioxidant and hepatoprotective activities.

A K Meena et al. (2010) Desmodium gangeticum is a traditional Ayurvedic plant used for centuries as an anthelminthic, anti-catarrhal, diuretic, expectorant, astringent, febrifuge, nerve tonic, anti diarrheal, bronchodilator, vasopressor, analgesic, antipyretic, cardio tonic, stimulant, antioxidant and antiinflammatory agent. The whole plant, its extract and isolates have been extensively investigated in several laboratories for their different biological activities. In addition researchers have evaluated the anti-inflammatory, antioxidant, immunomodulatory and other pharmacological effects of Desmodium gangeticum preparations/extracts.

DISCUSSION AND CONCLUSION
Herbal medicine is best for Human health care, even though several differences exist between herbal and conventional pharmacological treatments. Several specific herbal extracts have been demonstrated to be efficacious for specific conditions. Even though public do the carry risk of taking allopathic medicine instead of herbal treatments. It is seen from the literature that Desmodium gangeticum is a very important plant for its large number of medicinal properties as well as medicinally important chemicals like isolation of alkaloids, pterocarpans, phospholipids, sterols, flavones and flavonoid glycosides. The plant shows many pharmacological activities like Anti-inflammatory, Anti-nociceptive, Analgesic, Anti-amnesic, Anti-diabetic, Anti-oxidant, anti-ulcer, batter CVS activites, CNS depressant, Antibacterial, Wound Healing, antipyretic and Several Miscellaneous activities. In view of time duration the fresh sample is more potent then old sample for pharmacological activites.
In view of various solvents like methanol, ethanol, chloroform and aqueous extract, methanol extract is more potent for several activities of Desmodium gangeticum. Thus, Desmodium gangeticum is quite promising as a multipurpose medicinal agent so further clinical trials should be performed to prove its efficacy.

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