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REVIEW ARTICLE

On the identification and medicinal importance of Dashmula plant 'Shalparni' *Pleurolobus gangeticus* (L.) J.St.-Hil. Ex H.Ohashi and K.Ohashi (*fam*. Fabaceae)

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Abstract

Nature has been a source of divergent bioactive compounds for thousands of years. A large number of bioactive compounds valued in modern drugs have been isolated from natural resources. Traditional medicines are an important source of potentially useful new compounds for the development of chemotherapeutic agents. Therefore, there is a necessity to explore these medicinal plants in respect with their pharmacognostic and pharmacological studies to discover their therapeutic properties. *Pleurolobus gangeticus* (L.) J.St.-Hil. ex H. Ohashi & K. Ohashi (Syn. *Desmodium gangeticum* (L.) DC.) is a spreading annual herb found throughout India. It is of great therapeutic value in treating various ailments such as typhoid, piles, inflammation, asthma, bronchitis and dysentery. This review attempts to highlight the available literature on *Pleurolobus gangeticus* with respect to ethnobotany, chemical constituents and summary of various pharmacologic activities.

Keywords: Chemical constituents, Medicinal plant, *Pleurolobus gangeticus*, Therapeutic uses.

Introduction

India is known for its rich repository of medicinal plants. Ayurveda is widely practiced in India. The emphasis on development of biologically active new molecules has been gradually replaced by the use of total herbs as medicine and food supplements. Medicinal plants must be given the status of "National Resources" because their continued availability is essential to sustain one of the world's oldest medicinal traditions, a priceless legacy of the Indian people.

Pleurolobus gangeticus (L.) J.St.-Hil. ex H. Ohashi & K. Ohashi (Syn. *Desmodium gangeticum* (L.) DC.) commonly known as Shalparni, is widely used medicinal herb. It is commonly used in systems of medicine viz. Ayurveda, Sidha, Unani, Tibetan, Folk, & Homeopathy. It is used in popular 'Ayurvedic' preparation like 'Dashmularishta'. It belongs to family Fabaceae. According to Bhavaprakasha (1974), the following descriptive synonyms are given.

Prisniparni, Prthkparni, Chitraparnyahi, Parnyapi Krestuvinna, Simhapucchi, Kalasi, Dhavaniguha.

P. gangeticus is a woody herb attaining a height of between 20-120 cm, with a short woody stem and numerous irregularly angled branches covered in a fine grey pubescence. It is found throughout the tropical India into the lower portions of the Himalayan range. The meaning of its Sanskrit name 'leaves like *Sala*' suggests its leaf structure is similar to those of the tree *Shorea robusta* C.F. Gaertn. (Kirtikar and Basu, 1935 and 1974; Warrier *et al*., 1994).

Classification

The Plant classification details are as follows:

Classification System: APG IV 2016

Superregnum	:	Eukaryota		
Regnum	:	Plantae		
Cladus	:	Angiosperms		
Cladus	:	Eudicots		
Cladus	:	Core eudicots		
Cladus	:	Rosids		
Cladus	:	Eurosids I Ordo	:	Fabales

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Familia : Fabaceae
Subfamilia : Faboideae
Tribus : Desmodieae
Subtribus : Desmodiinae
Genus : *Pleurolobus*
Species : *Pleurolobus gangeticus*

Synonyms

Aeschynomene gangetica (L.) Poir. *Desmodium latifolium* Wight, *Hedysarum gangeticum* L, *Desmodium gangeticum* (L.) DC., *Hedysarum collinum* Willd., *Meibomia gangetica* (L.) Kuntze, *Pleurolobus maculatus* J.St.-Hil.

Vernacular names of Pleurolobus Gangeticus (Kirtikar and Basu, 1974)

Arabic : Organsi
Bengal : Salpan, Salpani, Salvani
English : Tick Trefoil
Gujrati : Salwan
Hindi : Salpan, Salpani, Salun, Salwan, Shalparni
Kannad : Shaliparni
Malayalam : Pullati
Marathi : Darh, Ranbal, Salparni, Salwan
Porebunder : Ekapanipanddhiyo
Punjabi : Shalpurni
Sanskrit : Shaalaparna,Shaalaparni
Tamil : Pulladi, Orila, Sirupulladi Moovilai
Telegu : Gitanaram, Kolakuporna, Nallanelapariki
Urdu : Shalwan

Distribution

Pleurolobus gangeticus is a woody herb (under shrub) growing in waste places, in open or in partially shaded localities during the winter season. The plant is distributed throughout India and the Tropical Asia (Ceylon, Burma, Malay Peninsula and Islands, China, Philippines), Australia, Polynesia and Tropical Africa and introduced in the West Indies (Anonymous, 1956; Hooker, 1961; Cook, 1967).

Description

The member of the genus *Pleurolobus* (*Desmodium*) contains 170 tropical and subtropical species (Trout, 1997). The species *Pleurolobus gangeticus* (Figure 1), it is a perennial erect or ascending prostrate under shrub, distributed throughout the warmer parts of India. A common shrub: 2-4 ft. high, found almost throughout India ascending to 5000ft. from Himalayas. It is very variable and is met with in its various forms in forest and waste land. It is slender, suberect, diffusely branched under shrub, stem woody, branches slender, irregularly angled and clothed with upwardly directed short soft grey hairs. Leaves unifoliate, alternate, stipulate; acute to acuminate, glabrous above, pubescent beneath, petioles 1–2 cm long (Anonymous, 1956). Flowers arranged in terminal or axillary raceme. The flower is complete with five hairy sepals (2 mm in size), triangular in shape; five petals (4 mm), pink/violet or white in colour, arranged papilionaceously and Androeciums (9+1) present around the single carpel (Kawale *et al*., 2011-2012). The flowering occurs from May to June and September to October. Fruits compressed, slightly falcate, moniliform, six to eight jointed glabrescent lomentum, slightly indented above, joints separating when ripe, indehiscent, one seeded, more or less straight or lightly curved above and rounded on the lower side (Photoplate -1) (Kirtikar and Basu, 1974, Purushothaman *et al.,* 1986). Seeds compressed reniform without a strophiole (Narayana *et al.,* 1957).

Seedling Morphology

The germination of the seeds is epigeal. The radicle comes out as a protuberance from just below the concavity. When the radicle is a few mm long, the hypocotyl elongates in the form of a hook carrying with it the two cotyledonary leaves enclosed within the testa. The cotyledonary leaves expand and turn green.

Dry seeds when mechanically injured and kept for germination could break the seed dormancy giving 22% germination (Chaghatai *et al*., 1978).

Use of Tissue Culture Technology for Cultivation

Patil and Deokule (2012) studied an *in vitro* seed germination and plantlet development of *P. gangeticus* (L.) DC as well as rapid *in vitro* regeneration (Patil and Deokule, 2014).

Threats

P. gangeticus (Syn. *Desmodium gangeticum* (L.) DC.) species is totally prohibited from wild collection (overexploitation for medicine). They can only be collected from cultivated fields when grown by registered farmers and can be exported using only permits (Rajasekharan & Wani, 2020).

P. gangeticus (Syn. *Desmodium gangeticum* (L.) DC.) is considered as one of the threatened plants in India by CSIR-National Botanical Research Institute, Lucknow. On the website (https://nbri.res.in/threatened-plants-

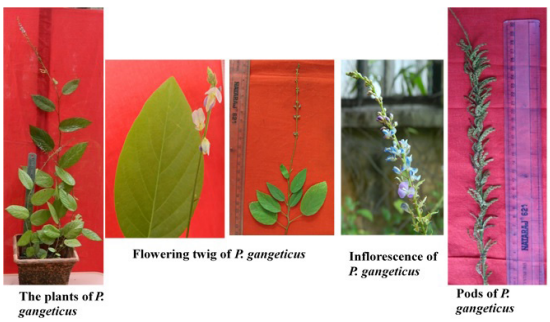

Figure 1: Exo-morphology of the plant.

conservation/) List of threatened plant in India is available and *P. gangeticus* is at Sr. No. 995. Thus urgent conservation action is to be taken up in terms of recovering the species.

Parts Used

Whole Plant (Leaf, stem and flowers) is used to cure different ailments. But root is considered as one of the ingredients of different formulations.

Important Formulations (Purushothaman *et al.,* 1986)

- Dashmularishta
- Chyavanaprasam
- Agusthya Rasayanam
- Sukumara gritham
- Dashmula Katuthiayadi Kashyam
- Dashmula thailam
- Danvantra thailam
- Mahamasha thailam
- Anu thailam
- Vidaryadi gritham

Biology

Pleurolobus gangeticus a perennial herb reproduces by seed and requires full exposure for growth. The herb is tolerant to drought, heat and humidity, pollution, seashore, slope and wind.

Phytochemical Constituents, Medicinal Properties and Other Work Done

Phytochemical Constituents

The sterols, N, N- dimethyltryptamine, their oxides and other derivatives have been isolated from aerial parts of the plant (Behari and Varshney, 1986). Pterocarpanoids such as gangetin, gangetinin, desmodin and desmocarpin are the major chemical constituents of the root reported by Purushothaman *et al*., (1971 & 1975). The phytochemical analysis of *P. gangeticus* reported to have flavonoids, glycosides, pterocarpanoids, lipids, glycolipids and alkaloids (Mishra *et al*., 2005). Phospholipids, sterols and flavone glycosides have also been reported by Behari and Varshney (1986). Pterocarpans constitute the second largest group of natural isoflavonoid and play an important role as phytoalexins. They have been mainly found in a large number of species belonging to diverse sub-families of the Leguminosae (Fabaceae). The main structural feature of pterocarpans consists in the presence of a tetracyclic system of benzofuran-benzopyran rings (Daniel and Purkayastha, 1995) which contains two chiral centres in the positions 6a and 11a, which determinate the stereochemistry of the molecule, although it is well known that only compounds with a cis fusion of B/C rings are present in nature. Computational studies showed that the trans isomers are much less energetically favoured than their cis counterparts (Schoening and Friedrichsen, 1989). Chemical investigations have been revealed that this plant contains alkaloids such as tryptamines, phenethylamines and their N-oxides (Ghosal and Banerjee, 1969), Phospholipids reported by Rastogi *et al.,* (1971). Presence of sterols and flavones glycosides, 40,5,7-trihydroxy-8-prenylflavone-40-Oa-L-rhamnopyranosyl- (1-6) – b – D - glucopyranoside, 8 and 8 – C – prenyl – 5 , 7 , 50 – trimethoxy - 30, 40 - methylenedioxy flavones investigated by Yadava and Reddy(1998). Chemical studies on *P. gangeticus* revealed the presence of alkaloids, pterocarpnoid, flavnoid and isoflavonoid glycoside (Avasthi and Tewari, 1955). Chemical investigations have revealed the presence of isofavones, isofavanones, C-glycosyl favonoids, pterocarpans, and coumaronoch (Subha *et al.,* 2011 & Xueqin *et al.,* 2011). Additionally, three unusual isoflavanones, characterized by the presence of an -OH group in position 2′ were isolated from *P. gangeticus* (Ingham and Dewick, 1984). Niranjan and Tewari (2008) reported the phytochemical composition and anti-oxidant potential of *P. gangeticus*.

Medicinal Properties

It is an important medicinal plant used in the indigenous system of medicines (Ghosal and Bhattacharya 1972; Ghosh and Anandkumar 1981; and Narayana *et al*., 1957). It is used in Ayurveda to treat the various conditions such as snakebite, Anti-ulcer and diabetes mellitus (Dharmani *et al*., 2001; & Dharmani and Palit, 2006).The plant is used as a bitter tonic, febrifuge, digestive and antiemetic in inflammatory conditions which are due to *vata* disorder (Chopra *et al*., 1956; Nadkarni, 1976). It is used in 'Ayurvedic' preparations like 'Dashmularishta' and 'Dashmulakwaath' (Dymock, 1890) for the post-natal care to avoid secondary complications and for the treatment of nervous disorders (Prayagadatta, 1966). Alkaloids isolated from aerial part comprise indol-3-alkyl-amines and β-carbolines and have anticholinesterase, smooth muscle and CNS stimulant activities (Ghosal and Bhattacharya, 1972). Gangetin, a pterocarpan shows anti-fertility (Muzaffer *et al*., 1982), antidiabetic (Hanumanthachar, 2005), anti-inflammatory, anti-nociceptive (Rathia *et al*., 2004), anti-rheumatic activities (Sharma *et al*., 2001; Govindarajan and Vijayakumar, 2006). It is considered to be febrifuge and anticatarrhal. A decoction of the plant is directed to be used in catarrhal fever, cough and other diseases supposed to be caused by deranged phlegm. It is also used in remittent fever, puerperal fever, inflammatory affections within the chest and affection of the brain. The root is described as alterative, tonic, remedy for vomiting, fever, asthma and dysentery (Dymock, 1890). *P. gangeticus* has been reported to contain alkaloids, flavones and isoflavonoid glycosides. Total alkaloids of this species showed anticholinesterase, smooth muscle stimulant, CNS stimulant and depressant responses (Purushothaman *et al*., 1971). The plant has been reported to contain gangetin, a pterocarpnoid shown to possess anti-inflammatory and analgesic activities (Ghosal and Bhattacharya, 1972; Rao

et al., 2004). Antidotes in snake bite, in asthma, bronchitis, dysentery and fever these therapeutic properties reported by Jain, (1991). It is of great therapeutic value in treating diseases such as typhoid, piles, inflammation, asthma, bronchitis and dysentery (Yadava and Tripathi, 1998; Kirtikar and Basu, 1987). Dashamularishta (DMK) is a classical Ayurvedic preparation. It contains ten plants – *Aegle marmelos* (L.) Correa., *Oroxylum indicum* (L.) Vent., *Stereospermum chelonoides* (L.f) DC. *Premna serratifolia* L., *Gmelina arborea* Roxb. ex Sm., *Solanum virginianum* L., *Solanum violaceum* Ortega, *Pleurolobus gangeticus* (L.) J.St.-Hil. ex H. Ohashi & K. Ohashi, *Uraria picta* (Jacq.) Desv. ex DC. and *Tribulus terrestris* L. In the Ayurvedic system of medicines, it is used as analgesic, antiarthritic, against cough, rheumatism, etc. (Anonymous, 1992). *P. gangeticus* is a perennial shrub and widely used as medicine in the treatment of ischemic heart disease (Kirtikar and Basu, 1974) in Indian systems of medicine. Potent antioxidant activity of *P. gangeticus* roots in the severity of mycocardial infraction has been reported by Kurian *et al*., (2005). It used as astringent, tonic and also used to treat diuretic, fever, diarrhea, biliousness, cough, vomiting, asthma, snake bite, scorpion- sting (Anonymous, 1952 and Chopra *et al*., 2002). *P. gangeticus* has great therapeutic value in typhoid, piles, inflammation, asthma, bronchitis, dysentery treatment and for leucorrhea reported by Nazar *et al*., (2008). It forms the ingredient of many Ayurvedic formulations used for diabetes. Moreover, it strengthens the nervous system, improves digestion and secretion of digestive enzymes (Mishra *et al*., 2005). The aqueous extract of this species has been reported to show severe antiwriting activity, moderate central nervous system depressant activity (Jabbar *et al*., 2001) and antileishmanial activity (Singh *et al.,* 2005). The pterocarpin, gangetin isolated from a hexane extract of the root of *P. gangeticus* demonstrated significant anti-inflammatorv activity in the exudative and the proliferative phases of inflammation (carragenin induced edema, cotton pellet granuloma, granuloma pouch and formaldehyde induced arthritis), in doses of 50 and 100 mg/kg orally, in albino rats (Ghosh and Anandkumar 1981). Govindarajan and Vijayakumar (2006) demonstrated the antioxidant activity of *P. gangeticus* and its phenolics in arthritic rats. The root is prescribed in combination with other drugs for the treatment of snake bite and scorpion sting. This cure is mentioned in the Shrangdhara samhita and the Charaka samhita by Sushruta (Dharmani and Palit, 2006). Jain *et al.,* (2006) evaluated the wound healing activity of *P. gangeticus* in different wound models. Joshi and Parle (2006, 2007) studied the pharmacological evidences for the antiamnesic effects of *P. gangeticus* in mice. Govindarajan *et al.,* (2003) reported the anti-inflammatory and anti-oxidant activity *P. gangeticus* fractions in carrageenan induced inflamed rats. Jabbar *et al.,* (2004) reported the bioactivity studies of the individual ingredients of the Dashamularishta. It is used as Ayurvedic drug in India from centuries, however there was no scientific report available on traditional claims of the water decoction of aerial portion of the plant. In India, tribal peoples used the aerial part of the plant for the treatment of open wounds. Further chemical constituents present in aqueous extract shows the presence of flavonoids and terpines which are known to promote wound healing properties. The presence of flavonoids and tannins etc. could be attributed for the immune-stimulatory activities as these constituents are reported to stimulate nonspecific macrophage functions. An extract of *P. gangeticus* was evaluated for its possible antileishmanial activity using a radiorespirometric microtest technique based on the *in vitro* inhibition of catabolism of $14CO_2$ from a battery of 14C - substrates by promastigotes. It was determined to be active against a visceral *Leishmania* isolate at concentrations of 50 mg/ ml or less (Iwu *et al*., 1992). Ohashi (1995) summarized an enumeration of *P. gangeticus* and its allied genera.

Singh *et al.,* (2005) demonstrated the efficacy of *P. gangeticus* extract and its fractions against experimental visceral leishmaniasis. Bhargava *et al*., (2008) summarized the *P. gangeticus* is an ingredients of Sudarshan Churna.

Jadeja and Nakar (2010) had suggested the ethno-medico botany of *P. gangeticus* root is given orally three times in a day in snake bite. Farhana *et al*., (2010) had given the evaluation of antinociceptive effect of methanol extracts of *P. gangeticus* stems and *Benincasa hispida* (Thunb.) Cogn. leaves on acetic acid-induced gastric pain in mice. Sagar *et al.,* (2010) evaluated the antinociceptive and anti-inflammatory properties of *P. gangeticus* in experimental animal models. Prasobh *et al*., (2021) from preliminary field investigation, they found that many tribes from the Western Ghats region of Kerala used this plant for the treatment of various ailments such as fever, typhoid fever, cough, diuretic, infammations, cough, asthma, and dysentery.

Moreover, few recent studies from the laboratories suggest protective nature of *P. gangeticus* against ischemic reperfusion injury (Kurian *et al*., 2009, 2010). Kurian *et al.,* (2010) demonstrated the novel approach for oral delivery of insulin via *P. gangeticus* aqueous root extract. In another report of Kurian *et al.,* (2010) reported the interpretation of inotropic effect exhibited by *P. gangeticus* in chloroform root extract through GSMS and atomic mass spectroscopy and evaluation of its anti-ischemia reperfusion property in isolated rat heart. Nusrath *et al.,* (2011) given an evaluation of renal protective effects of *P. gangeticus* in streptozotocin – induced diabetic rats. Srivastava et al., (2015) studied the anticancer activity of crude extracts and isolated compound salicin of *P. gangeticus* (*Desmodium gangeticum* (L.) DC) against ehrlich ascites carcinoma in swiss albino mice and from study they conclude that *P. gangeticus* extracts as well as salicin compound have potent dose dependent anticancer activity, which approaches that of 5-fluorouracil.

Other Work

Pantulu (1941) summarized the megaspore tetrads of *P. gangeticus* which is a second species with the normal type of embryo sac to show this kind of megaspore tetrad. A five layer anther wall has been reported in *P. gangeticus* (Pantulu, 1942). Patel and Moniz (1948) described about the bacterial leaf-spot of *P. gangeticus*.

Ramakrishnan (1964) has given about a short note on the ecology of *P. gangeticus*. Roy and Bharadwaj (1968) reported a new species *Volutella desmodii* which causing leaf spot disease of *P. gangeticus*. Banerjee and Ghosal (1969) summarized the simple Indole bases of *P. gangeticus* Leguminosae. Bhardwaj and Dwivedi (1969) evaluated leaf blight disease of *P. gangeticus* . Bhalla and Dakwale (1977) reported the taximetrics of *Desmodium* Species.

Datta and Sen (1983) reported the thermo-control of seed germination in *P. gangeticus.* Sanjappa and Bhatt (1985) reported the karyomorphological observations in some species of *Pleurolobus* (*Desmodium*). Datta and Sen (1987) evaluated the comparison of the germination characters of *Desmodium* Species. Patil and Deokule (2013) studied the multiple shoot induction and genistein production in *P. gangeticus* by using different concentrations of 6-benzyladenine. Use of different concentrations of BAP for high frequency of multiple shoot induction in the same plant (Patil and Deokule, 2016). Paul *et al*., (1991) reported the taxonomic studies in the genus *Pleurolobus* (*Desmodium*) Papilionaceae from Chotanagpur Plateau Bihar. Khare (2007) described taxonomy and medicinal usage of *P. gangeticus*. Patil and Deokule (2017, 2018) studied an induction of callus from stem explants and leaf explants by using auxins in *P. gangeticus*.

Conclusion

P. gangeticus is widely distributed medicinal plant. Each and every part of it is useful having pharmacological activity, but most in roots. Application of plant based formulations over synthetic compounds remains preferred treatment of various diseases. India is home to a variety of traditional medicinal systems that rely on native plant species for their raw drug material to a large extent. Further studies on plant *P. gangeticus* are desired towards the development of novel therapeutic agents from the various compounds with diverse pharmacologic properties, as well as elucidation of their mechanism of action.

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