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Phytopharmacology of Indian plant *Sesbania grandiflora* L.

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Abstract: *Sesbania grandiflora* L. is an Indian medicinal plant which belongs to family Leguminosae. It is cultivated in south or west India in the ganga valley and in Bengal. The plant contains rich in tanins, flavonoides, coumarins, steroids and triterpens. The plant used in colic disorder, jaundice, poisoning condition, small-pox, eruptive fever, epilepsy etc. The present work is carried out on phytopharmacological survey of the plant.

Keywords: *Sesbania grandiflora*, Plant, Biological source, Phytopharmacology

Introduction: Plant drug profile

Plant name - *Sesbania grandiflora* L.

Synonym – *Agati grandiflora* L.

English – *Agati sesban*, *Swamp pea*

Ayurvedic – Agastya, agasti, munidrum, muni, vangasena, vakrapushpa, kumbha

Siddha/Tamil – Agatti

Biological source

It consist of dried leaves of *Sesbania grandiflora* L., belonging to the family Leguminosae.¹

Geographical source

It is cultivated in south or west India in the ganga valley and in Bengal. It is believed to have originated either in India or Southeast

Asia and grows primarily in hot and humid areas of the world. *Sesbania* is found from northern Luzon to Mindanao in settled areas at low and medium altitudes. It was certainly introduced into the Philippines. This tree occurs also in India to the Mascarene Islands, through Malaya to tropical Australia, and is planted in other tropical countries.^{2,3}

Botanical classification⁴ :

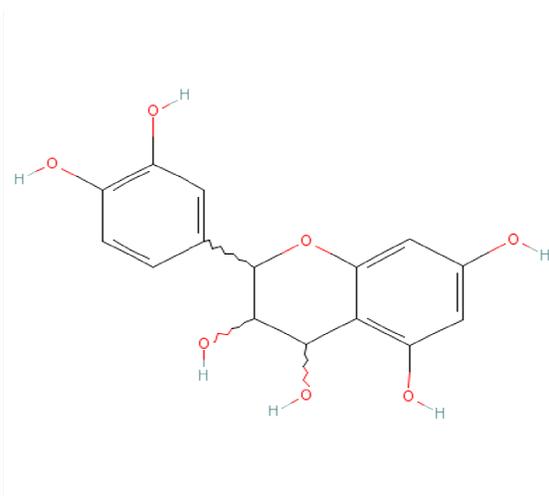
Kingdom	Plantae
Subkingdom	Tracheobionta
Superdivision	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Order	Fabales
Family	Leguminosae
Genus	<i>Sesbania</i>
Species	<i>Sesbania grandiflora</i>

Macroscopical character⁴

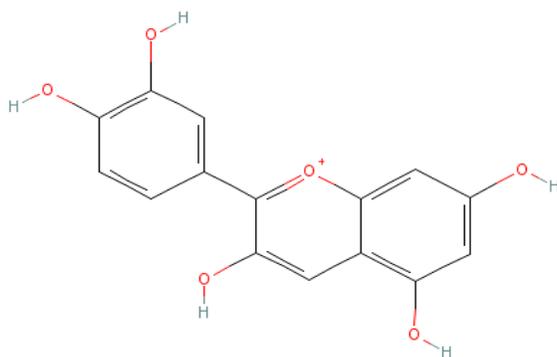
Sesbania grandiflora L. is a small erect, fast-growing, and sparsely branched tree that reaches 10 m in height. The bark of this species is light gray, corky and deeply furrowed and the wood is soft and white. All *Sesbania* species have pinnately compound leaves where each leaf is divided into multiple leaflets. Agati leaves can be up to 30 cm long with 5-15 paired leaflets that are oblong to elliptic in shape and about 3 cm in length. The flowers of *Sesbania grandiflora* L. are large (7–9 cm long) and are borne on an unbranched, pendulous inflorescence. Two varieties of *Sesbania grandiflora* L. are recognized including variety *grandiflora* which has white flowers and variety *coccinea* which has rose pink or red flowers. The flowers are similar in shape and arrangement to Pea flowers with five petals that are differentiated into a standard, wing, and keel petals. The standard petal is usually upright, the wing petals spread out on either side of the flower, and the keel is boat-shaped and in this species is curved down and away from the flower. The fruit is a thin pod which can be up to 60 cm long and contains from 15-50 seeds.

Chemical constituents^{5,6}

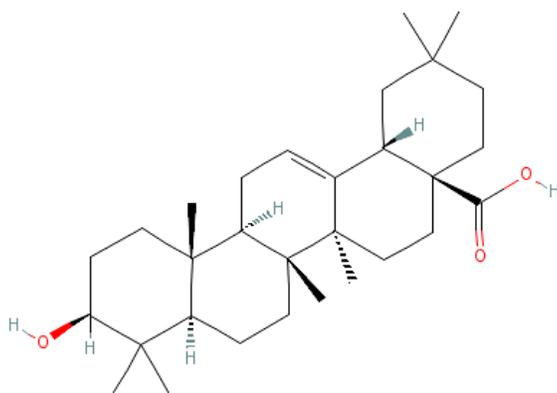
The tanins, flavonoides, coumarins, steroids and triterpens were present on all organ tested, with more or less important contents according to the intensity of coloring obtained. The alkaloids are generally found in the form of traces. The saponosides were more often present in methanolic extracts than aqueous extract. The saponosides would be rather present in the form of triterpens and steroids that in the form of heterosides. Leucocyanidin and cyanidin are the active ingredients of *Sesbania grandiflora L.* seeds and oleanolic acid and its methyl ester & kaemferol-3-rutinoside are the major chemical constituents of flower. The bark contains tannins and gum. Saponin and Sesbanimide isolated from seeds.



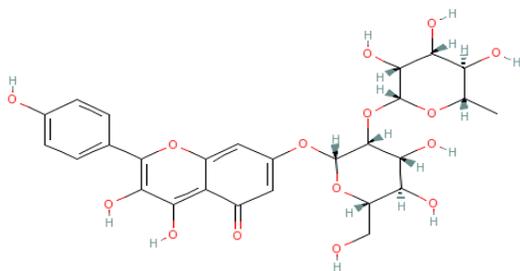
Leucocyanidin



Cyanidin



Oleanolic acid



Kaempferol-3-rutinoside

Traditional uses⁸

Fruits are curative agent in colic disorder, jaundice and poisoning condition. Bark is given as infusion in the first stages of smallpox and other eruptive fever. Root is given with honey in catarrh. Juice of the leaves and flowers is a popular remedy for nasal catarrh and headache when it is sniffed up the nostrils. It is also used in epilepsy in elderly people. Flowers juice is also useful in eye diseases. The superior efficacy of the juice of flowers as an ideal expectorant, we have largely used it in pneumonia with marvelous results.

Edible uses⁹

The flowers and young leaves of *S. grandiflora* are edible and are often used as a vegetable to supplement meals. Tender pods may also be eaten as string beans. The dried leaves of both *S. grandiflora* and *S. sesban* are used in some countries as a tea which is considered to have antibiotic, anti-helminthic, anti-tumor and contraceptive properties. Fruits and flowers are largely eaten by villagers in form of curries. The taller species of perennial Sesbania such as *S. grandiflora*, *S. formosa* and *S. sesban* can also be used as shade trees for coffee, tea and cocoa as well as living trellises for pepper and as windbreaks for citrus, bananas and coffee.

Medicinal uses¹⁰

All parts of *Sesbania grandiflora* L. are utilized for medicine in Southeastern Asia and India including preparations derived from the roots, bark, gum, leaves, flowers, and fruit. In Folk Medicine it is resorted to be aperient, diuretic, emetic, emmenagogue, febrifuge, laxative, and tonic. Agati is a folk remedy for bruises, catarrh, dysentery, eyes, fevers, headaches, smallpox, sores, sore throat, and stomatitis. Different parts of this plant are used in Siddha system of Indian

traditional medicine for the treatment of a wide spectrum of ailments including anemia, bronchitis, fever, headache, ophthalmia, nasal catarrh, inflammation, leprosy, gout and rheumatism. It also possesses anxiolytic and anticonvulsive and hepatoprotective properties. In addition, *S. grandiflora* is mentioned as a potent antidote for tobacco and smoking-related diseases. However, the mechanisms underlying its beneficial effects against chronic smoking associated diseases are yet to be determined. The various parts of sesbania are used as medicine for many diseases and disorders.

In a number of cultures the root is applied as a poultice for application to inflammation and fever. Powdered roots of *Sesbania grandiflora* L. var. *coccinea* are mixed in water and applied externally as a poultice or rub to rheumatic swelling. The juice of the root is given with honey as an expectorant in catarrh. The bark is very astringent, and an infusion of it is given in smallpox and other eruptive fevers. The bitter bark is considered tonic and febrifuge, it is also used for the treatment of ulcers in the mouth and alimentary canal, treatment of thrush and infantile disorders of the stomach. The pounded bark is applied to scabies. A

decoction of the bark is prescribed against haemoptysis. The bark is also given in diarrhea and dysentery. In small doses, the bark is used for dysentery and sprue, in large doses, laxative, in still larger doses, emetic.

In Ayurvedic medicine the leaves are utilized for the treatment of epileptic fits. The juice of the leaves is considered anthelmintic and tonic and is used to treat worms, biliousness, fever, gout, and itchiness, and leprosy. The tonic leaves useful in biliousness, fever, and nyctalopia. The crushed leaves to sprains and bruises. Leaves are aperients, diuretic, laxative, alexeteric. The flowers have an excellent source of calcium and a fair source of iron. They are a good source of Vitamin B, also. The juice of the leaves and flowers is used as a popular remedy for nasal catarrh, and headache, head congestion, or stuffy nose. Flowers are used as emollient, laxative, aperitif and refrigerant the flowers, for biliousness, bronchitis, gout, nyctalopia, aphrodisiacs, pain, thirst, ozoena, and quartan fever. The juice of the flower is squeezed into the eye to correct dim vision. In Ayurveda, fruits are used for anemia, bronchitis, fever, tumors. The fruits are calexeteric, laxative, and intellectually

stimulating properties. It is also prescribed for the pain and thirst.

Phytopharmacology of *Sesbania grandiflora*:

- **Sheikh A.A., et al, (2011)¹¹** studied the wound healing activity of the ethanolic extract of *Sesbania grandiflora* Linn. flowers. They used 2% and 4% ointment of the extract for excision and incision wound model and found that the plant has a significant response to it. The 4% ointment of the plant ethanolic extract showed better result than the one with 2%. Nitrofurazone (0.2%) was taken as the standard for the study.
- **Avalaskar A.N., et al, (2011)¹²** performed the phytochemical and TLC screening on the ethanolic extract of the plant *Sesbania grandiflora*. The phytochemical screening of the plant showed the presence of multitude of compounds like alkaloids, glycosides, volatile oils, tannins, saponins, flavonoids, etc. which are secondary metabolites and are responsible for the therapeutic efficacy. The compounds

were confirmed by the TLC studies using different visualizing reagents.

- **Kachroo V., et al, et al, (2011)¹³** studied the antimicrobial activity of different extracts of *Sesbania grandiflora*, viz. extracts from leaves and bark, using the *Escherichia coli*, *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* by disc diffusion method they evaluated the microbial growth inhibitory (Minimum inhibition concentration) property of the extracts and used ciprofloxacin as standard antimicrobial drug. The bark extract was found to possess better antimicrobial activity than the leaves extract. The highest susceptible microorganism was found to be E.coli and least P.aeruginosa. The lowest MIC was calculated for E.coli and highest for P.aeruginosa.
- **Kachroo V., et al, (2011)¹⁴** studied *Sesbania grandiflora* pharmacognostically. They studied the dried stem bark of the plant for the macroscopical, microscopical evaluation as well as the ash value, moisture content and extractive

values. The stem bark and its TS were used for the studies. They found galactomannans, linoleic acid, β -sitosterol and carbohydrates as its chemical constituent.

- **Sarvanakumar A., et al, (2010)¹⁵** studied the hypolipidemic activity of aqueous extract of *Sesbania grandiflora* in triton wr-1339 induced hyperlipidemic rats. Wistar albino adult male rats were used for the study were induced hyperlipidemia by triton wr-1339. The aqueous extract of the plant showed a significant decrease in the levels of serum cholesterol, triglycerides, phospholipids, LDL, VLDL and a significant increase in the level of HDL.
- **Gowri S.S., et al, (2010)¹⁶** evaluated the free radical scavenging and antioxidant activity of 70% acetone and 50% hydroalcoholic extract of *Sesbania grandiflora* leaves and flowers by comparing it with standard antioxidants. They found the 70% extract more potent than the hydroalcoholic extract by comparing the values with the standard antioxidant α -tocopherol in terms of

recovery percent, higher reducing power activity and highest lipid peroxidation inhibiting activity.

- **Patil R.B., et al, (2010)¹⁷** studied the anti-inflammatory and anti-arthritic effect of petroleum ether, chloroform and methanol extracts of barks of *Sesbania grandiflora* and *Sesbania sesban*. Carrageenan induced paw edema and Freund's adjuvant induced arthritis was used to study the pharmacological effects of the plant. The different extracts of both the plants elicited the protective effect against the inflammatory response but the petroleum ether extract from *Sesbania sesban* was found to be the best for both the activities.
- **Bhalke D., et al, (2010)¹⁸**, investigated the antiulcer activity of the ethanolic extract of the leaves of *Sesbania grandiflora*. Various screening procedures; aspirin induced, indomethacin induced, ethanol induced and pylorus ligation were used for assessing the ulcer protective activity and total acid output. The ethanolic extract of the plant decreased the intensity of

gastric mucosal damage caused by the ulcerogenic agents. In the pylorus ligated rats the extract significantly reduced the basal gastric acid secretion however the antiulcer activity of the extract was less than that of the standard drugs used.

- **Karthikeyan P., et al, (2010)¹⁹** evaluated the wound healing activity of methanolic extract of *Sesbania grandiflora* poir. bark. The wound healing activity was evaluated using the excision and incision models for wound. Methanolic extract of the bark in conc. of 2.5%, 5% and 10% w/w was applied topically as an ointment prepared using 2% sodium alginate. The plant elicited significant result at the higher dose when compared to 1% framycetin sulphate used as standard drug in the study.
- **Ramesh T., et al, (2010)²⁰** studied the aqueous suspension of *Sesbania grandiflora* against the antioxidant capacity in the liver and kidney of the rats exposed to cigarette smoke. They using a modified method of Eun-Mi *et al* the rats were exposed to cigarette smoke for 90 consecutive

days. The hepatic marker enzymes such as aspartate aminotransferase (AST), alanine aminotransferase (ALT) and alkaline phosphatase (ALP) as well as renal markers such as urea and creatinine were analyzed in the serum. Lipid peroxidation markers mainly thiobarbituric acid reactive substances (TBARS) and antioxidant enzymes namely superoxide dismutase (SOD), Catalase (CAT) levels were studied. In addition the micronutrients mainly copper (Cu), zinc (Zn), manganese (Mn) and selenium (Se) were analyzed in liver and kidney of the rats exposed to cigarette smoke. The aqueous suspension of the plant extract administered significantly decreased the elevated hepatic, renal and lipid peroxidation markers and ameliorated the diminished antioxidant levels and restored the hepatic and renal architecture in the cigarette smoked rats.

- **Ramesh T., et al, (2006)²¹** evaluated the hypolipidemic activity of aqueous suspension of *Sesbania grandiflora* leaves in cigarette smoked rats. They using a modified

method of Eun-Mi *et al* estimated the total lipids, total cholesterol, triglycerides, phospholipids, HDL-cholesterol, LDL-cholesterol, VLDL-cholesterol levels. Administration of the extract at 1000 mg/kg the plant decreases the levels of total cholesterol, total lipids, TGL, LDL, VLDL while increased the levels of phospholipids and HDL ensuring the hypolipidemic activity against the cigarette smoked induced hyperlipidemia associated diseases.

- **Jalalpure S.S., et al, (2006)²²** studied various seed oils from different plants for their antihelmintic property. They investigated various seed oils by using three different concentrations against *Pheretima posthuma* by determining the time taken in paralysis and time of death of the helminth. *Sesbania grandiflora* in a dose dependent way proved to be the most potent against the worm in a concentration of 10, 50 and 100 mg/ml. The plant at its highest concentration, elicited the shortest time of paralysis and the time of death for the worm used.

- **Subramanian E.H., et al, (2003)²³** evaluated various pharmacological effects of petroleum ether, chloroform, methanol and water extracts of roots of *Sesbania grandiflora* L. The study involved screening of analgesic, antidiarrheal, antibacterial (*Staphylococcus epidermidis*, *Staphylococcus aureus*, *Micrococcus luteus*, *Bacillus cereus* and *Klebsiella pneumonia*) and antifungal activity (*candida albicans* and *Aspergillus niger*). They found significant results with all extracts and concluded to be potent for analgesic activity using writhing reflex and tail immersion methods; for antidiarrheal activity using castor oil induced diarrhea; antibacterial using tryptone soya agar medium and sabourand dextrose agar medium.
- **Rajasekaran A., et al, (2003)²⁴** evaluated the diuretic, CNS depressant and laxative effects of methanolic extract from the leaves of *Sesbania grandiflora* using the Lipschitz method, Actophotometer and Charcoal meal test respectively for their studies. They using the

methanolic extract of the plant on the male wistar rats observed a significant increase in the urine output and Na^+ and K^+ excretion, decreased locomotor activity and also elicited a promising laxative effect. Though the result for the diuretic activity of the plant was less than the standard Furosemide but the excretion of Na^+ and K^+ indicates the possession of natriuretic and kaliuretic property in the plant. The plant showed good results for the locomotor activity as it elicited a 61% reduction to that elicited by the standard dose of Diazepam and the distance traveled by the charcoal meal confirms it having a good gastric motility property too.

- **Sertie J.A.A., et al, (2001)**²⁵ studied the ethanolic extract of the bark of plant *Sesbania grandiflora* for being antiulcerative. They used the stress induced and NSAIDs induced lesions models for the ulcer protective activity. The bark extract prevented the acute gastric mucosal injury induced by restraint stress and water immersion in a dose dependent manner. The study also revealed that

the extract also bears a protective effect on the gastric mucosa when administered concomitantly with NSAIDs and did not modify the gastric volume, pH and hydrochloric acid contents of gastric secretion.

Conclusion:

From the above work it is concluded that all parts of *Sesbania grandiflora L.* are utilized for medicine in Southeastern Asia and India including preparations derived from the roots, bark, gum, leaves, flowers, and fruit. In Folk Medicine it is resorted to be aperient, diuretic, emetic, emmenagogue, febrifuge, laxative, and tonic.

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