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A *Sesbania grandiflora* Article on Phytochemical, Pharmacognostical, Physico-Chemical and Pharmacological Review

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ABSTRACT

Sesbania grandiflora, the scientific name for the most widely recognized plant in traditional usage, is a member of the Fabaceae family. The seeds, flowers, bark, leaves, and roots of this plant include a variety of plant-based ingredients or phytochemicals, such as cyanidin and leucocyanidin, oleanolic acid, tannins and gums, iso flavonoids, and medicarpin in that order. They are used in traditional medicine to treat a wide range of illnesses, including rheumatism, anaemia, gout, leprosy, ophthalmia, nasal catarrh, fevers, headaches, and smallpox. a strong remedy for illnesses brought on by smoking and tobacco use. S. grandiflora powder containing lignified fibres, oil globules, epidermal cells, pollen grains, trichomes, etc. was studied under a microscope. *S. grandiflora's* physicochemical characteristics are Loss on Drying (9.5%w/w), Total ash(14%w/w), Water soluble ash (1.0%w/w), Acid insoluble ash (1.5%w/w), Alcohol soluble extractive value (7.0%w/w), Water soluble extractive value (8.0%w/w). Theirs pharmacological activities including anti-cancer, anti-diabetic, wound healing, hepatoprotective, anti-ulcer, anxiolytic, anticonvulsant, immunomodulatory, anti-microbial, anti-inflammatory, ani-arthritis, anti-diarrhoeal, analgesic, anti-pyretic, antioxidant, anti-urolithiatic, anti-worm, hypolipidemic, cardioprotective and anti-tubercular.

INTRODUCTION

According to assessments from the World Health Organization (WHO), conventional medicine provides nearly all of the primary health needs for 80% of people in underdeveloped nations.[1] India is the world's biggest botanical garden. Since there are so many herbs in India, they are the primary source of medicine there. *Sesbania* is, a plant medicine that is increasingly widespread in our daily meals, offers additional medical effects. The WHO recently verified an inventory of more than 20,000 species of medicinal plants.[2] The hummingbird tree, or *Sesbania grandiflora*, is a short-lived, open-crowned shrub with loose branches. The characteristic that sets *Sesbania* plants apart from other kinds of plants is their exceptionally fast development rate. Because they can thrive in saline, low-fertility, salty, and gloomy soils, agarose plants are unique. It can tolerate acidic soils thanks to its pH of 4.5. High clay soils can thrive in areas with 2,000–4,000 mm of annual precipitation. There have been isolated reports of agast has occasionally been seen thrive well in regions with dry weather lasting for as long as nine months and yearly rainfall as little as 800 mm. It is further adapted to situations with yearly temperatures ranging from 220ºC - 300ºC in the grassland tropical regions that exceed 800 meters and occasionally greater than 10,000 meters above the sea level.[3]

TAXONOMIC CLASSIFICATION [4]

Botanical name : *Sesbania grandiflora*
Kingdom : Plantae
Subkingdom : Viridiplantae
Infrakingdom : Streptophyta
Superdivision : Embryophyta
Diviosion : Tracheophyta
Subdivision : Spermatophytina
Subphylum : Angiospermae
Class : Magnoliopsida
Superorder : Rosiflorae
Order : Fabales
Family : Fabaceae
Genus : *Sesbania*
Species : *Sesbania grandiflora* (L.) Pers.

Synonyms [5,6]

Robinia grandiflora (L), *Aeschynomene grandiflora* (L), *Agati grandiflora* (L.), *Sesban grandiflora Poir.*

Vernacular names [7]

Tamil: Agathi; Telugu: Avesi, Avaasinara; Kannada: Agaci, Agasi; English: Vegetable Humming bird, Sesban, Swamp pea; Hindi: Agast, Basna, Hadga, Hathya; Bengali: Agathi, Agate, Agusta, Bagphol; French: Poisvalliere, Crest de gallo, Pico.

Traditional name or Ayurveda name: Vakrapushpa, Kumba, Agastya [8].

DISTRIBUTION (ORIGIN) [9]

It is distributed in North Australia and South East Asia, including Malaysia, the Philippines, and Brunei. It is also grown over much of India, Sri Lanka, and Indonesia. It is also found in the surrounding areas of Tumakuru district, Karnataka's Obalapura hamlet, Pavagadataluk, and others.

PHYTOCHEMICAL SUBSTANCES [10]

Plant parts	-	**Constituents**
Seeds	-	Leucocyanidin & cyanidin (Active ingredients) Saponin & Sesbanimide (Isolated components)
Flower	-	Oleanolic acid & its methyl ester, Kaemferol-3-rutinoside
Bark	-	Tannins & Gum
Root	-	Iso flavonoids, isovestitol, medicarpin & sativan, Betulinic acid.

TRADITIONAL USES [11,12]

It is used as an aperient, diuretic, emmenagogue, febrifuge, laxative, and tonic in conventional medicine. Agati is a traditional treatment for smallpox, diarrhoea, catarrh, fevers, headaches, and stomatitis. The Siddha school of Indian traditional medicine states that various components of this plant are used to cure a wide range of conditions, such as rheumatism, anaemia, gout, leprosy, headaches, fever, ophthalmia, nasal catarrh, inflammation, and bronchitis. It also has hepatoprotective, anticonvulsive, and anxiolytic

effects. *S. grandiflora* is also suggested as a potent antidote for ailments related to tobacco use and smoking.

PHARMACOGNOSTICAL ASPECTS

Macroscopic analysis / Morphological description [13-17]

Examining plant components that are measurable and apparent to the unaided eye is known as macroscopic analysis.

Flowers: The colour of *Sesbania grandiflora* is white, pink or red; Odor is Customary; Size is up to 10 cm diameter; Squishy texture; look for signs of agitation.

Leaves: *Sesbania grandiflora* has Pari-pinnately structured leaves that can reach a maximum length of 25 cm. A plant leaf measuring 12-44 x 5 -15 mm has 20–50 leaflets oriented in an opposite direction. An individual leaflet is 2-4 cm long and 10–15 mm wide.

Stem: The stem bears bark on both the outside and inside. The bark is corky and extremely wrinkled, with a tint of pale grey. The white-coloured wood of the shrub is soft.

Fruit: The plant's fruit, also known as pods, is green and has a flat appearance. Pods are subcylindrical, linear, and have a small curvature. Pods are 30 to 45 cm in length and 5 to 8 mm in width.

Seeds: The seeds are cylindrical or bean-like elliptical in shape, with an olive green or reddish-brown hue. Approximately six to eight seeds are included in one pod.

FLOWER

LEAVES

STEM

FRUIT

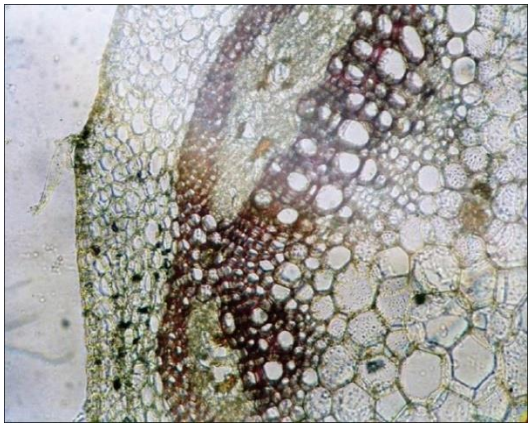
SEEDS

Parts of *Sesbania grandiflora* (L.) PERS.

Microscopic evaluation/ study [18]

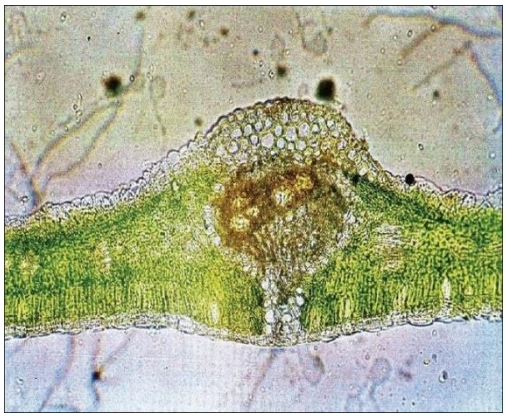
Microscopic study is the study of plant objects and regions that are not visible using the type of microscope required to investigate intracellular plant parts.

Leaf: In the lower epidermis, stomata are anisocytic and have three subsidiary cells surrounding the guard cells; in the upper epidermis, stomata are both anisocytic and anomocytic. The trichome covering is unicellular, thick-walled, and adhered to the epidermis. It has a conical, bulbous base [Figures A and B]. Single-layered, barrel-shaped cells are seen in the upper epidermis, while relatively barrel- to oval-shaped cells are seen in the lower epidermis. Polygonal, thin-walled parenchymatous cells were observed using powder microscopy [Figures C and D]. The typical number of vein islets in the upper and lower epidermis is between 20 and 23, the stomatal index is between 15 and 20, and the palisade ratio is between 7-8. **Powder analysis:** Powder form of *S. grandiflora* having lignified fibres, oil globules, epidermal cells, pollen grains, trichomes, etc. under microscopical study/evaluation.

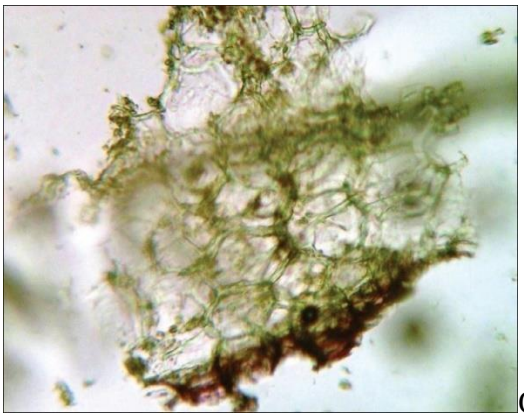


A).Petioloe showing vascular bundles & resin based mucilage containing cells with presence of appressed trichome

B). Powder microscopy showing conical appressed trichomes



C).TS of leaflets showing upper & lower epidermis along with palisade cells



C).

D). Powder microscopy showing epidermal cells

PHYTOCHEMICAL EVALUATION [19]

Screening of Phytocompounds in *S. grandiflora*

Parameter	*S. grandiflora*
Alkaloids	presence
Flavonoids	presence
Glycosides	presence
Tannin	presence
Anthraquinone	presence
Steroid	presence
Pholobatannins	presence
Terpenoids	presence
Protein	presence
Carbohydrate	presence

PHYSICO-CHEMICAL EVALUATION OF *SESBANIA GRANDIFLORA* [20]

Physical evaluation	constant value
Loss On Drying (LOD)	9.5%w/w
Total ash	14.0%w/w
Water soluble ash	1.0%w/w
Acid insoluble ash	1.5%w/w
Alcohol soluble extractive value	7.0%w/w
Water soluble extractive value	8.0%w/w

PHARMACOLOGICAL STUDY

Anticancer activity and Chemo preventive activity [21]

Sesbania Fraction 2, or SF2, is a protein fraction that was isolated from the flower of the medicinal plant *Sesbania grandiflora*. In this study, its anticancer potential was evaluated. Two murine ascites tumour cell lines and human cancer cell lines from various sources were used to evaluate the fraction's anticancer qualities. DNA fragmentation revealed that in Daltons Lymphoma Ascites (DLA) cells and colon cancer cells (SW-480), SF2 promoted

apoptosis and reduced cell proliferation. Research conducted *in vivo* using ascites and solid tumour models offers robust validation for the results obtained *in vitro*. These investigations demonstrate that SF2 injection can increase tumour-bearing mice's survival and decrease tumour volume, indicating that SF2 injection may be a promising anticancer treatment.

Anti-diabetic activity [22, 23]

Using an *in vitro* alpha-amylase inhibitory assay, the antidiabetic potential of *S. grandiflora* extract was investigated. Comparing an extract at 1000 mg/ml to 93% of the standard (Acarbose), 81% of the enzyme is inhibited. The IC_{50} of the extract was found to be 50.95 µg/ml, whereas the standard was 34.83µM. Lignin and terpenes were the primary contributors to the antidiabetic effect. From this *S. grandiflora* leaf chemical profile obtained by HPLC purification and bio-fractionation, fourteen major metabolites were found. The anti-diabetic effects of the discovered metabolites were assessed using α-amylase and α glucosidase assays. Vomifoliol, Loliolide (a terpenoid), and quercetin (a flavonoid) within the 14 metabolites displayed possible inhibitory effects on α glucosidase, with IC_{50} values of 64.5, 388.48, and 17.45 µM respectively.

Wound healing activity [24]

The curative property of 0.2%w/w Nitrofurazone ointment and 2%w/w and 4%w/w ethanolic floral extract as a light ointment basis were compared. Flower extract began to demonstrate significant effectiveness in the Wistar rat excision and incision wound models on the fourth day following that. For instance, the floral extract contains tannins, which are plant-based constituents that aid in tissue regeneration.

Hepatoprotective activity [25]

The current investigation examined the considerable liver protection that resulted from giving rats an ethanolic extract of *S. grandiflora* leaves orally for 15 days at a dose of 200 mg/kg/day in response to erythromycin estolate (800 mg/kg/day)-induced liver toxicity. Rats given with erythromycin estolate had significantly lower levels of the elevated serum enzymes (alkaline phosphatase, aspartate transaminase, alanine transaminase), phospholipids, hydroperoxides, bilirubin, triglycerides, free fatty acids, cholesterol, plasma Thio barbituric acid reactive compounds, and then rats administered with *Sesbania* extract and erythromycin estolate concurrently. The study's findings indicate that *Sesbania* may have a considerable beneficial impact against the liver toxicity caused by erythromycin estolate. The

consequences of *Sesbania* and silymarin, a model liver protective medication, were contrasted.

Anti-ulcer study [26]

Research has shown that *S. grandiflora* has plant-based constituents that are anti-ulcerogenic. For leaves, a dosage of 36.75 mg/kg and for bark, 100 mg/kg is effective in preventing gastric ulcers and protecting the mucosa of the stomach. Most notably, the process of digestion and absorption was not affected by these extracts. It was shown that tannins extracted from *S. grandiflora* effectively suppressed gastric secretion by shielding the mucosa in rats from stress-related damage.

Anxiolytic & Anticonvulsant activity [27]

The present investigation used a range of animal models of convulsions to assess the anticonvulsive efficacy of *S. grandiflora* leaves. To determine which fraction possessed anticonvulsant activity, a bioassay aided isolation procedure was utilized. In mice with convulsions initiated by Pentylenetetrazol (PTZ) and Strychnine (STR), the Benzene: Ethyl acetate fraction (BE) of the acetone soluble part of a Petroleum ether extract substantially postponed the initiation of seizures and decreased the time span of tonic hind extension of the limbs in mice with seizures provoked by Maximum Electroconvulsive Shock (MES). The *S. grandiflora* fraction that contains triterpenes has an extensive range of anticonvulsant properties and anxiolytic activity.

Immunomodulatory activity [28]

The research conducted on *S. grandiflora's* immunomodulatory traits. When 400 mg/kg of methanolic flower extract was given to Sheep Red Blood Cells (SRBC), the development of humoral immune responses, B-lymphocytes, plasma cells, and serum antibodies increased. On cyclophosphamide-induced myelosuppression, this floral extract increased WBC count (6128.67±49.74/mm3) while WBCs decreased (3575.17±55.47/mm3). A combination of *S. grandiflora'*s flower and *Cocculus hirsutus'*s leaf extract (1:1) has a consistent immunomodulatory effect, as evidenced by the significant increase in immunoglobulins (IgM and IgG) and circulating antibodies in anti-SRBC in mice. Both plants contain active phytochemicals that boost immunity.

Anti- microbial activity [29]

S. grandiflora, *Senna siamea* and *Telosma minor* are three types of traditional Thai flower vegetables that were chosen for this study due to their reputation for helping people with digestive issues. A flower: water (1:2) ratio was utilized, and the mixture was shaken for seven days in order to extract water. The antibacterial qualities of the crude extracts were next investigated using the diffusing disc assay on 3 different species of bacteria: *Staphylococcus aureus*, *E. coli*, and *Bacillus cereus*. *S. aureus* had the biggest blocking zone of all three floral vegetables, and the seven-day extraction exhibited the strongest anti-microbial properties on all microorganisms, according to the study report.

Anti-inflammatory and anti-arthritis activity [30]

The bark extract of *S. grandiflora* has anti-inflammatory effects when given orally with a concentration of 300 mg/kg BW p.o. Oedema of the paw was utilized to quantify inflammation; abnormalities of the thymus, spleen, and body weight were used to quantify arthritis and primary and secondary oedema of the paw was calculated. The shrub *Sesbania grandiflora* reduces inflammation by isolating triterpenoidal compounds.

Anti-diarrhoeal activity [31,32,33]

Eight-week-old, healthy Swiss-Wistar albino mice weighing 25–30g were chosen to be employed in the *in vivo* assessment of the anti-diarrheal qualities. The standard antidiarrheal medication was loperamide. Mice with castor oil-induced diarrhoea were used to test the anti-diarrheal properties of *S. grandiflora* leaves. Four groups (n = 5) of twenty Swiss albino mice were randomly assigned. Loperamide was given to the positive control group, and 200 or 400 mg/kg body weight of the extract were given to the test groups. Water that had been distilled was given to the controls. Four hours following the castor oil therapy, the mice were checked every sixty minutes for symptoms of diarrhoea. The beginning and ending times of the faeces incidents were recorded. Defecation inhibition was calculated. By altering the procedure, the acute toxicity of the CEE of *S. grandiflora* leaves was ascertained in mice.

Analgesic & Anti-pyretic activity [34]

This study assessed the analgesic and antipyretic qualities on the flowers of *Sesbania grandiflora*. Using the Hot Plate and Tail Flick techniques, three dis tinct extracts with solvents (petroleum ether, ethyl acetate, ethanol) were tested for their analgesic efficacy in

albino rats. The ethyl acetate extract showed better analgesic and anti-pyretic qualities when contrasted with ethanol and petroleum ether extract.

Antioxidant & anti-urolithiatic activity [35]

This study looked at *S. grandiflora's* potential for treating renal calculi. It looked into the anti-urolithiatic and antioxidant properties of *S. grandiflora* leaf juice, in addition to the median fatal dose and significant behavioural alterations. The anti-urolithiatic action was assessed with a diet model that causes calculi. Calcium oxalate-type stones were created using rat chow that included 5% ammonium oxalate and gentamicin that was delivered subcutaneously. Kidney weights, calcium and oxalate deposition in the kidney, and calcium and oxalate excretion in the urine are the parameters being tracked in this study. As *in vivo* antioxidant measurements, catalase, lipid peroxidation and glutathione reductase were assessed. It was also determined how well the plant juice scavenged free radicals such 2-diphenyl-2-picryl hydrazyl and nitric oxide. In addition to its antioxidant properties, *S. grandiflora* leaf juice demonstrated considerable anti-urolithiatic efficiency against calcium oxalate-type stones. Findings from the study support the effectiveness of *S. grandiflora* leaf extract as an anti-urolithiatic agent. *S. grandiflora* leaf extract has strong anti-urolithiatic effects on calcium oxalate-type stones in addition to its antioxidant qualities.

Anthelmintic activity [36, 37,38]

Aqueous extracts from *S. grandiflora* leaves have demonstrated anti-worm activity and indisputable efficacy on *Asaridia galli*. Phytoconstituents like tannin, phenols, alkaloids, terpenoids, and saponin are the cause of this. The anti-worm activity of crude extracts from *S. grandiflora* leaves was investigated in relation to the adult Indian earthworm, *Pheretima posthuma*, using ethanol, methanol, and ethyl acetate. A range of concentrations, from 10 mg/ml to 100 mg/ml, were investigated in the study. The ethanolic leaf extract demonstrated strong anthelmintic activity in the presence of phenol and alkaloidal components. In a research employing several seed oils, *S. grandiflora*, *Sapindus lauridolia* , *Tinospora cardifolia*, *Passiflora edulis* and *Jatropha curucas* were tested at three different concentrations (10, 50, and 100 mg/ml) against *Pheretima posthuma*. When *S. grandiflora* was tested against piperazine citrate, a commonly used medicine, it showed the strongest anthelmintic activity at 100 mg/ml. The most potent anthelmintic action of *S. grandiflolra* seed oil was observed in cases of mortality and disability.

Hypolipidemic activity [39]

Hyperlipidaemia was more likely to be caused by coronary heart disease. Pharmaceuticals utilised to treat hyperlipidaemia these days have a lot of unfavourable side effects; in contrast, herbal remedies are readily available, reasonably priced, and have negligible to no side effects. Research suggests that flavonoids might play a part in lowering hyperlipidaemia. In the triton-induced hyperlipidaemic rats, portions of *S. grandiflora* at 20µg/kg dramatically decreased blood cholesterol, triglycerides, phospholipids, VLDL, and LDL levels. Serum HDL levels also increased at the identical dosage. Considering that *S. grandiflora* leaf aqueous extract increased blood HDL and decreased serum total cholesterol, its hypolipidemic efficacy was examined in connection to a triton-induced hyperlipidaemic profile.

Anti-tubercular activity [40]

Substances such as sativum, medicarpin, isivestitol, and isoflavonoids that were separated from *S. grandiflora* roots and in conjunction with the well-known medication betulinic acid also had diminished anti-tuberculotic activity. The compounds' structures have been described using spectroscopic techniques. In *M. tuberculosis*, the methanolic extract has anti-tuberculotic activity of 625 ug/ml, but the substance under investigation only demonstrates 50 ug/ml.

Cardio-protective activity [41]

Rats were used in the experiment to assess *S. grandiflora's* cardio-protective qualities against oxidative smoke damage. Adult male *Wistar Kyoto* rats received oral *S. grandiflora* aqueous suspension (SGAS, 1000 mg/kg body weight per day) for three weeks following ninety days of inhalation of cigarette smoke. Rats subjected to cigarette smoke had significantly increased levels of the cardiac lipid peroxidation product and serum lactate dehydrogenase activity, but significantly lower levels of glutathione, vitamin C, and vitamin E. On the other hand, there was a noticeable increase in the heart's activities of glutathione reductase, catalases, glucose-6-phosphate dehydrogenase, superoxide dismutase, glutathione-s-transferase and peroxidase. In addition to having increased copper levels in their hearts, rats subjected to cigarette smoke also had significantly lower amounts of zinc, manganese, and selenium.

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