Phytochemical, pharmacological and phytopharmaceutics aspects of
Sesbania grandiflora (Hadga) : A review

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ABSTRACT

Sesbania grandiflora (Linn) belonging to family Leguminosae contains plenty of sterols, saponins and tannins which are responsible for its various pharmacological properties. The various parts of the plant like roots, bark, leaves, flower and fruit are known to possess different pharmacological properties. The information published about chemical composition and biological activity of Sesbania grandiflora of different genera is reviewed here. The available data on the biological action of individual constituents is presented. The perspectives of research and therapeutic use of Sesbania grandiflora as an excipient, hydrophilic matrix material, natural polysaccharide, binding agent and as a drug in ophthalmic dosage form are discussed here in terms of phytopharmaceutics.

Keywords: Sesbania grandiflora, hadaga, ophthalmic.

INTRODUCTION

Sesbania grandiflora (Linn) belonging to family Leguminosae commonly known as sesbania is often planted for its edible flowers and pods in tropical countries. 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 countries1-6.

The other scientific names of sesbania are Robinia grandiflora Linn, Aeshynomene grandiflora Linn, Sesban grandiflora Por, Agati grandiflora (L.) Desv. Locally it is known as caturay, katurai (Chamorro), corkwood tree, scarlet wisteria, sesban, vegetable hummingbird (English), agati a grandes fleurs (French), ohai ke’oke’o(Hawaiian), katurai (Palauan), sepania (Samoan), afai, ofai, ouai, oufai (Tahitian), agathi, agati (Tamil), hadga (hindi, marathi).

A small erect quick-growing short-lived soft-wooded tree sparsely branched. Bole straight and cylindrical, the wood white and soft. The tree is 5 to 12 meters in height. The leaves are 20 to 30 centimeters long, and pinnate having 20 to 40 pairs of leaflets, which are 2.5 to 3.5 centimeters long. The flowers are white and 7 to 9 centimeters long. The pods are linear, 20 to 60 centimeters long, 7 to 8 millimeters wide, pendulous, and somewhat curved, and contain many seeds.

A. Phytochemical aspects

The active ingredients of sesbania are leucocyanidin and cyanidin present in seeds, oleanolic acid and its methyl ester and kaemferol-3-rutinoside which are present in flower. The bark contains tannins and gum. Saponin isolated from the seeds. Sesbanimide isolated from seeds.

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All parts of *Sesbania grandiflora* 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, opthalmia, 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.

**Roots**

In a number of cultures the root is applied as a poultice for application to inflammation and fever. Powdered roots of *Sesbania grandiflora 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.

**Bark**

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 haemophthisis. The bark is also given in diarrhoea and dysentery. In small doses, the bark is used for dysentery and sprue, in large doses, laxative, in still larger doses, emetic.

**Leaves**

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 aperient, diuretic, laxative, alyxeetric.

**Flowers**

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.

**Fruit**

In Ayurveda, fruits are used for anemia, bronchitis, fever, tumors. The fruits are calcesteric, laxative, and intellectually stimulating properties. It is also prescribed for the pain and thirst.

**B. Pharmacological studies**

The pharmacological studies were reviewed here to know its various potentials to lead as a therapeutic candidate in drug development process. It has been found a wonder plant having such a variety of potentials as mentioned below.

**Antiulcer activity**

In this study the antiulcer potential *S. grandiflora* was evaluated. The ethanolic extract of the bark of *S. grandiflora* prevented acute gastric injury in rats. Stress and nonsteroidal antiinflammatory or drugs-induced lesions were significantly prevented by the extract of sesbania.

**Protective Effect of Sesbania grandiflora Against Cigarette Smoke-Induced Oxidative Damage in Rats**

This study is investigated the harmful effects of cigarette smoke on lung antioxidant defense system and restorative property of *Sesbania grandiflora* in rat lung. In this the adult male WKY rats were exposed to cigarette smoke for a period of 90 days and consecutively treated with aqueous suspension of *S. grandiflora* for a period of 3 weeks. The level of lipid peroxide was evaluated as marker of lung damage. Antioxidant status of the lung was assessed from the levels of reduced glutathione, vitamin C and vitamin E and the activities of superoxide dismutase, catalase, glutathioneperoxidase, glutathione reductase, glutathione-S-transferase and glucose-6-phosphate dehydrogenase. The levels of copper, zinc, manganese and selenium in lung were also measured. The results suggest that chronic cigarette smoke exposure enhance oxidative stress, thereby disturbing the tissue defense system and *S. grandiflora* protects the lung from the oxidative damage through its antioxidant potential.

**Antioxidant activity and antiurolithiatic activity**

In this study the potential of *S. grandiflora* in the treatment of renal calculi was investigated. The leaf juice of *S. grandiflora* was evaluated for median lethal dose, gross behavioral changes, antiurolithiatic and antioxidant activities. The antiurolithiatic activity was evaluated by a calculi-producing diet model, using gentamicin (subcutaneously) and 5% ammonium oxalate in rat feed to induce calcium oxalate-type stones. The parameters monitored in the present study are calcium and oxalate deposition in the kidney, kidney weights, urinary excretion of calcium and oxalate. The *in vivo* antioxidant pa-
rameters lipid peroxidation, glutathione reductase and catalase were monitored. The plant juice was also evaluated for scavenging of nitric oxide and 2-diphenyl-2-picryl hydrazyl free radicals. The leaf juice of *S. grandiflora* showed significant antiurolithiatic activity against calcium oxalate-type stones and also exhibited antioxidant properties. The results obtained in this study provide evidence for the efficacy of the leaf juice of *S. grandiflora* as antiurolithiatic agent. The leaf juice of *S. grandiflora* showed significant antiurolithiatic activity against calcium oxalate-type stones and also exhibited antioxidant properties.

**Anticancer and Chemopreventive activity**

In this study anticancer efficacy of a protein fraction, SF2 (Sesbania Fraction 2) isolated from the flower of the medicinal plant, *Sesbania grandiflora* was evaluated. The fraction was evaluated in two murine ascites tumor cell lines and human cancer cell lines of different origin for its anticancer effect. SF2 inhibited cell proliferation and induced apoptosis as evidenced by DNA fragmentation and externalization of phosphatidyl serine in Daltons Lymphoma Ascites (DLA) and colon cancer cells (SW-480). *In vivo* studies using ascites and solid tumor models strongly support *in vitro* findings as SF2 administration increased the life span and decreased the tumor volume in mice bearing tumor may serve as a potential anticancer drug candidate.

**Anxiolytic activity and anticonvulsive effect**

In this study the anticonvulsive activity of *S. grandiflora* leaves were evaluated using a variety of animal models of convulsions. Bioassay guided separation was carried out to identify the fraction possessing anticonvulsant activity. The benzene: ethyl acetate fraction (BE) of the acetone soluble part of a petroleum ether extract significantly delayed the onset of convulsions in pentylentetrazol (PTZ) and strychnine (STR) - induced seizures in mice and reduced the duration of tonic hind leg extension in the maximum electroconvulsive shock (MES) induced seizures in mice. The triterpene containing fraction of *S. grandiflora* exhibits a wide spectrum of anticonvulsant profile and anxiolytic activity.

**Hepatoprotective activity**

This study evaluated the oral administration of an ethanolic extract of *S. grandiflora* leaves (200 mg/kg/day) for 15 days produced significant hepatoprotection against erythromycin estolate (800 mg/kg/day)-induced hepatotoxicity in rats. The increased level of serum enzymes (aspartate transaminase, alanine transaminase, alkaline phosphatase), bilirubin, cholesterol, triglycerides, phospholipids, free fatty acids, plasma thioacetate acid reactive substances and hydroperoxides observed in rats treated with erythromycin estolate were significantly decreased in rats treated concomitantly with sesbania extract and erythromycin estolate. The results of the study reveal that sesbania could afford a significant protective effect against erythromycin estolate-induced hepatotoxicity. The effect of sesbania was compared with that of silymarin, a reference hepatoprotective drug.

**Antimicrobial activity**

In this study, three types of Thai traditional flower vegetables, *S. grandiflora*, *Senna siamea* and *Telosma minor*, were used due to their claim on helping person who has stomach disorder. Ratio of flower

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*Figure 1: Sesbania grandiflora Linn*
to water of 1:2 was used for water extraction with shaking condition for seven days. The crude extracts were then examined for antimicrobial properties using disc diffusion test on three types of bacteria, *Bacillus cereus*, *Escherichia coli* and *Staphylococcus aureus*. The results indicated that the seven-day extraction provided the highest anti-microbial properties of these three flower vegetables on all bacteria, especially for *S. aureus* that had the highest inhibition zone.

**Analgesic and antipyretic activity**

In this study the analgesic and antipyretic activity of *Sesbania grandiflora* flowers was evaluated. The three different extracts using petroleum ether, ethyl acetate and ethanol as solvent were subjected for screening on albino rats for analgesic activity using Hot Plate and Tail Flick methods. The ethyl acetate extract showed better analgesic and antipyretic activities compared with petroleum ether and ethanol extract.

**C. Phytopharmaceutics of Sesbania grandiflora**

The system of ayurveda embraces within its fold drugs of plant, animal and mineral origin, both single drugs and formulations. In ancient times, ayurvedic medicines used to be prepared by the practicing physician himself for the use of patients. At this stage, the need for proper formulation development for ayurvedic medicines was felt to produce a consistent quality product. Here, *Sesbania grandiflora* reviewed for its phytopharmaceutics development as ayurvedic formulations and also for the research and development activities on different parts of the plant.

Natural gums have been widely explored as pharmaceutical excipients. The gums are biocompatible, cheap and easily available, thus making them attractive substitute for costly semisynthetic and synthetic excipients. Sesbania gum is available locally in large quantities and has been explored by some studies as a pharmaceutical excipients. Sesbania grandiflora gum has not only studied in conventional dosage form, but even in sustained release tablet as a hydrophilic matrix material and natural polysaccharide for microbially triggered colon specific drug delivery system. *Sesbania grandiflora* seed galactomannan was established as a potential binding agent for pharmaceutical formulation. Sesbania grandiflora (hadga) has also studied for formulation and evaluation of ophthalmic dosage form for the improvement of dim vision.

The *Sesbania grandiflora* linn, was extensively studied by different scientists and academicians for its phytopharmacological potentials specially on leaves, flowers and seeds; but the root, bark and fruits are still not researched in details.

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