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Review Article

Evaluation of Phytochemical and Pharmacological Activity of Sesbania Grandiflora

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Abstract

Sesbania grandiflora L., commonly known as Agathi, is a fast-growing leguminous tree belonging to the Fabaceae family, widely recognized for its diverse medicinal properties. Various parts of the plant, including the leaves, bark, seeds, and flowers, have been historically utilized for their therapeutic potential, supported by a rich profile of bioactive phytochemicals such as alkaloids, flavonoids, tannins, saponins, and terpenoids. While extensive research has documented the antioxidant, antimicrobial, and anticancer activities of the leaves and flowers, there is a notable research gap concerning the pharmacological utility of the root system. One can aim to investigate and experimentally evaluate the phytochemical profile and hepatoprotective (liver-protective) activity of Sesbania grandiflora roots.

By addressing these under-studied components, the research seeks to contribute valuable scientific data that could lead to the development of natural, plant-based hepatoprotective agents and provide a more comprehensive pharmacological understanding of Sesbania grandiflora as a whole..

Key words: sesbania grandiflora; phytochemical screening; hepatoprotective activity; fabaceae agathi; medicinal plants

Introduction

Sesbania grandiflora L. is a perennial, deciduous, evergreen, rapidly proliferating mid-size leguminous tree from the Fabaceae family with a comparatively short life span of 20years. Sesbania grandiflora L. is commonly known by its various local names, such as agati, vegetable hummingbird tree, etc., and its native range extends from south to southeast Asian countries. However, according to reports, its native range is restricted to Malaysia and Indonesia(cabi.org2022). Sesbania grandiflora L. can also be found in countries of Asian, American, African origin. The leaves, bark, root, seed, flower, fruit, and the whole plant serve as medicinal components. There is a great deal of research that supports the value of agati as a nutraceutical and the fact that it contains some phytochemicals such as alkaloids, anthraquinone, flavonoids, steroids, phytosterol, terpenoids, tannins, catechin, etc. Agatii also reported to possess in dispensable medicinal properties. It possesses numerous beneficial properties against bacterial infection, inflammation, tumour, etc., it is also known for its rich source of minerals, vitamin A, calcium, carbohydrates and phosphorus. This plant is used in Ayurvedic, Unani and Siddha medicine for various ailments. All the parts of the plant namely root, stem, bark, leaves, flowers, fruit are used as medicine, food and for other miscellaneous purposes. Traditionally this plant used for treatment of disease like diarrhea, dysentery, fever, cough and cold, and as tonic, expectorant etc. The antioxidant properties of Sesbania grandiflora are due to the presence of diverse types of phytochemical constituents. It also has pharmacological properties like anti-cancer, ant-helmintic, anti-diabetic, anti-ulcer, hepato-protective, anti-bacterial, anti-viral, hypolipidemic, anti-tuberculosis, cardio protective, anti-arthritic, immuno-modulatory, anti-inflammatory, analgesic, wound healing [1,2].

Extraction Methods for Sesbania Grandiflora

1. Maceration (Cold Extraction)

Maceration is a conventional, simple, and inexpensive method used primarily for extracting thermolabile (heat-sensitive) compounds.

- Preparation: Clean, shade-dry, and grind S. grandiflora leaves/flowers into a coarse powder.
- Soaking: Place 100g of powder in a conical flask and add 500mL of solvent (e.g., Ethanol, Methanol, or Water).
- Incubation: Seal the flask and allow it to stand at room temperature for 24–72 hours.
- Agitation: Shake the flask occasionally to ensure maximum solvent-solute contact.
- Filtration: Filter the mixture using Whatman No. 1 filter paper to separate the marc (residue) from the filtrate.
- Concentration: Evaporate the solvent using a rotary evaporator or water bath to obtain the crude extract[3,4].

2. Soxhlet Extraction (Hot Continuous Extraction)

This is the most widely reported method for Sesbania grandiflora as it ensures exhaustive extraction of bioactive components through continuous solvent recycling.

Loading: Place approximately 250g of dried S. grandiflora powder into a porous thimble (cellulose).

- Setup: Place the thimble in the Soxhlet extractor; attach a round-bottom flask containing the solvent (e.g., Ethanol or Petroleum Ether) below.
- Heating: Heat the solvent to its boiling point. Solvent vapors rise, condense, and fill the thimble.
- Siphoning: Once the thimble is full, the solvent (now containing extracted compounds) siphons back into the flask.
- Cycles: Repeat the process for 8–36 hours (or until the solvent in the thimble becomes colorless).
- Recovery: Distill the solvent under reduced pressure to leave behind the concentrated semi-solid extract[5,6].

3. UAE Ultrasound-Assisted Extraction

A modern "green" extraction technique that uses sound waves to create cavitation, disrupting the plant cell walls for faster extraction.

- Mixing: Mix the powdered plant sample with a solvent (e.g., 70% ethanol) in a ratio of 1:10 or 1:20.
- Sonication: Place the mixture in an ultrasonic bath or use an ultrasonic probe.
- Parameters: Set the frequency (usually 20–40 kHz) and temperature (e.g., 40°C) for 20–30 minutes.
- Centrifugation: Centrifuge the resulting mixture at 4,500 rpm for 20 minutes to separate the supernatant.
- Evaporation: Collect the supernatant and evaporate it to dryness using a vacuum evaporator [7,8].

4. Microwave-Assisted Extraction (MAE)

MAE utilizes microwave energy to heat the moisture within the Sesbania cells, creating pressure that ruptures the cell walls.

Procedure:

- Sample Loading: Place the dried powder and a microwave-absorbing solvent (like Methanol/Water) into a closed-vessel system.
- Irradiation: Apply microwave power (e.g., 150W to 600W) for short durations (typically 1–5 minutes).
- Cooling: Allow the vessel to cool to room temperature to prevent the degradation of heat-sensitive compounds.
- Filtration: Filter the extract to remove plant debris.
- Storage: Concentrated extract is dried and stored in an airtight container at 4°C [9,10].

Different extraction procedures were depicted in figure 1.

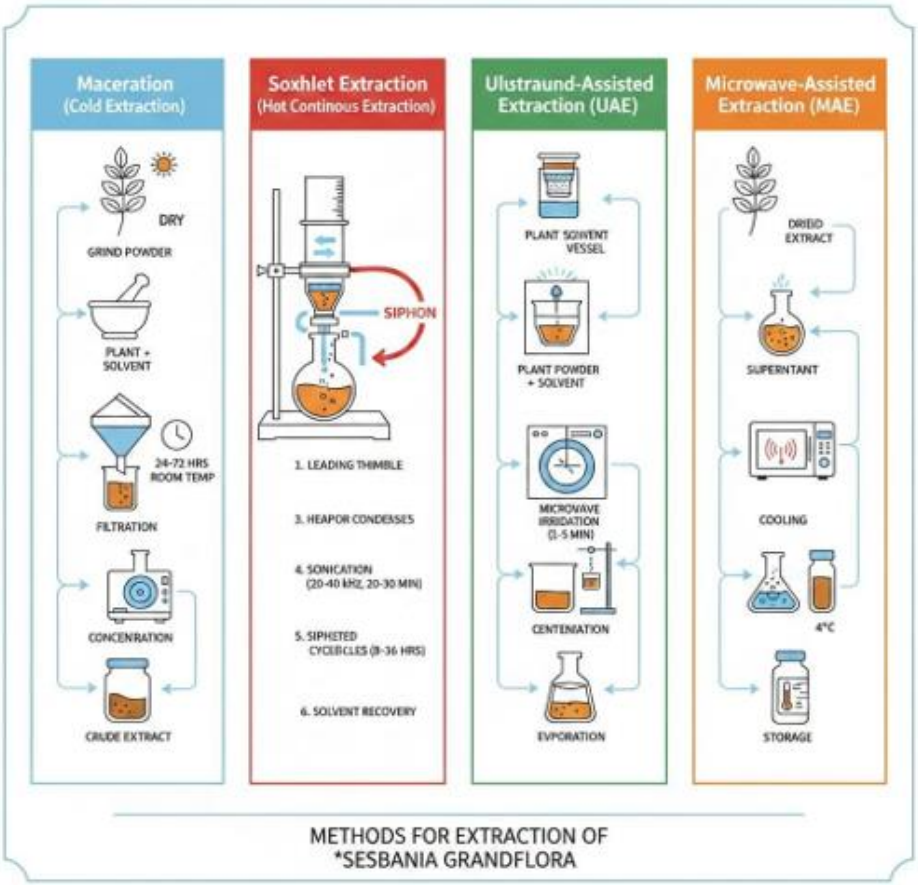

Figure 1: Different methods to extract sesbania grandiflora

5. Infusion

Infusion is a dilute medical preparation made by soaking the plant material in hot or cold water. This is ideal for extracting volatile oils and delicate water-soluble compounds from S. grandiflora leaves and flowers.

Procedure:

- Sample Preparation: Weigh approximately 10g of dried or fresh S. grandiflora flowers/leaves.
- Solvent Application: Boil distilled water and allow it to cool slightly (to about 90°C).
- Soaking: Pour the hot water over the plant material in a closed vessel to prevent the loss of volatile components.

- Steeping: Allow the mixture to stand (steep) for 15–20 minutes.
- Filtration: Strain the mixture through a fine muslin cloth or filter paper.
- Yield: The resulting liquid (the infusion) is used immediately or concentrated under low [11,12]

6. Decoction

Decoction involves boiling the plant material in water for a specific period. This method is used for harder plant parts like the bark, roots, or seeds of Sesbania grandiflora to extract heat-stable compounds like tannins and alkaloids.

Procedure:

- Preparation: Crush or coarsely grind the hard parts of the plant (bark or dried seeds).
- Ratio: Mix the sample with distilled water (commonly a 1:4 or 1:10 ratio w/v).
- Boiling: Heat the mixture and bring it to a boil.
- Simmering: Continue boiling for a specific duration (usually 15–30 minutes) until the water volume is reduced to one-fourth of the original [13].

Cooling & Filtration: Allow the decoction to cool and filter it while still warm to ensure maximum solute recovery. The filtered liquid is either used directly or lyophilized (freeze-dried) for powder storage. The pharmacological activities of sesbania grandiflora when extracted with different solvents was shown in figure 2

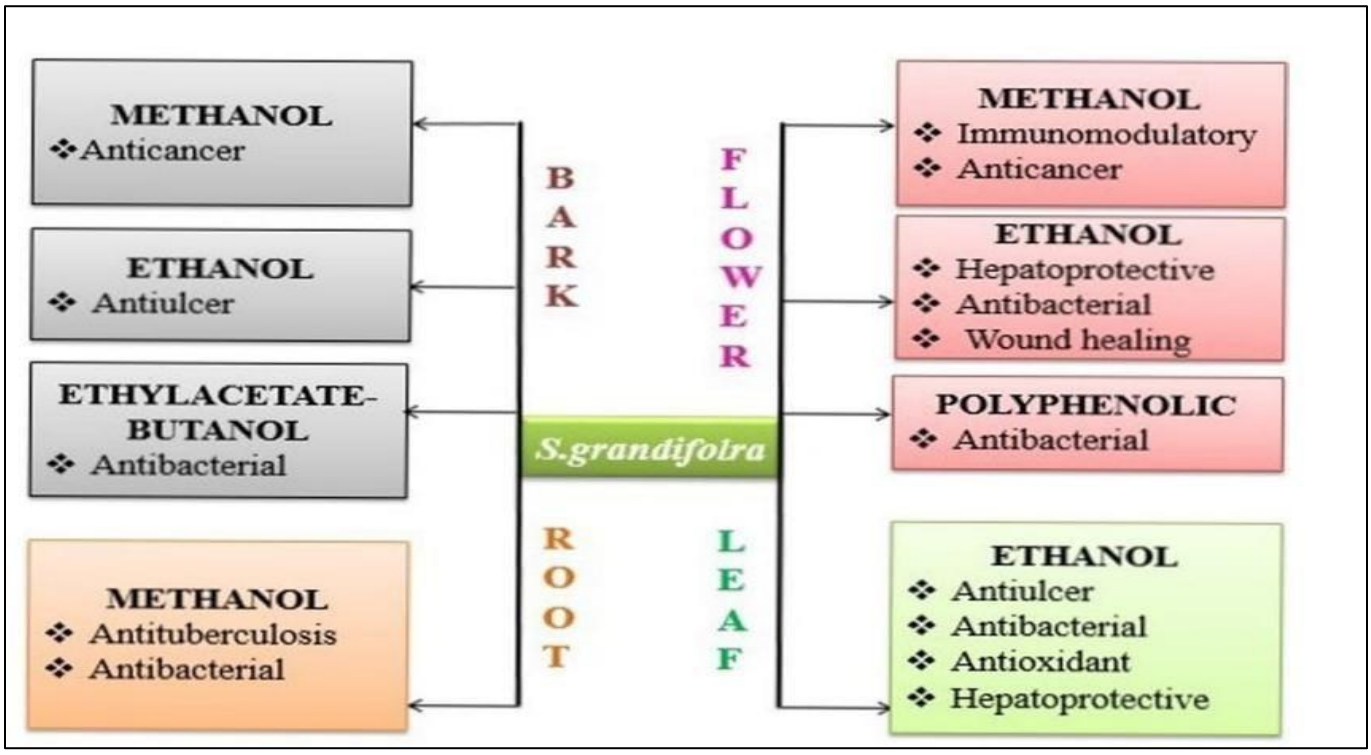

Figure 2: Figure shows different pharmacological activity of sesbania grandiflora when extracted with different solvents

Pharmacological Activities:

Anticancer Activity:

Ethanol extract of leaves and flowers of plant sesbania grandiflora reported for anticancer activity which performed on Swiss albino mice and the dose was 100 and 200mg/kg body weight.

Hepatoprotective Activity:

The ethanolic extract of leaves of Sesbania grandiflora reported for hepatoprotection against Erythromycin etiolates and the dose was 200mg/kg/day. The ethanolic and aqueous extract of Flowers of Sesbania grandiflora show hepatoprotective activity in ccl4 induced hepatotoxicity models in Rats. The dose required is 200mg/kg BW.

Antioxidant And Cardio Protective Effect:

The plant Sesbania grandiflora was studied for the cardio protective activity against cigarette smoke induced oxidative damage in rats. Male wistar -kyoto rats was placed in cigarette smoke for 90 days and then treated with Sesbania grandiflora aqueous extract. The dose required is 1000mg/kg g body weight per day orally. The testing is for 3 weeks. Sesbania grandiflora plant protects the heart from the oxidative damage through its antioxidant potential.

Wound Healing Activity:

The plant Sesbania grandiflora studied for wound healing activity of methanol extract of bark had been estimated by using Wister albino rats wound model. The dose required for significant wound healing activity was 10% w/w. when compared to standard 1% framycetin Sulphate. In results it was confirmed that methanol extract of Sesbania grandiflora bark showed significant wound healing activity.

Antibacterial Activity:

The plant Sesbania grandiflora shows antibacterial activity. The Aqueous, methanol and hydro-acetone extractions of leaves, stems, granules, pods of fruit and roots of the plant shows antibacterial activity by extracting of total phenols, flavonoid and tannins.

Anxiolytic And Anticonvulsant Activity:

The anticonvulsive activity of leaves of Sesbania grandiflora was evaluated using different animal's models of convulsions like pentylenetetrazol (PTZ) and strychnine (STR) induced seizures in mice. Benzene; ethyl acetate fraction (BE) of plant Sesbania grandiflora contained a triterpens as a major component and the mice treated with BE preferred to remain in the open arm of the elevated plus maze indicating anxiolytic activity.

Antiulcer Activity:

Sesbania grandiflora plant prevented acute gastric: injury in rats by using ethanol. The dose is used for activity was 36.75mg/kg (p.o). When the doses used, the animals had no depressive, excitatory or sleepiness symptoms it was suggesting that probably centrally acting components which contains in anti-ulcer action are not found in the extract.

Anthelmintic Activity:

Sesbania grandiflora plant extract was reported for anthelmintic property against the organism like Pheritima pasthuma. The seed oil used for study in that three different concentrations were used (10, 50, 100 mg/ml) which involved the determination of time paralysis and time of death of the worm.

Hypolipidemic Activity:

Sesbania grandiflora plant has ability to reduce hyperlipidemia. The flavanoid content present in Sesbania grandiflora which affected on hyperlipidemia with dose 200µg/kg (p.o) in triton induced hyperlipidemic rats. The plant extract showed a significant reduce in the levels of serum cholesterol, phospholipids, triglyceride, LDL, VLDL and significant increase level of serum HDL at the given dose.

Anti-Inflammatory And Anti-Arthritics Activity:

Sesbania grandiflora bark extract when administration at dose 300mg/kg BW p.o shows anti-inflammatory activity. Inflammation was assessed by measuring paw swelling and the arthritis was assessed by measuring primary and secondary paw swelling and changes in thymus, spleen and body weight. The plant Sesbania grandiflora modifying the inflammation

Antiurolithiatic Activity:

Sesbania grandiflora leaf juice was evaluated for median lethal dose, antiurolithiatic and antioxidant activities.

Analgesic Activity:

The antipyretic activity of flowers of Sesbania grandiflora was reported by the three different extract that was petroleum ether, ethyl acetate and ethanol as solvent were tested on albino rats and for analgesic activity tested using Tail Flick methods. The ethyl acetate extract of flowers of Sesbania grandiflora showed better analgesic and antipyretic activities with respect to petroleum ether and ethanol extract [14,15].

Conclusion

The present study focuses on Sesbania grandiflora, a medicinal plant rich in diverse phytoconstituents and pharmacological properties. Through a comprehensive review of research papers and scientific journals, it was observed that various parts of the plant—such as leaves, flowers, bark, and seeds—have been extensively studied for their therapeutic activities including antioxidant, antimicrobial, antidiabetic, anticancer, analgesic and anti-inflammatory effects. However, the root part of Sesbania grandiflora remains comparatively less explored, particularly regarding its hepatoprotective potential. Recognizing this research gap, one can aim to investigate and experimentally evaluate the hepatoprotective activity of the roots based on availability of the roots the research will be done. This exploration may contribute valuable scientific data that could support the future development of natural, plant-based liver- protective agents and expand the pharmacological understanding of Sesbania grandiflora as a whole.

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