

TRADITIONAL USES, PHYTOCHEMISTRY AND ETHNOPHARMACOLOGICAL INSIGHT OF SESBANIA GRANDIFLORA (L). : A review

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Abstract : The present paper reviews various uses and phytochemistry of wild edible plant *Sesbania grandiflora* L. along with its ethnopharmacological validation of claims for various uses. Flowers and leaves of plant are used as vegetable by local people. The plant is found to have medicinal properties used for treatment as effective remedy on chronic disorders related to oxidative stress including cardiovascular, cancer, diabetes. The plant is also a effective remedy for gout, rheumatism, tumor, and liver disorders. Leaves are used as remedy for pulmonary diseases. The flower posses anticancer,hepatoprotective antidiabetic properties which are validated by invitro studies. The present paper is an effort to review ethnopharmacological properties of less known plant which can effectively used as nutraceutical in regular diet.

Key words : Nutraceutical,Chemical profile,Anticancer activity,anti-inflammatory effects.

Introduction: Nowadays, nutraceuticals have received considerable interest due to potential nutritional, safety and therapeutic effects. *Sesbania grandiflora* is found to be a important nutraceutical with nutritional and medicinal properties. Use of nutraceuticals in regular diet is going to be new way of treating chronic diseases and as source of alternative medicine. In this review article emphasis has been made to present a review on *Sesbania grandiflora* as an effective remedy on chronic disorders related to oxidative stress including cardiovascular, cancer, diabetes, antinflammatory effects along with antimicrobial activity. There is lack of data regarding various biological activities shown by *Sesbania grandiflora*. During the review searches were done on the scientific databases i.e., Science Direct, SpringerLink, PubMed, Google Scholar and etc. Internet searches were undertaken on the search engine. Different combinations of keywords and synonyms were used during the searches.

Morphology of Plant : *Sesbania grandiflora* (Linn). belongs to family Fabaceae is planted for its edible flowers and pods in tropical countries. *Sesbania grandiflora* L. commonly known as Hadga in Maharashtra Agati in South India is a small tree indigenous from Malaysia to North

Australia (Wagh et al., 2009). The plant is a small tree with soft wood, branchlets pubescent, leaves abruptly pinnate, leaflets oblong elliptical. Flowering in December to April. Flowers white creamy with pink ting produced in few flowered axillary racemes, calyx campanulate, corolla glabrous, pods long slightly curved at end.

Chemical profile of plant: Leucocyanidin, cyanidin, saponins are present in seeds (32), A galactomannan, has been isolated from the seeds of *Sesbania grandiflora* pers. Galactomannans are known for their anticancer properties (26). Seeds contain tocopherols and sterols which have antioxidant properties in seeds indicate hidden potential and possibility of exploitation for commercial use of oils (34). Oleanolic acid and its methyl ester, kaempferol-3-rutinoside are isolated from flower. The active ingredients in flowers are cyanidin, delphinidin glucosides, tannins, oleanolic acid, cysteine, isoleucine, asparagine, phenylalanine, valine, nicotinic acid and vitamin C [41]. The flowers have an excellent source of calcium, Iron and Vitamin B. The nutritive value of *Sesbania grandiflora* leaves contains protein 8.4g, fat 1.4g, minerals 3.1g, crude fibers 2.2g, carbohydrates 11.8 mg, energy 93 mg, calcium 1,130 mg, phosphorus 80 mg, and iron 3.9 mg/100gm [37]. The flowers have an excellent source of calcium, Iron and Vitamin B. The nutritive value of *Sesbania grandiflora* leaves contains protein 8.4g, fat 1.4g, minerals 3.1g, crude fibers 2.2g, carbohydrates 11.8 mg, energy 93 mg, calcium 1,130 mg, phosphorus 80 mg, and iron 3.9 mg/100gm [37]. The bark contains tannins and gum. Sesbanimide is isolated from seeds. (36) Plant possesses amino acids arginine, cysteine, histidine, isoleucine, phenylalanine, tryptophan, valine, threonine, alanine, asparagine, aspartic acid, leucocyanidin and cyanidin along with sugars like are galactose and rhamnose [30, 37]. Various plant parts contain several kinds of alkaloids, triterpenoids, carbohydrates, saponin, tannin, chlorogenic acid, flavonoid, anthocyanin, steroidal glycosides and phenolic compounds [38, 39]. Three isoflavonoids, isovestitol, medicarpin, and sativan, along with other known compound, betulinic acid, were isolated from the root [40]. Two new 2-arylbenzofurans, sesbigrandiflorain A and B, from the ethanolic stem bark extract of *Sesbania grandiflora* (13).

Traditional Uses : Flowers are used in regular diet with characteristic odour. Gynoecium is removed before use. All parts specifically flowers and leaves are widely used in Ayurveda for the treatment of leprosy, gout, rheumatism, tumor, and liver disorders as anti-inflammatory, analgesic, antipyretic, anti-epileptic effects, antibiotic, anthelmintic, antitumor, and contraceptive properties, leaves are the richest source of amino acids, minerals, and vitamins used as vegetable. (28) 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. Flowers are used 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. The dried leaves of *Sesbania grandiflora* are used in some countries as a tea which is considered to have antibiotic, anthelmintic (41). The plant is used for treatment of dementia a neurological disorder. (35). The juice of the flower is squeezed into the eye to correct dim

vision. The dried leaves of *Sesbania grandiflora* are used in some countries as a tea which is considered to have antibiotic, anthelmintic. Leaves of *Sesbania grandiflora* have the potential to be used as a remedy for thrombosis, diarrhea, and inflammatory diseases [3,4]. The juice of the leaves of *Sesbania grandiflora* has been reportedly used in the treatment of bronchitis, cough, vomiting, wounds ulcers, diarrhea, and dysentery.

Miscellaneous uses : Powdered roots of this plant are mixed in water and applied externally as a poultice or rub for rheumatic swelling (5) Saifudin et.al, reported that flower acts as a promising material to develop the active ingredient of anti-plaque toothpaste as well as mouthwash solution (07).Leaves of plant are used in Ayurveda for the treatment of epileptic fits. The anticonvulsive activity of *S. grandiflora* leaves using a variety of animal models. The benzene:ethyl acetate fraction (BE) of the acetone soluble part of a petroleum ether extract significantly delayed the onset of convulsions in pentylenetetrazol (PTZ) and strychnine (STR)- induced seizures in mice. (31)

Anticancer and Chemopreventive activity: Anticancer efficacy of a SF2 protein fraction isolated from the flower of the medicinal plants was tested on two murine ascites tumor cell and human cancer cell lines with different origin found to inhibit cell proliferation and induced apoptosis. The present study was also supported by DNA fragmentation and externalization of phosphatidyl serine in Daltons Lymphoma Ascites (DLA) and colon cancer cells (SW-480) (2). In vivo studies using SF2 protein fraction strongly support role to prevent cancer cell proliferation and can be further target for drug discovery. *Sesbania grandiflora* protects the lung from the oxidative damage through its antioxidant potential [8]. Alcoholic extract of *Sesbania grandiflora* flowers exerted antiproliferative effects especially on lung cancer cells followed by apoptosis (10). chromosomal instability in terms of the number of micronuclei polychromatic erythrocytes (MNPCEs) and PCE ratio ($PCE/(PCE + \text{normochromatic erythrocytes (NCE)})$) ratio was tested it was shown that *Sesbania grandiflora* possesses genotoxic potential for murine BMCs. This activity indicates presence of bioactive compounds that require further isolation and characterization for the active molecules. (20).Aqueous ethanol extract of *Sesbania grandiflora* leaf and flower significantly reduced the proliferation of activated HSC-T6 cells through regulation of fibrogenic cytokines (28)

Antimicrobial Activity : Traditional claims of use for stomach disorders was tested with seven day soak water extraction method with constant shaking. The crude extracts of leaf was examined for antimicrobial properties on *Bacillus cereus*, *Escherichia coli* and *Staphylococcus aureus* the highest activity for *S. aureus*.(3) The fractionated extracts obtained from ethyl acetate or butanol showed the pronounced antibacterial activity with ethyl acetate possessed the strongest antibacterial activity. Butanol extract of the stem bark was effective against Gram negative bacteria.(9) Polyphenolic extracts of *Sesbania grandiflora* leaves showed antimicrobial effect against pathogenic bacteria and growth promoting property against probiotic

organism *Lactobacillus acidophilus*.(23) *Sesbania grandiflora* (*S. grandiflora*) flower extract showed antimicrobial activity against plaque forming bacteria *Streptococcus mutans*(24) Methanolic extracts of flower show synergistic activity with oxytetracycline showing effect in very low concentrations indicating that flowers exhibit antimicrobial property even in low concentration

Analgesic and antipyretic activity: Flower extracts with solvents like petroleum ether, ethyl acetate and ethanol subjected for screening on albino rats for analgesic activity using Hot Plate and Tail Flick methods. The ethyl acetate extract showed highest analgesic and antipyretic activities.(4)

Hepatoprotective activity : Ethanolic extract of *Sesbania grandiflora* leaves (200 mg/kg/day) for 15 days produced significant hepatoprotection against erythromycin estolate (800 mg/kg/day). The results of the study reveal that *sesbania* could afford a significant protective effect against erythromycin estolate-induced hepatotoxicity.(5). Aqueous extract of flowers reported hepatoprotective activity against CCl₄ induced hepatotoxicity in rats [9]. Aqueous extract of leaves of *Sesbania grandiflora* with dose of 500mg/kg body weight was orally administered to carbon-tetrachloride induced liver damage in albino rats showed the decreasing value of SGPT (Serum level of Glutamic Pyruvate Transaminase), ALP, cholesterol and total bilirubin.(17)

Anti diabetic activity : antihyperglycemic and hypoglycemic activity was observed in glucose overloaded mice was studied with different dosage as 100, 200 and 400 mg/kg *Sesbania grandiflora* leave The highest dose showed both of the activities.(45).*Sesbania grandiflora* fruits 400 mg/kg used using streptozotocin induced diabetic rats showed positive antidiabetic activity. [46] The decoction and infusion of leaves of plant inhibit enzymes acetyl choline esterase, tyrosinase α -glucosidase, α -amylase related to type 2 diabetes mellitus. (25)

Antioxidant activity : The ethanolic and aqueous extracts of *Sesbania gradiflora* showed potent antioxidant activity in the scavenging of DPPH radicals (11). Lipid peroxidation and antioxidants status was analyzed in the brain adult male Wistar-Kyoto rats with exposure of cigarette smoke for a period of 90 days when treated with aqueous suspension of 1,000 mg/kg body weight per day by oral gavage for a period of 3 week showed significant increase in conjugated dienes (CD), hydroperoxides (HP) and malendialdehyde (MDA) levels with concomitant decrease in superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx), glutathione reductase (GR), glutathione-S-transferase (GST) and glucose-6-phosphate dehydrogenase (G6PDH) activities. Also the levels of glutathione (GSH) was reduced. (18)

Antiviral activity : The methanolic extract of flowers of *S. grandiflora* was showed antiviral activity against herpex simplex-1, herpex simplex-2, vaccinia, vesicular stomatitis and coxsackie. (15)

Antihelmintic activity : The ethanolic extract of the flower showed anthelmintic activity at highest concentration of 200 mg/ml in model *Pheretiima posthuma* with penetration and paralysis. (19)

Antiulcer activity : The bark ethanolic extract of *S. grandiflora* prevented acute gastric mucosal injury induced by restraint stress and water immersion in a dose dependent manner with ED₅₀ of 36.75 mg/kg. Ethanolic extract of leaves at the dose of 400mg/kg has decreased the intensity of gastric mucosal damage induced by ulcerogenic agents. [29]. The leaves extract of *Sesbania grandiflora* prevented acute gastric mucosal injury induced by aspirin. (12)

Nano particle synthesis : Nickel oxide nano particles were synthesized using nickel nitrate as precursor from flower extract of *Sesbania grandiflora*. These nanoparticles showed cytotoxicity against two human derived cell lines namely human cervical cells (HeLa) and human breast cancer cells (MM2) by using MTT assay with cisplatin used as a positive control. (14),(21). Silver nanoparticles (AgNPs) using leaf extract of *Sesbania grandiflora* showed antibacterial activity against selected human pathogens. (22)

Conclusion : The present review confirms various pharmacological and potential biological activities shown by *Sesbania grandiflora*. The traditional claims about uses of various plant parts can be validated in present review. The plant parts mainly root, bark leaves and specifically flowers contain various phytochemicals which shows different biological activities which are confirmed by sample extracts from different organs of plant. Presence of chief chemical constituent like leucocyanidin, saponins, oleanolic acid and its methyl ester, kaempferol-3-rutinoside have been isolated from flowers and seeds. Leaves contain essential mineral elements. Alkaloids, glycosides of different type have been reported. The reviews confirm the presence of flavonoids, madecarpin in roots and new isolates as Arylbenzofuran and grandifloran from flowers. The extracts of flower shows maximum pharmacological activities including anticancer, chemoprotective and antioxidant potential. The pharmacological activity validates the traditional claims of flower use as nutraceutical. The leaf shows antimicrobial activity. The flower shows antimicrobial specifically against plaque forming bacteria. The floral extract in ethylacetate shows analgesic and antipyretic activity. Leaves show hepatoprotective, antidiabetic, antiviral and antihelmintic activity. The innovative approach regarding nanoparticle synthesis from flower and leaf extracts have also been reported which will be a novel tool for use of nutraceutical in drug delivery system.

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