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Short Communication

Medicinal and Therapeutic values of Sesbania grandiflora

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Abstract

There are around 60 global species belonging to the genus *Sesbania* which are commonly found to be grown in Africa, Australia, and Asia. The leaves of *Sesbania grandiflora* have been used in local traditional medicine since ancient times. Major chemical constituents are alkaloids, flavonoids, glycosides, tannin, anthraquinone, steroid, pholobatannins, and terpenoids. Isovestitol, medicarpin, sativan (iso flavonoids) and betulinic acid (tannin substance) are the major constituents responsible for antibacterial and antifungal, antioxidant, anti-urolithiatic, anticonvulsant and anxiolytic, and hepatoprotective properties. Also, the plant extract contains alkaloids, phenolics, tannins, triterpenoids, and sterols. All parts of *S. grandiflora* are used in traditional medicine and phytochemical investigations have been conducted on extracts of the leaves, seeds and roots of *S. grandiflora* to provide scientific validation of its properties. The paper best finds its interest towards plant medicine researchers who need to explore venues of plant specific information regarding previous research for future path.

Keywords: Bokphool; Isoflavonoids; Cardio-Protective; Hepatoprotective; Heron Flower; Neuroprotective; *Sesbania grandiflora*

Abbreviations

Acetylcholinesterase (Ache); Advanced Glycation End Products (Ages); Hemoglobin A1c (Hba1c); Hydroxy Methoxy Benzaldehyde (HMB); Low-Density Lipoprotein (LDL); Michigan Cancer Foundation-7 (MCF-7); Multi-Drug Resistant (MDR); Polyunsaturated Fatty Acid (PUFA); Silver Nanoparticles (Agnps); Tetrachloromethane (Ccl4); Triglyceride (TG)

Importance of *Sesbania grandiflora*

Native to tropical Asia, commonly known as vegetable hummingbird, agati or hummingbird tree, is a small tree in the genus *Sesbania*. It is a short-lived, soft-wooded, loosely-branching tree with a rather open crown; it can grow 8-15 meters tall (Figure 1).

The *Sesbania grandiflora* or the humming bird tree bears a big white flower that is heartily used in Bengali cuisine. White flower variety of *S. grandiflora* found to be non-toxic, the purple flower type is highly toxic [2]. The tree's leaves, fruits and flowers can all be consumed – eaten alone as vegetables and added to curries or salads. Known as Bokphool in West Bengal, the flower is commonly consumed by dipping in batter and frying. The flowers and leaves are enriched with vitamins and minerals and have been reportedly associated with anti-inflammatory, analgesic and antipyretic effects. A fraction isolated from flowers, preferentially killed leukemic cells in another study (Figure 2).

Leaves of *Sesbania grandiflora* have the potential to be used as a remedy for thrombosis, diarrhea, and inflammatory diseases and against few important bacterial pathogens [3,4]. The juice of the leaves of *S. grandiflora* has been reportedly used in the treatment of bronchitis, cough, vomiting, wounds ulcers, diarrhea, and dysentery. The flowers have reported antimicrobial activity. Powdered roots of this plant are mixed in water and applied externally as a poultice or rub for rheumatic swelling [5]. The leaves are traditionally used to treat nasal catarrah, nyctalopia and cephalagia. Studies show that, *S. grandiflora* possess antioxidant, antiuroithiatic, anticonvulsive, anti-arthritic, anti-inflammatory, anti-helminthic, anti-bacterial and anxiolytic activity [6-8]. In 2017 *Gandhi et.al,* reported that anti-biofilm and antibacterial efficacy of *S. grandiflora* plays a vital role

Figure 1: Front view of *Sesbania grandiflora* [1].

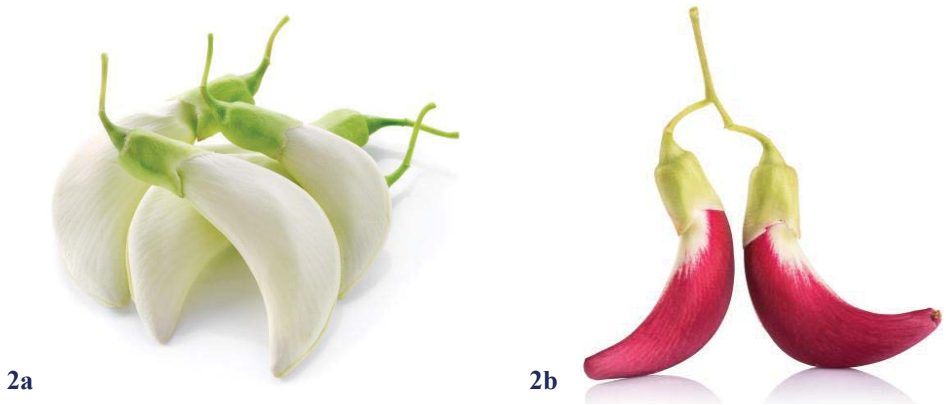

Figure 2: Bok phool or Heron flower white [2a] and purple [2b].

over biofilm producing pathogens and act as a good source for controlling the microbial population [9]. *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 [10]. It has been reported that a biofilm is strongly associated with the drug resistance property [11]. Hence, eradication of biofilm is often considered to be a difficult task and therefore use of plant products to inhibit biofilm may be a viable alternative [12]. *Ramesh et.al,* showed brain oxidative damage restored by *Sesbania grandiflora* in cigarette smoke-exposed rats [13]. Earlier, the lead author and associates presented cardio-protective action of *S. grandiflora* aqueous suspension that restored the antioxidant status and retained the levels of micronutrients in cigarette smoke-exposed rats [14,15]. Afterwards, *Ramesh et.al,* reported that *S. grandiflora* aqueous suspension significantly decreased the elevated hepatic, renal and lipid peroxidation markers and ameliorated the diminished antioxidant levels while restored the hepatic and renal architecture in cigarette smoke-exposed rats [16]. *Semwal et.al*, reported significant neuroprotective effect in celecoxib treated mice through the modification in cholinergic system or by the blockage of oxidative stress and inhibition of AchE enzyme.at the doses of 200 and 400 mg/kg in mice [17]. *S. grandiflora* protects the lung from the oxidative damage through its antioxidant potential [18]. Earlier, *Pajaniradje et.al*, reported methanolic fraction of *S. grandiflora* was found to exert potent antiproliferative effects especially in the human lung cancer cell line, A549 [19]. *Bhoumik et.al,* reported hepatoprotective activity against CCl4 induced hepatotoxicity in rats by aqueous extract [20]. Plants contain a huge range of active compounds with the most abundant being polyphenols, carotenoids, vitamin (vitamin A, C, riboflavin, nicotinic acid), and minerals like zinc and selenium which form an integral part of antioxidant systems and reduce cellular damages [21,22]. *Roy et.al,* reported that a fraction isolated from flowers, preferentially kills leukemic cells (particularly those of histiocyte lymphoma) by triggering programmed cell death [23]. In 4 different studies from 2012 to 2016, it was found that the flower, fruit and

the whole plant extract reduced blood glucose, cholesterol, TG and LDL, lipid peroxidation and increased superoxide dismutase, catalase, insulin and hemoglobin in experimental animals [24-27]. Afterwards, *Prasanna et.al*, demonstrated the hydroxy methoxy benzaldehyde (HMB) content as anti-glycogen lead that inhibited formation of early HbA1c and advanced glycation end products (AGEs) [28]. The hypoglycemic activity is thought to be due to increased hepatic metabolism followed by stimulation of synthesis and/or release of insulin from pancreatic beta cells and/or insulin sparing effect. High contents of quercetin, myricetin and kaempferol were identified in a methanolic extract of the leaves and a novel protein fraction was isolated from the fresh flowers, which displayed chemo-preventive effects [29,30]. The ethanol extract of the leaves and flowers were effective in inhibiting the tumor growth in ascitic models and that is comparable to 5-Fluorouracil [31]. *Chung et.al*, reported that silver nanoparticles (AgNPs) synthesized with leaf extracts were demonstrated to be cytotoxic to MCF-7 cancer cells [32,33]. Moreover, the synthesized AgNPs showed potent antibacterial activity against multi-drug resistant (MDR) bacteria such as *Salmonella enterica* and *Staphylococcus aureus* [34]. Later on, several studies revealed antimicrobial potential of *S. grandiflora* synthesized AgNPs [35-40]. *Gupta et.al*, revealed antioxidant action of flavonoids especially quercetin and hydro-alcoholic extract found to reduce the levels of TNF-α and IL-6 in acetic acid induced ulcerative colitis in mice [41]. Sesbania could afford a significant protective effect against erythromycin estolate-induced hepatotoxicity [42]; alcohol and polyunsaturated fatty acid (PUFA)-induced oxidative stress and nephrotoxicity (due to presence of phenolic compounds and anthocyanins) [43]. Also, the leaf juice of *S. grandiflora* showed significant antiurolithiatic activity against calcium oxalate-type stones in an older study [44]. The fruits are used for anemia, bronchitis, fever, tumors. They are laxative, and possess intellectually stimulating properties [45]. Fruit extract significantly decreased the levels of blood glucose, cholesterol, TG and LDL, lipid peroxidation and increased and superoxide dismutase and catalase in rats [46]. *Hasan et.al*, first reported of the four compounds (Isovestitol, medicarpin, sativan and betulinic acid) isolated from the root of *S. grandiflora* and their anti-tuberculosis properties [47]. The bark extract has shown the protective effects against the acute and chronic inflammation [48,49]. The bark of *S. grandiflora* is very bitter and considered as an astringent and bitter tonic. Decoctions of leaves and flowers is used to treat leucorrhoea and vomiting of blood. The bark of *S. grandiflora* is used as an astringent and treatment of small pox, ulcers in the mouth and the alimentary canal, infant stomach disorders and scabies [43,50]. Use of leaf powder as an iron and folate supplement showed improvement in hemoglobin levels of individuals with mild and moderate anemia [51]. Ethanolic extract of *S. grandiflora* significantly inhibited gastric mucosal damage induced by aspirin, ethanol and indomethacin [52]. Methanolic extract of *S. grandiflora* displayed a significant and dose dependent analgesic activity [53]. Also, triterpene containing fraction of *S. grandiflora* exhibits a wide spectrum of anticonvulsant profile and anxiolytic activity [54].

Conclusion

Among very few plants of the world, *S. grandiflora* is the one whose all parts are utilized for the treatment of various types of ailments. Other than this, it has capability to fix atmospheric nitrogen and can be used as green manure to improve soil conditions. It can also be planted as windbreak and shade tree in plantations. The wood is soft and light, used as poles, in floating fishing nets, for fuel and charcoal-making. It is also a major source of pulp for making paper. So, the diversity of use surely demands more research in future regarding its cultivation, adaptation in new environments, impact of environmental factors on its major therapeutic contents, raw material collection, storage conditions and availability sources for regular use in pharmaceuticals.

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