Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(4): 879-882
Received: 22-05-2019
Accepted: 24-06-2019

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Sesbania grandiflora the anti-ulcer effect: A review

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Abstract
Sesbania grandiflora commonly known as hummingbird or (Kathurumurunga *in Sinhalese)* is well known for its herbal qualities for generations. All the components of the tree are agreed to have medicinal qualities according to studies and folklaw. The plant is rich in tanins, flavonoides, coumarins, steroids and triterpens. Various parts of the plant used to cure ulcers, colic disorder, jaundice, poisoning condition, small-pox, eruptive fever, epilepsy etc. The present review is focused upon the antiulcer activity of *Sesbania grandiflora.*

Keywords: *Sesbania grandiflora*, anti-ulcer effect, tannin

Introduction

Biological and Geographical profile

Sesbania grandiflora (family: Leguminosae*)* (Kashyap and Mishra, 2012) [17] commonly known as hummingbird (Kathurumurunga in Sinhalese) is well known for its herbal qualities for generations. It is found in the plains of western Himalayas to Sri Lanka (Chopra *et al*., 1956) [5] and commonly grown in hot and humid tropical areas in the world. This is a quick growing, soft wooded tree, 6-10m height and 0.6 m in girth and at some parts of the world it is grown as an ornamental plant. *Sesbania grandiflora* is grown in Sri Lanka, Malaysia, many parts of India such as Punjab, Delhi, Bengal, Assam and the Andaman (Bhalke *et al*., 2010) [29]. This tree's leaves are used as fodder and its leaves and flowers are used as food (Himgauri *et al*., 2012) [12]. It is planted in gardens for its intercropping compatibility and soil-improving properties.

Table 1: Botanical classification (Wagh *et al*., 2009) [36]

Kingdom	Plantae
Subkingdom	*Tracheobionta*
Superdivision	*Spermatophyta*
Division	*Magnoliophyta*
Class	*Magnoliopsida*
Subclass	*Rosidae*
Order	*Fabales*
Family	*Leguminosae*
Genus	*Sesbania*
Species	*Sesbania grandiflora*

Medicinal properties

Plant extracts have been used for centuries, as popular remedies against several health disorders (Sura *et al*., 2011) [33]. In recent years, large advances in chemical and pharmacological studies have contributed to the knowledge about new therapeutically active compounds obtained from the natural products. These compounds can be used directly as leads for the development of new medicines or as pharmacological tools to discover new active compounds. These can be life-saving completely or may be used to improve the quality of life in long-lasting diseases (Himgauri *et al*., 2012) [12]. From top to the bottom of the *Sesbania grandiflora* plant is consisted with very rich nutritional and medicinal properties (Kirtikar, 1993). The bark and leaves of *Sesbania grandiflora* are known to cure malaria, smallpox, eruptic fever, diarrhoea, dysentery, snake bite, scabies, ulcer, and stomach disorders. The bark consists of astringent, cooling bitter tonic, anthelmintic and antipyretic properties. The fruits are reported for centuries as laxatives and stimulants and used in treatment of anaemia, bronchitis, fever, pain, thirst and tumours.

In Ayurvedic medicine root is used for inflammation. Leaves have alexeteric, anthelmintic properties and used for epilepsy, gout, itch and leprosy. Further leaves are tonic and antipyretic and cures night blindness (Bhalke *et al*., 2010) [29].

Chemical constituents

Qualitative photochemical studies have revealed the presence of alkaloids, carbohydrates, phytosterols, saponnins, tannins and flavonoids in *Sesbania grandiflora* (Bhalke *et al*., 2010) [29].

Flavonoid and tannin content

Many authors have been assumed 'Tannin' as one of the major compounds responsible for the anti- ulcer effect of *Sesbania grandiflora.* Arfan *et al*., 2016 [1], carried out a detailed experiment to find the components in *Sesbania grandiflora* and total flavonoid and tannin content are given below.

Table 2: Total flavonoid and tannin content of CEE of *S. grandiflora* and its various fractions

Extract Fraction	Flavonoid[a]	Tannin[b]
CEE	None	21.0±0.6
EASF	57.4± 0.6	47.1±0.2
CSF	51.8±1.8	30.1±0.1
PSF	44.4±0.5	39.5±0.0

CEE = crude ethanolic extract; EASF = ethanol acetate soluble fraction; CSF = chloroform soluble fraction; PSF = petroleum soluble fraction

[a.] Total flavonoid content is expressed in terms mg of quercetin equivalents per gram of dry extract.

[b.] Total tannin content is expressed in terms mg of tannic acid equivalents per gram of dry extract.

According to Arfan *et al*., 2016 [1], the qualitative phytochemical screening revealed the presence of alkaloids, flavonoids, and tannins in all extract fractions. The same for carbohydrates with the exception of PSF. Reducing sugar was detected only in EASF and CSF, and steroid only in PSF. The total flavonoid content of leaves of *S. grandiflora* was calculated using the linear equation obtained from the standard curve of quercetin (y = 0.0098x - 0.0364; R2 = 0.9724) and expressed as quercetin equivalents (QAE) per gram of the plant extract. The ethyl acetate soluble fraction (ESF) exhibited the highest flavonoid content while the petroleum soluble fraction (PSF) was found to possess the lowest flavonoid content. The tannin content was determined using the Folin-Coicalteu reagent and is expressed in terms of tannic acid equivalents (mg of TAE/g) (the standard equation Y= 0.0999x - 0.0161; R2=0.9996). The total tannin content was highest in the ESF and lowest in the CEE (Table 1).

Peptic ulcers are open sores that develop on the inside lining of the stomach, upper small intestine or esophagus and a typical gastrointestinal disorder (Dandiya and Kulkarni, 2005) [7]. Ulcers are mainly differentiated into three types, viz, gastric ulcer - occurs in the stomach, duodenal ulcer – occurs in the first part of the small intestine (duodenum) and esophageal ulcer – occurs in the lower section of the esophagus. It is often associated with chronic gastroesophageal reflux disease. The most common symptom of a peptic ulcer is burning pain. This pain is caused by the ulcer and is aggravated by stomach acid coming in contact with the ulcerated area. Less often, ulcers may also cause severe signs or symptoms such as vomiting of blood, which may appear red or black, dark blood in stools or stools that are black or tarry, nausea or vomiting, unexplained weight loss, chest pain (Himgauri *et al*., 2012; Harsh Mohan, 2000; Hoogerwerf *et al*., 2006) [12, 21, 13]. According to Udaykumar, 2005 [35], formation of the peptic ulcers are due to imbalance between acid and pepsin secretion and the mucosal defense factors. Although stress and spicy foods were once thought to be the main causes of peptic ulcers, doctors now know that the cause of most ulcers is the corkscrew-shaped bacterium *Helicobacter pylori*. *H. pylori* lives and multiplies within the mucous layer that covers and protects tissues that line the stomach and small intestine. Often, *H. pylori* causes no problems, but sometimes, it can disrupt the mucous layer and inflame the lining of the stomach or duodenum, producing an ulcer. Generally mucosal resistance can be disrupted due to injury caused by NSAIDs and *Helicobacter pylori* (Chan and Leung, 2002) [3]. One reason may be that people who develop peptic ulcers already have damage to the lining of the stomach or small intestine, making it easier for bacteria to invade and inflame tissues. Moreover, the regular use of painkillers such as NSAIDs, smoking and excessive alcohol consumption contribute to ulcer formation (Himgauri *et al*., 2012; Sura *et al*., 2011; Page *et al*., 2002) [12, 33, 24]. Increased gastric motility (Garrick *et al*., 1986) [10], vagal Hyperactivity (Ogle *et al*., 1976) [23], mast cell degranulation (Cho and Ogle, 1979) [4] reduced flow of blood to the gastric mucosa (Kitagawa *et al*., 1979) [19] and decreased prostaglandin levels during conditions involving stress are involved in generation of gastric ulcers. Reactive oxygen species plays a role in experimental gastric damage induced by ischemia and reperfusion (Perry *et al*., 1986) [26], hemorrhagic shock (Itoh and Guth, 1985) [14] and ethanol administration (Salim 1990) [30]. This has been the basis for the development of new antiulcer drugs and search for novel molecule (Bhoumik *et al*, 2016) [2].

Discussion

Due to the vast usage, the objective of the present study was to investigate the antiulcer activity of *S. grandiflora*. The leaves and flowers (Ethanol extracts) of *Sesbania grandiflora* has showed anticancer activity in an experiment conducted using Swiss albino mice against Ehrlich Ascites Carcinoma cell line at the doses of 100 and 200 mg/kg (Sreelatha *et al*., 2011) [32]. Further antioxidant and cardioprotective effect was evaluated in rats with the dose of 1000 mg/kg bw of *Sesbania grandiflora* aqueous suspension (Ramesh *et al*., 2010, Ramesh *et al*., 2008) [28-27]. According to Doddola and Pasupulati, 2008 [8], the juice extracted from leaf showed significant antiurolithiatic activity against calcium oxalate-type stones in rats. Moreover Pari and Uma, 2003 [25] showed the ethanol extract of leaves exhibiting a significant protective effect against erythromycin estolate-induced hepatotoxicity. The anticonvulsive activity of leaves was evaluated using a variety of animal models of convulsions (Kasture and Deshmukh, 2002) [18]. Furthermore, wound healing activity of methanol extract of bark had been evaluated by using excision wound model in Wistar albino rats (Karthikeyan, 2011) [16]. Not only exterior parts, seed oils of *Sesbania grandiflora* were investigated for their anthelmintic property against *Pheritima pasthuma* (Jalalpurea, 2006) [15].

According to Sertié *et al*., 2001 [31], 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 ED_{50} of 36.75 mg/kg. Sertié describes the preventive antiulcer activity of *S. grandiflora* as a result of presence of 'tannins' and 'triterpenes' in the bark extract. 'Tannins' have astringent action, precipitating proteins of

mucosal membranes and skin (Costa, 1975) [6]. According to Tani (1979) [34] and Esaki *et al*. (1986) some tannins suppresses the gastric secretion, having a local action of protection of the gastric mucosa in stress-induced gastric lesion in rats. In Sertié's experiment, the action of the extract when administered intraperitoneally also prevented acute gastric mucosal injury produced by stress-induced lesions, revealing that probably not only tannins may be responsible for the antiulcer action leading to Sertié's assumption towards triterpenes. Some triterpenes are known as antiulcer agents and its action has been mentioned to be due to: (I) activation of cellular protection (Hara, Okabe, 1985; Murakami *et al*., 1982); (II) reduction of mucosal prostaglandins metabolism-citoprotective action (Konturek, 1986), and (III) reduction of gastric vascular permeability (Wagner, 1982). Further the experimental extract also revealed an important protective effect on gastric mucosa, when administered concomitantly with nonsteroidal anti-inflammatory drugs, without interfering with the antiflogistic activity of NSAID (Sertié *et al*., 2001) [31]. According to Bhoumik *et al*., 2016 [2], ethanolic extract of *Sesbania grandiflora* leaves possesses anti-ulcer activity which might be due to its antisecretory and cytoprotective nature.

Bhalke *et al*., 2010 [29], used an 'Ulcer index' parameter to evaluate of anti-ulcer activity since ulcer formation is directly related to factors such as reduction in gastric volume, decrease in fre and total acidity. Bhalke *et al*., 2010 [29], identified that ethanolic extract of leaves at the dose of 400mg/kg has decreased the intensity of gastric mucosal damage induced by ulcerogenic agents. This ethanolic extract at the dose of 400mg/kg produced a significant (p<0.05) reduction in the ulcer index 21.41and showed protection index of 84.95%. Bhalke *et al*., 2010 [29], suggests the possible protective effect of ethanolic extract of *Sesbania grandiflora* against asprin induced gastric lesions could be due to prevention of direct irritation, increased mucus secretion and due to its 5-lipoxygynase inhibitory effect. Furthermore, ethanolic extract of *Sesbania grandiflora* showed the ability to reduce significantly the severity of ulceration of stomach induced by absolute ethanol. This ethanolic extract at the dose of 400mg/kg produced a significant (p<0.05) reduction in the ulcer index 36.00 and showed protection index of 69.36%. The results of histopathological investigation revealed that the pretreatment with ethanolic extract of *Sesbania grandiflora* absolutely prevented the ethanol induced congestion, hemorrhage, edema, necrosis, inflammatory and dysplastic changes, erosions and ulcerations in the gastric mucosa of rats. Moreover, ethanolic extract of *Sesbania grandiflora* showed significant (p<0.05) effectiveness at indomethacin induced ulcers (protection index of 70.68%) and pylorus liagation induced ulcers (protection index of 61.08%). in Bhalke's experiments. Bhalke *et al*., 2010 [29] agrees with Sertié *et al*., 2001 [31] at presence of tannins in *Sesbania grandiflora* plays a major role in anti-ulcer effect. Moreover, he brings up the presence of flavonoids in *Sesbania grandiflora* as the other important cause for anti-ulcer effect. Tannins have astringent action precipitating proteins of mucosal membranes and skin (Bhalke *et al*., 2010) [29]. Some tannins are known to suppresses the gastric secretion, having a local action of protection of the gastric mucosa (Tani *et al*., 1979) [34], (Esaki *et al*., 1986).

Himgauri *et al*., 2012 [12] experimented on ethanolic leaf extract of *Sesbania grandiflora*. According to their experiment, the leaves extract of *Sesbania grandiflora* prevented acute gastric mucosal injury induced by aspirin. The leaves extract did not modify the volume, pH and hydrochloric acid content of gastric secretion. It is known that pepsin requires acidic digestion medium for protein digestion. At pH of 1.6-3.2, the pepsin is most active. Its digestive enzymatic activity decreases as the gastric pH increases. The lack of change in gastric secretion parameters observed with *Sesbania grandiflora* leaves extract may be important because it may not interfere with the process of food digestion and the absorption of diet proteins, avoiding opportunistic infections of the digestive tract (Himgauri *et al*., 2012) [12]. Interestingly Himgauri's study also agrees with importance of tannins' presence in *Sesbania grandiflora* in related to anti – ulcer activity. Further they have identified the significance of triterpenes in related to anti – ulcer reaction. Some triterpenes are known as antiulcer agents and its action has been mentioned to be due to activation of cellular protection, reduction of mucosal prostaglandins metabolism, cytoprotective action and reduction of gastric vascular permeability. Repeatedly in this experiment also the ethanolic extract of *Sesbania grandiflora* prevented acute gastric injury in rats. Stress and nonsteroidal anti-inflammatory drug induced lesions were significantly prevented by the extract (Himgauri *et al*., 2012) [12].

In an Overall view, *Sesbania grandiflora* has shown a substantial and significant protection against ulcers using various parts of the plant. This protective effect might have been mediated by both anti- secretory and cytoprotective mechanisms. Further insight into the mechanisms, actions and complete potency of *Sesbania grandiflora i*s needed and it's encouraged the usage of this plant in contemporary medicine.

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