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Ajeet Singh

Department of Botany and
Microbiology, Gurukul Kangri
University, Haridwar, Uttarakhand-
249404, India

Navneet

Department of Botany and
Microbiology, Gurukul Kangri
University, Haridwar, Uttarakhand-
249404, India

Ethnomedicinal, Pharmacological Properties and Phytochemistry of *Sida spinosa* Linn. A mini review

Ajeet Singh*, Navneet

ABSTRACT

The comprehensive survey information as provided in this review on *Sida spinosa* Linn traditional uses, ethanobotanical aspects, phytochemistry and pharmacology. The plant has a variety of traditional uses. Leaves are reported to possess demulcent, refrigerant properties, and are useful in cases of gonorrhoea, gleet and scalding urine. They are bruised in water and the filtrate is administered. Root is used as a tonic and diaphoretic and is given in mild cases of debility and fever. A decoction of it is said to be given as a demulcent in irritability of bladder and in gonorrhoea. Decoction given as a demulcent in irritability of bladder and genitourinary tract. Leaves are used as demulcent and refrigerant; used for scalding urine. *Sida spinosa* possesses various traditional and pharmacological properties includes antibacterial, antifungal, anti-helminthic, anti-fertility, antidiabetic, anti-inflammatory, antioxidant, anti-HIV, anti-arthritic, cytoprotective, hepatoprotective, anti-diarrhoeal and analgesic activities of *Sida spinosa*.

Keywords: *Sida spinosa* Linn., traditional medicine, antimicrobial potential, pharmacology and phytochemistry.

1. INTRODUCTION

About 3.4 billion peoples in the developing world depend on plant based traditional medicines. Natural products have been an integral part of the ancient traditional medicine systems (Ayurveda) [1-2]. Plants have unlimited ability to synthesize secondary metabolites such as tannins, terpenoids, alkaloids, glycosides and phenols which have been found to have antimicrobial properties. It has been estimated that 14-28% of higher plant species are used in medicinal purposes and that 74% of pharmacologically active plant derived components were discovered after following up on ethnobotanical uses of the plants [3-5].

Sida is a large genus with about 200 species distributed throughout the world and 17 are reported to occur in India [6]. All the species of this genus are annual herbs except *S. rhombifolia* which is a perennial herb. In India *Sida* species generally occur as weeds of waste places, open scrub forests and along roadsides throughout the tropical and subtropical plains.

Sida spinosa Linn. belongs to the family malvaceae. It is an erect, branched small perennial herb (or) small shrub which grows abundantly on cultivated fields, waste areas, road sides and open clearing in India. The plant has a variety of traditional uses. Leaves are reported to possess demulcent, refrigerant properties, and are useful in cases of gonorrhoea, gleet and scalding urine. They are bruised in water and the filtrate is administered. Root is used as a tonic and diaphoretic and is given in mild cases of debility and fever. A decoction of it is said to be given as a demulcent in irritability of bladder and in gonorrhoea [7-9]. Decoction given as a demulcent in irritability of bladder and genitourinary tract. Leaves are used as demulcent and refrigerant; used for scalding urine. Ethnobotanical survey conducted by Khare (2007) reveals that ethanol extract of the plant *S. spinosa* exhibits hypoglycaemic activity [10]. Recent studies suggest that the ethanol extract of the plant *S. spinosa* has significant antidiabetic activity [11]. Shaikh *et al.*, (2015) [12] *S. spinosa* exhibits hypoglycemic, antipyretic and diaphoretic activity.

1.1 Plant description

S. spinosa is an erect annual hairy herb having height up to 70 cm. Leaves are ovate-oblong or lanceolate, obtuse or acute, 1-4 cm long, serrate, leaving a distinctive, spine like scar on falling. Flowers are axillary, solitary or 2-5 together; corolla yellow; mericarps 5, trigonous, strongly reticulately veined, hairy at apex; seed ovoid. Flowering and fruiting occurs in October- December [13, 7].

Correspondence:

Ajeet Singh

Department of Botany and
Microbiology, Gurukul Kangri
University, Haridwar, Uttarakhand-
249404, India

Email: ajeetchoudharykv[at]gmail.com

1.2 Taxonomy

Kingdom-Plantae
Division-Tracheophyta
Class-Magnoliopsida
Order-Malvales
Genus-*Sida*
Species-*spinosa*

1.3 Habit and habitat

It is a weed of waste places distributed at higher and lower altitudes in South India. It is an annual herb seen in Deccan and Karnatic Districts. The leaves are obtuse, pedicels jointed near the flower [14]. It is widely distributed in Bangalore, Belgaum, Chikmagalur, Dharwar, Hassan, Mysore, and North Kanara regions of Karnataka, India [15].

1.4 Common name

Sida alnifolia
S. Spinosa, *S. alba*

2. TRADITIONAL USES

The genus *Sida* is used as 'Bala' in Ayurveda. Bala is of great importance in the Indian traditional system of medicine and this is perhaps the most widely used raw drug in the production of different Ayurvedic formulations. Root is the medicinal part. The drug called 'Bala' in Sanskrit is well reputed as anti-rheumatic and anti-pyretic in the Ayurvedic system of medicine and is also used for curing neurological disorders, headache, leucorrhoea, tuberculosis, diabetes, fever and uterine disorders. It is also reported to possess anti-tumor, anti-HIV, hepatoprotective, abortifacient, antimicrobial and immune-stimulant properties [6]. Khare (2007) reported that the roots of *S. spinosa* are used as nervine tonic and diaphoretic, in debility and fevers [10]. 'Nayopayam kashayam' is a simple ayurvedic preparation of 'Bala'. The source of *Bala* for the preparation of kashayam in northern India is *S. cordifolia* while in Kerala it is *S. alnifolia*.

Root, Leaves and Bark

S. spinosa is used in treatment of asthma and other chest ailments and as a tonic [16]. Ethanolic extract of the *S. spinosa* exhibits hypoglycaemic activity. It depressed the normal blood pressure and lowered the activity of smooth muscles of the ileum of experimental animals [10]. The roots and leaves of *S. spinosa* are used in treatment of diarrhoea and dysentery [17].

Leaves

The leaves are demulcent and refrigerant and are useful in cases of gonorrhoea, gleet and scalding urine [18].

Root and Root Bark

The root of *S. spinosa* acts as a gentle tonic and diaphoretic, and is employed in mild cases of debility and fever.

The decoction of the root bark and root of *S. spinosa* are used as a demulcent in irritability of the bladder and in gonorrhoea [18].

Action and uses in Ayurveda

The root, leaf and fruit destroys "kapha" and "vata", tonic in wasting disease; cure ulcers and biliousness; useful in urinary discharges, leprosy and skin infections; the fruit is also astringent and cooling [18].

Action and Uses in Siddha

It is used in treatment of leucorrhoea, respiratory disorder, healing of wounds, tonic and as diaphoretic [19].

3. PHARMACOLOGICAL PROPERTIES

S. spinosa has been used in traditional medicine for treatment of diarrhoea and dysentery, skin diseases, asthma and other chest ailments, snakebite, etc. Ethno-botanical survey conducted by Khare (2007) revealed that roots of *Sida spinosa* are used as nervine tonic and diaphoretic, in debility and fevers [10]. The plant has a variety of traditional uses. Leaves of *S. spinosa* are reported to possess demulcent, refrigerant properties, and are useful in cases of gonorrhoea, gleans and scalding urine. They are bruised in water and the filtrate is administered. Root of *S. spinosa* is used as a tonic and diaphoretic and is given in mild cases of debility and fever. A decoction of it is said to be given as a demulcent in irritability of bladder and in gonorrhoea [7, 20, 9]. It is used as tonic and for the treatment of asthma and other chest ailments. The ethanol extract of *S. alnifolia* possesses hypoglycaemic activity. It also depressed the normal blood pressure. It is a tonic in wasting diseases, cures ulcer and biliousness, useful in urinary infection, leprosy and skin infection. The leaves possess demulcent and refrigerant properties and useful in gonorrhoea, gleet and scalding urine. The roots of *S. spinosa* are used as tonic diaphoretic and useful in treatment of fever, debility as demulcent in irritability of bladder [21].

3.1 Antibacterial activity

Selvadurai *et al.*, (2011) [22] reported the antibacterial activity of ethanol extract of whole plant of *S. spinosa* against *Staphylococcus aureus*, *Bacillus subtilis*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Candida albicans* and *Aspergillus niger*. Navaneethkrishnan *et al.*, (2011) [20] reported the antibacterial activity of ethanol leaf extract of *S. spinosa* against *S. aureus*, *B. subtilis*, *E. coli*, *P. aeruginosa*, *C. albicans*, and *A. niger*. The ethanol leaf extract of *S. spinosa* and shown a potential activity against growth of both Gram positive and Gram negative bacteria. It effectively inhibited the growth of *Bacillus subtilis* and gave a sensitive activity against *S. aureus*, *E. coli*, *P. aeruginosa* when compared with ciprofloxacin and *C. albicans*, and *A. niger* showed significant inhibition activity, When compared with amphotericin B. Karteek *et al.*, (2011) [23] reported the *in vitro* antibacterial activity of ethanol leaf extract against *E. coli*, *B. subtilis*, *S. aureus*, *P. aeruginosa*, and *P. vulgaris*. Sangreskopp *et al.*, (2013) [24] reported antibacterial activity of *S. spinosa* aqueous root extract against *S. aureus*, *B. subtilis*, *E. coli*, and *P. aeruginosa*.

3.2 Antifungal activity

Selvadurai *et al.*, (2011) [22] reported antifungal activity of *S. spinosa* whole plant extract against *Candida albicans* and *Aspergillus niger*. Navaneethkrishnan *et al.*, (2011) [20] reported antifungal activity of *S. spinosa* ethanol extract of leaves against *C. albicans* and *A. niger*.

3.3 Antihyperglycemic and antidiabetic activity

The potent antihyperglycemic effect exhibited by aqueous extract in STZ-induced diabetic rats. *S. spinosa* root is beneficial in controlling diabetes by reducing blood glucose and increasing the level of insulin. Antihyperlipidemic efficacy is due to increase in secretion of insulin from pancreatic β -cells by the plant extracts [11].

3.4 Antipyretic activity

The aqueous extract of *S. spinosa* root possesses a significant antipyretic effect in yeast provoked elevated body temperature. The aqueous extract at higher dose caused a significant reduction in body temperature, with the effect being comparable with that of aspirin. Aspirin produces antipyretic action, through inhibition of prostaglandin synthesis within the hypothalamus. Therefore it appears that antipyretic action of aqueous extracts of *S. spinosa* root may be related to the inhibition of prostaglandin synthesis in hypothalamus which is mainly because of presence of flavonoids and phenolics tannins in aqueous extract of *S. spinosa* root [24].

3.5 Diuretic activity

Aqueous and alcoholic extracts of *S. spinosa* leaves were tested for diuretic activity in rats.

The parameters studied on individual rat were body weight before and after test period, total urine volume, urine concentration of Na⁺, K⁺ and Cl⁻. In the present study alcoholic and aqueous extracts of *S. spinosa* leaves (100mg/kg of body weight) showed increase in urine volume, cation and anion excretion [25].

3.6 Antioxidant activity

Jayasri *et al.*, (2011) [26] reported that ethanolic extract of *S. spinosa* was screened for their free radical, hydroxy radical, superoxide and nitric oxide scavenging activity. Total antioxidant activities of ethanolic extract were compared with standard antioxidants ascorbic acid, copper sulphate 2, 6-di-ter-butyl-phydroxytoluene (BHT). Results indicated that the ethanolic extract exhibited antioxidant potential of *in vitro* screening methods. The results indicated that ethanolic extract showed moderate activity against standard drugs.

3.7 Wound healing activity

Navaneethakrishnan *et al.*, (2011) [20] reported the ethanolic leaf extract of *S. spinosa* (5% w/w and 10% w/w) are in the form of an ointment was used for evaluating the wound healing potential in excision and incision model. In the excision model the extract treated wounds were found to epithelialize faster and the rate of wound contraction was higher, as compared to control wounds. The extract facilitates the healing process as evidenced by increase in the tensile strength in the incision model. The results were also comparable to those of a standard drug 0.2 % w/w of nitrofurazone.

4. PHYTOCHEMISTRY

Narendra *et al.*, (2011) [25] reported the preliminary phyto chemical analysis of aqueous, alcoholic leaves extracts showed the presence of flavanoids, glycosides, saponins, carbohydrates, proteins and amino acids, tannins, terpenoids and alkaloids in all the extracts.

Selvadurai *et al.*, (2011) [22] studied the preliminary phytochemical analysis of the whole plant of *S. spinosa* and found alkaloids, carbohydrates, glycosides, flavonoids, phytosterols, fixed oils and fats, saponins, phenolic compounds and tannins, lignins, proteins and free amino acids, and gums and mucilage in petroleum ether, chloroform, acetone, alcohol and aqueous extracts.

The root contains alkaloids- betaphenethylamine, ephedrine, si-ephedrine, vasicinol, vasicinone, vasicine, choline, hypaphorine, methyl ester, betaine [10], phytosterols, α -amyrin, starch and ecdysterone. Roots are used as nervine tonic and diaphoretic, in debility and fevers [15].

Alkaloids: [16].

- Phenethyl amine bases i) β - phenethylamine ii) Ephedrine iii) Ψ -ephedrine
- Quinazoline i) Vasicine ii) Vasicinol iii) Vasicinone
- Choline
- Betaine
- Hypaphorine
- Hypaphorine methyl ester
- Cryptolepine
- Gossypol
- S-(+)-Nb methyl tryptophan methyl ester
- S-(+)- Nb,Nb dimethyl tryptophan methyl ester.

5. CONCLUSION

S. spinosa reside in a significant place in the Ayurvedic medicine in all over, India, Sri Lanka including tropical Asia and Africa. It is fascinating to message that pure phytochemicals and crude extracts of leaves of *S. spinosa* Linn. have been screened for some pharmacological activities and found to have analgesic, anti-inflammatory, hepato-protective activity and stem bark of the plant have anti-diabetic activity, and juices are screened for hypocholesterolemic and antioxidant activity.

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Conflict of Interest

Authors are no conflict of interest.

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