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A Review on *Sida spinosa* Linn.

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ABSTRACT

The plant *Sida spinosa* Linn belongs to the family Malvaceae, is a popular Ayurvedic remedy for the treatment of various disorders. *Sida spinosa* Linn., is one of the important species of *Sida* genus which is found through out the tropical and subtropical region of both hemispheres of India and Srilanka. It is also known as “Nagabaala” in Hindi and Sanskrit. The plant name Bala is coined on the name of ‘Parvati’ (Goddess of strength and beauty). It is abundantly found throughout the hotter parts of India from North West India to Ceylon and Tropical and subtropical regions of both hemispheres. The root, bark, leaves of this plant are traditionally used for the treatment of leucorrhoea, respiratory disorders, healing of wounds, tonic, diaphoretic, asthma, chest ailments and also in diarrhoea and dysentery. The plant was found to contain phytoconstituents like alkaloids, glycosides, phytosterols, tannins, flavanoids, lignins and saponins. The plant is rich in alkaloids and various phytochemical constituents like glyceryl-1-eicosanoate and 20-hydroxy, 24-hydroxymethylecdysone, Apigenin and Kaempferol has been isolated from this plant. This plant showed antipyretic & antimicrobial, anti diabetic, antioxidant and diuretic activity. This review summarizes the list of phytochemical compounds isolated and pharmacological activities over the past few decades.

Keywords: *Sida spinosa* Linn., Pharmacognostical review, Phytochemical compounds, Pharmacological activities.

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INTRODUCTION

The genus of *Sida* comprises of about 987 species of the Malvaceae family is traditionally used to for the treatment various diseases. *Sida spinosa* Linn., is one of the important species of this genus which is found throughout the tropical and subtropical region of both hemispheres of India and Srilanka. It is also known as “Nagabaala” in Hindi and Sanskrit¹ The plant name Bala is coined on the name of ‘Parvati’ (Goddess of strength and beauty). *Sida spinosa* is found to contain ephedrine, beta phenylethylamine, vasicinol, vasicinone as main constituents. The root, root bark and leaves of this plant are traditionally used for the treatment of leucorrhoea, respiratory disorders, healing of wounds, tonic, diaphoretic, asthma, chest ailments and also in diarrhoea and dysentery. The present review highlights the contribution of *Sida spinosa* in modern system of herbal medicine for new drug development.

Plant description²

Sida spinosa Linn. (Malvaceae) is an erect, branched small perennial herb (or) small shrub with grey minute stellate hairs, which grows abundantly on cultivated fields, waste areas, road sides and open clearing in India.

Plant Taxonomy³

Kingdom	:	Plantae – Plants
Subkingdom	:	Tracheobionta – Vascular plants
Superdivision	:	Spermatophyta – Seed plants
Division	:	Magnoliophyta – Flowering plants
Class	:	Magnoliopsida – Dicotyledons
Subclass	:	Dilleniidae
Order	:	Malvales
Family	:	Malvaceae – Mallow family
Genus	:	<i>Sida</i> L. – fanpetals
Species	:	<i>Sida spinosa</i> L. – prickly fanpetals

Synonyms

Sida alba Linn

Sida angustifolia Linn

Sida glandulosa Linn

Common Names⁴

False mallow, Indian mallow, Prickly fanpetals, Prickly mallow, Prickly Sida, Spiny sida, teaweed, Thistle mallow.

Vernacular names⁵

Arabic	:	Kulbahebarri
Bengal	:	Bonmethi, Gorakchaulia, Pilabarela
Deccan	:	Janglimethi
Gujarati	:	Kantalobal
Hindi	:	Bariara ,Gangeran, Gulsakari, Janglimethi, Khareti;
Malayalam	:	Kattaventiyaam, Mayirmanikkam
Marathi	:	Gandedhaman, Gangeti, Kanteritukati
Sanskrit	:	Avishta, Bhadrاندani, Nagabala, Pila, Vishvadeva
Tamil	:	Arivalmanaippundu, Mayirmanikkam
English	:	Prickly sida, Spiny sida
Telugu	:	Chinnamuttamu, Mayilumanikyam.

Habit and Habitat⁵⁻⁷

It is a small erect or suberect, annual or perennial branched shrub, stellate, 30 cm to 1 m tall, found throughout the hotter parts of India from North West India to Ceylon and Tropical and subtropical regions of both hemispheres, ascending to an altitude of 1350 m. The plant starts flowering usually during the rainy and cold seasons mostly from October to December, but may occasionally bear flowers all through the year. The young shoots covered with soft grey mealy stellate down and bearing simple small ovate or rounded cordate, variable leaves usually with two or occasionally three, small or minute, stiff somewhat spiny projections or articulates near the flower.

Phytochemical Constituents

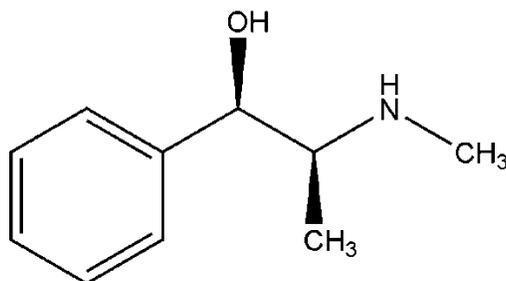
The plant was found to contain phytoconstituents like alkaloids, glycosides, phytosterols, tannins, flavanoids, lignins and saponins⁸.

Alkaloids

The root contains alkaloids-beta phenethylamine, ephedrine, si-ephedrine, vasicinol, vasicinone, vasicine, choline, methyl ester, hypaphorine and betaine. These alkaloids are present in aerial parts as well⁶.

Ephedrine

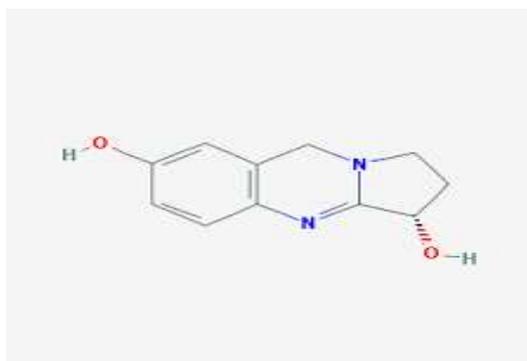
Chemical name: 2 methyl amino-1-phenylpropan-1-ol



Vasicinol

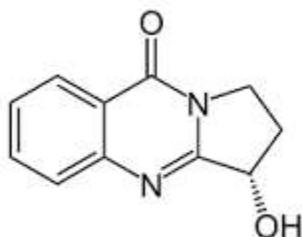
Chemical name: 1,2,3,9-Tetrahydropyrrolo [2,1-b] quinazoline-3,7-diol, 9CI. 7-

Hydroxypeganine. 7-Hydroxyvasicine



Vasicinone

Chemical name: 2,3-Dihydro-3-hydroxypyrrolo [2,1-b] quinazolin-9 (1H)-one, 9CI



Traditional Uses

Parts Used- Root, Leaves and Bark

Sida spinosa Linn is used in treatment of asthma and other chest ailments and as a tonic⁹. Ethanolic extract of the plant exhibits hypoglycaemic activity. It depressed the normal blood pressure and lowered the activity of smooth muscles of the ileum of experimental animals⁶. The roots and leaves of *Sida spinosa* Linn are used in treatment of diarrhoea and dysentery¹⁰.

Leaves⁵

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

Root and Root Bark⁵

The root 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 is used as a demulcent in irritability of the bladder and in gonorrhoea.

Action and uses in Ayurveda⁵

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.

Action and Uses in Siddha¹¹

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

Pharmacognostical Review

Morphology^{5,12}

Leaves

Leaves are up to 2-4 cm long, elliptic, crenate, obtuse or crenate at the base, rounded or narrowed at the top to obtuse triangular, not acuminate, ultimately glabrate above, grey beneath. These are alternate, elongated, with toothed margins, Figure 1, 2.



Figure 1: Leaves (Back side)



Figure 2: Leaves

Petioles

Petioles are 1.2-2.5 cm long with often 1-3 small recurved spines beneath the petiole, Figure 3.



Figure 3: Petiole

Flowers

Pedicles are 0.2 cm long, clustered or solitary, jointed just below the calyx. Calyx grey, stellately hairy; lobes triangular, axillary, situated at the end of short pedicels, sometimes in small clusters. Corolla slightly exceeding the calyx, pale yellow. Carpels 5, pubescent; awns 2, about half the length of the carpel from a conic base, slightly divergent, with spreading or erect hairs, Figure 4.



Figure 4: Flower

Mericarp

Apical surface is smooth, puberulent, lower dorsal & lateral walls strongly reticulate, 5 mericarps, 3-4 mm long, grading apically into 2 antrorsely pubescent awns 0.5-1.5 mm long, Figure 5, 6.



Figure 5: Mericarp (Fresh)



Figure 6: Mericarp (Dried)

Seeds

Seeds are 1.5 mm long, glabrous or with a few hairs around the hilum, smooth, brown to black, Figure 7.



Figure 7: Seed

Microscopic Description¹²

The microscopic characters for the leaves, stem, petiole and root of *Sida spinosa* Linn., are as follows

Leaves

The leaflets have thick abaxially projecting midrib and lamina. It consists of prominent epidermal layer of wide squarish thick walled cells. The vascular strand is single, broadly bowl shaped and collateral. The lamina is distinctly dorsiventral with adaxial, abaxial differentiation consists of epidermal cells and compact mesophyll tissue. Epidermal trichomes are seen especially on the abaxial side of the lamina. The stellate trichomes are evident on abaxial surface of the lamina. The abaxial epidermis is stomatiferous, the epidermal cells are thick walled and have wavy anticlinal wall, the stomata is Anomocytic (irregular epidermal cells which are indistinguishable from other epidermal cells. i.e; subsidiary cells are absent). The guard cells are 15x25 μm in size.

Stem

The vascular system of the young stem occurs in a continuous cylinder of secondary xylem surrounded by secondary phloem. The xylem elements are present in radial files of three or four elements in parallel with xylem fibres; the vessels are narrow, circular or elliptical and thick walled. The phloem occurs as a narrow strip around the xylem cylinder; pith is wide and consists of thin walled polygonal shaped parenchyma cells; starch grains are abundant in the pith cells of the stem.

Root

Primary xylem elements are present in the center of the root; secondary phloem occurs as a narrow band around the xylem cylinder.

Powder analysis

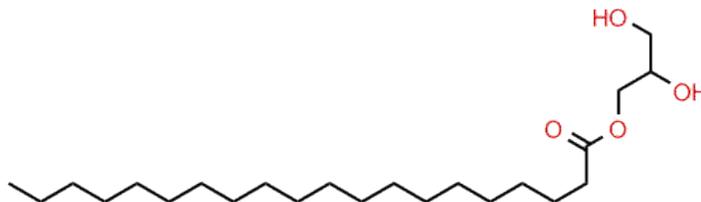
Powder analysis on the whole plant of *Sida spinosa* showed the presence fibers, vessel elements.

The quantitative microscopy for the leaves of *Sida spinosa* like vein islet & vein termination were estimated.

Phytochemical Review

Three types of alkaloidal constituents, viz., beta-phenethylamines, quinazolines and carboxylated tryptamines, in addition to choline and betaine have been isolated from *Sida acuta* Burm., *S. Humilis* Willd., *S. rhombifolia* L., and *S. Spinosa* L. are characterized by their physical and spectral properties and by chemical transformations. The qualitative and quantitative variations in the alkaloidal constituents of roots and aerial portions at different stages of growth were also noted. Elaboration of the quinazoline alkaloids seems to be a characteristic feature of this genus.

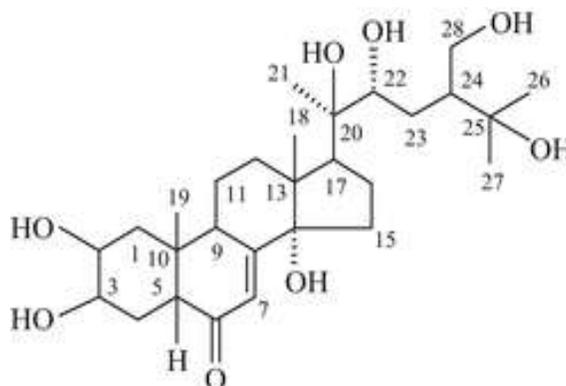
The favourable combination of sympathomimetic amines and vasicinone in these species would account for their major therapeutic uses in the Indian system of medicine⁹. Two compounds were isolated from the aerial parts of *Sida spinosa* L. Their structures have been established as glyceryl-1-eicosanoate and 20-hydroxy, 24-hydroxymethylecdysone by 1D and 2D-NMR techniques. In addition 12 known compounds have been isolated and identified¹³.



Glycerol 1-eicosanoate

Formula: $C_{23}H_{46}O_4$

MW: 386.61

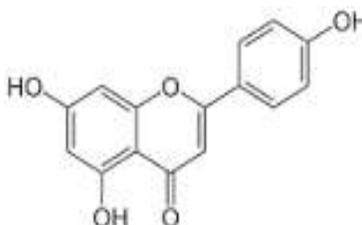


20-hydroxy, 24-hydroxymethylecdysone

Formula : $C_{28}H_{46}O_8$

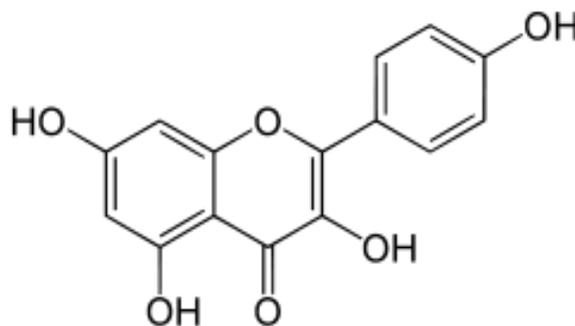
Mol wt : 510.3192

Two compounds were isolated from Ethyl acetate extract of *Sida spinosa* which were Apigenin, Kaempferol. Characterization and structural elucidation of isolated marker compounds were carried out by different spectroscopic methods: UV, IR, NMR, Mass spectroscopy⁷.



Apigenin

Molar mass: 270.24 g/mol

**Kaempferol**

Formula: C₁₅H₁₀O₆

Molar mass: 286.23 g/mol

Biological Review

Antipyretic and Antimicrobial Activity¹⁴

Aqueous extract demonstrated highly significant ($P < 0.01$) antipyretic activity during various assessment times (1-5 h) when challenged in yeast induced pyrexia test. Maximum attenuation (65.73% at 3h) was observed at 400mg/kg o.p. Antimicrobial activity against *S. aureus*, *B. subtilis*, *E. coli* and *S. aeruginosa*, was also carried out. All microbes were sensitive and activity was concentration dependent. *Sida spinosa* Linn., root possesses potent antipyretic and antimicrobial activity and has therapeutic potential.

Anti Diabetic Activity¹⁵

Anti diabetic effect of ethanolic extract of *Sida spinosa* Linn., whole plant was studied in normal and alloxan induced (120mg/kg, single intraperitoneal injection) diabetic rats. Anti diabetic activity in normal rats was tested after administration of 200mg/kg and 400mg/kg of test extract. Glibenclamide was used as reference drug and showed significant anti diabetic effects in normal rats. In anti diabetic study a dose of 200 mg/kg of ethanolic extracts has shown reduction in triglycerides (TG), cholesterol and glucose level.

Anti Microbial Activity^{16,17}

The test organisms were *Staphylococcus aureus*, *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Candida albicans*, *Aspergillus niger*. Amongst the test extracts the results suggested that Ethanolic extract to whole plant of *Sida spinosa* showed antimicrobial activity. All the different concentration of ethanolic leaf extracts of *Sida spinosa* exhibited the concentration dependent significant anti microbial activity comparable with ciprofloxacin 5µg/disc and amphotericin B 30µg/disc were used respectively as standard for bacteria and fungi stains.

Anti oxidant activity¹⁸

The ethanolic extract of *Sida 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-p-hydroxytoluene (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.

Diuretic Activity¹⁹

Aqueous and alcoholic extracts of *Sida 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 *Sida spinosa* leaves (100mg/kg of body weight) showed increase in urine volume, cation and anion excretion. Furosemide was used as reference diuretic.

CONCLUSION

In recent years emphasis of research has been focussed on utilizing traditional medicines that have long proven history of treating various ailments. In this regard a thorough extensive literature survey revealed that many biological important constituents were isolated from *Sida spinosa* like glyceryl-1-eicosanoate and 20-hydroxy, 24-hydroxymethylecdysone, Apigenin and Kaempferol. This review also reports the various pharmacological potentials which are explored by various researchers like antipyretic and antimicrobial, anti diabetic, antioxidant and diuretic activity. Much more attention should be focussed on *Sida spinosa* Linn., for its potential in preventing and treating various diseases.

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