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PHYTOPHARMACOLOGICAL ACTIVITIES OF *SPERMACOCE LATIFOLIA* AUBL: A REVIEW

C. K. Amritha*¹ and Elamaran Tamil Jothi¹

¹Department of Pharmacology, Devaki Amma Memorial College of Pharmacy, Chelembra, Malappuram, Kerala, India.

ABSTRACT

Spermacoce latifolia Aubl. Commonly known as broad leaf button weed is an important ethnobotanical plant belonging to the Rubiaceae family which is having a lot of medicinal properties. Traditionally it has been used for the treatment of malaria, boils and other skin diseases. The plant has been reported to have antimicrobial, larvicidal, cytotoxic and anti-diabetic activity. A few phytochemical studies on this plant revealed the presence of secondary metabolites like alkaloids, iridoids, flavonoids, tannins, triterpenoids, and phenolic compounds. It consists of pharmacologically important phytochemical constituents like ursolic acid, stigmasterol, and β sitosterol. This review involves all the updated information on the phytochemical constituents and biological activities of *Spermacoce latifolia* Aubl.

KEYWORDS

Spermacoce latifolia Aubl, Rubiaceae, Traditional uses, Phytochemical constituents and Bioactivity.

Author for Correspondence:

Amritha C K,
Department of Pharmacology,
Devaki Amma Memorial College of Pharmacy,
Chelembra, Malappuram, Kerala, India.

Email: amrithackammu@gmail.com

INTRODUCTON

Plants have been using for their therapeutic properties in the traditional health care system since prehistoric period. The traditional system of medicine including the Indian Ayurveda, Chinese medicine, Siddha, Arabic Unani medicine continues to be widely practiced on many accounts. According to the World Health Organization (WHO) estimation, almost 80% of the world population is depending on the traditional system of medicine and about 60% of the Indian population depends upon the traditional system of medicines which is the only affordable source of health care especially for the poorest people^{1,2}. The rise in

population, inadequate supply of drugs, increasing cost of modern medicines, side effects of synthetic drugs etc., have led to increased emphasis on the use of plant material as a source of medicines for a wide variety of human ailments³. Medicinal plants are considered as a rich source of structurally diverse classes of biologically active ingredients which attributes to their biological functions. Our nature consists of expansive wealth of medicinal plants which are regarded as the rich source of therapeutic agents for the treatment and prevention of various diseases. There are many plants in the world that are still not explored to reveal their properties in the field of medicine⁴.

Rubiaceae is one of the largest family of flowering plants comprising of about 630 genera and 13,000 species of herbs, shrubs, lianas, small trees and tall canopy trees found worldwide. The *Spermacoce* genus, the largest of the tribe Spermacoceae belonging to Rubiaceae family comprises about 250-300 species of perennial or annual herbs that are widespread in tropical and subtropical America, Africa, Asia, and Europe. *Spermacoce stricta* L.f., *Spermacoce ocymoides* Burm.f., *Spermacoce hispida* L., *Spermacoce confusa* Rendle., *Spermacoce podocephala* DC., *Spermacoce mauritiana* Gideon., *Spermacoce pusilla* Wall., *Spermacoce latifolia* Aubl., *Spermacoce hispida* L. and *Spermacoce articularis* L. were some of the species found in India commonly growing in the open habitats, roadsides and agricultural fields⁵. Some plant species in this genus are important for their traditional uses such as for the treatment of malaria, diarrhoea and other digestive problems, fever, haemorrhage, urinary and respiratory infections, hepatoprotective, headache and skin diseases with alkaloids and iridoids as the major active principles⁶.

Spermacoce latifolia Aubl. Commonly known as broadleaf button weed belongs to the genus *spermacoce* of Rubiaceae family. It is an herbaceous species native to South America. In many tropical and subtropical countries of the world, *Spermacoce latifolia* Aubl. Is known as an exotic invasive plant. In Bangladesh it is locally known as Ghuiojhil Shak and there it is an

important member of medicinal plants. The whole plant is important for its medicinal uses and is widely distributed in Sri Lanka, India, Bhutan, Malay Peninsula, and tropical Africa. It has been used for the treatment of malaria, boils and other skin diseases. All the parts of the plant are having ethnomedicinal importance but there were very few research works conducted on this plant. It has been reported that the plant possesses antioxidant, antimicrobial, cytotoxic, anti-leukemic and larvicidal properties⁷.

Synonyms: *Spermacoce alata* Aubl., *Spermacoce aspera* Aubl., *Spermacoce scrabrida* Pohl ex DC, *Spermacoce caerulescens* Aubl., *Spermacoce bartlingiana* Hemsl., *Borreria alata* Aubl., *Borreria latifolia* (Aubl.) K. Schum., *Borreria eraddi* Ravi, *Borreria sideritis* Cham. and Schltdl., *Borreria perrottetii* DC., *Borreria platyphylla* DC., *Borreria tetraptera* Miq., *Borreria fockeana* Miq., *Tardavel latifolia* (Aubl.), etc⁸.

Habitat

Spermacoce latifolia Aubl. Grows very well in the humid tropical regions or in the sunny or lightly shaded shadow fields. It usually prefers sandy soil. It is a common weed that is growing along with annual upland crops like rice maize etc., and also with sugarcane, rubber, tea etc.,

Distribution

Spermacoce latifolia Aubl. Is native to tropical America but now has a pan-tropical distribution. It is a common weed in Malaysia, Indonesia and Thailand. It is reportedly naturalized in tropical Africa, China, Nepal, India, Sri Lanka, Bangladesh, Andaman Nicobar Islands, Borneo, Java, Myanmar, Sumatra, Queensland, Fiji and Samoa. It grows in open forest and on agricultural land but also found along the road sides, monsoon forest and rain forest. It is distributed in all districts of Kerala and Nilgris in Tamil Nadu.

MORPHOLOGICAL CHARACTERS

Spermacoce latifolia Aubl. Is a prostrate or decumbent perennial herb which grows to about 60cm high but usually much less (Figure No.1).

Leaves

The leaves are simple, sessile to shortly petiolate, opposite, elliptical, and broadest above the middle, tip broadly and shortly pointed, base rounded or cuneate, and apex acute, loosely hispid on both sides with prominent lateral veins. Variable in size about 2.5-5.0cm long and 2.5 cm wide, thick hairy on both sides, ribs are depressed on the upper face, protruding on the underside, short leaf stalk; leaf base joined with cup-shaped stipules with bristles on edges. (Figure No.2).

Stem

Stem is usually thick and fleshy, square in cross-section, with wings along the corners running along the stem, colour varies from yellow-green to reddish.

Flowers

Flowers are bisexual, grouped together in an axillary, stalkless glomerule, Calyx tube 1.5 mm long, corolla is white to a very pale purple, funnel-shaped, outside pilosulous to hirtellous, 4 mm long, hairy at throat, 4 lobes, lobes ovate and acuminate, stamens attached at throat between lobes (Figure No.3).

Fruits

Fruit is a capsule of 2 loculus, one seed per locule, ellipsoid to subglobose, 3 to 4 mm long and 2 to 3 mm in diameter, brown in colour, densely hirtellous and often also hirsute on upper portion, densely puberulent to strigillose on sides, stiffly papery to cartilaginous, septicidal from apex with valves usually remaining connected at base, then both valves loculicidal through septum (Figure No.4).

Seeds

Seeds are 2 in number, 1.5-2 mm long, pale brown or dark brown, elliptical-obovoid, flattened convex, reticulate-rugose on the dorsal side, 1.6 to 3 mm long and 1.2 to 1.8 mm wide and 0.7 to 1.2 mm thick, finely punctuated⁹.

TRADITIONAL USES

Spermacoce latifolia Aubl is considered as one of the important member of the medicinal plants of Bangladesh. The root juice of the plant is used for the treatment of malarial fevers. Leaf paste is used for the treatment of boils by Tanchangya ethnic

people in Bangladesh. It is also included in the treatment of fever, hemorrhage, skin diseases, urinary and respiratory infections¹⁰.

PHYTOCHEMICAL CONSTITUENTS

Spermacoce latifolia Aubl. Has been investigated for its phytochemical composition and has reported the presence of a number of active constituents like stigmasterol, ursolic acid, sitosterol, anthraquinone, naphthoquinone etc., The preliminary phytochemical investigations confirm the presence of alkaloids, flavonoids, triterpenes, iridoids, phenols, etc.,

Sayed Koushik Ahamed *et al*, reported the different chemical tests conducted on the methanolic extract of *Spermacoce latifolia* and revealed the presence of alkaloids¹¹.

Jain-Wen Tan *et al*, reported that the phytochemical study on the whole plant of *Spermacoce latifolia* led to the isolation of a new ursane triterpene acid, 3 β , 6 β , 23-trihydroxy-urs-12, 20(30)-dien-28-oic acid and a new oleanane triterpene acid, 3 β , 6 β , 29-trihydroxy-olean-12-en-28-oic acid together with seven known triterpenic acids whose structures were established by different spectroscopic analytical methods⁷.

Jain-Wen Tan *et al*, also reported that the phytochemical study conducted on the whole plant of *Spermacoce latifolia* Aubl. Led to the isolation of a new anthraquinone, 1, 2, 6-trihydroxy-5-methoxy⁹, 10-anthraquinone, and a new naphthoquinone, (2R)-6-hydroxy-7-methoxy-dehydroiso- α -lapachone, together with three known anthraquinones whose structures were established on the basis of detailed spectroscopic analysis, including one- and two-dimensional NMR, ESI-MS, and HR-ESI-MS techniques⁷.

M.A. Sukari *et al*, isolated some of the major active constituents like ursolic acid, stigmasterol and β sitosterol from *Spermacoce latifolia* Aubl¹².

Ursolic acid is a pentacyclic triterpenoid which is widely found naturally in various stem barks, leaves, fruit peels and vegetables. It possesses several biological and pharmacological effects like anti-oxidant, anti-apoptotic, cardiac protectant, anticarcinogenic, anti-inflammatory etc^{13,14}.

Sitosterol, structurally similar to cholesterol is one of the several phytosterols present in plants. It is found to be beneficial in the treatment of hypercholesterolemia as it can reduce the blood cholesterol level. In Europe, β sitosterol is used in herbal medications for the treatment of Benign Prostatic Hyperplasia (BPH). Chai *et al*, reported that β -sitosterol could inhibit the proliferation of MCF-7 cells, in a dose-dependent manner¹¹. β -sitosterol is also reported for its antioxidant, immunomodulatory, anthelmintic, anti-mutagenic, genotoxicity, analgesic, anti-diabetic and angiogenic properties^{15,16}.

Stigmasterol is one of the potential valuable constituents and has been isolated from many plants to date and evaluated for many pharmacological and biological activities. Stigmasterol was investigated by Gabay O *et al*, for its antiosteoarthritic activity. Stigmasterol has also been investigated for its pharmacological prospects such as cytotoxicity, antitumor, hypoglycaemic, antioxidant, anti-inflammatory and CNS effects¹⁷.

Ana Claudia Oliveira Firak *et al*, reported that the phytochemical results on *S. latifolia* revealed the presence of phenolic, flavonoid, tannin, steroid, free triterpene, coumarin and alkaloid compounds¹⁸.

Shahin Aziz *et al*, reported that the study on the aerial parts of *Spermacocelatifolia* led to the isolation of stigmasterol, 2, 6-di-*t*-butyl-4-hydroxymethylene-cyclohexa-2, 5-dienone and 3 β -hydroxy-12-oleanen-28-oic acid from the chloroform extract and phthalic acid from the methanol extract⁶.

BIOACTIVITY

Antioxidant activity and larvicidal activity

Ana Claudia Oliveira Firak *et al*, reported the larvicidal and antioxidant property of *Spermacocelatifolia* Aubl. The antioxidant potential of the methanolic extract of *Spermacoce latifolia* Aubl. Was determined based on the free radical scavenging activity of 2, 2-diphenyl-1-picrylhydrazyl (DPPH). The content of total phenols (TPs) (482.7 ± 1.8 mg mg GA g⁻¹) and flavonoids (165.4 ± 1.5 mg QE g⁻¹) present in the plant accounted for the antioxidant activity of 150 μ g

mL⁻¹ methanolic extract. The methanolic extract of the aerial parts of the plant was effective in controlling larvicide with LC₅₀ ranging from 0.61 - 0.63 mg mL⁻¹¹⁸.

Anti-microbial activity

Sayed Koushik Ahamed *et al*, reported the antimicrobial activity of methanolic extract of the whole plant *Spermacoce latifolia* Aubl. Against a wide range of both gram-positive (*Bacillus subtilis*, *Staphylococcus aureus*) and gram-negative (*Escherichia coli*, *Salmonella typhi* and *Pseudomonas aeruginosa*) bacteria and also fungi (*Candida albicans*, *Aspergillus niger*) by disc diffusion method using Ciprofloxacin as standard. The crude extract showed mild to moderate antimicrobial activity and could be used as the prophylactic agent in the treatment of many of the diseases¹¹.

Cytotoxic activity

The methanolic extract of *Spermacoce latifolia* Aubl. was screened for its cytotoxic properties using brine shrimp lethality bioassay with the cytotoxic agent Vincristine sulphate as positive control. The results of the brine shrimp lethality bioassay shows that the crude methanolic extract of *S. latifolia* Aubl. possesses cytotoxic principles (with LC₅₀ 32.62 mg/ml) by comparing with positive control vincristine sulphate (with LC₅₀ 0.839 mg/ml).¹¹

In another study, M.A. Sukari *et al*, reported the cytotoxic activity of the extracts and ursolic acid isolated from *S.articularis*, *S.exills* and *S. latifolia* against HL-60 cancer cells through MTT Assay. Most of the extracts of *spermacoce* species exhibited high cytotoxicity against HL-60 cells. The hexane extract of *Spermacoce latifolia* demonstrated moderate activity against the HL-60 cells with the IC₅₀ value of 13.0 ± 0.19 μ g/mL. The isolated ursolic acid from *S. latifolia* Aubl. Showed strong cytotoxic activity against HL-60 cancer cells with an IC₅₀ value of 1.3 ± 0.03 μ g/mL¹²

Antidiabetic activity

Jain-Wen Tan *et al.*, reported the anti-diabetic activity of the isolated compounds from *S. latifolia* by performing α -Glucosidase inhibition assay. It was determined spectrophotometrically in a 96 well

microtiter plate based on p-nitrophenyl- α -D-glucopyranoside (PNPG) as a substrate. The isolated triterpenic acids show significant activity with IC₅₀ values from 0.009 to 0.422Mm, most of which were more potent than the reference compound Acarbose¹⁰.

Table No.1: Vernacular names of *Spermacoce latifolia*

S.No	Language	Name
1	English	Broadleafbuttonweed Oval leaf false buttonweed
2	Malayalam	Tharthaval, Pachapalla, vellatharavu, kudalchurukki
3	Sanskrit	Madanaghanta
4	Kannada	Daarekaddi, Madanganti
5	Nepali	Paundhi

Table No.2: Taxonomy of *Spermacoce latifolia*

S.No	Kingdom	Plantae
1	Phylum	Tracheophyta
2	Class	Magnoliopsida
3	Order	Gentianales
4	Family	Rubiaceae
5	Genus	<i>Spermacoce</i>
6	Species	<i>Spermacoce latifolia</i>
7	Binomial name	<i>Spermacoce latifolia</i> Aublet



Figure No.1: *Spermacoce latifolia* Aubl



Figure No.2: *Spermacoce latifolia* Aubl Leaves



Figure No.3: *Spermacoce latifolia* Aubl Flowers



Figure No.4: *Spermacoce latifolia* Aubl Fruits

CONCLUSION

Spermacoce latifolia Aubl. Is one of the most important plants, which as the most significant values. *Spermacoce latifolia* Aubl. Contains an impressive number of structurally diverse secondary metabolites like alkaloids, iridoids, flavonoids, phenols and terpenoids and is an important source of many pharmacologically and medicinally important phytochemicals like ursolic acid, stigmasterol, β -sitosterol etc., The plant is studied for its pharmacological activities like antioxidant, antimicrobial, antitumor and larvicidal and anti-diabetic. However, the plant had not yet gathered much attention of the researchers. There is a scope to do a more detailed phytochemical and biological study on this plant in the future.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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