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Sphaeranthus indicus Linn.: A Pharmacological Review

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Abstract

Sphaeranthus indicus (SI) Linn. belonging to the family Asteraceae, the whole plant as well as various parts of plant widely used for curing various ailments in the Indian traditional system of medicine. This review focused on review of various pharmacological activities of SI such as anxiolytic, antioxidant, antidiabetic, analgesic, antipyretic, hepatoprotective activity, antimicrobial, antiulcer, anti-inflammatory, neuroleptic, antiviral, ovicidal, anthelmintic activities, and various other activities. Based on vast medicinal use and preclinical trials of this plant, the reported pharmacological activities of SI are covered in this review for exploring the enormous medicinal potential of this plant.

keywords: Asteraceae, *Sphaeranthus indicus* Linn., *Sphaeranthus hirtus*, *Sphaeranthus indicus* Linn. pharmacological activities, *Sphaeranthus mollis* Roxb.

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Introduction

Long before the pre-historic period, utilization of plants has been done for medicinal purposes. It is considered to be very safe as almost none or minimal side effects are observed in treatment with the medicinal plant. It was believed by ancient scholars that the number of health-related problems and diseases can be cured using herbs (National health portal).[1] *Sphaeranthus indicus* (SI) Linn. is an herbal medicinal plant widely used by humankind for curing various illnesses. It is mainly obtained from damp places like rice fields.[2] It is traditionally called Gorakhmundi which has been used in past for the natural treatment of various diseases. SI whole plant is used for the formulation of the medicine. It is pungent and bitter, traditionally been used for glandular swelling in the neck, urethral, discharge, jaundice liver, gastric disorder, chest pain, cough, and bowel complaints.[1-3] Synonyms of SI Linn. are *Sphaeranthus mollis* Roxb. and *Sphaeranthus hirtus* Wild.

Vernacular Names

SI Linn. is known by different names in different parts of India.[1]

Hindi: Gorakhmundi and mundi
Sanskrit: Mahamundi, shravani, tapasvini, mundi, and hapus
Marathi: Barasavodi and gorakhmundi
Bengali: Chagulnadi and ghorkmundi
Gujarati: Bodiokalara, mundi, and dorakhmundi
Tamil: Kottakaranthai
Telugu: Boddatarupa and boddasoram
Urdu: Kamdaryus
English: East Indian globe thistle
Malayalam: Adakkamanian, attakkamanni, and mirangani
Santal: Belaunja
Panjabi: Ghundi, khamadrus, and mundibuti
Undari: Mundi

Taxonomic Classification

Table 1: Taxonomical classification

Kingdom	Plantae
Subkingdom	Viridaeplantae
Phylum	Tracheophyta
Subphylum	Euphyllophytina
Infraphylum	Radiatopses
Class	Magnoliopsida
Subclass	Asteridae
Superorder	Asteranae
Order	Asterales
Family	Asteraceae
Genus	*Sphaeranthus*
Species	*Indicus*

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Geographical Distribution, Habitat, and Propagation

Geographical Distribution

Geographically, SI is mainly originated from India and distributed all over the country, while as a weed, it spreads throughout the other parts of world in tropic regions such as Malaysia, China, and Australia.[2] SI is mainly obtained from damp places such as rice fields, ascending to an altitude of about 1500 m, and is abundantly seen there as a weed. It has different flowering periods depending on the regional environmental conditions. Its flowers are developed from September to March in India while in Java country, flowers are developed from May to February.[3]

Habitat

SI is procured from the natural habitat. After crop harvesting, SI is available to the rice field and wheat field. The spherical violet color flowers appear after the maturation of the plant.[4]

Propagation

Plant seeds are the mode of propagation for SI.

Agro-technique Cultivation and Collection

During raising propagules of SI, well-prepared nursery beds seeds are sown during August month. The germination of this herb takes around 10–12 days. Saplings are prepared within a month to the height approx. Fifty–60 mm then it may be subject to field plantation.

Climate and Soil

It is generally found in paddy grounds and grows usually after the harvesting completion of paddy.[4] Medium clayey soil is used for the propagation of the plant.

Traditional Uses

SI has been used to treat gout and high uric acid levels. It has been explained as one of the best herbs for Gout by the Ayurveda – traditional Indian system of medicine. SI is pungent and bitter, traditionally been used for glandular swelling in the neck, urethral discharge, jaundice liver, gastric disorder, chest pain, cough, and bowel complaints.[1]

Parts Used

The whole plant, seeds, flowers, and roots [Figure 1].

Pharmacological Activities

Anxiolytic Activity

Ambewade *et al.,* 2006, reported prominent anxiolytic activity of petroleum ether of flower part of SI in mice as compared to ethanolic and water extract. Elevated plus maze, open field test, and footshock-induced aggression were used to screening the anxiolytic activity of SI.[5]

Galani *et al.,* 2010, reported the effect of hydroalcoholic extract of SI against experimentally induced anxiety, depression, and convulsions in rodents.[6]

Figure 1: (a–d) Whole plant and parts of the plant. (a) Full image of the plant during the blooming period. (b) Leaves of the plant. (c) Spherical shape purple-colored flower of the plant. (d) Dried brownish color fruit of the plant

Antioxidant Activity

Shirwaikar *et al.,* 2006, exhibited *in vitro* antioxidant activity of ethanolic extract of SI (1000 µg/mL).[7]

Tiwari *et al.,* 2009, described significant *in vivo* antioxidant activity of methanolic extract (ME) of SI. In the rats, there were decreased levels of malondialdehyde due to high levels of glutathione peroxides, superoxide dismutase, and catalase.[8]

Antidiabetic Activity

Kumar *et al.,* 2010, showed a significant level of blood glucose level using petroleum ether extracts of SI flower head (50, 100, and 200 mg/kg) in alloxan-induced diabetes in the rat.[9]

Antihyperglycemic Activity

Dhar *et al.,* 1968, exhibited hypoglycemic activity of 50% ethanolic extract of SI plant.[10] Prabhu *et al., 2008,* reported oral administration of alcoholic extract of SI for consecutive 15 days resulted in a significant normalization in blood glucose levels and increase in plasma insulin and hepatic glycogen levels using nicotinamide (120 mg/kg, i.p.) and streptozotocin (60 mg/kg, i.p.) induced diabetes in rat's model.[11]

Analgesic and Antipyretic

Malairajan *et al.,* 2012, described analgesic and antipyretic activity of petroleum ether, benzene, ethanol, chloroform, and triple distilled water extracts of the whole plant of SI (200 and 400 mg/kg, p.o.). Eddy's hot plate, tail immersion, and brewer's yeast-induced pyrexia methods were used during the studies. Among all of those chloroform, ethanol, and petroleum ether extracts showed significant analgesic activity at both doses from 1 h onward. The aqueous extracts of SI exhibited antipyretic activity from 2 h onward.[12]

Antimicrobial Activity

Duraipandiyan *et al., 2009,* studied the antimicrobial activity of SI L. and reported the significant antibacterial activity of hexane extracts of flower and aerial parts of SI against Gram-positive organisms.[13]

Upadhyay *et al., 2011,* exposed the potential antimicrobial activity flower part of SI then its aerial parts.[14]

Irfan *et al., 2014,* reported the antimicrobial activity of ethanolic, chloroformic, and aqueous, MEs of SI L. It was tested against uropathogenic organisms *Klebsiella pneumoniae*, *Proteus mirabilis*, *Escherichia coli*, and *Pseudomonas aeruginosa*.[15]

Hepatoprotective Activity

Shirode *et al., 2015,* reported that the hepatoprotective activity of SI ethanol extract against rifampicin-induced liver damage.[16]

Antiulcer Activity

Antiulcer activity of the ethanol extract of SI was screened using pylorus ligation, indomethacin, and ethanol-induced ulcer model.[17]

Anti-inflammatory Activity

Jain *et al.,* 2003, showed the anti-inflammatory of aqueous extract of SI plant (root)[18] Heinrich *et al.,* 1998, have also reported anti-inflammatory activity of SI plant.[19]

Neuroleptic Activity

The neuroleptic activity of petroleum ether, alcohol, and water extracts of flower part of SI was used against apomorphine-induced catalepsy and cage climbing model. The neuroleptic activity was found in petroleum ether extract (300 mg/kg, i.p.) in the apomorphine-induced catalepsy model. Catalepsy was seen in aqueous (300 mg/kg, i.p.) and alcoholic (300 mg/kg, i.p.) extracts.[20]

Galani *et al.,* 2009, from the studies reported the neuroleptic activity of hydroalcoholic extract of the whole plant of SI. Hydroalcoholic extract of doses 100, 200, and 500 mg/kg, p.o. produced catalepsy antagonized apomorphine-induced stereotypy and potentiates haloperidol-induced catalepsy.[21]

Sedative Effect

Galani *et al.,* 2009, reported the sedative potential shown by hydroalcoholic extract of the whole herb of SI doses (100, 200, and 500 mg/kg, p.o.). The activity was evaluated using experiments in which it reduced locomotor activity of mice, exploratory activity, and potentiated pentobarbital-induced sleep in mice.[21]

Immunomodulatory Activity

The methanol extract of flower heads of SI and its fractions (100 and 200 mg/kg, p.o.) showed significant immunostimulating activity. Petroleum ether and chloroform extracts from flower heads of SI Linn. were effective in increasing phagocytic activity and delayed-type hypersensitivity.[22]

Shekhani *et al.,* 1990, also reported immunostimulating activity of isolated eudesmanolide from SI.[23]

Antiviral Activity

Antiviral effect of the methanol extract of SI (MESI) was seen in mouse at a concentration as low as 0.4 µg/mL (Dhar *et al*., 1968). Vimalanathan *et al*., 2009, also reported antiviral activity of SI against vaccinia and Ranikhet viruses.[24]

Ovicidal Activity

Sharma *et al.,* 1996, reported the ovicidal activity of petroleum ether extract of SI at 50–250 ppm. In laboratory experiments, marked decrease in mosquito populations was seen due to the mortality rate of larvae, pupae, and adults.[25]

Antifeedant Activity

Ignacimuthu *et al.,* 2006, exhibited the antifeedant activity of MESI against instar larvae of *Spodoptera litura*. 7-hydroxy frullanolide, one of the fractions from the isolated compound showed the highest antifeedant activity at 1000 ppm. Studies also revealed the deformities in larvae, pupae, and adults.[26]

Anthelmintic Activity

Ethanolic and aqueous extracts of SI showed significant anthelmintic effect using *Pheretima posthuma* and *Ascaridia galli* organisms. The highest concentration of 100 mg/ml showed the most significant activity against both types of worms.[27]

Macrofilaricidal Activity

Tiwari *et al.,* 2003, studied the macrofilaricidal activity of ME of SI and reported that at 4 mg/ml ME concentration showed significant activity. The adult *Setaria digitata* was used as an organism using the worm motility assay method.[28]

Anti-arthritic Activity

The anti-arthritic activity of the petroleum ether extract of flower part of SI Linn. was studied using doses 10, 30, and 100 mg/kg/day p.o.[29]

Hypolipidemic Activity

Tenpe *et al.,* 2008, studied lipid profile in dexamethasone (10 mg/kg/day, s.c) induced alteration in lipid profile in rats. SI Linn. showed a significantly decreased level of serum total cholesterol, triglyceride, low-density lipoprotein, and very low-density lipoprotein.[30]

Nephroprotective Effect

The nephroprotective effect of the ethanolic extract of SI Linn. was studied on gentamicin-induced acute renal failure in rats.[31]

Other Activities

Apart from all these pharmacological activities exhibited by SI Linn. plant, other prominent activities are reported. They include anticancer activity and antiprotozoal activity against the organism *Entamoeba histolytica*,[10] hypotensive, peripheral vasodilatory, and cathartic activities from the alcoholic extract of the flower,[32] nematocidal activity by the ME of dried fruit and the extract of the plant was found to inhibit hyaluronidase.[33]

Conclusion

Geographically, SI is mainly originated and distributed throughout India. Its various parts such as stem, leaf, flower, root, and seed are widely used for curing various ailments and explored for activities such as anxiolytic, antioxidant, antidiabetic, analgesic, antipyretic, hepatoprotective activity, antimicrobial, antiulcer, anti-inflammatory, neuroleptic, antiviral, ovicidal, anthelmintic activities, and various other activities. From pharmacological studies reported in this review, there is considerable evidence that plant extracts have the potential to be used as preventative or treatment therapies for various diseases. As SI has been extensively exploited due to its medicinal property, it shows a wide range of therapeutic effect, now there is a need to explore clinical trials for further studies such as safety and efficacy, it will be important to

establish whether they offer therapeutic benefits, either alone or in combination with other therapies. Considering the preclinical studies need to focus on the clinical evaluation which may prove the plant as good remedies for various ailments and also need to focus on structure–activity relationship of the phytoconstituents present in SI and other spices.

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