

Medicinal Uses of *Sphaeranthus Indicus* : A Review

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ABSTRACT

Use of plant based medicines is increasing day by day mainly because they are cheaper, effective and produce minimal or no side effects when compared with modern medicines. Lot of research is being conducted on medicinal plants to verify the claims of their medicinal properties in traditional medicinal systems.

Sphaeranthus indicus is an aromatic herb belonging to family Asteraceae. It is distributed throughout the plains and wet lands in India and grows as weed in paddy fields. In traditional Indian system of medicine the entire plant or the specific parts of it e.g. roots, leaves, flowers are used in treatment of migraine, jaundice, liver diseases, diabetes, leprosy, fever, cough, gastritis, hernia, hemorrhoids, helminthiasis, dyspepsia and skin diseases. The present article reviews the scientific works conducted by various researchers on pharmacological properties of *S. indicus*.

Keywords : *Sphaeranthus indicus*, antioxidant, anticancer, anti-inflammatory, antidiabetic

INTRODUCTION:

Medicinal uses of different plants were known to humans since ancient times. Traditional Indian healthcare systems like Ayurveda and Siddha are still in practice where plant based medicines are used to cure variety of diseases. Many people prefer these medicines due to their effectiveness and minimal side effects.¹ Many phytoconstituents from herbs are used in modern day medicines e.g. phytoconstituents from *Vincarosea*, *Allium sativum*, *Aloe vera* etc. They are used in allopathic formulations to enhance immunity and to fight cancer more effectively.²

Sphaeranthus indicus (*L*) is an annual spreading herb with round purple flowers. It belongs to the family Asteraceae and usually grows as a weed in paddy fields. The plant is distributed throughout the plains and wet lands in India, Sri Lanka and

Australia.³ It is commonly known as Gorakhmundi in Hindi and Kottakaranthai in Tamil. The entire plant possesses broad spectrum of activity on several ailments and is traditionally used in indigenous systems of medicine to treat variety of diseases like migraine, jaundice, liver diseases, diabetes, leprosy, fever, cough, gastritis, hernia, hemorrhoids, helminthiasis, dyspepsia and skin diseases.⁴

PHYTOCHEMICAL CONSTITUENTS

Large numbers of phytochemicals were isolated from whole plant, leaves and flowers of *S. indicus*. Aerial parts of this plant showed presence of an essential oil, glycosides, and eudesmanoids, an alkaloid sphaeranthine and an isoflavone 5,4'-dimethoxy-3'-prenylbiochanin 7-o- β -galctoside with some interesting sesquiterpene.⁵ Bhuwan B. Mishra isolated a new Flavonoid C-glycoside,

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along with eight known compounds, namely n-pentacosan, hentriacontane, n-triacontanol, β -sitosterol, stigmasterol, β -D-glucoside of β -sitosterol, sphaeranthine and a phenolic glycoside ($C_{22}H_{26}O_{12}$).⁶ The essential oil, obtained by steam distillation of the whole herb, contains ocimene, α -terpinene, methyl-chavicol, α -citral, geraniol, α -ionone, β -ionone, d-cadinene, p-methoxycinnamaldehyde.⁷

MEDICINAL PROPERTIES OF *S. INDICUS*:

Antioxidant

Annaie Shirwaikar et al evaluated in vitro antioxidant activity of ethanolic extract of *S. indicus* underground parts. They found that ethanolic extract at the concentration of 1000 μ g/ml has maximum scavenging of radical cation 2-2 Azinobis-(ethylbenzothiazoline-6 sulphonate (ABTS), followed by scavenging of stable radical 1, 1 diphenyl 2- pycrilhydrazil (DPPH). It has only moderate scavenging activity of iron chelation.⁸ Tiwari and Khosa studied in vivo antioxidant activity and hepatoprotective effects of methanolic and aqueous extracts of flower heads of *S. indicus*. They showed that methanolic extract (300mg/kg) significantly elevated the levels of superoxide dismutase (SOD), catalase and glutathione peroxidase by reducing malondialdehyde and decreased the amount of lipid peroxides against acetaminophen induced hepatotoxicity. It also reduced the liver function markers glutamate-oxaloacetate transaminase (SGOT) glutamate pyruvate transaminase (SGPT), acid phosphatase (ACP) and alkaline phosphatase (ALP) bilirubin and total protein in acetaminophen induced hepatotoxicity.⁹

Anti-inflammatory

Anti-inflammatory activity of ethanolic extract of *S. indicus* leaves was evaluated by Meher BR. They revealed that ethanolic extract at doses of 100, 200 and 400 mg/kg exhibit dose-dependent anti-inflammatory effect in acute as well as chronic inflammatory models in rat (carrageenan induced paw edema and cotton pellet induced granuloma respectively) which is comparable with that of aspirin.¹⁰

Chakrabarti et al prepared methanol extract of *S. indicus* flowers and screened for fraction showing anti-TNF- α activity. This standardized fraction, NPS31807, was evaluated for proinflammatory cytokine production from human monocytic cell line (THP-1) and normal human epidermal keratinocytes (NHEK). NPS31807 decreased release of proinflammatory cytokines like TNF- α , IL-6 and IL-1 β from THP-1. It also reduced TNF- α and IL-8 expression in NHEK.¹¹

Rheumatoid arthritis is a chronic, progressive, systemic autoimmune disease causing inflammatory erosion of synovial joints, ultimately culminating in joint destruction, deformity and disability. Badgular et al found that administration of petroleum ether extract of *S. indicus* at a dose of 100 mg/kg/day for a period of 21 days to arthritic animals suppressed the chronic phase of inflammation as well as elevation of WBC count significantly. Animals did not show any gastrointestinal side effects like ulcers. As the secondary chronic phase in arthritis, induced by Freund's adjuvant, is due to production of auto antibodies, they proposed that inhibition in the chronic inflammatory response was exhibited due to immunomodulatory property of the steroids present in *S. indicus* petroleum ether extract. This

anti-inflammatory and immunomodulatory activity may be due to a synergistic action of all the steroidal saponins in the extract.¹²

Antitumor

Alok Nahata demonstrated that the petroleum ether extract of flower heads of *S. indicus* possessed potent cytotoxic effects on human colon (Colo-205), prostate (PC-3 and DU-145), lung (A-549), breast (MCF-7) and acute lymphoblastic leukemia (HL-60) cell lines but not in ovarian cancer (IGR-OV-1) cell line as assessed by sulforhodamine B assay. Further studies were done on HL 60 cell line where the authors proposed that the extract caused cell cycle arrest at subG0 phase and induced apoptosis by causing DNA laddering. They also demonstrated that petroleum ether extract caused mitochondrial damage leading to loss of their membrane potential. Also caspase 3 and caspase 9 activities were increased in cells treated with the extract.¹³

Gayatri S. et al studied anti cancer activity of chloroform extract of whole plant of *S. indicus* against Ehrlich ascites carcinoma in Swiss albino mice. The extract increased the nonviable tumor cell count, mean survival time and restored the hematological parameters in tumor bearing animals. These changes were comparable with 5-fluorouracil - the standard drug.¹⁴

Immunomodulatory

According to Bafna AR, methanol, petroleum ether, chloroform extracts and methanol fractions of *S. indicus* increased phagocytic activity, haemagglutination antibody titre and delayed type hypersensitivity. Methanol fraction normalized WBC count in cyclophosphamide-induced myelosuppression in mice.¹⁵ Shekhani et al isolated new sesquiterpene glycoside, sphaeranthanolid

and was shown to possess immune stimulating activity.¹⁶ Sneha J Anarthe et al revealed that methanolic extract of whole plant of *S. indicus* has immunomodulatory potential. They used plaque forming cell assay, quantitative hemolysis of sheep RBC, antibody response to sheep RBC, delayed type hypersensitivity, T cell population and drug induced myelosuppression to study effects on both humoral and cell mediated immunity.¹⁷

Anxiolytic

Ambavade et al in 2006 studied anxiolytic activity of petroleum ether, ethanol and aqueous extracts of *S. indicus* flowers. They found that petroleum ether and ethanolic extracts at dose of 10 mg/Kg and aqueous extract at the dose of 30 mg/Kg produced significant anxiolytic effect. Petroleum ether extract was more effective than the other extracts but less effective when compared with standard anxiolytic drug diazepam. This study was done by using elevated plus maze, open field test and foot-shock induced aggression test in mice.¹⁸ Galani and Patel in 2010 also reported that hydroalcoholic extract of whole plant of *S. indicus* at dose of 100 mg/Kg produced anxiolytic as well as anticonvulsant effect.¹⁹

Antimicrobial and antibacterial

Duraipandiyan et al found that hexane extract of *S. indicus* flowers possessed more antibacterial activity than the aerial parts against gram positive organisms. Extract also had strong antifungal activity.²⁰ Similar findings were reported by Mohd. Irfan et al with ethanolic extracts of *S. indicus* leaves.²¹ In vitro study by Rachana et al demonstrated that *S. indicus* essential oil showed maximum activity against the *E. coli*. Both gram-positive and gram-negative bacteria were sensitive to this oil.²²

Analgesic, Antipyretic

According to Dipti Padhan topical application of essential oil from flower heads of *S. indicus* produced significant analgesic effect at 90 and 120 minutes of application. This effect was comparable with that of diclofenac.²³

Nanda BK demonstrated that petroleum ether, chloroform and ethanol extract of whole plant showed significant analgesic effect from one hour onward similar to diclofenac. Petroleum ether and chloroform extract also possessed significant antipyretic action after one hour and was comparable with that of paracetamol.²⁴

Antihyperglycemic and antihyperlipidemic

Treatment with ethanolic extract of roots and stolons of *S. indicus* showed significant decrease in blood sugar level in diabetic rats when compared to control group but glibenclamide produced better effect. Animals in treatment group showed better weight gain than the glibenclamide group. Other effects observed included decrease in glycosylated haemoglobin, serum triglyceride and cholesterol levels and enhanced insulin release. Extract treatment also prevented fall in HDL cholesterol.^{25,26} Similar results were described by Muhammad T. Razi et al in alloxan induced diabetic rabbits.²⁷ Pande and Dubey found that 500mg/kg/day ethanolic extract of *S. indicus* flowers exhibited significant antihyperlipidemic effects in rats fed with atherogenic diet for 60 days.²⁸

Other effects

Galani and Patel in 2009 demonstrated sedative effects of hydroalcoholic extracts of *S. indicus* in mice.²⁹

Jessy Mathew found that the ethanol extract at dose of 150 and 300 mg/kg and ethyl acetate extract at dose of 100, 150 and 300 mg/kg possess significant mast cell stabilizing activity when compared with the standard drug ketotifen in sheep serum model. Similar results were also found when peritoneal mast cells were treated with the compound 40/80.³⁰

Sadaf et al revealed that 15 days application of cream containing ethanolic extract of aerial parts of *S. indicus* significantly increased rate of wound healing in guinea pigs and was comparable with that of neomycin.³¹

Methanolic extract of whole plant of *S. indicus* was shown to possess protective action against histamine induced bronchospasm in guinea pigs.³²

Methanolic extract of *S. indicus* was also proven to possess renoprotective action in gentamicin induced acute tubular necrosis in rats.³³

Srivastav et al demonstrated hypotensive, peripheral vasodilatory and cathartic activity of alcoholic extract of *S. indicus* flowers.³⁴

CONCLUSION:

The literature survey shows that *S. indicus* L. possesses varied pharmacological properties. Its properties are found to be comparable with standards. But still there is paucity of scientific data about the mechanism of action of the extracts especially for its anticancer activities in different types of cancers. Hence, further studies need to be conducted to reveal molecular basis of actions of *S. indicus* extracts.

DECLARATION:

Information from the published research articles available from Pubmed, google scholar, Science Direct and other sources was used in the preparation of this review article. Authors are also conducting research on antioxidant and anticancer activity of aerial parts of *S. indicus* to reveal its mechanism of action.

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