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SCIENTIFIC VALIDATION OF ACTIVITIES OF MUNDI
(SPHERANTHUS INDICUS L): A REVIEW

B.H.NOTANI¹, PROF. K. NISHTESWAR²

¹ Ph.D Scholar, ² Professor & ²HOD, Department of Dravyaguna, I.P.G.T. & R.A,
G.A.U Jamnagar, Gujarat, India.

ABSTRACT:

Sphaeranthus indicus L. is a multi-branched herb with round purple flowers that grows plentifully in rice fields and is distributed throughout India, Ceylon, Malay, China and Africa. It used indigenously in the Indian system of traditional medicine as a remedy for various ailments, being used as a tonic, laxative, digestive, anthelmintic, in the treatment of insanity, tuberculosis, diseases of the spleen, anaemia, bronchitis, elephantiasis, pain of the uterus and vagina, piles, asthma, leucoderma and hemicrania. The plant is bitter, stomachic, restorative, alterative, demulcent and externally applied as soothing agent. The ayurvedic pharmacopeia of India recommends the dried leaf in cervical lymphadenitis, chronic sinusitis, migraine, epilepsy, lipid disorders, diseases of spleen, anaemia, dysuria. The essential oil is active against vibrio cholera and Micrococcus pyrogenes var. aureus. Flowers gave a sesquiterpene glycoside, spherantholide, which exhibited immune stimulating activity. The whole plant and its isolated secondary metabolites and different parts (Roots & Inflorescence) have been reported for antioxidant, analgesic, antipyretic, anti-inflammatory, anthelmintic, antimicrobial, hepatoprotective, anxiolytic, neuroleptic, anti-diabetic, antihyperlipidemic, central nervous system depressant, anti-arthritis, nephroprotective and anticonvulsant activities. The present study is an effort to review of reported research activities of S. indicus L.

KEYWORDS: Analgesic, Antipyretic, Anti-inflammatory, Antioxidant, Sphaeranthus indicus L

INTRODUCTION

Correspondent:**Prof. K.Nishteswar****Prof. & H.O.D, Dept. of****Dravyaguna****I.P.G.T.R & A, Jamnagar,****India**

Sphaeranthus indicus Linn. (Asteraceae), commonly known as 'Gorakhmundi,' is a highly branched herb that is found to be distributed throughout the plains India in wet places. It is of 30-45 cm tall with winged stem. Heads are terminal and 0.6-2 x 0.5 – 1.5 cm in size and globose or ovoid in shape. Achenes are nearly 1 mm long, oblong, obconical, angled, sub compressed and almost glabrous. Though, it is not classified under Charaka Dashemani, Sushruta and Vagbhata considered it under surasaadigana. It has been identified with some specific synonyms like Mundika, alambusha, kadmbapushpi, bhukadamba, kulahala to describe the head inflorescence of this plant. The whole plant is used as tonic, alterative and aphrodisiac, while flowers are specifically suggested to use as alterative, cooling agent and tonic .The

aerial parts have shown number of phyto constituents such as essential oils, glycosides, eudesmanolides, sesquiterpenes, phenolic glycosides, sesquiterpene lactones, flavonoid n-pentacosan, stigmasterol, hentriacontane, D-glucoside of hentriacontane, n-triacontanol, phaeranthine¹⁶ etc. Steam distillation of fresh flowering herb yields an essential oil containing methyl chavicol, alpha-ionone, d-cadinene, p-methoxycinnamaldehyde as major constituents. In Ayurveda, it has been advised specially for problems of krimi, apachi, galaganda, yoni vyapath etc. It is used as an ingredient of some important Ayurvedic formulations like shwadamshtadighrita, chandanaaditaila, amritaaditaila, parushakaghirta, tritiyasarpiguda etc.

In folk medicine, the entire herb is used for insanity, epileptic convulsions, vomiting, and hemicrania and is valued as an aphrodisiac and nervine tonic. Previous phytochemical studies have reported the presence of a sesquiterpene lactone, a steroid, a flavanoid, an essential oil, and eudesmanolides in *S. indicus*. The herb has been reported to have immunomodulatory, antioxidant, and hypoglycaemic activities, while neuroleptic and anxiolytic activity.

RESEARCH ACTIVITIES CARRIED OUT ON *SPHERANTHUS INDICUS* L1. HEPATOPROTECTIVEACTIVITY¹

A study was designed to evaluate the hepato-protective and antioxidant effect of aqueous (AQS) and methanolic (MES) extract of flower heads of *Sphaeranthus indicus* on Paracetamol (APAP)-induced hepatotoxicity in rat's in-vivo. Activities of liver marker enzymes ,glutamate-oxaloacetate transaminase (SGOT), glutamate pyruvate transaminase (SGPT), acid phosphatase (ACP) and alkaline phosphatase (ALP) bilirubin and total

protein at an oral dose of MES (300mg/kg) showed a significant hepatoprotective effect in comparison with the same dose of aqueous extract. This fact was confirmed by studying the liver histopathology of treated animals. As Regards the antioxidant activity, MES exhibited a significant effect ($P < 0.05$) showing increasing levels of superoxide dismutase (SOD), Catalase (CAT), and glutathione peroxides (GPx) by reducing malondialdehyde (MDA) levels.

2. ANTIDIABETIC & ANTIHYPERLIPIDEMIC ACTIVITIES¹

In a study the drug was aimed to evaluate for its antidiabetic, antihyperlipidemic, and *in vivo* antioxidant properties of the root of *Sphaeranthus indicus* Linn. in streptozotocin- (STZ-) induced type 1 diabetic rats. Administration of ethanolic extract of *Sphaeranthus indicus* root (EESIR) 100 and 200 mg/kg to the STZ-induced diabetic rats showed significant ($P < .01$) reduction in blood glucose and increase in body weight compared to diabetic control rats. Both the doses of EESIR-treated diabetic rats showed significant ($P < .01$) alteration in elevated lipid profile levels than diabetic control rats.

The EESIR treatment in diabetic rats produced significant increase in superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx) and decrease in thiobarbituric acid reactive substances (TBARS) levels than diabetic control rats. Administration of EESIR 200 mg/kg produced significant ($P < .01$) higher antioxidant activity than EESIR 100 mg/kg. The high performance liquid chromatography (HPLC) analysis of EESIR revealed the presence of biomarkers gallic acid and quercetin. In conclusion, EESIR possesses antidiabetic, antihyperlipidemic, and *in vivo* antioxidant activity in type 1 diabetic rats.

3. ANXIOLYTIC ACTIVITY²

A study was investigated for the anxiolytic activity of petroleum ether, alcohol and water extracts, obtained from the flowers of *Sphaeranthus indicus* Linn, in mice. Elevated plus maze (EPM), open field test (OFT) and foot-shock induced aggression (FSIA) were the screening tests used to assess the anxiolytic activity of the extracts on mice. Diazepam (1 mg/kg) served as the standard anxiolytic agent. The animals receiving extracts or diazepam (1 mg/kg) showed an increase in the time spent, percent entries and total entries in the open arm of the EPM; increased ambulation,

activity at centre and total locomotion in the OFT; and decreased fighting bouts in the FSIA, suggesting anxiolytic activity. Petroleum ether extract (10 mg/kg), alcoholic extract (10 mg/kg) and water extract (30 mg/kg) resulted in prominent activity in the mice. Petroleum ether extract (10 mg/kg) resulted in more prominent anxiolytic activity in the EPM and OFT than ethanolic or water extracts, but was less than that produced by diazepam (1 mg/kg). Petroleum ether extract of *S. indicus* flowers produces prominent anxiolytic activity in mice.

4. ANTI-ANXIETYACTIVITY³

In a study the effects of a hydroalcoholic extract of the *Sphaeranthus indicus* (SIE) against experimentally induced anxiety, depression and convulsions in rodents. The SIE (100, 200, 500 mg/kg, *p.o.*) was used in elevated plus maze, open field, forced swimming, and tail suspension tests in mice. The same doses were also used to evaluate its anticonvulsant effect on pentylenetetrazole (PTZ)-induced convulsions in mice and maximal electroshock (MES)-induced convulsions in rats. SIE was found to increase the number of entries and the time spent in the open arms of the maze at a dose of 100 mg/kg, *p.o.*, indicating its anxiolytic activity. On the other hand, higher doses of

SIE (200 and 500 mg/kg, *p.o.*) decreased open arm entries and time spent in the open arms of the maze in the elevated plus maze test indicating the absence of anxiolytic activity. However, this effect could have been related to a decrease in the locomotor activity of the mice and not to an anxiogenic effect, as indicated by the reduction in the total number of entries in the elevated plus maze. SIE also (at doses of 200 and 500 mg/kg, *p.o.*) decreased locomotor activity but did not affect emotional activity parameters in the open field test, suggesting a possible central nervous depressant activity. SIE also increased the immobility time in the forced swimming test at an oral dose of 500

mg/kg, but did not significantly modify the activity in the tail suspension test. SIE protected rats against MES-induced convulsions and mice against PTZ-induced convulsions. *Sphaeranthus indicus* demonstrated

anxiolytic, central nervous depressant, and anticonvulsant activities in rodents, thus supporting the folk medicinal use of this plant in nervous disorders.

5. ANTI-OXIDANTACTIVITY⁴

In a study of the free radical scavenging potential of the plant *S. indicus* was evaluated by using different antioxidant models of screening. The ethanolic extract at 1000 microg/ml showed maximum scavenging of the radical cation, 2,2-azino-bis-(3-ethylbenzothiazoline-6-sulphonate) (ABTS) observed upto 41.99% followed by the scavenging of the stable radical 1,1-diphenyl, 2-picrylhydrazyl (DPPH) (33.27%), superoxide

dismutase (25.14%) and nitric oxide radical (22.36%) at the same concentration. However, the extract showed only moderate scavenging activity of iron chelation (14.2%). Total antioxidant capacity of the extract was found to be 160.85 nmol/g ascorbic acid. The results justify the therapeutic applications of the plant in the indigenous system of medicine, augmenting its therapeutic value.

6. ANTIAMNESTICACTIVITY⁵

A study was aimed at discovery of novel acetylcholinesterase (AChE) inhibitors. In vitro AchE inhibitory activity of various extracts of *Sphaeranthus indicus* flower heads was carried out. The petroleum ether fraction of *S. indicus* flowers (SIPE) exhibited significant activity. The fraction was found to be rich in sesquiterpene lactone content possibly responsible for in vitro AChE inhibition. In further study, the anti-amnesic activities of SIPE in mice on the learning and memory impairments induced by scopolamine (1.0 mg/kg, i.p.) were examined. SIPE (10 mg/kg, p.o.)

administration significantly reversed cognitive impairments in mice by passive avoidance test ($P < 0.05$). It also reduced escape latencies in training trials and prolonged swimming times in the target quadrant during the probe trial in the water maze task ($P < 0.05$). These results indicated that *S. indicus* due to its sesquiterpene lactones have anti-cholinesterase activity. A major sesquiterpene lactone, 7-hydroxy frullanolide along with other constituents were isolated from SIPE and evaluated for AchE inhibitory activity. Negative results

were obtained in case of isolated compounds. It concludes Synergistic effect between constituents of SIPE was

confirmed to have anti-amnesic activities that may be useful for cognitive impairment treatment.

7. ANTI-INFLAMMATORY AND ANALGESIC ACTIVITIES⁶

A study was aimed to evaluate the intensity of the anti-inflammatory and analgesic activities of *Sphaeranthus indicus* on albino mice and rat of either sex. The flowers of *S. indicus* are an important part of the herb used in folk eastern medicines. In this study, the ethanolic extract of *S. indicus* in doses of 300 and 500 mg/kg was used. Anti-inflammatory activity was evaluated by measuring the mean decrease in hind paw volume after the sub planter injection of carrageenan. The analgesic activity was tested against acetic acid induced writhing response using albino rats. Result of the

study shows that at the end of one hour, the inhibition of paw edema was 42.66 and 50.5% respectively and the percentage of protection from writhing was 62.79 and 68.21 respectively. *S. indicus* possesses several important pharmaceutical and pharmacological properties. The current study describes that flower of *S. indicus* has significant anti-inflammatory and analgesic properties. Conclusion of the study is that this herbal medicine can be used as an alternative therapy for the treatment of minor to moderate types of inflammation and as a painkiller.

A study was aimed to investigate the analgesic and antipyretic activity of whole parts of the plant *Sphaeranthus indicus* Linn. (Compositae) on albino rats by Eddy's hot plate, Tail immersion and Brewer's yeast induced pyrexia method respectively. Dried powder of whole plant materials were subjected to successive solvent extraction taking Petroleum ether, Benzene, Chloroform, Ethanol and triple distilled water. The different extracts at a dose of 200mg/kg and 400mg/kg body weight were subjected for evaluating analgesic and antipyretic activities. The

8. ANTIPYRETICACTIVITY⁷

petroleum ether, chloroform and ethanol extract s showed significant analgesic activity in both doses ($p<0.001$ & $p<0.01$) from 1 hour onwards as compared to the standard drug diclofenac sodium. The chloroform and ethanol extracts showed potential significant antipyretic activity ($p<0.05$) from 1 hour onwards where as aqueous extracts exhibit activity from 2 hours onward as compared to the standard drug paracetamol amongst various extracts.

DISCUSSION

Chakradutta (11AD) indicates mundi in the management of *Vatarakta* (Arthritis which includes Rheumatoid and gouty arthritis), *Apachi* (Being glandular swellings), *Gandamala* (Cervical tubercular gymphaedemopathy) and *Kamala* (Jaundice). *Bhavmishra* indicated it in *Amavata* (Rheumatoid arthritis). All these indications refer to anti inflammatory activity of *Mundi*. The author of *Rajamartanda* (11AD) indicated it for *Yonishoola* (vaginismus), while *Sodhala* (11AD) and *Sarangadhara* (13 AD) indicated in *Suryavata* (Headache due to sinusitis) and *Ardhavabheda* (migraine).

These indications reflect analgesic and antispasmodic activities of *Mundi*. *Vangasena* (12 AD) employed *Mundi* as and external application for restoration of the shape of flabby breasts which indicates that the drug is useful to tone up the muscles. He also indicated it in the management of 'Vichcha' a variety of skin diseases of paediatric group. *Charaka* interpreted *Sravani* (*Mundi*) and *Mahasravani* (a variety of *Mundi*) in rasayana formulations which indirectly refers to its antioxidant and immunomodulatory activities.

CONCLUSION

Spheranthus indicus (*Mundi*) is a popular drug described in all major ayurvedic classics and Nighantus and ascribed with multifarious activities and indications. Its pharmacotherapeutic applications include *Apachi* (swellings of benign origin), *Ardhavabhedaka* (Migraine) etc. Several compendia included its *Rasayana* activity (Cell MNfactor/ cell longevity protector). Therapeutic indications delineated for

Mundi clearly indicate that the drug possess anti-inflammatory, analgesic, antimicrobial, antioxidant and immunomodulator activities.

Recent researches confirmed that a source plant of *Mundi* exhibited significant activities which have successfully produced scientific validation for classical activities and indications described in ayurvedic literature.

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