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Spilanthes oleracea L. - An Asteraceae Herb with Ornamental Value Naturalized in Peninsular India

Lavanya Devi K[1]., S. Ganeshan[2], M. B. Shivanna[3]

[1&2] Division of Plant Genetic Resources, Indian Institute of Horticultural Research, Hessaraghatta, Bengalruru, Karnataka- 560089.

[1 &3] Department of Applied Botany, Jnana Sahyadri, Kuvempu University, Shankaraghatta, Shivamogga, Karnataka-577451.

Abstract: ***Spilanthes oleracea L. is an annual herb belonging to the Family Asteraceae, tribe Heliantheae and sub tribe Spilanthinae. The flower head has attractive bright yellow color with reddish violet spot in the centre unlike the other Spilanthes species which are yellow in color. This gives ornamental value and has been used as an 'edge plant' in gardens. The genus Spilanthes is commonly used as a folklore remedy for toothache hence the name 'Toothache plant". In the present study morphological traits and distribution with niche modeling of Spilanthes oleracea in Peninsular India is discussed which would help in promoting the plant as an "ORNAMED" crop***

Keywords: *Spilanthes oleracea*, Niche Modeling, DIVA GIS, Morphological traits.

1. Introduction

Spilanthes oleracea L. is an annual herb, belonging to the Family Asteraceae, grown in warmer regions of both Northern and Southern hemispheres. The plant is commonly grown in garden as an ornamental plant as the flower heads have attractive bright yellow color with reddish violet spot in the centre hence the name *Spilanthes* (*Spiloma*= stained, *anthos*= flowers). The plants are grown as edge plants in Indian gardens. This species is frequently used in traditional medicines along with other species of *Spilanthes.*

Most of the species of this genus are found to be medicinal by the presence of alkamides, which are responsible for medicinal properties (Anon., 1989). The inflorescence is the main source of alkamides. Spilanthol is the main bioactive principle. In Folklore medicine, flower decoction is used for curing Malaria (Ahua, 2007). The leaves and flower decoction with alkamides- Z-Non-2-en-6,8-diynoic acid isobutylamide and (Z)-dec-2-en-6,8-diynoic acid isobutylamide (Gregor *et al*, 1984) is used as an active ingredient for curing stammering, toothache, stomatitis and throat complaints (Chadha, 2008). The flower decoction is effective as anti-trypanocidal (Bizimana, 2006).

The niche of a species is the set of environmental variables that determine the geographic distribution of that species, either in the presence of biotic interactions including competition (the realized niche) or without these biotic interactions (the fundamental niche) (Hutchinson, 1959; Pulliam, 2000; Holt, 2003). Ecological niche models use various mathematical techniques to relate the occurrence of species to environmental data (Guisan and Zimmerman, 2000). Niche modeling has received increased attention recently because it has important implications for conservation and management efforts. The niche modeling also known as bioclimatic modeling approach. This uses geo-referenced primary occurrence data of a species, in combination with digital maps representing environmental parameters to build models characterizing ecological requirements of species. In the present study morphometric analysis and distribution of *Spilanthes oleracea* in peninsular India are discussed which would help in promoting the plant as an "ORNAMED" crop.

2. Materials and Methods

2.1. Plant Distribution Study

The study was conducted in peninsular India region, collecting data by literature survey, floras, herbaria records and other possible sources from regions covering outskirts in the forests of Western and Eastern Ghats, Planes in regions of Karnataka, Kerala, Maharashtra, Andhra Pradesh and Tamil Nadu states as *Spilanthes* were mostly reported in these regions. Few plants were collected for morphological characterization.

The data were geo referenced to specific locations on the earth surface, using geographic information systems (GIS). Thus the exact coordinates (longitude and latitude) of the place of occurrence were obtained and digitized using GIS MapInfo software.

2.2. Niche Modeling

Species specific niche models for prediction of distribution of *Spilanthes oleracea* were developed using the software DIVA-GIS. This used climatological data of a sample of existing occurrence and relatively searched for similar habitat features in the rest of the landscapes.
Based on the data collected from literature survey through herbarium collections, floras, forests departments and interaction with the indigenous localities the distribution maps were developed. The environmental factors (Layers) considered in developing the maps were:

2.2.1.Layers:
L1- Annual mean temperature, L2 –mean diurnal range (monthly min-max. temperature), L3- isothermality (L2/L7), L4- Temperature seasonality, L5- max. temperature of the warmest month, L6- min. temperature of the coldest month, L7- annual temperature range (L5-L6), L8- Mean

temperature of the wettest quarter, L9- mean temperature of the driest quarter, L10- mean temperature of the warmest quarter, L11-mean temperature of the coldest quarter, L12-annual precipitation, L13-precipitation of the wettest month, L14-precipitation of the driest month, L15-precipitation seasonality (coefficient variant), L16-precipitation of wettest quarter, L17-precipitation of the driest quarter, L18-precipitation of the warmest quarter, L19-precipitaion of the coldest quarter. The distribution maps were developed accordingly and field visits to two locations were made to collect the samples.

2.3 Exploration and Collection of Plant Material

This study dealt with the morphology of the genus *Spilanthes oleracea* L. Collections were made from Karnataka and Kerala. Herbaceous stem cuttings, whole plants and seeds were obtained for the present study. The plants collected were grown in Field Gene Bank (FGB) of Division of Plant Genetic resources, Indian Institute of Horticultural Research, Hessaraghatta Bangalore for three consecutive years October 2010 to December 2013. The cuttings were grown in the pots of diameter 30 cm with each pot and potting mixture included 1:1 Sandy loam soil and farm yard manure. The morphometric observations were taken in assigned time intervals depending on the part of the plant for observation.

2.4 Plant Identification

The plant specimens collected were subjected to identification at the Herbarium, Flora & Phyto-Taxonomy Researchers. Authentication of specimens was carried out using botanical keys before being compared with reference flora of India which confirmed species as *Spilanthes oleracea* L.

Tribe: Heliantheae
Sub tribe: Spilanthinae
Genus: *Spilanthes*
Species: *oleracea* L.

2.5 Morphometric Traits

Spilanthes oleracea were characterized by a number of morphometric traits. The observations were recorded on five randomly selected plants for 50 traits at specified stages of the crop growth period when the characters showed full expression. Among 51 morphological traits studied, 37 were visually assessed and 14 were measured. The quantitative characters taken were: Plant height (cm), Number of leaves per plant, Leaf lamina length (cm), Leaf lamina width (cm), Stipule length (cm), Number of flowers per plant, Total number of heads per branch, Inflorescence width at widest point (mm), Flower head diameter (mm), Length of peduncle (cm), Disc floret length (µm), Disc floret corolla tube length (µm), Disc floret width (µm), and Ovary length(µm) of the disc floret were measured.

3. Results

3.1 Distribution

Spilanthes oleracea L. has been explained in Indian Floras as an ornamental herb grown in marshy areas of Deccan Plateau as well as North East regions of India. The species is native to Brazil, has been considered as immigrant species, which is cultivated in India as garden plants. In the present study the distribution of *Spilanthes oleracea* in Peninsular India region is been recorded as there were no earlier data regarding its distribution (Fig. 1). Based on the location map generated by geo referenced data, prediction maps were developed using DIVA GIS software (Fig.2). Modeling of niche of a species and its potential distributions is becoming a powerful tool for biogeographers, conservation biologists and ecologists in recent years (Carpenter *et al.*, 1993; Hernandez *et.al.*, 2006 and Skov, 2000). Predictive distribution models aid in forecasting the spatial occurrence of species, especially, habitat suitability or realized niche based on the data from traditional field work in conjunction with climatic and topographic factors (such as slope, elevation, and precipitation) (Pearson, 2007). This niche prediction is done through various algorithms or principles which integrate the species occurrence information and environmental data to find out the possible favorable locations for growth of the plant species.

Leaves are broadly ovate to triangular, irregularly crenate-serrate leaf margin, very rarely entire, glabrous, usually acute leaf tips. The leaf petiole pubescent about more than one fourth of the leaf lamina in length. Leaf base truncate; Leaves opposite decussate, venation tri-venated (Fig. 3d). Roots are fusiform, fleshy, long, finger like thick, cylindrical and tapering having some hair like rootlets. When dry it is brownish externally and whitish internally. It has shrunken surface, compact bristle, shows the presence of aromatic acid with pungent taste.

3.3.2. Reproductive part- Morphological Traits

Flower heads are ovoid, solitary, yellow florets with reddish violet spot in the centre of the inflorescence, peduncles long (Fig.3c & e). A single branch bears 1-3 flower heads with flower head diameter reaching up to 1 to1.5 cm. At full blooming stage of the plant long peduncles (7 to 8.5 cm) and the purple pigmentation of the stem adds beauty to the plant. Involucral bracts oblong, lanceolate sub acute, pubescent, less than half as long as head of flowers. Inflorescence discoid, bisexual, actinomorphic, ray flowers and ligules are very often absent. The plant species exhibit flowering and fruiting throughout the year. The anthesis begins from the peripheral florets and takes 2-3 days for whole inflorescence to open. The pollen grains are spherical with spiny exine and smooth intine (Fig.3g) and are viable. Stigma is bifid with style and bicarpellary syncarpous inferior ovary. The disc florets show maximum fertilization with all the disc florets forming seeds. The inflorescence remain fresh in natural conditions for 15-20 days. Achenes black in color, ciliate at the edge. The seeds germination takes 1-3 weeks after sowing.

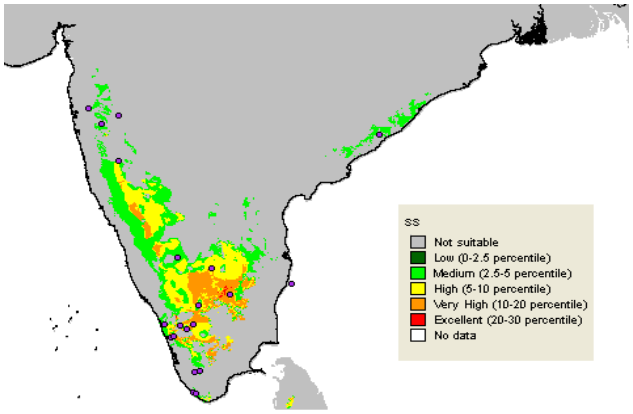

Fig. 2 Prediction Mapping for *Spilanthes oleracea* L

Figure 1: Prediction map of *S. oleracea*

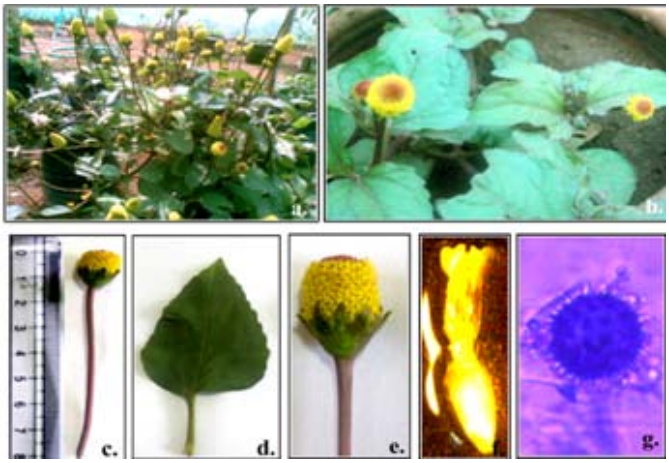

Figure 2: a, b. Potted plant c. Single Inflorescence d. Leaf e. Discoid Inflorescence with Involucral bracts f. Disc floret g. Pollen grain of *S. oleracea.*

Table 1: Morphometric analysis of *Spilanthes oleracea* L.

Sl. No.	PH (cm)	NL	LL (cm)	LW (cm)	SL (cm)	NF
1	41	59	6.5	5.4	1.9	25
2	42.5	60	6.8	4.7	1.8	24
3	47.7	45	4.3	3.9	2.1	31
4	36.2	71	6.6	5.4	2.3	18
5	38.1	52	5.9	3.4	1.9	15
M± SE	41.1± 4.431	57± 9.71	6.0± 1.01	4.5± 0.896	2± 0.2	22.6± 6.268

PH- Plant Height, NL- Number of Leave per plant, LL-Leaf lamina length, LW- Leaf lamina width, SL- Stipule length, NF- Number of flowers per plant.

Table 2: Morphometric analysis of *Spilanthes oleracea* L

Sl. No.	IW (cm)	FD (cm)	PL (cm)	DFL (mm)	DCL (mm)	DFW (mm)
1	0.9	1.5	7.8	0.046	0.02	0.009
2	1.1	1.4	7.7	0.055	0.023	0.008
3	1.3	1	7.8	0.049	0.021	0.009
4	1.2	1.1	7.7	0.048	0.021	0.008
5	1.3	1	7.6	0.049	0.021	0.005
M± SE	1.16± 0.167	1.2± 0.234	8.1± 0.08	0.050± 0.002	0.022± 0.001	0.007± 0.001

NHB- Total number of heads per branch, IW- Inflorescence width at widest point, FD- Flower Head diameter, PL-Length of peduncle, DFL- Disc Floret length, DCL- Disc floret corolla tube length, DFW- Disc Floret width, OL- Ovary length, M- Mean, SE- Standard Error.

4. Discussion

Spilanthes oleracea is one species which has both ornamental and medicinal value. The plant is also used as green leafy vegetable (Anon, 1989). As the plant is herbaceous, forming small bushy appearance and bear attractive small flowers, it assumes significance as an ornamental plant. The plants are low growing with attractive flowers and prolonged field life makes it ideal for use as 'edge plants' as well as potted plants in gardens. The prediction mapping would help to identify more locations where the species may occur in natural conditions. Considering the favorable climatological conditions based on the prediction mapping, this species can be promoted for cultivation as a garden plant in these regions.

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Author Profile

Lavanya Devi K., M.Sc. in Applied Botany from Mangalore University, Karnataka and M. Phil. in Botany from Bharathiar University, Tamil Nadu. Presently working in Indian Institute of Horticultural Research, Bangalore, registered for Ph.D. programme in Kuvempu University. Interested in medicinal plant morphological and molecular phylogenetic relationships and chemical profiling.

Dr. Anuradha Sane, is the Principal Scientist in Division of Plant Genetic Resources, Indian Institute of Horticultural Research, Bangalore (Karnataka) India. M.Sc. and Ph.D. in Horticulture (Floriculture) from University of Agricultural Sciences, Gandhi Krishi Vignan Kendra, Bangalore. Her field of research interests: Molecular characterization of Horticultural crops.

Dr. M.B. Shivanna, is the Professor in the Department of Applied Botany at Kuvempu University located at Jnana Sahyadri, Shankaraghatta, Karnataka State, India. M.Sc. M.Phil; Ph.D. in Applied Botany from Mysore University on Seed plant pathological aspects and Ph.D. in Agriculture from Gifu university, Japan on Biocontrol with PGPF. His field of interests are plant pathology and biocontrol and molecular characterization of fungal species and medicinal plants; ethno-botany and plant biotechnology.

Dr. S. Ganeshan, is the Principal Scientist and Head, Division of Plant Genetic Resources, Indian Institute of Horticultural Research (IIHR), Bangalore (Karnataka) India. M.Sc. in Genetics and Cytogenetics from Osmania University, Hyderabad, Ph.D. in Botany, Bangalore University in plant tissue culture. Former Director of Jawahar Lal Nehru Tropical Botanical Garden and Research Institute, Palode, Thiruvananthapuram, Kerala. His area of specialization are pollen biology, cryopreservation of pollen and other germplasm.