

REVIEW ARTICLE

Occurrence of *Symphotrichum squamatum* (Spreng.) G.L.Nesom in Uttar Pradesh, India: A new record

Amit Kumar Tripathi*, Jyoti Kumar Sharma

Center for Environmental Sciences and Engineering, School of Natural Sciences, Shiv Nadar University, Greater Noida, Uttar Pradesh, India; * amitnehu@gmail.com

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Abstract

Symphotrichum squamatum (Spreng.) G.L.Nesom, is an erect herb of the Compositae family, recorded from the campus of the Shiv Nadar University, Uttar Pradesh, India. The species is being recorded for the first time from India as there are no earlier reports of its occurrence in the literature. The taxonomic description of the plant along with colored illustrations of morphological characteristics such as habit, leaf, flower, root etc. are provided for easy identification of the species in wild. As the plant is known to have a tendency to spread rapidly, it may become an aggressive weed in India in near future.

Keywords: *Symphotrichum squamatum*, compositae, new record, Shiv Nadar University, India

Introduction

The genus *Symphotrichum* belonging to the family Compositae, contains about 108 accepted species (The Plant List 2013); most of the species are distributed in the North, Central and South Americas (Tunçkol et al. 2017). *Symphotrichum squamatum* is native to South America (Nesom 2005) and commonly known as 'annual saltmarsh aster'. The species is morphologically similar to *Aster subulatus* (Michx.) Hort. ex Michx. (Syn.-*Symphotrichum subulatum* (Michx.) G.L.Nesom) and sometimes misapplied with this name. According to Nesom (2005), *S. subulatum* heads are usually dense in an elongate, pyramidal-paniculate arrangement, inner phyllaries 6-7 mm long, pappus accrescent while *S. squamatum* heads are corymbiform to thyriform, diffusely paniculate, inner phyllaries 4-6.5 mm long, pappus not accrescent. The species is reported to be alien invasive and have tendency to spread rapidly to become an aggressive weed (Arianoutsou et al. 2010, Uludağ et al. 2017, Mokni & Iamonico 2018).

During the floristic survey of the campus of Shiv Nadar University *S. squamatum* was found growing scarcely at the banks of SNU's wetland in the Botanic Garden area which was later found growing in continuous large patches in the campus.

Subsequently, the occurrence of the species was also recorded at a few more places outside the SNU campus. The paper reports the addition of *S. squamatum* to the flora of India for the first time and describes its distribution and morphological characteristics. The paper also discusses the possible impact of *S. squamatum* on the ecosystem as an invasive species.

Materials and Methods

During floristic exploration survey of campus of Shiv Nadar University (SNU), Greater Noida, District Gautam Buddha Nagar, Uttar Pradesh, India, a species of Compositae was found growing in a few places at the banks of SNU's wetland (Latitude 28°31'13.60" N, Longitude 77°34'32.81" E). Subsequently, the species was also collected from few more places outside the SNU Campus in Chithara Village Panchayat and nearby areas. After wide consultation of the regional floras such as Flora of the Upper Gangetic Plain and of the Adjacent Siwalik and Sub-Himalayan Tracts (Duthie 1903-29), Illustrations of the Flora of Delhi (Maheshwari 1966), Flora of Agra District (Sharma & Dhakre 1995), Flora of Ghaziabad District (Vardhana 2007), e-flora of India (BSI) etc. and other available literatures, it was found that no species of Compositae has been reported with

similar morphological characteristics in India so far. After detailed morphological examination and consultation with the expert, the species was identified as *S. Squamatum* (Spreng.) G.L.Nesom. The illustrations showing habit and different parts of the plant such as leaf, flower and root are provided in Fig. 1.

With respect to the influence of climatic conditions, it appears that the seed germination and emergence of seedlings are favored by the low temperatures prevailing during January-February. However, the growth of plants accompanied by flowering and fruiting are favored by warm climate having high temperatures and wet period of monsoon during March-October (Fig. 2 and Fig. 3).

For the analysis of physical and chemical properties of soil, samples were collected at a depth of 10-20 cm from five locations at the margin of SNU's wetland and pooled together to make a composite sample utilized for analysis.

Results and Discussion

Botanical name

Symphytotrichum squamatum (Spreng.) G.L.Nesom.

Basionym

Conyza squamata Spreng.

Habit and habitat: The 'annual saltmarsh aster' *S. squamatum* is an erect herb found growing at the margins of wetlands in SNU campus. The species was found growing in close association with other species such as *Erigeron bonariensis*, *Paspalum distichum*, *Saccharum spontaneum*, *S. Benghalense* and *Typha domingensis*.

Growth phases of the plant: Plants were observed mostly throughout the year in the field for their growth. The plants are erect herbs and grow almost for a year before senescence sets in during December and early January as evident from the various growth phases.

January (late)-February: First emergence of new seedlings

March-April: Maturation of plant

May-November: Flowering and fruiting

December-January (early): Plants senesce and dry up

Soil characteristics and growth of *S. squamatum*: The soil was fertile alluvial soil containing fine sand (46.2%), silt (24%) and clay (28.8%), characteristic of soils in Wheat-Rice agriculture system in the southwestern plain of Upper Gangetic Plain (Sharma et al. 2012) of India. The soil was characterized by low P (1.9 ppm) and N (0.032 %) whereas nutrient-wise the soil contained 0.320% organic carbon. The soil was slightly alkaline (8.62) with reasonably good maximum water holding capacity (MWHC) of 41.95% (Tab. 1).

Soil characteristics are very important for seed germination and establishment and growth of plants. Probably poor N and P content and other characteristics of the soil favored good colonization by *S. squamatum*.

Locality: Shiv Nadar University Campus, Uttar Pradesh, India.

Distribution: The species is reported to be native to South America with widespread occurrence; rare in the south-

Table 1. Physical and chemical properties of soil.

Physical Parameters	Value	Chemical Parameters	Value
Fine Sand (%)	46.2	pH (1:2.5)	8.62
Coarse Sand (%)	1	OC (%)	0.32
Silt (%)	24	EC (dSm ⁻¹)	0.252
Clay (%)	28.8	N (%)	0.032
BD (g/cm ³)	1.3	P (ppm)	1.9
PD (%)	42.88	Ca ⁺	0.07
MWHC (%)	41.95	Mg ⁺	0.042
		Cu (ppm)	3.256
		Zn (ppm)	0.475
		Mn (ppm)	6.714
		Fe (ppm)	18.252

OC-Organic Carbon; EC-Electrical Conductivity; MWHC-Maximum Water Holding Capacity; BD-Bulk Density; PD-Particle Density

eastern USA and California; naturalized in Australia, Japan, Iraq, Africa, France and perhaps other parts of the world (Nesom 2005). It is also noted to occur on Ireland Island and Boaz Island, Bermuda (Britton 1914; Nesom 2005). In Asia, the distribution of the species has been recorded only from Japan and Iraq (Nesom 2005). However, the species is widely distributed in Greece (Arianoutsou et al. 2010), Turkey (Uludağ et al. 2017) and Malta (EPP0 2018). It is also reported from Romania as a new alien species (Petronela et al. 2016). Recently, Mokni & Iamonic (2018) found that *S. squamatum* is well established in Tunisia.

Flowering and fruiting time: May-November

Taxonomic description: Tap rooted 50-160 cm high, erect herbs. Stems dark green, glabrous. Leaves 2-13 × 0.5-1.5 cm, dark green, linear-lanceolate, entire or sometimes slightly serrulate; apex acute to acuminate; base sheathing to the stem, lower leaves often fallen at flowering time. Heads numerous, in corymbiform, diffuse, paniculate synflorescences. Involucre cylindric; phyllaries 4.5-6 mm long, subulate or linear-lanceolate, strongly unequal, margin scarious, entire, apex acute to acuminate. Ray florets short, numerous, in 1-3 series; laminae white or bluish-white, lavender, 1.4-2 mm long; disk florets up to 14, yellow, 3.5-4.5 mm long; throats narrowly funnellform; lobes erect, triangular. Achenes light brown to purple, lanceoloid, 1.5-2.5 mm, sparsely strigillose. Pappus white, fine bristles, 3-5 mm.

The possible impact of *S. squamatum* on the ecosystem as an invasive species

The number of florets per capitulum in *S. squamatum* varies from 50-500. In some branched plant of about 150 cm, more than 600 florets per plant were recorded. *S. squamatum* has high reproductive potential and may produce more than 10,000 tiny seeds in a large individual plant. The size of the seeds is very small measuring between 1.5-2.5 mm. When the florets are mature with the slight disturbance due to wind all the seeds are dispersed and germinate producing numerous seedlings around the mother plants and in the vicinity. Probably this is the reason why there is a gregarious growth of young seedlings around the mother plant.

Thus, the species has the capacity to spread rapidly and become an aggressive weed. Earlier, a species of *Symphytotrichum* i.e., *Symphytotrichum pilosum* var. *pilosum* has been recorded in India from Kashmir where it inhabits ruderal

areas along the roadsides as a naturalized species (Kaul 1975). Having strong invasive capacity, the *S. squamatum* spreads rapidly and colonize new habitats affecting the native flora. As the species appears to be highly aggressive due to its capacity to germinate and produce a large number of seedlings in the following season, it may extend its present distribution range in future and inhibit the development of native vegetation in India. A detailed survey is needed of Gautam Buddha Nagar district to ascertain its occurrence. Recently, Mokni & Iamonico (2018) reported the status of naturalization for alien species *S. squamatum* in Tunisia. *S. squamatum* is one of the most prominent invasive species in Greece where it has been established in a wide range of habitats (Arianoutsou et al. 2010). This also shows high fecundity of *S. squamatum*. Since the seeds are very small with a minute pappus they will also become

wind-borne and carried to great distances, which will help in starting a new population. Uludağ et al. (2017) reported that *S. squamatum* is one of the naturalized alien plants in Turkey. The natural/semi-natural habitats in Turkey are often invaded by alien taxa, particularly by those that are able to naturalize (Uludağ et al. 2017). Suitable edaphic and climatic conditions along with the production of a large number of viable seeds could be the reasons for such type of gregarious growth of plants in the following season. The invasion of exotic species is one of the most important global scale problems experienced by natural ecosystems (Sharma et al. 2005). Therefore, it is vital to examine the ecology and genetic makeup of the concerned invasive species for developing suitable management strategies (Singh et al. 2010).

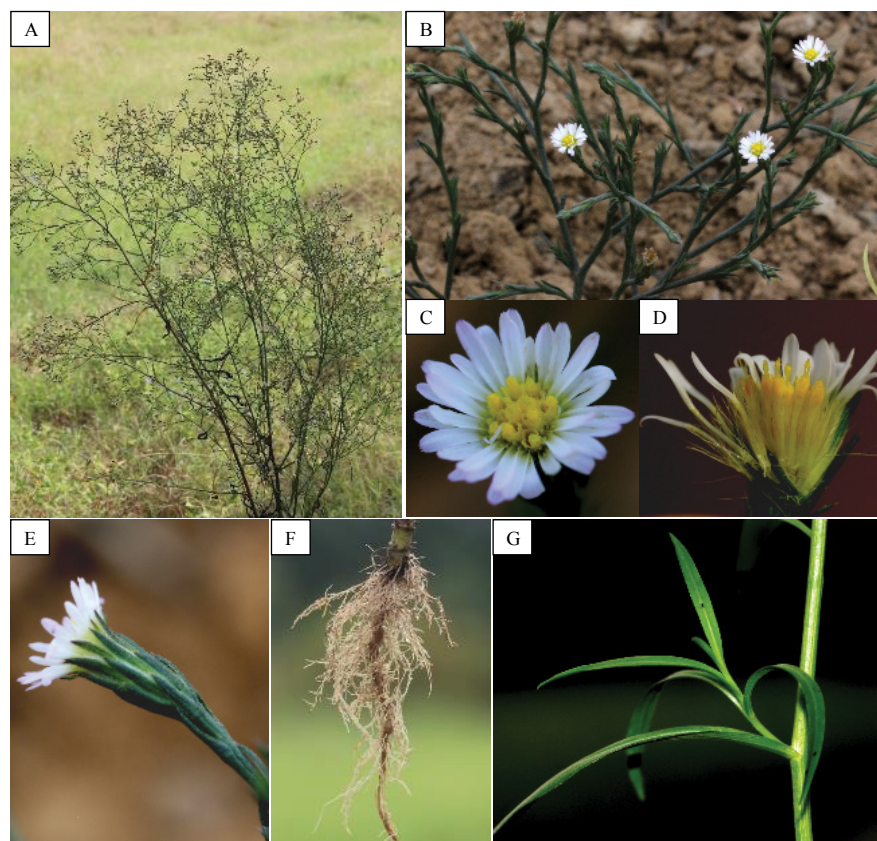


Figure 1. *Symphotrichum squamatum* A-Habit; B-Upper portion with flowers; C-A single flower; D-Flower showing disc florets; E-Involucre of bracts; F- Tap root; G- New shoot arising in leaf axil.

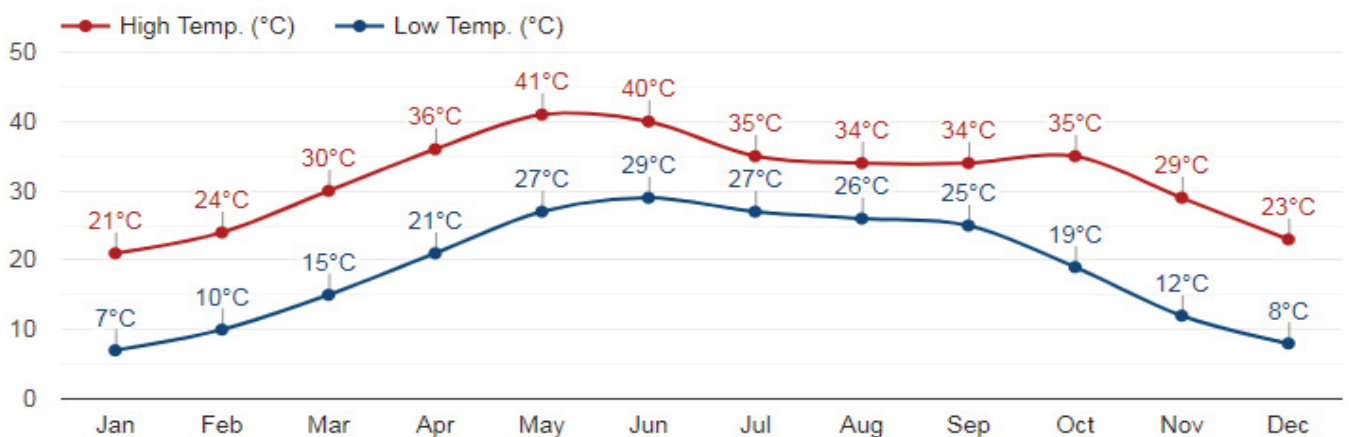


Figure 2. Average monthly temperature (°C) Greater Noida, India (Weather Atlas 2019).
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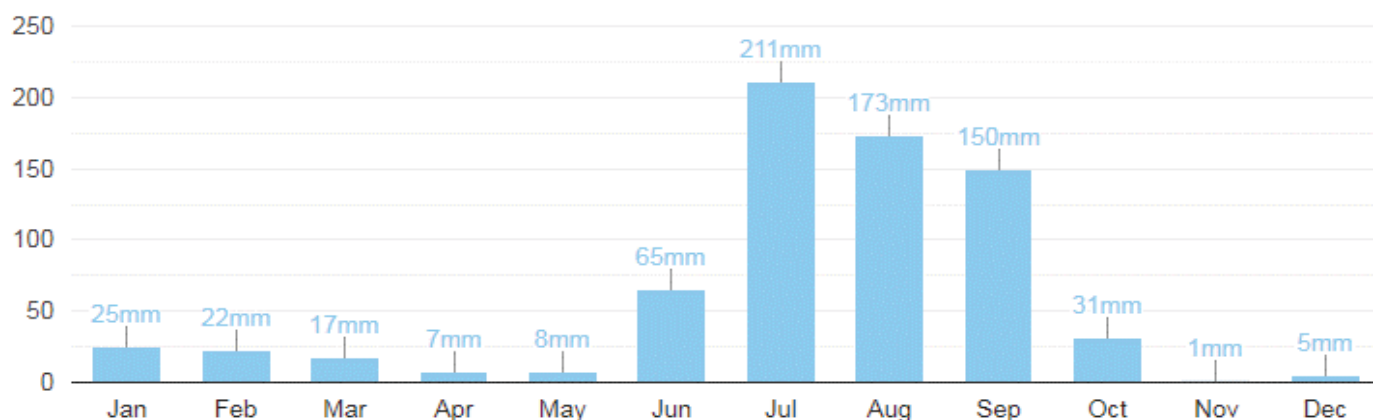


Figure 3. Average monthly rainfall (mm) Greater Noida, India (Weather Atlas 2019).

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