

CONTRIBUTION TO FLORA OF PAKISTAN: THREE NEW RECORDS FOR AMARANTHACEAE AND FABACEAE INCLUDING A NEW GENERIC RECORD

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Abstract

The current study is based on vegetation surveys, conducted throughout Pakistan from 2014 onwards and three plant species viz., *Alternanthera philoxeroides* (Mart.) Griseb., *Amaranthus albus* L. (Amaranthaceae) and *Galactia striata* (Jacq.) Urb. (Fabaceae) were identified as new records for Pakistan. Macro- and micro-morphological characteristics of these three species were studied and descriptions and illustrations are provided for easy identification.

Key words: Invasive plants, *Alternanthera philoxeroides*, *Amaranthus albus*, *Galactia striata*, Pakistan.

Introduction

Pakistan possesses diverse habitats and topography, from the sea to high mountain elevations, including the K2, 8767 metres a.s.l. Due to its geographical location, Pakistan has a wide variety of flora. More than 6,000 plant species are found in this area (Stewart, 1972), out of which more than 5,600 plant species have been described within 224 volumes of Flora of Pakistan. Apart from the native/endemic flora, non-native and invasive plant species have also been reported during past few years (Hussain *et al.*, 2000; Khan *et al.*, 2010). Occurrence of several other invasive plant species e.g., *Dentella repens*, *Anredera cordifolia*, *Oenothera laciniata* (Sultan *et al.*, 2021), *Solanum rostratum* (Ishaq *et al.*, 2020), *Salvia reflexa* (Hussain *et al.*, 2019), *Ludwigia adscendens* (Hameed *et al.*, 2019), *Soliva anthemifolia* and *S. pterosperma* (Mujahid & Shabbir, 2017) have more recently been documented from Pakistan. The biological invasions of alien flora and fauna create one of the most prominent threats to natural ecosystems, its biodiversity and food security (including agriculture, forestry, fisheries and human health etc.). In Pakistan, the issue of alien invasive species and their impact on biodiversity is not adequately investigated but has been recognized by researchers and scientists to some extent. There is, however, lack of awareness and capacity to address the issue specifically in Asia, including Pakistan (Hussain *et al.*, 2000). Developing inventories of native and alien plant species and their documentation in the form of research publications play a significant role in monitoring the occurrence and ecological consequences of alien invasive species on a country's flora, fauna and agriculture.

Several botanical expeditions were made in order to add specimens from different parts of country to the national collection. During explorations plant species were collected which were not documented in the accounts of families Amaranthaceae (Townsend, 1974), Papilionaceae (Ali, 1977) in Flora of Pakistan and annotated catalogue of vascular plants of West Pakistan and Kashmir (Stewart, 1972). The current study reports the presence of *Alternanthera philoxeroides* and

Amaranthus albus in Pakistan which are highly invasive globally. The native range of *Alternanthera philoxeroides* is Trinidad and Southern America and it is declared as one of the worst weeds because of its aggressive invasive behaviour in both aquatic and terrestrial habitats. It is reported to cause choking of rivers, water channels, wetlands and irrigation systems (Anon., 2016) similarly *Amaranthus albus* is reported as a potentially invasive plant by Aneva *et al.*, (2018).

Material and Methods

Extensive vegetation surveys were conducted for collection from 2014 onwards in various parts of Pakistan. Specimens of *Alternanthera philoxeroides* were collected from Head Treemu area, specimen of *Galactia striata* was collected from Deri Nala near Kotli in Azad Jammu & Kashmir, while a preserved specimen of *Amaranthus albus* was studied. The studied voucher specimens have been deposited in National Herbarium of Pakistan (RAW).

Results

Alternanthera philoxeroides (Mart.) Griseb.

Alligator weed: Prostrate straggling perennial herb, forming thick mats on water. Stem glabrous except a line of long trichomes, ribbed, pinkish, fleshy, hollow, approx. 1 m long, nodes bearing adventitious roots, flowering stems erect, internodes c. 1–6.5 cm, nodes bear long tufts of trichomes between leaf bases. Leaves opposite, elliptic to oblanceolate, glabrous or sparsely pilose especially on the abaxial surface with ciliate margins when young, papillate, slightly succulent, minutely denticulate, 2–8 x 0.7–2 cm, cuneate, sessile or subsessile, acute. Inflorescence a terminal or axillary long pedunculate capitate head (c. 1.6–1.8 cm in diameter), peduncle 5.5–6.5 cm, peduncle glabrous except a line of long trichomes, bracts three, ovate, 2.5 x 1.5 mm, apiculate, tepals papery white, ovate, acute 6.5 x 2.5 mm, filaments 2 mm, flattened, basally dilated, basal 1 mm fused, anther 1.5 x 0.5 mm, pistil c. 3.5 mm, ovary obovoid 2.5 x 5 mm, style 0.5 mm, stigma capitate, 0.5 mm. Fruit single seeded, tiny

capsule, reproduces vegetatively from stem fragments (Fig. 1).

Material examined: Head Treemu area, *Amir Sultan & Zafeer Saqib*, April, 2014, RAW100830; several populations of *Alternanthera philoxeroides* have been observed in Islamabad and adjacent areas (personal observation).

Alternanthera philoxeroides is an amphibious, herbaceous weed in family Amaranthaceae commonly known as alligator weed. Mostly found on stagnant or slow moving water bodies, channels, creeks, riverbanks and occasionally flooded areas. It is also found in terrestrial habitats as a pasture weed. Native range of this species is South America and is distributed from south of Buenos Aires Province to south Brazil. *Alternanthera*

philoxeroides is now recorded as invasive in 25 countries having 25,893 GBIF occurrences (GBIF Secretariat, 2021).

It was introduced in China as a fodder crop however later due to its invasive nature, speedy vegetative reproduction from stems, rhizome or roots and dispersal by water movement, boats, machinery and vehicles and in hay, it is now one of the worst weeds of China (Pan *et al.*, 2007). Due to quick vegetative growth and reproduction, it quickly forms huge mats which spread out on water bodies. It not only disturbs ecology of water banks and shallows but also out-competes native aquatic flora, disrupts water flow, intensifies flood, increases sedimentation, limits human access and provides breeding sites for various disease vectors like mosquitoes (Anon., 2016).



Fig. 1a. *Alternanthera philoxeroides* habit; 1b: Inflorescence.



Fig. 2. *Galactia straita* a. habit, b. pod.

Amaranthus albus L.

Prostrate pigweed: Annual plants, stem erect, ascending, pale brownish, ribbed, papillate, much-branched. Petiole 0.1-1cm, leaf obtuse, mucronulate with yellowish spine, narrowly cuneate, entire, leaf blade 6-20 x 2.5-6 mm, oblong-obovate, tuberculate. Inflorescence either in the axillary clusters or short terminal spikes. Bracts and bracteoles subulate-lanceolate, 1.75-2 x 0.5 mm, rigid, acuminate-spinescent, scarious-margined, keeled. Female flowers: tepals 3, linear, c. 1 mm long, acute, stigmas 3, divergent. Male flowers: interspersed with female flowers, tepals 3, stamens 3, longer than perianth. Utricles brownish, circumscissile, rugose distally, 1.5 x 1 mm. Seeds dark brown-black, shiny, globose, 1 mm in diameter.

Material examined: Khyber agency, Shillman hills, S. A. Khan, 5 June, 1980, (RAW 51933) (Fig. 3).

Amaranthus albus L is recorded as highly invasive in 43 countries having 17,778 GBIF occurrences and 12,918 geo-referenced records (GBIF Secretariat, 2021).

Galactia striata (Jacq.) Urb. (Fig. 2)

Herbaceous perennial with twining slender, pilose stems. Leaves 3-foliolate, leaflets oblong, 2.8-4.2 x 0.9-1.5 cm, sparsely pubescent above, more densely appressed pilose on the undersurface, petioles 1-3 cm long; stipules linear, c. 2 mm, petiolule c. 1.5 mm, stipels subulate c. 1mm. Flowers in lax 2-10-flowered racemes on peduncles 0.5-1.5 cm long, bracts and bracteoles ovate-lanceolate, 1.5-2.5 mm long. Calyx pubescent, lobes lanceolate, 3-6 mm long, the lowest longest. Standard whitish, pale lilac or pinkish-mauve and purple, elliptic or oblong-obovate, 1-1.2 cm long, hairless (fide Chen *et al.*, 2010). Pods linear-oblong, 3-6 cm long, finely appressed pubescent, usually 6-12-seeded.

Galactia striata has 4740 GBIF occurrences and 2598 geo-referenced records (Anon., 2021).

Material examined: Azad Jammu and Kashmir, Deri Nala, District Kotli, *Sayed Afzal Shah*, 14 September, 2015 (RAW 100445).

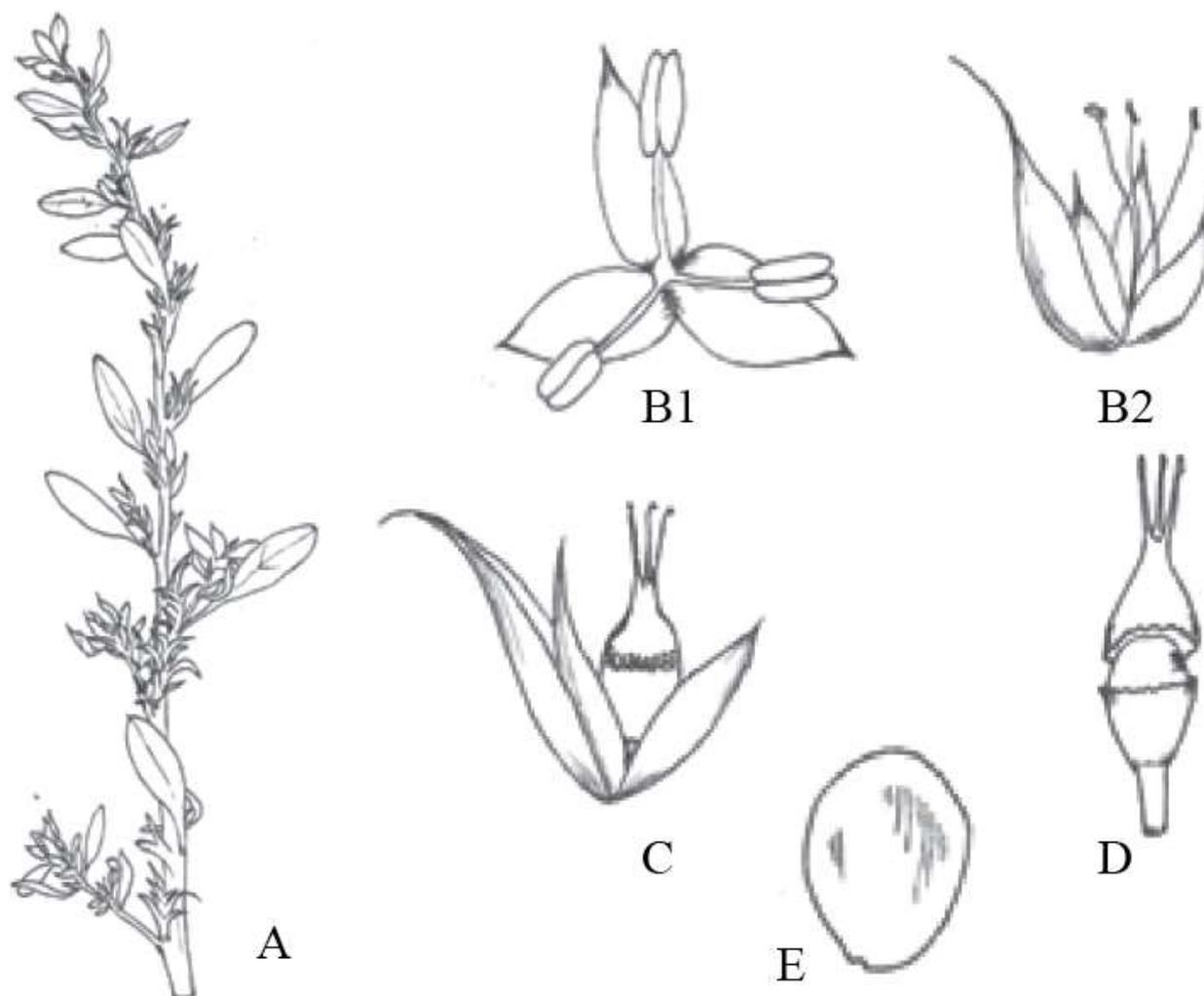


Fig. 3. *Amaranthus albus*: A: habit; B: male flower; C: female flower; D: fruit; E: seed.

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