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Bidens L. (Coreopsideae, Asteraceae), a new generic record for Abu Dhabi, United Arab Emirates

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Abstract

We report a collection of *Bidens pilosa* L. from an urban habitat in Abu Dhabi. This represents a new generic record of *Bidens* L. for the emirate. The species has most likely been accidentally introduced and has the potential to affect the native flora because of its fast rate of growth. The new record expands the geographic distribution of the species and highlights the importance of expanding surveys to include urban habitats, which would help track the spread of non-native species within the emirate.

Keywords

Accidental introduction, Arabian Peninsula, *Bidens pilosa*, invasive alien species, urban habitat

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Introduction

The Emirate of Abu Dhabi, which is the largest emirate in the United Arab Emirates (UAE), occupies an area of 67,340 km^2, supports diverse habitat types with characteristic flora and fauna. Abu Dhabi is home to around 436 species of native plants (Al Dhaheri et al. 2017) and eight alien plant species (Soorae et al. 2015). Apart from the main native habitats, the emirate also supports urban habitats that exhibit rich biodiversity like their native counterparts. Until recently, little attention was given to vegetation in arable land and urban green spaces, even though they are common in the emirate. Recently, field surveys in urban habitats recorded *Bidens pilosa* L. for the first time from the Emirate of Abu Dhabi, and the genus *Bidens* L. (Coreopsideae, Asteraceae) was not previously known from the emirate. In Abu Dhabi, Asteraceae is the second largest family after Poaceae, and is represented by 43 species belonging to 27 genera (EAD 2016).

The genus *Bidens*, the largest genus of the tribe Coreopsideae, consists of approximately 230 species which are distributed in tropical, subtropical, and temperate regions (Sherff 1937; Chowdhery 1995; Strother and Weedon 2006; Knope et al. 2020; POWO 2021). *Bidens pilosa* is one of the common species of the genus, with a documented occurrence in 59 countries around the pantropical areas of the world (Xuan and Khanh 2016). The species, which is native to South and Central America,

has now become a naturalized weed of tropical, subtropical, and warm temperate regions of the world (ISC 2014). In the Arabian Peninsula, the species have been reported from Saudi Arabia, Oman, Yemen, and the UAE (POWO 2021). In the UAE, the species was previously recorded only in Ras Al Khaimah, in the northern region (Mahmoud et al. 2015). Our new record is an addition to the segetal flora of Abu Dhabi and expands the geographic distribution of the species. This record also highlights the importance of expanding surveys to include urban habitats, which would help track the spread of non-native species within the emirate.

Methods

We carried out vegetation surveys in various urban habitats of the Emirate of Abu Dhabi during 2018–2021 to document the alien and native species present within the emirate. Sites included locations on Abu Dhabi Island, in its mainland suburbs and in Al Ain City. Urban habitats surveyed included gardens, golf course, date palm orchards, and roadside verges. The field attributes were collected using an iPad based IOS Collector App, which directly syncs with the Environment Agency – Abu Dhabi (EAD) plant database. Specimens were collected and identified using relevant literature and floras (Sherff 1937; Chowdhery 1995; Mahmoud et al. 2015; Jeetendra Kumar 2017). A voucher specimen of the new record is deposited in the EAD herbarium. The distribution map of the species was prepared using ArcGIS v. 10.5 (Fig. 1).

Results

Bidens L.

Sp. Pl. 2: 831 (Linnaeus 1753). Type: *B. tripartita* L. (Sherff 1937)

Erect or diffuse herbs. Stems terete or angulate, branched, variously pubescent, striate, or sulcate. Leaves opposite, simple or compound or pinnatisect, entire, toothed. Heads homo- or heterogamous, radiate or discoid, solitary or corymbose-panicles, usually pedunculate. Involucre campanulate, biseriate, shortly lyrate at the base; outer involucral bracts (outer phyllaries) membranous or leafy; inner involucral bracts (inner phyllaries) membranous, with spinulose margins. Receptacles flat or convex. Ray florets, white or yellow, mostly sterile. Disc florets yellow, fertile, 5-lobed. Anthers black. Style branches, apically pilose with a short, narrow appendage. Achenes black or brown, fusiform or linear, tetragonous, truncate and erostrate at the apex. Pappus of stiff, smooth or retrorsely barbed bristles (Jeetendra Kumar 2017).

Bidens pilosa L.

Sp. Pl. 2: 832 (Linnaeus 1753). Lectotype: LINN 975-8! designated by D'Arcy (1975)

Figure 2

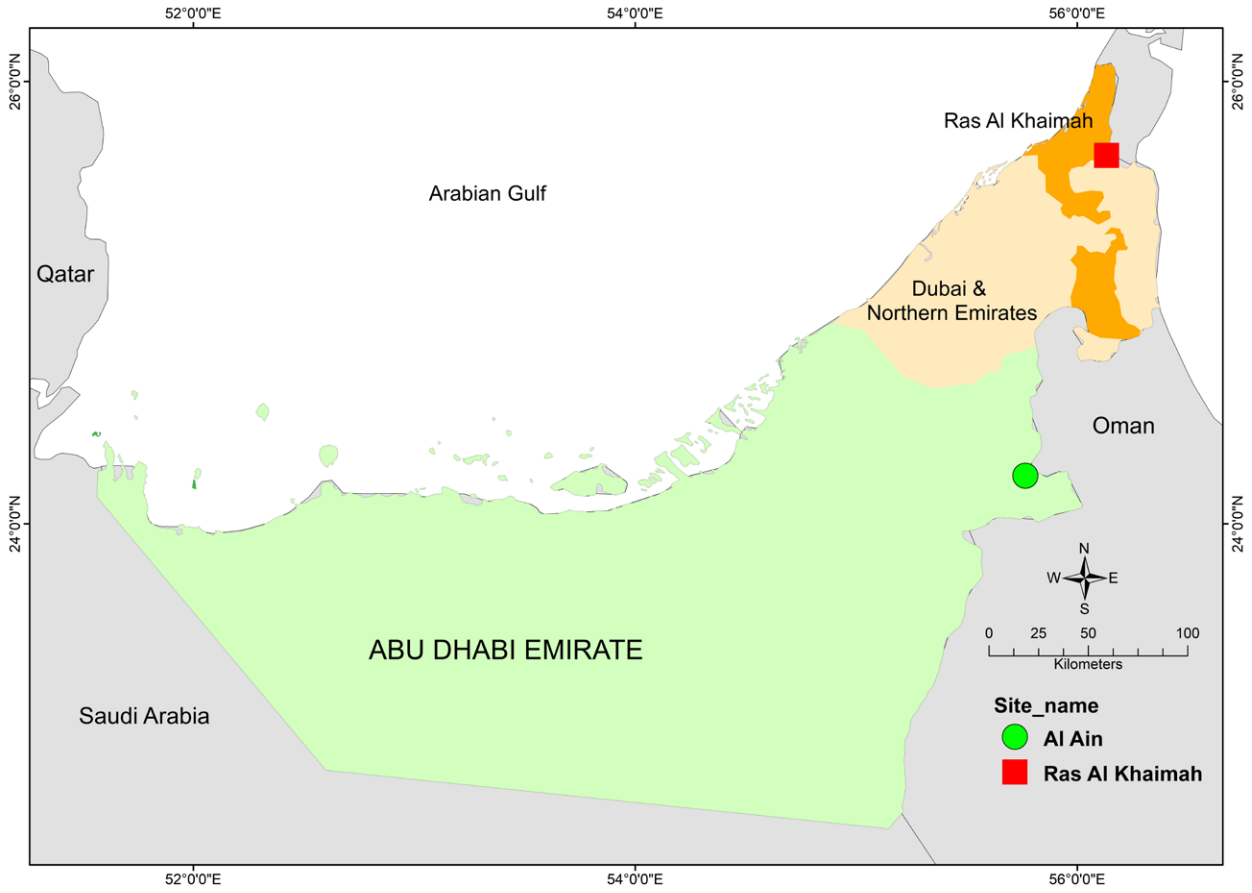

Figure 1. Geographic distribution of *Bidens pilosa* L. in the UAE. The green circle represents the new record of the species from Al Ain. The red square represents the previous record of the species from Ras Al Khaimah.

Figure 2. *Bidens pilosa*. **A.** Habitat. **B.** Habit. **C.** Radiate capitulum; notice wilted white ray florets in the periphery. **D.** Discoid capitulum. **E.** Achenes.

New record. UNITED ARAB EMIRATES – **Abu Dhabi Emirate** • Al Ain City, date palm orchard; 24°13.064′N, 055°45.963′E; alt. 289 m; 10.II.2021; Sabitha Sakkir leg.; EAD777.

Annual herbs, 30–120 cm tall. Stems erect, branched, more or less quadrangular, green, sparsely pilose. Leaves opposite, petiolate; lamina pinnatisect 2.5–18×2–11cm, segments ca. 6 × 3 cm, ovate or ovate-lanceolate, base truncate, apex acute or acuminate, margins serrate-ciliate, pinnately nerved, sparsely pilose on both surfaces.

Peduncle ca. 8 cm long, terminal, pilose solitary or several heads in lax corymbs. Capitula discoid or radiate, glabrous. Phyllaries in 2 series; outer phyllaries 7–10, linear to linear-spatulate, 2.7–5.0 mm long, 0.5–1.2 mm wide, green, surface glabrous, margin ciliate; inner phyllaries 8–10, lanceolate, 3–5 mm long, 1.0–1.8 mm wide, brown, glabrous, margin hyaline. Receptacle flat or convex, hispid. Ray florets present or rarely absent, 3–8 if present, usually sterile, corollas true ray, commonly white or rarely yellow, tube up to 5 mm long, limb 0.45–6.0 × 2.0–3.5 mm. Disc florets, 35–75, perfect, corollas tubulose, yellow, 3–4 mm long. Stamens 5, anthers linear, flat, 1 mm; ovary inferior, oblong, 4-angled, 1.5 mm. Style 3 mm, stigma bifid, hairy. Achenes 8–16 mm long, linear, obcompressed-quadrangulate, 2-grooved on both sides, 4–6 ribbed, costate, dark brown to black, glabrous below, tuberculate above, outer achenes shorter than inner ones. Pappus, 1–3 mm long, composed of 3–5 awns, retorsely barbed.

Chromosome number n = 36 (Ballard 1986; Tereza et al. 2006).

Habitat and ecology. The new record *B. pilosa* is from a date palm orchard, in a moist shady habitat. The date palm orchard is in the middle of Al Ain City and is the largest of Al Ain's oases and a UNESCO World Heritage site, covering an area of 1,200 ha. *Bidens pilosa* is a segetal species of this date palm orchard. The associated species include ruderal or segetal species such as *Cyanthillium cinereum* (L.) H. Rob, *Euphorbia helioscopia* L., *Lysimachia arvensis* (L.) U. Manns & Anderb., *Sida urens* L., *Medicago* sp., *Sonchus* sp., etc. The species is abundant in the date palm orchard, with more than 500 mature individuals.

Discussion

Due to increased urbanization and changes in land use, many alien species have been recently introduced into Emirate of Abu Dhabi through various means (Shahid 2014; Mahmoud et al. 2015; Soorae et al. 2015). The Emirate of Abu Dhabi includes Abu Dhabi City and Al Ain City, which are amongst the fastest-growing urban centers in the Middle East. Frequent disturbances due to rapid development of infrastructure have paved the way for many alien introductions. Like other parts of the world, the use of exotic species as ornamentals rather than native species in urban landscaping has intensified the introduction of many alien species, many of which are invasive (Alam et al. 2017).

Recently, the flora of the UAE has been enriched by many alien species of American origin, which are found to be naturalized because of change in land use practice (Shahid 2014). These are mainly invaders, which have expanded their former range and benefitted from human impact. Factors that influence their introduction, establishment, proliferation, and consolidation in urban settings are still not fully known. *Bidens pilosa* is a problematic species for many reasons throughout its range and a troublesome weed to at least 30 crops in over 40 countries (GISD 2021). The presence of the species in the UAE also indicates its great tolerances to the harsh climatic conditions (Mahmoud et al. 2015).

Until now, the species has not been found to spread far beyond orchards. The orchards in Al Ain City are a part of culture and tradition of the UAE and tourist attraction with an influx of visitors. Based on our field observation, *B. pilosa* was most likely accidentally introduced and has the potential to become invasive (Pysek et al. 2004). The species is capable of producing a large number of flower heads in four generations per year, with a potential of producing a large number of viable seeds ranging from 3000 to 6000 per generation (ISC 2014; Xuan and Khanh 2016). Moreover, the seeds of *B. pilosa*, which are awned, could cling onto suitable surfaces such as clothes, shoes, and the fur of animals (Xuan and Khanh 2016) and get transported easily by wind, humans, and animals (ISC 2014).

The fast growth rate and high reproduction potential and easy dispersal will enable them to invade varied urban and semi-natural plant communities, and they may ultimately invade natural habitats. Our record of *B. pilosa* from Abu Dhabi is not only important as a new record of the genus in the emirate, but it also is an alert for future threat to the native flora. As *B. pilosa* is a highly reproductive weed with aggressive dispersal (Mahmoud et al. 2015), it is essential that systematic surveys are needed to measure the rate of spread in urban habitats. To avoid plausible threats to the flora of Abu Dhabi from accidental introduction of invasive plants, regular monitoring programs are needed to keep a close watch on the spread of non-native species.

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Authors' Contributions

Conceptualization: SS and PS. Formal Analysis: SS and PTA. Project Administration: PS. Writing – original draft: SS and PTA. Data curation: SS and MAM. Methodology: SS and PS. Validation: SS and PTA. Writing-review and editing: SS, PTA, MAM, and PS.

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