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Parthenium hysterophorus and *Bidens pilosa*, two new records to the invasive weed flora of the United Arab Emirates

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ABSTRACT

Parthenium hysterophorus L. and *Bidens pilosa* L., two species of Asteraceae, are recently recorded for the first time in the United Arab Emirates (UAE). This information is based on our recent field work and critical evaluation of the existing literature. *P. hysterophorus* is a highly invasive alien weed of global significance and is now present in more than 30 countries of its invasive range alone. In many parts of the world this weed has been reported to reduce the crop and pasture production, native plant biodiversity and human and animal health. The presence of these cosmopolitans under the hyperarid climates of UAE indicates their great tolerances to the harsh climatic conditions. Both species are considered as good colonizers; they have explosive reproductive potential and ability to thrive in diverse habitats. The population dynamics of the *P. hysterophorus* L. and *B. pilosa* L. should be monitored in order to assess their future spread. All known populations of these two invasive weeds need to be eradicated and cleared sites needs to be continuously monitored for the presence any soil seed bank. Plant specimens of *P. hysterophorus* and *B. pilosa* are deposited to the Sharjah Seed Bank and Herbarium (SSBH), UAE. Descriptions and photographs of these species are provided.

Key Words: *Parthenium hysterophorus, Bidens pilosa*, Invasive weeds, Asteraceae, UAE, New record.

INTRODUCTION

Asteraceae is the largest family of flowering plants, with over 1600 genera and 23,000 species (Jeffrey, 2007). In the United Arab Emirates (UAE), it is represented by 36 genera and 59 species (Jongbloed, 2003; Karim and Fawzy, 2007; El-Keblawy et al., 2005). During the floristic studies (2013-2014) in Sharjah and Ras Al Khaimah of UAE (Fig. 1), the authors collected two invasive weed species, *Parthenium hysterophorus* and *Bidens pilosa* belonging to family Asteraceae. The comparisons of the morphological characteristics with similar species in the UAE and floras, mainly Saudi Arabia, Egypt, India, Pakistan, Australia, indicated that these species are new records for the flora of the UAE. Dr Samia Heneidak, a key taxonomist in the regional flora of the Middle East, also confirmed the identification of the two species as *P. hysterophorus* L. and *B. pilosa* L. The review of literature further confirmed that these two

species hitherto not reported from UAE (Jongbloed, 2003; Karim and Fawzy, 2007). Hence, we are reporting them here as an addition to the Asteraceae flora of UAE. The voucher specimens are deposited in Sharjah Seed Bank and Herbarium (SSBH), Sharjah, UAE.

Indeed, the invasive weeds especially those from tropical America are largely considered troublesome and have caused adverse ecological, economic and social impact worldwide. These weeds have threatened the integrity of ecosystems throughout the world, by affecting species diversity of native areas and their biological integrity (Kohli et al., 2006). It is believed that the introduction of *P. hysterophorus* and *B. pilosa* to UAE was accidental. Possibly it could have been introduced via the imported agricultural products. These two species have been recognized as serious weeds as they have explosive reproductive potential and ability to thrive in diverse habitats, which enabled them to become potential invasive weeds in different parts of the world (Haseler, 1976; Tamado and Milberg, 2000; Cui and He, 2009; Lemos et al., 2013). *P. hysterophorus*is is among the top ten worst weeds of the world and has been listed in the global invasive species database (Callaway and Ridenour, 2004; Kapoor, 2012). This weed is too difficult weed to be managed using one method so that, integrated approaches using cultural, physical, chemical, and biological techniques is necessary to be successful (Kumari, 2014).

The distinctive growth strategies such as fast growth rates, short life-cycles, greater reproductive potential, high competitive abilities and allelopathy make these weeds as successful invaders of native habitats (Kumari, 2014).

MATERIAL AND METHODS

Field explorations were conducted during 2013-2014 as part of plants and seed collection by SSBH, Sharjah Research Academy, Sharjah. Along with plant samples, all relevant field data including geographic coordinates of the collecting sites, associated species and habitat in which plant grow have been recorded. The specimens were studied in detail and identified using relevant flora, literatures and with the help of plant taxonomists. After identification, the specimens were processed and deposited in SSBH, Sharjah, UAE.

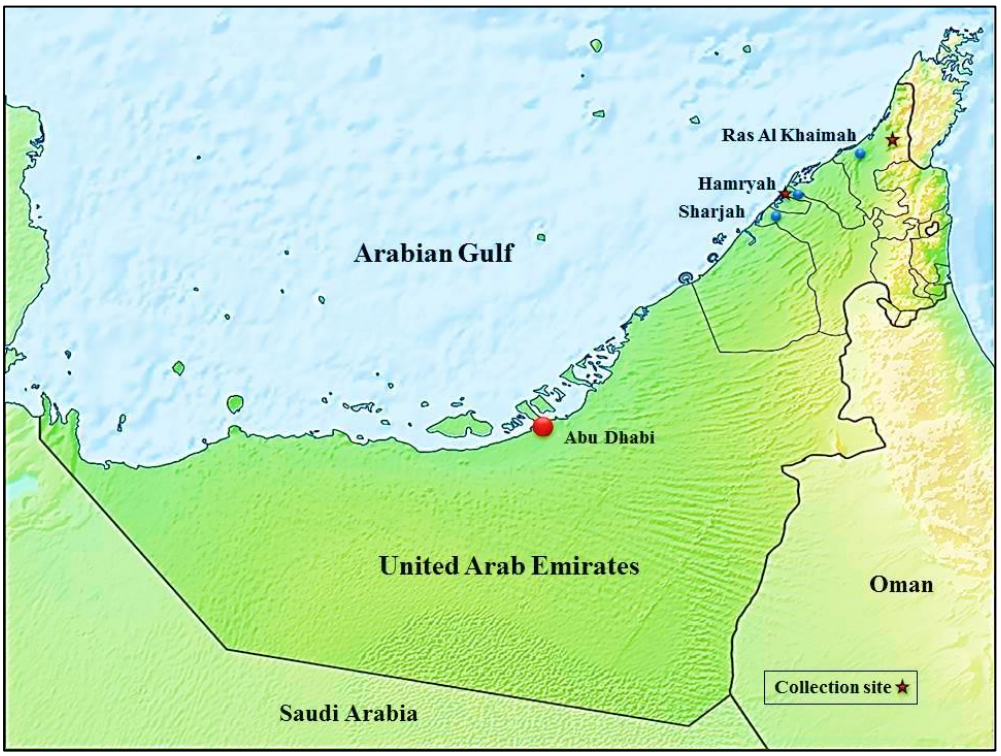

Fig.1. Map showing collection sites for two newly recorded species.

RESULTS AND DISCUSSION

The specimens of *P. hysterophorus* and *B. pilosa* collected by the authors have been recorded for the first time from United Arab Emirates. Below are the relevant details of newly recorded species:

1- *Parthenium hysterophorus* L. Fig. 2
Syn. *Parthenium lobatum* Buckley.

Parthenium L. is a small genus of approximately 12 species of shrubs, herbaceous perennials, and annuals (Mears, 1975). *Parthenium* species are commonly known as feverfew (ITIS, 2015). Notable species include Guayule (*P. argentatum*) which has been used as a rubber substitute, especially during the Second World War (Ray, 1993; Jeffrey, 1993), and *P. hysterophorus*, a serious invasive species in the Old World and aggressively colonizes disturbed sites (GISD, 2010).

Common names: Parthenium weed, Congress grass, Carrot weed, White top weed, Ragweed, Famine weed and Santa Maria feverfew.

Description: *Parthenium hysterophorus* is a much-branched, annual or short lived perennial, erect herbaceous plant. It usually grows to 0.5-1.5 m tall. Mature stems are greenish and longitudinally grooved, covered with small stiff hairs, and become much branched at maturity. The leaves are simple with stalks up to 2 cm long. Lower leaves form a basal rosette, 3-30 cm long, 2-12 cm wide and bi-pinnatifid or bi-pinnatisect. Upper leaves decrease in size and less in number. The undersides of the leaves, are appressed pubescent. Flowers are numerous, white or creamy and arranged in terminal panicles. Flower-head is 4-5 mm across, with a stalk 1-8 mm long and has five to eight tiny ray florets of 1 mm long. It has 12-60 tubular florets and is surrounded by two rows of small green bracts. Color changes to light brown when seeds are mature and about to shed. Four to eight small seeds are produced in each flower-head. Seeds are striped grey to black and a narrow diamond shape, 1.5 -2 mm long and flattened. Seeds are topped with two or three small pappus about 0.5-1 mm long.

Phenology: *P. hysterophorus* can germinate at any time of the year and the seed has no dormancy. Elsewhere in Australia, it is reported that this plant can flower 4-8 weeks after germination, and flowering may continue for 6 to 8 months. However, the specific months in which flowering occur can vary slightly depending on the geographical distribution. In UAE, authors observed flowers and fruits in May and June.

Habitat: It has been reported that *P. hysterophorus* grow almost in all soil types. It prefers disturbed sites and is an aggressive invader of fallows, wastelands, roadsides, overgrazed pastures (Khalid, 2000). More notably, previous studies also reported that this weed has strong adaptive strategies to tolerate both moisture and saline stress. In UAE, we found it growing in a small garden in Hamryah coast. The climate of the UAE is characterized by high temperatures (up to 49˚C in July), high humidity and low rainfall. The average, annual rainfall in the mountain region (140-200 mm) and along the east coast (100-140 mm) is generally higher compared to the gravel plains (100-120 mm), with the west coast receiving the lowest average of less than 60 mm (Boer, 1997).

Global distribution: The native range of *P. hysterophorus* encompasses around 20 countries in South, North and Central America. Notable countries are Mexico, Argentina, Brazil, Bolivia, United States and Panama and Also Caribbean islands. It was introduced to about 34 countries in South Asia, East and South East Asia, Australia, East Africa and Southern Africa (Dale, 1981; Shabbir, 2014). *P. hysterophorus* was introduced to 3 countries in the Middle East region Egypt (Zahran and Willis, 2009), Israel (Joel and Liston, 1986) and Yemen (Alhammadi, 2010). In the Gulf countries it was recorded only in Oman (Alhammadi, 2010).

In UAE: In May 2013, a total of 4 individuals, all were at maturity stage, were recorded in a home garden at Hamryah coast, Sharjah, UAE (N: 25.47843˚ and E: 55.49994˚, Alt.: 1.5 m a.s.l.).

Associated species: *Launaea nudicaulis* L. Hook.f., *Chloris virgata* Sw., *Carthamus tinctorius* L., *Senecio glaucus* L. and *Heliotropium kotschyi* (Bunge) Gürke.

Invasiveness and impact: *P. hysterophorus*, is considered as one of the most aggressive, troublesome and noxious weeds, especially in India, Pakistan and Australia (Navie et al., 1996; Kohli et al., 2006; Shabbir and Bajwa, 2006). In many parts of the world, the adverse effects of this noxious weed on human beings, livestock, crop production, and biodiversity are well-documented (e.g., Kohli et al., 2006; Shabbir and Bajwa, 2006; Adkins and Shabbir, 2014).

Since it was growing in a garden in UAE, we assume that *P. hysterophorus* might have come along with some seed imported from invaded country or it may came along as contamination of potting mix/medium with plants imported from a country of origin. Moreover, introduction of this weed by natural means may be possible as we know that this weed is present in the neighbour of UAE i.e. in Oman and Yemen. The movement of attached seed to the vehicles and machinery is considered to be an important introduction/spread pathway in other parts of the world such as India and Pakistan etc.

Fig. 2. ***Parthenium hystyrophorus*** flowering twigs. Voucher specimens deposited in SSBH

Fig. 3. ***Bidens pilosa*** **L.** habit (left) and flowering part (right)

2-*Bidens pilosa* L. Fig. 3

Syn. *Bidens leucantha* (L.) Willd,
Bidens sundaica (Blume)

Bidens L. is a genus with about 230 to 240 species worldwide (Karis and Ryding, 1994; Pozharitskaya et al., 2010). Among them, *B. pilosa* is globally distributed across temperate and tropical regions. *B. pilosa* is a ruderal, invasive herb (Silva et al., 2011) originated from the South America and currently found in many tropical and subtropical countries. Due to its invasive tendencies, *B. pilosa* is generally considered an obnoxious weed in many countries (Young et al., 2010). In the Middle East, it has been naturalized in both Egypt and Saudi Arabia (CABI, 2014). *B. pilosa* has also been included in the Global Invasive Species Database (GISD, 2010).

Common names: Spanish needle, beggar's tick, Pitchforks and cobbler's pegs.

Description: *Bidens pilosa* is an erect, annual herb either glabrous or hairy. It reaches up to 1.2 m high. Stem is quadrangular, reddish tinged, simple, or branched from the base. Leaves are opposite with serrate, lobed, or dissected margins. Flowers are white or yellow. Heads have two rows of involucral bracts; solitary or in lax paniculate cymes at the ends of the main stem and lateral branches. Achenes are black, long and narrowly ribbed.

Phenology: Plants produce flower and fruits from May to October. It has the potential to produce 80 flower heads with seeds production of 3000 seeds per individual per year (Mvere, 2004). In UAE, we observed flowers and fruits in April.

Habitat: *Bidens pilosa* has the ability to invade diverse habitats, including roadsides, crops, pastures, gardens, disturbed areas, fallow lands and urban open space.

Global distribution: The native range of *B. pilosa* is tropical America but is now a pantropical weed (Wagner et al., 1999). Latin America and eastern Africa have the worst infestations of this weed (Mitich, 1994). On the level of countries, Argentina, Australia, Brazil, Columbia, Cuba and Jamaica are notable countries with native *B. pilosa*. It was introduced to many countries covering wide ranges of environmental conditions. These include USA, Canada, Belgium, UK, France, Greece, Portugal, Israel, Japan, China, Indonesia, Kenya, Nigeria, Botswana and Egypt (CABI, 2014).

In UAE: In April 2014, a total of 7 individuals were recorded from a farm in Wadi Al Baih, Ras Al Khaimah, UAE (N: 25.800532˚ and E: 56.095335˚, Alt.: 140 m a.s.l).

Associated species: *Melilotus indicus, Chloris virgata, Centaurium pulchellum, Trigonella hamosa* and *Launaea nudicaulis*.

Invasiveness and impact: *Bidens pilosa* is a problematic plant species for many reasons throughout its range. It is reported as a troublesome weed to at least 30 crops in over 40 countries because of its high potential to reduce the crop yields (Holm et al., 1977). It has a fast growth rate, strong seed production capacity, forming dense stands as well as producing allelopathic compounds in addition to being a victor host for many plant parasites. For these reasons, presence of *Bidens pilosa* within the farm plants and crops is strong indicator for germination suppression, aggressive competition then significant low production and loss of crop yields. Thick stands of *B. pilosa* impede access to roads, trails and recreational areas; moreover its burrs are a nuisance to people, as well as, sheep and other fleece producing livestock (DPI, 2008; Mvere, 2004).

Concluding Remarks

The report of new additions to the flora of UAE indicated that the country needs thorough botanical explorations. The introduction of these two species in the Arab Gulf region may seriously affect the crop productivity in the countries that are suffering from critical shortage of fresh water resources. Therefore, further research is needed to monitor their spread and understand their population dynamics and to evaluate the threat posed by these species to rare plants and their habitat in UAE. In addition, it is important to study the allelopathic behavior of the two species, which might explain their expected superiority, or takeover, over other species and impacts on natural ecosystems in UAE. We recognized that the country's mountain habitats – a key biodiversity areas, remain severely understudied, and need a rigorous inventory. Similarly, many other habitats are critically important for the conservation of endemic, rare and threatened species. So, botanical explorations should be focused more in those key habitats.

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