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Golden crownbeard (*Verbesina encelioides*, *Asteraceae*), first record for the Tunisian flora

Abstract

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A new alien plant – *Verbesina encelioides* (*Asteraceae*) – was recorded in Tunisia at Hencha-Sfax. Its identification was based on specimens' examination and relevant literature. A floristic exploration was made during October-November 2013 to map the spatial distribution and to measure some biological traits of this species. Within an area of 40 km² and along 35 km of roadsides 19 infestations we recorded. The large part of them was located in ruderal environments and in lesser extent in field crops. During field trips we noted *V. encelioides* behavior in each habitat. It is a drought tolerant erect annual plant, germinating in early spring or autumn; some seedlings may survive the winter season. From the observations this species look like more adapted to roadsides than to field crops.

Key words: xenophytes, alien flora, Tunisia, invasive weed.

Introduction

Asteraceae family in the Tunisian flora comprises 109 genera and 282 species (Le Floch & al. 2010). However, there were no herbarium or literature data of the genus *Verbesina* in Tunisia (CABI 2015). This monophyletic genus is the largest one in the tribe *Heliantheae*. It contains about 300 world-wide species of herbs, shrubs and trees, ranging from eastern Canada to central Argentina (Panero & Jansen 1997). Robinson & Greenman (1899) divided it into 12 sections, using characters such as corolla color, inflorescence morphology, capitulum size, and ray flowers presence.

Verbesina encelioides is a member of the section *Ximenesia* (Coleman 1966). It was divided into two subspecies (*encelioides* and *exauriculata*) (Coleman 1974). It is native to North and South America (Wagner & al. 1990). Panero & Jansen (1997) studies support a North American origin for this genus. It has successfully naturalized in many warm regions of the world. Its current world distribution includes the five continents of America (Argentina, Arizona, Hawaii, Mexico), Africa (Algeria, Egypt, Morocco), Asia (India, Saudi Arabia, Yemen), Europe (Belgium, France, Spain) and Oceania (Australia, Victoria) (CABI 2015).

V. encelioides figures on the European Plant Protection Organization (EPPO) observation list of Invasive Alien Plants (EPPO 2015). It was recently recorded in Morocco, where it colonizes wastelands, roadside borders and field crops (Taleb & Bouhache 2006). It is regarded as a noxious weed in several states of the United States of America (Jain & al. 2008). In particular, it is problematic for peanut farmers in southern states of the United States (Feenstra & Clements 2008). In Australia, it occurs as a weed of sandy loams along roadsides, stock routes, field headlands and in some woodland communities (Parsons & Cuthbertson 2001). In North India, it is a prominent weed infesting field crops and abundant along roadsides and railway tracts and on the wastelands, occurring mostly in sandy and sandy-loam soils (Kaul & Mangal 1987).

In Tunisia, it was detected in 2011 at Hencha-Sfax. The way of its introduction and time of its arrival remain unknown. The present paper is its first report in Tunisia. It is an alert of probable emerging problem and a starting point for its management plan, including quarantine and potential eradication.

Material and methods

Species and subspecies identification

Specimens were collected from the infested habitat and examined to identify the species based on dichotomous genus and species keys of the *Asteraceae* (Haines 2011), relevant literature (Parker 1972; Kaul & Mangal 1987; Wagner & al. 1990; Taleb & Bouhache 2006) and online databases (e.g. Euro+Med Plantbase, African plant database). Subspecies identification was based on the description of the auricles shape and position, achene apices shape and phyllaries length (Coleman 1966).

Plant biology in the study site

Specimens were collected from agricultural fields and pathway borders to study the subspecies biological traits (plant height, capitula number.plant⁻¹ and achenes number per capitulum⁻¹).

Plant distribution in Tunisia

The study site covers 40 km² around the detected infestation in 2011 along the highway (A1: Tunis-Sfax) at Hencha-Sfax (Lat. 35°07' N, Long. 10°45'E, Altitude: 62 m; (ANME 2005)). It is a semi-arid region with an annual rainfall of 200-300 mm.

The study site was monitored from October to November 2013 for the plant presence and to map its distribution across its total area and along 35 km of pathways. Infestations were localized with a Global Positioning System (GPS) Garmin eTrex Vista by recording their geographic coordinates (degrees of latitude and longitude) captured in their centers. Geographic records were used to generate the plant distribution map.

Results and discussion

Species distinguishing features

Capitula are composed with 10-15 yellow ray flowers and numerous disk flowers. Lobes of disk corollas are not villous-tomentose. Capitulum receptacles are convex

and chaffy with foliaceous involucre bracts. The Cypsela (achene) body is with evident lateral wings. Pappus composed of two short awns (1-2.5 mm). Leaves are opposite, upper ones alternate, ovate or deltoid, 7.0-9.5 cm long by 3.7-4.5 cm wide. Both leaf surfaces are hairy but upper surfaces are more hairless; leaf margins are coarsely and often irregularly serrate; upper leaf petioles are dilated at base to form a pair of stipules like auricles. It has a taproot system and many branched stems, covered by fine white hairs. Height of adult plants varies from 2 to 20 dm. In average, plants growing in pathways (8-20 dm) were taller than those growing in agricultural fields (2-10 dm).

Subspecies distinguishing features

Our observations allowed to deduce that auricles are semi-ovate which borne on petioles of most leaves, achene wing apices are acute and phyllaries (bracts) mostly averaging more than 12 mm long. Accordingly, we conclude that the collected specimens belong to the subspecies *encelioides* (Fig. 1).



Fig.1. *Verbena encelioides* subspecies *encelioides* at Hencha-Sfax, 20 August 2011 (Photo by N. Sayari).

Biology of Verbesina encelioides subsp. encelioides in the study site

Our observations allowed to deduce that the plant is an annual herb with a germination peak taking place during the spring. However, some achenes germinate in autumn and may survive throughout the winter season. It exhibits efficient self- and cross-pollination with a main flowering peak from July to November. A plant produces 29 to 254 capitula. In average, plants growing in pathways hold much more capitula (127 ± 93) than those growing in agricultural fields (57 ± 37). A capitulum produces 37 to 175 achenes. Commonly, those providing from plants growing in agricultural fields were more prolific (103 ± 46), compared to capitula of plants growing in pathways (88 ± 26). In fact, for mature plants excessive vegetative growth can have a negative impact on reproduction. These findings confirm the invasive behavior of the plant including high seed production (as many as 300-350 seeds per capitulum and numerous capitula per plant), seed dormancy, ability to tolerate dry conditions, and possible allelopathic effects. According to Booth & al. (2010), rapid growth from vegetative stage through to flowering stage and high seed production are among the ideal characteristics of invasive weeds. Furthermore, its winged achenes are easily dispersed by light winds (Kaul & Mangal 1987).

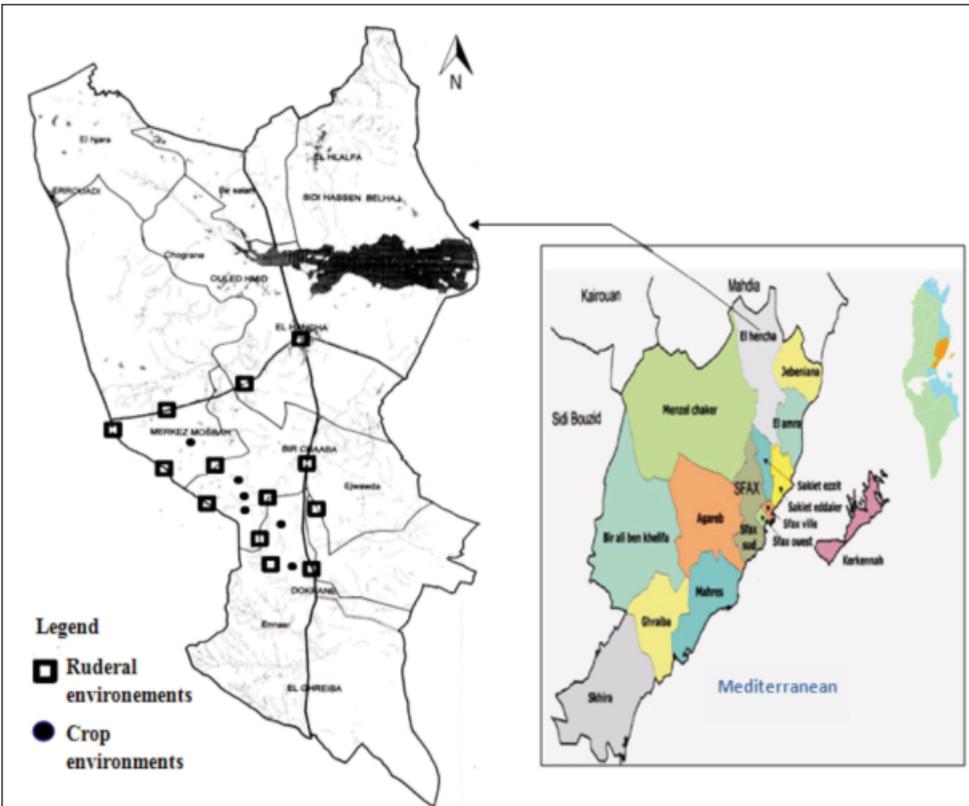


Fig.2. *Verbesina encelioides subsp. encelioides* distribution map at Hencha-Sfax (2013).

Distribution in Tunisia of V. encelioides subsp. encelioides.

Results showed that the weed is not yet widespread in Tunisia. Within the study site 19 infestations we recorded (Fig. 2). 78% of them occur in ruderal zones (pathways and urban zones) and 22% occur in orchards (olive and almond). In ruderal environments *V. encelioides subsp. encelioides* was found associated to other weed which the most abundant were *Nicotiana glauca* Graham, *Solanum elaeagnifolium* Cav., *Scolymus hispanicus* L. and *Hordeum murinum* L. However, in the crop environments (orchards) weed flora composition changed and *V. encelioides subsp. encelioides* was found associated to *Cynodon dactylon* (L.) Pers. which grows mainly around trees, *Amaranthus albus* L., *Diplotaxis muralis* (L.) DC. and *Portulaca oleracea* L.

Conclusions

Our findings provide an updated of the range of *Asteraceae* family in Tunisia. The genus *Verbesina* is reported here for the first time. The taxon *Verbesina encelioides subsp. encelioides* is a North American plant recently detected in Tunisia. Actually, its presence is limited to few locations in the Center-East of Tunisia, a semi-arid region. In fact, it is a drought tolerant erect annual plant, germinating in early spring or autumn with a main flowering peak from July to November. The plant grows better in ruderal zones than in agricultural fields. In fact, the large part of the infestations (78%) was recorded in ruderal zones. However, the plant is easily dispersed and it is likely to establish elsewhere in the semi-arid region. It can be considered as an emerging invasive plant in Tunisia which requires the implementation of an appropriate management plan, including quarantine and potential eradication.

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