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Onopordum* (Asteraceae) in Algeria with special focus on *O. ambiguum

Abstract

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The flora of Algeria includes six species of *Onopordum* (Asteraceae). Twenty-one morphological characters were recorded from herbarium specimens and identification keys were built using the program suite DELTA. Information on the distribution of these species in Algeria is provided. After studying aspects related to populations size and ecology, provisional regional conservation status for *O. ambiguum* is given: Endangered (EN).

Key words: Taxonomy, Key, DELTA, Ecology, Distribution, Ksour Mountains, Aïn Sefra.

Introduction

Asteraceae is the largest family of angiosperms in Algeria. It includes 557 taxa in 136 genera (Dobignard & Chatelain 2011). Members of this family are often herbaceous plants and shrubs, rarely bushes. *Onopordum* L. (Asteraceae, *Carduoideae-Cardueae*), with about 60 accepted species, is mainly distributed in central and western Asia, Europe, North Africa and the Canary Islands (Susanna & Garcia-Jacas 2007; POWO 2021). In Algeria, only five species of this genus are reported in the main floras, of which *Onopordum algeriense* (Munby) Pomel is endemic to the country (Quézel & Santa 1963; African Plant Database 2021). It is customary to point out that only Bouraada & al. (2014) reported this taxon in the High Plains of eastern Morocco at Tandrara and Bouârfâ. However, according to Fennane (2017), this notice is still doubtful as no specimens have been deposited in a known herbarium of Morocco or appear in any online databases such as Euro+MedPlant Base and Plants of the World Online (POWA).

In the course of numerous surveys carried out in the Ksour Mountains, especially in the region of Aïn Sefra (Nâama Province), a number of observations were directed to populations growing in the famous dune north of Mekter Mountain and the adjacent gardens of the Ksar (Gordo 2021). Close examination of these populations led to the recognition of two different *Onopordum* species occurring in the same station. The first corresponds to *Onopordum arenarium* (Desf.) Pomel, while the second remained unidentifiable by the keys available in the Flora of Algeria by Quézel & Santa (1963), or in other floras of neigh-

boring countries such as that of Morocco by Fennane & al. (2014) or Tunisia by Pottier-Alapetite (1981). It should be noted that this genus is not described in either the flora of the Sahara (Ozenda 1991) or that of Mauritania (Barry & Celles 1991). The specimens were identified provisionally as *O. ambiguum* Fresen. (Fig. 1). This species was recorded in the Algerian flora on the basis of a single specimen collected from Biskra by B. Balansa as early as 26 April 1853. This record was later seconded by another collection by Battandier & Trabut (1888) from the Aïn Sefra region in Nâama Province. Subsequently, the species has not been seen for more than a century since it does not appear in the floristic lists established later by other botanists who explored the Ksour Mountains, such as Bonnet & Maury (1888), Hochreutiner (1904) and Maire (1916), as well as the more recent accounts of the Algerian flora (e.g. Quézel & Santa 1963; Ozenda 1991).

The range of *O. ambiguum* extends from the eastern Mediterranean to Iraq and the Arabian Peninsula. It is present in the following countries: Egypt, Iraq, Palestine, Saudi



Fig. 1. Habit of *Onopordum ambiguum* (April 2021, Photo by B. Gordo).

Arabia, Sinai (Egypt) and Yemen (POWO 2021). It is worth noting that *O. ambiguum* has a markedly discontinuous distribution in N. Africa as it has so far been repeatedly recorded from the Sinai Peninsula in the extreme east and in Algeria in the west, with no records as yet from Libya, Tunisia and Morocco.

A computer-generated key for the identification of the six *Onopordum* species, together with detailed description of every species in terms of 21 characters recorded comparatively for each of them are provided using computer program package DELTA. A further objective of this contribution is to analyze ecology and regional conservation status of *O. ambiguum* confirmed for the country after more than one century of its last record.

Materials and Methods

Various botanical explorations were carried out from 2012 to 2021 throughout the city of Aïn Sefra which is administratively attached to the province of Nâama, a part of the biogeographic sector called the Western Saharan Atlas or Ksour Mountains (Fig. 2). Throughout these explorations, the majority of the Algerian *Onopordum* were collected

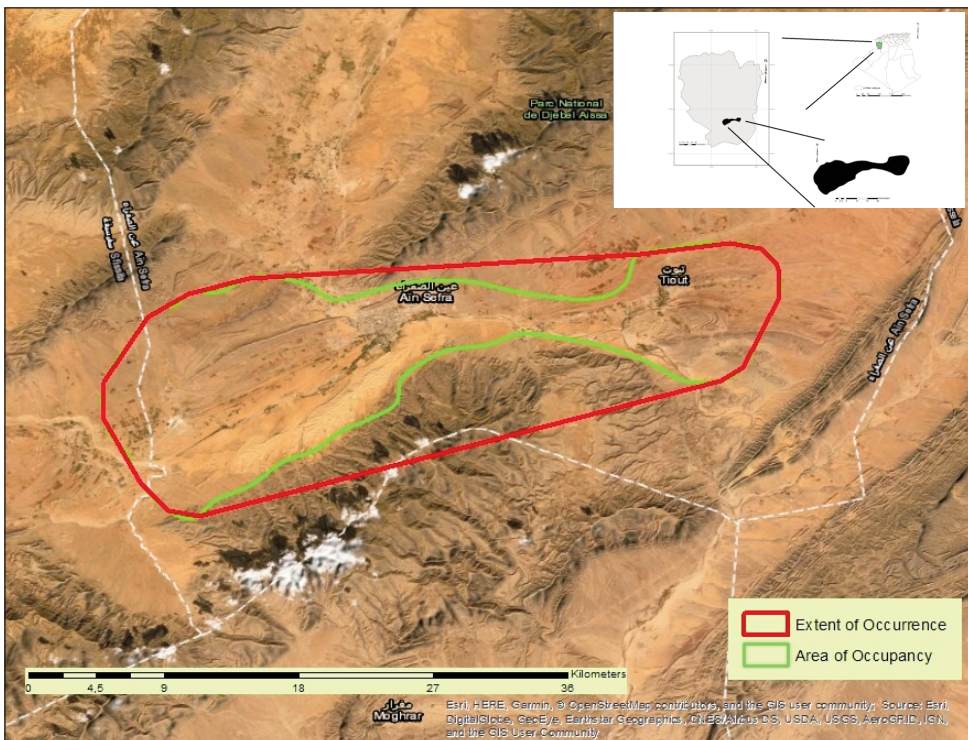


Fig. 2. Distribution of *Onopordum ambiguum* in Algeria. Range determined from GeoCat tool (<http://geocat.kew.org/editor>).

(Gordo 2021). In addition, we have surveyed *O. acaulon* and *O. macracanthum* in other more rocky habitats. These specimens are conserved in the personal herbarium of the first author (B. G.) which is deposited in the Herbarium of the University of Oran 1. Concerning *O. algeriense* and *O. acanthium*, we have referred to the digital version of the Herbarium specimens (P and MPU) and even digital photographs available online. We also took into account references from the literature: Marcel & Petit (1996) and Fennane & al. (2014). To determine the distribution of taxa in Algeria, we used the work of Pomel (1874), Battandier (1914), Quézel & Santa (1963) and Djelid & al. (2020). As for the specimens of *O. ambiguum* to which we paid special attention, they were collected from two sites around the famous dune and at altitude 1100-1300 m a.s.l. in the region of Aïn Sefra. Provisional identification of the specimens was carried out. Samples were re-affirmed using: (i) the computer-generated key to the spiny *Asteraceae* of Egypt (El-Gazzar & al. 2019), (ii) the keys in the local floras of Egypt (Boulos 2002) and Palestine (Feinbrun-Dothan 1977; 1978) (iii) the referral specimens collected from Egypt, Saudi Arabia and Yemen and kept in the Cairo University Herbarium (CAI) and (iv) matching with images of the same species in several virtual herbaria. The specimens are deposited in the Herbarium of Nâama University Centre, under the reference GB1-2021.

The regional assessment of *O. ambiguum* is based on the criteria determined by UICN (2018). We also used the GeoCat online platform (<http://geocat.kew.org>) to calculate AOO (Area of Occupancy) and EOO (Extent of Occurrence). These were used as bases for assigning a provisional status to the taxon.

For easy distinction between the six *Onopordum* species in Algeria, a data matrix was compiled to accommodate the variation in 21 morphological characters, which was subjected to analysis using the DELTA key-generating package of computer-programs (Dallwitz & al. 2000; 2005; Dallwitz 2010).

The following list of 21 characters includes are used in the generation of a conventional key to the six *Onopordum* species in Algeria.

- #1. Plant/ 1. erect/ 2. dwarf/
- #2. Plant/ 1. green/ 2. greyish/
- #3. Stem/ 1. grooved/ 2. not-grooved/
- #4. Wings with spiny margin on stem/ 1. broad/ 2. inconspicuous/
- #5. Leaves/ 1. basal only/ 2. basal and cauline/
- #6. Leaf blade/ 1. narrowly linear/ 2. lanceolate-elliptic/
- #7. Leaf blade/ 1. dissected to the mid-rib/ 2. with flat intercostal areas/
- #8. Leaf blade upper surface/ 1. rugose/ 2. smooth/
- #9. Spines on tips of leaf lobes/ 1. simple and bifurcate / 2. simple/
- #10. Leaf veins/ 1. prominent/ 2. not prominent/
- #11. Leaf veins/ 1. only midrib is white/ 2. all veins white/
- #12. Capitula/ 1. in a basal aggregate/ 2. in two or more terminal aggregate/
- #13. Capitula/ 1. peduncled/ 2. sessile/
- #14. Outer phyllaries/ 1. linear-lanceolate/ 2. ovate/
- #15. Outer phyllaries/ 1. longer than inner/ 2. shorter than inner/
- #16. Outer phyllaries/ 1. convex outwards/ 2. flat/
- #17. Outer phyllaries apical spine/ 1. pinkish/ 2. yellow/

- #18. Outer phyllaries margin/ 1. pinkish/ 2. green/
 #19. Inner phyllaries/ 1. linear-lanceolate / 2. ovate/
 #20. Pappus/ 1. creamy-golden yellow/ 2. pinkish-white/
 #21. Achenes/ 1. uniform/ 2. polymorphic/

Results and discussion

The Account of Onopordum in Algeria

Onopordum acanthium L.

Plant erect. Plant greyish. Stem grooved. Wings with spiny margin on stem broad. Leaves basal and cauline. Leaf blade lanceolate-elliptic. Leaf blade with flat intercostal areas. Leaf blade upper surface rugose. Spines on tips of leaf lobes simple. Leaf veins not prominent. Leaf veins only midrib is white. Capitula in two or more terminal aggregate. Capitula peduncled. Outer phyllaries linear-lanceolate. Outer phyllaries shorter than inner. Outer phyllaries flat. Outer phyllaries apical spine yellow. Outer phyllaries margin pinkish. Inner phyllaries linear-lanceolate. Pappus pinkish-white. Achenes uniform.

Uncultivated land, road and path margins in the Western High Plains, Hodna region; sub-Mediterranean Eurasian species (Quézel & Santa 1963; Tutin & al. 1976; Hanf 1983).

Onopordum acaulon L.

Plant dwarf. Plant greyish. Stem not-grooved. Wings with spiny margin on stem inconspicuous. Leaves basal only. Leaf blade lanceolate-elliptic. Leaf blade with flat intercostal areas. Leaf blade upper surface rugose. Spines on tips of leaf lobes simple and bifurcate. Leaf veins not prominent. Leaf veins only midrib is white. Capitula in a basal aggregate. Capitula sessile. Outer phyllaries ovate. Outer phyllaries longer than inner. Outer phyllaries convex outwards. Outer phyllaries apical spine pinkish. Outer phyllaries margin pinkish. Inner phyllaries linear-lanceolate. Pappus creamy-golden yellow. Achenes uniform.

Stony and clay mountain pastures, lowfertility soils in semi-arid areas of the Saharan Atlas region; western Mediterranean: Algeria, Andorra, Corse, France, Morocco, Spain, Tunisia (Quézel & Santa 1963; Euro+Med 2006-; USDA 2019).

Onopordum algeriense (Munby) Pomel

Plant erect. Plant green. Stem grooved. Wings with spiny margin on stem broad. Leaves basal and cauline. Leaf blade lanceolate-elliptic. Leaf blade dissected to the mid-rib. Leaf blade upper surface smooth. Spines on tips of leaf lobes simple and bifurcate. Leaf veins prominent. Leaf veins all are white. Capitula in two or more terminal aggregate. Capitula peduncled. Outer phyllaries linear-lanceolate. Outer phyllaries shorter than inner. Outer phyllaries convex outwards. Outer phyllaries apical spine pinkish. Outer phyllaries margin pinkish. Inner phyllaries linear-lanceolate. Pappus creamy-golden yellow. Achenes uniform.

The Baïnem Forest, in the Algiers region, whose altitude varies between 30 and 320 m, is characterised by a rugged terrain, a geological substrate composed of schist, gneiss and mica schist; endemic to Algeria (Djelid & al. 2020).

***Onopordum ambiguum* Fresen.**

Plant erect. Plant greyish. Stem grooved. Wings with spiny margin on stem broad. Leaves basal and cauline. Leaf blade lanceolate-elliptic. Leaf blade with flat intercostal areas. Leaf blade upper surface rugose. Spines on tips of leaf lobes simple. Leaf veins prominent. Leaf veins all veins white. Capitula in two or more terminal aggregate. Capitula peduncled. Outer phyllaries linear-lanceolate. Outer phyllaries shorter than inner. Outer phyllaries convex outwards. Outer phyllaries apical spine yellow. Outer phyllaries margin pinkish. Inner phyllaries linear-lanceolate. Pappus creamy-golden yellow. Achenes uniform.

Granite and sandstone hillsides; Algeria, Egypt, Iraq, Palestine, Saudi Arabia, Sinai and Yemen (Boulos 2002).

After more than 130 years, the recording of *Onopordum ambiguum* in the flora of Algeria by B. Balansa in 1853 and later by Battandier & Trabut (1888) is confirmed. The two possible reasons why this species may have gone unnoticed for a long time are: (i) its very restricted range, (ii) and its close resemblance to *O. arenarium*.

O. ambiguum has been observed in two types of biotopes. The first corresponds to the edge of the dune of Aïn Sefra where it behaves as a psammophyte. The second is the gardens of the Ksar, especially the abandoned ones, where it changes its behaviour by sneaking through the weeds. Flowering and fructification occur during the months of May and June.

Field observations show that 105 individuals are distributed around the dune of Aïn Sefra as well as in the gardens located to the north (Fig.2). The estimated extent of occurrence (EOO) is 438 km² and the area of occupancy (AOO) is 200 km². Having no data on the numerical variations of the population, we used criteria B (geographical range). This taxon can be listed as regionally endangered (EN). Notably, goat grazing is a real threat to *O. ambiguum*.

***Onopordum arenarium* (Desf.) Pomel**

Plant erect. Plant green. Stem grooved. Wings with spiny margin on stem inconspicuous. Leaves basal and cauline. Leaf blade narrowly linear. Leaf blade dissected to the midrib. Leaf blade upper surface smooth. Spines on tips of leaf lobes simple. Leaf veins prominent. Leaf veins all veins white. Capitula in two or more terminal aggregate. Capitula peduncled. Outer phyllaries ovate. Outer phyllaries longer than inner. Outer phyllaries convex outwards. Outer phyllaries apical spine pinkish. Outer phyllaries margin green. Inner phyllaries ovate. Pappus creamy-golden yellow. Achenes polymorphic.

Sandy deposits in Hodna, Western Sahara Atlas, and Northern Sahara regions; endemic to the Maghreb (Northwest Africa).

***Onopordum macracanthum* Schousb.**

Plant erect. Plant greyish. Stem grooved. Wings with spiny margin on stem broad. Leaves basal and cauline. Leaf blade narrowly linear. Leaf blade with flat intercostal areas. Leaf blade upper surface smooth. Spines on tips of leaf lobes simple. Leaf veins prominent. Leaf veins all veins white. Capitula in two or more terminal aggregate. Capitula peduncled. Outer phyllaries linear-lanceolate. Outer phyllaries longer than inner. Outer phyllaries convex outwards. Outer phyllaries apical spine yellow. Outer phyllaries margin green. Inner phyllaries linear-lanceolate. Pappus pinkish-white. Achenes uniform.

Uncultivated land, pasture lands and forest in Algiers, Constantine, Kabylia and Numidia, Oran, High Plains, and Western Saharan Atlas regions,; western Mediterranean: Algeria, Balears, Morocco, Portugal, Sardegna, Spain (Quézel & Santa 1963; POWA 2021).

Distributions

In order to better illustrate the distribution of *Onopordum* in Algeria, we have taken into account the biogeographical dimension. This led us to refer to the phytogeographical map of Algeria (Fig. 3). *O. arenarium* and *O. macracanthum* are two more widely distributed therophytes. Indeed, while the former is present in the Northern Sahara (SS), the High Plains (H) and the Western Saharan Atlas (AS1); the latter is known in the Tell, but its range extends beyond the Ksour Mountains which constitute its southern limit. Both species have remarkable ecological plasticity. Indeed, *O. arenarium* is found in the Saharan and arid bioclimate, whereas *O. macracanthum* is found in semi-arid, sub-humid and humid bioclimate. *O. acaulon* is a species of the Western and Central Saharan Atlas (AS1 and AS2). This hemicytrophite occurs only in semi-arid bioclimate. On the other

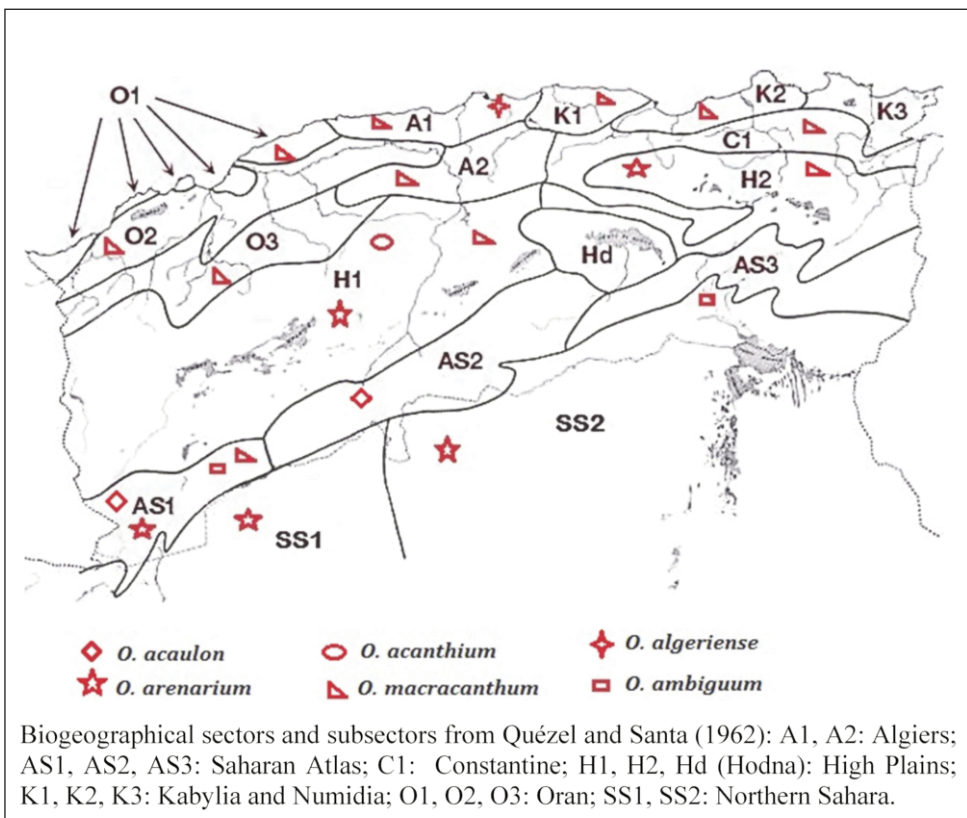


Fig. 3. Phytogeographic range of *Onopordum* taxa in Algeria.

hand, *O. ambiguum* occurs in an arid and Saharan bioclimatic. It shows a disjunct area divided into two subsets, one eastern (SS1: Eastern Northern Sahara) and one western (AS1: Ksour Mountains). Two species appear to be exceptions: *O. acanthium* and *O. algeriense*, which have a very restricted range. The first occurs in semi-arid bioclimate. It was indicated to the south of Tiaret (Cheddad), i. e. at the level of the Western High Plains (H1); the second is located in the Baïnem forest (A1: Algiers Coast). This therophyte can be observed in sub-humid bioclimate (Pomel 1874; Battandier 1914; Quézel & Santa 1963; Djelid & al. 2020).

Dichotomous key

1. Leaf blade upper surface rugose 2
1. Leaf blade upper surface smooth 4
2. Plant erect; stem grooved; wings with spiny margin on stem broad; leaves basal and cauline 3
2. Plant dwarf; stem not-grooved; wings with spiny margin on stem inconspicuous; leaves basal only ***O. acaulon***
3. Leaf veins prominent; leaf veins all are white; outer phyllaries convex outwards; pappus creamy-golden yellow ***O. ambiguum***
3. Leaf veins not prominent; leaf veins only midrib is white; outer phyllaries flat; pappus pinkish-white ***O. acanthium***
4. Plant green; Leaf blade dissected to the mid-rib; outer phyllaries apical spine pinkish; pappus creamy-golden yellow 5
4. Plant greyish; Leaf blade with flat intercostal areas; outer phyllaries apical spine yellow; pappus pinkish-white ***O. macracanthum***
5. Wings with spiny margin on stem broad; leaf blade lanceolate-elliptic; spines on tips of leaf lobes simple and bifurcate; outer phyllaries linear-lanceolate ***O. algeriense***
5. Wings with spiny margin on stem inconspicuous; leaf blade narrowly linear; spines on tips of leaf lobes simple; outer phyllary ovate ***O. arenarium***

Conclusion

Six species of *Onopordum* occurs in Algeria. The presence of *Onopordum ambiguum* in Aïn Sefra (Algeria) is confirmed after more than a century of its first recording from Biskra and its total absence in all subsequent floristic investigations of various localities. Indeed, this discovery is in line with the work previously undertaken since 2012 in this region (Gordo & Hadjadj-Aoul 2019, 2021; Gordo 2021). The study of aspects related to its ecology and the size of its populations allowed *O. ambiguum* to be given a regional conservation status: Endangered species (EN). The protection of its main habitat (dune) is becoming a priority as the gardens of the Ksar are facing strong anthropic pressure. We propose to include *O. ambiguum* in the next official lists dedicated to the preservation of threatened plants of Algeria. Accordingly, it seems plausible to suggest that a comprehensive effort to explore the different regions of the country to update the current floristic knowledge is worthwhile.

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