Floristic diversity of steppe vegetation in the region of Djelfa, North-West Algeria

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Abstract

This study is a floristic investigation of the steppe region of Djelfa located in northern Algeria, with the aim of characterizing and analysing the wild flora of this region. Four stations were chosen according to a stratified sampling method and phytogeographical surveys were carried out in 32 plots of 100m² each. This allowed us to identify 127 taxa of plants belonging to 33 families dominated by Asteraceae (29%) and Poaceae (12%). The analysis of biological types has shown the dominance of annual Therophytes (56%) in this flora, which indicates the presence of the phenomenon of Therophytization in these regions. This phenomenon was also measured by calculating the perturbation index. The analysis of chorological types has shown the dominance of the Mediterranean element (48%), with an interesting number of endemic taxa. However, all the endemic taxa cited in the literature for this region have not been found, which reinforces our fears about the state of conservation of these taxa of biological and heritage value.

Key words: Chorology, Djelfa, Endemic Flora, Steppe, Stratified method

Introduction

The Mediterranean region is characterized by an exceptional biological diversity as well as considerable biological richness estimated at 25,000 species of vascular plants, which corresponds to 9.2% of the total diversity of species in a territory representing only 1.5% of the terrestrial surface (Médail & Quézel, 1997; Myers, 1988, 1990; Mittermeier et al., 2004). Algeria, due to its geographical position, presents a great diversity of habitats occupied by an important floristic richness (Médail & Quézel, 1997; Véla & Benhouhou, 2007 in Miara et al., 2018a).

According to Quézel & Santa (1962-63 in Véla & Benhouhou, 2007), the Algerian flora comprises
3,139 species consisting of 3,744 taxa including 464 endemic and 1,818 more or less rare species. This inventory is now evaluated at 4,449 taxa including 3,951 native taxa and 498 introduced to Algeria (Dobignard & Chatelain, 2010-13). The flora of this country is mainly dominated by 3 botanical families with more than 150 species each: Asteraceae, Poaceae and Brassicaceae (433, 289 and 171 species, respectively), while 7 genera present between 30 and 58 species: Helianthemum, Linaria, Centaurea, Ononis, Trifolium, Astragalus, Silene (Abdelguerfi & Ramdane, 2003).

The Algerian steppes constitute a geographical unit whose limits are defined by a bioclimatic criterion. With an estimated area of about 20 million hectares, the Algerian steppes are located between the 400-mm rainfall isohyet to the North and 100 mm-rainfall isohyet to the South, forming a 1000-km-long ribbon over a width of 300 km in the west and in the center, reduced to less than 150 km in the East (Halem, 1997 in Miara et al., 2018b). According to Nedjraoui & Bedrani (2008), the steppe regions constitute a buffer between coastal Algeria and Saharian Algeria, of which they limit the negative climatic influences on the former.

Several studies (Le Houerou, 1969; Djebaili, 1978; Aiduod, 1983) confirm that in the Algerian steppe, the reduction in floristic diversity is not only occurring as a result of climatic factors (dryness and heightened aridity), but it is also strongly impacted by anthropic factors (primarily fires and grazing), which are prompted by irrational land exploitation such as overgrazing and land clearing.

To this, the effect of the phenomenon of therophytization is also to be considered. According to Quézel & Médail (2003), Therophytization can be defined as the generalized invasion by annual and often ruderal species, which are mainly disseminated by herds. According to Daget (1980), this is a characteristic of arid zones, expressed as a strategy of adaptation to unfavorable conditions and a form of resistance to harsh climatic conditions.

The region of Djelfa is located in the south of the Algerian Tell Atlas in contact with the Saharian Atlas. This region is a typical example of the North African steppe which is highly threatened and weakened by ecological and anthropic factors including desertification (Nedjraoui & Bedrani, 2008).

So, in order to contribute to better conservation of these very sensitive natural spaces, a deeper knowledge of the biodiversity of these areas is essential. Unfortunately, and despite several floristic studies published recently for the region of Djelfa (Korichi, 2016; Maamri, 2016; Rahmoune, 2018; Benalia et al., 2018; Bekai et al., 2019), the floristic knowledge on this area is still insufficient, while several endemic and rare taxa cited in this region since the colonial period there has not been observed, namely: Erodium hymenodes L’Her., Echium suffruticosum Baratte., Celsia battandieri Murb., Bellium rotundifolium (Desf.) DC., Atractylis polycephala Coss. and A. phaeolepis Pomel.

This research aims to highlight the floristic diversity of the wild steppe areas of the Djelfa region in the Northwest Algeria, by seeking the aforementioned taxa. Specifically, we will assess the floristic biodiversity of this region to analyze some aspects related to the local flora such as life traits (biological types) and chorology (chorological types).

Materials and methods

Study area

The province of Djelfa is located in the central part of Algeria beyond the southern boundary of the Tellian Atlas; our study area is located between 2° and 5° of longitude East and 33° and 35° of North latitude (Figure 1). Three quarters of the territory of the province of Djelfa is made up of steppe ecosystems. In addition, a significant forest heritage exists in this region and consists mainly of Aleppo pine (215,182 ha), representing only 6.67% of the total area of the province (Cherfaoui, 2017).

Figure 1. Geographical location of the study area.

Field sampling

We carried out a total of 32 phytosociological surveys at 4 stations (Table 1) which were chosen according to a stratified sampling method (Gounot, 1969).
The station I is located in Ain Oussara at approximately 90 km northwest of the province of Djelfa. It is characterized by some diversified steppe formations with Stipa tenacissima L. and Artemisia herba-alba Asso. The station II is located in Guernini at approximately 80 km northwest of the province of Djelfa. It contains some degraded rangelands with vegetation dominated by Stipa tenacissima L. and Lygeum spartum L.

The station III is located in Zaafrane, 60 km northwest of the province of Djelfa. It is characterized by sand dunes with vegetation dominated by Tamarix gallica L. In this area, there are also some artificial plantations of Atriplex canescens Sieb is located in the region of Ain Maabed at 30 km from the province of Djelfa.

The station IV is located in the city of Moudjbara at approximately 18 km southeast of the province of Djelfa. It is characterized by pre-forest formations dominated by Pinus halepensis Mill., Stipa tenacissima L. and Artemisia herba-alba Asso.

Data collection and plant identification

The location of the 32 phytosociological surveys was chosen in a random way in zones that were clearly homogeneous and representative. Surveys were carried out according to the method of Braun-Blanquet (1951). For each survey, we noted the floristic, geographical and environmental data.

| Stations | Longitude | Latitude | Altitude |
|----------|-----------|----------|----------|
| Station I (Ain Oussara) | 2.95 | 35.34 | 728 |
| Station II (Guernini) | 2.73 | 35.21 | 814 |
| Station III (Ain Maabed) | 3.06 | 34.89 | 881 |
| Station IV (Moudjbara) | 3.40 | 34.57 | 1320 |

In each station, we took eight floristic samples from an area measuring 100 m². According to Djebaili (1984), this surface is the minimum area required to be a representative sample of the characteristic flora of the Algerian steppe regions. These floristic surveys were carried out during the optimal periods (spring) of 2016 and 2017. The botanical identification of the collected taxa was made using the flora of Quézel & Santa (1962-63) and that of Ozenda (1977). The species chorology was defined according to Dobignard & Chatelain (2010-13). Chorological types have been grouped according to Benabadj et al. (2007) which comprises the following groupings: 1) Mediterranean species (West-Mediterranean, East-Mediterranean, Ibero-Mauritanian, Center-Mediterranean, Sub-Mediterranean), 2) Nordic species (European, Eurasians, Paleo-temperate, Boreals-circum and Paleo sub-tropical), 3) widely distributed species (Euro-Mediterranean, Atlantic-Mediterranean, Eurasian-Mediterranean, Irano-Touranian, Cosmopolitan), 4) Saharan species and 5) endemic species. The nomenclature of the identified taxa was updated using the synonymic index of North Africa (Dobignard & Chatelain, 2010-13). The specimens of plants harvested in the field were coded and deposited in the herbarium of the Botanical laboratory of the University of Tiaret, Algeria.

The perturbation index (PI) is used to quantify the therophytisation. It is calculated according to Loisel & Gamila (1993) as the ratio of the sum of chamaephytes and therophytes on the full number of the species.

Results and discussion

Floristic analyses

In total, we recorded 127 taxa at the four sites (Table 2). This number seems very interesting compared to that obtained by some authors who worked in the same region including Zehraoui (2016) with 107 species, Korichi (2016) with 66 species, Maamri (2018) with 129 species, Rahmoune (2018) with 126 species, Benalia et al. (2018) with 84 species and Bekai et al. (2019) with 106 species.

Our taxa belong to 33 botanical families. The most represented families are: Asteraceae (37 taxa, 29%), Poaceae (15 taxa, 12%), Brassicaceae and Fabaceae with a total of 11 taxa (9%) per family (fig.2). Other families like Amaranthaceae, Lamiaceae and Caryophyllaceae are moderately represented with 6, 5 and 4 taxa respectively. The rest of the families are poorly represented and accounted less than 4 taxa. According to Ozenda (1977), Asteraceae, Poaceae and Brassicaceae characterize the arid and semi-arid areas in the Mediterranean regions.

In Algeria, some studies (Benabadj et al., 2007; Kazi-Tani et al., 2010) highlighted the dominance of Asteraceae, Poaceae and Fabaceae in the steppe regions. This was also reported in Morocco by Fennane et al. (2012).

In the region of Djelfa, the study of Djballah & Chehma (2008) about the floristic and nutritional characteristics of the steppe rangelands mention the dominance of the same families in the most stations. It is also the case in the studies published by Korichi (2016), Maamri (2016), Rahmoune (2018), Benalia et al. (2018) and Bekai et al. (2019) in the same region.

The biological types

The abundance of the various species related to their biological type according to Raunkiaer (1934) is as follows: therophytes > hemichryptophytes > chamaephytes > geophytes > phanerophytes, with a clear predominance of therophytes (71 taxa, 56%) and hemichryptophytes (fig. 3).
Table 2. List of the inventoried taxa.

| Taxa (Dobignard & Chatelain, 2010-13) | Biological types | Chorological types | Locality |
|--------------------------------------|------------------|--------------------|----------|
| Aizoaceae                            |                  |                    |          |
| Aizoanthemopsis hispanicum (L.) Klak | Th               | Med                | SI       |
| Amarantaceae                         |                  |                    |          |
| Atriplex canescens (Parsh) Nutt.     | Ch               | Wd                 | SIII     |
| Blitum exsucum C. Loscos             | Th               | Wd                 | SLSII    |
| Caroxylon vermiculatum (L.) Akhani & Roalson | Ch | Wd                | SLSII    |
| Hammada schmittiana (Pomel) Botsch.  | Ch               | Sah                | SLSII    |
| Hammada scoparia (Pomel) Iljin       | Ch               | Sah                | SI       |
| Noaea mucronata (Forssk.) Asch. & Schweinf. | Ch | Wd                | SLSII, SIII |
| Anacardiaceae                        |                  |                    |          |
| Pistacia atlantica Desf.             | Ph               | End (North Africa)| SI       |
| Apiaceae                             |                  |                    |          |
| Eryngium ilicifolium Lam.            | Th               | Med                | SII      |
| Stoibrax pomelianum (Maire) B. L. Burtt | Th         | Med (Algeria-Morocco) | SIV |
| Thapsia garganica L.                 | Hc               | Med                | SLSII    |
| Apocinaceae                          |                  |                    |          |
| Nerium oleander L.                   | Ph               | Med                | SIII     |
| Asparagaceae                         |                  |                    |          |
| Muscari comosum (L.) Mill.           | Ge               | Med                | SLSII    |
| Asteraceae                           |                  |                    |          |
| Anacyclus clavatus (Desf.).          | Th               | Wd                 | SLSII, SIII, SIV |
| Anacyclus monanthos subsp. cyrtolepidioides (Pomel) Humphries | Th | End (North Africa) | SLSIII |
| Andryala integrifolia L.             | Th               | Med                | SIV      |
| Artemisia campestris L.              | Ch               | Nor                | SLSII, SIII,SIV |
| Artemisia herba-alba Asso             | Ch               | Med                | SLSII,SIII |
| Atractylis caespitosa Desf.          | Hc               | Med                | SLSII    |
| Atractylis cancellata L.             | Th               | Med                | SLSII, SIII, SIV |
| Atractylis serratuloides Sieber ex Cass. | Ch         | Sah                | SLSII,SIII |
| Bombycilaena discolor (Pers.) M. Lainz | Th | Wd                 | SLSII    |
| Calendula arvensis (Vaill.) L.       | Th               | Med                | SLSII,SIII,SIV |
| Carduus spachianus Durieu            | Th               | Med                | SLSII    |
| Carthamus eriocephalus (Boiss.) Greuter | Th         | Sah                | SLSII,SIII,SIV |
| Carthamus lanatus L.                 | Th               | Wd                 | SLSII,SIII,SIV |
| Carthamus rhaponticoides (Pomel) Greuter | Th | End (Algeria-Morocco) | SIV |
| Centaurea furfuracea Coss. & Durieu  | Th               | Med                | SLSII,SIII |
| Centaurea maroccana Ball             | Th               | Med                | SLSII    |
| Centaurea oranensis Greater & M. V. Agab. | Hc | End (Algeria-Morocco) | SLSII,SIII,SIV |
| Centaurea sicula L.                  | Th               | Med                | SLSII, SIV |
| Echinops spinosissimus Turra         | Hc               | Sah                | SLSII    |
| Erigeron trilobus (Decne.) Boiss.    | Th               | Med                | SIII     |
| Filago crocdion (Pomel) Chrtek & Holub | Th         | End (Algeria-Morocco) | SLSII,SIII |
| Koelpinia linearis Pallas.           | Th               | Wd                 | SLSII,SIII,SIV |
| Launaea fragilis (Asso) Pau          | Th               | Wd                 | SLSII    |
| Launaea mucronata (Forssk.) Muschl. subsp. mucronata | Th | Sah                | SLSII    |
| Launaea nudicalis (L.) Hook. f.      | Th               | Wd                 | SLSII    |
| Onopordum acaulon L.                 | Hc               | Med                | SLSII,SIII |
| Species Name | Author | Location | Page Numbers |
|--------------|--------|----------|-------------|
| *Onopordum* spinae Coss. ex Bonnet | | Hc | Med | SI |
| *Pallenis hierichuntica* (Michon) Greuter | | Th | Sah | SLSII,SIII |
| *Pallenis spinosa* (L.) Cass. | | Ch | Wd | SI |
| *Picris asplenioides* subsp. *saharae* (Coss. & Kralik) Dobiward | | Th | End (North Africa) | SLSII,SIII |
| *Reichardia tingitana* (L.) Roth | | Th | Med | SLSII,SIII |
| *Scolymus hispanicus* L. | | Hc | Med | SLSII,SIII |
| *Scorzonera undulata* Vahl | | Ge | Med | SLSII,SIII |
| *Senecio gallicus* Vill. | | Th | Med | SIII |
| *Xeranthemum inapertum* (L.) Mill | | Th | Wd | SLSII,SIII |

**Boraginaceae**

- *Echium humile* subsp. *pycnanthum* (Pomel) Greater & Burdet
  - Th | Sah | SLSII,SIII |
- *Lappula patula* (Lehm.) Gürke
  - Hc | Wd | SLSII |

**Brassicaceae**

- *Brassica fraticulosa* Cirillo
  - Hc | Med | SIV |
- *Clypeola cyclodontea* Delile
  - Th | Med | SIV |
- *Clypeola jonthlaspi* subsp. *microcarpa* (Moris) Arcang.
  - Th | Wd | SII |
- *Diploptaxis harra* (Forssk.) Boiss.
  - Th | Wd | SLSII |
- *Enarthrocarpus clavatus* Delile ex Godr.
  - Th | End (North Africa) | SLSII |
- *Eruca vesicaria* (L.) Cav.
  - Th | Med | SLSII,SIII,SIV |
- *Maresia nana* (DC.) Batt.
  - Th | Wd | SLSII,SIII |
- *Matthiola fraticulosa* (Loefl. ex L.) Maire
  - Ch | Med | SIV |
- *Matthiola longipetala* (Vent.) DC.
  - Th | Wd | SLSII |
- *Muricaria prostrata* (Desf.) Desv.
  - Th | End (North Africa) | SLSII,SIII |
- *Pseudorucaria clavata* (Boiss. & Reut.) O. E. Schulz
  - Th | Sah | SIII |

**Caprifoliaceae**

- *Lomelosia crenata* (Cirillo) Greater & Burdet
  - Th | Sah | SLSII,SIII,SIV |

**Caryophyllaceae**

- *Herniaria cinerea* DC.
  - Th | Nor | SLSII,SIII,SIV |
- *Paronychia argentea* Lam.
  - Hc | Med | SLSII,SIII,SIV |
- *Silene secundiflora* Orth
  - Th | Med | SIII |
- *Telephium imperati* L. subsp. *imperati*
  - Hc | Med | SLSII,SIII |

**Cistaceae**

- *Helianthemum cinereum* (Cav.) Pers.
  - Ch | Wd | SIV |
- *Helianthemum helianthemoides* (Desf.) Grosser
  - Ch | End (North Africa) | SLSII |
- *Helianthemum ruficomum* (Viv.) Spreng.
  - Ch | Med | SIV |

**Cucurbitaceae**

- *Citrullus colocynthis* (L.) Schrad.
  - Hc | Wd | SIII |

**Euphorbiaceae**

- *Euphorbia falcata* L.
  - Th | Wd | SLSII,SIII |

**Fabaceae**

- *Argyrolobium uniflorum* (Decne.) Jauh. & Spach
  - Hc | Sah | SII |
- *Astragalus crenatus* Schult.
  - Th | Sah | SLSII |
- *Astragalus gombo* Bunge
  - Hc | Sah | SIII |
- *Astragalus reiniti* Ball.
  - Hc | End (Algeria-Morocco) | SLSII,SIII,SIV |
- *Coronilla scorpioides* (L.) W.D.J. Koch
  - Th | Med | SLSII,SIII |
- *Hippocrepis multisiliquosa* L.
  - Th | Med | SIV |
- *Lathyrus clymenum* L.
  - Th | Med | SIII |
- *Lotus ornithopodioides* L.
  - Th | Med | SLSII |
- *Medicago littoralis* Loisel.
  - Th | Med | SLSII |
- *Medicago minima* (L.) L.
  - Th | Wd | SLSII,SIII |
Onobrychis alba (Waldst. & Kit.) Desv. Hc Nor SIV
Ononis serrata Forssk. Hc Med SIII
Retama raetam (Forssk.) Webb Ph Wd SIII

Geraniaceae
Erodium crassifolium (Forssk.) L’Hér. Th Med SLSII

Hyacinthaceae
Dipcadi serotinum (L.) Medik. Ge Wd SI,SIV

Iridaceae
Moraea sisyrinchium (L.) Ker Gawl. Ge Nor SLSILSIII
Ajuga iva (L.) Schreb. Th Med SLSILSIIISIV
Maropsis deserti (de Noé) Pomel Hc Sah SIII
Salvia verbenaca L. Hc Wd SLSII
Teucrium polium L. Hc Wd SLSILSIII
Thymus algeriensis Boiss. & Reut. Ch End (North Africa) SIV

Malvaceae
Malva aegyptia L. Th Wd SLSILSIII
Malva parviflora L. Th Wd SLSILSIII

Nitrariaceae
Peganum harmala L. Ch Wd SLSILSIII,SIV

Orobanchaceae
Cistanche lutea (Desf.) Hoffmanns. & Link Ge End (North Africa) SIII

Papaveraceae
Glaucium corniculatum (L.) Rudolph Th Med SIV
Papaver hybridum L. Th Med SIV

Pinaceae
Pinus halepensis Mill. Ph Med SIV

Plantaginaceae
Kickxia aegyptiaca (L.) Nábelek Th Sah SI
Plantago albicans L. Hc Med SLSILSIIISIV
Plantago ciliata Desf. Th Wd SLSILSIII
Plantago ovata Forssk. Th Med SLSILSIII

Poaceae
Aegilops peregrina (Hack.) Eig Th Med SII
Anisantha rubens (L.) Nevski Th Nor SLSILSIV
Centropodia forsskalli (Vahl) Cope Th Sah SI
Cynodon dactylon (L.) Pers. Ge Wd SLSILSIIISIV
Echinaria capitata (L.) Pers. Th Wd SLSILSIII
Hordeum murinum L. Th Nor SLSILSIIISIV
Lygeum spartum L. Ge Med SLSILSIII
Macrochloa tenacissima (L.) Kunth Hc Med SLSIII
Poa bulbosa L. subsp. bulbosa Th Nor SIV
Rostraria cristata (L.) Tzvelev Th Wd SLSII
Schismus barbatus (Loefl. ex L.) Thell. Th Wd SLSII
Stipa parviflora Desf. Hc Med SLSILSIII
Stipagrostis obtusa (Delile) Nees Hc Wd SIII
Stipagrostis plumosa (L.) Munro ex T. Anderson Hc Wd SI
Stipagrostis pungens (Desf.) De Winter subsp. pungens Hc Wd SIII

Ranunculaceae
Adonis aestivalis L. Th Nor SLSILSIIISIV

Resedaceae
Indeed, the dominance of therophytes characterizes the arid and semi-arid regions (Aidoud, 1984; Miara et al., 2016). Several authors (Daget, 1980; Barbero et al., 1990; Aidoud, 1984) underline the relationship between the high rate of therophytes and the increasing gradient of aridity in the Algerian steppe areas. The phenomenon of therophytisation observed in the present study is probably related to the arduous climatic conditions but also to the anthropogenic actions (Benabadji & Bouazza, 2002; Benaradji et al., 2009; Hachemi et al., 2012). The high number of therophytes taxa represented in our list indicate some undergoing degradation of the local vegetation like in the Mediterranean region (Miara et al., 2016).

Hemicryptophytes are classified in second position of contribution with 27 taxa (21%). The prevalence of hemicryptophytes can be explained by the degradation of the ecological conditions generally related to the climate and the anthropic action (Ozenda, 1977).

The other chorological types (chamaephytes, geophytes, phanerophytes) are moderately or weakly represented with 16, 7 and 6 species respectively. Indeed, Kadi-Hanifi (2003) reported that the number of the phanerophytes, hemicryptophytes and geophytes declined with the aridity and openness of the environment.

The rates of the perturbation index (PI) in the four stations of study vary between 59% and 81%. This confirms the presence of the phenomenon of Therophytization in these regions by the dominance of Therophytes annual species more or less needing water resources, trophic and the opening areas (Regagba, 2012). This also indicate the adaptation of these species to the effect of the anthropic actions (Grime, 1977; Barbero et al., 1989a, 1989b). The Therophytisation is the ultimate stage of degradation of the ecosystems with the dominance of the sub-

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![Figure 3. Biological types (number of taxa).](image)

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nitrophiles species related to the overgrazing (Hachemi et al., 2002).

**Chorological types**

The chorological spectrum of our studied areas is generally marked by the prevalence of the Mediterranean element (48 taxa, 35%). This reflects the global and logical affinity of our flora to the Mediterranean region that is generally appropriate to the climate which characterizes this area (Le Houerou, 1995; Quézel, 1983).

The wide distribution taxa come in second position with 38 taxa (28%). The abundance of these species is generally related to the phenomenon of Therophytization of the Mediterranean flora induced by the action of several ecological and anthropogenic factors (Miara et al., 2016). The Nordic taxa occupies the third position with a total number of 19 taxa (14%). This number can also be explained by the remote geographical location of northern Europe.

The Saharian element comes in fourth position with 17 taxa (13%). The presence of a significant number of these taxa in these environments is explained by the geographic situation of the steppe areas bordering the desert (Aidoud, 1983).

Finally, the endemic type is represented with 14 taxa (10%). These taxa belongs to Algerian-Moroccan (5 taxa) and North African elements (9 taxa). The number of endemic species reported in this study is quite low compared to the endemic taxon richness of these regions (Bekai et al., 2019). Indeed, an important reduction of the rates of endemic taxa in the steppe area was observed by the previous studies (Kadi-Hanifi, 2003; Abdelmooumen & Zoheir, 2015; Nacère et al., 2016). In the Mediterranean region, these endemic taxa, even when they occur as Therophytes, are very fragile and vulnerable to anthropogenic disturbances (Quézel and Médail, 2003).

All the endemic species cited for the region in the flora of Quézel and Santa (1962-63) were not found in particular: Erodium hymenodes, Echiium suffruticosum, Celsia battandieri, Bellium rotundifolium, Atractylis polyccephala, A. phaeolepis. This may indicate local extinctions which are the result of a trivialization of the local flora by annual therophyte sub- nitrophiles taxa with greater ecological valence.

**Conclusion**

The results obtained show an interesting richness of the local flora (127 taxa, which is mainly dominated by therophyte taxa of low ecological and heritage value. It also turns out that the phenomenon of therophytization observed in this region has contributed to a certain “trivialization” of the regional flora which normally is quite specific and rich with strict endemic taxa. This is confirmed by the chorological analysis showing the absence of all endemic plants (including strict endemics) reported in this region in the past. In addition, the presence of a good number of other endemics of North Africa relatively preserves the floristic originality of this region. Finally, we insist on the necessity and the urgency to protect these natural spaces containing a rich and original biodiversity.

**Conflicts of interest**

The authors declare no conflict of interest throughout this research and writing process.

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