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THE STATUS OF ASTERACEAE IN THE ARID AND SAHARAN FLORA OF NORTH AFRICAN REGION: CASE OF TUNISIA

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Abstract

In North Africa, mainly in Tunisia, the family of Asteraceae is largely represented by a number of species, since in the center and in the south of the country, the number of species is more than 172 species with 13.5% of the whole of the flora of Phanerogames in the center and the south of country. This study consists of an analysis of the botanical importance of the Asteraceae family in the southern Tunisia flora, in particular its generic composition, the biological types and the phytochoric status, which characterize this flora. The analysis shows that the Therophytes are the most abundant in Tunisia. On the other hand, the Geophytes are represented within the family of Asteraceae. The relation between Asteraceae present in Tunisia and their phytogeographical origin shows that the origin of the totality of the species is the Mediterranean circumference region.

The taxons with North African origin are on the other hand slightly represented. Moreover, in spite of the abundance of the species within the family of Asteraceae, 10 genera most representative of Asteraceae are inventoried in the south of Tunisia. The genus *Centaurea* includes only 8% of the Asteraceae present in the South of Tunisia, followed by the genera of *Atractylis* and *Senecio* with 5% of species. The *Launaea* and *Chrysanthemum* genus add up each one 4% of the species located in the zone of study. Lastly, the genus of *Ormenis, Calendula, Onopordum, Crepis* and *Leontodon* are the least rich of all taxon, with approximately 2% of species.

Introduction

The flowering plants or angiosperms (Angiospermae or Magnoliophyta) are the most widespread group of land plants. There are about 445 families, 12 000 genera and 300 000 species (Thorne, 2002; Scotlannd & Wortley, 2003;). Asteraceae is probably the largest family of flowering plants, with its approximately 1 620 genera and more than 23 600 species, growing from sea-level to the highest mountain peak (Stevens, 2001). This family is distributed worldwide except for Antarctica but is especially diverse in the tropical and subtropical regions of North America, the Andes, eastern Brazil, Australia, southern Africa, the Mediterranean region, central Asia, and southwestern China (Rahman *et al*., 2008). The majority of Asteraceae species are herbaceous, yet an important component of the family is constituted by shrubs or even trees occurring primarily in the tropical regions of North and South America, Africa and Madagascar and on isolated islands in the Atlantic and Pacific Oceans . As for the remainder of the countries of the world, Asteraceae occupy a privileged place within the Flora of Tunisia, with at the present time approximately 2250 species of Angiospermae (Cuénod *et al*., 1954; Pottier-Alapetite, 1979, 1981). Indeed, considering Mediterranean bioclimatic classification (Emberger, 1955), Tunisia whose surface does not exceed 164.103 km2 and approximately the 3/5 of its territory is marked by the climatic aridity. In this context, the arid and saharan stages alone occupy a surface of 94.103 km2 (Le Houérou, 1959, 1969). This portion of the territory contains approximately 1300 vegetable species (Le Houérou, 1995).

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The family of Asteraceae is the most represented in a number of taxa, since in the center and the south of Tunisia the number of species inventoried is more than 172 species, that is to say approximately 13.5% of the whole of the flora of Phanerogames in the center and the south of country. All these species result from a long process of relatively old evolution and antropisation. The majority of these species are well adapted to their ecological context, marked by the climatic and edaphic aridity (Floret & Pontanier, 1984). The majority of Asteraceae met under arid and saharan bioclimate of Tunisia, are characterized by the pillosity and the spinescence of the aboveground phytomass and the reduction of the leaf area index. Thus underlines variability on the level of the generic composition of this flora. The number of species in each genus, and the number of genus per family thus remain variable.

In this work, we are giving an outline of the place which the Asteraceae within the flora of arid Tunisia occupy. It is a synthesis carried out on the basis of floristic document relating to this part of the Tunisian territory.

Material and Methods

This study consists of an analysis of the botanical importance in the flora of the Asteraceae family in arid and saharan region of Tunisia (Fig. 1). Its objective is to see the generic composition of these Asteraceae, their biological status (Raunkiaer, 1937), as well as the phytochorics elements which characterize this flora. This analysis is carried out on the basis of the documentation available that is to say in the whole of Tunisia and the North Africa. The results will give information about to the possible measures to take for the protection of the present species and the use of protection operations of the biodiversity as well as the improvement of ecological balance under arid bioclimate.

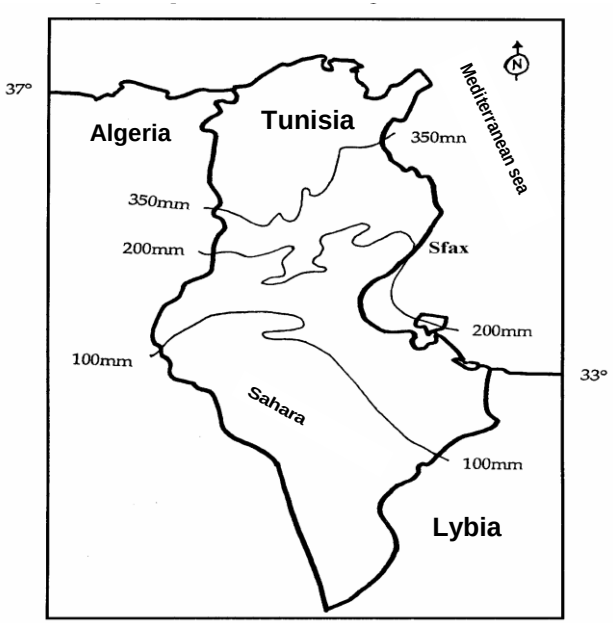

Fig. 1. Geographical context of study

Results and Discussion

According to Fig. 2, Asteraceae are cosmopolitan representing the largest family of flowering plants, with approximately 7.86% of total flowering flora in the world (Stevens, 2001). On the other hand, Le Houérou (2001) showed that Asteraceae represents 15% in the North African steppic flora, which is the largest family, in terms of number of species with 352 species compared to others families such as Fabaceae (12%), Poaceae (11%), Brassicaceae (7%) and Caryophyllaceae (5%) (Fig. 3).

According to Fig. 4, we note that in the Asteraceae family, the Therophytes are most abundant in Tunisia, with a rate of approximately 75%. On the other hand, the Chamephytes and the Hemicryptophytes appear with the same floristic importance with an overall rate of 10%. The Geophytes are finally represented within the family of Asteraceae with a rate of 2%. The analysis of these values reveals that the flora of Asteraceae in Tunisia is mainly represented by the annual species, which under arid and saharan bioclimate, present a very short life cycle, not exceeding a few weeks such as *Senecio gallicus*. The growth and the development of these species are generally observed during the winter and spring seasons, times when the soil water storage is significant (Floret & Pontanier, 1982). From the end of spring, there is the drying of the majority of Asteraceae and only Chamephytes and Hemicryptophytes continue to be observed in the natural environment in the south of Tunisia. It is the case of *Rhanterium suaveolens*, *Artemisia herba-alba*, *Artemisia campestris* and *Inula viscosa*. The estival drying of Asteraceae in Tunisia lets suppose that the majority of these species are characterized by a biochemical type of photosynthesis in C_3.

By its geographical localization, Tunisia is subject to the joint influence of the Mediterranean and the Saharan climates. This acts incontestably on the phytochoric relation of the vegetable species present in the territory considered. Indeed, the establishment of the relation between Asteraceae present in Tunisia and their phytogeographical origin (Fig. 5) shows that the totality of the species are from the Mediterranean circumference according to the following proportions: 33% of species are strictly Mediterranean, 20% are mediterraneo-steppic, 17% have a Maghreb origin such as *Atractylis* genus and 15% are of an Ibero-maghrebine origin like *Centaurea* genus. More of the 1/3 of the species has a Mediterranean phytogeographical origin. The species with no origin in Maghreb are on the other hand slightly represented, with respectively 15% of species of Saharo-Arabic origin and 5% of Euro-Siberian origin.

Inspite of the abundance of the species within the family of Asteraceae, 10 genera most representative of Asteraceae are inventoried in the south of Tunisia. Finally, the *Centaurea* genus only includes 8% of the species present in the south of Tunisia, a follow-up by the genus of *Atractylis* and *Senecio* with 5% of the total inventoried species. The genera of *Launaea* and *Chrysanthemum* total each one of them 4% of the species located in the zone of study. The genera of *Caladanthus*, *Calendula*, *Onopordum*, *Crepis* and *Leontodon* are the least rich of all species, with approximately 2% of species of each one. The other Asteraceae genera met in the zone of study comprise only one species, with an average of 5 species per genus. Several species which should moreover be announced are characterized by the speniscence of their aboveground phytomass (case of *Onopordum espinae* Coss. & Bonnet), which reduces their pastoral interest. On the other hand, the *Artemisia* species in particular *A. herba-alba* Asso is one of the most grazed species, at a point where it is threatened today of rarefaction in the Tunisian steppes.

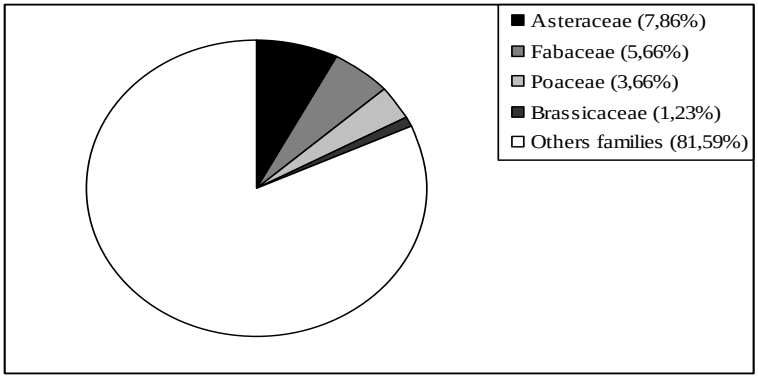

Fig. 2. Place of Asteraceae compared to others families in the world Angiospermae flora.

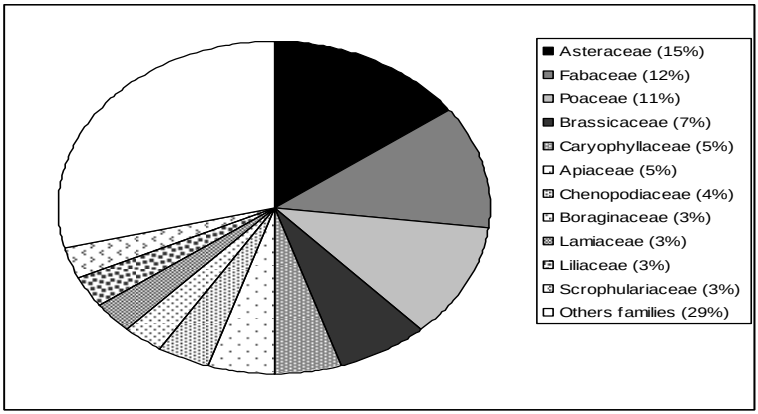

Fig. 3. Place of Asteraceae compared to others families in the North African steppic flora.

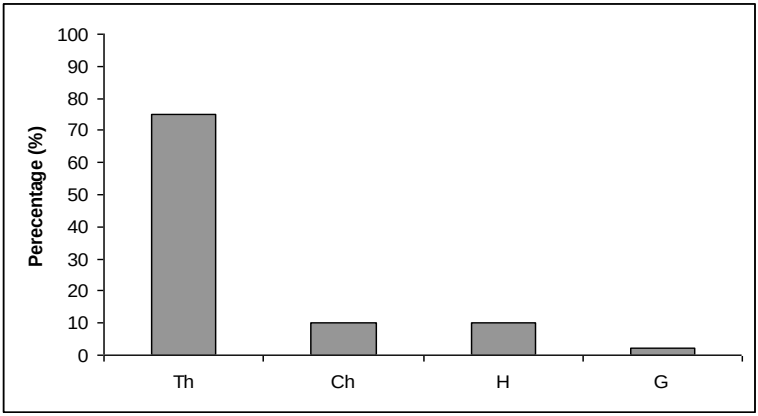

Fig. 4. Main biological types (sensus Raunkiaer, 1937) characterizing the family of Asteraceae in the south of Tunisian Flora.
(Ch: Chamephytes; H: Hemicryptophytes; Th: Therophytes; G: Geophytes).

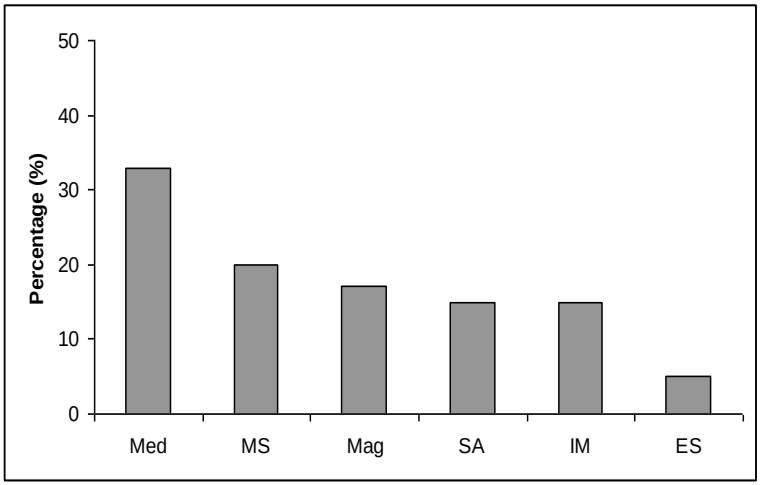

Fig. 5. Phytochoric elements of Asteraceae in Tunisia (Mag.: Maghrebian; MS: Mediterraneo-Steppic; SA: Saharo-Arabic; ES: Euro-Siberian; IM: Ibero-Maghrebian; Med.: Mediterranean).

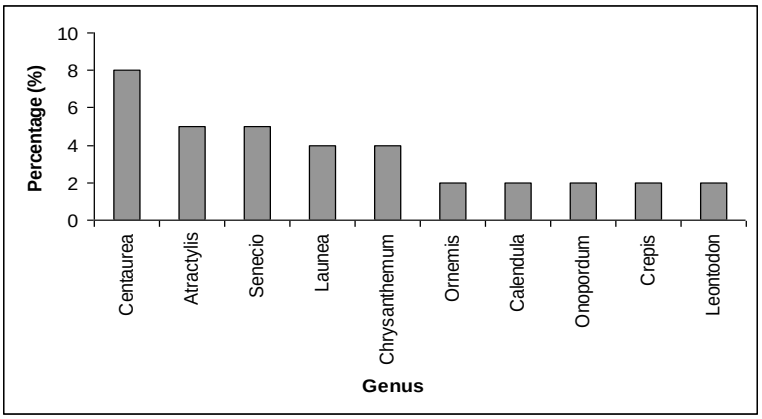

Fig. 6. Principal genera of the family of Asteraceae present in south of Tunisia.

The influences of Mediterranean and Saharan climates which reign in the south of Tunisia have a direct effect on the biology of the vegetable species. In this situation, although Asteraceae are most abundant in arid and Saharan regions of Tunisia, it is necessary to announce a low diversity of the biological types, with in particular the abundance of the annual species. These species categories occupy the medium during a weak period in the year, since their drying occurs in spring. Chamephytes like *Atractylis serratuloides* Sieber ex Cass., and *A. herba-alba* are very rare in arid zones of Tunisia. At the phytogeographical level, the family of Asteraceae is mainly made up of Mediterranean species, which constitute a common character with the remainder of the countries of the Mediterranean area.

The analysis of the generic structure of this family reveals that approximately 35% of the species are present in arid and saharan zones of Tunisia, and are divided only into 10

genera. Among these genera, *Centaurea* and *Atractylis* contain alone 13% of the species. The perennial genus, in particular the *Artemisia* is very poor in species, with only *A. campestris* and *A. herba-alba*. Lastly, no Phanerophyte or Nanophanerophyte species to the family of Asteraceae are present in Tunisia.

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