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Diversity and floristic composition of Djebel Nessara region (Tiaret -Algeria)

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ABSTRACT This work undertaken represents an phytoecological approach of Djebel Nessara vegetation (Tiaret Mountains). The floristic analysis allowed us to release a list of 119 taxa distributed in 96 genera and 35 families. Angiosperms constitute 97.47% (Monocotyledonous 21% and Dicotyledonous 76.47%) while gymnosperms represent only 2.52%. The most represented families are Asteraceae, Fabaceae and Poaceae with percentages of 19.3%, 10.9% and 9.2%, respectively. The comparison of the different biological spectra shows the importance of the therophytes to the number of 57 species with 47.9%. On the biogeographical level, we notice the predominance of Mediterranean biogeographical species with 47.1%. Shannon's biodiversity index (H) is 4.28, while Piélou's Equitability (J) is 0.89 and the Simpson's index (1-D) is 0.98. However, the Perturbation index (PI) is in the order of 61.34%.

KEY WORDS Biodiversity index; Djebel Nessara; floristic richeness; inventory; phytoecology.

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INTRODUCTION

In addition to ten hot spots identified by Medail & Quézel (1997) in the Mediterranean basin, Algeria is one of the two regions that have not yet received the attention they deserve (Véla & Benhouhou, 2007). Due to its geographical location, it has a wide variety of biotopes with a significant floristic richness (Véla & Benhouhou 2007) and is home to important plant areas (IPA) that host a number of species of high heritage value (threatened and/or locally endemic or rare) (Yahi et al., 2012).

The forest and pre-forest of the Tiaret region contain a magnificent flora characterized by a large number of endemic and rare plants (Miara et al., 2018) and medicinal plants (Nouar et al., 2021) where anthropogenic action is crucial to the dynamics of these ecosystems (Miara et al., 2017; Nouar, 2020).

Knowledge, classification and characterization of the different taxa are a scientific priority for the evaluation, management and conservation of this regional biological heritage. In this context, this work is focused mainly on systematic, biological and biogeographical analysis and treatment of biodiversity index of Djebel Nessara natural flora.

MATERIAL AND METHODS

Our study area (Djebel Nessara) is an integral part of the Tiaret Mountains (Fig. 1), at about 02 km from the capital of the wilaya, at 35°21'41.69"N latitude and 1°16'11.99"E longitude. The climat is semi-arid with cold winter, these mountains are located mainly in the upper level of Meso-Mediterranean vegetation, which

Figure 1. Location of the study area.

is the favorite floor of the green oak, which is the dominant essence of the massif (Miara et al., 2012).

In order to meet our study objectives, we have followed the Sigmatist Phytosociological Method of Braun-Blanquet (1951). This method consists of determining the smallest area called "minimum area" which reflects the nature of the plant association. In the Mediterranean region, the minimum area is between 100 and 400 m² for forest groups, 50 to 100 m² for matorral formations (Dahmani, 1997). In our case we have deliberately chosen a minimum surface area of 100 m², as we believe that this surface gives us the desired results in this research. Within our study area, we have carried out 25 floristic surveys, that were carried out during the period March to June in 2015 to 2017. Each vegetation survey consists of an exhaustive inventory of all plant species encountered by stratum, and each species is accompanied by two indices: abundance-dominance and sociability. The identification of taxa was made from the flora of Quèzel & Santa (1962–1963) updated by the index of Dobignard & Chatelain (2010–2013).

The global table of floristic inventories (presence-absence of species by floristic survey) was used as a database for the calculation of some ecological index:

- Shannon-Weaver index: $H = - \sum pi \log2 pi$
- Pielou-Equability index: $J = H / Hmax$
- Simpson's Index: $D = \sum (ni (ni-1) /N (N-1)$
- Perturbation index: IP= (Chamaephytes + Therophytes) / Total of species

RESULTS

The results obtained from the systematic and numerical analysis of the floristic surveys are shown in Table 1.

Systematic composition	
Families	35
Genera	96
Taxa_S	119
Gymnosperms	3
Monocotyledonous	25
Dicotyledonous	91
Biological spectrum (%)	
Chamaephytes	13.4
Geophytes	12.6
Hemicryptophytes	16
Phanerophytes	10.1
Therophytes	47.9
Chorological spectrum (%)	
Mediterranean	47.1
West Mediterranean	10.9
Ibero-Mauritanian	5.9
Cosmopolitans	5
Others	<5 each
Biodiversity index	
Shannon_H	4.28
Equitability_J	0.89
Simpson_1-D	0.98
Perturbation-IP (%)	61.34

Table 1. Floristic and numerical analysis of study area.

DISCUSSION

The inventoried flora of the study area includes 119 species, 96 genera and 35 families. These families are heterogeneously represented. We note the dominance of Asteraceae (23 species; 19.3 %), followed by Fabaceae (13 species; 10.9 %), Poaceae (11 species; 9.2%). These three families are the richest in species of the flora of Algeria (Quèzel & Santa, 1962–1963). Then Lamiaceae (7 species; 5.9%), Apiaceae, Brassicaceae and Cistaceae were fifth (6 species; 5%), then Asparagaceae and Linaceae with (4 species; 3.4%). The rest of the families represent a low participation with a percentage less than 3% for each one (Fig. 2).

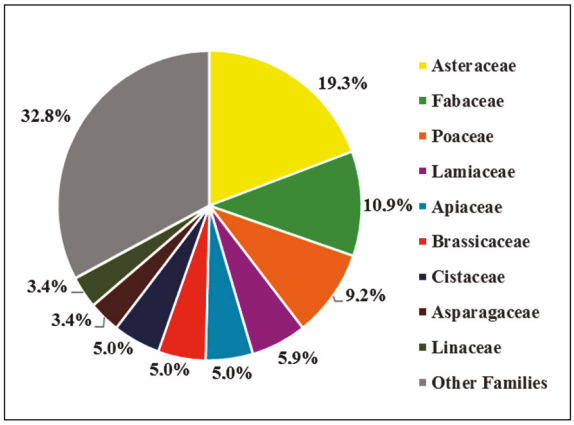

Figure 2. Composition of flora by family.

The determination of biological spectra was made from the classification of Raunkiaer (1934). The biological spectrum of the study area is of type : TH > HE > CH > GE > PH dominated by Theophytes (47.9%), followed by Hemicryptophytes (16%), Chamæphytes (13.4%), Geophytes (12.6%) and finally Phanerophytes (10.1%) (Fig. 3).

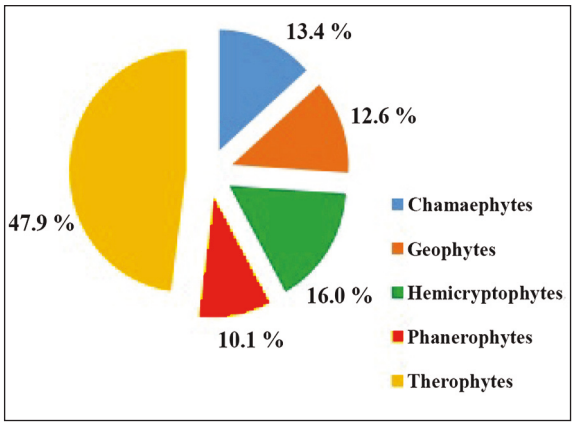

Figure 3. Composition of flora by biological types.

Several authors agree that this Therophytization is linked to the harsh climate and to anthropogenic actions that increasingly degrade the conditions for the installation of new species. The level of Therophytes is related, whatever the scale of analysis and the level of perception adopted, to the opening of vegetation and the overall humidity of the environment (Daget, 1980; Barbéro et al., 1990; Hachemi, 2015).

The analysis of flora by biogeographical types shows the predominance of Mediterranean biogeographical species (Med) with 56 species (47.1%).

These results go in the same direction with those of Miara et al. (2017) and Nouar (2020). The western Mediterranean elements (W. Med) follow the Mediterranean (13 species; 10.9 %), in third place the Ibero-Mauritanian (Ibero-Maur) (7 species; 5.9%), then the Cosmopolitans (Cos) (6 species; 5%) and the North African Endemics (End. N.A.) then the Euro-Mediterranean (5 species; 4.2%), Europeans (Eur) and Paleo-Temperate (Paleo-Temp) (3 species; 2.5%). The remaining types represent low participation (< 2%), but contribute to the diversity and richness of the plant potential of the study area (Fig. 4).

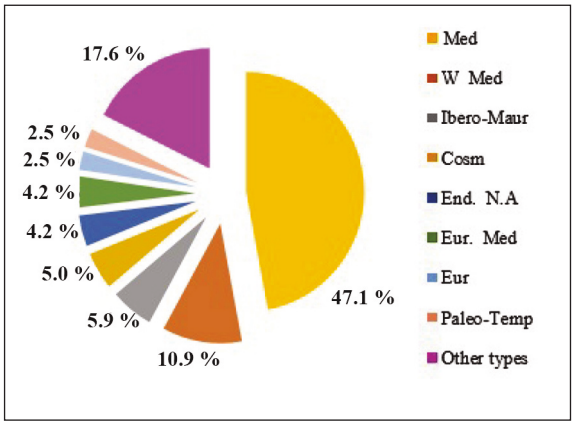

Figure 4. Composition of flora by biogeographical types.

The calculations of the various ecological indicex show that the Shannon H index reveals a diversity of the flora studied (4.86%) (Yabi et al., 2013). The value of the Pielou equitability index (J) is 0.89% showing an equitable distribution of the species (Médail, 1996). The Simpson diversity index (1-D) equals 0.98% reflecting a low diversity of stands (Nouar, 2020) and the disturbance index shows a percentage of 61.34%. This rate is slightly high (Hachemi, 2015) which reflects an opening of the environments and a change in the floristic composition.

CONCLUSIONS

One of the first and main conclusions that can be drawn from this analysis is the overall state of the flora, which is characterized by a dominance of short life cycle specises (47.9%) and confirms the therophytization phenomenon of vegetation in western Algeria.

Based on the systematic plan, 119 species were inventoried, the families of the Asteraceae, Fabaceae and Poaceae were most represented and adapted to local conditions in the environment where they constituted more than 39% of the vegetation studied. This latter is strictly Mediterranean with a large dominance of Mediterranean biogeographical plants with 47.1%.

The calculated biodiversity index show that the studied vegetation is diversified and marked by the dominance of annual plants with a high perturbation rate, which requires more attention for the protection of these natural spaces.

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