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Contribution to the phytodiversity study of the Ouled Sidi Abdelaziz (forest of Ouled Sidi Yahia) in North-West of Algeria

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ABSTRACT This work consists in evaluating the phytodiversity of the western foothills of Ouarsenis (Algeria). For this purpose, we favored subjective sampling. The study of floristic diversity has made it possible to establish a list represented by 103 species distributed in 39 families with more common Fabaceae, Liliaceae and, finally, Asteraceae. The biological spectrum of these species reveals the dominance of phanerophytes and therophytes. On the biogeographic level, the flora is dominated by Mediterranean species with a rate of 51%. This contribution revealed significant results that could be used for the valorization and preservation of these zones.

KEY WORDS Biodiversity; phytodiversity; Ouled Sidi Abdelaziz; Algeria.

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INTRODUCTION

Forests are one of the main reservoirs of plant and animal diversity in the world. Particularly, Algeria is part of the Mediterranean basin which is one of the richest regions in the world in terms of plant biodiversity. This plant heritage is currently threatened by the combination of several natural (especially recurring droughts and climatic aridity) and anthropogenic factors (fires, clearing, overgrazing, etc.).

The preservation of this diversity has become a major international issue and Algeria has a responsibility both for its own ecosystems and for international action. Few floristic studies have focused on this region, as the works of Pons & Quézel (1955) along the coast of central and western Algeria.

The main objective of this work is the evaluation of the phytodiversity of Sidi Abdelaziz District (Algeria). We have achieved inventory studies, monitoring and evaluation of the natural flora in the southern part of the Wilaya of Relizane. This study area is integrated into the mountainous Ouarsenis complex and is characterized by remarkable biodiversity.

MATERIAL AND METHODS

The Sidi Abdelaziz District extends on an area of 891 Ha and occupies the center part of the forest of Ouled Sidi Yahia. From the administrative point of view, Sidi Abdelaziz is located 30 km east of the Wilaya of Relizane and falls territorially in the commune of Dar Ben Abdellah.

Sidi Abdelaziz District is managed by the Zemmora Forest District (Relizane Wilaya Forest Conservation).

Sidi Abdelaziz has been chosen as a study area for the development of the plan of exploitation of medicinal and aromatic plants according to several criteria, which are: the floristic richness of the site and especially the aromatic and medicinal plants; the proximity of the site to the town center of the commune of Sidi Lazreg; the ease of access to this canton.

This study uses two types of data, depending on the availability of climate data (see also Table 1). 1) Every weather data from the meteorological station of the experimental station of El H'madena, INRAA (Latitude 35°54'N, Longitude O°47'E. Altitude 48 m) located about 25 km from the forest of Ouled Sidi Yahia. 2) Recent climatic data from Relizane meteorological station, located at about 15 km of the Sidi Abdelaziz District.

The floristic diversity of a natural environment is evaluated from an inventory of the plant species present. The methodological approach adopted for our study is based on two stages, the first consists of carrying out the surveys and the second concerns the evaluation of biodiversity.

We favored the subjective sampling, which is the simplest and most intuitive form of sampling (Gounot, 1969) and it allows a qualitative recognition of the vegetation. This method, based on the physiognomic aspect, considers the dominant species and the structure of the vegetation.

According to Géhu & Rivas-Martinez (1981), a floristic survey is an inventory of botanical species accompanied by quantitative and qualitative coefficients (abundance-dominance) and ecological notations such as topography, soil, and microclimate. In the Mediterranean region, the minimum area is defined using the "area-species curve" (Gounot 1969; Guinochet, 1973). In practice, the value of the minimum area is substantially constant for the various surveys of a given group, but varies considerably from one group to another (Ozenda, 1982). This area is of the order of 100 to 400 m^2 for forest groups, 50 to 100 m^2 for matorral formations, from 20 to 50 m^2 for lawns (Ozenda,

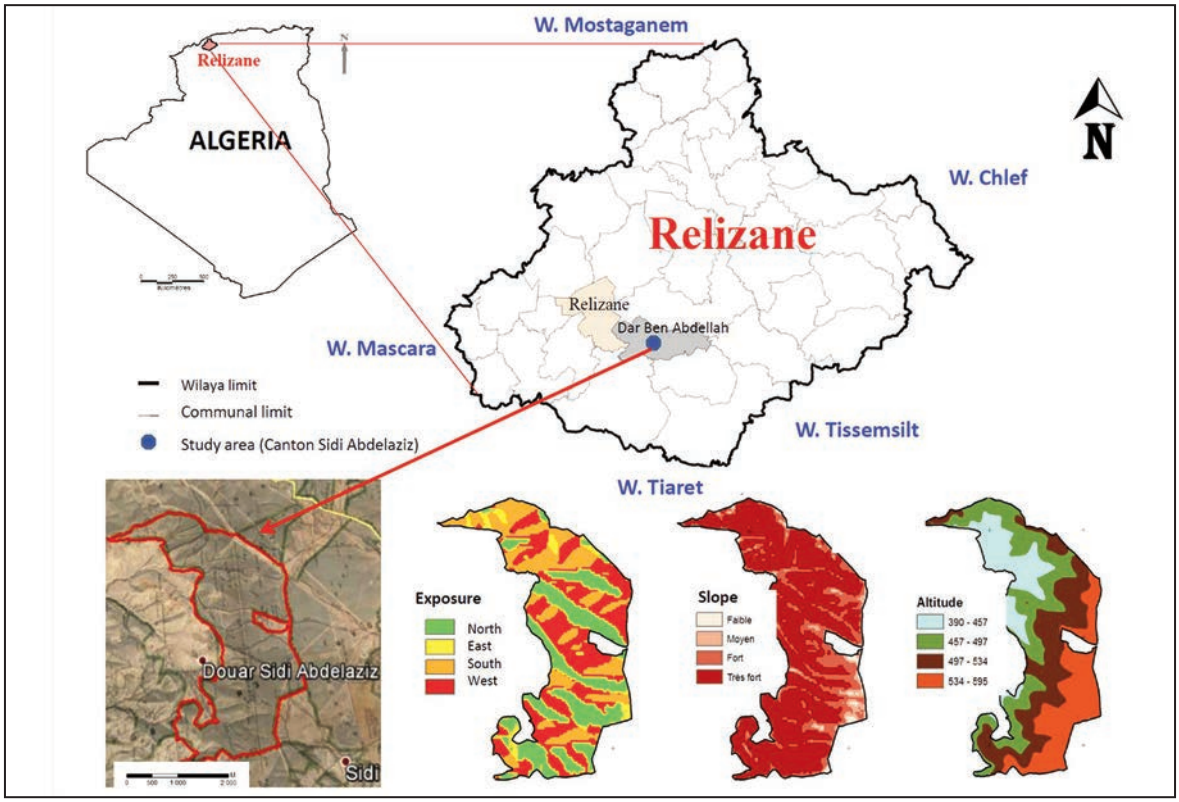

Figure 1. Geographical location of the study area.

Period	Old		Recent	
Station	H'madena 1951-1979*		Relizane, 2004-2014**	
Month	Temperatures (°C)	Rainfall (mm)	Temperatures (°C)	Rainfall (mm)
January	10.11	49.26	10.90	39.69
February	11.20	46.34	12.09	40.02
March	12.69	40.23	13.95	33.05
April	15.80	33.37	17.36	49.89
May	19.70	29.40	21.35	31.83
June	23.49	9.73	25.46	7.51
July	27.77	0.34	29.87	1.15
August	28.66	2.77	30.09	6.75
September	24.15	15.62	25.85	15.45
October	19.39	42.74	21.83	29.81
November	14.20	45.50	15.53	60.32
December	10.79	49.33	11.17	40.40
Annual average	18.16	364.63	19.62	355.86

Table 1. Climatic data monthly and annual average of the study area. *Bellague, 1998; ** Baghdadi, 2017.

1982). This is why, the surface of the surveys carried out is around 128 m².

The survey allows us to realize a complete list of the species present in the study area (Braun-Blanquet et al., 1952). To characterize the place occupied by the species, each of them is affected by its coefficient of abundance-dominance. Abundance expresses the number of individuals that make up the population of the species present in the survey. Dominance represents the recovery of all individuals of a given species, such as the vertical projection of their aerial vegetative apparatus on the ground. The abundance-dominance coefficient is estimated visually (Walter, 1994).

Most species have been recognized in the field. The unidentified species were harvested, dried and then determined following Maire (1928), Quézel & Santa (1962-1963), Blamey & Gray (2009). The identification of the plants is confirmed by the comparison of the collected samples with those of the Herbarium of our laboratory of University center of Rélizane.

The biodiversity of a given territory is reflected in its richness in biocenoses both quantitatively and qualitatively (Ouelmouhoub, 2005). According to Blandin (1986), diversity indices are a means of assessing and estimating plant biodiversity. Those selected for our work are:

- The floristic richness: It represents one of the fundamental parameters characteristic of a natural environment, it is frequently used to measure the vegetal biodiversity of a natural site (Ramade, 1984). There are two indices: total wealth (S) and average wealth (s).

- Biological types: Plants adapt in various ways to the environment and these adaptations do not always correlate with the classification. It often happens that plants very far from the systematic point of view have the same adaptations, which gives them the same morphology (Maire, 1926). The biological types or life forms defined by Raunkiaer (1934) classify plants according to their size and the position of the buds in relation to the soil surface. This criterion is used to account for the plant's ability to endure the adverse season (Khelifi, 2008). The classification of Raunkiaer (1934) makes it possible to recognize the following main life forms: phanerophytes, chamaephytes, hemicryptophytes, geophytes, and therophytes.

- Biogeographic types: Algeria has a very diverse flora with species belonging to different biogeographic elements (Quézel & Santa, 1962-1963). We were able to determine the distribution of taxa from a biogeographical point of view and to define the chorological types (Senterre, 2005).

RESULTS AND DISCUSSION

During the 28 years corresponding to the period from 1951 to 1979, the average temperatures varied, between 10 °C and 28 °C respectively for the month of January and August. The average annual temperature is 18 °C. The coldest months are January and December (10 °C), while the months of August and July are the hottest months with an average of 28 °C. The rains are often regular in quantity from one year to another and for the same month.

During the recent period (2004–2014), during the last 11 years the average temperatures vary, between 11 °C and 30 °C respectively for the month of January and August. The average annual temperature is 20 °C. The coldest months are January and December (11 °C), while the months of August and July are the warmest months with an average of 30 °C. The rains are often irregular from one year to another and for the same month. The climate of our study area is Mediterranean. It presents a dry period of five months and spreads from the beginning of May to the end of September (see Fig. 2).

The floristic inventory of the pre-forest formations studied, allowed us to list 103 taxa. These species are distributed in 39 botanical families differently represented taxonomically (Fig. 3). The richest families are: Fabaceae with 13 species divided into 09 genera, Liliaceae 8 genera and 12 species, Asteraceae with 8 genera and 8 species, Poaceae with 8 genera and 8 species, Lamiaceae 6 genera and 8 species and, finally, Cistaceae 3 genera with 6 species. Finally, of the 18 remaining species, 9 families are represented by 2 taxa and 19 families contain only one species.

The analysis of the biological spectrum shows that the therophytic species (33%) have the highest rate while the Phanerophyte species are 19%. This is explained by the pre-forest structure of the vegetation of our study area, where the shrub species - *Tetraclinis articulata* (Vahl) Mast., *Phillyrea angustifolia* L., *Olea europaea* L., *Pistacia lentiscus* L. - and lianas - *Clematis cirrhosa* L., *Smilax aspera* L. - are dominant.

Therophytes are the proof of the degradation of the area. When the latter undergoes strong anthropozoic pressure, the forest species diminish or disappear to give way to therophytes: *Trifolium arvense* L., *Sherardia arvensis* L., *Anagallis arvensis* L.

Hemicryptophytes are relatively important (16%) with: *Convolvulus althaeoides* L., *Daucus carota* L., *Inula viscosa* (L.) Aiton and *Lotus creticus* L.

Geophytes (15%) are composed of species such as: *Asphodelus microcarpus* Viv., *Gladiolus segetum* Ker Gawl., *Allium roseum* L., *Ranunculus bulbolus* L., *Allium album* L. and *Arisarum vulgare* Targ. Tozz.

Chammephytes are17% of the all listed species. There are: *Asparagus albus* L., *Cistus monspeliensis* L., *Ruta chalepensis* L., and *Globularia alypum*.

The biological spectrum carried out on all the listed species follows this pattern: Therophyte>

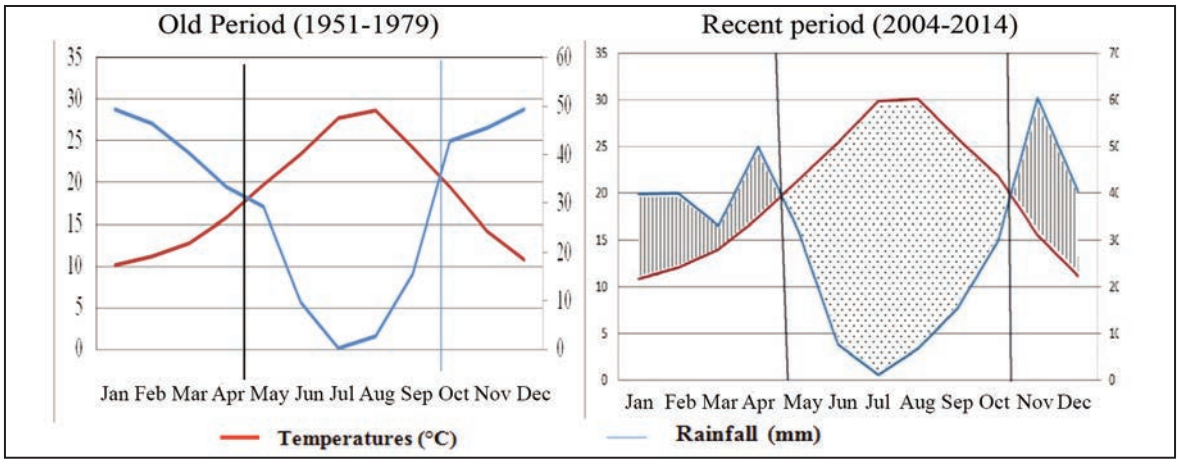

Figure 2. Comparison of the Bagnouls and Gaussen Ombrothermal Diagram, 1953 of the study area.

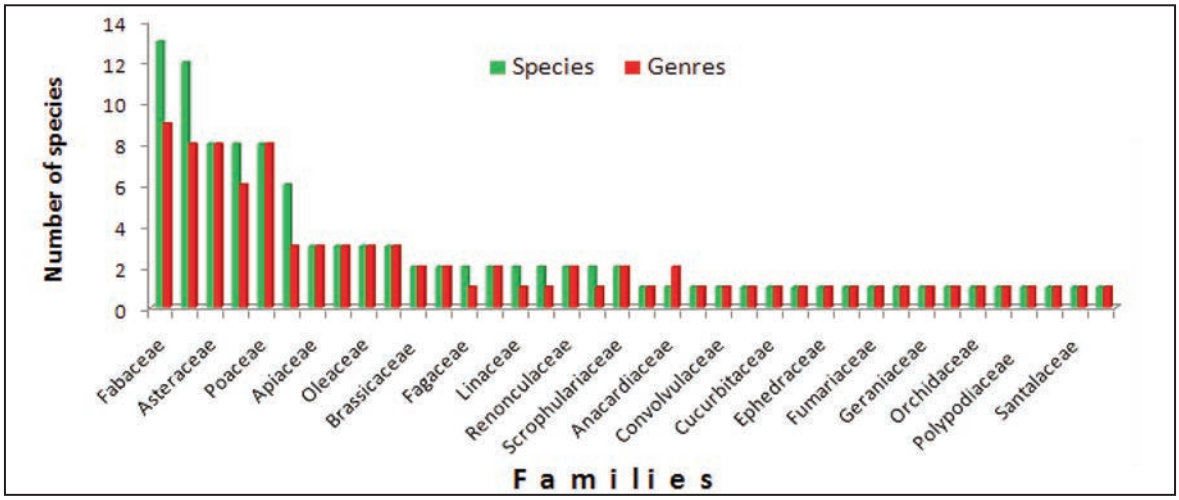

Figure 3. Number of genera and species per family.

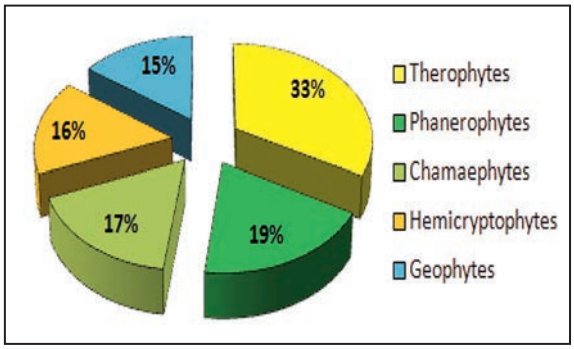

Figure 4. Distribution of species by biological types.

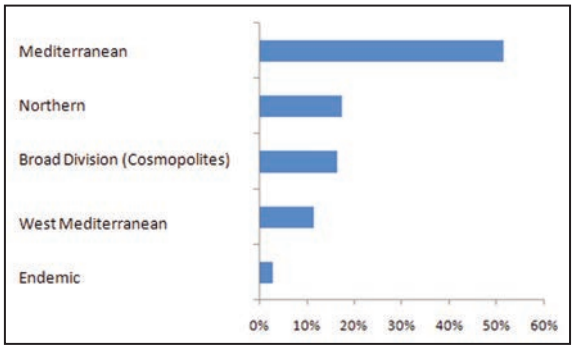

Figure 5. Biogeographic spectrum.

Phanerophyte> Chamaephyte> Hemicryptophyte> Geophyte.

Algeria is subdivided into 10 biogeographical sectors. Our study area is located in the Oran sector and more specifically in the Coastal Plains Sub-sector (O2). These subdivisions are part of the Mediterranean Maghreb area (Maire, 1926, Quézel & Santa, 1962-1963).

Spectrum analysis (Fig. 5) shows that the flora that makes up our study area is essentially Mediterranean (51%), and, following, the northern type (17%), the cosmopolites (16%), the West-Mediterranean (13%), and finally the endemic (3%).

The vegetation of our study area, characterized by *Tetraclinis articulata* and *Olea europea* subsp. *sylvestris* with tall bushes of *Phillyrea angustifolia* and *Pistacia lentiscus*, may favor the penetration of lower species such as, *Lavandula stoechas* L., *Cistus monspeliensis*, and *Cistus salvifolius* L.

The herbaceous layer is very poor or close to zero because of the almost total closure of this group. This vegetation unit is a dense matorral with 85% to 100% coverage. It is located on average slopes (20 and 30%) and altitudes that vary between 370 m and 517 m. The presence of *Cytisus spinosus* (L.) Bubani,, *Lavandula stoechas*, *Cistus monspeliensis* and *Globularia alypum*, within our group, indicates the disturbance of the environment (fire passage, especially).

The presence of *Anagallis arvensis*, *Blakstonia perfoliata* (L.) Hudson, *Galactites tomentosa* Moench, *Marrubium vulgare* L., *Daucus carota*, *Convolvolus althaeoides* L., *Oxalis corniculata* L., *Bromus madritensis* L., *Vicia sativa* L., and *Sher-*

ardia arvensis, reveals the anthropization of the environment.

CONCLUSIONS

This work focuses on the evaluation of phytodiversity in the southern part of the Ouled Sidi Yahia forest (Canton Sidi Abdelaziz). As we have seen, the southern part of the Ouled Sidi Yahia forest (Canton Sidi Abdelaziz) has a remarkable specific richness, with a number of 103 species belonging to 39 botanical families. In terms of biological types, phanerophytes are the most dominant. This is certainly related to the pre-forest structure of our plant formations. Therophytes are second and they are particularly important because they indicate the degradation of the environment. On the biogeographic level, a very varied flora, dominated by Mediterranean species with a rate of 51%. Endemism is 3% with the presence of *Ebenus pinnata* L., *Ephedra altissima* Desf. et *Linum corymbiferum* ssp. *corymbiferum* Martinez), which require special conservation measures. Based on the results obtained, our study area offers a relatively large floristic diversity that should be conserved by developing a conservation strategy.

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