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PHYTOECOLOGICAL STUDY OF ALEPPO PINE GROUPS IN NORTH-WEST ALGERIA (CASE OF FOREST OF OUARSENIS IN TISSEMSILT)

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ABSTRACT

The present work concerns the study of a vegetal group at Pin d'Alep for the forest of el Ouarsenis located in the northwest of the Wilaya of Tissemsilt in Algeria. It is an original study carried out by a phytoecological approach, it is limited to 5 stations belonging to the 5 cantons whose plant cover is well diversified and the species of Aleppo pine is well represented. Results were obtained in taxonomic, morphological, biological and biogeographical aspects. These results made it possible to identify 104 plant species divided into 83 genera and 34 families. Angiosperms represent 95% of which 83% are dicotyledons.

The most important families are the Asteraceae with 25% and the Fabaceae with 10%. From a morphological point of view, annual herbaceous plants are the most dominant with 46%/ For the biological type the Therophytes represent 51%, and for the biogeography of the species 41% are of the Mediterranean type.
Keywords **:** phytoecology, plant diversity, Aleppo pine, Ouarsenis forest, Tissemsilt

Introduction

The forest is an important natural resource for man from its socio-economic and environmental side. The Aleppo pine (P*inus halepensis Mill.)* of this forest, it has been an integral part of the Mediterranean landscape for at least 3 million years, species occupies an area of 3.5 million hectares (Laala, 2009), its longevity is estimated at 150 years with an average of 120 years (Nichane, 2009; Quezel and Barbero, 1992).

This species is used in reforestation programs for the protection of watersheds and the fight against desertification (Bouazza, 2013), and its wood is highly sought after for industrial uses and timber.

The Aleppo pine has the widest ecological amplitude. It is both thermophilic and heliophilous, supporting high temperatures but fearing excessive humidity, frost and snow (Nahal, 1986). This species likes marly and calcareous-marly substrates where it finds deep soils in particular, but does not tolerate loamy or loamy-clay lowlands with compact soil. (Quezel and Barbero, 1992).

In Algeria, the Aleppo pine is present in all the bioclimatic variants with predominance in the semi-arid stage. It occupies 860,000 hectares and is largely located in its natural state in the eastern and central regions of the country (DGF, 2005).

Like all the forests of the Mediterranean basin, the Aleppo pine forest has been subjected to intense human pressure for centuries (clearing, illegal cutting, fires, pastures) thus causing deforestation and the regression of the plant cover. Added to this are the successive and prolonged droughts which are the cause of the drying out and dieback of standing trees; these combined factors have led to a net decrease in forest cover which has caused a breakdown in the natural system of soil defense and restoration (Bentouati, 2006).

In this study, our work is focused on the study of this species (Aleppo pine) in the Ouarsenis forest located northwest of the Wilaya of Tissemsilt which is characterized by an important floristic biodiversity. We are interested in the autoecological behavior of this species which is in the form of a clear high forest often mixed with the oak grove with holm oak in this forest and the various floral processions which can be individualized around this species in this region, and this by the interpretation of the floristic diversity through the morphological, biological and biogeographical type and the structure of the plant cover through the factorial analysis of correspondences.

Material and Methods

1. 1. Presentation of the study area

The Ouarsenis forest is located in the Ouarsenis massif in northwestern Algeria, in an area characterized by an essentially limestone lithology, a varied altitude range of 330 to 1985 meters, and 40% of its area is represented by slopes greater than 12.5%. The bioclimatic stage is subhumid, characterized by a long dry summer season and a wet winter season. This forest which consists of 67 cantons occupies an area of 22428 ha, it is spread over three watersheds (Oued Fodda, Oued Ligh and Oued Sly). The most responsive vegetation consists mainly of pine forest, cedar, oleolentisk and tetraclinaie (Tebani, 2008)

For this study, we have delimited part of the Ouarsenis forest, the most important in terms of plant cover and better distribution of our studied species (Aleppo pine), it is part of two municipalities which are: Lazharia and Boucaid (Figure 01)

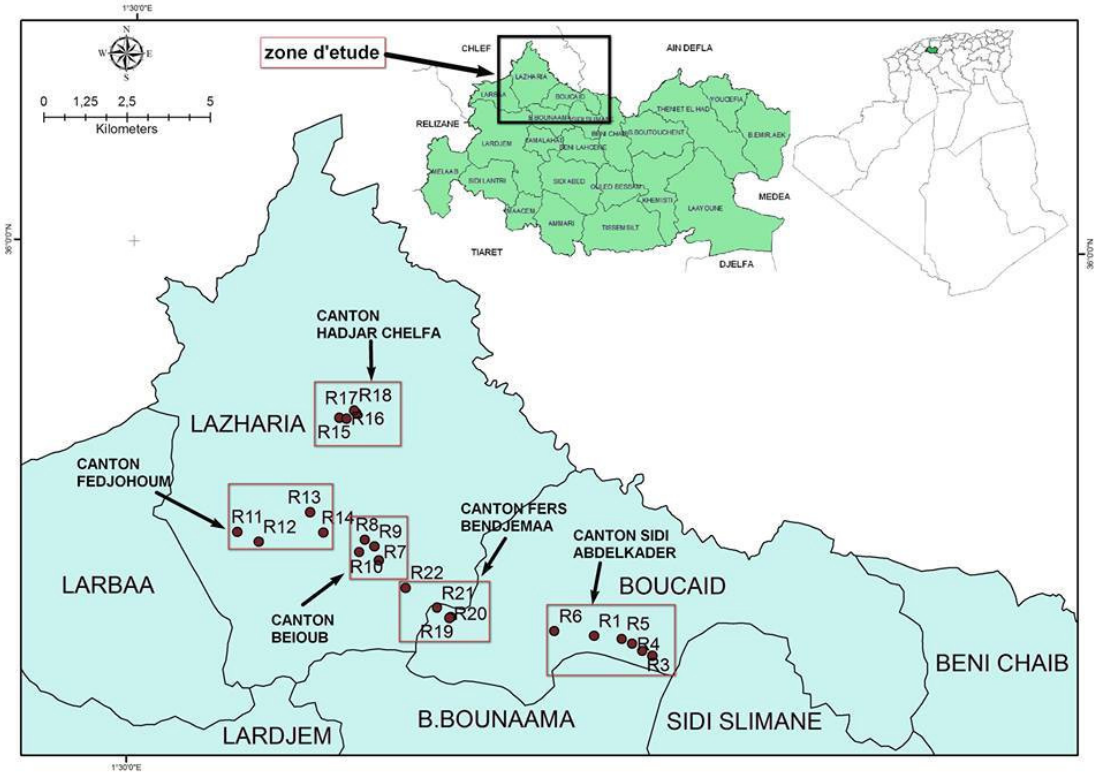

Fig. 1 : Location of the study area and location of the readings in selected stations

2. Methodology adopted and material used

The method adopted in this work is divided into two stages: a first stage which consists of sampling and the development of a floristic study based on field trips; a second stage based on the floristic, biological, biogeographical and statistical analysis of the vegetation of the Aleppo pine *groups (Pinus halpensis).*

A first perception outing was made in March (early spring) to get an idea of the study area and to see the general state of the forest and its vegetation, then we started the work through several other visits that were made during the months of April and May (full flowering period).

Within the study area, we chose five stations for five representative cantons over an area of 3163 ha (14% of the total forest area of Ouarsenis), in which we chose the statements indicated in Figure 01, each of these stations includes the main ecological characteristics measured in the field: surface area, altitude, slope and rate of coverage (Table 01).

Table 1 : Characteristics of the stations in the study area

No.	Station	canton	Area (Ha)	Altitude (m)	Slope (%)	Vegetation cover rate (%)
01	Ain Antar.	Sidi Abd El Kader	896	1195	10 - 15	75
02	Koudia.	Beyoub	458	988	15 - 20	50
03	kouacem	Fedjouhom	335	962	15 – 20	20
04	Sidi Brahim	Fares Ben djamaa	896	1210	30 - 45	75
05	Sidi Saleh	Hdjer El Chelfa.	578	925	35- 50	45

Sampling, therefore, constitutes the basis of any floristic study, it designates all the operations which aim to identify a population; individuals to constitute the sample (Gounot, 1969) and all available information can be used for the selection of station representing a sample as complete as possible, with regard to their diversity, originality and representativeness (Gillet, 2000).

In our case, the sampling method that meets our objective is centered on the notion of the presence of the Aleppo pine species. The surveys were carried out using the minimum area method described by Gounot in 1969, which lends itself better to rapid research over large areas, knowing that in the Mediterranean region the minimum area is around 100 to 400 m² for forests (Benabid, 1984).

The sampling equipment used includes: a GPS to take the geographical coordinates of each station, a digital camera to show photos of the species and the stations studied, plaster and cord to delimit the sampling area, an auger to take samples of soil, pruning shears for cutting species specimens,

bags for collecting specimens and tape for attaching labels, and a notebook and pencil for recording data.

Results and Discussions

Biological and biogeographical diversity

Systematic composition

According to the floristic inventories that were carried out in the selected stations, our study area includes 34 families, 83 genres and 104 species. Angiosperms represent 95% and consist of 83% dicotyledons.

The distribution of families in the study area is not homogeneous, the best represented families are the Asteraceae with 25%, the Fabaceae 10%, the Lamiaceae 6% and the other families have a low representation. Most genera are represented by only one or two species (Figure 02)

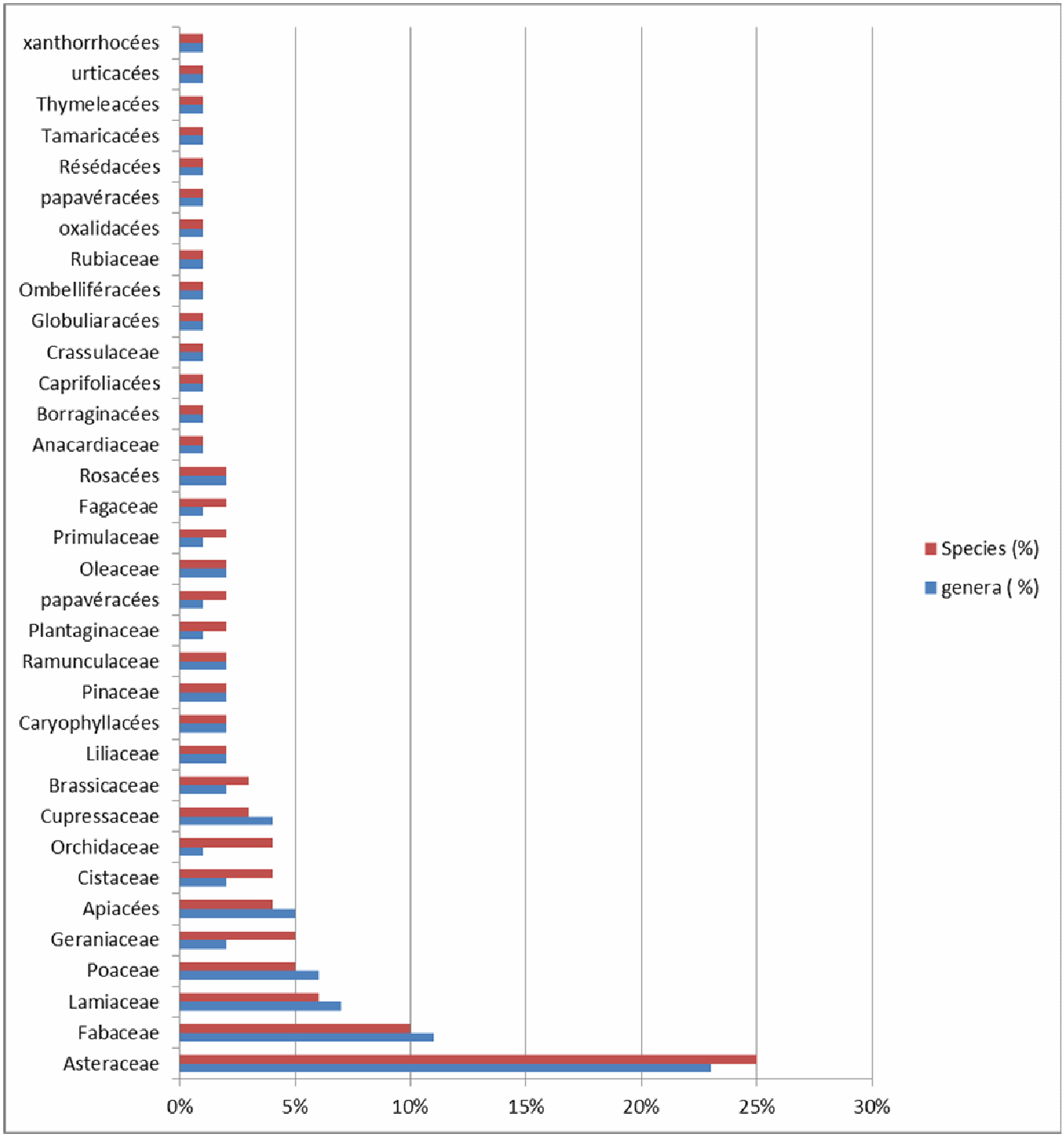

Fig. 2: Composition in families, genera and species of the study area expressed in %.

Morphological types

The plant formations in the study area are heterogeneous between woody and herbaceous, and between perennials and annuals. Annual herbaceous plants are the most dominant with 46%, then perennial herbaceous plants and finally woody perennials which are less represented (Figure 3).

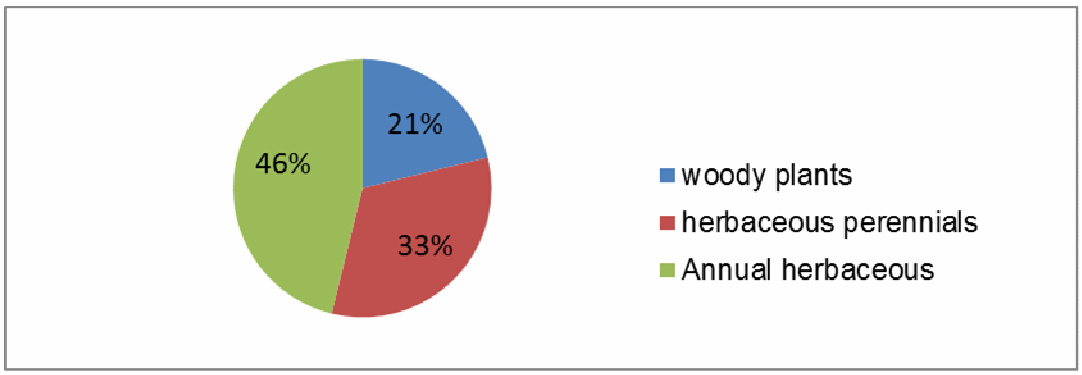

Fig. 3 : The morphological types of the study area expressed in %.

Biological characterization

Biological classification of plants

The five biological types retained in the five stations show a heterogeneous distribution in the plant formations between the stations (Figure 04)

The therophytes have the highest rate with 50%, which testifies to the strong anthropogenic pressure in this region, especially through grazing and ecotourism. We also notice a good distribution of Hemicryptophytes (16%) in the study area, geophytes are less represented with (7%), the chamaephyte and the phanerophytes represent respectively 15% and 9%. So the vegetation in the study area is of the TH > HE > CH > PH > GE type.

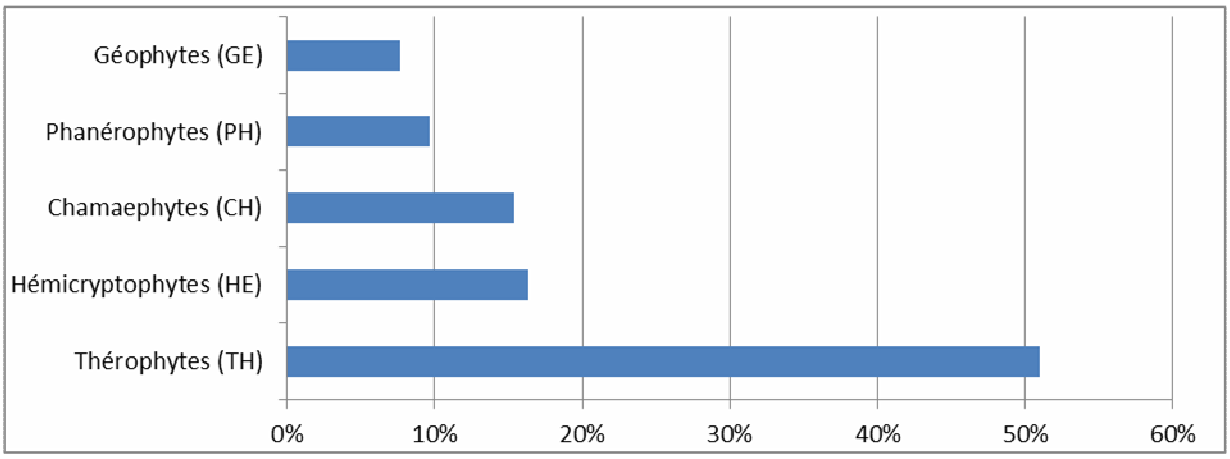

Fig. 4 : The biological types of the study area expressed in %.

Disturbance index

The disturbance index allows us to quantify the therophytization of an environment (Loisel and Gamila, 1993), It is calculated according to:

$$IP = \frac{Number\ of\ chamaephytes + Number\ of\ therophytes}{Total\ number\ of\ species}$$

The disturbance index being around 66.34% for the study area, the strong degradation caused by human action is clearly visible (fire, clearing and grazing). This index is higher for the Kouacem station (Figure 05).

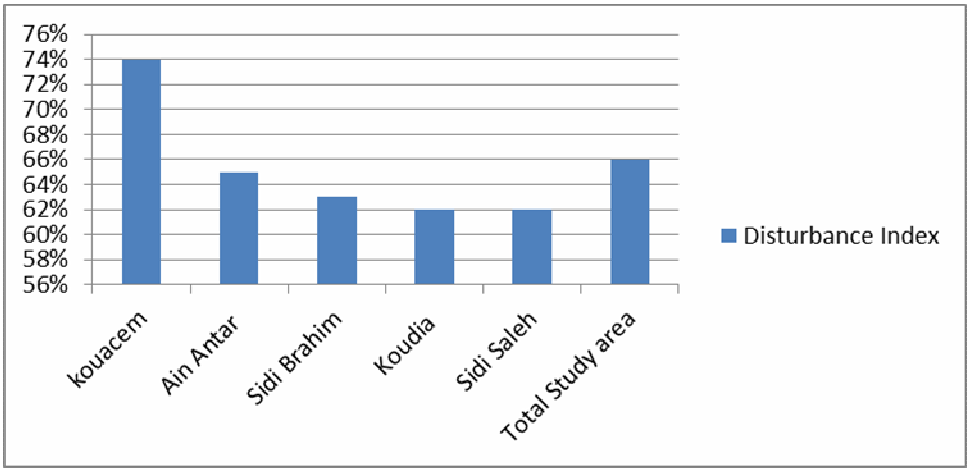

Fig. 5: Disturbance Index of Stations in the study area

Biogeographic Types

Figure 6 shows the predominance of Mediterranean biogeographic type species in the study area with a percentage of 40.38%, then the Eurasian type with a percentage of 7.96%, after the European Mediterranean element comes in third position with 6.73%, then European with 5.76%. The rest represents a low participation, but contributes to the diversity and richness of the plant genetic potential of the region.

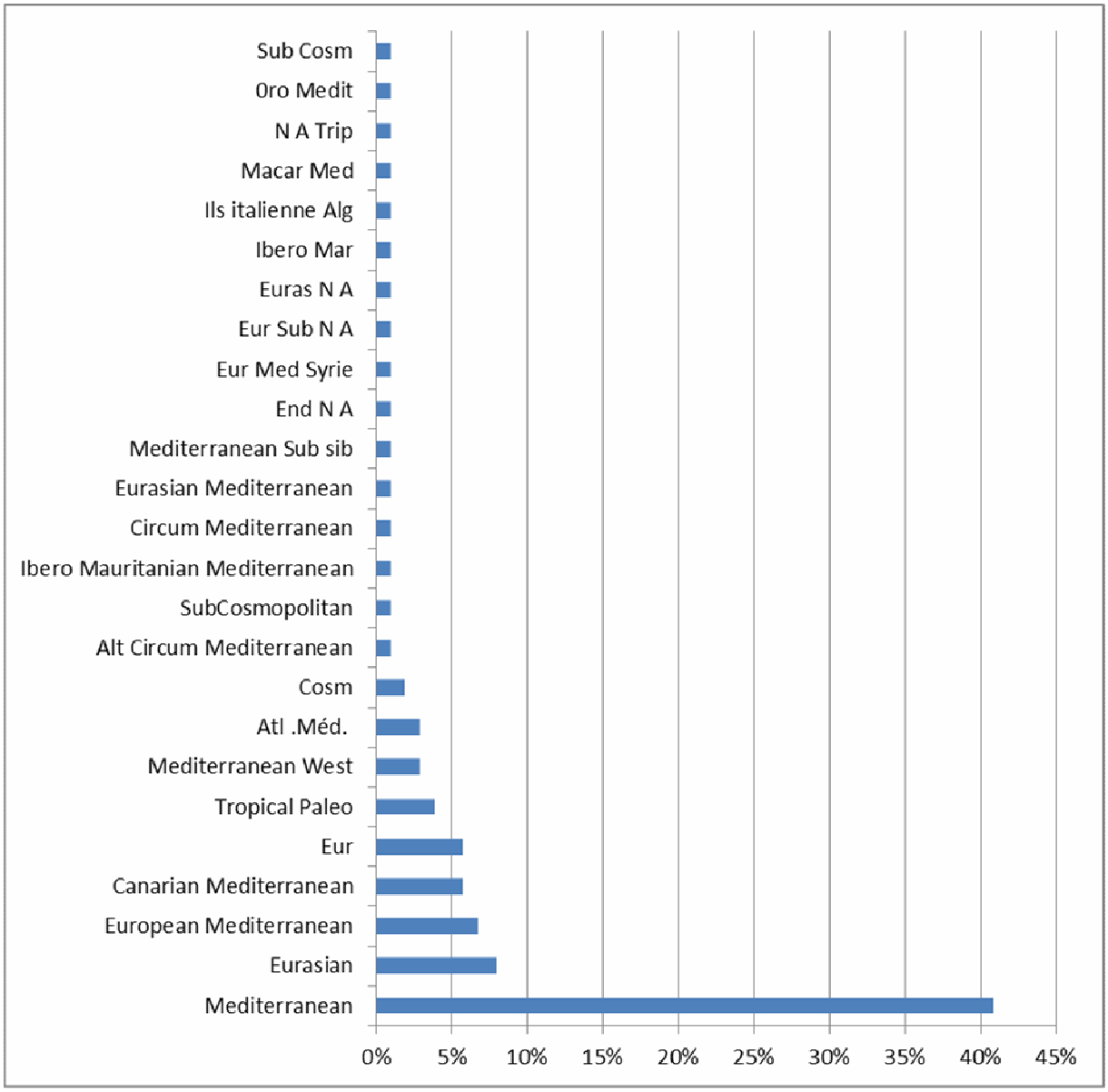

Fig. 1 : The biogeographical types of the study area expressed in %.

Statistical analysis of results

To ensure data processing and meet our objective, we have chosen statistical processing by factorial analysis of correspondences. We established a double-entry table to gather the data whose columns correspond to the readings and the lines represent the species listed in the study area.

This analysis was carried out using the Minitab16 software to search for the homogeneity of the vegetation and identify any plant groups. The interpretation of the results is based on the inertia of the system which indicates the explanatory power of a factorial axis and the contribution which measures the importance of a row point (recorded) or of a column point (species) with respect to a factorial axis.

Indeed, since Roux's initial work, it has been shown that the plant groups studied are ordered according to gradients of ecological factors. From the clouds of points obtained relating to the species and the significant factorial axes, it is possible to highlight the ecological gradients which act on the distribution of the plants and the groups which constitute them in the forest of Ouarsenis.

The results obtained show that on the one hand, therophytes constitute a strong contribution compared to other species, and on the other hand a group of species belonging to the forest and near-forest domain is individualized, including our species (*Pinus helpensis*) and others.

Conclusion

For this research, the Ouersenis forest in the wilaya of Tissemsilt was chosen for the phytoecological study of *Pinus*

halpensis groups, because this species is the most important and the most dominant in this region. To achieve our objective of this study, we carried out floristic surveys at the level of the five most diversified and representative stations of this species.

104 plant species have been identified belonging to 83 genera represented by 34 families dominated by Asteraceae and Fabiaceae.

From a morphological point of view, annual herbaceous plants are the most dominant with *46%,* for biological types, Therophytes are the most dominant, i.e. 51%, which indicates the influence of anthropic action on the environments. . Biogeographically, species of the Mediterranean type are the most representative with *44%*.

From the disturbance index calculated (66.34%) for the study area and thanks to the factorial analysis of the correspondences which shows the plant groups largely penetrated by therophyte species , this shows a strong degradation caused by clearly visible human action (fire, clearing and grazing) which leads to the rupture of ecological balances. It is therefore necessary to program forestry interventions in order to preserve this phytogenetic heritage at the level of the Ouarsenis forest.

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