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Structure and Diversity of Arthropod Communities in the Jebel SidiR'ghiss Forest (Oum El Bouaghi) North East Algerian

Hinda Hafid[1, 2*], Noua Allaoua[1, 2], Amir Hamlaoui[1], Abderraouf Chouaib Rebbah[1] and Djemoi Merzoug[1, 2]

[1] Laboratory of *« RessourcesNaturelleset Aménagement des Milieux Sensibles », University of Oum El Bouaghi, Algeria.*
[2] *Departement of Natural Sciences, University of Oum El Bouaghi, Algeria.*

ABSTRACT

Arthropods form a cosmopolitan group that has been adapted to natural environments (deserts, forests, abysses, mountains. During the year 2018, using the methods of the filleting net, the barber pots and the direct collection, we inventoried the Arthropods in seven stations at the level of the Jebel SidiR'ghiss forest in the region of Oum El Bouaghi. The sampling yielded 1301 individuals belonging to 59 faunistic species. These stands are diverse with high Shannon-Weaver values. The numbers of stands are in equilibrium because the values of equitability are greater than 0.5. A total of five (5) animal classes (Malacostraca, Arachnida, Myriapoda, Insecta and Chilopoda); 13 Orders and 33 Families are inventoried in the seven stations. The Insect class is best represented with a rate of 88% Coleoptera order is the most abundant with an abundance rate of 25% followed by that of Hymenoptera with a rate of 24%. Formicidae is the most abundant family of the five harvested families of Hyminoptera.

Keywords: *Oum El Bouaghi (Jebel SidiR'ghiss Forest), Arthropods, Inventory, Barber Pots.*

Corresponding author: Hinda Hafid
e-mail✉ hafidhinda @ yahoo.fr
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1. INTRODUCTION

The forest is considered, , an ecosystem with multiple roles that should be conserved and restored. It is an excellent biodiversity conservatory because there are more animal and plant species than in open environments (Dajoz, 2007). Forests are dynamic elements. Already known in the fossil state, in the middle of the Devonian, they were very different from those in the present state. An important characteristic of this change the progressive increase in the relative importance of woody plants relative to herbaceous ones, together with a diversification of animals, especially insects. which This diversification shows the importance of the forest environment in the establishment of animal diversity (Retallack, 1997). These ecosystems have long been considered almost exclusively as wood producers, and for this reason, have been managed so as to obtain the maximum yield of fuel. Consequently, for many years, as they have economic value, any biotic or abiotic factors that interfere by reducing the production of wood have been considered damaging and should be removed. Today, this restrictive view is starting to be discarded and some aspect of forest entomology is being developing, It consists of studying the biology and ecology of all forest insects in particular and invertebrates in general and finding out what is their role in the functioning of the ecosystem (Clere and Bretagnolle, 2001).

According to 'Clere and Bretagnolle ,2001), Arthropods occupy a very special place in the forest ecosystem. Arthropods, in addition of being good biological indicators, are, to a large extent, essential elements of food availability for many animal species. Insects, which represent the richest group in species, play several important roles in forests. We can find, for example, phytophagous insects, decomposers, pollinators, predators, parasites or vectors of pathogenic organisms.

The consideration of arthropods in the management and conservation of natural areas has been in continuous increasing for the past ten years. However, the study of this group suffers from a lack of professional resources (professional entomologists, training) and a still too incomplete knowledge on the part of the managers, however strongly interested by this vast group.

The knowledge of arthropods, their compositions and their structures remain the essential point for the development of a database. Indeed, the realization of quantitative and qualitative inventories of the arthropodological fauna which frequent the garrigue-type environments is announced as the first step to be taken for the collection of sufficient data on these populations.

In this perspective, to contribute to this lack of studies in Algerian terrestrial environments, our study is only a contribution to the knowledge of some of the arthropods associated with the vegetation of the Jebel SidiR'ghiss forest. It is a study that comes within the framework of biodiversity, in order to enrich the local inventory and participate to complete our national heritage.

2. MATERIAL AND METHODS

2.1. Presentation of the study area

The wilaya of Oum El Bouaghi is located in the north-east of Algeria in the Constantine Highlands and covers an area of 7638.13 km². The commune of Oum El Bouaghi is located in the region of the high Constantine plains, between the mountain ranges of the Guelma region (in the North) and the Auras (in the South). It bends from the north to the south where it passes from an altitude of 1635m (Jebel sidiR'ghiss) in the North, to that of 808m (Garaa of Tarf) to the South. It is composed of three main isolated reliefs namely DjebelSidiR'ghiss in the North, Jebel Guellif in the South-West of an altitude of 1161m and Djebel el Tarf in the South of an altitude of 1134m. Around these isolated mountainous landforms are the flat areas (the plains) with an average altitude of about 850m

The mountain of SidiR'ghiss is characterized by a special vegetal cover different from other areas in the region of Oum El Bouaghi. This is due to the importance of the area and the altitude which varies between 1030 m and 1635 m like the mountainous reliefs which characterize the chain of Auras. The grounds of the mount of SidiR'ghiss are in majority rendzine, calcairo-clay-type with the existence of clay soil zone, soil rich in minerals such as Iron "ferruginous soils", slightly salty carbonated soil, there are also acidic and fine clay-limestone soils allowing the infiltration of water.

2.2. Presentation of the study stations

We chose the DjebelSidiR'ghiss forest as a study environment, where seven stations were chosen (see map below) in three different plant formations, namely the pine forest, the green oak grove, and the mixed Aleppo pine and Eucalyptus forest, over a period of study spread from January to May. During this period about fifteen trips were made according to the accessibility of the terrain and weather conditions. The choice of stations was random and stratified in order to collect and inventory fauna in the different habitats.

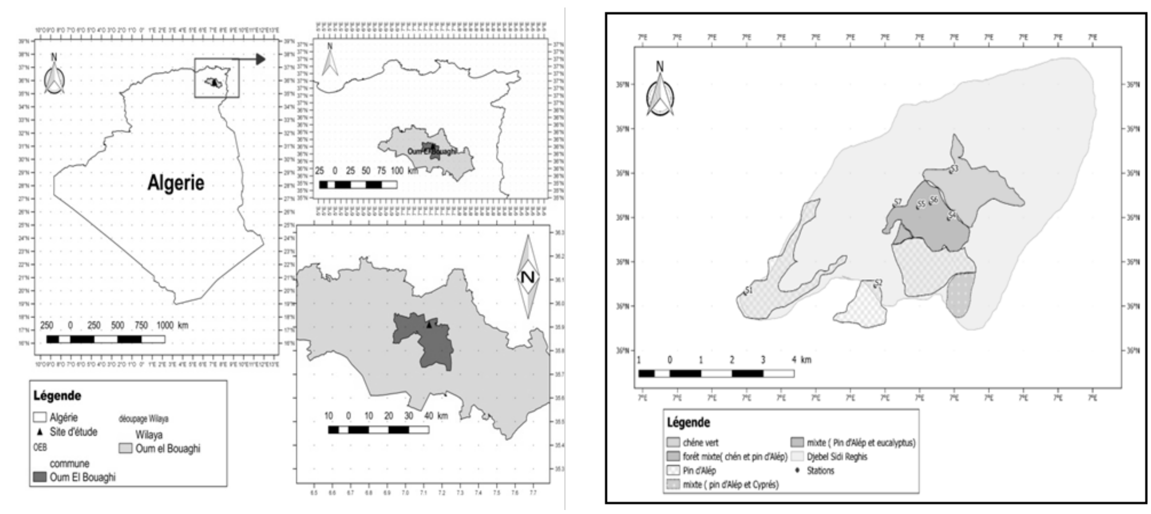


Figure 1: Distribution card of the stations in the various types of habitats in the forest of DjebelSidi R' ghiss by the straight-line method

2.3. Sampling procedures of Arthropodo-faune and exploitation of the data

2.3.1. Sample collection

According to Dajoz (1970) and Benkhelil (1992) various capture methods can be used to capture insects according to the habitats where they live, in the air, on the foliage, on the trunks of trees, on low plants, in fruits, on the ground, near roots, among rubbish, in nests or in bird shelters. Therefore, to be able to make a large number of observations in the field, special equipments or collecting tools must be provided. In the present work three methods are used, those of Barber pots or buried traps, yellow plates and the direct catch with two exits per week.

The samples thus taken are stored in a bottle filled with 70% alcohol, to allow their preservation. Both types of traps are collected and stored in pots identified by the date of collection and the trapping station for later identification under a binocular loupe up to the level of the species.

2.3.2. Preparation and identification of the samples

a) Preparation

The insects collected alive are killed with acetic acid, which has the advantage of causing rapid death and maintaining the flexibility of the articulations of the specimens. The specimens are then spread out and stitched with pins (Lepidoptera, Coleoptera,) or glued on a rectangle of white cardboard for small individuals of Coleoptera, Hemiptera, Lepidoptera, (Moulin et al., 2007), while large specimens should be spread out and arranged so that important organs (wings, antennae, legs, etc.) are clearly visible for identification.

b) Identification

Very few species of insects can be identified on site, the vast majority of species, even those of fairly large size, requires a laboratory study with a binocular magnifying glass. Only adult insects are identifiable at the species level (Moulin et al., 2007).

c) Conservation

Most trapped specimens are stored properly in 70% alcohol.

In order to protect the parts of the body observed during the identification, it is very important to pin the insects in the right place, which varies according to the different orders of insects.

The results obtained were evaluated by the following ecological indices:

1) Total wealth (S) which is the total number of arthropod species captured by Barber pots (Blondel, 1975).
2) The relative abundance (A.R.%) which is the ratio of the number of individuals of a species to the total number of individuals, all species combined N (Zaime & Gautier, 1989, Finnamore, 1998).
3) The diversity index of Shannon Weaver (H ') which is currently considered the best way to translate diversity (Blondel et al., 1973). It is given by the following formula: $H' = -\sum q_i \log_2 q_i$ where H' is the diversity index expressed in bit units and q_i is the relative frequency of species i taken into consideration. The equitability index (E), is the ratio of observed diversity (H') to maximum diversity (H'max) (Blondel, 1979). It is calculated by the following formula**:**

$E = H'/H'_{max}$. Maximum diversity is represented by the following formula: $H'_{max} = \log_2 S$ where S is the total richness (Guenser, 2008). Equitability values are within a range of 0 to 1. They tend to 0 when almost all of the numbers are for a single stand species. On the other hand, its approximation of 1 is due when each species is represented by the same number of individuals (Ramade, 1984).

3. RESULTS

The ecological indices applied are followed by a statistical processing by using the A.C.P of software XLSTAT 2015.

3.1. Number and relative abundance of arthropods harvested at the different stations

The numerous outings made during the five months using the various sampling methods, allowed us to collect 1301 individuals grouped in the table below, distributed in the different study stations.

Table N° 01: A number of individuals in each station of Djebel Sidi R' ghiss. P1 = Pot 1 ; P2 = Pot 2 ; Cd = Direct Colletions; Ac = coloured Plates

Station	Number of individuals	Site	Number of individuals
S1	451	P1	73
		P2	58
		Cd	320
S2	321	P4	25
		P5	28
		Cd	268
S3	85	P7	8
		P8	13
		Cd	64
S4	136	P10	20
		P11	19
		Cd	97
S5	163	P13	16
		P14	17
		Cd	130
S6	121	P16	14
		P17	4
		Cd	103
S7	24	Ac	24
Total	1301	Total	1301

The number of individuals collected by the hunting method and the recovery of the contents of the Barber pots varied from one station to another so that the highest value recorded was that of the S1 station of 925 m altitude and which represents an association of Aleppo pine (Pined) with 451 individuals, while the lowest value was recorded in the S7 station with only 24 individuals collected by the yellow plates.

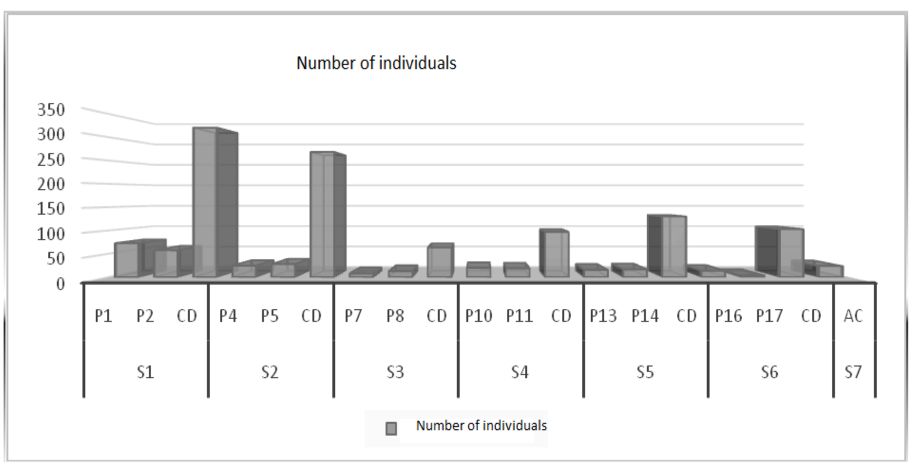


Figure N 2 : numbers of the individuals of the species collected in the seven Stations

According to Figure 2, there is a variation in the number of individuals in each pot and we have realized that the direct collection method is the most efficient in each of the sampled stations. collection method is the most efficient in each of the sampled stations.

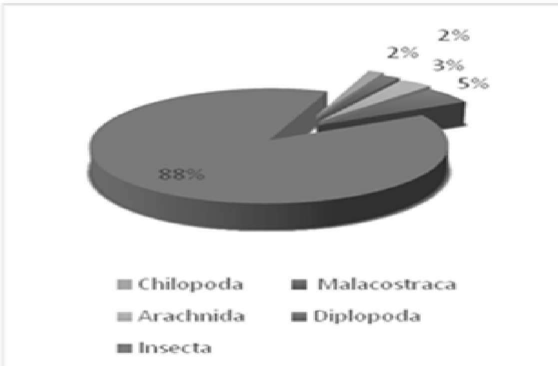


Figure N 3 : Abundance of the orders classes

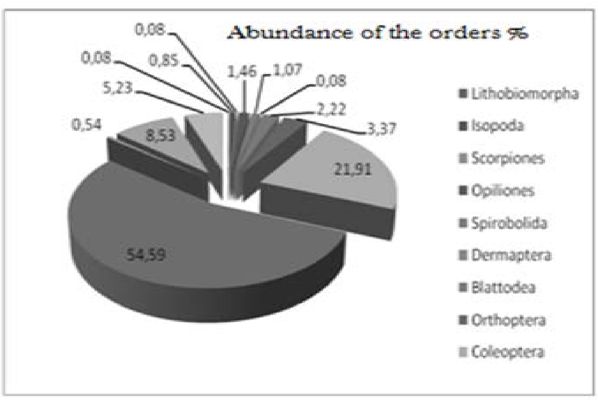


Figure 4 : Abundance des orders

A total of 59 Arthropod taxa divided into five classes, 13 orders and 33 families were sampled at the seven DjebelSidiR'ghiss stations. The class of insects, is best represented, for orders, we counted a total of 13 orders dominated by that of the Hymenoptera with 54.59% of the total collected, the beetles occupy the second position with (21.91%), followed by those of the Diptera, Lepidoptera, Orthoptera, with respectively (8.53%, 5.23% and 3.37%), The remaining orders are only slightly represented. Our results are weak (diversity) compared to those of Chalane and Djouder (1999) having worked in three stations of different types of plant formations in the region of Bejaia, among them a Garrigue type station, but always with the dominance of insects especially the Hymenoptera.

VI-2: Diversity of the arthropods

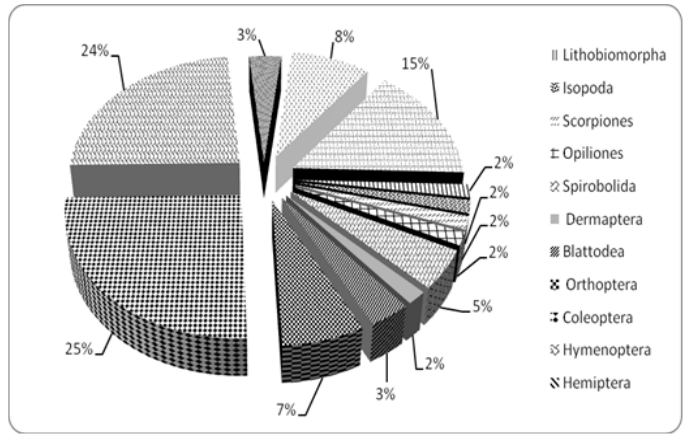


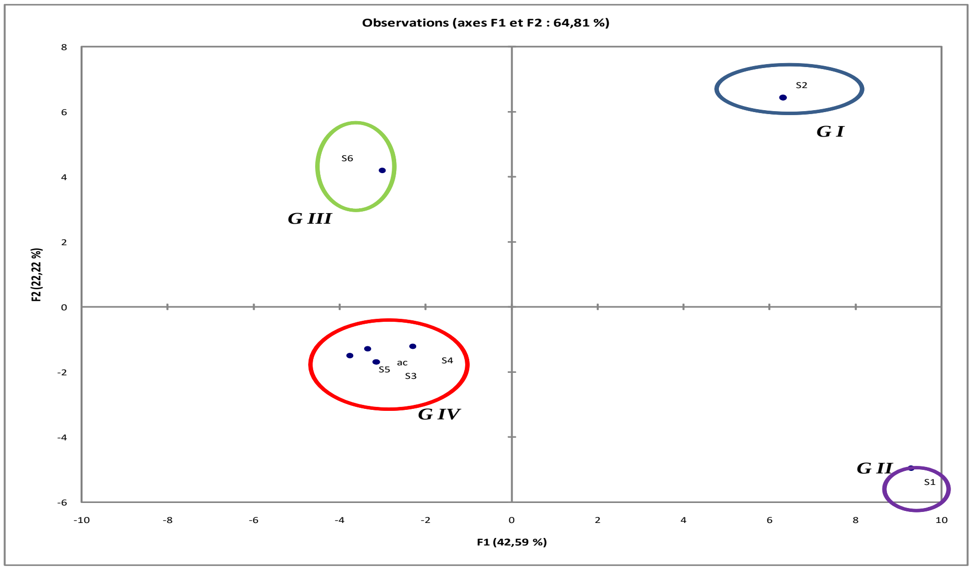
Figure N° 5 : Richness of the orders in species in the forest of DjebelSidi R' ghiss

The faunistic composition of the various orders has revealed the dominance of the Coleopteran Order (Figure 5), which is the most numerous worldwide: in the world there are more than 300 000 different species, more than double of the number of known butterflies. It is a very diverse group. in second position comes the order of Hymenoptera which includes phytophaga, pollinators and a large share of entomophages playing a central role in the maintenance of natural equilibrium, The other orders are poorly represented.

According to the values of the Shannon index, the distribution of diversity is heterogeneous and unequal between the seven stations; the station S1 is the most diversified then comes the station S2. The results of the analysis show a value of 0.8 bits. This is weak, indicating a low diversity of spontaneous species, which implies unequal distribution of the vegetation cover. In addition, the calculated equitability value is equal (E = 0.5) and the numbers of most species are moderately fair.

VI-3: Principal Component Analysis (PCA)

In order to establish a biotypology of the stations, we used the principal component analysis (PCA), the interest of which, in such a situation, has been emphasized by many authors (Yacoubi-Khebiza, 1996, Boulal, 2002).). It was applied to a data matrix represented by 59 lines corresponding to the main taxa collected and 7 columns representing the studied stations. Examination of the numerical results of the principal component analysis makes it possible to know the contributions to the total variance of each of the main factorial axes which are given below for the first two axes.



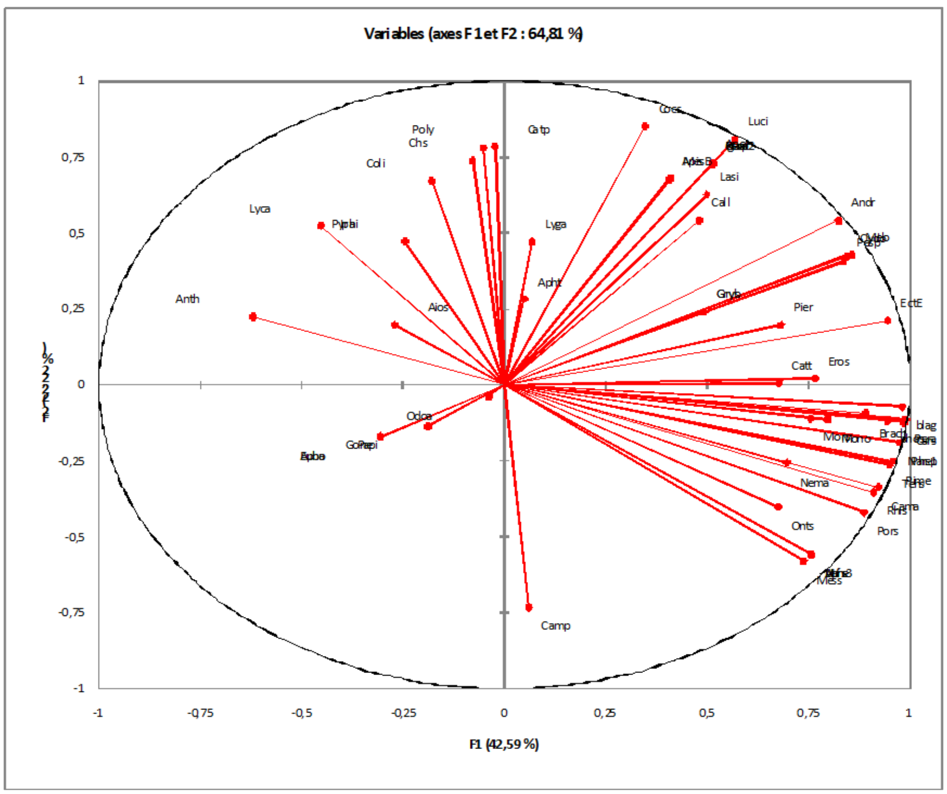


Figure 6 : Circle of correlation of the densities of the arthropod species harvested according to the factorial axes 1 and 2 and the geographical distribution of the stations

The analysis clearly shows that the percentages of inertia of the first two main axes sum up 64.81% of information and the existence of four distinct and unequal sets of stations (figure 6)

Group1: consisting of a single station (S2), which is located in a pine forest, shown on the negative side of the first factorial axis; this station is located in the green chenaie, it hosts the most diversified stand with 24 species.

Group 2: it also contains a single station shown on the positive side of axis 1, it hosts 22 species and opposes with group 1, and all stations.

As for group 3, a single station (S6) projected towards the negative values of axis 1, it clearly hosts a diversified stand dominated by the species: *Aphaeno gaster* , *Testaceo pilosa*, *Polyommatus icarus*, *Lygaeus sp*..

And finally the G4 group: consisting of four stations planned not far from the intersection of the two axes

These are species-poor compared to other stations which indicate a poorly structured set.

4. Discussion and conclusion

The entire scientific community agrees on the importance of arthropods(Finnamore et al., 1998, Lebreton et al.1988)Insects, which represent about half of the described living species and three-quarters of those in the animal world, occupy a broad thermal spectrum of desert areas, where the contrasts in temperatures between seasons and between day and night are extremely high, the coldest pack ice (Kergoat 2004, Calatayud 2011, Sauvion et al 2004.)

The inventory of Arthropods of Jebel SidiR'ghiss in seven stations in the region of OUM EL BOUAGHI which was carried out from January to May 2018, allowed us to collect a total of 1301 individuals belonging to 59 fauna species. These stands are diversified with high Shannon-Weaver values 0.8-bit). Stand numbers are in equilibrium because the values of fairness have not exceeded 0.5.

During this inventory we encountered five classes belonging to the branch of arthropods. The class of insects is best represented with 52 species (96.47%).

Among the 52 species recorded in the insect class, it is Camponotus sp. which has the highest percentage with 13.22%, in second place comes Monomoriumsalomonis with 12.22%, followed by Pimeliasp (9.3%). The remaining 07 species are characterized by a relative abundance that does not exceed 3.53%.

The dominance of ant species was confirmed by CHALAN et DJOUDER., 1999 also in a faunistic study where he found that the family Formicidae is the best represented with Camponotus sp. (13.2%).

Likewise (Deghiche et al, 2015) points out that the Hymenoptera occupy the first place with 600 individuals including Camponotus sp. (18.2%) and Cataglyphis bicolor (10%) are the most common in the Chréa cedar.

A total of five (5) animal classes belonging to (Gastropoda, Arachnida, Myriapoda, Crustacea and Insecta) make up our inventory carried out in the seven sampling stations. That of Insects is best represented in both stations with a rate of 88%.

The Diplopoda class occupies the second position with a centesimal frequency of 05%, followed by that of the Arachnida with (03%). The class of Chilopoda and Malacostraca takes the fourth place in the study stations with 2%.

Samples taken during the study period made it possible to highlight the structure of Arthropoda stands at the seven stations. Fairness values (greater than 0.50) reflect a medium that tends toward equilibrium and stability of species.

In perspective, it is interesting to complete the quantitative and qualitative study of invertebrate stands through the use of other sampling techniques such as light traps.

Finally, this study as a first in the region allowed us to have an idea about arthropodofauna. In the future it would be appealing to complete the arthropodofaunistic study by using other techniques such as threshing using the Japanese umbrella and night traps. It is important to study the composition and structure of the arthropodo fauna in different types of environments throughout the territory of the wilaya and to highlight the relationships that exist between species and their environment, as it would be noteworthy to deepen studies on ecological and biological aspects to establish the status of species in these groups and to define the bioecological relationships that link invertebrate species to plant species. It should be remembered that the conservation of agricultural areas in the Sahara is still a priority at the moment if one really wants to conserve their fauna and flora. In the future, it would be motivating to complete or enlarge this study on a regional and national scale in order to be able to set up a total list of the fauna, to know the state of each species and to proceed with preservation.

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