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# ECOLOGICAL ANALYSIS OF LOCUST FAUNA IN THREE REGIONS OF EASTERN ALGERIA (MILA, ALGERIA) BIODIVERSITY, INVENTORY AND CENSUS

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## Abstract

**Description of the subject:** This study is a contribution to the knowledge of the locust fauna in Algeria in its eastern region while describing the species distributed in several places, the study of the ecology and the diversity of the Orthopteran insects is included.
**Objective** : A thorough knowledge of the composition of Orthopterofauna in the Mila region and establish a complete list of locust species of this region.
**Methods :** The realization of an inventory of the locust fauna and the census of the species in three sites with different altitudes: Chigara, Sidi merouane and Sennaoua and the study of the diversity and the distribution through the tests and the ecological indices.
**Results :** the fauna census showed the presence of twelve species belonging to two families:
Pamphagidae and Acrididae
**Conclusion :** The ecological and statistical analysis of the inventoried locusts revealed that the Sennaoua site is the most diversified.
**Keywords** : Locust fauna, richness, eastern Algeria, diversity indexes, inventory.

# ANALYSE ÉCOLOGIQUE DE LA FAUNE ACRIDIENNE DANS TROIS RÉGIONS DE L'EST ALGÉRIEN (MILA, ALGÉRIA). BIODIVERSITÉ, INVENTAIRE ET RECENSEMENT

## Résumé

**Description du sujet :** Cette étude est une contribution à la connaissance de la faune acridienne en Algérie dans sa région de l'est tout en décrivant les espèces répartis à plusieurs endroits, l'étude de l'écologie et la diversité est inclus.
**Objectifs :** Une connaissance approfondie de la composition de l'Orthoptérofaune dans la région de Mila et établir une liste complète que possible des espèces acridienne de cette région.
**Méthodes :** La réalisation d'un inventaire de la faune acridienne et le recensement des espèces dans trois sites à différent altitudes : Chigara, Sidi merouane et Sennaoua et l'étude de la diversité et la répartition à travers les tests et les indices écologique.
**Résultats :** le recensement de la faune a montré la présence de douze espèces appartenant à deux familles :
Pamphagidae et Acrididae.
**Conclusion :** L'analyse écologique et statistique des acridiens inventoriés a révélé que le site de Sennaoua est le plus diversifié.
**Mots clés:** Faune acridienne, richesse, est algérien, indices de diversité, inventaire.

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## INTRODUCTION

Orthopteran insects are medium to large in size. They have a robust body, with a pronounced pronotum. In almost all species, the hind legs are highly developed and adapted to the jump. In principle, they have two pairs of wings, but there are species in which one or both pairs of wings are reduced or absent. Their mouthpiece is of the grinder type.

In North Africa, the problem of acrediens pests has always been and remains one of the major concerns of farmers. Algeria, part of this region has not been spared. At the national level, extensive damage to various crops (olive trees, fruit trees and cereals) has been reported in different parts of the country; oasis, highlands, mountains and meadows.

The objective of this work is to make a better knowledge of the Caeliferous richness as complete as possible in different biotopes of eastern Algeria. We have done this work in the Mila area by making an inventory of the locust fauna in three selected stations; the ecological analysis of the data is also included.

## MATERIALS AND METHODS

### *1. Study sites*

In order to carry out the inventory of locusts and associated flora in the Mila region located in the east of Algeria and to identify the maximum number of species, we have chosen three study sites: Sennaoua, Sidi Merouane, and Chigara. The choice of sites is taken according to the relief, the altitude and the type of the vegetation.

The Chigara site is located 30 km from the Mila region at 1000 m altitude, it is an area more or less mountainous, the herbaceous layer is the most dominant compared to the shrub layer. We find especially: *Olea europaea* and *Echinops spinosus.*

The Sidi merouane site is located 14 km from the wilaya of mila at 500 m altitude, the herbaceous layer does not exceed one meter in height. The dominant floras are:, *Geranium sp Daucus carota* and *Centaurea scabiosa.*

The Sennaoua site is located at 03 Km from the wilaya of Mila at 350 m altitude; it is a cultivated field. The grass layer does not exceed 40 Cm in height. This site is a little more diversified compared to the other two sites, we find: *Hordom minimum, Asphodelus albus, Avena fatua, Ampelodesmos mauritanicus* and *Matricaria chamomilla.*

### *2. Sampling of locusts*

Samples were taken during the spring of 2014, on average twice a month for each site from 9:30 am to 4 pm. We followed the transect method using surfaces of 250 $m^2$ (50 m x 5 m). This method allowed us to achieve 6 transects at each site respectively (prospective area = 1500 $m^2$). We recorded the number of individuals in an area of 50 meters long. We used the filleting net for the capture of adults. Hunting and catching by hand are the best ways to have not winged locusts. Once the locust is caught, it is placed carefully in a plastic box on which the date and the place of capture are mentioned. As the temperature rises, species become more and faster so their capture becomes difficult. The inventory of locusts allows us to acquire knowledge about their diversity and establish a reference collection.

### *3. Locust preparation and conservation*

To kill the locusts, it is only necessary to put them in the freezer at -15 ° C. After this operation, the fat individuals are emptied of their internal contents while preserving their genitals; an incision at the level of the membrane uniting the tergites and the abdominal sternites is practiced carefully with fine scissors and with the aid of a small forceps the viscera are taken out by the opening practiced. Once the general cavity of the insect is emptied, it is cleaned with cotton and filled with the same material. After identifying it, the locust is pricked with an entomological pin at the pronotum and placed in a collection box equipped with naphthalene.

### *4. Determination and identification of sampled species*

We are based on the study of morphological characters for the identification of sampled species: the shape of the pronotum, the coloration of the membranous wings and the form of hind legs (Fig. 1). We have considered the phallic complex for the identification of Pamphagidae. We used the identification keys of [1], [2], [3], [4], [5], [6], [7]. The nomenclature has been updated using the website http://orthoptera.speciesfile.org and MNHN Paris website http://acrinwafrica.mnhn.fr

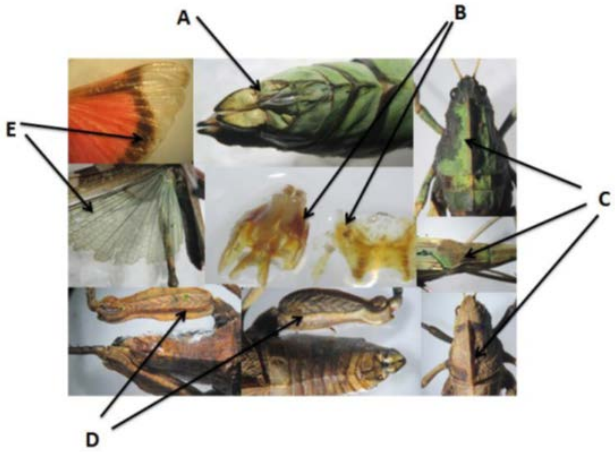


Figure 1 : Some parts of the locust's body helping to the identification
A: Back view of the female reproductive system, B: Dorsal view of the phallic complex (male genitalia), C: Dorsal view of the pronotum, D: Lateral view of the posterior femur, E: Lateral view of the hind wing

### *5. Ecological and data analysis*

A thorough knowledge of Orthoptera insects is required in order to control them biologically and ecologically, it is in this directive that we have tried to identify several ecological parameters helping to know the type of distribution of the locust species inventoried in the sites of study such as the study of richness, the shannon and weaver index and the equitability, relative frequency and similarity of stands.

And with the help of SPSS ver 20 software, we made several tests to better know the diversity of the locust community of each site.

## RESULTS

### *1. Faunistic inventory*

The inventory of the locust fauna showed the presence of twelve species belonging to two families: the Pamphagidae and the Acrididae and that are divided into six sub-families (Table 1).

Table 1: Inventory of locust species in the three study sites

| Family | Subfamily | Species | Chgr | Sd Mer | Sen |
|---|---|---|---|---|---|
| Pamphagidae | Pamphaginae | *Ocneridia volxemii* (Bolivar, 1878) | + | + | + |
| | | *Pamphagus auresianus* (Burmeister, 1838) | - | + | + |
| | | *Pamphagus cristatus* (Descamps & Mounassif, 1972) | - | - | + |
| | | *Acinipe calabra* (Casta, 1836) | - | + | + |
| | Thrinchinae | *Tmethis pulchripennis* (Serville, 1839) | + | + | + |
| Acrididae | Cyrtacanthacridinae | *Anacridium aegyptium* (Linné, 1764) | + | + | + |
| | Gomphocerinae | *Dociostaurus jagoi jagoi* (Soltani, 1983) | - | + | - |
| | Odipodinae | *Aiolopus strepens strepens* (Latreille,1804) | + | + | + |
| | | *Duroniella lucasii* (Bolivar,1881) | - | - | + |
| | | *Acrotylus patruelis patruelis (*Herrich-Schaeffer,1758) | - | - | + |
| | | *Thalpomena algeriana algeriana* (Lucas 1849) | - | - | + |
| | Truxalinae | *Truxalis nasuta* (Linné, 1758) | - | + | - |

+ : Presence, - : Absence, Chgr : Chigara, Sd Mer : Sidi merouane, Sen : Sennaoua

***2. Normality test***

With 135 individuals collected in Chigara, 319 in Sidi merouane and 825 in Sennaoua. The normality of the species in all the sites was tested through Shapiro-Wilk's law; the values recorded in Table 2 showed that all species follow Normal distribution (P > 0.05).

***3. Ecological analysis***

During the whole spring period, 27 field trips were made with 9 outings for each site. The diversity expressed by the Richness, the shannon and weaver index and the equitability showed that the site of Sennaoua reaches the highest values followed by sidi merouane and finally Chigara which receives the lowest values (Table 3).

Table 2: Normality test for inventoried species

| Sites | Species | Sig |
|---|---|---|
| Chigara | 4 | **0.591** |
| Sidi merouane | 8 | **0.084** |
| Sennaoua | 10 | **0.102** |

Table 3: Ecological parameters that showed diversity in the three sites

| Site | Richness | Shannon and Weaver index | Equitability |
|---|---|---|---|
| Chigara | 4 | 1.18 | 0.24 |
| Sidi merouane | 8 | 1.79 | 0.31 |
| Sannaoua | 10 | 2 .22 | 0.33 |

According to Fig. 2, the relative frequency values of the locust species identified in the site of Sidi merouane shows that *Dociostaurus jagoi jagoi* is the most dominant in this site followed by the only species of Oedipodinae *Ailopus strepens strepens*, while the species of Pamphagidae are the least abundant.

For the Sennaoua site, the pamphagidae records more or less average values despite being represented by five species, whereas the Oedipodinae are the most abundant on the ground. The Oedipodinae are also the most abundant in Chigara (*Ailopus strepens strepens* 41%). In all the sites *Anacridium aegyptium* receives the lowest value since it is an autumnal species.

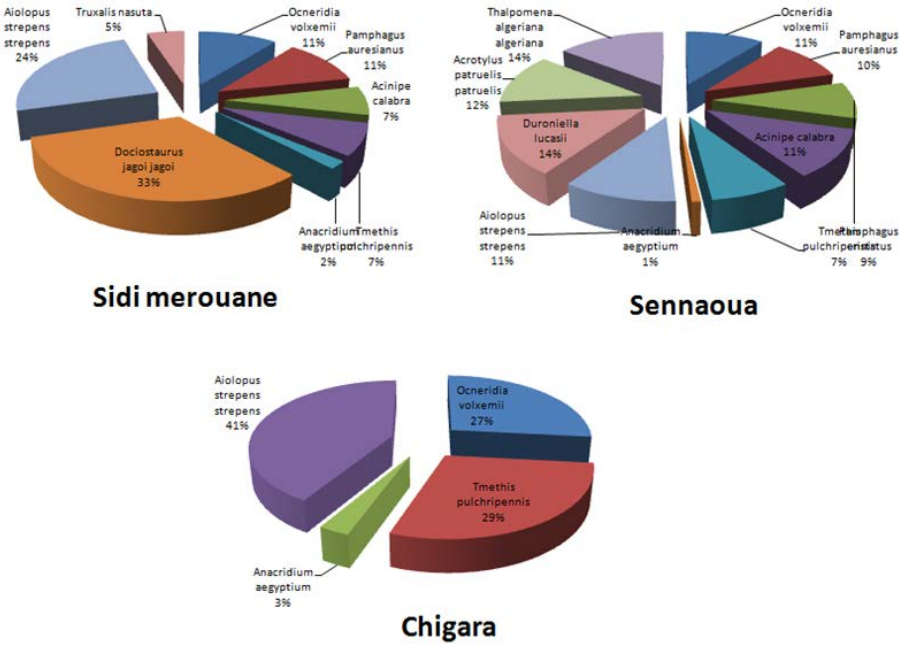


Figure 2: Relative frequency of locust species identified at the three sites

***4. Comparison between grasshopper colonies***

The values of the similarity of the colonies between the sites are calculated and have shown that the locust composition of Sennaoua is very close to that of Sidi merouane (C = 0.66) and far from the fauna of Chigara (C = 0.57).

To go deeper in these results we must first measure the variation in the distribution of all species through the months, we note the suppression of the values recorded for the month of March which are considered as outliers according to the almost total disappearance of adults.

Statistical analysis using student test (t) showed that locusts are more abundant on land in the month of May compared to the month of April with a highly significant difference in Chigara and Sidi merouane with p = 0.036, p = 0.040 respectively and a very highly significant difference in Sennaoua (p = 0.005).

The species *Ocneridia volxemii*, *Tmethis pulchripennis* and *Aiolopus strepens strepens* are present in all the sites, they are therefore considered as species with a large geographical distribution.

## DISCUSSION

The Orthopterological fauna of Algeria remains little known, except for the gregarious or locust which are well studied and considered as species of economic interest such as *Dociostaurus maroccanus* (Thunberg, 1815) [8] and [9], *Schistocerca gregaria* (Forskal, 1775) [10] and [11], and *Locusta migratoria* (Linnaeus, 1798) [12].

The census of locust fauna in the region of Mila revealed the presence of twelve species belonging to two families; Acrididae, and Pamphagidae and that are divided into six sub-families.

Several non-gregarious species have been the subject of much work based on ecology, biology, ethology and distribution to prevent access to the pest status of crops.

*Ocneridia volxemii* (Bolivar, 1878) is considered as species with a large geographical distribution, is a common phytophagic species in the framed cornfields [13]. According to [14], this species is characterized by its spectacular voracity; it is a graminivorous species. *Anacridium aegyptium* (Linnaeus, 1764) recorded the lowest values of the appearance on field with 17 individuals only on the total of study sites, it appears in Constantine [15], in the palm groves of Biskra [16], on the coastal plains of Jijel [17] and in the Tlemcen mountains [18].

*Tmethis pulchripennis* it is found in arid environments, with flat vegetation on stony or sandy soil. For *Aiolopus strepens strepens* it is common in mesohygrophilous environments, with one or two generations per year

The results obtained on the study of the specific richness according to the altitude, shows that the number of species decreases with the increase of the altitude (Fig. 3)

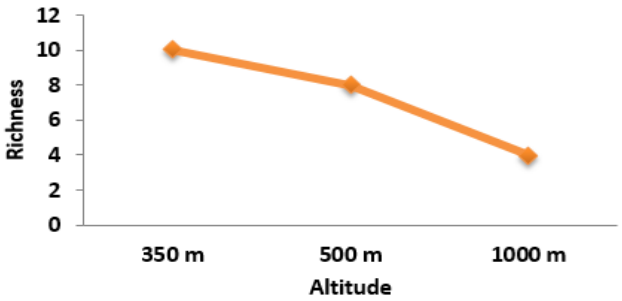


Figure 3: Variation of Richness as a function of altitude

The study of the diversity and distribution of species along elevation gradients and the understanding of the factors that influence this distribution are among the concerns of many ecologists and biogeographers, particularly with the mid-domain effect theory [19]. The Mila region is about 500 m above sea level, according to the mid-domain effect; there is peak diversity at 250 m altitude.

The sennaoua site is 300 m above sea level (near altidunal gradient center) with a well-diversified flora composed of several species of Poaceae which is the main source of food for locusts compared to the other two sites which present a poor floristic richness.

In a similar work [20], we found that in the mountains of Aurès (2400 m), the site of Djerma (1200 m) presents the great diversity of Orthopteran insects .

## CONCLUSION

The very short period of sampling reveals the little faunistic and ecological information about insects. So in order to complete these results, it is important to widen the sampling period. The spring period is considered as the first stage of the annual locust activity (Pamphagidae), the summer is for the Oedipodinae and the autumn for *Anacridium aegyptium.*

Other places with different climatic conditions are desired to be investigated and to better understand the current distribution of locusts, the study of their diet is desirable

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