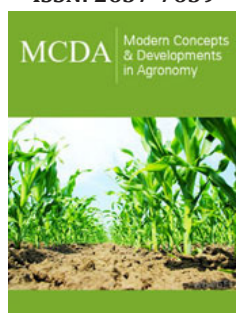


Bioclimmagrams of Species of Grasshopper and Locust Fauna (Orthoptera, Acridomorpha) In Eastern Algeria, Algeria

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Abstract

The inventory of grasshopper and locust fauna in several stations in Eastern Algerian revealed the presence of more than 80 species. They are belonging to five families. Most of the collected species are belonging to family Acrididae. Consideration of the work carried out in other Algerian stations has made it possible to define certain climatic constraints of most species. The arid and semi-arid climate is the most favorable conditions for the presence of grasshopper fauna. The desert locust, *Schistocerca gregaria* Forskal, 1775), the migratory locust, *Locusta migratoria* (Linne, 1758), the Egyptian locust, *Anacridium aegyptium* (Linnaeus, 1764), The Boukrouma locust *Ocneridia volxemii* (I. Bolivar, 1878), the Barbary locust, *Calliptamu sbarbaru sbarbarus* (Costa, 1836) and the Moroccan locust *Dociostaurus maroccanus* (Thunberg, 1815) could be economic insect pests in arid and semi-arid regions.

Keywords: Inventory; Eastern Algerian; Grasshopper; Climatic constraints; Arid regions

Introduction

The geographical location of Algeria and the extension of its territory, occupy a preponderant place, in the habitat area of certain locust species. There are several gregarious and many other non-gregarious locust species or hopper species can cause extensive damage to many crops [1]. Locust species have very diverse ecological preferences; therefore, they have a wide ecological habitat and able to adapt to the changes in the amplitudes of environmental factors. On the other hand, other species have narrow ecological niches and low adaptation capacity with the variations in the ecological factors peculiar to their habitat. They are incapable to develop in certain very specific environments (Joern 1979a, 1979b, Voisin, 1986, Gueguen, 1989 in Moussi [2]. Locusts and grasshoppers are poikilothermie or cold-blooded and rely on their thermoregulatory behavior to maintain body temperature (Uvarov, 1966). So, temperature is considered an important ecological factor for locusts. It has a direct influence on daily activity, embryonic and larval development, behavior, and especially on geographical distribution (Dreux [3], Duranton et.al., 1987 in Medane [4]. The present research includes a review of the studies being done on locust fauna in Eastern Algeria and has been carried out in region belonging to different bioclimatic stages: Constantine, Mila, Batna, Biskra, Setif, Jijel, Annaba, Skikda, Guelma, Khenchela, Oum El Bouaghi and M'silla (Figure 1).



Figure 1: Geographical study areas.

Materials and Methods

Our geographical location is in the Northeast Algeria, which is belonging to the Mediterranean basin in North Africa. We have carried out a revision of all the boxes of locust and grasshopper collections available at in the biosystematics and ecology of Arthropods laboratory, brothers Mentouri Constantine [5] University, since 1996. The collected samples are prepared from sampling carried out in 73 stations in the East Algerian. The species are rearranged and identified according to morphological characters such as: the shape of the pronotum, the coloration of the membranous wings and the form of hind legs. To carry out a proper identification, several keys were used: Chopard [6], Jago (1963), Dirsh [7], Voisin (1979), Louveaux & Benhalima (1996), and Massa [8], Massa et al. [9], Massa et al. [10]. Classification and nomenclature have been updated through the OSF [2] website (<http://orthoptera.speciesfile.org>). In case of identifying the species of the Pamphagidae family, the assembly of male genitalia was used. The rainfall coefficient of EMBERGER Sauvage [11] is an index of aridity in the Mediterranean basin in addition to the annual thermal amplitude. Such climagramis particularly suitable for defining climatic constraints on terrestrial Mediterranean organisms and taking into account mean minimum (m, in °C), maximum (M, in °C), annual precipitation (P, in mm) and Q2 ($Q2 = 3.43 (P/Mm)$). Emberger has also classified all meteorological stations into two coordinates, the values of this coefficient and the average temperature of the coldest month. Therefore, it shows that the Mediterranean basin can be subdivided into five bioclimatic stages: arid, semi-arid, subhumid, humid and hyper-humid. Climatic data were collected from meteorological stations in each region. The regions were ranked according to the amount of Q2 in each region.

Results

The inventory of grasshopper and locust fauna in several

stations in Eastern Algerian revealed the presence of more than 80 species. They are divided into five families. The Acrididae family is the most represented one. The study areas are located in four bioclimatic stages, namely: the humid, subhumid, semi-arid and arid or Saharan stage (Figure 2). The number of locust and grasshopper species distribution according to bioclimatic stages is shown in Table 1. According to Table 1, the semi-arid bioclimatic stage is most represented by 71 species followed by the arid stage with 30 species. It could be attributed to the climatic factors of these bioclimatic stages that may be favorable for the life and development of locust species. Among the locusts and grasshopper species in arid and semi-arid regions: *Ocneridia volxemii* (Bolivar, 1878), *Schistocerca gregaria* (Forsk., 1775), *Locusta migratoria* (Linnaeus, 1758), *Anacridium aegyptium* (Linnaeus, 1764), *Calliptamus b. barbarus* (Costa, 1836) *Dociostaurus maroccanus* (Thunberg, 1815) and *Thalpomena algeriana* (Lucas, 1849) could have economic importance. *Ocneridia volxemii* was the most common species. According to the data collected from thirty-three stations taken into account, twenty-four stations of them, showed the widest range of altitude, from 43 to 1300m. *Ocneridia volxemii* was found in the semi-arid, subhumid and humid bioclimatic stages, when the temperature was below 6°C. Adults were abundant from the second half of April to the end of June. *Dociostaurus maroccanus* was found in Oum-Elboughi, and Ain-Mlila, near a Sebkh. It is worthy note that the soil of these areas is salty and had been previously documented in many stations, from Setif and M'sila region. With altitudes range from 440m to 1100m. This species is mostly found in semi-arid and arid stages when temperature is more than 6 °C. This species is an economic insect pest of cereals in Algeria. *Locusta migratoria* was found in Tidisse, near Constantine, at an altitude of 500m. It is common species in semi-arid bioclimatic stages between 3 and 5 °C and subhumid between 1 and -3 °C. It is also found in Biskra region. Adults were observed in May in Constantine region (Figure 3).

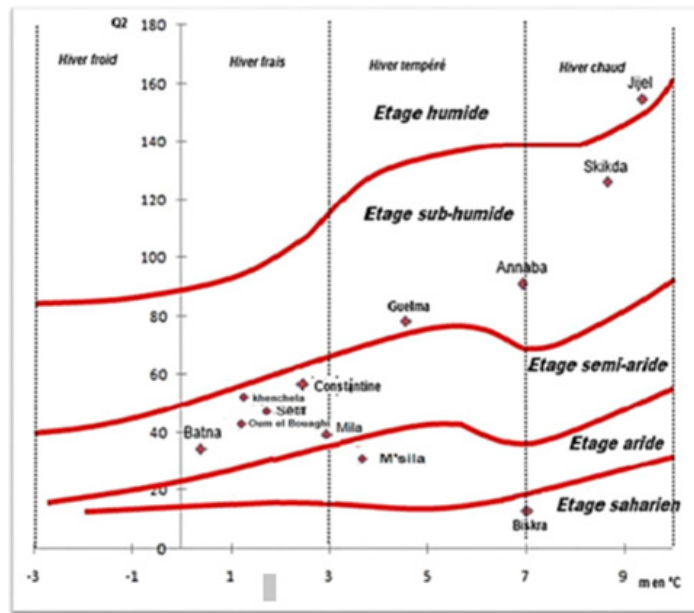


Figure 2: Location of study areas in the emberger climatogram.

Table 1: Distribution of locust and grasshopper species according to bioclimatic stages.

Bioclimatic Stage	Subhumid & Humid				Semi-Arid					Arid & Saharien	
	An	Sk	Gu	Ji	Co	Ba	Se	Kh	Ou	M's	Bi
Regions	An	Sk	Gu	Ji	Co	Ba	Se	Kh	Ou	M's	Bi
Q2	83,6	125.2	98.94	108.25	51.6	35.96	45.12	46.83	43.8	16.20	12.9
Num of species	8	19	13	18	43	35	40	24	45	15	28
Total	28				71					30	

Source: Co: Constantine; Ba: Batna; Se: Setif; Kh: khenchela; Mi: Mila; Ou: Oum El Bouaghi; An: Annaba; Sk: Skikda; GU: Guelma; Ji: Jijel; M's: M'sila; Bi: Biskra; Q2 : coefficient of Emberger

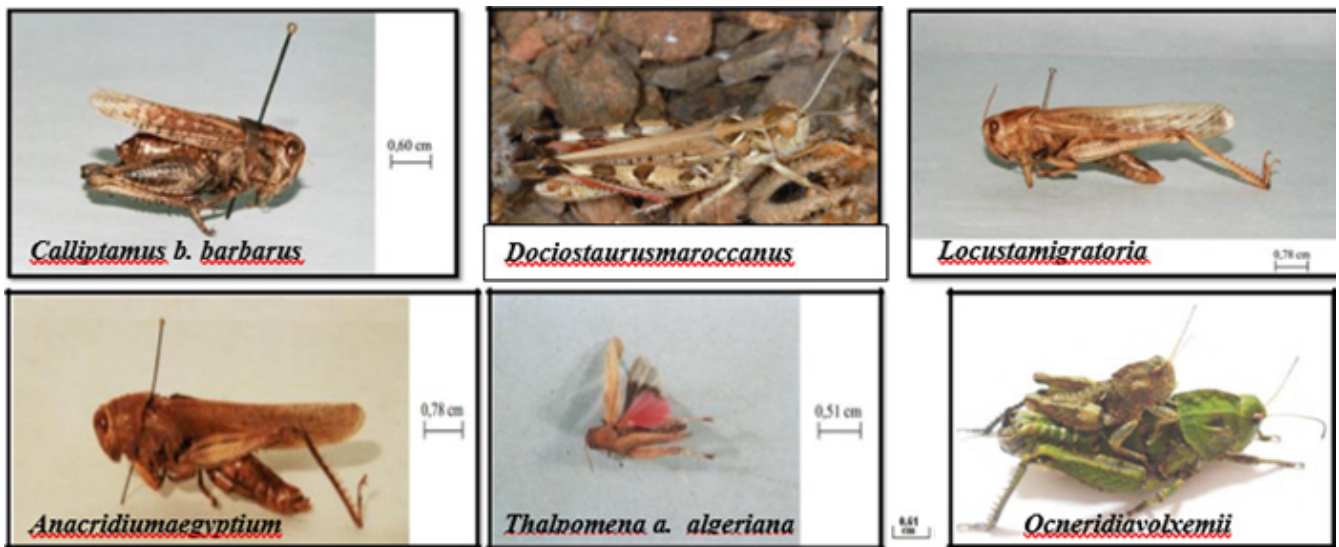


Figure 3: Economic important species locust and grasshopper in eastern Algeria.

Schistocerca gregaria was found in the collection boxes but without a defined station. This species is also known as an important pest of cereals in Algeria. *Anacridium aegyptium* was the most common species found in all the study areas. It was found

with the widest range of altitude, from 43 to 1300m, in arid, semi-arid, subhumid and humid bioclimatic stages. Adults were observed from the second half of April. It is known as ravaging fruit trees and garden crops. *Calliptamus barbarus barbarus* was the very

common species of wet floor with m below 0°C , to semi-arid with m above 6°C . It is also found in Biskra with the arid floor with m above 4°C and also in Constantine and Ain M'Lila, Adults were seen in June on cereal fields. *Thalpomena algeriana* has a large bioclimatic range, it is particularly common on the wet floor with m less than 0°C , but it could also be found in the arid floor with m above 4°C . Adults have been observed at the end of March in the Jijel and Skikda regions.

Discussion and Conclusion

The distribution of grasshopper and locust species in the study areas according to the bioclimatic stage clearly shows that the largest number of species (71) is reported in the semi-arid stage, followed by the arid or Saharan bioclimatic stage with 30 species, then the sub humid and humid bioclimatic stage with 28 species. When the conditions of life in a given environment are favorable, there are many species were found. So, those climatic conditions in the semi-arid stage are favorable for the development of locust species. Previous researches carried out in other Algerian localities, facilitate defining certain climatic constraints influencing the distribution of most species. According to Benfekih et al. [12], the validity of a bioclimatic study is based on the fact that each locality mentioned, for which a certain number of climatic parameters are known, constitutes a favorable biotope for the life of the insect. The frequency of *Locusta migratoria* is the highest in the sub-humid and humid stages at mild and warm winter and semi-arid at warm winter Benfekih et al. [12]. Findings of Benkenana [13] stated that the semi-arid Mediterranean stage with cold and sub-humid winter is the most favorable conditions for the Pamphagidae family. The distribution of locust and grasshopper species among the twelve study regions depends on biogeographic differences climatic variations, sampling technique and the duration of the experimental period. According to Chopard [6], locusts prefer warm and dry regions [14-16]. This will enable us to have idea of climatic constraints of locust species in Eastern Algeria. However, this preliminary study and a lot of studies should be designed in order to fill all related gaps. It would be interesting to extend the sampling to other study stations to complete the list of locust species in Eastern Algeria, in order to give or offer detailed studies on locust species that can access the status of crop pests [17,18].

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