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Biodiversity of Orthoptera in the Palm Groves of Gourara and Touat in Algeria

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Abstract

This work consisted of carrying out an orthopteric inventory with a view to their importance in agricultural production. Economic losses and sociological crises are caused by the direct influence of some harmful orthoptera on yield. Two representative sites were selected in two palm groves in the Adrar region (Touat and Gourrara). Sampling was done after prospecting trips during the period from September 2017 to February 2018 using the sweep net. The biodiversity indices used relate to the quality of sampling, total richness, average richness, relative abundance and frequency of occurrence and constancy. The results mentioned that in the Adrar region we were able to inventory 16 species of locusts belonging to 5 families and 9 subfamilies which are distributed between the suborder of Caeliferae and the suborder of Ensiferae.. The Caeliferae, which constitute the largest group (69.82%) of the entire orthopteric fauna, Acrididae and Pyrgomorphidae are the most important families to which the majority of locust species belong. While the Gryllidae, Gryllotalpidae and Phasgonuridae are less represented.

Keywords: Adrar, Touat, Gourrara, Orthoptera, Biodiversity, Sweep net.

1. INTRODUCTION

For several centuries, the problems posed by harmful insects have received much attention. However, locusts are undoubtedly the most formidable enemies of man since the appearance of agriculture, there is practically no group of animals other than that of locusts which have always been associated with man. and to the imagination of fatally inevitable destructive catastrophic events. (Kara, 1997). But these insects are, like most invertebrates, a little-studied taxon and rarely taken into account in the management of natural spaces. (Julien, 2005). Orthoptera are

insects characterized by their chewing mouthparts, jumping hind legs and leathery forewings. We distinguish between Ensifera and Caelifera (Boitier, 2007). These are widely distributed and generally abundant insects (Boitier, 2003). They form a significant part of the terrestrial biomass, often the most important of the invertebrates, their role as primary consumers of plants sometimes makes them very harmful to agriculture, and which are often distinguished by their loyalty to a specific type of habitat and by their great sensitivity to the evolution of ecosystems (Boitier, 2003). Certain species of Orthoptera are scourges mainly in the Middle East where migratory species occasionally devastate crops. (Zahradnik, 1988). In Algeria, there are many locust and grasshopper locusts which sometimes cause very significant damage to crops (Doumandji-Mitiche et Doumandji, 1994). The eco-climatic conditions of the Sahara, above all, give this geographical region not only a permanent habitat favorable to the maintenance, development and reproduction of these locust species, but also a transition and dispersal zone for locusts, during periods of remission or during invasion (Popov *et al.*, 1991). Given the importance of palm groves in the Saharan regions and their role as a shelter for orthoperofauna and with the aim of knowing the different species of orthoptera which frequent palm groves, we proposed an establishment of a non-exhaustive inventory of orthoptera frequenting the environment phoeniciole of Touat and Gourara in the Adrar region.

2. MATERIAL AND METHODS

2.1. Choice of study stations: The Adrar region is located in the central part of the Sahara (0° 11' E.; 27° 49' N.), in the southwest of Algeria. It covers an area of 427,968 km^2, representing 17.97% of the total area of Algeria. It is located at an average altitude of 287.5 m. The Adrar region is characterized by a desert climate where rain is rare. The average annual temperature fluctuates around 24.3ºC. July is the hottest month of the year (36.9ºC), while the coldest month is December (10.6ºC). However, average precipitation is around 16 mm per year with a difference of 3 mm between the rainiest month and the driest month.

We found that the Gourara region which includes the areas of Timimoun and Aougrout and the Touat region which includes the Adrar area, two very differentiated ecological regions so in order to make an inventory of the Orthoptera of two regions we chose only one site from each region. These sites are chosen because of their richness in plant species and which could be quite favorable for the installation and reproduction of arthropods.

INRA station in Ouled Aissa (Touat)

This station is located at an altitude of 278 m (27° 49' N; 0° 11' E), it extends over an area of 69 ha. An extension of 30 ha was added at the beginning of the 1990s. It is intended for the creation of a palm grove of the Takerboucht variety resistant to Bayoud. The planted area currently exceeds 15 ha. It is limited to the north by the INPV station, to the east, south and west by irrigated areas. The vegetation in this resort is based on traditional oasis agriculture, the main crop is the date palm, there are more than 2000 date palms. Fodder cultivation ranks second, with an area of more than 1.5 ha. Cereal growing comes in third position and local varieties are the most dominant.

Aougrout station (Gourara)

This station (28° 45' N; 0° 15' E) is located in the region of Aougrout whose area is 13,736 km², at a distance of 120 km north of the town of Adrar and at an altitude of 281 m. It is limited by the irrigated areas to the north, south, east and west. The agricultural operation is located within the development perimeter with a cereal growing irrigation system under pivot, by drip for market gardening and by channels under palm groves. Livestock breeding is diversified, particularly cattle. The vegetation in this station is composed of: *Silybum marianum, Anacyclus clavatus, Hordeum vulgare (Poaceae), Delphinium sp. (Ranunculaceae); Silene latifolia (Cryophyllaceae) and Medicago polymorpha (Fabaceae).*
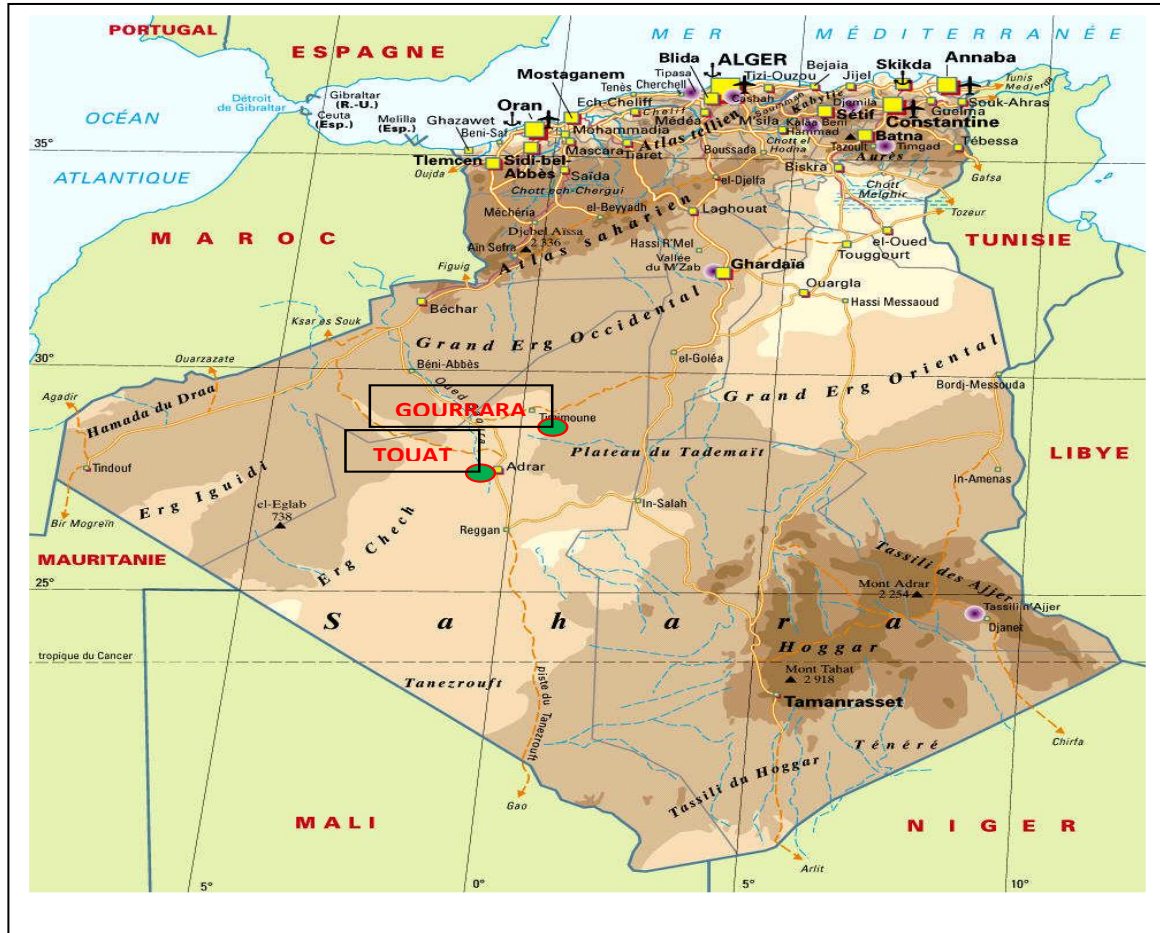
Fig 1. Geographical location of the Adrar region (Encarta 2008)

2.2. Orthoptera sampling method

Sampling of orthoptera species was carried out in the morning between 9 a.m. and 12 p.m. using the sweep net. The survey of the different stations was carried out once each month from September 2017 to February 2018. The sweep net consists of a cylindrical metal wire hoop with a section diameter of between 3 and 4 mm, mounted on a handle. The pocket is made of tight mesh canvas such as a sheet or tarpaulin. The depth of the bag for the majority of authors varies between 40 and 50 cm (Benkhelil, 1991). The method consists of moving the net with horizontal movements back and forth, striking the grasses at their bases. In this way the insects which are on the herbaceous layer fall into the pocket of the net. The speed of mowing strokes also plays an important role in capturing species which may react by falling to the ground and flying away (Lamotte and Bourlière, 1969).

We sampled in the different study environments, making 10 shots using the sweep net at ground level. This operation will be repeated 3 times, and each time we put the contents of this net in a plastic bag, then we put it in Petri dishes bearing a label where the place and date of capture are noted. For the determination of orthoptera species at the laboratory level we used a binocular magnifying glass to observe the morphological criteria, flexible forceps, petri dishes to place the locusts, entomological pins to fix the orthoptera on a rack and an incubator for drying. For the identification of orthoptera species we used the determination keys of Chopard (1943).

2.3. Exploitation of results using ecological indices

The results obtained are used by ecological composition indices (quality of sampling, total (S) and average (Sm) richness, relative abundance (AR%), frequency of occurrence constancy (C%) , the Shannon-Weaver index (H') and the equitability index (E).

Quality of sampling: According to Blondel (1979), the quality of sampling is the ratio between the number of species seen once in a single specimen (a) and the total number of surveys carried out N. When the value of this index approaches 0, we say that the sampling is very good (Ramade, 1984).

Specific richness (total): It represents one of the fundamental parameters characteristic of a population. Total richness (S) is the total number of species contained in the population considered in a given ecosystem (Ramade, 2003).

Relative abundance (AR%): Relative abundance (AR%) is a concept which makes it possible to evaluate a species, a category, a class or an order (ni) in relation to all the animal populations present combined (N) in a faunal inventory (Faurie et al., 2003). It is calculated according to the following formula: AR% = (ni x 100) / N

Occurrence index: The occurrence index of a species (I.O.%) is the ratio between the number of surveys containing the species in question (na) and the total number of surveys carried out Nt (Lejeune, 1990).Il est donné par la formule suivante : I.O. (%) = (na x 100) / Nt. The use of

Sturge's rule makes it possible to determine the number of constancy classes, then the interval of each of them (Scherrer, 1984). It is given by the following formula:

Number of classes (N.C.) = 1 + (3,3 * log$_{10}$ N)

N.C. is the number of constancy classes. N is the total number of species.

Shannon-Weaver diversity index (H): This is the diversity index most commonly used in the literature, it is given by the following formula:

H' = - Σ ((Ni / N) * log$_{2}$(Ni / N))

Ni: number of individuals of a given species, i ranging from 1 to S (total number of species).

N: total number of individuals.

H' is minimal (=0) if all the individuals in the population belong to one and the same species, H' is also minimal if, in a population, each species is represented by a single individual, except one species which is represented by all the other individuals in the population (Grall and Hily, 2003).

Equitability index (E): The equitability index (E) which is the ratio of the observed diversity (H') to the maximum diversity (H' max) (Ramade, 1984). Maximum diversity is given by the formula H' max = log2(S) where S is the total richness (Weesie & Belemsobgo, 1997). Fairness varies between 0 and 1.

If E < 0.5 the regularity is low and the species are not equally distributed.

If E > 0.5 (or equal to 0.7), evenness is high and species are fairly distributed.

3. RESULTS AND DISCUSSION

3.1. Composition of orthoptera in the two stations Ouled Aissa and Aougrout

The species inventoried in the Ouled Aissa station (S1) in Touat and that of Aougrout (S2) in Gourara are grouped in table 1.

Table 1. List of different orthoptera species inventoried in the two study sites.

Order	S/Order	Families	Species	S1	S2
Orthoptera	Caelifera	Acrididae MacLeay 1821	*Morphacris fasciata* Thunberg 1815 *(M. fas)*	+	+
			Aiolopus thalassinus Fabricius 1781 *(A. tha)*	+	+
			Aiolopus savignyi Krauss 1890 *(A. sav)*	+	+
			Acrida turrita Linnaeus 1758 *(A. tur)*	-	+
			Acrotylus insubricus Scopoli 1786 *(A. ins)*	+	+
			Sphingonotus rubescens Walker 1870 *(S. rub)*	+	+
			Sphingonotus savignyi Saussure 1884 *(S. sav)*	+	-
			Locusta migratoria Linnaeus 1758 *(L. mig)*	+	+
			Schistocerca gregaria Forsskål 1775 *(S. gre)*	+	+
			Heteracris harterti Bolívar 1913 *(H. har)*	+	+
			Ochrilidia geniculata Bolívar 1913 *(O. gen)*	+	+
		Pyrgomorphidae	*Pyrgomorpha cognata* Krauss 1877 *(P. cog)*	+	+
	Ensifera	Gryllidae	*Gryllus bimaculatus* De Geer, 1773 *(G. bim)*	+	+
			Acheta domesticus Linnaeus, 1758 *(A. dom)*	+	+
		Gryllotalpidae	*Gryllotalpa gryllotalpa* Linnaeus, 1758 *(G. gry)*	+	+
		Phasgonuridae	*Conocephalus* sp. Thunberg 1815 *(C.)*	+	+

In the Ouled Aissa station (Touat) and that of Aougrout (Gourara), we were able to identify 15 species of orthoptera, belonging to 5 families including 2 families of Caelifera (Acrididae and Pyrgomorphidae) and 3 families of Ensifera (Gryllidae, Gryllotalpidae and Phasgonuridae). The Acrididae family is the most represented and it brings together 11 species *(Morphacris fasciata, Aiolopus thalassinus, Aiolopus savignyi, Acrotylus insubricus, Sphingonotus rubescens, Locusta migratoria, Schistocerca gregaria, Heteracris harterti, Ochrilidia geniculata, Acrida turrita and Sphingonotus savignyi).* It should be noted that the species Acrida turrita is only recorded in Aougrout (Gourara), while *Sphingonotus savignyi* is only recorded in Ouled Aissa (Touat). The Pyrgomorphidae family is represented by a single species *(Pyrgomorpha cognata)* recorded in the

two stations Ouled Aissa and Aougrout. That of the Gryllidae they are represented by two species *Acheta domesticus* and *Gryllus bimaculatus*. The Gryllotalpidae by *Gryllotalpa gryllotalpa* and the Tettigoniidae by *Conocephalus* sp.

3.2. Sampling quality of Orthoptera captured using the sweep net in the two study stations

The sampling quality values of Orthoptera captured using the sweep net at the two stations are presented in Table 2.

Table 2. Sampling quality of Orthoptera obtained using the sweep net in the station of Ouled Aissa (Touat) and Aougrout (Gourara)

Settings	INRAA (Ouled Aissa)	Aougrout
a	2	3
Number of readings	18	18
Sampling quality = a/N	0,11	0,16

Species seen only once in a single specimen at INRAA (Ouled Aissa) are on number of 2 species (Tab. 2). The a/N ratio is equal to 0.11. This value tends towards zero, which implies that the sampling quality is good. In the Aougrout station, the species seen only once in a single specimen are 3 species; the a/N ratio is equal to 0.16. This value tends towards zero, so we can say that the sampling carried out is considered good.

3.3. Total wealth and average wealth

Table 3 gives the values of total and average wealth recorded in the two study stations.

Table 3. Total wealth and average wealth recorded in Ouled Aissa and Aougrout

years		2017				2018		Total
Month		September	October	November	December	January	February	
Ouled Aissa (Touat)	N	159	118	41	47	46	63	474
	S	11	8	11	6	5	7	15
	Sm	$9 \pm 3{,}51$						
Aougrout (Gourara)	N	108	92	87	74	46	38	445
	S	12	8	6	10	6	8	15
	Sm	$9{,}29 \pm 3{,}30$						

N: number of individuals ; **S**: total wealth ; **Sm**: average wealth

In Ouled Aisaa, over the course of six months from september to february, the number of species recorded varies between 5 and 11 species of orthoptera with an average richness of 9 + 3.51 species. Furthermore, in Aougrout the number of species recorded varies between 6 and 12 species of orthoptera with an average of 9.29 + 3.30. A total of 15 species of orthoptera were inventoried throughout the sampling period in the two study stations.

3.4. Relative abundance of orthoptera species recorded in the two stations

The relative abundance values of the orthoptera species recorded in Ouled Aissa and Aougrout are reported in Table 4.

Table 4. Relative abundance of orthoptera species inventoried in Ouled Aissa and Aougrout

Families	Species	Ouled Aissa		Aougrout	
		ni	A.R.%	ni	A.R.%
Acrididae	*Morphacris fasciata*	136	28,69	122	27,42
	Acrotylus insubricus	103	21,73	100	22,47
	Aiolopus thalassinus	12	2,53	12	2,70
	Aiolopus savignyi	13	2,74	8	1,80
	Acrida turrita	-	-	1	0,22
	Ochrilidia geniculata	44	9,28	68	15,28
	Heteracris harterti	4	0,84	10	2,25
	Sphingonotus rubescens	6	1,26	1	0,22
	Sphingonotus savignyi	2	0,42	-	-
	Locusta migratoria	10	2,11	6	1,35
	Schistocerca gregaria	1	0,21	4	0,9
Pyrgomorphidae	*Pyrgomorpha cognata*	131	27,64	90	20,22
Gryllidae	*Gryllus bimaculatus*	5	1,05	8	1,8
	Acheta domesticus	1	0,21	4	0,9
Gryllotalpidae	*Gryllotalpa gryllotalpa*	3	0,63	4	0,9
Phasgonuridae	*Conocephalus* sp.	3	0,63	7	1,57
	Total	**474**	**100%**	**445**	**100%**

In the Ouled Aissa station, sampling made it possible to identify 474 individuals distributed between 4 families with 15 species. The Acrididae family contains 331 individuals (69.8%). It is followed by the family of Pyrgomorphidae containing 131 individuals (27.6%), the

family of Gryllidae with 6 individuals (1.3%) and finally the family of Gryllotalpidae and that of Phasgonuridae with 3 individuals each (0.6 %). In terms of species, we note that the most abundant species is Morphacris fasciata with 28.7%, followed by the species Pyrgomorpha cognata (27.6%) and Acrotylus insubricus (21.7%).

In the second Aougrout station, sampling made it possible to identify 445 individuals distributed between 4 families and 15 species. The Acrididae family includes 332 individuals (74.6%). It is followed by the family Pyrgomorphidae containing 90 individuals (20.2%), the family Gryllidae with 12 individuals (2.7%), the family Phasgonuridae with 7 individuals (1.6%) and finally the family Gryllotalpidae with 4 individuals (0.9%).

In terms of species; it is noted that the most abundant species is Morphacris fasciata with 27.4%, followed by Acrotylus insubricus (22.5%), Pyrgomorpha cognata with 90 individuals (20.2%) and Ochrilidia geniculata with 68 individuals (15.3 %).

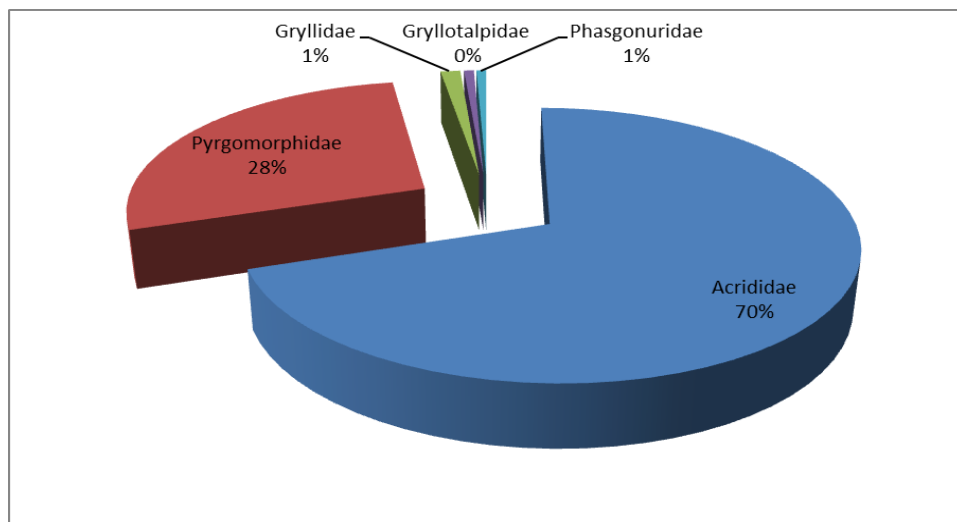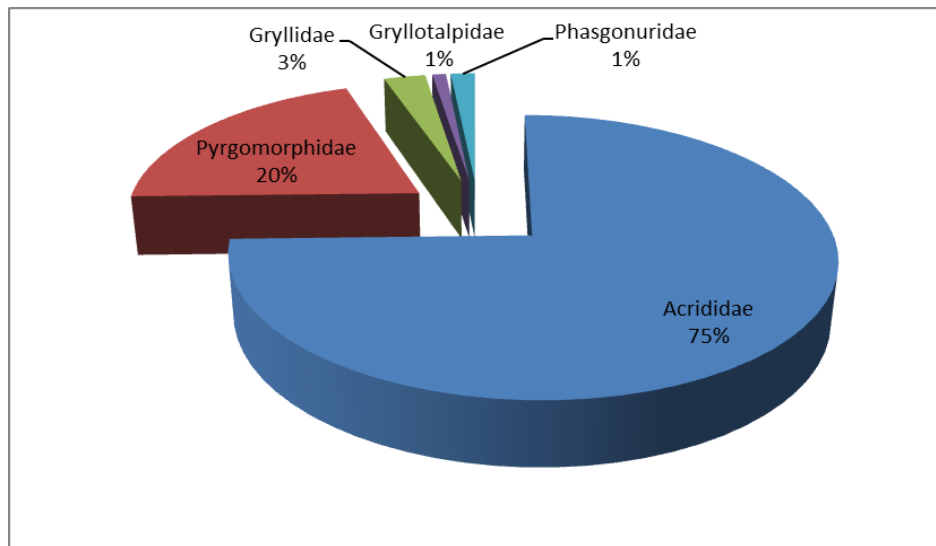Fig 2. Relative abundance of orthoptera families at Ouled Aissa station

Fig 3. Relative abundance of orthoptera families at Ougrout station

3.5. Frequency of occurrence and constancy

After calculating using Sturge's formula, we found 5 categories of constancy with an interval of 20%. These categories correspond to the following constancy classes:

0% < C < 20%   Accidental species, 20% < C < 40%   Incidental species

40% < C < 60%   Regular species, 60% < C < 80%   Constant species

80% < C < 100%   Ubiquitous species

The values of the frequency of occurrence and the constancy of the orthoptera species recorded in Ouled Aissa and Aougrout are reported in Table 5.

Table 5. Frequency of occurrence and constancy of orthoptera species recorded in the Ouled Aissa and Aougrout station.

Stations Species	Ouled Aissa			Aougrout		
	na	C%	Constancy	na	C%	Constancy
Morphacris fasciata	16	88,89	Omnipresent	17	94,44	Omnipresent
Acrotylus insubricus	17	94,44	Omnipresent	17	94,44	Omnipresent
Aiolopus thalassinus	6	33,33	Accessory	7	38,89	Accessory
Aiolopus savignyi	5	27,78	Accessory	4	22,22	Accessory
Acrida turrita	-	-	-	1	05,56	-
Ochrilidia geniculata	12	66,67	Constant	14	77,78	Constant
Heteracris harterti	3	16,67	Accidental	5	27,78	Accidental
Pyrgomorpha cognata	13	72,22	Constant	12	66,67	Constant
Sphingonotus rubescens	2	11,11	Accidental	1	05,56	Accidental
Sphingonotus savignyi	2	11,11	Accidental	-	-	-
Locusta migratoria	4	22,22	Accessory	3	16,67	Accidental
Schistocerca gregaria	1	05,56	Accidental	2	11,11	Accidental
Gryllus bimaculatus	3	16,67	Accidental	4	22,22	Accessory
Gryllotalpa gryllotalpa	1	05,56	Accidental	2	11,11	Accidental
Acheta domesticus	1	05,56	Accidental	3	16,67	Accidental
Conocephalus sp.	1	05,56	Accidental	5	27,78	Accessory

There are four categories of constancy. The Ouled Aissa palm grove contains 2 omnipresent species, these are Acrotylus insubricus (94.4%) and Morphacris fasciata (88.9%), 2 constant species with Pyrgomorpha cognata (72.2%) and Ochrilidia geniculata (66.7%), 3 incidental species recorded and 8 accidental species. Furthermore in Aougrout, we recorded 2 omnipresent species, these are *Acrotylus insubricus* and *Morphacris fasciata* with 94.4% for each, 2 constant species with *Ochrilidia geniculata* (77.8%) and *Pyrgomorpha cognata* (67.7%), 5 accessory species and 6 accidental species.

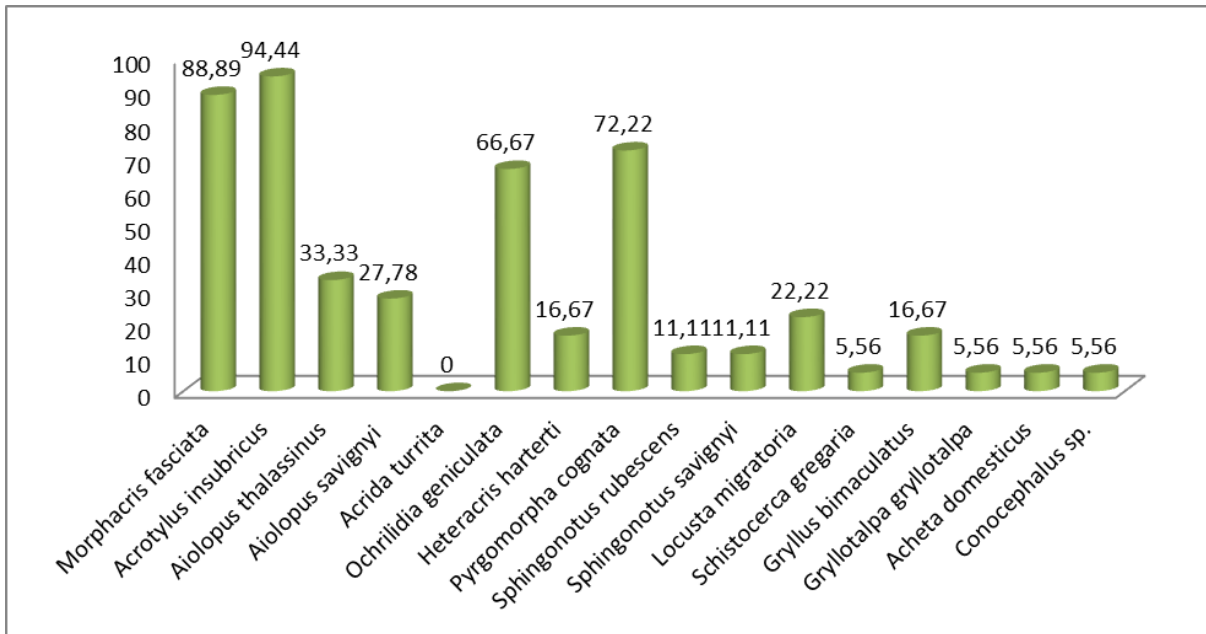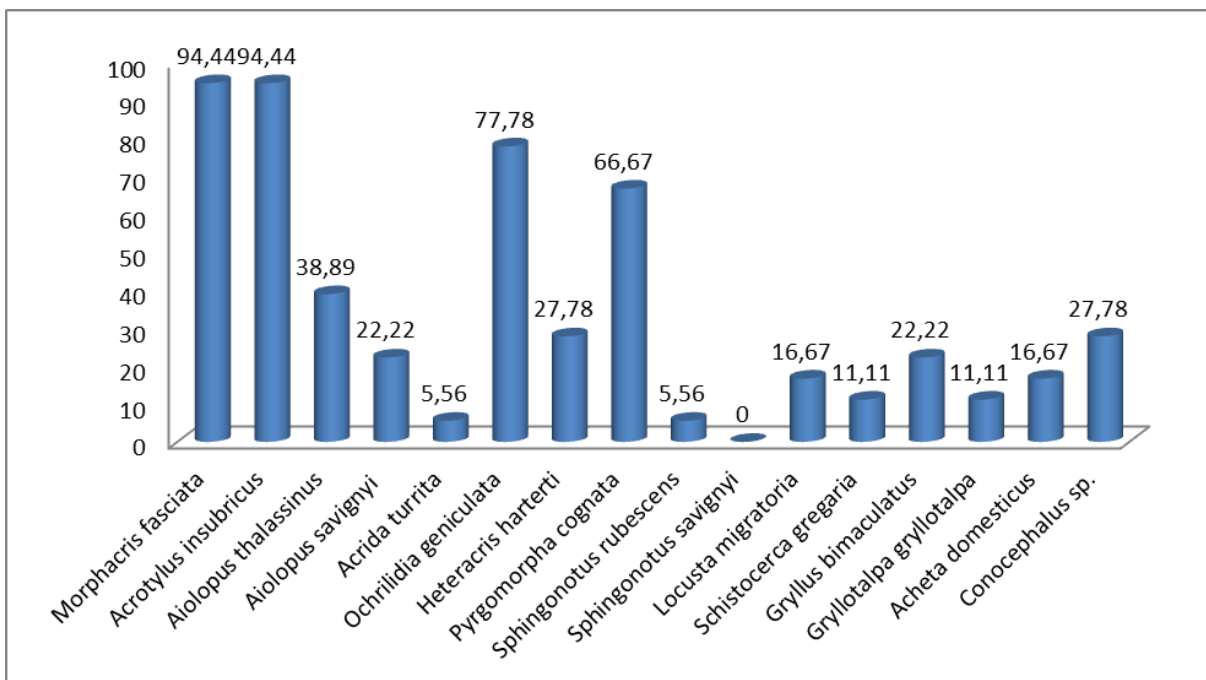Fig 4. Consistent frequency of orthoptera species in the Ouled Aissa station

Fig 5. Consistent frequency of orthoptera species in the Aougrout station

3.6. Biodiversity index (H) and fairness index (E)

The monthly values of the Shannon-Weaver diversity index (H'), maximum diversity (Hmax) and equitability (E) recorded in the two stations are grouped in Table 6.

Table 6. Values of the Shannon-Weaver diversity index (H'), maximum diversity (H max) and equitability (E) applied to the orthoptera species captured at the two study stations

Years		2017				2018	
Month		September	October	November	Décember	January	February
Ouled Aissa	H' (bits)	2,53	2,47	2,73	1,74	1,88	2,08
	H max	3,46	3	3,46	2,58	2,32	2,81
	E	0,73	0,82	0,79	0,67	0,81	0,74
Aougrout	H' (bits)	3,16	2,24	2,14	2,50	2,21	2,24
	H max	3,58	3	2,58	3,32	2,58	3
	E	0,88	0,75	0,83	0,75	0,85	0,75

If H'< 3 bits, we have low diversity. If 3≤H'<4 bits, we have average diversity. If H'≥4 bits, the diversity is high. In the Ouled Aissa station, the Shannon and Weaver diversity values recorded varied between 1.74 bits in January and 2.73 bits in November. These values are low in December, January and February and relatively average between September and November. The calculated fairness is between 0.67 and 0.82. These values tend towards 1 which implied that the numbers of orthoptera species recorded in Touat are in balance with each other.

Furthermore at Aougrout, the values of the Shannon-Weaver diversity index varied between 2.14 bits in November and 3.16 bits in September. These values are relatively average during all months, which means that the diversity of the sampled population is average. The calculated fairness is between 0.75 and 0.88. These values tend towards 1, which implied that the numbers of species inventoried in the Gourara are in balance with each other.

4. DISCUSSION

In the two stations we recorded 16 species of orthoptera during the period from September 2017 to February 2018. Maamri and Meddah (2013) recorded 31 species of Caelifera (19 species in the Ghardaïa region at the palm grove of Adjula Mohamed represented by Oued Zelfana and 24

species in the Ouargla region at the Kasdi Merbah University farm). Ouled El Hadj (1991) reported the presence of 17 species in the El-Goléa region (Saharan environment).

Our total wealth values are lower than those found by these authors, but they are relatively close. In the present study we found five families of orthoptera, these are Tettigonidae, Gryllidae, Pamphagidae, Acrididae and Pyrgomorphidae. All the species of these families belong to the two suborders of orthoptera the Caeliferae and the Ensiferae belonging to 5 families (2 families of locusts Acrididae and Pyrgomorphidae and 3 families of grasshoppers Gryllidae, Gryllotalpidae and Phasgonuridae). According to Chopard (1943), A Adrar, Doumandji-Mitiche et al. (1999) mentioned the presence of 11 species of orthoptera. 22 other species are added to this inventory (Doumandji-Mitiche et al. inventory (1999)) in the region, particularly following the installation of pivots for the irrigation of cereals and market garden crops.

In the present work, we have identified 16 species which belong to the suborder Cealéfera which are *Morphacris fasciata, Acrida* sp., *Aiolopus thalassinus, Aiolopus* sp. 2*, Acrotylus insubricus, Sphingonotus rubescens, Sphingonotus savignyi, Locusta migratoria, Schistocerca gregaria, Heteracris harterti and Ochrilidia geniculate.*

As for the species belonging to the suborder of Ensifera we have *Acheta domesticus, Gryllus bimaculatus, Gryllotalpa gryllotalpa and Conocephalus sp. Doumandji-Mitiche* et al. (2014) mentioned that these species are also present in the Adrar region. Concerning the quality of sampling, we recorded a quality which varies between 0.11 in Ouled Aissa and 0.16 in Aougrout. Sampling is done with fairly high precision in the two study stations. The sampling effort is sufficient. The species observed only once are *Sphingonotus savignyi* and *Acheta domesticus* in the Ouled aissa station and *Sphingonotus rubescens*, *Acheta domesticus, Acrida turrita* in the Aougrout station. Therefore the absence of certain species, or their presence in low numbers at the study stations must be due to ecological conditions which are not very favorable for them. Similarly, Chennouf (2008) found good sampling quality with values of 0.04; 0.1; 0.11 in cereal and market gardening environments and in a palm grove of the I.T.D.A.S. in Hassi Ben Abdelleh

in the Ouargla region. Ouled El Hadj (2004) reports very good sampling quality, varying from 0 to 0.1, in the different stations of the Algerian Sahara. In the Adrar region Sid Amar (2011) using a sweep net noted an average sampling quality (0.4) in the open field and in a greenhouse in Moulay Nadjem and in the open field in Sbaihi. In the Mahdia palm grove in Adrar the sampling quality is 1.2 using a sweep net. Regarding total and average richness, the total richness of all sampling months combined is equal to 15 species in the two study stations. During the inventory of orthoptera this richness presented fluctuations ranging from 5 to 12 species. Maamri and Meddah (2013) noted that the total richness in the different study stations in the Algerian Sahara showed fluctuations ranging from 6 to 12 locust species. This difference perhaps comes down to the nature of the environment and the seasons (climatic conditions, etc.).

In the Ouled Aissa station the Shannon and Weaver diversity values recorded vary between 1.74 bits in January and 2.73 bits in November. These values are low in December, January and February and relatively average between September and November. Furthermore, at Aougrout, my Shannon-Weaver diversity index values vary between 2.14 in November and 3.16 in September. These values are relatively average during all months, which means that the diversity of the sampled population is average. These values are relatively comparable to those noted by authors who have worked in regions located in southern Algeria. Indeed, Chennouf (2008) in Hassi Ben Abdellah in the Ouargla region obtained values which fluctuate between 1.9 bits for a cereal environment of Badisse and 4.1 bits at the level of the phoenicicultural environment of I.T.D.A.S. Sid Amar (2011) in the Adrar region found values fluctuating between 3.62 bits in the open field in the Moulay Nadjem station and 4.77 bits in the greenhouse in the same station. Concerning the calculated fairness is between 0.67 and 0.82 in Ouled Aissa. While in the Aougrout station, the calculated equitability fluctuates between 0.75 and 0.88. These results imply that the numbers of the orthoptera species present are in balance with each other. Chennouf (2008) in Ouargla found values lower than our results. This author mentioned 0.34 under the taproot, 0.64 under the greenhouses and 0.66 under the date palms. In our study region

Sid Amar (2011) recorded a value of 0.59 in the open field and 0.75 in the greenhouse in the Moulay Nadjem station, 0.56 in the open field and 0.48 in the greenhouse in Sbaihi and 0.74 in the Mahdia oasis. Regarding relative abundance, the inventory of species captured in the Ouled Aissa palm grove showed the existence of 474 trapped individuals belonging to 15 species with 3 categories. The first represented by the species *Morphacris fasciata* (28.7%), *Pyrgomorpha cognata* (27.6%) and *Acrotylus insubricus* (21.73) which has the highest rate with a value greater than 20%. In the Aougrout palm grove 445 individuals, concern the most important species which are *Morphacris fasciata* (27.41%), *Pyrgomorpha cognata* (20.22%), and *Acrotylus insubricus* (22.47%) have values greater than 20 % formed the highest rate.

Comparison: Concerning the Frequency of occurrence, we recorded in the palm grove of Ouled Aissa 2 omnipresent species, these are *Acrotylus insubricus* (94.4%) and *Morphacris fasciata* (88.9%), 2 constant species with *Pyrgomorpha cognata* (72.2%) and *Ochrilidia geniculata* (66.7%), 3 incidental species recorded and 8 accidental species.

Furthermore in Aougrout, we recorded 2 omnipresent species, these are *Acrotylus insubricus* and *Morphacris fasciata* with 94.4% for each, 2 constant species with *Ochrilidia geniculata* (77.8%) and *Pyrgomorpha cognata* (67.7%), 5 accessory species and 6 accidental species.

5. CONCLUSION

The inventory of the orthopterological fauna of the two palm groves (Touat and Gourara) during six months of prospecting, made it possible to collect a total of 16 species belonging to the order Orthoptera which is subdivided into two suborders, that of Caelifera. which bring together 11 species, which are divided between two families (Acrididae and Pyrgomorphidae) and six subfamilies (Acridinae, Cyrtacanthacridin, Eyprepocnemidinae, Gomphocerinae, Oedipodinae and Pyrgomorphinae).

The Ensifera suborder contains 4 species which are divided into 3 subfamilies Gryllinae, Gryllotalpinae and Conocephalinae which belong to 3 families (Gryllidae, Gryllotalpidae and

Phasgonuridae). It is the Acrididae family and the Pyrgomorphidae family which are the most present with 69.8% and 27.6% respectively in the palm grove of Ouled Aissa. Also in the Aougrout palm grove we recorded the family Acrididae (74.6%) and that of Pyrgomorphidae (20.2%). The other families are less abundant (Gryllidae, Gryllotalpidae and Phasgonuridae).

We can say that the inventoried species of these families have as their habitat area the sub-humid, humid, semi-arid and arid bioclimatic stages.

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