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Inventory of Arthropods in an agro-ecosystem Ziban oasis, Ain Ben Noui, Biskra, Algeria

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Abstract
The present study was carried out at the I.T.D.A.S. station (Ain Ben, Biskra), it consists on a contribution to the knowledge of the Ziban oasis arthropods. During the study (2013-2014), every seven days, arthropods were collected using five methods: pitfall traps, yellow water traps, collecting net, light traps and direct hunting. The sample was composed of 2 647 individuals belonging to 18 orders, 69 families and 127 species. The results showed a predominance of the Coleoptera order with 27especes followed by Hymenoptera order with 16 species, Hemiptera order with 15 species and Lepidoptera order with 13especes. A qualitative and quantitative analysis of species identified was done using the different ecological indices and data processing software R.

Keywords: Ain Ben Noui, sampling, oasis, diversity, arthropod.

1. Introduction
Adapted to the arid environmental conditions, different zoological groups inhabit the palm groves and have a varied spatial organization. Some move above the ground others occupy the dominant plant species (date palm). The rest of the fauna is localized on plant species that occupy the space between the palms.
Under the effect of the increasing use of pesticides, in recent decades, there has been an alarming decline of biodiversity [1] (insects, birds, wild plants). Knowledge of arthropods, their compositions, their structures and their current status are the key point for the development of a database. According to [2], morphological and physiological adaptations in different environments give them a privileged place for the study of various ecological issues. The main objective of this study is to establish a more comprehensive inventory as possible (updated list) of arthropods at the Ain Ben Noui palm grove.

2. Material and methods
2.1. Location of the study area
At the South east of Algeria, Biskra region (34, 48 N and 5, 44 E) is limited by the province of Batna in the north, to the North-West of the province of M'Sila, to the North east of the province of Khenchela, to the south by the province of El Oued and Ouargla and to the Southwest of the province of Djelfa [Fig.1]. The study region, palm grove Ain Ben Noui (34° 48 '21.68' 'N and 05° 39'24.72' 'E, 114 m a.s.l), is a part of the experimental station of the Technical Institute for Saharan Agriculture Development (ITDAS). It is located in the municipality of El Hadjeb at 8 km west of the capital of Biskra province, on National Highway No. 46 connecting Biskra in Tolga [Fig.1]. It covers an area of 21.5 hectares [3].

Fig1: Satellite image of the experimental station of ITDAS Biskra [4].

2.2. Sampling methods of arthropods

Arthropods were sampled using five methods; pitfall traps [Fig.2a], light traps [Fig.2b], yellow colored traps [Fig.2c], sweep net [Fig.2d] and hunting sight [Fig.2e]. The applied experimental device consists in total of 36 traps, 8 colored traps and tow light traps, installed in each cultivated plot. Trapped insects are collected four times a month from June 2013 until March 2014.The content is retrieved using a mesh; the separation of specimens is carried out in the laboratory using a binocular magnifier. Sample identification is performed to genus and species for the majority of families [5, 6, 7, 8, 9]. The identified insects were stored in collection boxes and kept in the entomology laboratory.

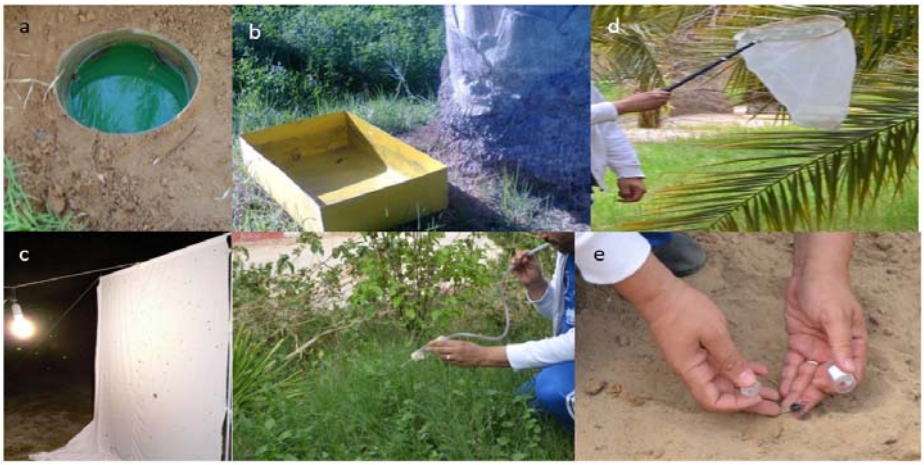

Fig 2: Methods used for sampling arthropods

For treatments of ours results, structural and diversity parameters (species richness (S) [10], relative abundance (RA) [12], density and consistency [13], Shannon index [14], evenness [15]) were measured. Principal Analysis Components (PAC) was also applied.

3. Results and Discussion

The inventory carried out according to the sampling device allowed us to identify 127 species belonging to 4 classes; 113 species in Insecta class, 12 species in Arachnida class and one species for each class Chilopoda and Malacostraca [Table.1].

Table 1: Total collected species collected In Ain Ben Noui Palm grove.

Classe	Ordre	Famille	Espèce
Hymenoptera Diptera		Buprestidae	*Anthaxia nitidula* (Linnaeus, 1758)
			Agrilus scythicus
		Curculionidae	*Larinus-jacae*
			Onthophagus taurus (Schreber 1759)
			Larinus sp
			Liophloeus tessulatus (Müller, 1776)
		Tenebrionidae	*Pimelia payraudi* (Latreille, 1829)
		Aphodiidae	*Ophodius sp*
		Cetoniidae	*Tripinota (epicometis) hirta* (Poda, 1761)
			Oxythyrea pantherina (Gorchy and Percheron, 1833)
			Hoplia argentea (Poda-1761)
		Melolonthidae	*Amphimallon solsticialis* (Linnaeus, 1758)
		Brachyceridae	*Brachycerus undatus* (Fabricius, 1798)
		Carabidae	*Lophyra flexuosa* (Fabricius, 1787)
			Carabus sp.
			Sphodrus leucophtalmus (Linnaeus, 1758)
			Brachinus explodens (Duftschmid 1812)
			Harpalus rufipes (De Geer, 1774)
			Bembidion sp
			Carabus glabratus (Paykull, 1790)
			Carabus sp
			Anthia sexmaculata (Fabricius, 1787)
		Cicindélidae.	*Cicindela campestris* (Linnaeus, 1758)
		Coccinellidae	*Coccinella septempunctata* (Linnaeus, 1758)
			pharoscymus ovoideus
			Cybocephaluspalmarum (Peyerimhoff, 1931)
			pharoscymnus numidicus
	Lepidoptera	Nymphalidae	*Danaus chrysippus* (Linnaeus, 1758)
		Crambidae	*Evergestis isatidalis* (Duponchel 1833)
		Pyralidae	*Ectomyelois ceratoniae* (Zeller, 1839)
		Geometridae	*Camptogramma sp*

		Pterophoridae	*Amblyptilia acanthadactyla* (Hübner, 1813)
			Emmelina monodactyla (Linnaeus, 1758)
		Pieridae	*Pieris rapae* (Linnaeus 1758)
		Sphingidae	*Hippotion celerio* (Linnaeus, 1758)
			Hyles euphorbiae (Linnaeus, 1758)
		Coliadinae	*Colias crocea* (Fourcroy, 1785)
		Lycaenidae	*Aricia-agestis* (Schiffermüller, 1775)
		Noctuidae	*Amphipyra sp*
		Gelechiidae	*Tuta absoluta* (Meyrick, 1917).
		Drosophilidae	*Drosophila sp*
			cyclorrhaphe sp
		Sarcophagidae	*sarcophaga sp*
		Muscidae	*Musca domestica* (Linnaeus, 1758)
		Calliphoridae	*lucilia sp*
		Tephritidae	*Ceratitis capitata* (Wiedemann, 1824)
			Bactrocera oleae (Gmelin, 1788)
		Culicidae	*Culiseta longiareolata* (Macquart, 1838)
			Uranautenia uranautaenea (Peyton (1972)
			Culiseta subochrea (Edwards, 1921)
		Psychodidae	*Pericoma* sp
		Tpulidae	*Tipula sp*. (Linnaeus, 1758)
		Formicidae	*Cataglyphis bicolor*
			Tetramorium biskrensis kahenae (Menozzi, 1934)
			Messor barbarus
			Pheidole Pallidula
			Camponotus forelli
			Camponotus aethiops (Latreille, 1798)
			camponotus sp
		Vespoidae	*polistes-gallicus* (linnaeus, 1767)
		Aphidae	*Xylocopa Pubescens* (Spinola*,* 1838*)*
		Ichneumonidae	*Ichneunom suspiciosus Wesmael*
			Apechthis compunctor (Linnaeus, 1758)
			Ophion luteus Linné
			Cryptus albitarsis
		Mutillidae	*Blakeius chiesi ibericus* (Suárez, 1958)
		Pyrrochoridae	*pyrrhocoris aegyptius*
			Lygaeus militaris (Fabricius, (1775).
	Homoptera	Aphididae	*Rhopalosiphum padi* (Linnaeus, 1758)
			Aphis craccivora (Koch, 1854)
			Aphis nerii (Fonscolombe, 1841)
			Aphis gossypii (Glover, 1877)
			Rhopalosiphum padi (Linnaeus, 1758)
			Myzus persicae (Sulzer, 1776)
			Aphis fabae (Scopoli, 1763)
			Brevicoryne brassicae (Linnaeus, 1758)
		Dictyopharidae	*Dictyophara europaea* (Linné, 1767)
		Diaspididae	*Parlatoria blanchardi* (Targ, 1868)
	Hemiptera	Pentatomidae	*Codophila varia* (Fabricius, 1787)
			Nezara viridula (Linnaeus, 1758)
			Perillus Bioculatus (Fabricius, 1775)
			Acrosternum heegeri (Fieber, 1861)
			Dolycoris baccarum (Linnaeus, 1758)
			Eurydema ornata (Linnaeus, 1758)
			*Ancyrosoma leucogrammes (*Gmelin, 1790)
			Pentatoma rufipes (Linnaeus, 1758)
			Carpocorpuris purpureipennis (DeGerr 1773)
		Miridae	*Stenotus binotatus* (Fabricius 1794)
		Lygaeividae	*Oxycarenus lavaterae* (fabricius, 1787)
		Cydnidae	*Sehirus luctuosus* (Mulsant & Rey, 1866)
		Stenocephalidae	*Dicranocephalus Albipes* (Fabricius, 1781)
		Cicadellidae	*Cicadella viridis* (Linnaeus, 1758)
	Orthoptera	Gryllotalpidae	*Gryllotalpa gryllotalpa* (Linnaeus, 1758)
		Pyrgomorphidae	*Pyrgomorpha agarena*
		Phasmidae	*ochrilidia gracilis*
		Acrididae	*Aiolopus thalassinus tamulus* (Fabricius, 1798)
			Locusta migratoria (Linnaeus, 1758*)*

			Duroniella lucasi (Bolivar, 1881)
			sphingonotus rubescens (walker, 1870)
		Blattidae	*Periplaneta americana* (Linnaeus, 1758)
		Gryllidae	*Gryllusbimaculatus*
	Odonatoptera	Libellulidae	*Sympetrum sanguineum* (Muller, 1764*)*
			Sympetrum vulgatum (Linnaeus, 1758)
		Coenagrionidae	*Coenagrion sp*
			*Ischnura elegans (*Vander Linden, 1820)
	Thysanoptera	Phloeothripidae	*Liothrips oleae* (Costa, 1857)
			Thrips sp
	Dermaptera	Forficulidae	*Forficula auricularia* (Linnaeus, 1758)
	Zygentoma	Lepismatidae	*Lepisma saccharina* (Linnaeus, 1758)
	Ephemeroptera	Baetidae	*Clpeon dipterum* (Linnaeus, 1761)
	Nevroptera	Chrysopidae	*Chrysoperla carnea* (Stephens, 1836)
	Mantodae	Mantidae	*Mantis religiosa* (Linnaeus, 1758)
			Sphodromantis viridis (Forskal, 1775)
	Hemiptera	Pentatomidae	*Codophila varia* (Fabricius, 1787)
			Nezara viridula (Linnaeus, 1758)
			Perillus Bioculatus (Fabricius, 1775)
			Acrosternum heegeri (Fieber, 1861)
			Dolycoris baccarum (Linnaeus, 1758)
			Eurydema ornata (Linnaeus, 1758)
			*Ancyrosoma leucogrammes (*Gmelin, 1790)
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		Miridae	*Stenotus binotatus* (Fabricius 1794)
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		Cydnidae	*Sehirus luctuosus* (Mulsant & Rey, 1866)
		Stenocephalidae	*Dicranocephalus Albipes* (Fabricius, 1781)
		Cicadellidae	*Cicadella viridis* (Linnaeus, 1758)
Arachnida	Arneae	Thomisidae	*Argiope trifasciata* (Forsskål, 1775)
		Salticidae	*Aelurillus sp.*
			Salticus sp.
		Gnaphosidae	*Leptodrassus sp*
			Trachyzelotes sp
			Haplodrassus moderatus (Kulczyński, 1897)
		Philodromidae	*Philodromus sp*
		Zodariidae	*Zodarion sp*
		Loxoscelidae	*Loxosceles sp.*
		Dysderidae	*Dysdera sp*
		Araneidae	*Argyope lobata* (Pallas, 1772)
	Solpugida	Daesiidae	*Syndaesia sp*
Chilopoda	Scutigeromorpha	Scutigeridae	*Centipede sp*
Malacostraca	Isopoda	Porcellionidae	*Porcellio scaber* (Latreille, 1804)

The insect class was the most dominant both in number of species (113 species) and in terms of abundance. The entomological species identified were divided into 18 orders including Coleoptera with 27 species covering 10 different families. Hemiptera and Hymenoptera come in second place with 26 and 16 species. Lepidoptera and Diptera were respectively with 13 and 12 species followed by Orthoptera with 11species. Other orders were poorly marked (4 species for each).

In another study, [16] described 67 species especially from insect class. In a subsequent work [17], we reported 117 species in five palm grove in Biskra region for a period of six months of collect. However, the total species richness of the palm groves in the Ouargla region was studied by [18] where she reported, 142 species of insects. Furthermore, in the Batna region [19], recorded 198 species of insects during 10 months of follow-up using different types of traps.

3.1. Treatment of results by ecological indices

3.1.1. The average richness

The sampling methods used indicated a good sampling quality (0, 25) [20], the average of species richness was equal to 28.38, the lowest value is marked in December in winter. The greatest richness is marked in March with 8.46 followed by June and February, with 3.41 and 3.38 respectively. This seems to be due to the improvement of the temperature and quality of the vegetation of the palm favorable to the activity of arthropods that provides food and shelter to species [13]. According to [21] insects cannot maintain their metabolic activities only within a limited range of body temperatures; they can escape the adverse thermal conditions by moving to stations with meso-climates or special microclimates.

3.1.2. Relative Abundance

The different type of traps captured 2 647 individuals of arthropods divided into 4 classes. The Insecta class with 2 520 individuals (95.2%) was the most dominant, followed by the Arachnida class, with 129 individuals and the Chilopoda class and Malacostraca class with only one individual (0.4 %). According to the orders, the Hemiptera is the most abundant order with 50.62%, in the second position Coleoptera and Diptera with 11%, the Hymenoptera order with 9% [Fig.3]. The important presence of orders in ours traps may be related to the flowering plants in a plot that promotes the maintenance and propagation of several species [22].

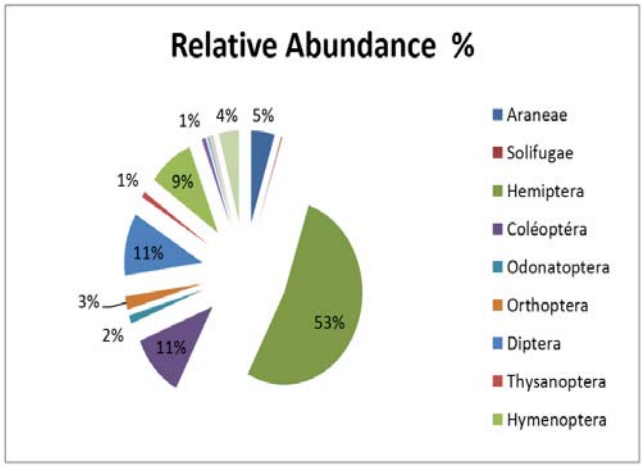

Fig 3: Relative abundances of the orders listed in the palm of Ain Ben Noui

3.1.3. Density and consistency

The results of ecological indices indicated that 5 species were constants whose constancy is between (54.05% and 72.97%). 12 were sporadic species their constancy was between 2.7% and 8.11% and bycatch species were the number of 30 species. Furthermore, it was noted that more than half of the species (80 species) trapped in the palm grove were accidental. The presence of a large number of accidental species may be explained by the short lifecycle of species that can be achieved between statement and another. The crop diversity applied in each plot, following a livestock feeding schedule, promotes the installation of deferent species.

3.1.4. Shannon index

The value of the diversity index of Shannon-Weaver [Table 2] for species trapped in the palm grove amounts to 6.08 bits. This high value indicates that the species caught were diversified and an equality of individual contributions to plant cover [23].

Table 2: Values of the Shannon diversity index (H ') and uniformity (E) applied to species captured at the palm of Ain Ben Noui.

Parameters	Values
H' (bits)	6,08
H'max (bits)	6,99
E	0,87

4. Analyses Principal Components (PCA)

4.1. Representation of variables: (The correlation circle)

The results obtained from the statistical treatment by the method principal components (PCA) using the software R.

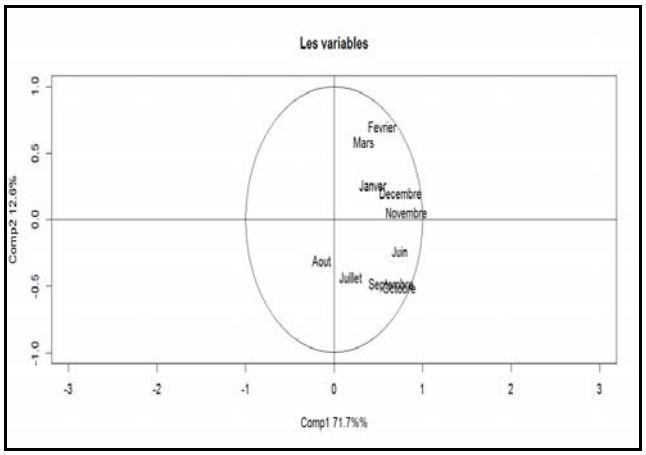

Fig 4: Representation of the variables on the first factorial plane

An inertial percentage on the horizontal axis 1 is 71.7% and 12.6% on the vertical axis 2 to the map 1; all variables occupy a relatively small area within the circle of correlations [Fig.4]. The maximum angle between two variables is less than 90 ° with the exception of the month of August, This suggests that all variables are positively correlated with each other [24].

4.2. Representation of individuals

The purpose of this representation is to provide plane images of individuals approached the cloud space situated in R. The set of projections of all points of the cloud of individuals (species) on the first factorial axis comp1 called first factor [25].

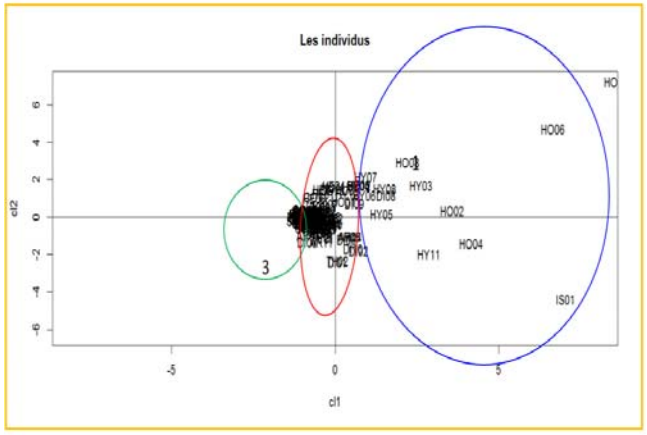

Fig 5: Representation of individuals on the factorial

The x-axis represents the general level of species and that of ordained represents their profile. Indeed, a species belonging to group 1 is characterized by strong presentation in all surveys; this is the case, for example *Myzus persicae* (Sulzer, 1776), species *Porcellio scaber* (Latreille, 1804), *Messor barbarus* (Linné, 1767) [Fig.5]. In contrast, Species belonging to group 2 are species that have an average representation in all surveys; this is the case *Camponotus sp*, *Cyclorrhaphe sp*. A species belonging to the group 3 have low presentation in all surveys; case of all rare or accidental species.

5. Conclusion

This study allowed us to establish an actualized list of entomological biodiversity present in station. This basic list may be a reference for Complementary studies to be carried out subsequently to study the evolution of biodiversity in palm groves of Biskra region.

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