Pakistan J. Zool., vol. 47(2), pp. 505-514, 2015.

Diversity and Distribution of Arthropod Community in the Lucerne Fields in Northern Sahara of Algeria

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Abstract. – The application of two sampling methods (pitfall traps and sweeping net) on three lucerne fields of different ages (one year, two years and three years) in a Saharan area of Algeria allowed the enumeration of 9158 arthropods divided into 4 classes, 13 orders and 73 families. About 4/5 of them are obtained by the pitfall and 1/5 caught by sweep netting. The comparison between the diversity in families of the three parcels reveals families diminution according to the age of Lucerne fields (52 for three years ≤ S: richness ≤ 66 for one year). Contrary to the individuals number which present a growth according to the age (1729 per one year ≤ IN: individual number ≤ 4947 per three years). On abundance, the class of Insecta is the most sampled by the two methods. Formicidae and Entomobryidae are most caught by the pitfall in the three lots, whereas Coccinellidae are most inventoried by sweeping net.

Keywords: Arthropods, pitfall traps, sweeping net, lucerne, Algerian Sahara.

INTRODUCTION

Arthropods, especially the insects, are the most abundant and most diverse animal. They are well spread all over the globe and occupy a wide range of ecological niches in the terrestrial environment. Some species are involved in the process of decomposition that leads to the recycling of nutrients (Pesson, 1971; Bachelier, 1978), others in the pollination of flowering plants, many are herbivores and have an impact on the biomass and the plants survival, whereas others play an important role in regulation of populations, either as pests, parasites or as predators (Tingle, 2002).

If studies on densities of the species which affect the crop plants in humid, sub-humid (Steyn, 1951; Chaboussou, 1974; Fekkoum *et al.*, 2011; Lozano *et al.*, 2013) and even arid areas (Brague-Bouragba *et al.*, 2006; Ali-Shtayeh *et al.*, 2010; Souttou *et al.*, 2011), are numerous in particular within the framework prejudicial or of struggle, it is not the same for those carried out the Sahara (Kourim *et al.*, 2011), especially for a culture that has a great interest in breeding livestock's, such as the lucerne, there feed is a serious limiting factor. The aim of this works was to give a preliminary description of the composition and structure of the arthropod community in three Lucerne fields of different ages in Ouargla (Northern Sahara of Algeria), using families abundance models and diversity analysis based on two sampling methods (Pitfall traps and sweeping net) lucerne fields. The purpose is to contribute to a currently limited knowledge of the ground-dwelling arthropod fauna of Ouargla.

MATERIALS AND METHODS

This study was carried out in the region of Ouargla (800 km South-East of Algiers). It is located north-east of the northern part of the Algerian Sahara (31 ° 58 'N., 5 ° 20' E.), on an altitude of 157 meter. It is an oasis known by an agricultural activity strongly dominated by the palm grove which constitutes until today a source of principal life for several families of the Sahara (Dubost, 1991). It is characterized by a contrasted climate (Rouvillois-Brigol, 1975). Its aridity is

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0030-9923/2015/0002-0505 $ 8.00/0

shown by high temperatures in summer, low rainfall and especially by the importance of evaporation due to the dryness of the air (Ould El Hadj, 2001). The year 2010 did not make the exception, with an annual total of rainfall equal to 22.6mm. This reveals a dry period which last the entire year. However, Ouargla belongs to the Saharan bioclimatic zone known by its mild winter (pluviothermic quotient: Q_3 = 4.89). In order to realize this work, three lucerne fields of different ages were selected at 26km in the South-east of Ouargla. Namely:

Lucerne fields 1: site (1) of 3 years old with a surface of 600m². It lies to the East side of the palm grove with an organized plantation. To the South side, there is greenhouse, to the West side windbreak (*Casuarina equisetifolia*) and to the North side buildings. This plot was irrigated by sprinkling.

Lucerne fields 2: site (2) of 2 years old with a surface of 500 m². It lies to the North-east side of the palm grove, about 50 m far from the first parcel, and about 15 m from a water basin. The parcel is surrounded by open areas at the North, the South and the West, and a windbreak (*C. equisetifolia)* at the East side. It was irrigated by flooding.

Lucerne fields 3: a young lucerne fields (1 year) with a surface of 500 m², it lies to the North side of the palm grove. It was irrigated by flooding at a rate of once per week in mild seasons and twice to three times in rustic season (summer).

Sampling of arthropods was carried out monthly for six months (from October 2010 until March 2011). The catches were performed by unbaited interception methods, on the ground (by pitfall traps) or on the vegetation (by sweeping net), so as to capture the arthropods randomly without affecting their behavior.

In each lucerne fields, there were 16 traps (pitfall) separated of 5m each from other, arranged on two parallels straight lines, where 8 traps were placed at the center of the lucerne fields and 8 others at the border, with a total of 96 traps used throughout the experimental period. After 24 h, the content of each trap was collected. The second technique of capture used was the sweeping net. This method consisted in animating the collecting net by back and forth movements near the horizontal and over the entire height of vegetation, for obtaining of the arthropods present on the lucerne.

However, the samples obtained with the two methods were placed in Petri dish and dichotomous keys were used for identification of the arthropods (Perrier, 1926, 1927, 1932, 1934, 1937; Chopard, 1943; Balachowsky, 1962; Chinery, 1983; Reichholf-Riehm, 1984; Zahradnik, 1984; Pihan, 1986) and were also compared with the insects collection of Agricultural and Forest Zoology Departments (ENSA, Algiers).

Total richness (*S*) which is the overall number of families or species sampled by different methods was determined (Blondel, 1975). Besides that average richness (*Sm*) which is the medium number of the categories (families) found in each statement (Ramade, 1984), the relative abundance (*RA* %) which is the percent proportion of the individuals number of each family (*IN*) to the overall number of the individuals of all families (*N*) (Zaime and Gautier, 1989), the Shannon-Weaver's index of diversity (*H'*) expressed by bits and obtained by the formula: $H' = -\Sigma qi \log_2 qi$ where (*qi*) where (*qi*) is the relative frequency of the family (*i*) taken in consideration (Ramade, 1984), the Evenness's index (*J'*) which is the ratio of diversity observed (*H'*) to the maximum diversity (*H' max*) which is given by $\log_2 S$ where *S* represents total richness (Weesie et Belemsobgo, 1997) were also calculated. However, some statistical tests such as Chi-square test (χ^2) (Snedecor and Cochran, 1971), and the principal components analysis (*PCA*) (Delagarde, 1983; Philippeau, 1992) was also done.

RESULTS

Arthropods in the lucerne fields

A total four classes of arthropods (Arachnida and Crustacea, Entognatha, Insecta) were inventoried following the application of two methods of sampling (pitfall traps and sweeping net) (Fig. 1).

Pitfall traps allowed the identification of four classes, where insects are the most sampled at three sites with relative abundances ranging from 64.4% (IN = 893) at site 3 and 71.1% (IN = 1,331) at site 2. It is followed by Entognatha with abundances of (24.7% at site 2 < RA < 28.7% at site 3).

Also, mowing with sweep netting method has allowed sampling two classes of arthropods only (Insecta and Arachnida) in each parcel. Insects were the most recorded with 98.3% at site 1 (IN = 807) and site 3 (IN = 336) and 99.3% (IN = 605) at site 2. However, abundances of Arachnids did not exceed 1.8% (Fig. 1).

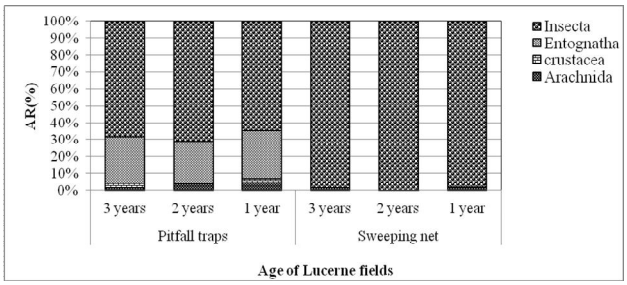

Fig. 1. Relative abundance (RA%) of the arthropod's classes listed in three different lucerne fields at Ouargla with the pitfall and sweeping net

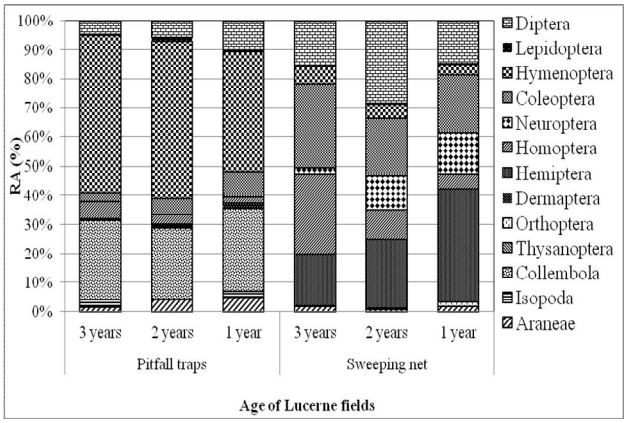

Fig. 2. Relative abundance (RA%) of the arthropod's orders listed in three different lucerne fields at Ouargla with the pitfall and sweeping net.

A total of 9,158 individuals of arthropods captured by both sampling methods belonged to 13 orders (Fig. 2). The comparison between the individual numbers of different orders according to the age of the lucerne fields shows the existence of a very highly significant difference (χ^2_{Obs} = 5894.8; χ^2_{Cri} = 79.1; ddl = 60; $p < 0.0001$). The pitfall traps enables to find out 12 orders where one notes the absence of Neuroptera and Dermaptera. For sweeping net, only 9 orders have been identified, with the absence of Isopoda, Collembola, Thysanoptera and Dermaptera (Fig. 2).

On the level of the three parcels, Hymenoptera ($41.1 \leq RA\ \% \leq 54.1$) and Collembola ($24.7 \leq RA \leq 28.7\%$) were the most captured by pitfall traps, whereas Coleoptera (RA = 28.5%), Homoptera (RA = 27.5%), Diptera (AR % = 28.4) and Hemiptera (RA = 39.2%) were counted by the technique of sweeping net.

In total, 73 families of arthropods were listed on the level of the three lucerne fields with the pitfall traps (71 families) and with sweeping net (43 families) (Table I, II). The families richness obtained with pitfall traps varies between 41 families at lucerne fields 1 (Sm = 5.5 ± 2.4) and 58 families at lucerne fields 3 (Sm = 4.5 ± 2.2). Whereas those of sweeping net are not very shifted ($30 \leq S\ family \leq 33$). For the number of individuals, it increases with the age of the lucerne fields for the pitfall traps from the younger site 3 (IN = 1,387) to the oldest site 1 (IN = 4,126). However it is the reverse for the method of sweeping net where it decreases from the younger site 3 (IN = 821) to the oldest site 1 (IN = 342).

The comparison between families richness shows a decrease according the age of lucerne fields (Table I). Indeed, that of one-year-old is the richest (S = 66 families), with 6 families specific to this parcel (Table II). Followed by lucerne fields 2 (2 years old) with 61 families (three specific families) and finally the first (3 years old) with 52 families (2 specific families). However the number of individuals growth on the age of lucerne fields ($1,726$ at site $3 \leq IN \leq 4,947$ at site 1) (Table I).

Formicidae are the more sampled with pitfall traps ($39.9 \leq RA\% \leq 53.6$) where they are regarded in the various lucerne fields (Table II). This family is also the richest in species, it contains 13 species at site 3 and 1 and 14 species at site 2. The Entomobryidae comes in second position ($24.7 \leq RA\% \leq 28.7$), represented only by one species only. It is to mention the absence of the Fulgoridae and the Chrysopidae in pitfall traps.

Moreover, the results obtained through sweeping net method show that the Coccinellidae ($18.9 \leq RA\% \leq 28.1$) was the most captured in three

Table I.– Individuals number (IN), total richness (S), and average (Sm) of the arthropod's families inventoried in three lucerne fields at Ouargla (Algerian Sahara).

	Lucerne fields 1			Lucerne fields 2			Lucerne fields 3			∑ Lucerne fields
	Pt.	Sn.	Glb.	Pt.	Sn.	Glb.	Pt.	Sn.	Glb.	Pt. + Sn.
IN	4126	821	4947	1873	609	2482	1387	342	1729	9158
S	41	31	52	54	32	61	58	30	66	73
Sm	5.45	13.83	-	4.73	6.92	-	4.48	6.25	-	-
SD	2.40	3.43	-	2.13	5.45	-	2.17	4.31	-	-

Pt., Pitfall traps; Sn., Sweeping net; Glb., global; SD, standard deviation.

Table II.– Individuals number (IN) and relative abundance (RA%) of the arthropod's families inventoried in three lucerne fields at Ouargla (Algerian Sahara).

Families	Lucerne fields 1				Lucerne fields 2				Lucerne fields 3			
	Pitfall traps		Sweeping net		Pitfall traps		Sweeping net		Pitfall traps		Sweeping net	
	Ni	AR%	Ni	AR%	Ni	AR%	Ni	AR%	Ni	AR%	Ni	AR%
Gnaphozidae	22	0.53	-	-	25	1.33	-	-	6	0.43	-	-
Salticidae	3	0.07	4	0.49	3	0.16	2	0.33	11	0.79	1	0.29
Lycosidae	11	0.27	-	-	24	1,28	-	-	36	2.60	1	0.29
Oxyopidae	14	0.34	-	-	20	1.07	-	-	7	0.50	-	-
Thomisidae	3	0.07	10	1.22	-	-	2	0.33	-	-	3	0.88
Drassidae	4	0.10	-	-	4	0.21	-	-	5	0.36	1	0.29
Agelenidae	-	-	-	-	-	-	-	-	1	0.07	-	-
Agnaridae	115	2.79	-	-	3	0.16	-	-	30	2.16	-	-
Entomobryidae	1127	27.31	-	-	463	24.72	-	-	398	28.70	-	-
Thripidae	1	0.02	-	-	5	0.27	-	-	3	0.22	-	-
Pyrgomorphidae	-	-	1	0.12	1	0.05	3	0.49	-	-	1	0.29
Tetrigidae	-	-	1	0.12	1	0.05	-	-	1	0.07	4	1.17
Acrididae	2	0.05	-	-	-	-	-	-	1	0.07	-	-
Labiduridae	-	-	-	-	7	0.37	-	-	3	0.22	-	-
Forficulidae	-	-	-	-	-	-	-	-	6	0.43	-	-
Pentatomidae	4	0.10	-	-	3	0.16	-	-	1	0.07	-	-
Lygaeidae	9	0.22	5	0.61	3	0.16	4	0.66	7	0.50	12	3.51
Capsidae	3	0.07	61	7.43	2	0.11	46	7.55	-	-	58	16.96
Coreidae	3	0.07	51	6.21	-	-	29	4.76	-	-	4	1.17
Anthocoridae	1	0.02	1	0.12	1	0.05	2	0.33	-	-	3	0.88
Nabidae	-	-	29	3.53	2	0.11	63	10.34	1	0.07	57	16.67
Corixidae	-	-	-	-	-	-	-	-	1	0.07	-	-
Aphididae	31	0.75	2	0.24	1	0.05	-	-	17	1.23	1	0.29
Fulgoridae	-	-	6	0.73	-	-	-	-	-	-	-	-
Jassidae	210	5.09	218	26.55	61	3.26	63	10.34	12	0.87	16	4.68
Chrysopidae	-	-	19	2.31	-	-	70	11.49	-	-	47	13.74
Eucnemidae	-	-	-	-	1	0.05	-	-	-	-	-	-
Anthicidae	86	2.08	3	0.37	21	1.12	2	0.33	7	0.50	1	0.29
Tenebrionidae	11	0.27	-	-	8	0.43	1	0.16	5	0.36	-	-
Elateridae	-	-	-	-	-	-	-	-	1	0.07	-	-
Curculionidae	-	-	-	-	2	0.11	1	0.16	1	0.07	-	-
Dytiscidae	-	-	-	-	3	0.16	-	-	2	0.14	-	-
Coccinellidae	22	0.53	231	28.14	50	2.67	115	18.88	99	7.14	68	19.88
Histeridae	2	0.05	-	-	12	0.64	-	-	-	-	-	-
Apionidae	-	-	-	-	1	0.05	1	0.16	-	-	-	-
Scarabaeidae	2	0.05	-	-	1	0.05	-	-	1	0.07	-	-

Continued

Families	Lucerne fields 1				Lucerne fields 2				Lucerne fields 3			
	Pitfall traps		Sweeping net		Pitfall traps		Sweeping net		Pitfall traps		Sweeping net	
	Ni	AR%	Ni	AR%	Ni	AR%	Ni	AR%	Ni	AR%	Ni	AR%
Staphylinidae	7	0.17	-	-	3	0.16	-	-	2	0.14	-	-
Cetoniidae	-	-	-	-	-	-	-	-	4	0.29	-	-
Megachilidae	-	-	2	0.24	4	0.21	1	0.16	2	0.14	1	0.29
Andrenidae	2	0.05	-	-	-	-	-	-	-	-	1	0.29
Formicidae	2213	53.64	38	4.63	996	53.18	15	2.46	553	39.87	6	1.75
Pompilidae	10	0.24	-	-	2	0.11	-	-	3	0.22	-	-
Cynipidae	2	0.05	3	0.37	1	0.05	-	-	1	0.07	-	-
Apidae	3	0.07	-	-	-	-	-	-	1	0.07	-	-
Chrysididae	-	-	2	0.24	3	0.16	8	1.31	1	0.07	1	0.29
Vespidae	-	-	-	-	1	0.05	-	-	3	0.22	-	-
Mymaridae	-	-	-	-	3	0.16	-	-	-	-	-	-
Trichogrammatidae	2	0.05	-	-	-	-	1	0.16	1	0.07	-	-
Braconidae	-	-	2	0.24	-	-	4	0.66	2	0.14	3	0.88
Sphecidae	-	-	-	-	1	0.05	-	-	-	-	1	0.29
Ichneumonidae	-	-	4	0.49	-	-	1	0.16	1	0.07	-	-
Chalcididae	2	0.05	-	-	2	0.11	-	-	2	0.14	-	-
Lycaenidae	4	0.10	2	0.24	3	0.16	-	-	2	0.14	-	-
Noctuidae	-	-	-	-	8	0.43	-	-	1	0.07	-	-
Tineidae	-	-	-	-	8	0.43	2	0.33	1	0.07	1	0.29
Pyralidae	-	-	-	-	3	0.16	-	-	2	0.14	-	-
Hesperiidae	1	0.02	-	-	-	-	-	-	-	-	-	-
Artiidae	-	-	-	-	2	0.11	-	-	2	0.14	-	-
Scatopsidae	7	0.17	1	0.12	9	0.48	-	-	15	1.08	-	-
Chloropidae	4	0.10	-	-	4	0.21	18	2.96	1	0.07	-	-
Tachinidae	18	0.44	8	0.97	6	0.32	13	2.13	7	0.50	1	0.29
Empididae	-	-	-	-	1	0.05	2	0.33	8	0.58	-	-
Drosophilidae	14	0.34	1	0.12	27	1.44	24	3.94	42	3.03	3	0.88
Dolichopodidae	13	0.32	1	0.12	6	0.32	-	-	8	0.58	6	1.75
Ceratopogonidae	-	-	4	0.49	2	0.11	3	0.49	5	0.36	3	0.88
Sciaridae	-	-	-	-	5	0.27	-	-	1	0.07	-	-
Syrphidae	6	0.15	4	0.49	4	0.21	1	0.16	-	-	-	-
Muscidae	128	3.10	102	12.42	34	1.82	54	8.87	26	1.87	27	7.89
Culicidae	-	-	3	0.37	3	0.16	51	8.37	1	0.07	1	0.29
Asilidae	-	-	-	-	-	-	2	0.33	3	0.22	9	2.63
Simuliidae	2	0.05	-	-	-	-	-	-	2	0.14	-	-
Sintapsidae	-	-	-	-	-	-	-	-	5	0.36	-	-
Tephritidae	2	0.05	2	0.24	4	0.21	5	0.82	16	1.15	-	-
Total	4126	100	821	100	1873	100	609	100	1387	100	342	100

-, Absence.

parcels (Table II). They are followed by Jassidae (RA = 26.6%) at site 1, Chrysopidae (RA = 11.5%) at site 2 and Capsidae (RA = 17.0%) in the third. Regarding species richness, this method shows that Formicidae occupy the first place at site 1 (S = 6) and 2 (S = 5), versus Coccinelidae (S = 3) and the Muscidae (S = 3) at site 3.

Arthropodos diversity in the lucerne fields

The diversity values of Shannon-Weaver of the pitfall traps ($2.14 \leq H' \leq 2.98$) are relatively lower than those of sweeping net ($3.1 \leq H' \leq 3.78$) (Table III), inversely for the maximum diversity, where the values of pitfall traps are higher compared to those of sweeping net (Table III). For the Evenness index, there is a tendency towards balance between the families individuals captured by a sweeping net ($0.63 \leq J' \leq 0.76$), whereas there is a tendency towards the predominance of some families (Entomobryidae and Formicidae) in the pitfalls, in particular in site 1 (J' = 0.40) and site 2 (J' = 0.43) (Table III).

Table III.– Index of diversity of Shannon-Weaver (H') and of Pielou (P) applied to the arthropod's families inventoried in Ouargla by two sampling methods.

	Lucerne fields 1		Lucerne fields 2		Lucerne fields 3	
	Pifall traps	Sweeping net	Pifall traps	Sweeping net	Pifall traps	Sweeping net
H' (bits)	2.14	3.10	2.49	3.78	2.98	3.50
H'max (bits)	5.36	4.95	5.75	5	5.86	4.91
J	0.40	0.63	0.43	0.76	0.51	0.71

Table IV.– Correlation matrix of Pearson applied to the arthropod's families listed by two sampling methods at Ouargla.

	Pt.Lucer.1	Sn.Lucer.1	Pt.Lucer.2	Sn.Lucer.2	Pt.Lucer.3
Pt.Lucer.1	1	-	-	-	-
Sn.Lucer.1	0.125	1	-	-	-
Pt.Lucer.2	**0.996**	0.126	1	-	-
Sn.Lucer.2	0.052	**0.807**	0.063	1	-
Pt.Lucer.3	**0.973**	0.151	**0.973**	0.099	1
Sn.Lucer.3	0.010	**0.646**	0.024	**0.863**	0.063

Pt., Pitfall traps ; Sn, Sweeping net ; Lucer, Lucerne fields, Bold type: significant value (α =0,050).

The application of the principal components analysis (PCA), shows that the results obtained by sweeping net are conversely correlated with those of the pitfall traps (Fig. 3). Indeed, there is a very weak correlation between families caught by pitfall traps and those of sweeping net and even within the same lucerne fields including the first (0.125), second (0.063) and third (0.063) (Table IV). However there is a very strong positive correlation within families captured by the same method according to the age, like pitfall traps of site 1 and site 2 (0.996), site 1 and 3 (0.973) and site 2 and 3 (0.973). It is the same for sweeping net but with correlations relatively low mainly between the first and the third lucerne fields (0.646).

The results obtained through the pitfall traps (83.1%) strongly contribute to the formation of axis 1 in particular with site 1 (28.0%). While those of sweeping net (83.3%) are greatly involved in the construction of axis 2 especially with site 2 (31.1%).

The projection of families on axis F1 and F2 allows visualizing of a distribution along with a gradient according to the types of trapping methods (Fig. 4). Formicidae (Fam41) and Entomobryidae (Fam09) are considered as highly representative families of the pitfall traps method. Against by Coccinellidae (Fam33) and Jassidae (Fam25) characterizing especially the sweeping net method. Families that are captured by the two methods are condensed near the origin.

DISCUSSION

Four classes were captured by pitfall traps and just half for sweeping net. Entognatha and Crustacea were not rated by this last method because they are the soil-inhabiting arthropods (Bachelier, 1978). Pitfall traps constitutes a good technique to collect invertebrates dense and are active in surface, against sweep netting rather allows obtaining animals visiting or living in the vegetation (Le Berre, 1969; Benkhelile, 1992; Tingle, 2002). Indeed, Myriapoda and Gastropoda are often mentioned in the wet climate of the Algeria in addition to the classes listed in this work (Fekkoum *et al.*, 2011).

Insects are the most inventoried by the two sampling methods. They are also important in sweeping net ($98 \leq RA\% \leq 99$) and pitfall traps ($64 \leq RA\% \leq 71$). This importance was noted in different ecosystems around the world (Ali-Shtayeh *et al.*, 2010 in Palestine; Hossain, 2010 in India; Clere and Bretagnolle, 2001 in France) and in Algeria (Dehina *et al.*, 2007; Fekkoum *et al.*, 2011;

Moulaï and Aissat, 2011; Souttou *et al.*, 2011).

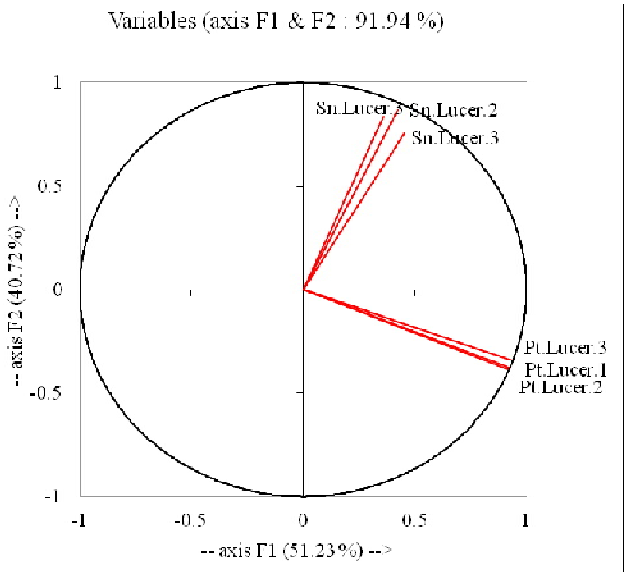

Fig. 3. Correlation circle of the sampling methods (Pt, pitfall traps; Sn, sweeping net) of arthropods according to the axis F1 and F2 (91.9% of total variability)

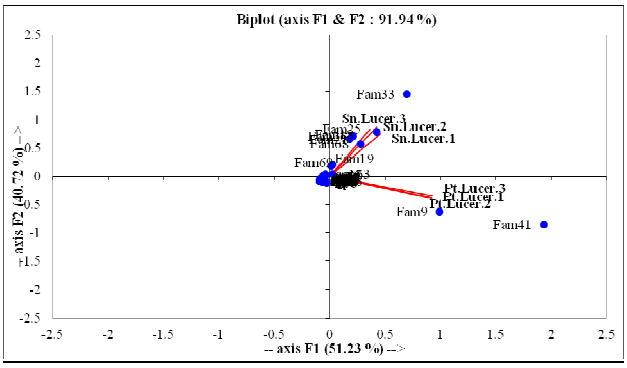

Fig. 4. Spatial repartition of sampling methods (Pt, pitfall traps; Sn, sweeping net) and arthropod's families (Fam) according to the axis F1 and F2 (91.9% of total variability).

In addition, Entognatha specifically Collombola are greatly captured by pitfall traps ($25 \leq RA\% \leq 29$). They are usually less numerous in soils of the savanna and the forest soils of hot countries than in soils of temperate regions (Athias *et al.*, 1974). Their presence in the Saharan community is certainly due to water runoff which contributes to the spread of many species which, float on the water surface (Bachelier, 1978).

Arachnida sampled in the lucerne fields are poorly represented with percentages ranging between 1.8% (sweeping) and 4.8% (pitfall). Just one order well represented in the family is noted (Aranea), often wandering, as the case of wolf spiders. The importance of spiders diversity compared to their individuals numbers is already reported in Algeria on the tellian Atlas (Kherbouche-Abrous, 2006), high plateau (Brague-Bouragba *et al.*, 2007) and even the Northern Sahara (Alioua *et al.*, 2012) and central Sahara (Kourim *et al.*, 2011).

Crustacea ($0.2 \leq RA\% \leq 2.8$) was represented by a single species (*Hemilepistus reaumeri*) captured only by pitfall traps. The presence of the latter in the arid and semi desert is too observed in Southeast of Russia (Dimo, 1945) and Central Asia (Vandel, 1961). However, it participates in the improvement of the soil, but also it can be redoubtable on crops and seedlings, in particular on Corn, Barley and lucerne (Bachelier, 1978).

Insect behavior plays a crucial role in their capture (Roth, 1963). In fact, 13 orders are recorded in this study. The comparison between them on the basis of the sampling methods and the age of the lucerne fields shows the existence of a difference very highly significant. There is the absence of Neuroptera in pitfall traps and Isopoda, Collembola, Thysanoptera and Dermaptera in sweeping net. Moreover, Hymenoptera (RA = 51.7%) are the most sampled by pitfall traps, by against Hemiptera (RA = 24%) and Coleoptera (RA = 23.7%) are the most noted by sweeping net. In Algeria, the use of pitfall traps has identified 20 orders of arthropods at the Tell area (Fekkoum *et al.*, 2011), 8 orders at the high plains (Souttou *et al.*, 2011) and 12 orders in the central Sahara (Kourim *et al.*, 2011), with a dominance of Hymenoptera and Coleoptera.

Families captured by sweeping net are inversely correlated with those of pitfall traps. However, there is a very strong correlation within families captured by the same method in different lucerne fields. The importance of Formicidae (IN = 3,762; RA = 51%) in pitfall traps should be mentioned. These results was also confirmed by several authors in different area (Yasri *et al.*, 2006; Brague-Bouragba *et al.*, 2006; Ali-Shtayeh *et al.*, 2010; Souttou *et al.*, 2011). The importance of ants

is even detected by other sampling methods as the direct capture on plant (Lozano *et al.*, 2013). In contrast, Coccinellidae (RA = 23.4%) and Jassidae (RA = 16.8%) are the most captured by sweeping net.

Generally, the richness of the lucerne fields is relatively low. We must remember that the arid and Saharan zones were characterized by low diversity compared to the enormity of the area (Ozenda, 1983). Indeed, the values of Shannon-Weaver index of pitfall traps ($2.14 \leq H' \leq 2.98$) are lower than those of sweeping net ($3.10 \leq H' \leq 3.78$). According to Roth (1963), the sweeping net is a very special capturing method which usually the results much differ qualitatively from those of other traps. However, the fauna inventoried by sweeping net tends towards equilibrium ($0.63 \leq J' \leq 0.71$) which reflects a trend towards an equitable distribution between the individuals number of arthropods. Contrary, there is a tendency towards dominance in pitfalls, in site 1 ($J' = 0.40$) and site 2 ($J' = 0.43$), for some families including Entomobryidae and Formicidae, inversely to what was observed on the high plains of the Algeria (500 km North of Ouargla) (Bragueu-Bouragba *et al.*, 2006; Souttou *et al.*, 2011).

The richness arthropods listed in three parcels are proportional inversely correlated to the age of the lucerne fields. Indeed, the lucerne from one year attracts more families of arthropods (S = 66 families), while that of three years contains the lowest richness (S = 52 fam.). Unlike the number of individual who is continuously increasing with the age of the lucerne fields, ranging from that of a year (IN = 1,729) to that of three years (IN = 4,947) which refers to specialization and settlement of some arthropods. Some invertebrates, insects in particular are extremely mobile and occupy a habitat that transiently, while others, may be sedentary, have a reduced habitat but they play an important roles in the ecology of this area (Southwood *et al.*, 1979 ; Erwin, 1982 ; Siemann, 1998 ; Tingle, 2002 ; Hossain, 2010).

Formicidae is the most sampled. The recorded values are growing depending the age of the lucerne fields from 559 individuals in that of one year, then almost double in two years (IN = 1,011) to quadruple in three years (IN = 2,251). Indeed, most ants (*Messor*, *Camponotus* and *Pheidole*) have a sedentary lifestyle and their prosperity is conditioned by the environment stability (Cagniant, 1973). In the same for Entomobryidae, we recorded a growth in the individuals number ranging from lucerne fields of 1 year (IN = 398) to 3 years (IN = 1,127), despite that the one year is irrigated by flooding, that normally constitutes a good factor of dispersion of the Collembola which increases their chance of being trapped (Bachelier, 1978). These results can be justified by the fact that different sampling methods were applied outside the irrigation periods.

CONCLUSIONS

These results to give account to the reaction of each insect family (for their ease of capture) to the two types of traps placed in some lucerne fields. Indeed, Formicidae and Entomobryidae were more captured by the pitfall traps. While Coccinellidae and Jassidae were most inventoried by sweeping net. It should be said that they are a complementary methods. However, the families richness sampled in three parcels reveal a decrease depending on the age of the lucerne fields. However, the individuals numbers having amplification depending on the age. Sustainability of lucerne, sober culture inputs, which plays an essential role in maintaining the structure and the creation of natural soil fertility especially when it comes to poor soils of the Saharan regions, should certainly encourage farmers in these areas to opt for this culture.

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(Received 3 December 2014, revised 1 January 2015)