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SPIDER COMMUNITIES (ARTHROPODA, ARANEAE) IN DIFFERENT PINE FORESTS OF ZÉRALDA GAME RESERVE (ALGIERS, ALGERIA): TAXONOMY AND BIODIVERSITY

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RÉSUMÉ.— *Communautés d'araignées* (Arthropoda, Araneae) *dans différentes forêts de pins de la réserve de chasse de Zéralda (Alger, Algérie) : taxinomie et biodiversité*.— La réserve de chasse de Zéralda est située dans le nord de l'Algérie, à environ 30 km à l'ouest d'Alger. Elle couvre une superficie de 1078 ha dont 460 ha sont principalement une forêt naturelle de *Pinus halepensis*, et des plantations de *Pinus pinea* et *Pinus canariensis*. Ces différents biotopes sont favorables à la présence de différentes faunes en général et de la faune du sol en particulier. L'échantillonnage a été effectué en utilisant des pièges Barber. Au total, 48 espèces d'araignées ont été collectées, appartenant à 33 genres et à 17 familles. Les résultats n'ont montré aucune différence dans la richesse des espèces entre les trois types de forêts, mais en ont montré d'une part entre les forêts fermées et celles ouvertes, et d'autre part entre les formations selon qu'elles sont pures ou mixtes. Les facteurs abiotiques comme l'humidité du sol, le pH et la couverture végétale ont un impact sur certaines espèces. Les sites ouverts avec une couverture herbacée dense sont les plus riches et les plus diversifiés. Ils présentent les niches écologiques favorables pour les espèces les plus rares en particulier.

SUMMARY.— The game reserve of Zéralda located in northern Algeria, at about 30 km West of Algiers, covers an area of 1078 ha of which 460 ha are mainly *Pinus halepensis* natural forest, with planted stands of *Pinus pinea* and *Pinus canariensis*. This mixed forest is favourable to the invertebrate fauna in general and the soil fauna in particular. The sampling was done using pitfalls traps. A total of 48 spider species were collected, belonging to 33 genera and 17 families. The results showed no difference in species richness between the three forest types but there were differences between closed and open forests on the one hand and between pure and mixed forests on the other. Abiotic factors such as soil humidity, pH as well as vegetation cover had an impact on some species. Open sites with dense herbaceous cover are the richest and the most diverse and provided favourable ecological niches for the rarest species.

Game reserves are controlled areas in which the fauna remains under control of the state. The fauna and the flora are protected to ensure the conservation of their biodiversity. In Algeria, four game reserves have been set up: (1) Mascara (north-west), (2) Tlemcen (north-west), (3) Djelfa (north-centre), and (4) Zéralda (suburb of Algiers). These areas are managed so as to follow planned activities in space and in time. The Zéralda game reserve is a presidential, not a public site. However, several limited hunting activities are developed to protect animals threatened with extinction such as the Barbary deer (*Cervus elaphus barbarus*, Benett, 1833).

Many ecological studies on pine forests have been undertaken in Algeria. The most recent are: Kadik, 2012; Achoubi-Kadik *et al*., 2014; Dahmani-Megrerouche *et al*., 2014 and Brakchi-Ouakour *et al*., 2015. Although several studies deal with Araneae, due to their great diversity and their ecological importance in woodlands (Docherty & Leather, 1997; Oxbrough *et al*., 2005; Valverde & Lobo, 2006, Pearce & Venier, 2006), only a few have been carried out in Algeria (Abrous-Kherbouche *et al.*, 1997; Kherbouche-Abrous, 2006) and only one in the game reserve of Zéralda in particular, focusing on agrosystems spiders (Chaib *et al*., 2016). The present study aims to identify the spider communities in this natural and protected area and to investigate the impact of some abiotic factors, especially pine species, on the distribution of the different populations, as most spiders are limited to a certain extent by environmental conditions. Different species have varying humidity and temperatures preferences and are limited to those parts of the habitat which offer a microclimate within the range of their physiological tolerances. We also determined the most important species in this ecosystem, given the importance of spiders as invertebrate predators and their potential to control certain insect populations.

MATERIAL AND METHODS

STUDY SITE

Zéralda game reserve is located in northern Algeria, at about 30 km west of Algiers and 2 km from the Mediterranean Sea (36° 41' 53.55"N - 2° 51'44.60" E) (Fig. 1). It covers an area of 1078 ha, of which 460 ha are Pine forests. *Pinus halepensis* is the dominant species covering 218 ha (21.13 %) of the total area. The other associated species are *Pinus pinea*, *Pinus canariensis, Quercus coccifera*, *Ceratonia siliqua*, *Cupressus sempervirens*, *Populus* sp., *Eucalyptus* sp., *Olea europea* and *Pistachia lentiscus.*

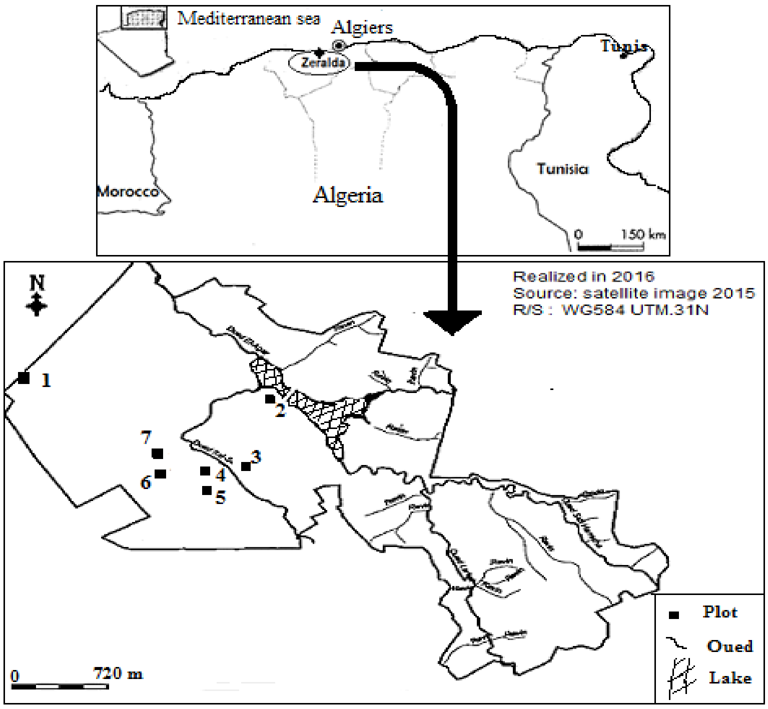

Figure 1.— Location of the game reserve of Zéralda(study area) and the sampling sites (1-7) in the west of Algiers in northern Algeria.

Seven plots (Z1-Z7) of about 50 m^2 each were selected differing in their vegetation structure, vegetation cover and other parameters such as altitude, litter composition and thickness (Tab. I). Three plots (Z1, Z2 and Z6) are natural forest of *Pinus halepensis*. Z4 is a dense planted *Pinus canariensis* forest, and Z7 plot is an old and closed *Pinus pinea* forest. The plots Z3 and Z5 are dominated by *Pinus halepensis* associated with *Olea europaea*, some *Pistachia lentiscus* and *Quercus coccifera* trees (Tab. I).

SOIL ANALYSIS

Soil granulometry was performed using a Robinson pipette. The pH and Electrical Conductivity (EC) were measured from soil suspensions with soil-water ratios of up to 1/5. Soil moisture was calculated as the difference in weight between air dried soil and after having been heated at 105°C. Total calcium carbonate was calculated using the Bernard calcimeter and organic matter was quantified by the Walkley-Black method (Bonneau & Souchier, 1979). Soil parameters were analysed in spring and in summer as this is the period of maximum activity of the soil fauna.

TABLE I

Characteristics of the different chosen sampling plots

Characteristics	Sampling sites						
	Z1	Z2	Z3	Z4	Z5	Z6	Z7
Latitude	36°42’47 "N	36°42’44"N	36°42’11"N	36°42’10" N	36°42’09 "N	36°42’10"N	36°42’12" N
Longitude	02°51’15"E	02°52’30"E	02°52’2 "E	02°52’13"E	02°52’13"E	02°52’02"E	02°52’02"E
Altitude (m)	83	54	118	109	109	83	83
Physionomy	Homogeneous forest	Homogeneous forest	Heterogeneous forest	Homogeneous forest	Heterogeneous forest	Homogeneous forest	Homogeneous forest
Dominant species	*Pinus halepensis*	*Pinus halepensis*	*Pinus halepensis*	*Pinus canariensis*	*Pinus halepensis*	*Pinus halepensis*	*Pinus pinea*
Litter thickness	thick	thin	thin	very thick	thick	thin	very thick
Litter composition	Needles of *Pinus halepensis*, and leaves of *Elymus repens.*	Twigs, few needles and cones of *Pinus halepensis*	Mixture of *Olea europaea*, *Pinus halepensis*, *Pistachia lentiscus* leaves.	Needles and cones of *Pinus canariensis*	*Pinus halepensis* needles, branches and *Olea europeae* leaves	Branches, needles and cones of *Pinus halepensis.*	Branches, needles and cones of *Pinus pinea.*
Short description	Pure stand of *Pinus halepensis* (fairly closed forest)	Pure stand of *Pinus halepensis* (open forest)	Clear forest of *Pinus halepensis* *Olea europea* and some *Pistachia lentiscus*	Dense stand of *Pinus canariensis* (closed forest)	Clear forest of *Pinus halepensis*, Olea europeae and *Quercus coccifera*	Old stand of *Pinus halepensis* (open forest).	Old and pure stand of *Pinus pinea* (closed forest).
Trees cover (%)	55	30	25	85	25	30	70
Herbaceous cover (%)	50	97	35	40	75	65	45.00

SAMPLING METHODS

In order to study the spider communities, pitfalls traps were used (Barber, 1931) as an effective sampling technique to determine the relative abundance and the species richness of epigeal spiders (Adis, 1979; Patrick & Hansen, 2013). A disadvantage of using Pitfall traps was discussed in Luff (1975), Topping & Suderland (1992), Melbourne (1999) and Lang (2000) assessing their underestimating species with low population densities. A detailed analysis of the advantages and disadvantages of the pitfall trapping method for characterising spider communities was discussed in De Baker *et al.* (2000). According to Gurdebeke & Maelfait (2002) pitfall trapping is the right solution to catch large number of specimen in a short period of time. It is not labour-intensive and it is inexpensive. Next to this the plastic bottle with funnel allows the invertebrates to fall in but it is difficult for them to get out and it is the best one used in areas with more arid conditions (pers. comm.).

In each plot, five traps were placed at least 1 m intervals from each other. This number of pitfall traps is considered to be sufficient to catch all locally reproducing species in a community (Maelfait & Baert, 1975; Adis, 1979; Alderweirldt, 1989; Desender, 1996; Gotelli & Colwell, 2001; Gurdebeke & Maelfait, 2002). The trap consists of PET plastic bottle (diameter 8 cm, height 18 cm) with a cut-off top. This top was used as a funnel (diameter 2.5 cm) in the plastic bottle. The top of the trap was levelled with the soil surface, with no gaps along the side of the trap into which invertebrates could fall. The traps were 1/3 filled with a formaldehyde solution (4%) as fixative containing some detergent to reduce surface tension. (Benkhelil, 1991; Gurdebeke & Maelfait, 2002). The traps were emptied monthly during two complete years (2013-2015).

After sorting, spiders were preserved in 70% alcohol and identified in the laboratory under a Stereomicroscope (Optika SZM-1), using the appropriate determination keys and taxonomic books: Beladjal & Bosmans (1997), Bosmans (1985a, b, 1986, 1994, 1997, 2006), Bosmans & Abrous (1990, 1992), Bosmans & Beladjal (1988, 1989, 1991), Bosmans & Bouragba (1992), Bosmans & Chergui (1993), Bosmans & Van Keer (1999), Grimm (1985), Heimer & Nentwig (1991), Ledoux & Canard (1981), Jocqué (1991) and Spider World Catalog (2017).

DIVERSITY INDEX AND MULTIVARIATE ANALYSIS

Spider diversity in each plot was estimated using the Shannon-Weaver index H′ (Wolda, 1983) $H' = -\sum_{i=1}^{R} pilnpi$, where p_i is the proportion of individuals belonging to the i^{th} species in the dataset of interest.

Evenness was calculated as $E = \frac{H'}{lnS}$, where S = species richness. In order to study the relationship between several groups of variables affecting the same individual (Nzobounsana & Gaymard, 2010).

Principal Component Analysis (PCA) and Canonical Correspondence Analysis (CCA) were carried out using XLSTAT software (version 4.01, 2015).

STATISTICAL ANALYSIS

The statistical analysis was performed using Statistica software package (Statsoft, 2013 version 12). Pearson's chi-squared test was used as a non-parametric analysis. $P < 0.05$ was considered as a significant level and $P < 0.001$ as a very highly significant one.

RESULTS AND DISCUSSION

SOIL ANALYSIS

The soil analysis data are summarized in Tables I & II. The analysis revealed a loam clay soil in three plots: Z2, Z3 and Z5, clay-loam one in the Z6 site, sandy loam in Z1 and Z4 plots and loam soil in plot Z7 (Tab. II). Differences in the soil moisture content can be explained by the fact that water is more easily retained in a clay loam soil than in a loamy one (Bachelier, 1978).

TABLE II

Soil characteristics

Characteristics	Sampling sites						
	Z1	Z2	Z3	Z4	Z5	Z6	Z7
Texture	Sandy loam	Loam clay	Loam clay	Sandy loam	Loam clay	Clay loam	Loam
Total limestone $CaCO_3$ (%)	0.75	0.75	0.75	0.75	0.75	1.13	1.13
pH	6.71	7.32	7.24	7.22	8.55	6.7	7.07
Conductivity mmhos/cm	0.1	0.32	0.1	0.06	0.11	0.22	0.13
Organic matter (%)	4.3	8.6	5.85	2.32	6.88	8.77	7.4
Humidity (%)	1.8	6.6	1.8	1.4	2	1	3

The low soil moisture in Z6 is due to its vegetation structure. The site is an open area where the sun in combination with the wind dries out the ground (Otto, 1998). However, the soil in the dense and closed Z7 (trees covers 70 % of the area) retains more water (Tabs I & II). In general, the soil of the study area is neither calcareous nor saline and high in organic matter. The plot Z5 was alkaline, the others were neutral (Tab. II). Forest soils are poorly processed, which results in stratification and a significant accumulation of organic matter (Servant, 1975; Soltner, 1982; Baize, 2000; Ranger *et al.*, 2000).

SPECIES RICHNESS AND RELATIVE ABUNDANCE

A total of 1215 adult spiders were sampled, belonging to 17 families, 33 genera and 48 species. (cf. Appendix). Plot Z2 had the highest abundance (347 individuals). The area is an open and pure *Pinus halepensis* forest with well-spaced trees and a tall herbaceous cover. The Nemesiidae was the most abundant family (28.81 %), followed by the Dysderidae (25.27 %) and the Gnaphosidae (18.85 %) (Fig. 2). *Nemesia* sp.2 was the most abundant species, followed by *Zelotes poecilochroaeformis, Dysdera crocata, Nemesia* sp.1 and several rare species such as *Lycosoides leprieuri, Harpactea metidjae, Nemesia* sp. 3*, Icius hamatus, Xysticus nubilus, Zodarion algiricum* (Fig. 3).

SPECIES RICHNESS AND DIVERSITY:

During the sampling period, a total of 48 species were collected with an average of 16.43 ± 2.21 species per plot. The Gnaphosidae and the Linyphiidae were the richest families with 9 and 7 species respectively (cf. Appendix). Ganphosidae are free-living nocturnal hunters while linyphiids are sheet-web builders.

The plot Z5 was the richest in species (S = 25) followed by Z2 (S = 24), Z1 was the poorest one (10 species) (Table III). Z5 is an open *Pinus halepensis* forest mixed with young *Olea europea*, some *Pistachia lentiscus* and abundant *Oxalis pescapraeas* and other herbaceous plant growing mostly in spring. No significant difference was found in the species richness between the different pine forests (*Pinus halepensis*, *Pinus canariensis* and *Pinus pinea*). This result is in accordance with Barsoum *et al*. (2014) who observed that the forest type has a weak effect on spider and beetle species richness, with no significant differences in mixed stands compared with monocultures.

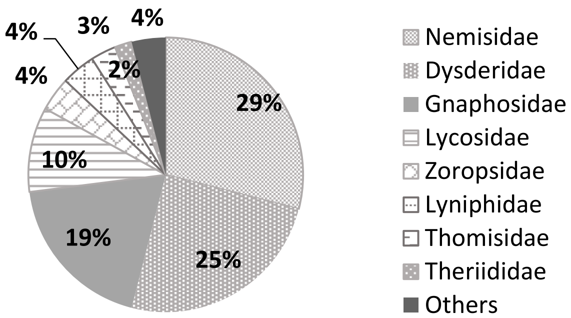

Figure 2.— Relative abundance (%) of the different sampled Araneae families.

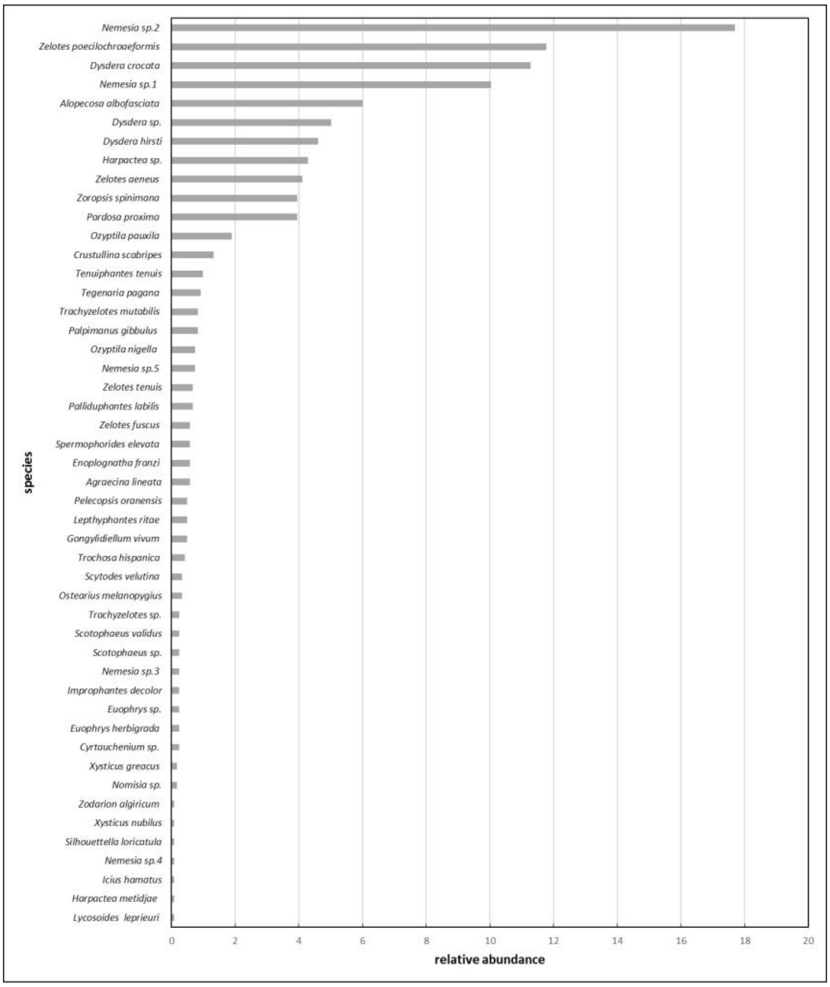

Figure 3.— Relative abundance (%) in descending order of the collected Araneae species.

TABLE III

Abundance, species richness (S), diversity (H'), maximal diversity (H_{max}) and evenness (E) by sites

Index	Sampling sites						
	Z1	Z2	Z3	Z4	Z5	Z6	Z7
Abundance	132	347	151	97	166	93	227
Species richness (S)	**10**	24	13	12	**25**	15	16
Diversity (H')	**1.86**	3.79	3.32	3.31	**4.12**	3.41	3.12
Maximal Diversity (H_{max})	3.32	4.58	3.7	3.58	4.64	3.91	4
Eveness (E)	0.56	0.83	0.9	0.92	0.89	0.87	0.78

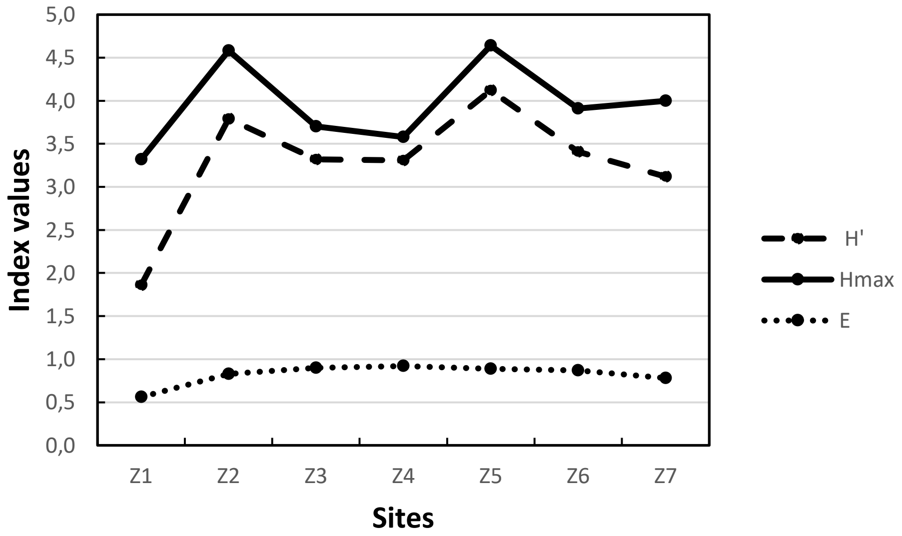

Figure 4.— Diversity (H'), maximal diversity (H_{max}) and Evenness (E) of the different sampling plots in the game reserve of Zeralda (Algeria).

Spider species richness shows a significant difference between closed forests and open ones ($\chi^2 = 78.45$, df = 6, $p < 0.05$), open pinewoods being the richest biotopes. The difference between homogenous and heterogeneous *Pinus halepensis* forests was highly significant ($\chi^2 = 91.44$, df = 6, $p < 0.01$) with the mixed forest the richest (Tab. III). The heterogenous associated vegetation provides more ecological niches and offers more prey for the spider community (Greenberg & McGrane, 1996). It also has greater herbaceous cover which allows spiders to build different forms of webs. A mixed tree composition is frequently proposed as a way to increase habitat heterogeneity and support greater biodiversity in forests (Barsoum *et al.*, 2014). This increased habitat heterogeneity might provide additional habitats for rare species to coexist (Apigian *et al.*, 2006).

Plot Z5 also had the highest diversity value (H' = 4.12 bits) which is very close to H_{max} (4.64). Diversity values for the other sites were similar except for Z1 (H' = 1.86 bits) (Tab. III, Fig. 4). According to N'Zala *et al.* (1997), Akpo *et al.* (1999) and Dajoz (2006), a high vegetation diversity index indicates a greater equality of individual species contribution to the plant cover; therefore, heterogeneity is provided by vegetation. Besides having the lowest diversity, Z1 has also the lowest species richness (Tab. III). According to Ramade (2009), the Shannon-Weaver diversity index (H') varies directly with the number of species (S) and rare species have a much lower influence on the index than common ones.

The evenness (E) approaches 1 for almost all plots except for Z1 (Tab. III). Equitability is achieved when all species have an equal distribution indicating that the ecological space is full (Barbault, 1981). The environment provides conditions for the well-adapted species. There is no dominant species and the competition for food is balanced. More populations are diverse and balanced when more individuals are present (Le Loc'h, 2004). The spider community in Z1 is unbalanced (E = 0.56) and there is only one dominant species, *Nemesia* sp.2 (Tab. III).

Principal Component Analysis (PCA)

The PCA analysis results are represented on Figure 5.

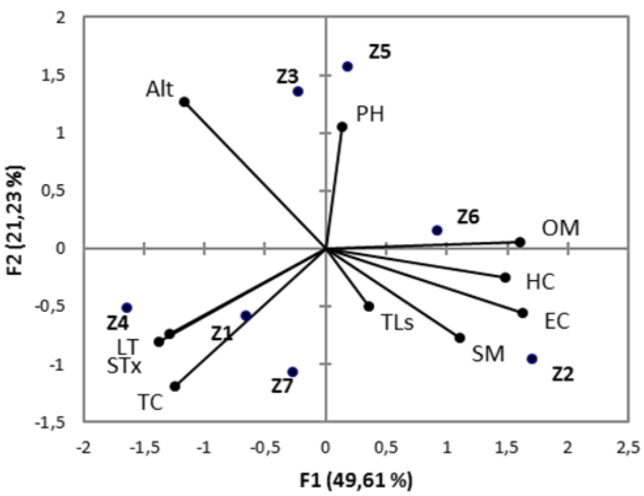

Figure 5.— Ordination of the station-parameter groups according to the first two axes of the PCA (TC: tree cover, HC: herbaceous cover, OM: organic matter, TLs: total limestone, EC: electric conductivity, Alt: Altitude, STx: soil texture, LT: litter thickness, SM: soil moisture, pH: potential hydrogen).

According to axis 1 (49.61 % inertia rate), two opposing groups were found; in the negative part, Z1 and Z4 plots and in the positive part Z2 and Z6. The first two groups (Z1 and Z4) are associated with poor litter, dense tree cover and poor organic matter compared to other plots. This difference is mainly due to the sandy nature of the soil (Rapp, 1984). Plots Z2 and Z6 are rich in organic matter with a high herbaceous cover and higher electrical conductivity (EC). The first axis separates open from closed forests. The second axis (21.23 % inertia rate) separates plots differently, Z7 is on the negative part while Z3 and Z5 are in the positive part, reflecting differences in soil pH and altitude. This axis shows the correlation between altitude and the location of the sampled sites in the game reserve.

Salinity, expressed as the Electrical Conductivity (EC), is positively correlated with quantity of organic matter (r = 0.787) (Tab. IV). Salinity reduces microbial activity and hence degradation of organic matter. It reduces the rate of formation of polymeric humus compounds (Mallouhi, 1989), thus resulting in the accumulation of organic matter on the superficial horizons of the soil. Soil moisture also tends to be highly correlated with increasing salinity (Hiouani & Bensaid, 2009) (r = 0.748).

Litter was more abundant when plant coverage was high (r = 0.863) (Tab. IV) because there is more input of plant matter to the surface of the soil under dense cover than sparse cover (Sabir *et al*., 1996). The soil of coniferous forests is known for its slow decomposition rate (Kadik, 2012).

TABLE IV

Pearson's correlation matrix of soil parameters

Variables	Total limestone	pH	Electrical conductivity	Organic matter	Soil moisture	Altitude	Litter thickness	Soil texture	Tree cover	Herbaceous cover
Total limestone	**1**									
pH	-0.410	**1**								
Electrical Conductivity	0.200	-0.133	**1**							
Organic matter	0.519	0.064	**0.787**	**1**						
Soil moisture	-0.185	0.111	0.748	0.451	**1**					
Altitude	-0.256	0.365	**-0.833**	-0.549	-0.735	**1**				
Litter thickness	-0.035	0.067	-0.537	-0.660	-0.156	0.212	**1**			
Soil texture	-0.344	-0.190	-0.593	**-0.836**	-0.128	0.125	**0.767**	**1**		
Tree cover	0.093	-0.433	-0.451	-0.677	-0.187	0.011	**0.863**	**0.850**	**1**	
Herbaceous cover	-0.198	0.284	0.705	0.338	0.634	-0.590	-0.048	-0.246	-0.206	**1**

Values in boldface show significant level at 5%

CANONICAL CORRESPONDENCE ANALYSIS (CCA)

In this analysis, the number of the explanatory variables was too large compared to the size of the data matrix. Some explanatory variables showed high levels of auto-correlation. Although Akossou & Palm (2005) suggest that the elimination of one or several explanatory variables to reduce the multi-co-linearity is most widely adopted. Borcard (1997) states that it is preferable to examine the correlations between all explanatory variables and to decide on which biological criteria are the least essential. In the present work, we chose to keep only the most biologically relevant and the most interpretable variables, bearing in mind that the others are not necessarily irrelevant.

Figure 6 shows the formation of 4 species-stations-parameters groups of biotopes:

(1) Positive part of axis 1: 14 species were associated with the Z5 plot. All these species are rare (infrequently encountered in North Africa in general and in Algeria in particular) the most notable ones being: *Dysdera hirsti, Zelotes tenuis, Ozyptila nigella, Gongylidiellum vivum* and *Enoplognatha franzi*. The plot is an open forest edge area, characterized by a basic pH. The edges are richer in plant and animal diversity than the forest environment (Alignier & Deconchat, 2011).

(2) Negative part of axis 1: Plots Z1 and Z7 were characterized by a neutral pH. The tree cover with low grass cover and high accumulation of litter often reduces biodiversity (Ranger *et al*., 2000). *Agraecina lineata, Silhouettella loricatula* and *Spermophorides elevata* are linked to Z7, a *Pinus pinea* forest with a loam soil. *Nemesia* sp.2 is more abundant in Z1, a *Pinus halepensis* forest with a sandy loam soil.

(3) Positive part of axis 2: *Zelotes poecilochroaeformis*, *Dysdera crocata*, *Dysdera* sp. and *Scotophaeus validus* were more sensitive to altitude and low soil moisture which were the characteristics of plots Z3 and Z4. *Trochosa hispanica*, *Improphantes decolor* and *Pelecopsis oranensis* were sampled only in Z6, which is characterised by a high level of organic matter and total calcium compared to the other plots. The rest of the species are common to Z3, Z4 and Z6 plots.

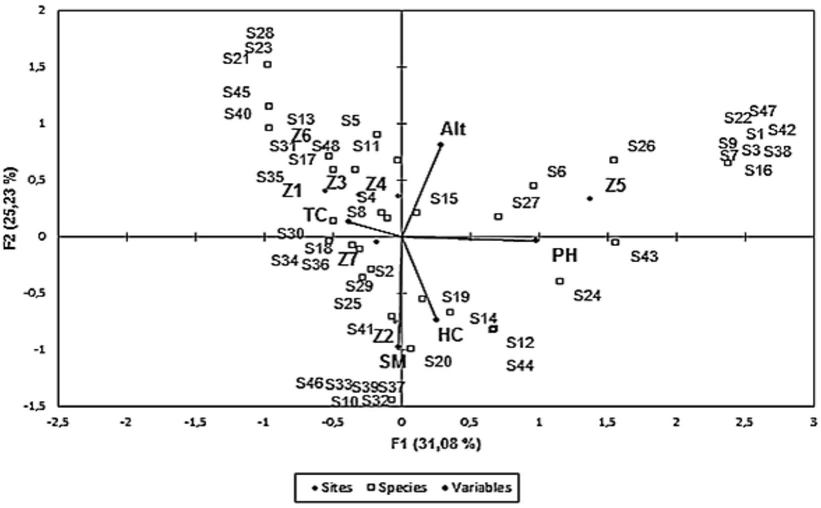

Figure 6.— Ordination of the different species groups according to the CCA axes 1 & 2 (TC: tree cover, HC: herbaceous cover, Alt: Altitude, SM: soil moisture, pH: potential hydrogen).

(4) Negative part of axis 2: Z2 is located at the lowest altitude, with the most abundant species: *Alopecosa albofasciata*, *Pardosa proxima* (Lycosidae) and *Nemesia* sp.1, *Nemesia* sp.5 (Nemesiidae). These two families represent more than 2/3 of all the species sampled in this plot, followed by *Trachyzelotes mutabilis, Zelotes aeneus* (Gnaphosidae), *Ozyptila pauxila* (Thomisidae) and *Crustulina scabripes* (Theridiidae). However, *Scotophaeus* sp., *Nemesia* sp.4, *Euophrys herbigrada*, *Icieus hamatus* and *Xysticus nubilus*, all considered as rare species, were only sampled in Z2.

The location of Z2 near a lake offers the best ecological conditions in terms of soil moisture, herbaceous cover and organic matter, making it favourable to most spiders. These beneficial effects are mainly due to the soil enrichment (water balance and fertility) (Akpo, 1998).

CONCLUSION

No difference has been found between the species richness in the three different pine forests (*Pinus halepensis*, *Pinus canariensis* and *Pinus pinea*). Open and mixed pinewoods are richer biotopes for spiders than the closed and single-species woods. This has an impact on species abundance and hence on predator-prey relationship.

Our results do not agree with the perception that a mixture of dominant tree species is beneficial to forest spider diversity. Because the relationship between tree composition and spider species diversity is very indirect, it is unlikely that there actually is an “optimum” mixture of trees. Further research, based on a more thorough survey not merely using pitfall trap catches for sampling, is required to determine the optimum mixtures of tree required to influence the arthropod fauna.

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APPENDIX

Density of spider species in each site collected during the sampling period

Families	Species	Sampling sites							Total
		Z1	Z2	Z3	Z4	Z5	Z6	Z7	
Agelenidae	*Lycosoides leprieuri* Simon, 1875)	0	0	0	0	1	0	0	1
	Tegenaria pagana Koch, 1840	0	4	7	0	0	0	0	11
Cyrtaucheniidae	*Cyrtauchenium* sp.	0	0	0	0	3	0	0	3
Dysderidae	*Dysdera crocata* Koch, 1838	8	26	29	20	13	10	31	137
	Dysdera sp.	0	0	22	16	7	16	0	61
	Dysdera hirsti Denis, 1945	0	1	0	10	26	3	16	56
	Harpactea metidjae Bosmans & Beladjal, 1991	0	0	0	0	1	0	0	1
	Harpactea sp.	3	13	4	3	6	13	10	52
Gnaphosidae	*Nomesia* sp.	0	0	0	0	2	0	0	2
	Scotophaeus sp.	0	3	0	0	0	0	0	3
	Scotophaeus validus (Lucas, 1846)	0	0	0	3	0	0	0	3
	Trachyzelotes mutabilis (Simon, 1878)	0	7	0	0	3	0	0	10
	Trachyzelotes sp.	0	0	3	0	0	0	0	3
	Zelotes aeneus (Simon, 1878)	0	29	4	0	10	0	7	50
	Zelotes poecilochroaeformis Denis, 1937	3	16	23	7	26	13	55	143
	Zelotes tenuis (Koch, 1866)	0	0	0	0	8	0	0	8
	Zelotes fuscus (Thorell, 1875)	0	0	6	0	0	0	1	7
Liocranidae	*Agraecina lineata* (Simon, 1878)	0	0	0	0	0	0	7	7
Lycosidae	*Alopecosa albofasciata* (Brullé, 1832)	0	42	10	4	10	3	4	73
	Pardosa proxima (Koch, 1848)	0	38	0	6	3	1	0	48
	Trochosa hispanica Simon, 1870	0	0	0	0	0	5	0	5
Lyniphiidae	*Gongylidiellum vivum* (Cambridge, 1875)	0	0	0	0	6	0	0	6
	Improphantes decolor (Westring, 1861)	0	0	0	0	0	3	0	3
	Lepthyphantes ritae Bosmans, 1985	0	3	0	0	3	0	0	6
	Tenuiphantes tenuis (Blackwall, 1852)	3	6	0	3	0	0	0	12
	Ostearius melanopygius (Cambridge, 1879)	1	0	0	0	3	0	0	4
	Palliduphantes labilis (Simon, 1913)	0	0	0	0	3	0	5	8
	Pelecopsis oranensis (Simon, 1884)	0	0	0	0	0	6	0	6
Nemisidae	*Nemesia* sp. 1	20	46	13	9	5	0	29	122
	Nemesia sp. 2	86	59	20	0	0	1	49	215

	Nemesia sp. 3	0	0	3	0	0	0	0	3
	Nemesia sp. 4	0	1	0	0	0	0	0	1
	Nemesia sp. 5	0	9	0	0	0	0	0	9
Oonopidae	*Silhouettella loricatula* (Roewer, 1942)	0	0	0	0	0	0	1	1
Palpimanidae	*Palpimanus gibbulus* Dufour, 1820	0	3	0	0	0	4	3	10
Pholcidae	*Spermophorides elevata* (Simon, 1873)	0	0	0	0	0	0	7	7
Salticidae	*Euophrys herbigrada* (Simon, 1871)	0	3	0	0	0	0	0	3
	Euophrys sp.	0	0	0	0	3	0	0	3
	Icius hamatus (Koch, 1846)	0	1	0	0	0	0	0	1
Scytodidae	*Scytodes velutina* Heineken & Lowe, 1832	3	0	0	0	0	1	0	4
Theriididae	*Crustulina scabripes* Simon, 1881	0	10	0	5	0	0	1	16
	Enoplognatha franzi Wunderlich, 1995	0	0	0	0	7	0	0	7
Thomisidae	*Ozyptila nigella* Simon, 1875	0	3	0	0	6	0	0	9
	Ozyptila pauxila (Simon, 1870)	0	16	0	0	7	0	0	23
	Xysticus graecus Koch, 1837	1	0	0	0	0	1	0	2
	Xysticus nubilus Simon, 1875	0	1	0	0	0	0	0	1
Zodaridae	*Zodarion algiricum* (Lucas, 1846)	0	0	0	0	1	0	0	1
Zoropsidae	*Zoropsis spinimana* (Dufour, 1820)	6	7	7	11	3	13	1	48
		134	**347**	**151**	**97**	**166**	**93**	**227**	**1215**