

DISTRIBUTION OF THE ARANEIDES FAUNA ACCORDING TO VEGETATION AND ALTITUDE IN TEBESSA REGION (EXTREME EAST OF ALGERIA)

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Abstract. The spider fauna is the subject of a bioecological study according to the vegetation cover and the altitude in the region of Tébessa, which is located at the East of Algeria. A total of 347 individual belonging to 18 families are enumerated, 14 families at El Merdja and 11 families at Ain Fodda. The families Gnaphosidae, Lycosidae and Salticidae are very abundant at El Merdja and the most diversified, while Gnaphosidae is the dominant family in Ain Fodda. The peak abundance of this fauna is found in April at El Merdja and in May at Ain Fodda which is due to the abundance of Gnaphosidae during these months, in both stations. The results showed a decreasing evolution of the diversity according to the altitude, accompanied by a high abundance of the tolerant fauna whereas the prairial vegetation allows the appearance of a great richness within this fauna.

Keywords: spider families, Tebessa, diversity, abundance, dominance.

Rezumat. Distribuția faunei de araneide în funcție de vegetație și altitudine în regiunea Tebessa (Estul extrem al Algeriei). Fauna arahnidelor face subiectul unui studiu bioecologic în funcție de acoperirea cu vegetație și de altitudine, în regiunea Tébessa, din estul Algeriei. Sunt enumerate în total 347 de exemplare din 18 familii, 14 în El Merdja și 11 în Aid Fodda. Familiile Gnaphosidae, Lycosidae și Salticidae sunt foarte abundente în El Merdja și sunt cele mai diversificate, în timp ce familia dominantă în Ain Fodda este Gnaphosidae. Abundența maximă a acestei faune se înregistrează în luna aprilie în El Merdja și în luna mai în Ain Fodda, ceea ce se datorează abundenței Gnaphosidae în aceste luni în ambele stații. Rezultatele au prezentat o evoluție descrescătoare a diversității în funcție de altitudine, însoțită de o abundență ridicată a faunei tolerante, în timp ce vegetația de prerie permite apariția unei bogății semnificative la nivelul acestei faune.

Cuvinte cheie: familii de arahnide, Tebessa, diversitate, abundență, dominanță.

INTRODUCTION

As generalist predators, spiders colonize all habitat types, although they are more diverse and abundant in natural environments (NYFFELER, 2000). Present in many terrestrial biotopes, spiders are represented by many species whose stands are indicative of precise ecological conditions (POZZI et al., 1998). Their sensitivity to changes in environmental structures have made these animals fine indicators of habitat evolution (DERRON & BLANDENIER, 2002). Habitat structure and, more precisely, vegetation complexity, has been consistently recognized as one of the most important factors in determining the presence of spider species, as well as their species richness and composition (BALFOUR & RYPSTRA, 1998), to the point where some authors have been able to propose methods of ecological classifications of natural habitats, based solely on the diversity of spiders (SCHIRMEL & BUCHHOLS, 2011). JOGAR et al. (2004) found that spider abundance is correlated with specific vegetation, suggesting that habitat availability is important for settlement and colonization of spiders. The oldest works on the Araneological fauna in Algeria are those of SIMON (1914, 1929, 1937), followed by those of Bosmans in collaboration with several Algerian researchers such as BOSMANS & BELADJAL (1988, 1989) in the park of Chrea; BOSMANS & ABROUS (1990); BOSMANS & BOURAGBA (1992) in the Algerian Atlas; BOSMANS & DESMET (1993). Later, BRAGUE-BOURAGBA et al. (2007) BRAGUE-BOURAGBA (2007) and (BOURAGBA et al. (2016) at Djelfa, KHERBOUCHE-ABROUS (2006), MANSOURI et al. (2013) at Algiers, and many others.

Research in this subject is non-existent in the east of Algeria, that's why we are interested in this work, which aims to complete the inventory of this fauna and to know the spatio-temporal evolution of this fauna in the study area.

MATERIALS AND METHODS

The region of Tébessa is located in the far east of the country on the highlands, it is coordinated 35° 29'N., 08° 8'E, it has an area of 13878 km². It is limited by the wilayas of Souk-Ahras in the North, El-Oued in the South, Oum El-Bouaghi and Khenchela in the West and East by the Tunisian territory (Fig. 1). The climate is typically semi-arid continental type (cold winter and hot summer) and the region belongs to the steppe with an agro pastoral vocation Fig. 1.

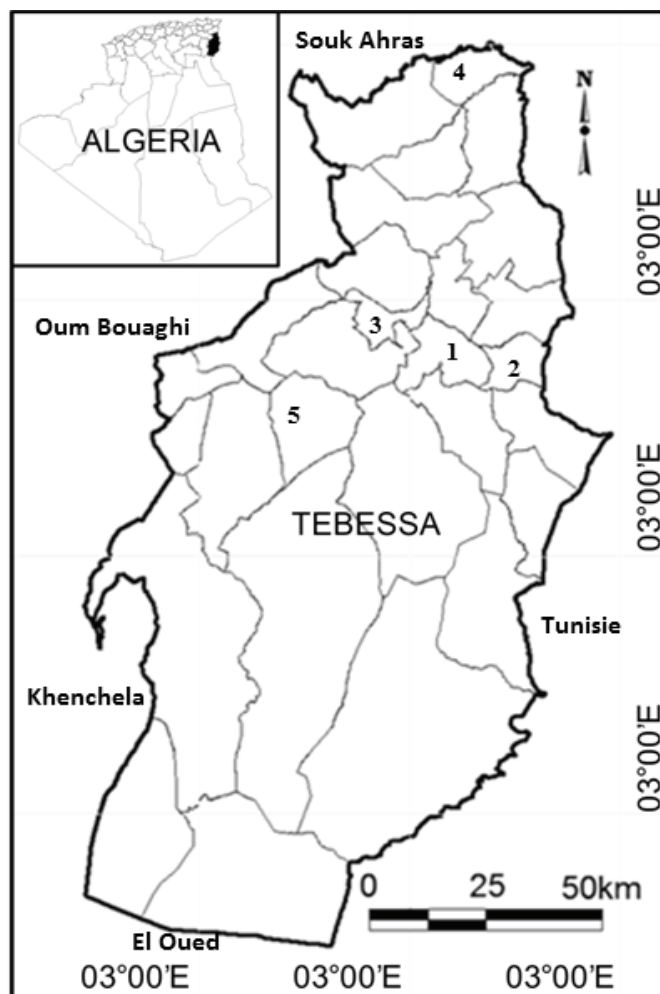


Figure 1. Geographical location of the study area (DJELLAB, 2013).

Based on altitude and vegetation cover, two stations were chosen for this study:

Station 1: El Merdja ($35^{\circ} 24' 52,55'' \text{N}$, $8^{\circ} 08' 00,15'' \text{E}$) is located in the high Tellian Plain area east of Tébessa at 811m altitude. Grassland type, with very varied vegetation, we mainly encounter Boraginaceae (*Borago officinalis* L. 1753), Poaceae (*Hordeum* sp.) and Apiaceae (*Daucus carota* L.1753).

Station 2: Ain Fodda ($35^{\circ} 33' 17, 51'' \text{N}$, $7^{\circ} 49' 00, 40'' \text{E}$) is located in a mountainous area west of Tébessa at 1103m altitude. The vegetation cover is limited to a pine forest (*Pinus halepensis* Mill. 1768) and a very spaced vegetation composed mainly of medicinal plants including lamiaceae (*Rosmarinus officinalis* L.1753 and *Thymus algeriensis* Boiss. & Reut.) and Asteraceae (*Artemisia herba alba* Asso 1779).

The visits take place every fortnight for 5 months. The spiders are harvested using ground traps (Barber) for the soil species, the species at canvas are captured by hand or with a filleting net.

Eight traps are placed at the rate of four per station, under the dominant plants of the study station.

The samples are kept in alcohol at 70° , they are sorted, identified, counted then stored in boxes of the collections. The spider families are determined with a binocular loupe based on identification keys (PERRIER, 1972; HUBERT, 1979; GODET, 1994; JONES et al., 2001) it is pushed to the genera and species for some dominant families.

The results obtained are exploited by ecological indices of composition (specific richness, abundance and relative abundance).

RESULTS

A total of 347 individuals were captured during the study period in the Tébessa region, belonging to 18 families (Table 1).

Table 1. inventory of spider families from Tebessa region during the study period.

Sub Phylum	Class	Order	Sub Order	Families
Chelicerata	Arachnida	Araneae	Araneomorphae	Gnaphosidae Pocock,1889
				Clubionidae wagner, 1887
				Lycosidae Sundevall,1833
				Dysderidae C.L. Koch, 1837
				Salticidae Blackwall,1841
				Thomisidae Sundevall,1833
				Agelenidae C.L. Koch, 1837
				Linyphiidae Blackwall,1859
				Araneidae Clerck,1757
				Pholcidae C.L. Koch, 1850
				Pisauridae Simon,1890
				Theridiidae Sundevall,1833
				Tetragnathidae Menge,1866
				Zodariidae Thorell,1881
Oxyopidae Thorell, 1870				
Oonopidae Simon,1890				
Sicariidae Keyserling, 1880				
Filistidae Ausserer, 1867				

Some families are nocturnal, hunters without a web like Gnaphosidae and Dysteridae, others are diurnal and without web like Thomisidae and Salticidae while others weave webs like Agelenidae and Araneidae. With 14 families, El Merdja is more diversified than Ain Fodda (11 families). Three families of spiders are mainly found at El Merdja where Gnaphosidae with 34,12 % is the dominant family followed by Lycosidae (24,17 %) and Salticidae (17,06 %). The other families are weakly found (Fig. 2).

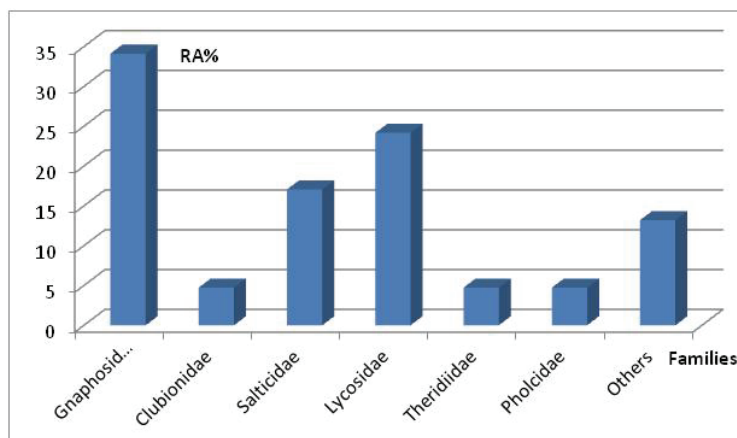


Figure 2. Relative abundance of spider families at El-Merdja station.

At Ain Fodda station, more than 3/4 of the spider population is represented by the family Gnaphosidae (75,73%), while the other families are weakly found (Fig. 3).

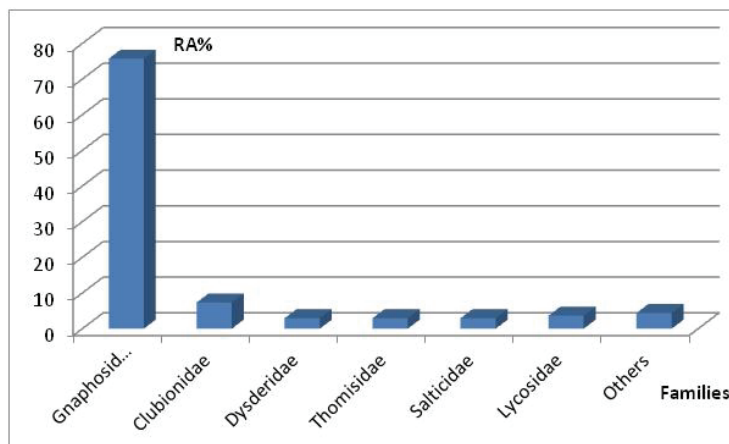


Figure 3. Relative abundance of spider families at Ain Fodda station.

Phenology of the Spider Stan

The distribution of abundance of spider families varies from month to month and from station to another (Table 2).

Table 2. Monthly variations in the abundance of spider families at study stations.

Stations Months Spider families	Ain Fodda					El Merdja				
	March	April	May	June	July	March	April	May	June	July
Gnaphosidae	4	22	33	37	7	13	40	5	8	6
Clubionidae	2	6	1	1	0	3	5	0	2	0
Dysderidae	0	1	1	2	0	0	2	0	0	0
Thomisidae	2	1	0	1	0	0	2	0	2	0
Salticidae	1	2	1	0	0	0	5	9	14	8
Lycosidae	0	2	1	1	1	3	9	11	13	15
Oonopidae	0	0	1	0	0	0	0	0	0	0
Pisauridae	0	0	1	0	0	0	0	0	0	0
Sicariidae	0	0	0	1	0	1	1	0	0	0
Filistidae	0	0	0	1	0	0	0	0	0	0
Theridiidae	0	0	0	0	0	0	4	1	4	1
Pholcidae	0	0	0	0	0	1	5	2	2	0
Zodariidae	0	0	0	0	0	0	0	0	1	0
Araneidae	0	0	0	0	0	0	1	0	2	0
Agelenidae	0	0	2	0	0	0	0	0	0	0
Linyphiidae	0	0	0	0	0	1	4	2	0	0
Oxyopidae	0	0	0	0	0	0	1	0	0	0
Tetragnathidae	0	0	0	0	0	0	0	1	0	1

The evolution curve of the abundance of spider families at El Merdja station over the months presents 2 picks, the most important is recorded during April, probably because Gnaphosidae is represented by an important abundance, while the second pick is less important and is noted in June because of the simultaneous abundance of Salticidae and Lycosidae (Fig. 4).

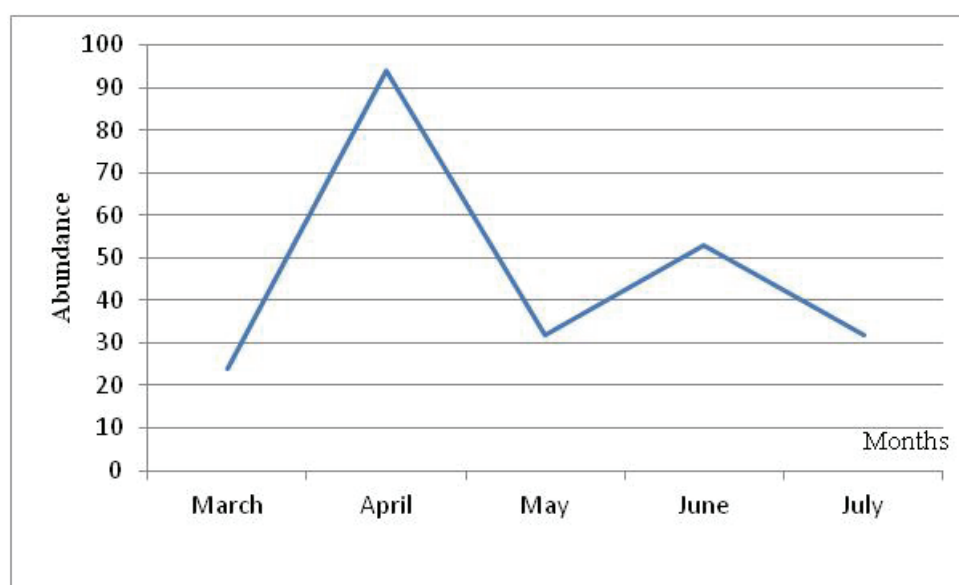


Figure 4. Evolution of abundance spider's families during the study period at EL-Merdja station.

At Ain Fodda station the maximum abundance is recorded in June, probably because of the family Gnaphosidae which is very abundant during this month (Fig. 5).

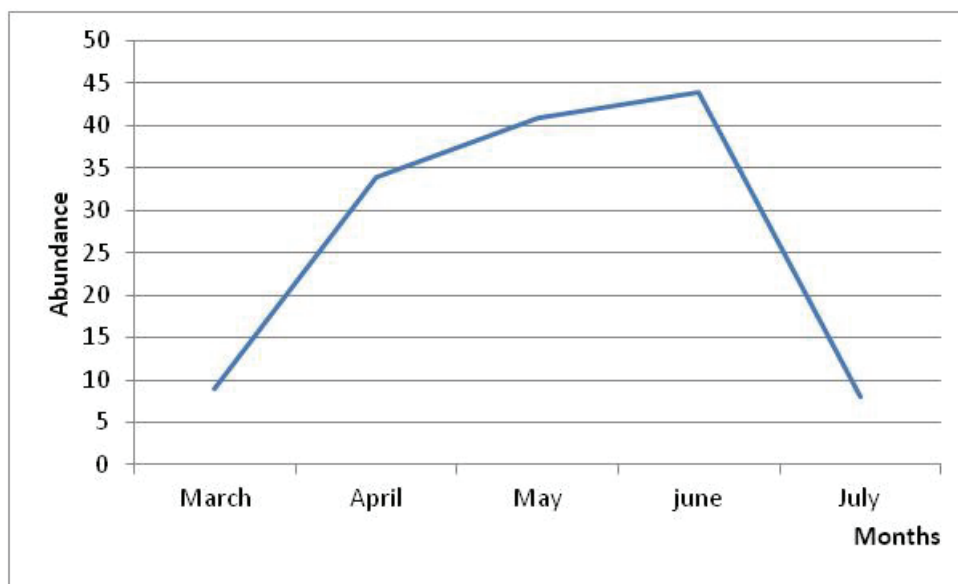


Figure 5. Evolution of abundance spider's families during the study period at Ain Fodda station.

Evolution of the main families of spiders during the study period

At El Merdja station, the main spider families show a variable relative abundance over the months of study, Gnaphosidae is the most dominant family during March and April (85.71%, 73.07%) respectively, Salticidae (50%, 41.02%) in June and Lycosidae in May and July (35,48% and 53.84%) (Fig. 6).

These are the same families that are the most diverse: Lycosidae with 9 genera like *Pardosa* and *Lycosa*, Gnaphosidae with 8 genera like *Gnaphosa* and *Drassodes* and Salticidae with 4 genera such as *Chalcoscirtus*; other families are not very diversified (between 1-2 genera).

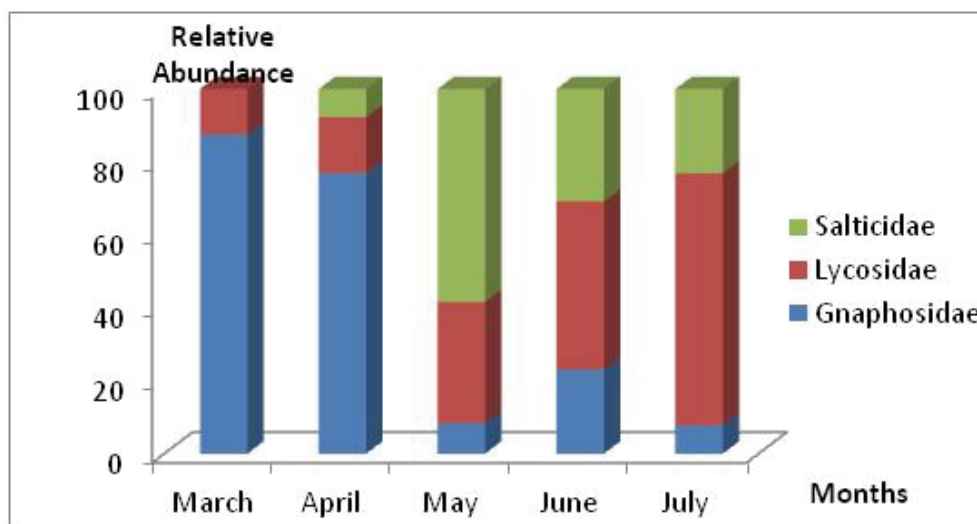


Figure 6. Relative frequencies of the main families at El-Merdja station.

It is interesting to note that Gnaphosidae is the most constant family in this station, followed by Lycosidae and Salticidae the other families are rare or accidental.

In Ain Fodda station, Gnaphosidae represents the dominant family during the five months of study recording a maximum in June (84,09 %) and a minimum in March (44,44%), it is supported during the last month by Thomisidae and Clubionidae ; the other families are weakly found (Fig. 7).

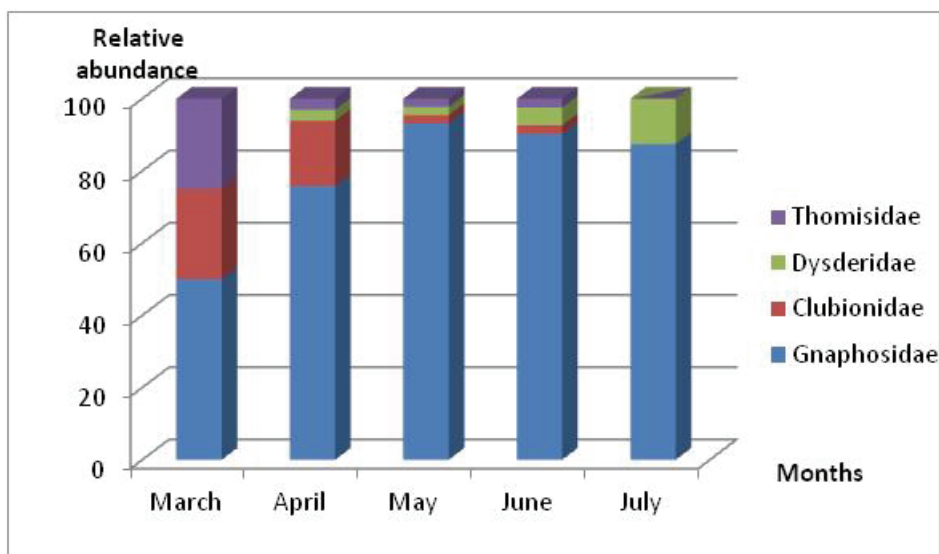


Figure 7. Relative frequencies of the main families at Ain Fodda station.

These are Gnaphosidae and Thomisidae with 5 genera and 4 genera respectively which are the richest where *Zelotes*, *Trochosa* and *Oxyptila* are the most common kinds.

DISCUSSION

The total number of individuals captured (347) with a diversity of 18 families during a five month period from March to July is comparable with other results recorded in the world: 21 families in Greece (CHATZAKI et al. 1997), 15-17 in the arid grasslands of New Mexico (MUMA, 1980), 20-22 family in a maquis in Greece (PARASCHI, 1988) and 17 families in northern Poland (SZYMKOWIAK & WOZNY, 1997).

With 14 families, El Merdja station is more diversified than Ain Fodda station (11 families), since the altitudinal factor acts only on its diversity. While 20 families were recorded in the first station in 2003 (DJABRI, 2004). In the Djellal station at Djelfa (semi-arid climate at western Algeria), BOURAGBA et al. (2016) identified 21 species in 1992 and 33 species in 1993, demonstrating the influence of several factors on the diversity of this fauna.

Gnaphosidae is the dominant and most abundant family in both study stations, this dominance is explained by the installation of this family in dry habitats (CHATZAKI et al., 1997) and is cited among the most dominant families in Egypt (SALLAM, 2006) and it's also the most abundant at Sicily in Italy, and is one of the largest xerophilous spider families in Greece like for all Mediterranean countries (CHATZAKI, 2008).

Lycosidae is the most diverse family at El Merdja with a fairly high abundance in this station because of the type of this habitat, since lycosides are the spiders of the grasslands par excellence and are emerging on Poaceae which form thin rows of grass (JOCQUÉ & ALDERWEIRELDT, 2005). However BOUMEZZOUGH (1983) has noted the dominant place occupied by this family among epigeic and riparian fauna of the watershed of "Aille" river in France. This family is absent in the second station since it is particularly rare in dense forests (WARUI et al., 2005). This family with a succession of species makes its appearance from March to July in 2003 (DJABRI, 2004), and is the most abundant spiders in this station on 2007 (CHERIAK, 2017).

The dominance of Salticidae during this period coincides with the appearance of the flowers because this family is nectivorous (JACKSON et al., 2001) in Greece. It is diversified and demonstrates a better density to compare with the other families of the site (CHATZAKI et al., 1997), and its diversity is correlated with the height of the vegetation in the environment (JACKSON et al., 2001).

Thomisidae has large distribution, with a wide ecological tolerance but with a great dependence of environmental factors because of its life cycle (JIMENEZ-VALVERDE & LABO, 2007).

With 211 individuals Araneological fauna is more abundant at El Merdja than Ain Fodda (136 individuals).

The peak of abundance which take place in April at El Merdja reflects the availability of this family in this site, since the cohabiting wading birds (*Ciconia ciconia*) and *Bulbulcus ibis* consumes their biggest share of spiders prey during this same month in this station (SELMANE, 2009; GHERISSI, 2010), on the other side the peak of abundance shifted in May at Ain Fodda station represents probably the first peak since the phenology of spiders in Mediterranean ecosystems show two peaks in spring and autumn (CHATZAKI et al., 1997).

Despite the dominance of Gnaphosidae Analysis of changes in the abundance of dominant families revealed at El Merdja station a succession of peaks of dominant families and the replacement of one by the other. In Poland Lycosidae is replaced by Erigonidae, and Tetragnatidae (SZYMKOWIAK & WOZNY, 1997) whereas at Ain Fodda station Gnaphosidae is the most abundant during all months of study, probably it has a large ecological tolerance, CHATZAKI et al. (2005)

considered this result from relaxation of competitive interactions with other species. In Crete (Greece) 76% family's species are found at more than 500m, while 24% are at more than 1000m (CHATZAKI et al., 2005).

CONCLUSION

The study of habitat and altitude impact on spider fauna in the Tebessa region of Algeria has shown that the maximum diversity of the araneological population is found in grassland type habitat (El Merdja) where the number of spider families is higher. Abundance of this fauna also varies depending on the habitat probably due to the activity of spiders that respond to local habitat conditions, with the exception of Gnaphosidae which is dominant in both habitats. The altitudinal factor acts on the phenology of spiders, they are early and more abundant at low altitude; and on diversity too which is higher in low altitude.

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