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ARACHNID FAUNA OF THE SEBKHAT EL MELAH-RAMSAR SITE IN THE SAHARA DESERT OF ALGERIA

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Abstract: The available data on the arachnids of Algeria are very scarce and sometimes very old, especially on the fauna of the Saharan part of the country. During the last decade a good amount of research on the spiders and scorpions of the Sahara has been carried out, and it has led to important findings such as the discovery of new species and the reporting of first records for the country, all of this contributing to the compilation of a global list for the country. This study is part of the previous work and concerns the arachnofauna of the Sebkhat El Melah wetland (El Menia, Algeria), one of the important Ramsar Sites of the Sahara desert. Arachnids were sampled between 2016 and 2019 using direct hunting and pitfall traps. The sample consisted of 139 adult arachnids. Taxonomically they were classified into 23 species of spiders, six species of scorpions, one species of pseudoscorpions and one species of camel spiders. This study aims to establish the first checklist of the arachnids of the surveyed area.
Key words: Arachnida, biodiversity, wetland, El Menia, Sahara desert, Algeria.

Arácnidos del Sitio Ramsar Sebkhat El Melah, en el Sahara argelino
Resumen: Los datos disponibles sobre los arácnidos de Argelia son muy escasos y a veces muy antiguos, especialmente en cuanto a la fauna del Sahara argelino. En la última década se ha investigado mucho sobre las arañas y escorpiones del Sahara, desembocando en hallazgos importantes, como el descubrimiento de especies nuevas y la aportación de primeras citas del país, todo ello contribuyendo al establecimiento de un catálogo de especies de Argelia. El presente estudio forma parte de esa serie de trabajos y se ocupa de la aracnofauna del humedal de Sebkhat El Melah (El Menia, Argelia), uno de los Sitios Ramsar importantes del desierto del Sahara. Se colectaron ejemplares de arácnidos entre 2016 y 2019 mediante caza directa y trampas de caída. La muesta consiste en 139 adultos. Taxonómicamente se han incluido en 23 especies de arañas, seis de escorpiones, una de pseudoescorpiones y una de solífugos. El trabajo pretende establecer el primer catálogo de los arácnidos del territorio estudiado.
Palabras clave: Arachnida, biodiversidad, humedal, El Menia, desierto del Sahara, Argelia.

Introduction

With the problems that threaten nature, essentially climate change, naturalists who were worried about the rapid destruction of these natural environments, introduced the term biodiversity, etymologically designating biological diversity (Lévêque & Mounolou, 2008) Realizing their impact on natural environments, researchers have studied and preserved these natural heritages (Sadine et *al*., 2012).

The Algerian Sahara occupies more than 3/4 of the total surface of the country (Côte, 1996), it provides very constraining edapho-climatic characteristics for the spontaneous survival of living beings (Chehma et *al*., 2005). As a result, in these entities life is limited in sporadic "islands" of greenery, represent very balanced and very diversified ecosystems such as palm groves, river beds and Dayas or at the edge of water points (lakes and sebkha).

The Arachnids are among the little explored animal groups in the Sahara Desert of Algeria, given their importance and diversity. During the last years, researchers started to give interest to the arachnofauna of the Sahara, many works are being conducting on spiders and scorpions either in natural or agricultural environments like the works of Alioua et *al*. (2012), Sadine et *al*. (2014), Alioua et *al*. (2016) and Lourenço et *al*. (2017).

Sebkhat El Melah is located in El Menia region (Sahara Desert of Algeria), it is one of the most important permanent wetlands and classified in the Ramsar list since 2004 (Ramsar, 2021), with a high specific richness including a large part of endemism. In the recent years, many authors have noted and reported different animal groups (birds, reptiles, ….) inhabiting the site (Chedad et *al*., 2020; Sadine et *al*., 2021; Chedad et *al*., 2021 a;b).

The present work concerns the arachnid fauna of El Menia through its wetland, it aims to establish the first checklist of spiders, scorpions, pseudoscorpions and camel spiders of the site.

Material and methods

Study area

El Menia is located in the North of the Central Algerian Saharan, at 870 km to the south of Algiers and covers a total area of 86,560 km^2. Geomorphological features are constituted by the Regs and Ergs (Benkenzou et *al*., 2007). The region is characterized by a dry Saharan climate with extreme thermal amplitudes between the day and the night, reaching 15 ° C (Sam, 2012). The coldest month is January with a minimal temperature of 6.2° C, whereas the hottest month is July with a maximum temperature of 41.8°C. Rain fall is extremely low in the region of Ghardaïa with an average value of 80.2 mm per year. Air humidity is rather weak with a maximum

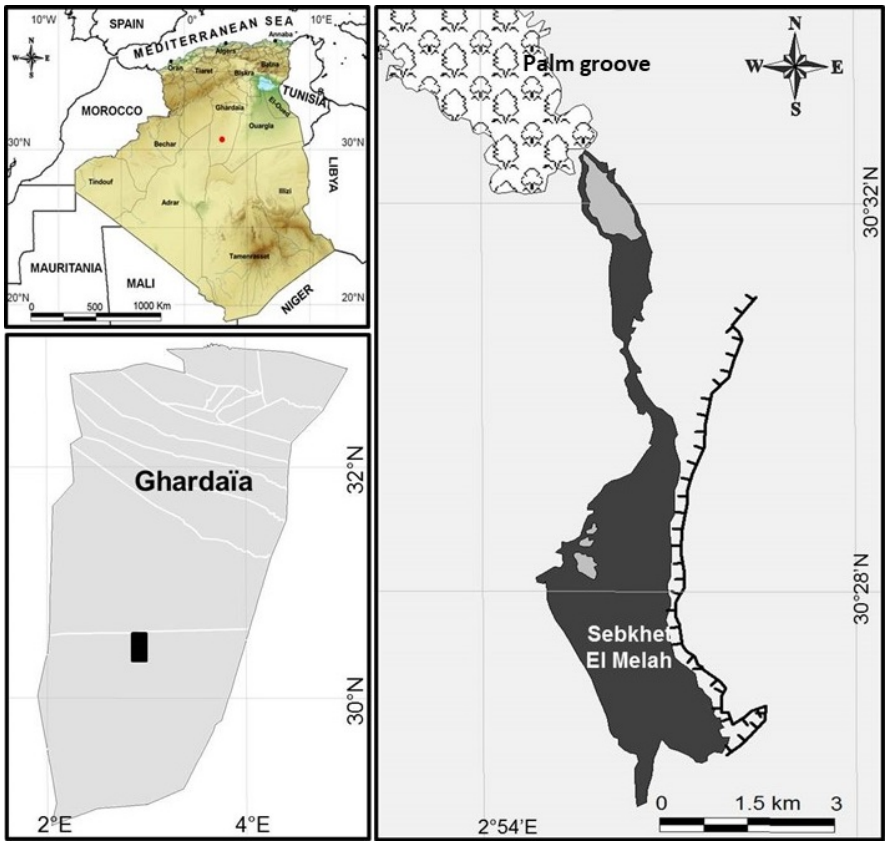


Fig. 1. Map of Algeria showing the location of Sebkhet EL Melah (White lines on Ghardaia map represent the administrative boundaries).

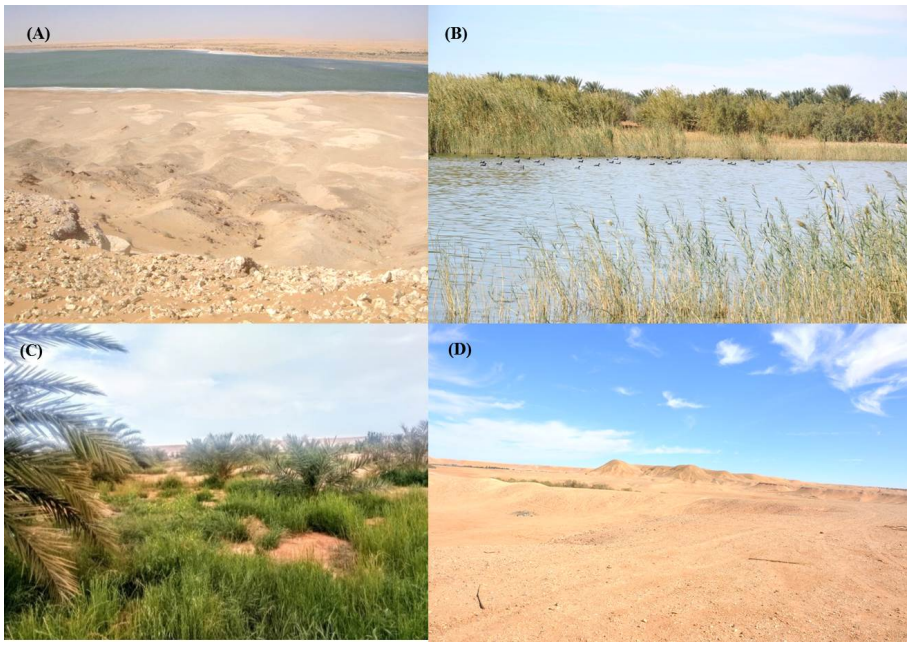


Fig. 2. Overview of the study area: (**A**) General view of Southern side of Sebkhat El Melah lake, (**B**) General view of the Northern basin, (**C**) Palm grove neighboring the lake (**D**) Reg biotope in the periphery of the lake

value of 55.5% in December and a minimum of 21.6% in July (Chehma, 2011). Analysis of dry periods over several years attest that 11 months of the year are dry ranging from February to December; only a short and slightly more humid period can be experienced in January.

Sebkhat El Melah wetland (Fig. 1) is located to the south of the city of El Menia (30° 25'- 30° 32' N and 02° 54'- 02° 56' E) at an altitude ranging from 330 to 397 m, with a total area of 72,000 ha (Alioua et *al*., 2016).

The region is crossed by the 'Oued Seggeur' and bordered to the west by the dunes of the 'Grand Erg Occidental'. It is remarkable for its oasis and great amounts of water, which led to the formation of the lake of 'Sebkhet El Melah'. The shallow lake, or 'Sebkha', is bordered on one side by an open field oriented towards the El-Goléa oasis (Fig. 2) and on the other side it is enclosed by rocky hills and sand dunes (Hacene et *al*., 2004). The variety of habitats, allows the presence of noticeable diversity (Ramsar, 2014). This region is characterized by a very important plant diversity varies according to the season, with a dominance of a few botanical families such as: Poaceae with *Stipagrostis obtus*, *Polypogon monspeliensis*, Amaranthaceae represented essential by *Chenopodium mural* and *Amaranthus hybridus* (Chehma, 2006; Alioua *et al*., 2016).

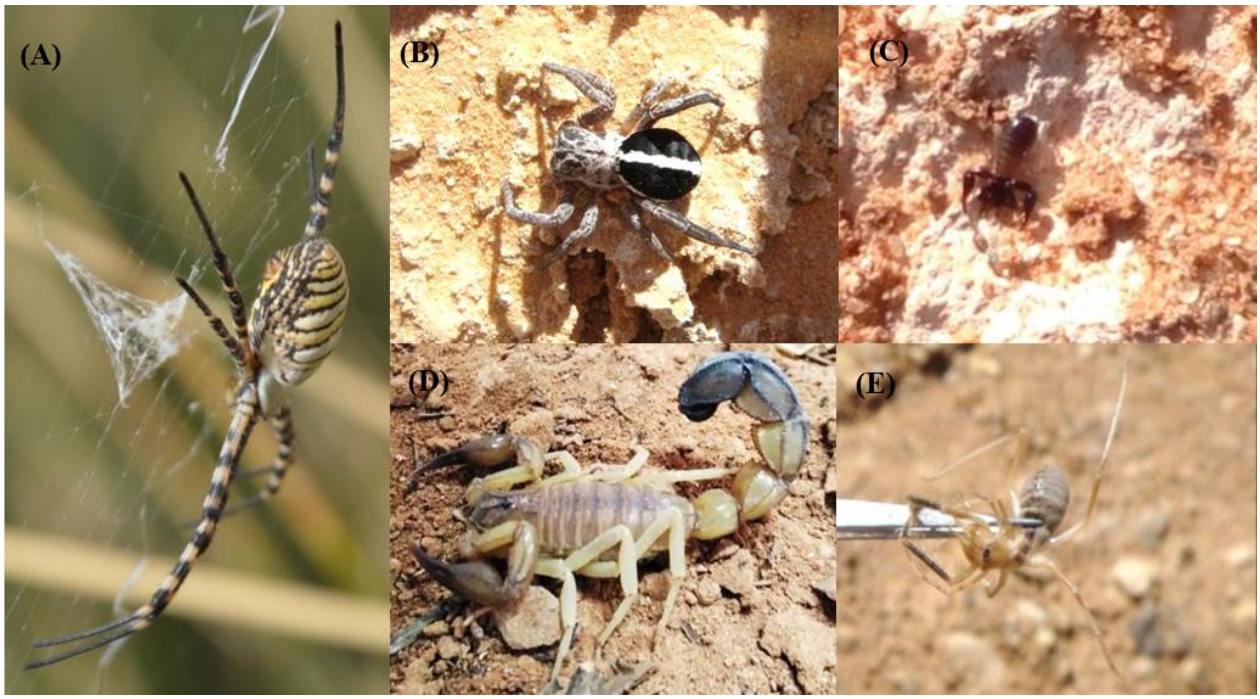


Fig.3. Photographs of some Arachnids recorded in Sebkhat El Melah: (**A**) *Argiope trifasciata* (Araneae), (**B**) *Stegodyphus lineatus* (Araneae), (**C**) *Minniza* sp. (Pseudoscorpionida), (**D**) *Androctonus australis* (Scorpiones) and (**E**) *Galeodes arabs* (Solifugae).

Table I: List of the Arachnid fauna of El Menia (Algerian Saharan Desert)

Orders	Families	Species	Number	Habitat
Araneae	Agelenidae	*Benoitia lepida* (O. Pickard-Cambridge, 1876)	16	Lake and Palm grove
	Araneidae	*Argiope trifasciata* (Forsskål, 1775)	2	Lake
		Cyrtophora citricola (Forsskål, 1775)	10	Lake and Palm grove
		Larinioides suspicax (O. Pickard-Cambridge, 1876)	11	Lake
	Dicynidae	*Archaeodictyna anguiniceps* (Simon, 1899)	1	Lake
		Devade indistincta (O. Pickard-Cambridge, 1872)	10	Lake
		Dictyna sp.	2	Lake
	Eresidae	*Stegodyphus lineatus* (Latreille, 1817)	2	Lake
	Gnaphosidae	*Pterotricha chazaliae* (Simon, 1895)	5	Lake
		Setaphis simplex (Simon, 1885)	1	Lake
	Hersiliidae	*Hersiliola macullulata* (Dufour, 1831)	5	Lake
	Lycosidae	Lycosidae sp.	1	Palm grove
		Pardosa gefsana Roewer, 1959	8	Lake and Palm grove
		Trochosa urbana O. Pickard-Cambridge, 1876	4	Lake and Palm grove
		Wadicosa fidelis (O. Pickard-Cambridge, 1872)	5	Lake
	Philodromidae	*Thanatus vulgaris* Simon, 1870	6	Lake and Palm grove
	Salticidae	*Aelurillus luctuosus* (Lucas, 1846)	1	Lake
		Bianor albobimaculatus (Lucas, 1846)	2	Lake and Palm grove
		Mogrus neglectus (Simon, 1868)	5	Lake
		Salticidae sp.	3	Palm grove
	Scytodidae	*Scytodes annulipes* Simon, 1907	1	Lake
	Theridiidae	*Steatoda paykulliana* (Walckenaer, 1806)	1	Lake
	Thomisidae	*Thomisus* sp.	2	Palm grove
Pseudoscorpionida	Olpiidae	*Minniza* sp.	17	Lake
Scorpiones	Buthidae	*Androctonus amoreuxi* (Audouin 1826)	8	Lake
		Androctonus australis (Linnaeus, 1758)	3	Lake and Palm grove
		Buthacus elmenia Lourenço & Sadine, 2017	1	Lake
		Buthacus samiae Lourenço & Sadine, 2015	1	Lake
		Buthacus spinatus Lourenço, Bissati & Sadine, 2016	1	Lake
		Lissothus chaambi Lourenço & Sadine, 2014	2	Lake
Solifugae	Galeodidae	*Galeodes arabs* C. L. Koch, 1842	2	Lake
4 Orders	**15 Families**	**31 Species**	**139**	/

Arachnids Sampling

The Arachnids individuals were sampled during many periods between the years 2016 and 2019. The specimens were collected from different localities around the lake (30°32'8.69"N and 2°55'2.05"E, 30°29'16.99"N and 2°55'32.82"E, 30°29'16. 52"N and 2°55'31.97"E, 30°29'15. 71"N and 2°55'25.99"E, 30°30'34.78"N and 2°55'34.89"E, 30°30'34.36"N and 2°55' 33.85"E, 30°28'3.66"N and 2°54'34.61"E, 30°30'13.24"N and 2°55'35.33"E, 30°32'8.60"N and 2°55'2.45"E, 30°30'35. 61"N and 2°55'36.20"E, 30°30'35.20"N and 2°55'35.63"E, 30°30'34. 99"N and 2°55'34.42"E, 30°30'34.48"N and 2°55'34.00"E, 30°30'34.65"N and 2°55'34.14"E) and also from the neighboring palm grove (30°32'46.27"N and 2°54'19.60"E), using direct hunting and pitfall traps methods.

Results and Discussion

During periods between the years 2016 and 2019, we have collected and examined 104 adult spiders, 17 pseudoscorpions, 15 scorpions and 2 camel spiders (Solifugae). The systematic list of families and species is mentioned in the table I.

Araneae (spiders): Among the 104 individuals, the identified spiders are belonging to 23 species under 12 families and 21 genera. The families Lycosidae and Salticidae were the most diversified in species with four for each one, then the two families Araneidae and Dictynidae with three species, the Gnaphosidae was represented by two species and for the rest of the families, they were represented by only one species for each of them.

El Menia or from its old name El Golea was known in literature by only three species of spiders: *Pterotricha insolita* Dalmas, 1921 by Dalmas (1921), *Setaphis fuscipes* (Simon, 1885) by Platnick & Murphy (1996) and *Odontodrassus mundulus* (O. Pickard-Cambridge, 1872) by Fage (1929). Later, Alioua et *al*., 2016 updated the list of El Menia with 10 species identified until the species level namely: *Benoitia lepida*, *Larinioides patagiatus* (Clerck, 1757) published as *Larinioides folium* (Schrank, 1803), *Devade indistincta*, *Brigittea civica* (Lucas, 1850), *Stegodyphus lineatus* (Fig.3a), *Pterotricha chazaliae*, *Hersiliola macullulata*, *Wadicosa fidelis*, *Thanatus vulgaris*, *Aelurillus* cf. *luctuosus*. Then, *Larina chloris* (Audouin, 1826) was recorded for the first time in Algeria from El Menia in addition to Kef Doukhne river in Ghardaia (Alioua et *al*., 2020). The results of this study extend the list of El Menia with nine other species, thereby, El Menia spider list counts now 24 species. It is to mention that *Larinioides patagiatus* in Alioua et *al*. (2016) was misidentified and corrected to *Larinioides suspicax*.

Pseudoscorpionida (false scorpion): This order is represented by one genus *Minniza* Simon, 1881 (Fig.3b) belonging to Olpiidae family. This genus was reported previously throughout North Africa (Beier, 1931), it is cited for the first time for the study area. We note that all the captured false scorpions (17 individuals) were sampled between February and Mars (2017) from the periphery of the lake.

Scorpiones: In El Menia wetland, we found 06 species of Buthidae: *A. amoreuxi* which was the most abundant species with a rate of 50 %. In the second position comes *A. australis* (18.75%) (Fig.3c). The other species *B. elmenia*, *B. spinatus*, *B. samiae* and *L. chaambi* are ranked as rare. Sadine (2018) reported that *A. amoreuxi* and *A. australis* were very abundant scorpions in Ghardaïa (more than 42%) in opposition to other species that had a very low abundance. We note that all the rare scorpion species cited here are new species and were recently discovered from the region (Lourenço & Sadine, 2014; 2015, Lourenço *et al*., 2016; 2017).

Solifugae (camel spiders): known also as wind scorpions and sun spiders. This group is represented by only one species *Galeodes arabs* (Fig.3d). According to Harvey (2002), the Camel spiders are poorly studied in the world, as well as in Algeria (Sadine & El Bouhissi, 2019). The genus *Galeodes* was cited as a widely distributed species in Algeria (El-Hennawy, 1999; Harvey, 2013). The collection of a small number of *G. arabs* can be explained by the nocturnal activity of this arachnid (Mebarki et *al*., 2021).

The result of this study is not a complete inventory, but it can be considered as representative and shows the important biodiversity of arachnids in this arid region (31 species). More than the half (57.69 %) of spider species belongs to the group of web builders under the guilds of sheet, orb, space and sensing webs, the rest (42.31 %) are either ground, ambush, or other hunters. According to Riechert and Luczack (1982) the structural support is a limiting resource for web spiders besides food. In Sebkhat El Melah, the abundant flora around the lake provides the structural support for the web builders.

Another important note concerns the habitat selection, about 67.74 % of the arachnids were captured around the lake, while only 3 species (9.67 %) were found strictly in the neighboring palm grove, the rest of the fauna is common between both agricultural and natural environments.

Finally, it is to mention that *Buthacus elmenia* Lourenço & Sadine, 2017 (Scorpiones) is an endemic species for this region (El Menia).

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