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New distribution data of orb-weaver spiders in Morocco (Araneae: Araneidae)

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ABSTRACT

The authors collected and examined 11 species of 7 genera of the Araneidae family in Morocco between the 1st of June 2012 and the 31st of November 2013. These 11 species belong to the following genera: Agalenatea, Araneus, Argiope, Cyclosa, Cyrtophora, Larinioides and Zygiella. In this paper we add the first report on 10 of these species in the area of Morocco. Of all the taxa we found in Morocco only one - Araneus arganicola Simon, 1909 - was known from the country previously.
(Keywords: *Araneidae*, faunistic data, spider, Morocco)

INTRODUCTION

The orb-weaver spider (*Araneidae*) shows high variety in morphologically forms including relatively small to large species (*Jäger,* 2012; *Jones,* 1983; *Loksa,* 1972; *Ubick et al.,* 2004). Their cephalic region of the prosoma is narrow, and then broadens like a bottle, but still usually remains flat. Their eyes are seated in two rows. The two lateral eyes in the lower row are further away from the rest of the eyes in the middle. They have strong chelicerae. Opisthosoma is very diverse in appearance, but usually carries the specific colour pattern for the given taxon. Pointed shoulders can often be seen on the dorsal side, as well as diverse protrusions facing the muscles and silk-gland. Their legs have well developed claws and are usually covered with spikes and hair (*Loksa,* 1972; *Ubick et al.,* 2004). Sometimes there is a significant difference in size and color between the sexes (sexual dimorphism). Most of their species make classic spiral orb webs, which are perpendicular to the ground, but some genera (eg. *Cyrtophora*), make their webs horizontal to the ground and these are more complexly built than the spiral orb webs. In other species a thicker decoration line can be seen starting from the middle of the tangle web (*Loksa,* 1972; *Ubick et al.,* 2004; *Álvares & Maria,* 2004).

There are very few data to be found about the occurrence of the species of this family in Morocco. Only one species is mentioned in the *World Spider Catalog* (2016), the *Araneus arganicola*. *Deltshev* (2015) has listed three species [*Araneus angulatus* Clerck, 1757, *Larinoides sclopetarius* (*Clerck,* 1757) and *Mangora acalypha* (*Walckenaer,* 1802)] in his work. In this research were examined the spider species from high Atlas Mountains, Morocco above of altitude of 2000 m. *M. acalypha* and the *Argiope lobata* (*Pallas,* 1772) were published from Morocco by *Denis* (1956). The *A. lobata* was found in Volubilis and Ifrane. *Beron* (2008) in his work has listed some spider species but only *L. sclopetarius* belongs of Araneidae from Morocco in Atlas Mountains.

MATERIALS AND METHODS

The first author collected in Morocco between the 1st of June 2012 and the 31st of November 2013 on the coastline between Rabat and Agadir. Potential habitats were checked on a weekly basis for months during the time of the research where special attention was paid for tangle webs. We documented our work with photographs. Specimens were collected individually and stored in the deep freezer until determination. We studied 40 females, 12 males and 4 juveniles. We examined the genitals in adults and other morphological characters. We used the papers of *Loksa* (1972), *Jones* (1983), *Ubick et al.* (2004) and *Jäger* (2012) for determination to species level. The prepared genitals of specimens are deposited in the private collection of the first author in his department.

RESULTS

In our research in Morocco we found species of the Araneidae family that we listed below and marked on map (*Fig*ure *4*).

Gen. ***Agalenatea*** Archer, 1951

Agalenatea redii (Scopoli, 1763) (*Figure 1.*) - The species was found in a strip of cork oak next to Sidi Allal el Bahraoui, (1♀, 34°06'01,48"N, 6°19'21,69"W, 20.09.2013., J. Gál).

Figure 1. ***Agalenatea redii*** **(Scopoli, 1763)**

Gen. ***Araneus*** Clerck, 1757

Araneus angulatus Clerck, 1757 - The spiders were collected in the center of Rabat in a park (1♀, 1♂, 33°59'32,83"N, 6°51'51,88"W, 30.10.2012., J. Gál).

Araneus arganicola Simon, 1909 - We found the species in a cork oak park northeast of Sidi Allal el Bahraoui (1♀, 34°06'12,43"N, 6°21'38,08"W, 19.09.2013., J. Gál), (1 juv., 33°59'28,88"N, 6°51'18,55"W, 10.09.2013., J. Gál), (1♀, 33°58'28,92"N, 6°52'03,53"W, 8.10.2013., J. Gál) (1♂, 33° 58'33,08"N, 6°52'01,07"W, 11.10.20134., J. Gál).

Gen. ***Argiope*** Audouin, 1826

Argiope lobata (Pallas, 1772) - We only found the spider in one place in Morocco, about 80 km north of Sidi Alla el Bahraoui in a cork oak forest (6♀,3♂, 34°05'56,27"N, 6°19'02,25"W, 17.09.2012., 22.09.2012., J. Gál).

Argiope trifasciata (Forsskál, 1775) - While collecting our samples, we found this species in areas north of Sidi Allal el Bahraoui, where they wove their tangle webs close to smaller lakes (11♀, 2♂, 34°06'09,14"N, 6°22'00,59"W, 13.08.2012., J. Gál). We found two animals sitting in their webs in parks in Rabat and we managed to verify one specimen sitting on artificially established hedges in front of the library of the Institut Agronomique et Vétérinarie Hassan II located at the crossing of Avenue Allal Al Fassi and Avenue Hfiane Cherkaoui (2♀, 33°58'49,53"N, 6°51'45,88"W, 18.09.2012., J. Gál) and at the Rabat Zoo (Jardin Zoologique de Rabat) (1♀, 33°57'16,92"N, 6°53'41,53"W, 01.10.2013., J. Gál).

Gen. ***Cyclosa*** Menge, 1866

Cyclosa conica (Pallas, 1772) - We collected this species in areas surrounding Kenitra (1♀, 34°15'02,60"N, 6°35'00,00"W, 10.08.2012., J. Gál), Fez (3♀, 34°02'04,38"N, 5°00'01,41"W, 19.09.2012., J. Gál) and Casablanca (1♀, 2♂, 33°32'06,09"N, 7°34'58,67"W, 27.08.2013., J. Gál).

Cyclosa oculata (Walckenaer, 1802) - We found the specimens in the region of the Atlantic Ocean in Morocco all along the coastline. We also collected specimens from northern Tanger (1♀, 35°46'07,18"N, 5°48'02,08"W, 21.10.2012., J. Gál) until Agadir (3 juv., 30°25'46,62"N, 9°35'53,86"W, 11.06.2013., J. Gál) going south.

Gen. ***Cyrtophora*** Simon, 1864

Cyrtophora citricola (Forsskál, 1775) (*Figure 2*) – We collected this species in more than one place in Morocco, including the parts of Kenitra (1♀, 34°15'02,60"N, 6°35'00,00"W, 10.08.2012., J. Gál) and Mohammedia (3♀, 2♂, 33°40'59,96"N, 7°23'00,00"W, 10.09.2012., J. Gál). We found more than one web between the branches of a medieval thuja located in Rabat (4♀, 33°59'05,71"N, 6°51148,04"W, 02.08.2013., J. Gál).

Figure 2. *Cyrtophora citricola* (Forsskál, 1775)

Cyrtophora citricola lurida Karsch, 1879 - We found the specimens in Morocco close to Rabat next to a lower-order road (2♀, 33°58'12,24"N, 6°47'35,95"W, 27.07.2013., J. Gál).

Gen. ***Larinioides*** Caporiacco, 1934

Larinioides cornutus (Clerck, 1757) (*Figure 3*) - We collected the spider close to Sidi Boukhalkhal and its web on dried vegetation close to a lake (1♀, 1♂, 34°06'03,16"N, 6°19'21,96"W, 13.10.2012., J. Gál).

Figure 3. *Larinioides cornutus* (Clerck, 1757)

Gen. ***Zygiella*** F. O. Pickard-Cambridge, 1902

Zygella x-notata (Clerck, 1757) - We found this species during our collecting close to Khemisset (1♀, 33°48'57,67"N, 6°06'14,91"W, 01.11.2012., J. Gál) next to the two lined A2 highway going to Fes.

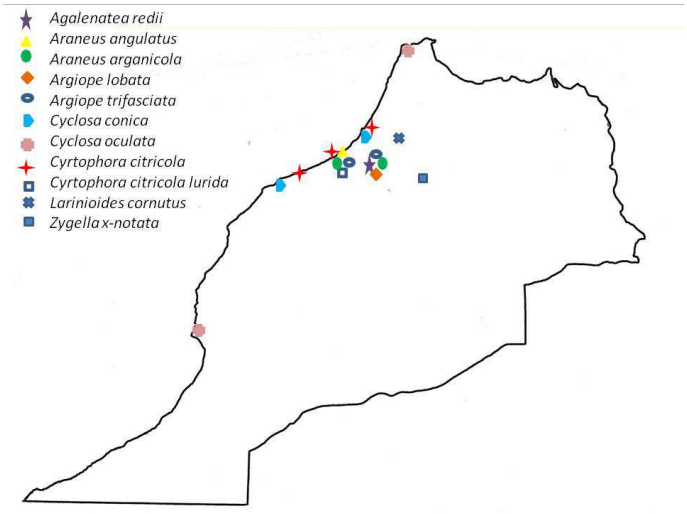

Figure 4. Map of sampling sites and distribution of the occurred species in Morocco

DISCUSSION

During the 17 months research we found 7 genera (*Agalenatea*, *Araneus*, *Argiope*, *Cyclosa*, *Cyrtophora*, *Larinioides* and *Zygiella* and 11 species all belonging to the Araneidae family. We confirmed the occurrence of *Araneus arganicola* in Morocco as mentioned in the *World Spider Catalog* (2016) by collecting specimens north-east of Sidi Allal el Bahraoui in a cork oak park and in Rabat. *Araneus angulatus* is known as a palearctic species (*World Spider Catalog*, 2016). We collected our evidentiary sample in a pine park in the center of Rabat. From our knowledge, at the moment we think that Morocco is the most southern area of the distribution of this species. We also found the palearctic *Agalenatea redii* in the northern part of Morocco. Despite the wide distribution area of *Argiope lobata* and *A. trifasciata* in the old world, Moroccan occurrence was cited by *Denis* (1956). While collecting spiders in Morocco we found *A. trifasciata* in areas north of Sidi Allal el Bahraoui, where they made their tangle webs between soft stem plants near smaller lakes. We found a high density of spiders in these locations (an average of 26.7 adults and sub-adults in an area of 10 m^2). We found specimens sitting in their nets in more than one place in Rabat, like in the park of the Hassan II University and in the man-made hedge in the areas of Rabat Zoo. We found *Argiope lobata* only in areas north of Sidi Allal el Bahraoui in an extreme dry, bushy habitat. *Wunderlich* (1991) published data on the occurrence of this species on the El Hierro Island of the Canary Islands. *Denis* (1956) recorded the species in Volubilis and Ifrane. On our expeditions searching south of Rabat, we did not find any species of the genus *Argiope*. We could certify the northern occurrence of the above mentioned species numerous times while doing our research in Morocco. Even though the two species of the genus *Cyclosa*: *C. conica* and *C. oculata* are found in the palearctic region (*World Spider Catalog*, 2016), we found several specimens in Morocco. We found *C. conica* as south as Casablanca, while a smaller population of *C. oculata* was found as south as Agadir which were live low to medium-height bushy vegetation. *Cyrtophora citricola* was found in the old world, the Greater Antilles, Columbia and Costa Rica (*Viquez*, 2007; *World Spider Catalog*, 2016), as well as in Brasil (*Álvares & Maria*, 2004) and Turkey (*Elverici et al.*, 2012) while *Cyrtophora citricola lurida* was found in northern Africa (*World Spider Catalog*, 2016). *Wunderlich* (1991) published data on the presence of *C. citricola* in the Canary Islands of the coast of Morocco. Both are species of the genus *Cyrtophora*, which we found in the outskirts, as well as in downtown Rabat and in the neighboring city, Kenitra, where the spiders and their tangle webs were found in smaller trees and bushes. *Larinioides cornutus* of the genus *Larinioides* is known to be a holoarctic species, which we found in the Sidi Allal el Bahraoui area next to its tangle webs built on a dried soft stem plant. *Zygella x-notata* of the genus *Zygiella* is known as a temperate zone and neotropical species. We marked its occurrence in Morocco on a cactus hedge next to a petrol station on the highway going to Fes. *Wunderlich* (1991) published data on the occurrence of this species on the Azores of the coast of Morocco.

In the case of other species, many publications can be found about them on other continents, sometimes worldwide. This way *A. angulatus* is known as a palearctic species by the *World Spider Catalog* (2016), while *Loksa* (1972) previously put the range of the species through Europe, Asia, Japan and North America. *Agalenatea redii* is a palearctic spider species (*World Spider Catalog*, 2016). The species is also known to be1 found on the Azores and the Canary Islands (*Wunderlich*, 1991). The species of the genus *Argiope* are spectacularly colored big spiders. *Argiope lobata* can be found in the

old-world (*Gray & Roobas*, 2015; *World Spider Catalog*, 2016). *Wunderlich* (1991) found the species on the El Hierro Island, which is part of the Canary Islands. *Levi* (1983) mentioned the species to be found in Burma, New-Caledonia and the northern part of Australia. *A. trifasciata* was stated both by *Levi* (1983) and *World Spider Catalog* (2016) to be found worldwide (mentioned as a cosmopolitan species). Genus *Cyclosa* has dozens of species all over the world. Their bulging protrusions have a characteristic physique on the end of the opisthosoma (*Loksa*, 1972). *C. conica* and *C. oculata* are palearctic species (*World Spider Catalog*, 2016). The species of the genus *Cyrtophora* have a very attractive body and the structure of the tangle web differs from the characteristics of the family (*Leborgne et al.*, 1998). According to *World Spider Catalog* (2016), *Cyrtophora citricola* can be found in the old-world, the Greater Antilles, Columbia and Costa Rica. *Wunderlich* (1991) mentions this species to be found on the Canary Islands off the coast of Morocco. There is also data of the later one in a statement by *Viquez* (2007). *Álváres & Maria* (2004) mentioned its occurrence in South America, in Brazil, while *Elverici et al.* (2012) found it in Turkey. On the other hand, *Cyrtophora citricola lurida* is listed as a species found in Northern Africa in *World Spider Catalog* (2016). The species of the genus *Larinioides* are small and have a typical pattern, but the color often varies between specimens even within a species. *Larinioides cornutus* is distributed across the holoarctic area (*Loksa*, 1972). Small species belong of the genus *Zygiella*. The *Zygella x-notata* can be found in the temperate zone and the neotropical region. We did not find any data on the occurrence of this species in the Northern African region (*World Spider Catalog*, 2016). *Wunderlich* (1991) mentions the presence of the species on the Azores.

Based on our data, we assume that some members of the Araneidae family somehow got to Morocco, either by man or by natural methods. *Wunderlich* (1991) also mentions this finding during his observations on the Macaronesian Island. We collected 11 species during our research and we couldn't find any literature or data on some species out of the 11 for the area of Morocco until now.

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