# DIVERSITY AND ECOLOGY OF THE SPIDER FAUNA (ARACHNIDA; ARANEAE) IN DIFFERENT FOREST OF NORTHEASTERN ALGERIA

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**Abstract.** In Algeria, spiders are poorly known arthropods, and sufficient information is still lacking regarding their biodiversity. This study contributes to the understanding of spiders in northeastern Algeria, focusing on their biodiversity. The spiders were collected from three different habitats (Cork oak forest, Kermes oak forest, and Algerian oak forest) over a 12-month period (2020-2021). The study assessed spider phenology, abundance, species composition, species richness inventory, functional diversity, and the potential influence of habitats on these parameters. The taxonomical study revealed 61 spider species belonging to 22 families, with Theridiidae being the most represented family. The Shannon index and Peliou's evenness showed significant diversity between forest types. The study also found that the species accumulation curves did not reach an asymptote in the three sites, suggesting the possibility of additional spider species not yet inventoried. The spider classification resulted in eight functional guilds based on their foraging mode, with Sheet web weavers category being the richest and most abundant feeding guild in all sites. The findings on spider species phenology were similar to other studies in Algeria. Further research is needed to better understand the conservation of this biological heritage and the negative impacts and changes that disrupt their essential functions.
**Keywords:** *Arachnidae, diversity, richness, oak forest, Algeria*

## Introduction

Biologists have always been inquisitive about patterns and measurement of species diversity (Macarthur, 1965; Peet, 1974). But even so, biodiversity has evolved from a comparative science to become an issue of public concern and political discussion (Magurran, 2004) in a way that variation in diversity alters ecosystem functions in local and large scale (Hautier et al., 2018; Hector and Bagchi, 2007) and can ultimately affect even the provision of ecosystem services that support human well-being.

Spiders, for example, play a prominent role in ecosystem functioning across a wide range of habitats (Tikader, 1977), thus making them an excellent example for studying biodiversity patterns (Platnick, 1999). Many studies have shown that spiders diversity


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causes quantitative changes in ecosystem functions (Greenop et al., 2018; Schmitz, 2009), as they are considered excellent predaceous arthropods (Mineo et al., 2010; Nyffeler and Gibbons, 2022). Habitat heterogeneity, on the other hand, affects the diversity of spiders (Buddle et al., 2000; Greenstone, 1984; Uetz, 1991) and even their foraging strategies (Goldsbrough et al., 2004; Ludwig et al., 2018).

Also, spiders are among the most ubiquitous and diverse group in terrestrial ecosystems (Cardoso et al., 2009), and the largest order of Arachnids, with more than 50,756 species grouped into 132 families and 4306 genera currently known on global scale (WSC, 2024), They can be used as successful biological indicators, and control agents (Marc et al., 1999; Nyffeler and Benz, 1987). In spite of this, they have been widely overlooked in conservation studies (Paul et al., 2009; Pearce and Venier, 2006).

The study of Algerian spiders dates back to the 19th century (Lucas, 1846; Simon, 1899), and information on it seems sporadic and resumed relatively recently with numerous papers on spiders diversity (Alioua et al., 2022; Boutmedjet et al., 2022) and taxonomy (Touchi et al., 2018), dynamics and abundance (Bourbia et al., 2018), ecology and phenology (Bensouilah et al., 2022; Chaib et al., 2022; Kherbouche, et al., 2015), in different type of habitats (wetland, forest and agroecosystem). But even here, there are gaps and omissions about the Algerian spider fauna, which is still poorly known and restricted to a few families in limited areas (Alioua et al., 2016; Mansouri et al., 2020; Touchi et al., 2018).

The present study comes within the framework of biodiversity, in order to a better knowledge of the diversity and the phenology of spiders present in three different sites in the northeast of Algeria. In light of these data, species richness and functional diversity in different sites were compared, and the possible effect of habitat characteristics on species diversity and phenology was discussed.

## Materials and methods

### *Sampling area*

The extremely north-east of Algeria (Annaba, El-Tarf, and Guelma) stretches from the Mediterranean in the north to the High Plateaux in the south (*Fig. 1*). It hosts a plethora of forest and aquatic ecosystems that support a diversified fauna. These habitats include extensive oak forests occurring on metamorphic complexes at altitudes ranging from 600 to 900 m (Auzende et al., 1975). These ecosystems also support a large number of endemic and subendemic taxa with fragmented ranges, which are rare in Algeria and often quite localized (Véla and Benhouhou, 2007)**.** Spiders were sampled in relatively homogeneous, contiguous areas of three vegetation types. The area are as follows.

#### *Cork oak forest in Séraidi, Annaba*

This site (36°56’21”N, 7°40’30”E) is considered to be part of the inner zones of the North African alpine chain. It has one of Algeria’s finest cork oak Quercus *suber* forests and considered as a regional biodiversity hotspot known as “Kabylie-Numidie-Kroumirie” (Toubal, 1986; Yahi et al., 2012), with 394 plant species belonging to 91 families and 276 genera recorded, giving a specific floristic richness equal to 9.58% of Algeria’s vascular flora, with 24 taxa being endemic, 4 are considered very rare and 41 are threatened (Hamel et al., 2013).


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*Kermes oak forest in El Kala, El Tarf*

The El-Tarf woodland (36°51'11" N, 8°19'30"E) is part of the El-Kala National Park (PNEK) which covers an area of approximately 80,000 ha and has a mosaic of ecosystems that are as diverse as they are rich. The degraded land is home to oak stands with kermes oak *Quercus coccifera*, often accompanied by *Pistacia lentiscus*, *Calycotome villosa*, *Genista ferox* and woody species indicative of very unfavorable conditions, such as *Cistus monspelliensis*, *Cistus salvifolius*, *Ampelodesma mauretanicum*, *Chamaerops humilis*, *Erica arborea* and *Lavandula stoechas* (Rouag, 2016).

*Algerian oak forest, Guelma*

This site (36°34'27"N, 7°30'45"E) is distinguished by its extensive vegetation cover, formed by plants and trees specific to the Mediterranean climate. The forests in the Guelma region situated at altitudes ranging from 500 to 900 m, it covers cover more than 32,590 ha (Boumaaza, 2017). This forest cover offers ecological niches at all levels. The flora is diversified, with species such as Aleppo pine *Pinus halepensis*, Algerian oak *Quercus canariensis* and cork oak *Quercus suber*. as well as olive trees and eucalyptus (Chahat, 2018)**.**

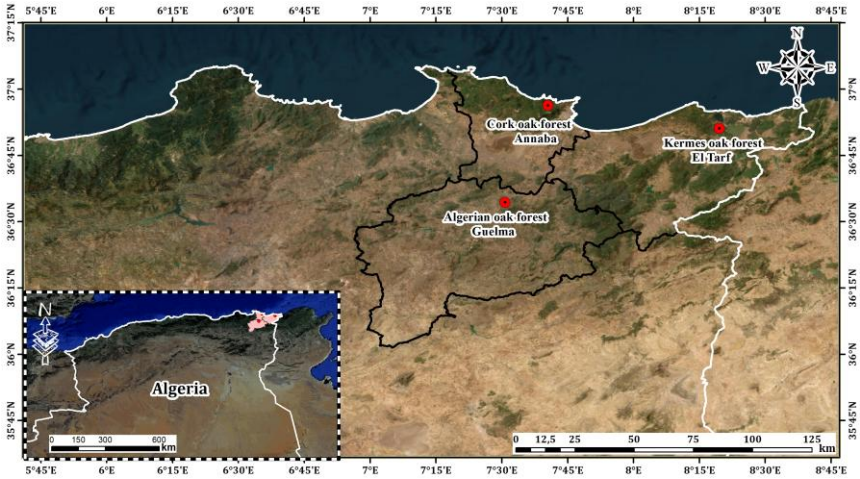


***Figure 1.*** *Map of the sampling locations of the study*

***Sampling procedures***

The current investigation was carried out monthly from September 2020 to August 2021. Spiders were collected during the study period from three different habitats. Because of the diversity of spiders, we used a combination of methods to obtain a representative sample of the complete spider community at the given sites. Besides pitfall traps, semi-quantitative sampling methods (visual searching, vegetative beating, sweep netting) were carried out to collect spiders living in shrubs, high vegetation, trees, and tree branches, as well as those spotted on the ground under leaf litter, rocks, and fallen or dry wood. In order to conserve and identify the collected spiders, every specimen was placed in vials containing 70% ethyl alcohol, for further identification in the laboratory using the appropriate spiders guide (Roberts, 2009) and Spider World Catalog (WSC, 2024). Based-on type of web and method of active hunting from (Cardoso et al., 2011), we classified spiders' families into different guilds.


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### *Statistical analysis*

Statistical analyses were carried out with R 4.2.1 (by R Development Core Team, 2023). Ecological indices were estimated based on Scorpion fauna data to characterize biodiversity in the different sampling habitat during the study period, and was evaluated by calculating the abundance. Biodiversity of spiders was assessed by (1) species richness (S) which represents the total number of species identified; (2) Shannon's index:

$$H' = -\sum(pi \cdot log_2\, pi) \quad \text{(Eq.1)}$$

The evenness

$$Evenness = H'/(log_2\, Sobs) \quad \text{(Eq.2)}$$

were applied for measuring spider diversity in each sampled site based on the relative density pi of the $i^{th}$ species (Magurran, 2004). The analysis of the similarity between number of spiders and sites was carried out by calculating several similarity indices (Jaccard and Sørensen) and dissimilarity indices (Bray-Curtis and Jaccard). Moreover, Similarity percentages (SIMPER) analyses were used to identify most abundant and/or most variables species in the three sites. To estimate total species richness across all sites, common nonparametric estimators and approaches (Chao 2, Jackknife and Bootstrapping) were used. All the diversity indices were assessed using vegan package (Oksanen et al., 2020). Furthermore, functional diversity was estimated based on spider's guild including eight classes using FD package (Laliberté et al., 2014). Values presented hereafter are mean ± SD.

## Results

A total of 1076 spider individuals were collected at 03 sampling sites of; 473 specimens (43.95%) from Site 1, 242 individuals (22.49%) from Site 2, and 361 individuals (33.55%) from Site 3. These specimens were identified then classified into 61 species belonging to 22 families. Among these families, Theridiidae is the most represented by 09 species, followed by Gnaphosidae and Linyphiidae with 08 species, and with Araneidae, Lycosidae with 7 species. The lowest number of species was recorded in 09 families with only one species (*Fig. 2*). The three studied forests had common species: *Araneus sp.1*. The Kermes Oak and Algerian Oak forest share only one species (*Linyphia sp.1*), while, the Kermes Oak and Cork Oak had six common species (*Aranus sp.1*, *Clubiona sp.1*, *Zelotes sp.*, *Drassodes sp.*, *Trochosa sp.*, *Tibellus sp.*).

### *Site-specific species abundance*

According to the type of habitat, the highest abundances of spider were recorded in sites 1 following by S3 and S2, respectively. *Stegodyphus lineatus* was the most abundant in site 1 with 41 individuals and *Ballus sp*, *Eusparassus sp*, and *Stroemiellus sp* were the less abundant with 6 individuals for each. In Site 2, *Pardosa sp* was the most abundant with 22 individuals and *Liniphya sp3* was the less abundant species with only 3 individuals. In Site 3, *Nigma puella* occupied the first class with the highest number of individuals followed by *Tetragnatha montana* in the second class, and *Phaeocedus sp* as a rare.


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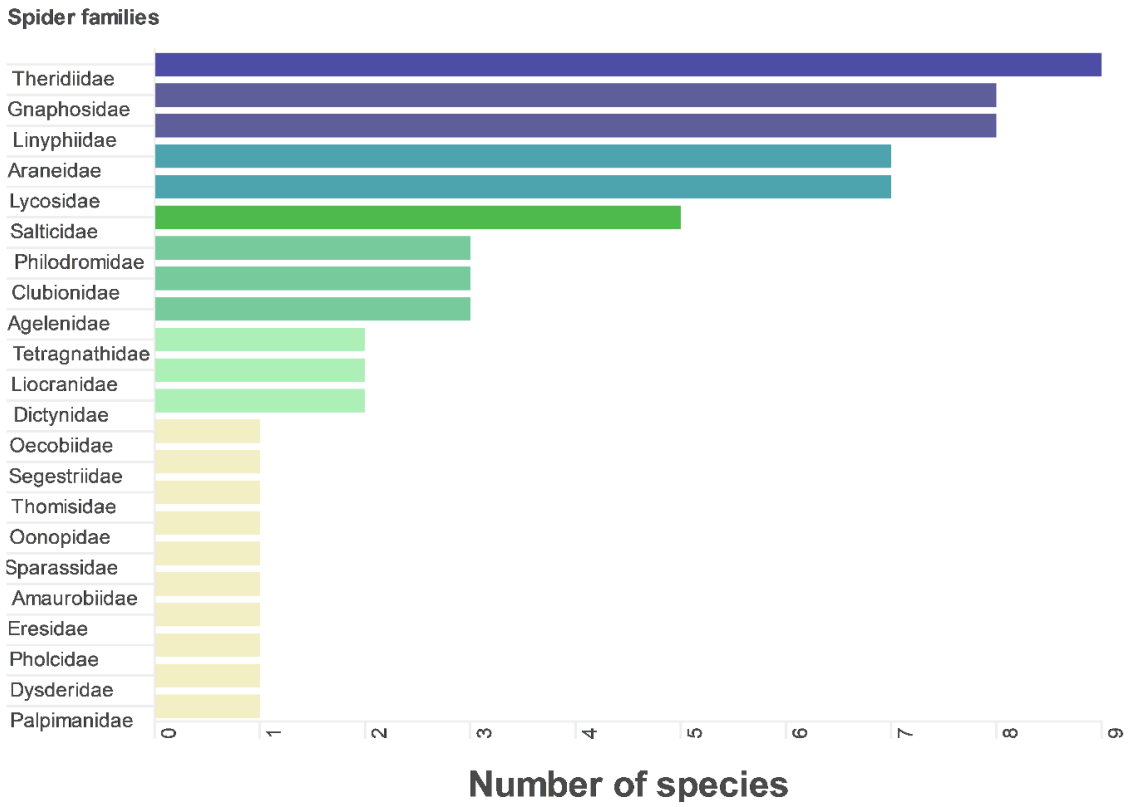


***Figure 2.*** *Distribution of the number of spider species by family in northeast Algeria. Colors represent the number of species belonging to each family, from light to dark color (from low number to high number of species)*

### *Richness and diversity of spider*

In our investigation, 61 species were identified, with 43 species (70%) reaching up only at the genus level. Richness, Shannon index, and Peliou's evenness varied between forest types (*Fig. 3; Table 1*). Holm oak and Algerian oak have similar Shannon's H' scores, however, this is resultant of distinct mechanisms. Algerian oak has a large number of species (high species richness) but is relatively uneven (moderate Pielou's Evenness), resulting in a moderate Shannon's H'. Holm oak, in contrast, has the smaller number of species but is very even, also resulting in a moderate Shannon's H' (*Fig. 3*). The species accumulation curves did not reach an asymptote in the three sites pooled during our study period, indicating not all species of spiders had been collected (*Fig. 4*). Based on different metrics of species richness such as Chao 2 (Chao, 1987), Jackknife and Bootstrapping, the total estimated species richness across all sites was ranged from 69 and 328 spider (Chao, 1987).

***Table 1.*** *Alpha diversity metrics in the three types of forest habitat in northeast Algeria*

| Type of habitat | Richness | Shannon index | Pielou's evenness |
|---|---|---|---|
| Cork oak | 33 | 3.306367 | 0.9456198 |
| Kermes oak | 22 | 2.977360 | 0.9632220 |
| Algerian oak | 23 | 2.967756 | 0.9465034 |


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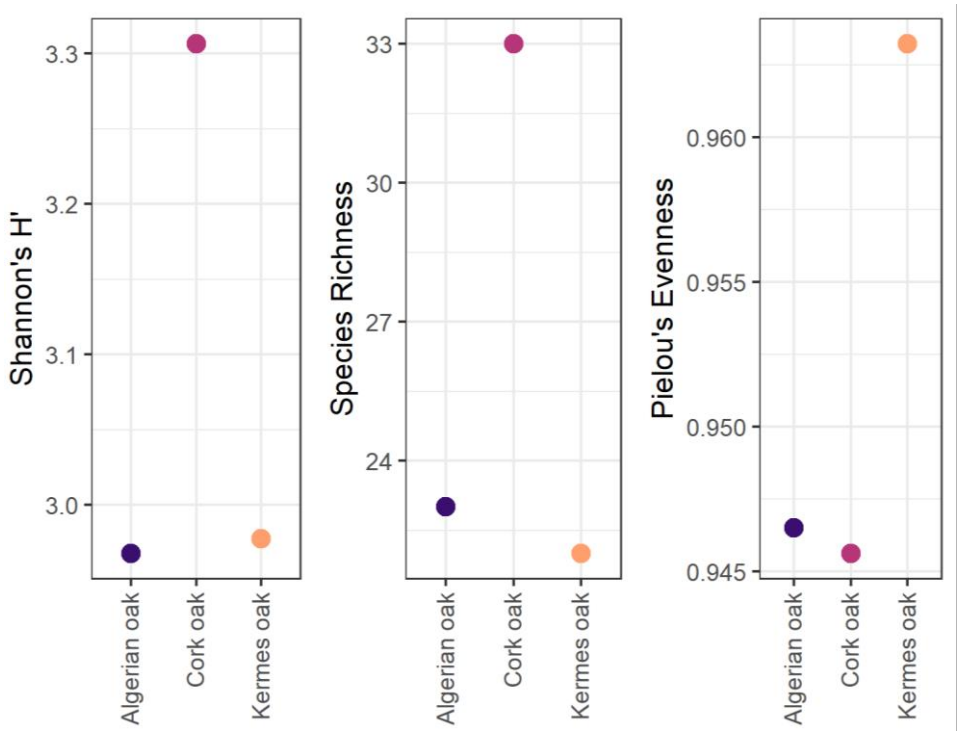


***Figure 3.*** *Alpha diversity metrics in the three types of habitats in northeast Algeria*

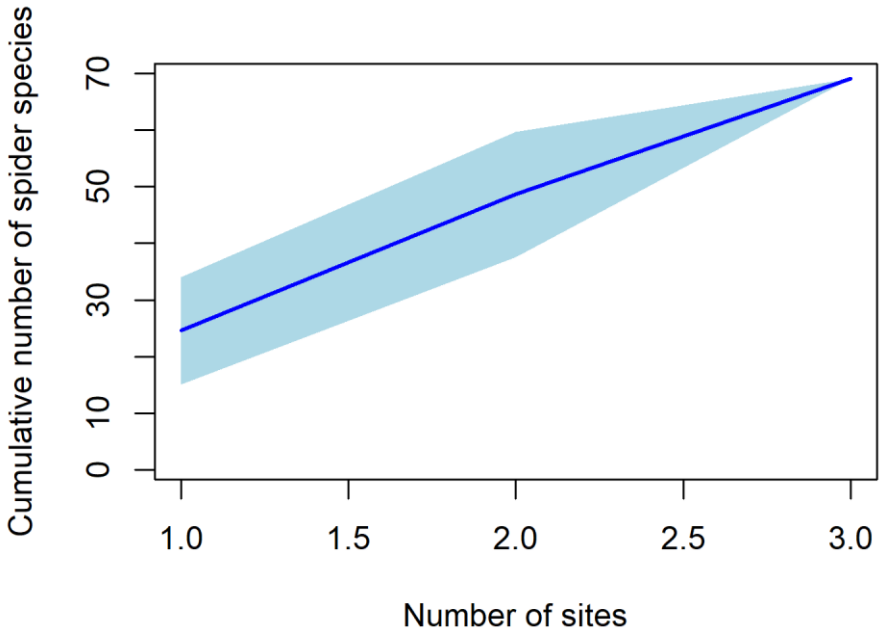


***Figure 4.*** *Accumulative curve of spider species during the study period 2019/2020, northeast Algeria*

### *The β diversity metrics*

The similarity calculation between the different sites (*Table 2*) showed that the most important valeur was found between the Cork oak (S1) and Kermes oak (S3), with a


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12.24% and 21.81% similarity for the Jaccard and Sorensen, respectively. The Bray–Curtis dissimilarity index showed that the greatest dissimilarity existed between the Cork oak and Algerian oak (96.41%) forest, while the least significant dissimilarity exists between the Cork oak (S1) and Kermes oak (S2) with (82.09%) (*Table 2*). According to SIMPER estimation results, Pardosa sp contributes the most (71.11%) to this dissimilarity between sites throughout our study period, followed by Trochosa sp and Zelotes sp with 69.86% and 68.58%, respectively.

***Table 2.*** *Similarity and dissimilarity index in spider between three Oak forests, Northeastern Algeria*

| **Jaccard's index** | | |
|---|---|---|
| | Cork oak | Kermes oak |
| Kermes oak | 0.12244898 | |
| Algerian oak | 0.03703704 | 0.04651163 |
| **Sorenson's index** | | |
| | Cork oak | Kermes oak |
| Kermes oak | 0.21818182 | |
| Algerian oak | 0.07142857 | 0.08888889 |
| **Bray–Curtis dissimilarity** | | |
| | Cork oak | Kermes oak |
| Kermes oak | 0.8209790 | |
| Algerian oak | 0.9640288 | 0.9502488 |

### *Functional diversity*

The spider classification resulted in eight functional guilds based on their foraging mode (*Fig. 5*), Sheet web weavers represented the richest and most abundant feeding guild in all sites with 21.6% of total capture, followed by space web weavers 20.4%, other hunters 15.7%, ambush hunters 13.7%, Orb web weavers 12.7%, ground hunters 12.1% and specialists 2.5% while sensing web weavers contributed 1.7% of all caught spiders and were only found in Kermes oak forest. The dominant Sheet web weavers constituted 13 species belonging to four families (Linyphiidae, Agelenidae, Eresidae and Amaurobiidae).

The FD analysis showed a higher diversity of functional roles of sheet web weavers (148 individuals), ambush hunters (44 individuals) and space web weavers (109 individuals) in Cork oak forest, Kermes oak forest and Algerian oak forest, respectively. The proportion of species and number of individuals with different traits were highly distributed in Cork oak forest and Algerian oak forest than in the other site, but Kermes oak forest had a higher functional richness (Fric) and functional evenness (FEve). The relatively higher evenness and functional richness, together with the presence of species with dissimilar traits (Sensing web weavers and Specialists) explained the overall high functional diversity (RaoQ) (*Table 3*).

### *Phenology*

With the exception of *Steatoda nobilis*, which was found in the Cork Oak Forest, the other two ecosystems (Kermes Oak forest and Algerian Oak forest) contain few


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representatives of this family. They are recorded predominantly in the winter and spring (*Fig. 6*). The Gnaphosidae display a substantial presence in all three examined ecosystems year-round, covering all four seasons; winter and spring show particularly high levels of representation. Year-round observations are made of three species: *Gnaphosa sp1*, *Haplodrassus sp*, and *Zelotes sp*. Throughout the year, individuals of the Linyphiidae family are observed in the guild of space web weavers, with particularly abundant and unique populations in the winter and spring.

The Lycosidae family and the Araneidae family each have seven species representatives. These two families are predominantly observed during two seasons (winter and spring) and are present in all three ecosystems that have been investigated. Five species of another family (Salticidae) are mainly observed in all three environments during the spring and summer. It is noteworthy that, the species *Heliophanus cupreus* is observed throughout the year in the Algerian Oak Forest ecosystem. It is essential to point out that only nine species are recorded throughout the year (*Fig. 6*).

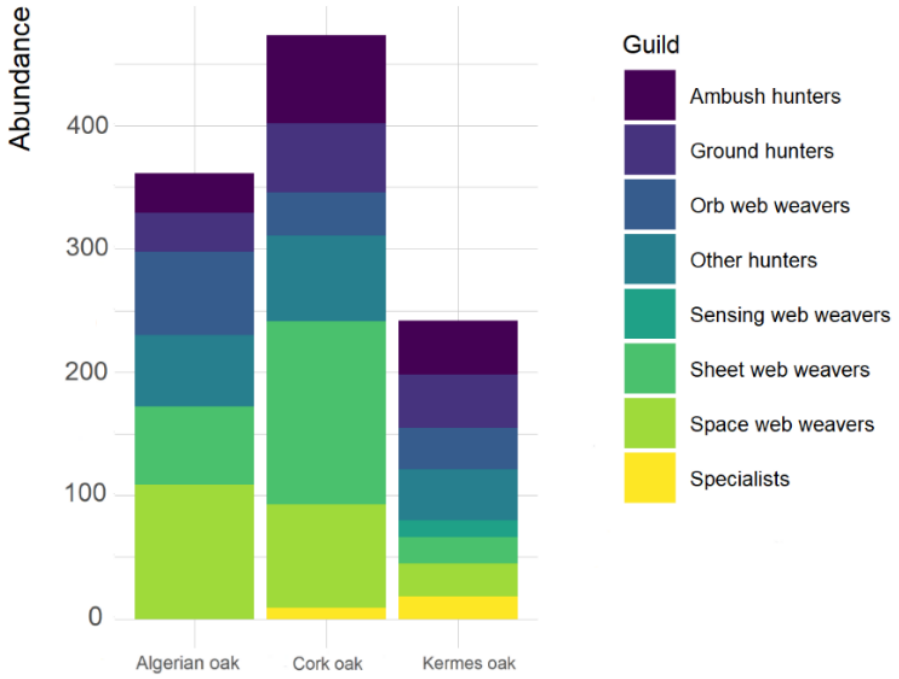


***Figure 5.*** *Variation in guild structure of spider assemblages across different sites in northeast Algeria*

***Table 3.*** *Functional diversity metrics in the three types of forest habitat in northeast Algeria*

| | **Cork oak** | **Kermes oak** | **Algerian oak** |
|---|---|---|---|
| Abundance | 473 | 242 | 361 |
| FRic | 7 | 8 | 6 |
| FEve | 0.1612903 | 0.3000000 | 0.1904762 |
| FDis | 0.3155386 | 0.3271236 | 0.3151218 |
| RaoQ | 0.1007838 | 0.1072587 | 0.1002314 |
| Functional Guild | Sheet.web.weavers | Ambush.hunters | Space.web.weavers |


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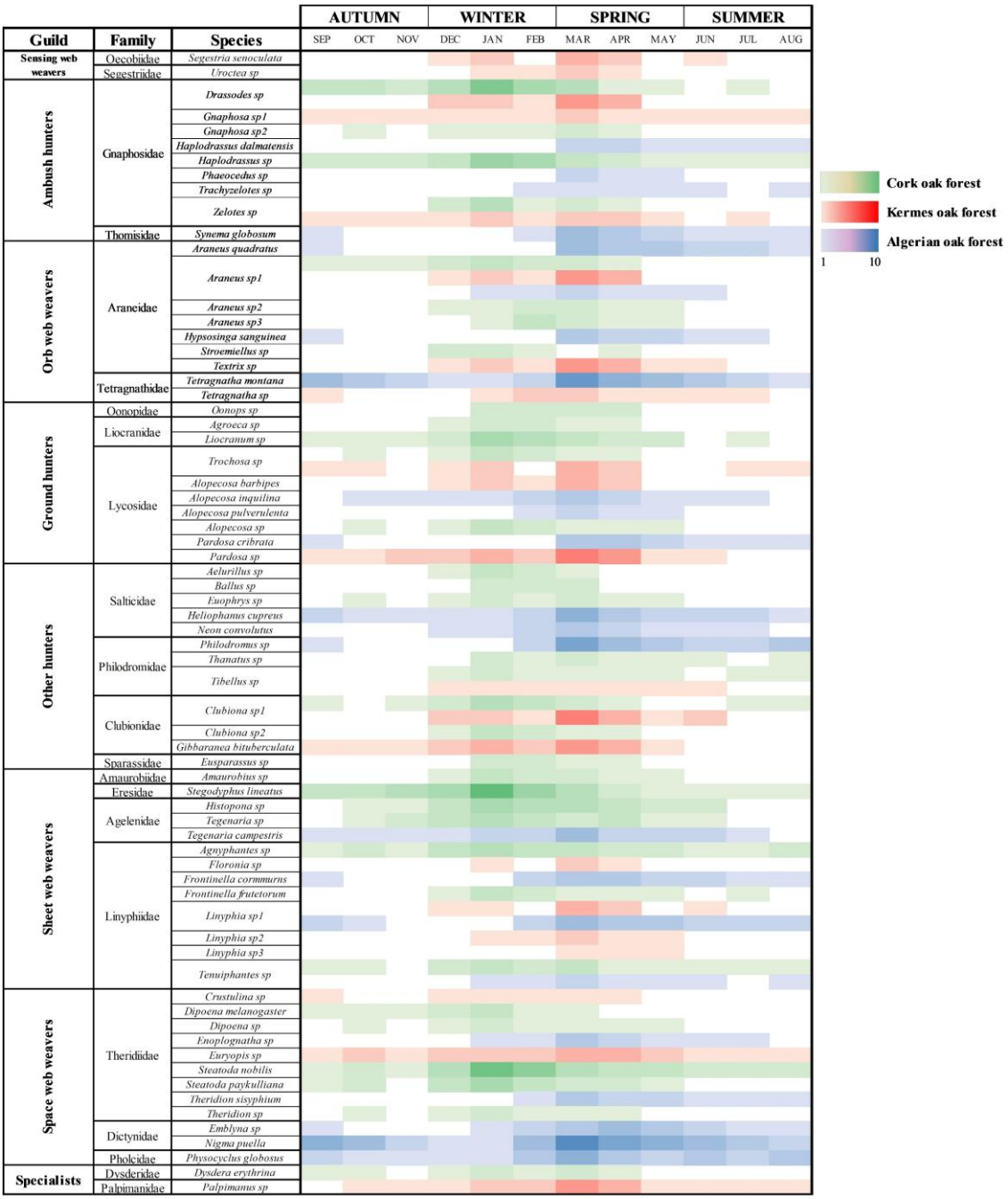


***Figure 6.*** *Phenologram of spider species recorded in the three types of forest habitat in Northeastern Algeria*

## Discussion

The current investigation examined the influence of habitat characteristics on spider diversity in three distinct forest habitats located in Northeast Algeria. This was achieved by calculating spider richness estimates, faunistic composition, and spider diversity parameters.

During the sampling period, a total of 1076 spiders were collected form 03 sampling sites, belonging to 61 species under 51 genera distributed in 22 families. This number


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remains important compared to other works on spiders in deferent parts of Algeria. Including, Touchi et al. (2018) inventoried 48 species (33 genera and 17 families) in Zéralda pine Forests (Algiers, Algeria). In different ecosystems of Tébessa region (Northeastern Algeria) 67 species (20 families) were identified (Ghellab and Guettiche, 2022). In Palm grove of Biskra (East Algeria). Berretima (2016) found 47 spider species (38 genera and 22 families). However, the greatest number of species was reported in northern Algerian Sahara with 124 spider species, belonging to 71 genera and 25 families (Alioua, 2018). Nonetheless, the lack of true replicates in our investigation, necessitates that all outcomes be viewed with caution.

### *Diversity*

The complexity of vegetation structure is a very important component that gives shelter and substrates for the construction of spiderwebs, attracts prey, and provides an appropriate micro-habitat for reproduction. Thus, can influence the abundance of spiders through several factors, such as: the structure of the webs, the sunshine, the abundance, the type of prey, and intraguild predation (Greenstone, 1984; Rypstra et al., 1999; Samu and Lovei, 1995). Indeed, the determination of whether a spider inhabits a large or small habitat is not a random choice. To provide an example, the macro-level comprises characteristics related to habitats, such as forest types; the micro-level relates to the choice and the use of specific plants; and the nano-level analyses the selection of particular components within a single plant (Rao, 2017). In our research area, the most prevalent spider families, each consisting of over 100 individuals, are Theridiidae and Lycosidae, with 145 and 129 specimens, respectively. These results are consistent with findings from comparable forest ecosystems in the extreme northeast of Algeria (Bourbia et al., 2018). Additionally, Lycosidae are co-dominant with Gnaphosidae in both cereal crops in the central region and Aleppo pine plantations (Pinus halipensis) in the central area as well (Boucherit et al., 2020; Touchi et al., 2018). However, in Saharan agro-ecosystems (Oasis) and steppe environments in the East, spider populations are solely dominated by Gnaphosidae, occasionally accompanied by Linyphiidae and Thomisidae, which are the most abundant family in Algeria (Alioua, 2012; Alioua et al., 2016; Berretima, 2016; Ghellab and Guettiche, 2022). Concerning the ecological connectivity of our neighboring environments and toward the East of Algeria, the Gnaphosidae family prevails in Tunisian ecosystems (Dimassi et al., 2017). This family is also abundant in Iranian habitats (Hosseini et al., 2014) and shares dominance with Salticidae specimens in Turkey (Demir and Seyyar, 2017). Conversely, Gnaphosidae are abundant in French ecosystems (Milano et al., 2019) and Hungarian environments (Grbić and Savić, 2010). In Belgium, the spider population composition and structure vary, with Philodromidae and Araneidae being dominant in studies conducted in terrestrial ecosystems in the Limburg region (Van Keer et al., 2020).

### *Functional diversity*

Functional diversity in spiders is a multifaceted notion that includes the diverse ecological functions performed by spiders within an ecosystem, and it is susceptible to a number of determinants, such as the habitat type and geographic location (Cardoso et al., 2011). In contrast to taxonomic diversity, which often demonstrates a stronger correlation with environmental changes (Petchey et al., 2009; Violle et al., 2007; Woodcock et al., 2014), functional diversity provides significant insights into the


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interactions between organisms and their surroundings. Our study reveals that the sheet-web weavers represented the richest with four families and the most abundant, and which involving woody vegetation, this finding was similar to that observed by (Schirmel et al., 2016). This is likely due to the presence of more suitable structures for web attachment and reduced exposure of webs to meteorological conditions (e.g., wind, precipitation) compared to herbaceous habitats (Schirmel et al., 2016). As our research was carried out in three distinct habitat structures of oak forest (Rouag, 2016; Yahi et al., 2012). Our findings indicate that the Algerian oak forest and Kermes oak forest were well-suited for space web weavers with two families and ambush hunters with one family, respectively. Furthermore, Kermes oak forest had a higher functional richness with eight families. This variation may due the heterogeneity of these forest habitat types (Måsviken et al., 2023). In fact, the ecology's physical characteristics, including vegetation cover and habitat complexity, may have an impact on the diverse ecological functions and foraging strategies used by spiders (Cardoso et al., 2011; Måsviken et al., 2023).

### *Phenology*

Temperature has an impact on the development of spider embryos and the behavior of mature spiders (Belozerov, 2012). The start of less severe seasonal weather causes a rise in spider activity, which is especially advantageous for reproduction. Adult spiders disperse during this period in order to find suitable reproduction sites, partners, and/or to disperse their offspring (Blandenier, 2009; Blandenier et al., 2013). As a result, the earliest species initiate their dispersal in February. The reproductive phase of the majority of spider species occurs during the summer season (Blandenier, 2009). Intensity and frequency of dispersal peaks differ based on the biology and phenology of the species. As an example, Erigone atra exhibits continuous activity throughout the year; however, its activity declines from late May to late November (Szymkowiak et al., 2007). *Agyneta rurestris*, an additional linyphiid species, disperses mainly between late July and mid-October (Blandenier and Fürst, 1998). The temporal distribution of the spider along study period shows that the appearance of spiders is mainly observed during the spring period in the three types of environments. Some species are observed throughout the annual cycle *Haplodrassus sp.* (Gnaphosidae), *Tetragnatha montana* (Tetragnathidae), *Heliophanus cupreus* (Salticidae), *Stegodyphus pacificus* (Eresidae), which is consistent with the findings of Bourbia et al. (2018) in northeastern Algeria. Meanwhile, *Nigma puella* (Dictynidae) presents similar characteristics. However, it is important to note that the majority of species (at least 37 species) are visible with more or less significant numbers during both seasons (winter and spring). The most important species are belonged to the families Araneidae (seven species), Gnaphosidae (six species), and then the most represented families such as Lycosidae, Lyniphidae, Clubionidae, Oonopidae, and Liocranidae (Alioua, 2012; Alioua et al., 2016; Jiménez-Valverde and Lobo, 2006; Roberts, 1995, 2009). Other species are mainly observed during the summer period with rare appearances during the spring season. For example, *Haplodrassus dalmatensis* (Gnaphosidae) and *Araneus quadratus* (Araneidae) are very abundant in the northeastern region of Algeria (Bourbia, 2018; Kherbouche, A.O., 2006). On the other hand, during the autumn period, we observe the fewest spider species (Alioua et al., 2016; Roberts, 1995, 2009). The rare species that we can observe during this period are *Dipoena sp.* and *Dipoena melanogaster* (Theridiidae) (Bouseksou, 2010; Kherbouche, Y. et al., 2015)


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## Annotated checklist of the spiders recorded in our study

### *Family Agelenidae C. L. Koch, 1837*

*Tegenaria sp.*

Synonyms: *Arachne* Audouin, 1826; *Trichopus* Templeton, 1834; *Philoica* C. L. Koch, 1837; *Drassina* Grube, 1861; *Mevianops* Mello-Leitão, 1941; *Philoicides* Mello-Leitão, 1944; *Iamatega* Kishida, 1955; *Sabitega* Kishida, 1955.

Distribution: Palearctic (Palaearctic) species (WSC, 2024), recorded in Zéralda pine Forests (Algiers, Algeria) (Touchi et al., 2018). In Palm grove of Touggourt (Algerian Sahara) (Benhacene et al., 2023; Berretima, 2016) cited five species of *Tegenaria* in North Algeria (Lucas, 1846).

Habitat: These spiders occupy a variety of habitats: lawns, open areas and ruderal micro-habitats (Lawrence et al., 2017). In North Algeria, *Tegenaria pagana* Koch, 1840 was found in pine Forests with thin Litter (Touchi et al., 2018). In Algerian Sahara, this species was found in Palm grove with windbreaks composed of Aleppo pine *Pinus halepensis*, coastal she-oak *Casuarina equisetifolia* and the Mediterranean cypress *Cupressus sempervirens* (Berretima, 2016).

*Textrix sp.*

Distribution: Species of this genus are found in Europe and East Africa (Demir and Seyyar, 2017). Also in the south of France and Mediterranean seaboard (Denis, 1936). In Algeria, they were cited in several localities; Laghouat and Ghardaïa (Simon, 1899), Ouargla (Alioua, 2012), Biskra and Touggourt (Berretima, 2016) and El-Oued (Alioua, 2018).

Habitat: In North Algeria, it was sampled from the cork-tree forest of the Mediterranean coast and Yakouren Forest (Denis, 1936; Simon, 1899). All other localities are situated in South of Algeria and mostly represented by palm groves (Alioua, 2012, 2018; Berretima, 2016; Simon, 1899).

### *Family Amaurobiidae Thorell, 1870*

*Amaurobius sp.*

Synonym: *Walmus* Chamberlin, 1947.

Distribution: Species of this genus can be found in Europe to Central Asia and Holarctic zone (Topçu et al., 2013). In Algeria, it was cited only in Tébessa region north east of Algeria (Sbiki, 2016). Three species of *Amaurobius* are reported in Littoral of Algeria (Benhacene et al., 2023).

Habitat: These spiders were sampled from a region characterized by a diversified herbaceous flora and some forest trees such as: Scotch pine *Pinus sylvestris*, Silver poplar *Populus alba* and Ash *Fraxinus excelsior* (Sbiki, 2016).

### *Family Araneidae Clerck, 1757*

*Araneus sp.*

Synonyms: *Aranea* Linnaeus, 1758; *Epeira* Walckenaer, 1805; *Atea* C. L. Koch, 1837; *Burgessia* McCook, 1894; *Neosconella* F. O. Picard-Cambridge, 1903; *Amamrotypus* Archer, 1951; *Cambridgepeira* Archer, 1951; *Conaranea* Archer, 1951; *Conepeira* Archer, 1951; *Cathaistela* Archer, 1958.


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Distribution: Species of this genus are found on all continents (WSC, 2024). In east of Algeria, this species was recorded in Aurès region (Denis, 1936), in Tébessa region (Sbiki, 2016) and in the National Park of El Kala (Bourbia et al., 2018). Form the central Algeria, Simon (1899) found three species; *A. circe* and *A. redii* from Laghouat and *A. dioidia* from Ghardaia.

Habitat: These species occupy several climatic regions with different altitudes. For exemple, *A. diadematus* Clerck, 1757 is a generalist species, widely distributed over a large number of different habitat types (Nyffeler and Bonte, 2020). In coastal lake at 6 meters above sea level (sub humid climate) with dominance of woody vegetation composed of lentisk *Pistacia lentiscus* and several species of oak *Quercus* sp. (Bourbia et al., 2018). In high altitudes of the Aures Mountains and Tébessa in forests of Aleppo pine (*Pinus halepensis*) and of Holm oak (*Quercus ilex*) (Denis, 1936; Sbiki, 2016). It can also live in arid areas at medium altitudes of central Algeria (Simon, 1899).

*Gibbaranea bituberculata (Walckenaer, 1802)*

Distribution: This species is found in the Palearctic zone (Demir and Seyyar, 2017). In Algeria, this species was recorded only in the National Park of El Kala (Bourbia et al., 2018).

Habitat: In the same region (National Park of El Kala), this species can occupy two different biotopes**:** high Forest trees dominated by cork oak and low vast wet meadows (Bourbia et al., 2018).

*Hypsosinga sanguinea (C.L. Koch, 1844)*

Synonyms: *Hypsosinga sanguinea* (C.L. Koch, 1845); *Singa sangu*inea C.L. Koch, 1844.

Distribution: Species of this genus are found in the Palearctic ecozone (Demir and Seyyar, 2017; Grbic and Tomic, 2008). In Algeria, this species was recorded in Algiers (Benhacene et al., 2023).

Habitat: In our survey, this species was found in Algerian oak forest with *Quercus canariensis* and cork oak *Quercus suber*.

***Family Clubionidae Wagner, 1887***

*Clubiona sp.*

Synonyms: *Hirtia* Thorell, 1881; *Atalia* Thorell, 1887; *Tolophus* Thorell, 1891; *Epiclubiona* Lohmander, 1944; *Euryclubiona* Lohmander, 1944; *Gauroclubiona* Lohmander, 1944; *Heteroclubiona* Lohmander, 1944; *Hyloclubiona* Lohmander, 1944; *Microclubiona* Lohmander, 1944; *Paraclubiona* Lohmander, 1944; *Japoniona* Mikhailov, 1990; *Anaclubiona* Ono, 2010; *Breviclubiona* Wunderlich, 2011; *Marmorclubiona* Wunderlich, 2011.

Distribution: Species of this genus are found on all continents (WSC, 2024). In Algeria all localities of these species are located northeast. *C. baborensis* Denis, 1937 (Syn. *C. diniensis* Simon, 1878) from Wilaya de Setif, Zouagha Forest (Bosmans et al., 2017; Denis, 1936). Five other species were recorded form Tébessa region (Sbiki, 2016) and one species in the National Park of El Kala (Bourbia et al., 2018). *C. leucaspis* Simon, 1932 was sampled from Touggourt and Biskra (Berretima, 2016). Benhacene et al. (2023) cited four species in the center and north east Algeria.


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Habitat: The spiders of this family are nocturnal predators who stand underneath a stone or among vegetation (Roberts, 2009). All along the Algerian coast, *C. diniensis* can live in litter in herbs, in *Pinus halepensis* forest, *Quercus suber* forest and at border of Lake Oubeira (Bosmans et al., 2017). In coastal lake, it has been captured either under a stone between the tufts of common myrtle *Myrtus communis*, spiny broom *Calicotome villosa* and salvia cistus *Cistus salviifolius* (Bourbia et al., 2018). Almost the same habitats in Tébessa region a diversified herbaceous and some forest trees (Sbiki, 2016).

*Crustulina sp.*

Distribution: The spiders are distributed in the Palaearctic region (Helsdingen, 2013). In Algeria, this genus is represented by two species: *C. erythropus* Lucas, 1846 and *C. scabripes* Simon, 1881, where they are located in the north-east of Algeria (Benhacene et al., 2023).

Distribution: *Crustulina* sp. was found in Algeria related to oak forest with *Q. canariensis* and Kermes oak *Q. coccifera*.

### *Family Dictynidae Pickard-Cambridge, 1871*

*Nigma puella (Simon, 1870)*

Synonyms: *Dictyna puella* Simon, 1870; *Dictyna lobensis* Schmidt, 1976; *Dictyna eburnea* Schmidt, 1982; *Nigma canariensis* Wunderlich, 1987.

Distribution: It can be found in Europe and the Palearctic (Marusık et al., 2011). In Algeria, it was recorded from Ghardaïa and Laghouat (Alioua, 2018; Bosmans, 2007), from Touggourt (Berretima, 2016).

Habitat: This species occupies a variety of habitats such as lawns, gardens, moors, scrubland, undergrowth and bushes (Canard and Rollard, 2015). It was reported in the palm groves of Touggourt with (Berretima, 2016). In our study (Northeastern Algeria), *N. puella* was found only in Algerian oak forest.

### *Family Dysderidae C. L. Koch, 1837*

*Dysdera erythrina (Walckenaer, 1802)*

Synonyms: *Aranea erythrina* Walckenaer, 1802; *Dysdera pumila* Thorell, 1873; *Dysdera cambridgii* Thorell, 1873.

Distribution: The spiders of this family are distributed in the West Palaearctic (Zamani et al., 2023). In Algeria, *D. erythrina* was recorded from Annaba in Northeastern Algeria (Bourbia, 2018) and in Tizi Ouzou region (Allache and Hamiti, 2020).

Habitat: *D. erythrina* was found in Seraidi forest (Bourbia, 2018), which shows an affinity of this species to live in humid and dense forest with a dominance of two species, cork oak and zeen oak. Zamani et al. (2023) shows a similar biotope in Caspian coast, forest in Chalus**.** While in Tizi Ouzou forest, this species **s**ubservient to the cultivation of the pear tree *Pyrus communis* (Allache and Hamiti, 2020).

### *Family Eresidae C. L. Koch, 1850*

*Stegodyphus lineatus (Latreille, 1817)*

Synonyms: *Eresus lineatus* Latreille, 1817; *Eresus acanthophilus* Dufour, 1820; *Eresus unifasciatus* C. L. Koch, 1846; *Eresus adspersus* C. L. Koch, 1846; *Eresus*


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*fuscifrons* C. L. Koch, 1846; *Eresus lituratus* C. L. Koch, 1846; *Stegodyphus molitor* Simon, 1873; *Eresus arenarius* Kroneberg, 1875; *Stegodyphus lineatus deserticola* Simon, 1908; *Stegodyphus quadriculatus* Franganillo, 1925

Distribution: This species distributed from North Africa in the west to the Middle East and Central Asia in the east and in Europe (Kraus and Kraus, 1988). In Algeria, it was recorded in Algiers, Béjaia, Msila, Batna and Laghouat (Simon, 1899), in Ghardaïa (Alioua, 2018; Simon, 1899) in Ouargla (Alioua, 2018) and in Annaba (Bourbia, 2018).

Habitat: *Stegodyphus lineatus* was found in different biotopes and in different climatic zones. From the coastal forests (sub humid climate) with dominance of woody vegetation composed of several species of oak *Quercus* sp. (Bourbia et al., 2018; Simon, 1899) to arid and semi-arid region in the palm groves and on spontaneous plants around the wetland (Alioua, 2018; Alioua et al., 2022; Boutmedjet et al., 2022; Simon, 1899).

### *Family Gnaphosidae Banks, 1892*

*Drassodes sp.*

Synonyms: *Geodrassus* Chamberlin, 1922; *Mesklia* Roewer, 1928; *Brachydrassodes* Caporiacco, 1934; *Sillemia* Reimoser, 1935; *Kirmaka* Roewer, 1961; *Siruasus* Roewer, 1961.

Distribution: Species of this genus have a general distribution in Palearctic (Platnick, 2013), found in Africa, Asia, Europe and America (WSC, 2024). In Algeria, it was mentioned in Annaba (Bourbia, 2018; Bourbia et al., 2018), in Biskra (Berretima, 2016), Ouargla (Alioua, 2012) and Ghardaïa (Alioua, 2018).

Habitat: Drassodes are spiders Ambush Hunters, they can be found under stones at moderate to high altitudes (Hervé and Rollard, 2009) also be found in humid forests Seraidi Annaba (Bourbia et al., 2018). In Algerian Sahara, *Drassodes* prefers the herbaceous layer in palm groves (Alioua, 2012, 2018; Berretima, 2016).

*Gnaphosa sp.*

Synonyms: *Cylphosa* Chamberlin, 1939; *Pterochroa* Benoit, 1977.

Distribution: Species of this genus *Gnaphosa* have a general distribution in Palearctic (Danflous et al., 2020; Platnick, 2013). In Algeria, it was cited in Annaba (Bourbia, 2018), in Blida region (Chaouch and Brahimi, 2021).

Habitat: Species of this genus *Gnaphosa* are independent of altitude (Chaouch and Brahimi, 2021). From low altitude of Lake Fetzara (Annaba) with a dense herbaceous layer (Bourbia, 2018) to the high altitude of the Chrea forests (Blida) with dominance of woody vegetation composed of several species such as Aleppo pine (*Pinus halepensis*) and Atlas cedar (*Cedrus atlantica*) (Chaouch and Brahimi, 2021). The same reported in Crete, Gnaphosidae are distributed along the low and middle altitudes, only a few shows a preference for more specialized ecotopes (Chatzaki et al., 2002).

*Haplodrassus dalmatensis (L. Koch, 1866)*

Synonyms: Drassus dalmatensis Koch, 1866; Drassus minusculus Koch, 1866; Drassus denotatus O. Pickard-Cambridge, 1874; Drassus delinquens O. Pickard-Cambridge, 1875; Drassus minusculus Koch, 1876; Drassodes carinatus Strand, 1906; Drassodes dalmatensis Simon, 1914; Drassodes palaestinensis Strand, 1915; Drassodes


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lithobius Roewer, 1928; Scotophaeus desertorum Caporiacco, 1928b; Pseudodrassus desertorum Caporiacco, 1935; Drassodes dalmatensis Miller, 1936; Haplodrassus dalmatensis Tullgren, 1946; Haplodrassus insularis Denis, 1962; Pseudodrassus desertorum Denis, 1966.

Distribution: This species is widespread in western and central Europe as far north as Sweden (BAS, 2024). West and Central Palaearctic: North Africa, Europe, South Urals (Hosseini et al., 2014; Marinaro, 1967). In Algeria, it was cited in Biskra (Berretima, 2016), in Tébessa region (Ghellab and Guettiche, 2022) and in Algerian Sahara, Ouargla and El-Oued (Alioua, 2018).

Habitat: This species was recorded in the palm groves of Algerian Sahara (Alioua, 2018; Berretima, 2016) and in forests of Aleppo pine and of Holm oak (Ghellab and Guettiche, 2022). It should be noted that the genus Haplodrassus can also be found in humid forests composed of several species of oak Quercus sp. (Bourbia et al., 2018).

*Trachyzelotes sp.*

Synonym: *Simonizelotes* Marinaro, 1967.

Distribution: This species is found in Europe, Turkey and Iran (WSC, 2024), on the Mediterranean (Platnick and Murphy, 1996). In Algeria, some species of this genus were recorded from Ouargla (Ben Chikhe and Mana, 2013), Biskra and Touggourt (Berretima, 2016) and from Zéralda (Touchi et al., 2018).

Habitat: These spiders preferred the sunny places, on bare sandy or stony soils or with little grass cover (Cruveillier, 2014). Similarly, the palm groves where this species was reported (Ouargla, Biskra and Touggourt) are characterized by strong sunlight and sandy soils (Ben Chikhe and Mana, 2013; Berretima, 2016). In the Chréa park, it is found at a low altitude in open forest (Touchi et al., 2018).

*Zelotes sp.*

Synonyms: *Melanophora* C. L. Koch, 1833; *Aracus* Thorell, 1887; *Scotophinus* Simon, 1905; *Zavattarica* Caporiacco, 1941.

Distribution: The genus *Zelotes* is a very numerous (Denis, 1936). Species of this genus are found on all continents except at the poles (Bosmans and Janssen, 1999; Platnick, 2013; Platnick and Murphy, 1996; Ponomarev and Tsvetkov, 2006). In Algeria, Zelotes species are recorded from Setif (Denis, 1936), in Blida (Chaouch and Brahimi, 2021), El Kala (Bourbia, 2018), Ouargla (Alioua, 2012), Tébessa (Sbiki, 2016), Biskra (Berretima, 2016) and El-Oued, Ghardaia and Illizi (Alioua, 2018).

Habitat: These spiders preferred the medium Altitude (Chaouch and Brahimi, 2021). In Zouagha Forest (Setif), they were found under stones, dead leaves, or dry herbs (Denis, 1936).

***Family Linyphiidae Blackwall, 1859***

*Floronia sp.*

Distribution: Species of this genus are found in Asia, Europe and South America (WSC, 2024). In Algeria, this species was recorded only in the National Park of El Kala (Bourbia, 2018).

Habitat: in our study, spiders of Floronia genus were sampled from El Kaka forest with dominance of kermes oak *Quercus coccifera* (Bourbia, 2018; Rouag, 2016).


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*Frontinellina frutetorum (C. L. Koch, 1834)*

Synonyms: Linyphia frutetorum C. L. Koch, 1834; Linyphia quadrata Wider, 1834; Linyphia fastuosa Lucas, 1846; Linyphia congener O. Pickard-Cambridge, 1872; Linyphia frutetorum punctiventris Chyzer & Kulczyński, 1894; Linyphia frutetorum occidentalis Simon, 1929; Linyphia frutetorum niger Giltay, 1932.

Distribution: Species of this genus are found in the Palearctic (Deltshev et al., 2003; Grbic and Tomic, 2008). In Algeria, it was mentioned in Annaba (Bourbia, 2018).

Habitat: This species was found in forest of Seraidi, where humidity is high and vegetation cover is dense mixed with two species, cork oak and zeen oak (Bourbia, 2018).

*Linyphia sp.*

Distribution: Species of this genus are found in the Palearctic ecozone (Demir and Seyyar, 2017; Grbic and Tomic, 2008). *L. peltata* Wider, 1834 in Setif region (Denis, 1936), *L. tenuipalpis* Simon, 1884 was reported in Algeria (Grbic and Tomic, 2008).

Habitat: The species of this genus show an affinity to the forest, Denis (1936) cited two species in Zouagha Forest, Algeria.

*Tenuiphantes sp.*

Distribution: Species of this genus are found in the Palearctic (Grbic and Tomic, 2008). *T. tenuis* (Blackwall, 1852) which is found a lot in North Africa (Bosmans, 1985; Denis, 1945). In Algeria, spiders blogging to this species are recorded from Zéralda (Touchi et al., 2018), in Ouargla (Alioua, 2018).

Habitat: *Tenuiphantes sp*. is found in heterogeneous biotopes between humid pine forest (Touchi et al., 2018) and palm groves in arid region (Alioua, 2018).

***Family Liocranidae Simon, 1897***

*Agroeca sp.*

Synonym: *Hilke* Keyserling, 1887.

Distribution: Species of this genus are found in the Palearctic (Grbic and Tomic, 2008; Topçu et al., 2007). In Algeria, spiders blogging to this species are recorded from Boumerdes, Tizi Ouzou, Bouira, Tlemcen, Blida and M'sila, (Bosmans, 1999).

Habitat: According to Bosmans (1999), many *Agroeca* species were sampled from different biotopes such as: salt marshes, under stones in grassland and in Oak forests.

*Liocranum sp.*

Distribution: Species of this genus are found in Europe, East Africa, Central Asia, the West Indies and New Guinea (WSC, 2024). In Algeria, it was cited in Ghardaïa (Alioua, 2018).

Habitat: In Algerian Sahara (Ghardaïa), the species of this genus show an affinity to cultivated fields (alfalfa and citruses) and to palm groves (Alioua, 2018).

***Family Lycosidae Sundevall, 1833***

*Alopecosa sp.*

Synonyms: *Jollecosa* Roewer, 1960; *Solicosa* Roewer, 1960.

Distribution: Species of this genus have a general distribution in Palearctic (Grbić and Savić, 2010). In Algeria, species of *Alopecosa* genus were recorded in the Kabylia


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region (Denis, 1936), in Annaba (Bourbia, 2018). in Zéralda (Touchi et al., 2018), in Ouargla (Alioua, 2012), Biskra and Touggourt (Berretima, 2016), El-Oued and Ghardaïa (Alioua, 2018), in Tébessa (Ghellab and Guettiche, 2022).

Habitat: This species shows significant plasticity in biotopes ranging from the mountains and grasslands in the north (Bourbia, 2018; Denis, 1936) to the palm groves of the south of Algeria (Alioua, 2012, 2018).

*Pardosa sp.*

Synonyms: *Acroniops* Simon, 1898; *Pardosops* Roewer, 1955; *Chorilycosa* Roewer, 1960.

Distribution: Species of this genus have a general distribution in Palearctic (Demir and Seyyar, 2017; Grbić and Savić, 2010). In North Africa, Spain, Italy (Alderweireldt and Jocqué, 1992). In Algeria, species of *Pardosa* genus were recorded in Mila region from northeast Algeria (Benhacene et al., 2023; Denis, 1936), in Annaba and El Tarf (Benhacene et al., 2023; Bourbia, 2018). In Chéliff from northwest Algeria (Boucherit et al., 2020). Biskra, Ouargla, Adrar, Bechar (Alioua, 2018).

Habitat: Denis (1936) has recorded *P. proxima* at low altitudes of Oued Endja from Mila region and in alluvial plain of Haut-Chéliff (Boucherit et al., 2020). Bourbia (2018) cited that in northeast, *Pardosa* species are the most abundant at several altitudes. Also, it is very adapted to Saharan biotopes (Alioua, 2018).

*Trochosa sp.*

Synonyms: *Trochosina* Simon, 1885; *Caporiaccosa* Roewer, 1960; *Metatrochosina* Roewer, 1960; *Piratosa* Roewer, 1960; *Trochosippa* Roewer, 1960.

Distribution: Species of this genus have a general distribution in Palearctic (Demir and Seyyar, 2017; Grbic and Tomic, 2008). In Algeria, *Trochosa* sp. was recorded in Annaba (Bourbia, 2018), in Ouargla (Alioua, 2012), Biskra (Berretima, 2016), Tébessa (Sbiki, 2016), El-Oued and Ghardaïa (Alioua, 2018).

Habitat: In the majority of cases, these species were found in palm groves (Alioua, 2012, 2018; Berretima, 2016). But also, it can be found in forest with herbaceous flora and some forest trees (Sbiki, 2016).

***Family Oecobiidae Blackwall, 1862***

*Uroctea sp.*

Distribution: Species of this genus are found in Asia, Africa and Europe (Hosseini et al., 2014; Thorell, 1875). In Algeria, it was sampled from Biskra (Alioua, 2018; Berretima, 2016). *U. durandi* (Latreille, 1809) in Djebel Aurès Batna (Denis, 1936).

Habitat: *U. durandi* specimens were collected in their tent-like webs under stones from dry areas (Kunt et al., 2008). In Algerian Sahara, this species were reported in palm groves of Biskra (Alioua, 2018; Berretima, 2016).

***Family Oonopidae Simon, 1890***

*Oonops sp.*

Distribution: Species of this genus are found mostly in America and Europe, and a few in Oceania and Africa (WSC, 2024). In Algeria, it was cited in Kabylia region in northern Algeria (Denis, 1936), Biskra (Berretima, 2016), in Annaba (Bourbia, 2018).


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Habitat: According Denis (1936), *O. lonuespinosus* was found under tufts of diss in Kabylia mountainous. While, *Oonops* sp. was cited in Palm groves of Biskra (Berretima, 2016).

### *Family Palpimanidae Thorell, 1870*

*Palpimanus sp.*

Synonyms: *Platyscelum* Savigny, 1826; *Chersis* Savigny, 1831; *Eumechanus* Gistel, 1848.

Distribution: Species of this genus are found Mediterranean and Asia (Demir and Seyyar, 2017; Kunt et al., 2008). In Algeria, it was cited in Biskra (Berretima, 2016), in Zéralda (Touchi et al., 2018), in Tébessa (Ghellab and Guettiche, 2022), in El Kala (Bourbia, 2018).

Habitat: Species of this genus prefer homogeneous and open forest as the Aleppo pine forest of Chréa park (Touchi et al., 2018) and the mixed forest (Aleppo pine and Holm oak) of Tébessa (Ghellab and Guettiche, 2022). In El Kala Park, it was found in vast wet meadows (Bourbia, 2018).

### *Family Philodromidae Thorell, 1870*

*Philodromus sp.*

Synonyms: *Artamus* C. L. Koch, 1837; *Artanes* Thorell, 1869; *Opitis* L. Koch, 1875; *Philodromoides* Scheffer, 1904; *Horodromoides* Gertsch, 1933; *Tibellomimus* Gertsch, 1933; *Emargidromus* Wunderlich, 2012; *Philodromimus* Wunderlich, 2012.

Distribution: Many species of *Philodromus* having a distribution Palearctic and the Holarctic (Demir and Seyyar, 2017; Demir et al., 2008). In Algeria, *Philodromus* genus was cited by several species in north of Algeria (Benhacene et al., 2023). In the Sahara it was represented by an endemic species *P. lamellipalpis* (Alioua, 2018; Muster et al., 2007).

Habitat: specimen *P. rufus* was collected in the forest of *Q. mirbeckii* in Djebel Daya.

*Thanatus sp.*

Synonym: *Paratibellus* Simon, 1932.

Distribution: Species of genus are found in in the Palearctic and the Holarctic (Logunov and Kunt, 2010). In Algeria, this genus was cited in Setif (Denis, 1936), Ghardaia (Alioua et al., 2016), in Annaba and El Kala (Bourbia, 2018), in Boumerdes (Alioua, 2018).

Habitat: Species of *Thanatus* genus the majority found in forest: *T. fuscipes* in Zouagha Forest, *T. vulgaris* Simon, 1870 in Boumerdes forest (Alioua, 2018) and *T. arenarius* L. Koch, 1872 and *T. atratus* Simon, 1875 in forest of Seraidi and El Kala Park (Bourbia, 2018).

*Tibellus sp.*

Synonym: *Tibellinus* Simon, 1910.

Distribution: **Demir and Seyyar (2017)** have cited *T. oblongus* (Walckenaer, 1802) in Holarctic ecozone. In Algeria, this genus was recorded from Mila: Djebel Daya (Denis, 1936) also in El Tarf (Benhacene et al., 2023).

Habitat: *T. Parallelus* (C. L. Koch) was found under tufts of diss Djebel Daya (Mila) (Denis, 1936).


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***Family Salticidae Blackwall, 1841***

*Aelurillus sp.*

Synonyms: *Dia* C. L. Koch, 1850; *Aelurops* Thorell, 1869; *Ictidops* Fickert, 1876; *Hemsenattus* Roewer, 1955; *Melioranus* Tystshenko, 1965.

Distribution: The majority of *Aelurillus* are cites as Mediterranean species (Azarkina and Logunov, 2006; Logunov, 2000). In Algeria, this genus was recorded in several localities: from Mila (Denis, 1936), in Biskra and Touggourt (Alioua, 2018; Berretima, 2016), it was mentioned in Annaba (Bourbia, 2018) and also in the extreme south of the country in Illizi and Tamanrasset (Azarkina and Logunov, 2006).

Habitat: Denis (1936) recorded some *Aelurillus* species at an average altitude from Zouagha Forest (Djebel Daya) with a dominance of cork oak (Mila) and in the humid forest of Seraidi (Bourbia, 2018). In the Sahara they were found in palm grove of Biskra and Touggourt (Berretima, 2016).

*Ballus sp.*

Distribution: Species of genus are limited at Europe, Turkey, Cyprus and North Africa (Logunov, 2015). In Algeria, *Ballus* species are limited at the North of the country (Algiers, Tizi ouzou, Tlemcen and Naama) (Benhacene et al., 2023).

Habitat: **(Bourbia, 2018)** cited this species at the humid forest of Seraidi (Northeast Algeria).

*Euophrys sp.*

Distribution: This species is distributed in the Palaearctic and Southern Europe (Coşar, 2015; Demir and Seyyar, 2017). In Algeria, *Euophrys* species are located in the Northeast of the country (Mila, Skikda and Oran) (Benhacene et al., 2023). In the Algerian Sahara, this species was recorded in El Oued (Alioua, 2018).

Habitat: The majority of biotopes where the *Euophrys* species has been cited are oak forests (Benhacene et al., 2023; Bourbia, 2018), except the locality of Sahara was a palm grove palm (Alioua, 2018).

*Heliophanus sp.*

Synonyms: *Trapezocephalus* Berland & Millot, 1941; *Heliocap ensis* Wesołowska, 1986; *Helafricanus* Wesołowska, 1986.

Distribution: This species is distributed in the Palaearctic (Demir and Seyyar, 2017; Logunov, 2009). In Algeria, this genus was cited in Mila (Denis, 1936) and in several localities in the north of the country such us: Algiers, Medea, Annaba, Chlef and Tlemcen (Benhacene et al., 2023). In south of Algeria, they are cited only in Biskra region (Alioua, 2018) and Naama (Benhacene et al., 2023).

Habitat: (Denis, 1936) indicated that *H. dilutus* was found under tufts of diss Djebel Daya (Mila).

*Neon sp.*

Synonym: *Dicroneon* Lohmander, 1944.

Distribution: This species is distributed in the Holarctic (Grbić and Savić, 2010; Logunov, 2015). In Algeria, this genus is limited in the north of Algeria: Mila (Denis, 1936) and Annaba (Bourbia, 2018).


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Habitat: The Neon species has been found under tufts of diss Djebel Daya (Mila) (Denis, 1936) and at low altitude of Lake Fetzara (Annaba) with a dense herbaceous layer (Bourbia, 2018).

### *Family Segestriidae Simon, 1893*

*Segestria senoculata (Linnaeus, 1758)*

Synonyms: *Aranea senoculata* Linnaeus, 1758; *Aranea scopulorum* Fabricius, 1779; *Segestria corvulus* Jarocki, 1825; *Segestria krausi* Braun, 1963

Distribution: This species is found in the Palearctic zone (Kunt et al., 2012; WSC, 2024). In Algeria, this species is cited only in El Tarf (Benhacene et al., 2023; Bourbia, 2018).

Habitat: This species was found in high Forest of National Park of El Kala with cork oak and low vast wet meadows (Bourbia et al., 2018).

### *Family Sparassidae Bertkau, 1872*

*Eusparassus sp.*

Synonym: *Cercetius* Simon, 1902

Distribution: This genus contains species such as *E. dufouri* from Portugal, Spain and Mediterranean seaboard (Denis, 1936). *E. letourneuxi* recorded in Algeria and Tunisia (Simon, 1899). *E. walckenaeri* is cited from Algeria to Iraq (Moradmand and Jäger, 2012). In Algeria, it was mentioned in many localities (Alioua, 2018; Benhacene et al., 2023; Bourbia, 2018).

Habitat: A wide distribution of species of this genus indicates an important adaptation to different biotopes. Denis (1936) indicated that *E. dufouri* easy to be find under stones.

### *Family Tetragnathidae Menge, 1866*

*Tetragnatha sp.*

Synonyms: *Eugnatha* Audouin, 1826; *Deinagnatha* White, 1843; *Eucta* Simon, 1881; *Limoxera* Thorell, 1890; *Prionolaema* Simon, 1894; *Arundognatha* Wiehle, 1963.

Distribution: This species is distributed in the Palaearctic (Demir and Seyyar, 2017). In Algeria, this species was recorded from El Kala (Bourbia, 2018; Bourbia et al., 2018). *Tetragnatha* sp. in Ouargla region (Alioua, 2012) and *T. nitens* in Ghardaïa (Boutmedjet et al., 2022).

Habitat: According to the bibliography, *Tetragnatha* species remain attached to water points. For exemple, *T. montana* was recorded from Lake Mellah of El Kala (Bourbia et al., 2018) and *T. nitens* from Kef Doukhane river de Ghardaïa region (Boutmedjet et al., 2022).

### *Family Theridiidae Sundevall, 1833*

*Dipoena melanogaster (C.L. Koch, 1837)*

Synonym: *Atea melanogaster* C.L. Koch, 1837

Distribution: This species is widely distributed in Europe and from North Africa to Azerbaijan (Bayram et al., 2007; Grbic and Tomic, 2008). In Algeria, *D. melanogaster* is limited in northern Algeria (Tizi Ouzou, Mila, Béjaia and Blida) (Benhacene et al., 2023; Bosmans and Van Keer, 2012; Denis, 1936) and in Annaba (Bourbia, 2018).


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Habitat: This species was found in forest of zeen oak *Quercus mirbeckii* in Mila region (Denis, 1936), also in the forest of Seraidi, with dense vegetation of two species, cork oak and zeen oak (Bourbia, 2018).

*Enoplognatha sp.*

Synonyms: *Phyllonethis* Thorell, 1869; *Symopagia* Simon, 1894.

Distribution: Many of these species belong to this genus with a Paleartic distribution ((Demir and Seyyar, 2017; Grbić and Savić, 2010). In Algeria, several species can be found throughout the country (Benhacene et al., 2023; Bosmans and Van Keer, 1999, 2012; Denis, 1936, 1945; Ghellab and Guettiche, 2022).

Habitat: *E. mandibularis* was found in Djebel Daya, Mila (Denis, 1936) and *E. diversa* in forests of Aleppo pine and of Holm oak (Ghellab and Guettiche, 2022).

*Euryopis sp.*

Synonyms: *Phycus* O. Pickard-Cambridge, 1871; *Atkinsonia* O. Pickard-Cambridge, 1880; *Phylarchus* Simon, 1889; *Diaprocorus* Simon, 1895; *Dipoenoides* Chamberlin, 1925; *Atkinia* Strand, 1929; *Acanthomysmena* Mello-Leitão, 1944; *Mufila* Bryant, 1949.

Distribution: The spiders of this genus are distributed in the Palaearctic (Demir and Seyyar, 2017; Demir et al., 2015). In Algeria, all species recorded in Algeria are situated in the north part of country (Benhacene et al., 2023; Bosmans and Van Keer, 2012).

Habitat: This species was recorded around the Lake Fetzara, Annaba (Bourbia, 2018).

*Steatoda nobilis (Thorell, 1875)*

Synonyms: *Lithyphantes nobilis* Thorell, 1875; *Steatoda clarkii* O. Pickard-Cambridge, 1879.

Distribution: This species ranging from Portugal to Italy, England, Algeria, Iran, USA, introduced (Türkeş and Mergen, 2007). In Algeria, it was recorded from Algiers (Bosmans and Van Keer, 2012) and Annaba (Bourbia, 2018).

Habitat: *S. nobilis* was found in forest of Seraidi, Annaba characterized by plant diversity with dominance of two species, cork oak and zeen oak (Bourbia, 2018).

*Steatoda paykulliana (Walckenaer, 1806)*

Synonyms: Theridion paykullianum Walckenaer, 1806; Theridion dispar Dufour, 1824; Phrurolithus hamatus C. L. Koch, 1839; Phrurolithus lunatus C. L. Koch, 1839; Phrurolithus erythrocephalus C. L. Koch, 1839; Latrodectus ornatus Lucas, 1846; Lithypantes latrodectoides Franganillo, 1913.

Distribution: This species distributed in Europe and from the Mediterranean to Central Asia (Grbić and Savić, 2010). In Algeria, it was recorded from several localities (Alioua, 2018; Benhacene et al., 2023; Bosmans and Van Keer, 2012; Bourbia, 2018; Ghellab and Guettiche, 2022).

Habitat: In the north of the country, this species was recorded in forest of oak (Bourbia, 2018; Ghellab and Guettiche, 2022) and in the southern Algeria, it can be found in the palm grove (Alioua, 2018).


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*Theridion sp.*

Distribution: The spiders of this genus are distributed in the Palaearctic (Türkeş and Mergen, 2007). In Algeria, *Theridion sp.* can be found in Kabylia and Batna (Denis, 1936), in El Oued (Alioua, 2018) and in Annaba (Bourbia, 2018) and in Tébessa region (Ghellab and Guettiche, 2022).

Habitat: *Theridion* species can be found in several biotopes. Denis (1936) found them under a thistle-head in Kabylia in the forest of *Quercus mirbeckii* as in forest of *Quercus suber* also they were sampled from the humid forest of Seraidi with a dominance of cork oak and zeen oak (Bourbia, 2018). However, in Algerian Sahara they were found in dense palm grove of El-Oued (Alioua, 2018).

***Family Thomisidae Sundevall, 1833***

*Synema globosum (Fabricius, 1775)*

Synonyms: Aranea globosa Fabricius, 1775; Aranea plantigera Rossi, 1790; Aranea irregularis Panzer, 1801; Aranea rotundata Walckenaer, 1802; Diaea nitida L. Koch, 1878; Synema japonica Karsch, 1879; Diaea kochi Thorell, 1881; Synema globosum nigriventris Kulczyński, 1901; Synema globosum canariense Dahl, 1907; Synema globosa clara Franganillo, 1913; Synema globosa flava Franganillo, 1913; Synema globosum pulchellum Franganillo, 1926; Diaea nitidula Mello-Leitão, 1929; Synema globosum daghestanicum Utochkin, 1960

Distribution: Synema globosum is widely distributed in the Palaearctic realm, ranging from the Canary Islands to Eastern Asia (Nentwig et al., 2024; Ono, 1988; Wunderlich, 1987). It is common throughout the Mediterranean region (Demir and Seyyar, 2017). Cited in Algeria in several localities (Algiers, Annaba, Constantine, El Tarf, Khenchela and Mila) (Benhacene et al., 2023; Lissner and Suárez, 2023).

Habitat: In terms of biotope, S. globosum is not demanding, it was found in Divergent biotopes; rock steppe with bushes and with bushes, oak forests, pine forest, mixed forest and in sand dune with bushes (Lissner and Suárez, 2023).

## Conclusion

In order to determine the true value of taxonomic diversity, this study examined spider composition, species richness inventory, and functional diversity. The main objective was to improve our understanding of the functional and taxonomic diversity present in various forest formations.

The analysis of species accumulation curve estimates indicated that the current study's sample size is insufficient for the compilation of an exhaustive inventory of species inhabiting these regions. Our hope is that this pioneering investigation will serve as an incentive for scientists in North Africa to conduct additional research on this taxon in subsequent studies. Further research is needed to investigate additional regions and, together with quantitative climate change projections for Northeast Algeria, examine the effects of global warming on the distribution of spiders across a broad environmental gradient.

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