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SOUFYANE KAHLESSENANE

soufyane.kahlessenane@univ-bejaia.dz

Université de Bejaia

SAMIRA BOUSEKSOU

University of Algiers Benyoucef Benkhedda

RIADH MOULAÏ

Université de Bejaia

OURIDA KHERBOUCHE-ABROUS

University of Sciences and Technology Houari Boumediene

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Diversity and ecological distribution of spider assemblages in the Babor Mountains (Northeast Algeria)

SOUFYANE KAHLESSENANE[1], SAMIRA BOUSEKSOU[2,3], RIADH MOULAÏ[1] & OURIDA KHERBOUCHE-ABROUS[3].

[1]*Laboratoire de Zoologie Appliquée et d'Ecophysiologie Animale, Faculté des Sciences de la Nature et de la Vie, Université de Bejaia, 06000 Bejaia, Algérie.*

soufyane.kahlessenane@univ-bejaia.dz; https://orcid.org/0009-0003-6691-5510

moulai741@hotmail.com; https://orcid.org/0000-0001-7935-4415

[2]*University of Algiers Benyoucef Benkhedda, Faculty of Sciences, Department of Natural and Life Sciences, 2 Rue Didouche Mourad, 16000 Alger Centre, Algeria.*
s.bouseksou@univ-alger.dz; https://orcid.org/0000-0001-7388-3201

[3]*Laboratory of Dynamic and Biodiversity Faculty of Biological Sciences, University of Sciences and Technology Houari Boumediene, BP 32 El Alia 16111 Bab Ezzouar, Alger, Algeria.*

Ouridakherbouche@Yahoo.fr; https://orcid.org/0000-0003-3681-253X

Corresponding author: Soufyane Kahlessenane

Abstract

This synecological study assesses, for the first time, the diversity of araneofauna group across different habitats in the eastern part of the Kabylia of Babor Range, north-eastern Algeria, while also examining the effects of selected biotic and abiotic factors on the structure and distribution of spider communities. Sampled monthly using three methods (pitfall traps, hand catching, and beating sheet sampling) in each of the six sampling plots located in Taza National Park and the Jijelian Corniche over an approximately one-year period, from February 2023 to March 2024. A total of 507 adult spiders were sampled, divided into 31 families, 82 genera and 125 species. The species richness recorded in this study is higher than that reported in previous similar studies in Algeria. The family Dysderidae was the most represented, with 107 individuals, of which *Dysdera crocata* C. L. Koch, 1838 and the endemic species *Harpactea jijelensis* Beladjal, Bouseksou & Kahlessenane, 2025 were the dominant species. CCA results clearly showed the influence of certain variables on species composition across sampling plots and on the structure of spider communities in the study region, such as altitude, soil moisture, soil pH, and habitat type.

Key Words: Araneae, Richness, Jijel, Taza, Synecology

Introduction

It is crucial to recognise the importance of biodiversity in regulating ecosystem structure and functioning (Hong et al. 2021; Yan et al. 2023). A good program of biological conservation of fauna and flora requires a good knowledge of biodiversity and their distribution within different ecosystems (Pimm et al. 2021).

Spiders are the most diverse and ubiquitous order in arachnid class in most terrestrial habitats worldwide, with more than 53000 species (Word spider catalogue 2026). These arthropods possess exceptional adaptive power and occupy a key position in the trophic networks and the functioning of ecosystems (Nentwig 2012; Pollard 2024; Cardoso et al. 2025). They are both generalist predators, possessing a controller effect on biodiversity, especially insects, and important prey for higher trophic levels such as birds and reptiles (Turnbull 1973; Amalin et al. 2009; Nyffeler & Birkhofer 2017; Pollard 2024; Cardoso et al. 2025). Their indispensable use in bioindication is also well-known (Kherbouche-Abrous et al. 2008; Targetti et al. 2012). Furthermore, their venom, haemolymph and webs are a source of inspiration for scientific researchers in biology, pharmacology, medicine and other disciplines (Riciluca *et al.* 2012; Ko & Wan 2018; Pineda et al. 2018).

Algeria, the largest country in Africa, located in the Maghreb region (Laaredj-Campbell 2016; Schneider & Ferguson 2020), counts 905 species of spiders to date of which 247 species are endemics (Beladjal et al. 2025 ; Benslimane et al. 2025 ; Berretima et al. 2025 ; Kahlessenane et al. 2025 ; Dekkoumi et al. 2026). Although, the species richness and endemism rate of spiders in Algeria are high compared to other neighbouring countries such Tunisia (423 species, 28 endemic) (Kmira et al. 2025), Morocco (549 species, 148 endemic species) (Benhalima & Bosmans 2024) and Libya (353 species, 57 endemic species) (Elkrew et al. 2024), few studies have focused on

the ecology and taxonomy of spiders and mainly concerned the North-central and southeastern part of Algeria. The most recent studies include: Bouseksou et al. (2015) ; Alioua et al. (2016) ; Bosmans et al. (2017) ; Bosmans et al. (2018) ; Touchi et al. (2018) ; Alioua et al. (2020) ; Boucherit et al. (2020) ; Mansouri et al. (2020) ; Bouseksou et al. (2021) ; Chaib & Kherbouche-Abrous (2021) ; Alioua & Bosmans (2022) ; Boutmedjet et al. (2022) ; Habita et al. (2022) ; Chaib et al. (2023a, b) ; Saadi et al. (2024) ; Beladjal et al. (2025) ; Benslimane et al. (2025) ; Berretima et al. (2025) ; Kherbouche Abrous et al. (2025); Outemzabet et al. (2025) ; Dekkoumi et al. (2026). Recently, a new species of Dysderidae was described from Jijel region (Kahlessenane et al. 2025) but no work concerned the spiders of northeastern part of Algeria. Several areas of ecological importance in this region have not yet benefited from the arachnological studies, such as the Taza National Park and the Kabylian Corniche of Babor range in Jijel. This study aims to compare, analyse, and categorise spider communities in this region, thereby updating the taxonomic and synecological data of Algerian spiders.

Material and Method

Study area

The research was carried out at Taza National Park (36°42'01"N 05°33'34"E) and the Jijelian Corniche (36°46'36"N 05°35'55"E), located in Jijel, which is part of the eastern Babors range (North-east Algeria) (Fig. 1).

Six plots of 50 m^2 each were selected at an altitude between 42 and 960 m. Five plots were established across Guerrouche forest and Taza region (Cork Oak forest, Zeen Oak forest, Afares Oak forest, Mixed forest and Riparian forest) within the Taza National Park and one plot (Matorral) was chosen in the Jijelian Corniche near to the cape of Cavallo (Fig. 2). They differ in their vegetation composition and in other parameters such as altitude and solar exposure; all characteristics are given in Table 1.

Soil analysis

There was one soil sample taken from each plot between two seasons (spring- summer), when the activity of soil fauna is at its peak (Kudureti 2023). The sampling area was 100 cm^2, with a depth of 5 cm because spiders are living above ground in this part (Ledoux & Canard 1981). Several methods were used to determine various soil characteristic: Soil granulometry was measured using a Robinson pipette and moisture content was calculated as the difference in weight between air dried soil and after having been heated at 105°C (calcination method). Soil organic matter was quantified as the difference in weight between soil before and after having been heated at 300°C (calcination method). The pH and electrical conductivity (EC) were measured from soil suspensions with soil-water ratios of up to 1/5. Total calcium carbonate content was determined using the Bernard calcimeter.

Sampling method

The first author collected the spider material using three methods in each sampling plot over approximately one year (February 2023- March 2024). The first one was the pitfall traps method (Barber 1931). The traps consisted of PET plastic bottle with a cut-off top (14 cm height, 7 cm diameter) filled with a saline solution 1/4. 10^{-3} Kg/m^3 and a small amount of detergent to reduce surface tension, serving as fixative. The traps were buried in the soil so that the lip of each cup was leveled with the soil surface. In each plot, six pitfall traps were installed and emptied once a month. They were placed at least 1 m intervals from each other (Benkhelil 1991). Hand catching was the second method used, consisting of searching in every corner of each habitat that can be considered as a refuge for spiders. Specimens were searched for inside cavities and holes, under the rocks and leaf litter, within the grasses, and beneath the bark of trees. The beating sheet method was also used, it was made with durable white cloth, attached to a frame about 1 m square, with two pieces of light wood crossing each other and fitted into pockets at each corner of the cloth. After placing the beating sheet under a tree or shrub, the branches or foliage were sharply beaten with a wooden stick. Specimens falling into the sheet are easily seen on the white cloth and removed by a sample vial (Gibb & Oseto 2010). All material collected was preserved in 90% ethanol.

Identification of the spider

At the laboratory, spiders were sorted and conducted under a Stereomicroscope (Optika SZM-1) for identification. Many appropriate old and recent keys were used until species level: Ledoux & Canard (1981) ; Grimm (1985) ; Bosmans (1985a, 1985b, 1986, 1994, 1997, 2006) ; Bosmans & Beladjal (1988, 1989, 1991) ; Heimer & Nentwig (1991) ; Jocqué (1991) ; Bosmans & Abrous (1990, 1992) ; Bosmans & Bouragba (1992) ; Bosmans & Chergui (1993) ; Beladjal & Bosmans (1997) ; Bosmans & Van Keer (1999) ; Beladjal et al. (2025) and Spider World Catalog (2026).

Functional traits and spider hunting guild

Spider hunting guild was studied for collected material. Eight functional hunting guild groups were taken in a count according to the classification proposed by Cardoso et al. (2011).

Data analysis

To evaluate the spider population in the studied region, basic ecological indexes were calculated including species richness, Shannon-Wiener diversity index H′ (Wolda 1983) and equitability or Evenness. A Chi-square of homogeneity test was applied to compare the distribution of spider hunting guilds in different sampling plots. Principal Component Analysis (PCA) and Pearson correlation matrix were used to examine the distribution of the several environmental factors in different studied habitats at 5% level. Canonical Correspondence Analysis (CCA) was used to visualise the relationship between environmental factors and distribution of spider richness in the different sampling plots. A permutational ANOVA test was conducted to verify the significance of the CCA model.

Spider species richness and the diversity indexes were calculated using PAST software, version 5.2 (Hammer et al. 2001). All correlation analyses and multivariate analyses were conducted using **RStudio** (R Core Team 2024).

Essential packages used for data analysis

The data analysis was conducted using the **RStudio** (version 2024.12.0+467) along with several specialised packages. The **FactoMineR** package (Sebastien et al. 2008; version 2.11) was used for exploratory multivariate analysis and data mining, while **Factoshiny** (Vaissie et al. 2025; version 2.7) enabled the performance of factorial analyses through an interactive interface based on Shiny. For community ecology analyses, the vegan package (Oksanen et al. 2025; version 2.6-10) was employed. Visualization of correlation matrices was facilitated by **ggcorplot** (Kassambara 2023; version 0.1.4.1), and graphical representations were produced using **ggplot2** (Wickham 2016; version 3.5.1).

Results

Soil analysis

The abundance and diversity of pedofauna including spiders, vary among sites depending on several edaphic parameters, such as organic matter content, texture and pH (Joint Research Centre 2010).

Table 2 summarises the results of soil analysis of all sampling plots. Sandy loam soil is found in Matorral (MT), Riparian Forest (RF) and Afares Oak (AO), while loamy soils characterised Cork Oak (CO), Zeen Oak (ZO) and Mixed Forest (MF). The soil of Matorral plot is the less humid, this can be explained by the solar exposure and the presence of cliffs above the soil that maybe increase its warming. The same case was obtained with the organic matter content and the Matorral recorded the lowest percentage confirming the highest degree of biological degradation. A difference was resulted in soils electric conductivity (EC): Matorral, Cork Oak and Riparian Forest recorded the highest values, they close to the sea while the other plots were far from the sea (Zeen Oak, Afares Oak and Mixed Forest). According to the European saltiness scale (Gros 1979), soils of Matorral, Cork Oak and Riparian Forest are classified as slightly saline while the remaining stations are classified as non-saline.

According to Baize & Jabiol (2011), total limestone content indicated that all soils were little calcareous except Zeen Oak, which was classified as non-calcareous. Overall, the soils of all studied plots were close to neutrality and very rich in organic matter (Schaefer 1975), but none of them is calcareous or saline.

Taxonomic composition

957 individuals were collected, including 262 females (27.38 %), 245 males (25.60 %) and 450 juveniles (47.02 %). They represent 31 families, 82 genera and 125 species. Among 507 adult spiders recorded, four families ranked first by their relative abundances: Dysderidae (21.1%), Nemesiidae (9. 86 %), Theridiidae (8.87 %) and Gnaphosidae (8.67 %). The Agelenidae and Theridiidae showed the greatest species richness (14 species each), followed by Linyphiidae (11 species) and Gnaphosidae with Philodromidae (9 species each) (Table 3).

Composition in spider hunting guilds

Two groups of guild hunting spiders sampled in the study region were found (Fig. 3). Wandering spiders dominate the assemblages (60%) while sedentary spiders represents 40%. Among the first group, specialist hunters dominate (25%), followed by ground hunters with 21%. In contrast, sheet web weavers dominate sedentary group with 13%, followed by space web weavers with 11%.

Dysderidae and Zodariidae dominate the category of specialist hunters, together represent 96% of all spiders in this category. The second category is ground hunters, mainly represented by Gnaphosidae (40%), Lycosidae (30%) and Liocranidae (24.54%). Sheet web weaver was the most abundant among sedentary spiders and was represented mainly by the Agelenidae (60.30%) and the Linyphiidae (23.52%).

The results of Chi-square of homogeneity test showed a significant difference in guild distribution among plots ($\chi^2 = 25.171$, df = 5, $p = 0.0001291 < 0.005$). The proportions of the hunting guilds vary across plots.

In almost, all sampling plots, predominance of wandering spiders is observed except at Cork Oak plot (CO) where an equal abundance of wandering and sedentary spiders is recorded (Fig. 4).

Abundance, species richness and diversity indexes

Abundance (A) and spider species richness (S) range from 43 individuals representing 27 species in the Riparian Forest plot (RF) to 168 individuals representing 56 species in the Cork Oak plot (CO), the latter being the richest and most abundant plot (Table 4).

The value of the Shannon-Wiener index (H') ranges from 2.89 bits/ind at the Mixed Forest plot (MF) to 3.43 bits/ind at the Cork Oak plot (CO). These relatively high values indicate the significant spider diversity characterizing the sampling plots. Moreover, a community dominated by a single species will have a lower index value than a community in which all species are codominant (Grall & Coïc 2005). The Evenness (E) value varies from 0.84 in the Mixed Forest plot (MF) to 0.96 in the riparian zone (RF). Magurran (2004) points out that E values close to 1 reflect high Equitability and equilibrium population and this is the case of most spider assemblages at our sampling plots where an equidistributional of individuals between spider populations is observed. The lowest E value recorded at the Mixed Forest plot (MF) is explained by the high abundance of the species *Pardosa* sp.1 (Appendix 1).

In the Riparian Forest plot (RF), diversity H' (3.15 bits/ind) is very close to maximum diversity value H_{max} (3.30), accompanied by the highest Evenness value (E = 0.96) despite a relatively low number of individuals and species richness. A little difference was noted in H' index value between the three types of oak forests (Cork Oak, Zeen Oak and Afares Oak). The Cork Oak plot (CO) records the highest value (H'=3.43 bits/ind).

Abundance and species richness vary depending on the sampling methods used. The trapping method contributed the most (297 individuals and 62 species), comes next hand catching (118 individuals and 58 species) while the beating sheet method is the least rich with only 92 individuals distributed among 38 species (Table 5).

Appendix 1 presents the list of 125 species of spiders collected in Taza National Park and the Jijelian corniche (Jijel, Algeria), including one new species for science *Harpactea jijelensis* Beladjal, Bouseksou & Kahlessenane 2025 (Kahlessenane et al. 2025).

Principal Component Analysis (PCA)

A Principal Component Analysis (PCA) was performed with the data matrix of species and sampling plots to study the relationship between the variables and the habitats (six plots). The PCA results are shown in Fig. 5 and highlighted two main axes explaining together 75.24% of the total variance of the data. The first axis represents 41.90% of the variance, while the second explains 33.34%.

On Axis 1, three plots (Riparian Forest, Matorral and Cork Oak) formed a first group and were placed in the positive part while Zeen Oak, Afares Oak and Mixed Forest were in the negative part and formed a second group. The first group reassembled plots located at low altitude and close to the sea and shared high herbaceous and shrub vegetation coverage, high soil pH, electrical conductivity (EC), dense plant cover, as well as higher total limestone content of the soil, but low litter accumulation. The second group was composed with plots located at altitude and far from the sea. Those plots showed varying levels of litter accumulation, from high to low, and low soil electrical conductivity values. Pearson's correlation coefficient between each variable and axis 1 was calculated. Positive correlation was found with soil electrical conductivity ($r = 0.93$, p. Value= 0.006) and a negative correlation was obtained with accumulated litter ($r = -0.82$, p. Value= 0.047) and altitude ($r = -0.91$, p. Value= 0.011).
Axis 2 separates plots differently, Cork Oak, Riparian Forest and Zeen Oak were on the positive side, while Matorral, Afares Oak and Mixed Forest were on the negative part, reflecting differences in soil organic matter and soil moisture. This axis represents soil parameters and degree of vegetation cover of the sampled sites. Within this axis, positive correlation was found with tree layer ($r = 0.904$, p. Value = 0.013) and soil moisture (SM) ($r = 0.814$, p. Value = 0.048).
The projection of the plots on the factorial plane highlights the ecological distribution of sites with coloration according to their soil texture, although having a modulatory role, does not seem to be a unique structuring factor but intervenes in interaction with physical and chemicals parameters and the vegetation cover (Fig. 5).

Thus, the PCA highlights two major ecological gradients: an altitudinal and edaphic gradient, primarily linked to soil conductivity and related indicators of fertility and productivity, structuring Axis 1, and a habitat gradient, associated with vegetation density and soil, moisture structuring Axis 2.

Correlation between ecological factors

Pearson correlation coefficient was used to assess relationship among the selected environmental variables, and the results are shown in Fig. 6. The variable marked by a multiple correlation (negative or positive) with the other environmental variables (six variables) is altitude and lowest value of $r = -0.97$ was recorded with soil electrical conductivity revealing a very strong and very significant negative correlation. A strong positive correlation between tree layer and soil organic matter was found ($r = 0.86$). This may reflect the effect of leaf fall on soil organic matter input rate. Almost the same strong significant positive correlation is recorded between the tree layer and soil moisture ($r = 0.85$). A marked strong positive correlation was obtained between soil electrical conductivity and herb layer ($r = 0.83$) and a significant negative correlation was recorded between pH and slope of plots ($r = -0.86$).

Canonical Correspondence Analysis (CCA)

In the Canonical Correspondence Analysis (CCA) performed on a dataset comprising only the 43 most common species (those present in at least 34.4% of the sampling plots), the total inertia was 83.40%, with 49.45% and 33.95% for the first and second axes respectively (Fig. 7). Highly correlated environmental variables were removed to reduce multicollinearity, retaining only those with the strongest predictive power according to previous analyses (Akossou & Palm 2005). In the present study, three parameters were chosen (soil pH, soil moisture and altitude), keeping in mind that the others are not necessarily irrelevant.

On the positive part of Axis 1 (Fig. 7), were grouped the plots located at altitude AO (Afares Oak), ZO (Zeen Oak) and MF (Mixed Forest), characterised by a high accumulation of litter and a slightly acidic pH close to neutrality. Sixteen species were located in this area (*Araniella cucurbitina*, *Zilla diodia*, *Castianeira munieri*, *Dysdera crocata*, *Harpactea jijelensis*, *Rhode biscutata*, *Drassodes lutescens*, *Nomisia recepta*, *Zelotes aeneus*, *Mesiotelus mauritanicus*, *Pardosa* sp.1, *Pardosa proxima*, *Palpimanus gibbulus*, *Episinus maculipes*, *Episinus* sp.1 and *Zoropsis spinimana*). They were associated with these mountain forest environments, rich in litter and relatively fresh. Conversely, the negative part of the first axis includes plots located lower in altitude and closer to the sea: CO (Cork Oak), MT (Matorral) and RF (Riparian Forest). In those plots soil pH is often more acidic, with the exception of plot RF (Riparian Forest) which has a slightly alkaline pH. The species associated with this side of the axis (*Agelena* sp.1, *Lycosoides* sp.1, *Lycosoides* sp.2, *Lathys humilis*, *Cybaeodes* sp.1, *Alopecosa albofasciata*, *Trochosa urbana*, *Nemesia* sp.1, *Nemesia* sp.2, *Philodromus rufus*, *Menemerus* sp.1, *Loxosceles rufescens*, *Zodarion ludibundum* and *Zodarion* sp.1), were therefore probably tolerant to acidic soils or less rich in litter.

The second axis (Fig. 7), with marked polarity ordination results, showed one plot that assemblages out from the others. Matorral plot (MT) was clearly far in the positive part of axis 2, while the others were near the center of

this axis. This plot was characterised by relatively dry soil (lowest soil moisture) and low organic matter content. These conditions can be explained by its Eastern exposure, which increases sunlight, and absence of tree strata as vegetation is mainly composed of shrub layer. The species associated with this type of habitat were: *Textrix* sp.4, *Amaurobius erberi*, *Zelotes poecilochroaeformis*, *Palliduphantes labilis*, *Nemesia* sp.4, *Cyrba algerina* and *Anelosimus pulchellus*. The negative part of this axis includes plots characterised by high organic matter content and high soil moisture, located in dense forest environments: ZO (Zeen Oak), CO (Cork Oak) and RF (Riparian Forest) plot. With these ecological conditions, ten species were present: *Lycosoides* sp.2, *Lathys humilis*, *Cybaeodes* sp.1, *Alopecosa albofasciata*, *Trochosa urbana*, *Nemesia* sp.1, *Philodromus rufus*, *Loxosceles rufescens*, *Zodarion ludibundum* and *Zodarion* sp.1.

The CCA model, performed using three environmental variables (soil pH, soil moisture (SM), and altitude (Alt)), showed a significant result in a permutational ANOVA test ($F = 1.8973$, $df = 3$, p-value = $0.04583 < 0.05$).

Discussion

Taxonomic and spider guilds composition

The study conducted across several habitat types (Cork Oak, Zeen Oak, Afares Oak, Mixed Forest (Afares-Zeen), Matorral and Riparian Forest) in the Taza National Park region, Jijel, belonging to Kabylia of Babors range mountains, in the North-East of Algeria, showed the existence of 125 species spiders (507 adult individuals), including one species newly described for science, *Harpactea jijelensis* (Kahlessenane et al. 2025). This species richness represented 14% of the total number of spider species recorded in Algeria (Beladjal et al. 2025).

The results of species richness were higher compared to previous similar studies in Algeria. Abrous-Kherbouche et al. (1997) identified 86 species and 5312 adult spiders while Touchi et al. (2018) recorded 48 species and 1215 adult individuals. Two years later Mansouri et al. (2020) reported 68 species out of 1117 adult individuals. Recently, Alioua & Bosmans (2024) found 79 species and 2037 adult spiders. These comparisons demonstrate that the number of specimens sampled has no effect on species richness. It seems that several factors influenced the results of these studies concerning the species richness of spiders observed. It does not seem to depend only on the characteristics related to the sampled environment, but also on the way in which the sampling of this faunal group was carried out. Small-scale studies have shown the influence of a few factors on species richness outcomes, such as the type of sampling method used, habitat type and sampling time during the day (Cardoso et al. 2007; Privet et al. 2020).

Trapping method contributed the most compared to other sampling methods used (hand catching and beating sheet) during this study, with 49.6% of total species richness and 58.58% of adult individuals sampled. This difference in the percentage of contribution can be explained by the duration of application of each method (Cardoso et al. 2007), moreover, the pitfall traps were left for 30 days in the plots between the first and second collection, which will give more chance to capture spiders and increase the species richness for this sampling method.

The Cork Oak forest is the most diverse and abundant plot. The presence of the three vegetation strata in this plot and especially the shrub layer has increased the complexity of the habitat structure. Habitat type has been shown to have a significant influence on spider communities (Weeks & Holtzer 2000), and vegetation type plays an important role in the species composition of a habitat (Rubio et al. 2008). This result corroborates those of Kherbouche-Abrous (2006) and Mansouri (2020). However, the Afares Oak plot shows a better distribution of individuals between spider populations compared to other plots.

The Agelenidae family is the most diverse and represents about 11% of the total species richness. The most abundant family is the Dysderidae (21%) with *Dysdera crocata* being the most abundant species (9.86%) (Appendix 1). Two plots (Cork Oak and Zeen Oak plots) host a large part of this species, these environments are dark, humid and relatively closed due to their vegetation. This affinity was previously noticed by Abrous-Kherbouche et al. (1997) and Chaib et al. (2022). The Dysderidae family predominates among specialist hunters, the most abundant category with 25% of the first hunting guild group composed of wandering spiders. The latter dominate with 60% of the spider material sampled in the study region. In contrast, a study conducted in open environments where the herb layer is well developed showed a predominance of sedentary spiders (Courtial 2024). The first three categories (specialist hunters, ground hunters, and sheet web weavers) are ubiquitous and occur in all surveyed plots. The Cork Oak plot (CO) was the preferred habitat for specialist hunters and sheet web weavers, where their dominance was particularly pronounced. The Zeen Oak plot (ZO) also strongly favours specialist hunters. This pattern can be explained by the fact that many spiders build webs for prey capture, and the attachment

and architecture of these webs require species structural features in the surrounding vegetation (Riechert & Gillespie 1986). Ground hunters predominate in the Mixed Forest (MF), Afares Oak (AO), and Matorral (MT) plots, which are characterised by more open areas. Specialist hunters were especially abundant in dense, mature forests with thick litter such in Zeen Oak (ZO) and Cork Oak (CO) plots. They preferentially exploit old, structurally complex forests (Paquin 1994).

Species richness and diversity

Three endemic species to Algeria were recorded in this study. All belong to the family Dysderidae, making it the richest family in terms of endemism: *Harpactea acuta*, *Harpactea innupta* and *Harpactea jijelensis* (Beladjal et al. 2025; Kahlessenane et al. 2025; World Spider Catalog 2026).

Harpactea jijelensis Beladjal, Bouseksou & Kahlessenane 2025 is a recently described new species of Dysderidae, endemic to the Jijel region, part of the Babors range (Kahlessenane et al. 2025). It is the second most abundant species after *Dysdera crocata* and shows the widest distribution across the sampling plots. This distribution reflects the characteristics of our study region, which is marked by relatively high humidity and dense vegetation cover.

Correlation between species and environmental variables

A very strong and significant negative correlation was observed between *Lathys humilis* (Lathyidae) and altitude ($r = -0.88$, $p = 0.021$), indicating a preference for low-altitude plots near the sea (Cork Oak plot). In contrast, *Mesiotelus mauritanicus* (Liocranidae) showed a very strong positive correlations with this parameter ($r = 0.93$, $p = 0.008$). Similar results were found for two Lycosidae: *Pardosa* sp.1 ($r = 0.94$, $p = 0.005$) and *Pardosa proxima* ($r = 0.84$, $p = 0.034$). High-altitude plots, such as oak afares (AO) and Mixed Forest (MF) located farthest from the sea and characterised by relatively acidic soils, seems to be preferred by these species. Furthermore, *Pardosa* sp.1 and *Pardosa proxima* showed significant negative correlations with soil pH ($r = -0.82$, $p = 0.045$ and $r = -0.84$, $p = 0.034$ respectively).

Five spider species showed strong positive correlations with soil pH: *Agelena* sp. 1 ($r = 0.88$, $p = 0.021$) and *Lycosoides* sp.1 ($r = 0.84$, $p = 0.036$), both belonging to Agelenidae, *Nemesia* sp. 2 (Nemesiidae) ($r = 0.87$, $p = 0.024$), *Icius hamatus* (Salticidae) ($r = 0.88$, $p = 0.021$) and *Zodarion ludibundum* (Zodariidae) ($r = 0.83$, $p = 0.041$). These species appear to prefer plots with acidulous soils closed to neutral, as well as moderately alkaline.

Only one species showed a strong positive correlation with soil moisture (SM): *Ozyptila* sp.1 (Thomisidae) ($r = 0.92$; $p = 0.008$). This species appears to favour humid, shaded plots such as Zeen Oak (ZO) site.

The ordination of the studied plots based on their abiotic factors was obtained through PCA, which was based on the environmental factors of each plot. This method produced a separation of the sampling plots into four distinct groups. These results are consistent with actual field conditions, particularly concerning the spatial distances between plots and their elevations, reflecting the latitudinal and altitudinal gradients of the study area.

Affinity between species

Strong correlations were observed between some spider species based on their distribution across the sampled habitats. The following correlations are statistically significant.

Significant positive correlations were observed between the following species: *Dysdera crocata* and *Harpactea jijelensis* ($r = 0.81$, $p = 0.049$); *Mesiotelus mauritanicus* and *Pardosa* sp.1 ($r = 0.89$, $p = 0.016$); *Nemesia* sp.1 with *Nemesia* sp.2 ($r = 0.86$, $p = 0.027$) and *Nemesia* sp. 1 with *Nemesia* sp. 4 ($r = 0.82$, $p = 0.044$). Significant negative correlations were found between: *Zelotes poecilochroaeformis* and *Lycosoides* sp.1 ($r = -0.83$, $p = 0.040$); *Pardosa* sp.1 and *Nemesia* sp.1 ($r = -0.88$, $p = 0.018$) and *Pardosa* sp.1 with *Nemesia* sp. 2 ($r = -0.83$, $p = 0.040$). The affinities between these spider species provide insight into their potential for cohabitation, which can be explained by similarities in ecological requirements and nocturnal activity patterns. These affinities can influence the structure of spider populations (Da Silva Filho et al. 2024). They can inhabit the same type of environment.

The CCA results clearly demonstrated the influence of certain environmental variables such as altitude, soil moisture, and soil pH on the distribution of spider species across the sampling plots. While each of these variables may also be correlated, positively or negatively, with other factors not included in this analysis, this does not imply that they lack an effect on spider distribution. For example, the correlation matrix revealed a very strong and significant negative correlation between altitude and soil electrical conductivity, as well as a very strong and

significant positive correlation between tree cover and soil moisture. This indicates that the variables are interrelated in their influence on spider distribution in the study region. The distribution of certain species, such as *Mesiotelus mauritanicus*, *Pardosa sp.1*, and *Pardosa proxima*, appears to be particularly influenced by the altitudinal gradient. *Mesiotelus mauritanicus* is found in six localities in Algeria: Algiers Oued Smar (Bouseksou et al. 2015), Blida: Blidian Atlas, Chrea National Park, Fertasse Peak (Mansouri et al. 2020), Ghardaia: Berriane, Sidi Mbarek (Alioua & Bosmans 2024), Mila: Djebel Arres (Denis 1937a); Djebel Daya (Denis 1937a), Tizi Ouzou: Djurdjura Massif, Tala guilef (Abrous-Kherbouche et al. 1997; Beladjal et al. 2025). This species has a Mediterranean distribution (World Spider Catalog 2026). *Pardosa proxima* was also found in ten localities in Algeria from the coastal area to highlands region: Aïn Defla: Bir Ould Khelifa (Boucherit *et al.* 2020), Algiers: Oued Smar (Bouseksou et al. 2015), Zéralda (Touchi et al. 2018), Blida: Chiffa Gorges (Simon 1899), Ghardaïa: Berriane, Balouh; Sidi Mbarek, Dhayet Bendhahoua, grazil, El Atteuf, Palm grove of El Atteuf (Alioua & Bosmans 2024), Mila: Zouagha Forest (Denis 1937a), Tizi Ouzou: Djurdjura Massif, Tala guilef (Abrous-Kherbouche et al. 1997; Beladjal et al. 2025).

The Kabylia of the Babor Range, located within the Numidian sector, the wettest part of the Maghreb Mediterranean region is distinguished by remarkable ecosystem diversity. This includes extensive forest stands, such as Zeen Oak, the cliffs of the Kabyle Jijelian corniche, and a characteristic regional fauna and flora. Among the most notable species are the Numidian fir (*Abies numidica*) and the Kabyle nuthatch (*Sitta ledanti*), which are well-known to botanists and ornithologists (Quezel 1956, 1957; Quezel & Santa 1962; Barry et al. 1974; Ledant 1977). In addition, the region hosts a distinctive arachnological fauna, including endemic species such *Harpactea jijelensis* Beladjal, Bouseksou & Kahlessenane 2025. This study thus emphasises the ecological importance of the Kabylia of the Babor Range in Algeria and further confirms the region's high species richness and elevated rate of spider endemism.

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Tables Captions

Table 1. Characteristics of sampling plots in the western region of Jijel (Algeria).

Table 2. Soil chemical and physical characteristics of sampling plots.

Table 3. Spiders genera, species richness and abundance in the study region.

Table 4. Abundance (A), species richness (S), Shannon-Wiener diversity index (H'), maximum diversity (H_{max}) and Evenness (E) in the different sampling plots.

Table 5. Spiders abundance (A) and species richness (S) by sampling method in the study region.

Appendix 1. Spider list and species abundance collected at the different sampling plots.

Figures Captions

Fig. 1. Localisation of sampling plots and Taza National Park. (QGIS, version 3.38.3).

Fig. 2. Sampling plots in Jijel region. **A.** Matorral (Jijelian Corniche); **B.** Cork Oak; C. Riparian Forest; **D.** Zeen Oak; **E.** Afares Oak; **F.** Mixed Forest (Taza National Park).

Fig. 3. Proportions of eight categories within the two groups of spider hunting guilds (according to Cardoso et al. 2011) sampled in the study region.

Fig. 4. Proportions of spider hunting guilds from each sampling plot.

Fig. 5. Factorial representation of study plots and correlations of environmental variables from PCA.

Fig. 6. Pearson correlation matrix between environmental variables. (TL = tree layer; SM = Soil Moisture; Lt=Litter; Alt=Altitude; SL=shrub layer; SP=Slope; PC=plant cover; EC=Electrical conductivity; HL=herb layer; T.LS=Total limestone; OM=Organic matter).

Fig. 7. Ordination of spider populations according to abiotic factors by Canonical Correspondence Analysis in the study region.

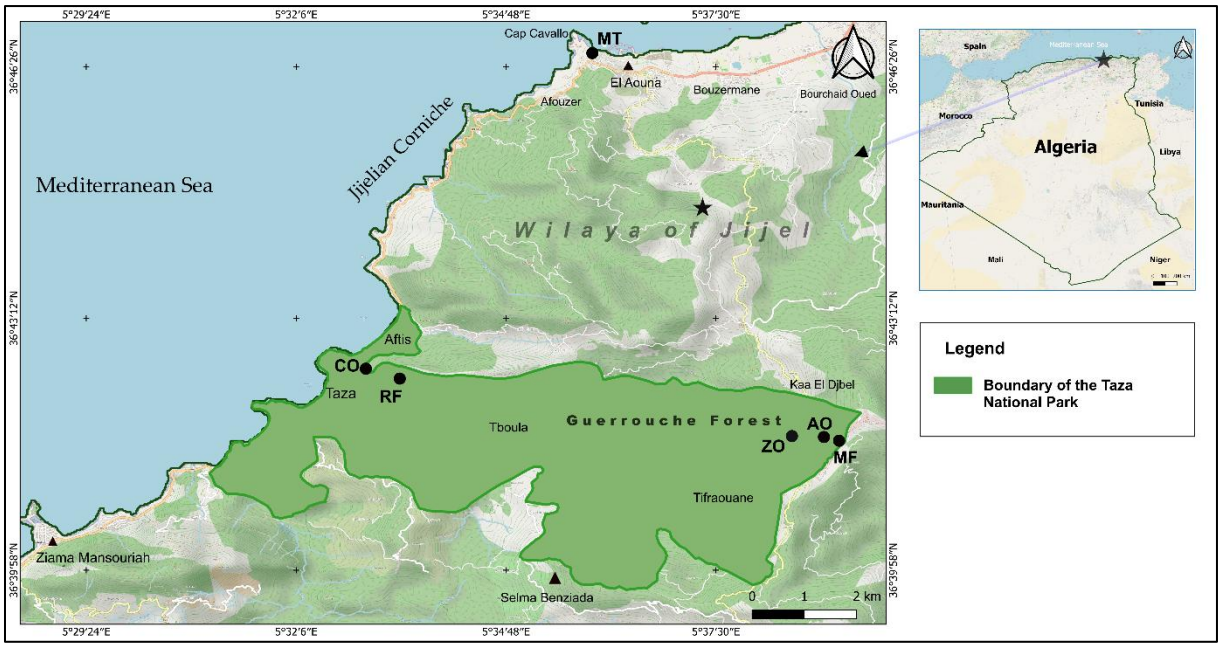


Fig. 1.



Fig. 2.

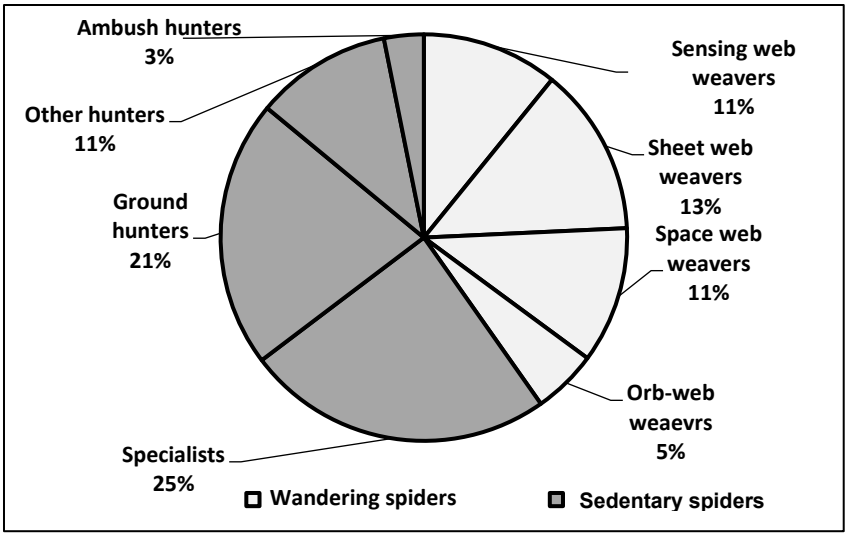

Ambush hunters
3%
Other hunters
11%
Ground
hunters
21%
Specialists
25%
Sensing web
weavers
11%
Sheet web
weavers
13%
Space web
weavers
11%
Orb-web
weaevrs
5%
Wandering spiders
Sedentary spiders

Fig. 3.

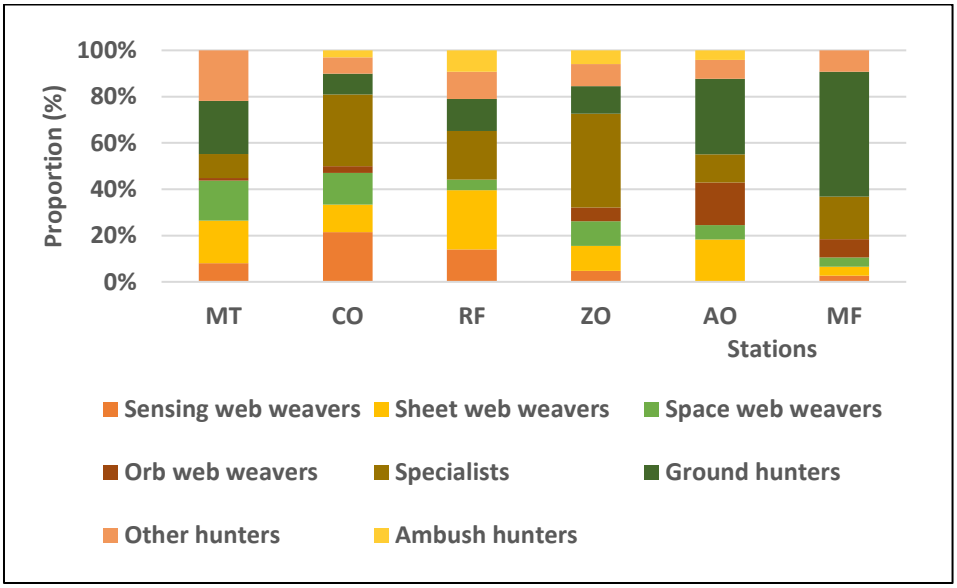

100%
80%
60%
40%
20%
0%
Proportion (%)
MT
CO
RF
ZO
AO
MF
Stations
Sensing web weavers
Sheet web weavers
Space web weavers
Orb web weavers
Specialists
Ground hunters
Other hunters
Ambush hunters

Fig. 4.

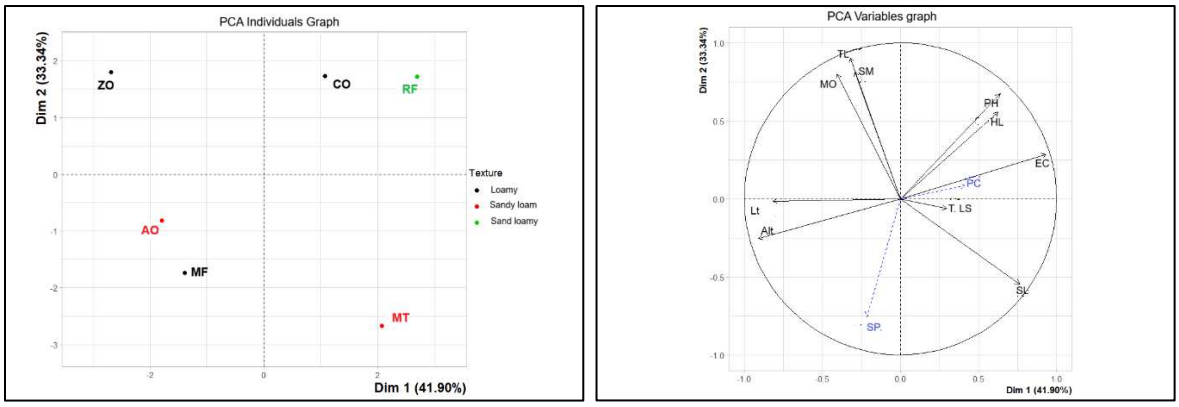

PCA Individuals Graph
Dim 2 (33.34%)
Dim 1 (41.90%)
ZO
CO
RF
AO
MF
MT
Texture
Loamy
Sandy loam
Sand loamy
PCA Variables graph
TL
SM
MO
PH
HL
EC
PC
T. LS
Lt
Alt
SL
SP

Fig. 5.

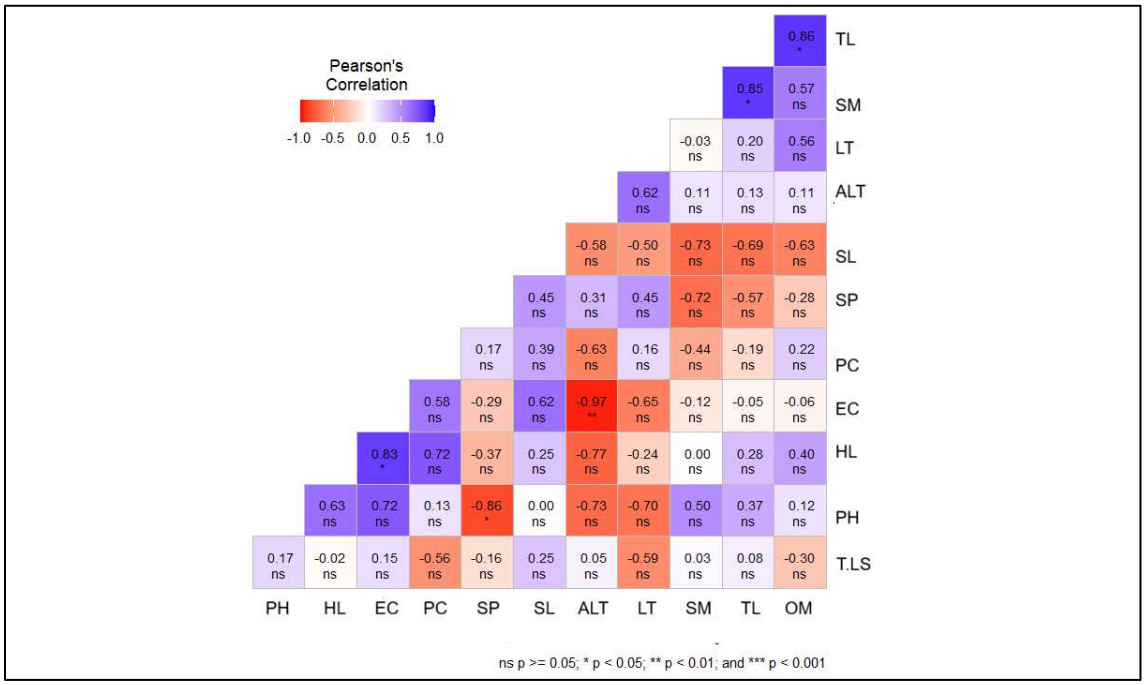

Pearson's Correlation
-1.0 -0.5 0.0 0.5 1.0
TL
SM
LT
ALT
SL
SP
PC
EC
HL
PH
T.LS
PH HL EC PC SP SL ALT LT SM TL OM
ns p >= 0.05; * p < 0.05; ** p < 0.01; and *** p < 0.001

Fig. 6.

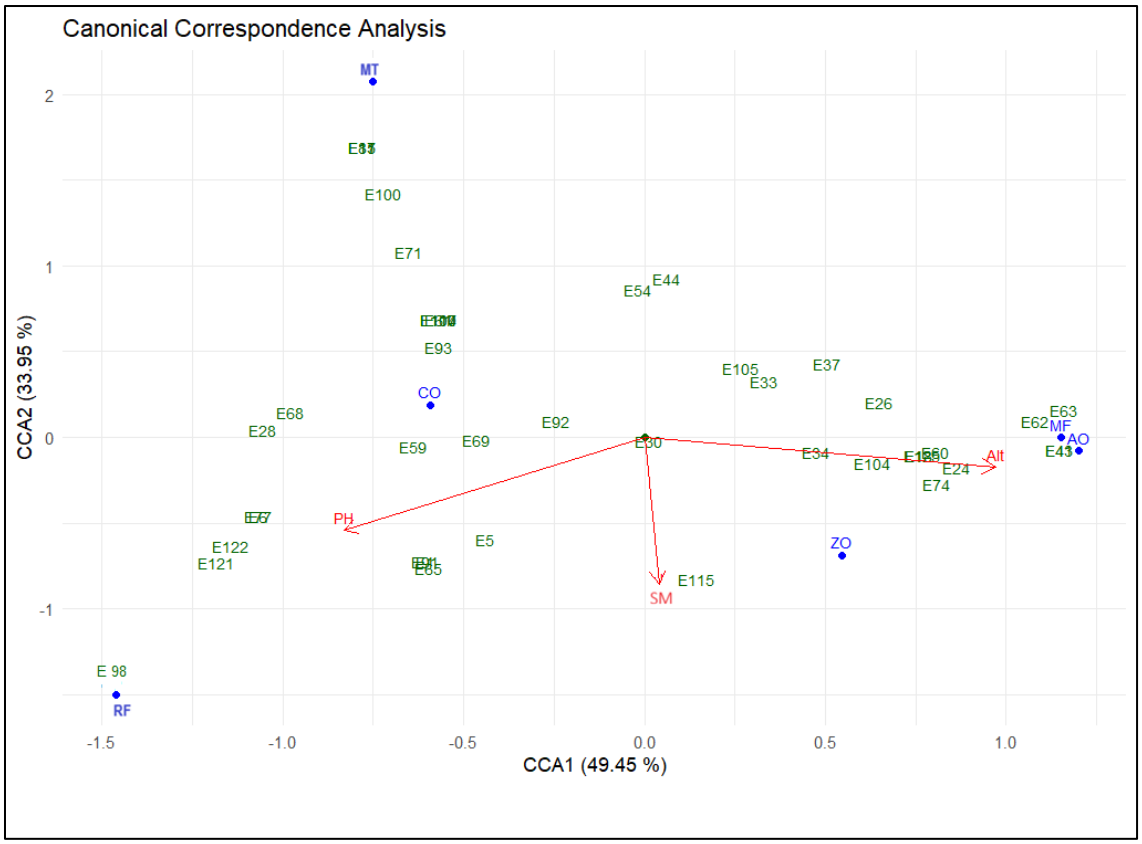

Canonical Correspondence Analysis
MT
E100
E71
E44
E54
E93
E105
E33
E37
CO
E68
E28
E92
E26
E63
E62
MF
AO
E59
E69
E30
E34
E104
E24
E74
Alt
PH
E5
E122
E121
ZO
E115
SM
E 98
RF
2
1
0
-1
-1.5
-1.0
-0.5
0.0
0.5
1.0
CCA2 (33.95 %)
CCA1 (49.45 %)

Fig. 7.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Tables.xlsx