

Seasonal Abundance and Spatial Distribution of Species *Diplotemnus balcanicus* (Pseudoscorpiones: Atemnidae) in Agricultural Habitats of Southern Iraq

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Abstract

The seasonal abundance of *Diplotemnus balcanicus* (Redikorzev, 1928) and its spatial distribution were investigated in agricultural habitats and locations within Province of Dhi Qar, south of Iraq, during the periods from July 2025 to June 2026. The samples collected monthly from 12 sites across 4 stations these are (Al-Nasr, Al-Rifai, Qalat Sukkar, and Al-Shatrah). Four hours was the one sampling time at each station. were collected manually and litter sieving, then specimens identified according to their morphological features and published descriptions. During collection, relative humidity and air temperature were recorded. A total of ninety (90) individuals were found and collected, Monthly and seasonal variation were clear. The peak monthly abundance was in October with 15 individuals with a ratio of abundance of (16.67%), followed by September with a ratio of (13, 14.44%) and November with a ratio of (12, 13.33%). No individuals were found in January (0%), and only one individual in February. Seasonally, the highest abundance was in autumn with 40 individuals with a ratio of (44.44%), spring was with a ratio of (27, 30.00%), summer ration was (20, 22.22%), and winter had the lowest ration with (3, 3.33%). Spatially, abundance was similar across stations: 24 at Al-Nasr station, 23 at both stations of Al-Rifai and Qalat Sukkar, and 20 at Al-Shatrah station. Study results indicate a strong seasonal peak of *D. balcanicus* during autumn and spring seasons, along with a similar presence of *D. balcanicus* across the stations. The study offers baseline new quantitative data on this species' ecology in Iraq and underscores the importance of multi-year research incorporating microhabitat and lifecycle different factors.

Keywords: *Diplotemnus balcanicus*, Seasonal abundance, Pseudoscorpiones; Atemnidae Spatial Distribution, Agricultural

الوفرة الموسمية والتوزيع المكاني لنوع *Diplotemnus balcanicus* (Pseudoscorpiones: Atemnidae) في البيئات الزراعية بجنوب العراق

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الخلاصة

درست الوفرة الموسمية والتوزيع المكاني للعقرب الكاذب *Diplotemnus balcanicus* (Redikorzev, 1928) في البيئات الزراعية بمحافظة ذي قار، جنوب العراق، خلال المدة من تموز/يوليو 2025 إلى حزيران/يونيو 2026. أجريت عمليات الجمع شهرياً في 12 موقعاً موزعة على أربع محطات هي: النصر، والرفاعي، وقلة سكر، والشطرة، وبواقع أربع ساعات عمل لكل محطة في كل زيارة ميدانية. جُمعت العينات باستخدام طريقتي البحث اليدوي وغريلة فرشاة التربة، ثم شُخّصت اعتماداً على الصفات المورفولوجية والأوصاف التصنيفية المنشورة. كما سُجلت درجة حرارة الهواء والرطوبة النسبية بالتزامن مع عمليات الجمع. بلغ العدد الكلي للأفراد التي جُمعت 90 فرداً، مع ظهور تباين واضح في الوفرة على المستويين الشهري والموسمي. وسُجلت أعلى وفرة شهرية في شهر تشرين الثاني/نوفمبر بـ 15 فرداً (16.67%)، تلاه شهر أيلول/سبتمبر بـ 13 فرداً (14.44%)، ثم شهر تشرين الثاني/نوفمبر بـ 12 فرداً (13.33%). ولم تُسجل أي أفراد خلال شهر كانون الثاني/يناير، في حين سُجل فرد واحد فقط خلال شهر شباط/فبراير. وعلى المستوى الموسمي، حقق فصل الخريف أعلى وفرة، إذ بلغ عدد الأفراد 40 فرداً (44.44%)، تلاه فصل الربيع بـ 27 فرداً (30.00%)، ثم فصل الصيف بـ 20 فرداً (22.22%)، في حين سجل فصل الشتاء أدنى وفرة بثلاثة أفراد فقط (3.33%). أما من حيث التوزيع المكاني، فقد أظهرت المحطات المدروسة تقارباً في أعداد الأفراد، إذ سُجل 24 فرداً في محطة النصر، و23 فرداً في كل من الرفاعي وقلة سكر، و20 فرداً في محطة الشطرة. وتشير هذه النتائج إلى وجود ذروة موسمية واضحة في وفرة *D. balcanicus* خلال فصلي الخريف والربيع، مع انتشار واسع نسبياً لهذا النوع في جميع المحطات المدروسة. وتوفر هذه الدراسة بيانات مرجعية كمية عن بيئة هذا النوع في العراق، وتمثل أساساً للدراسات المستقبلية المتعلقة ببيئته وانتشاره، كما تؤكد أهمية إجراء بحوث طويلة الأمد تأخذ في الحسبان خصائص الموائل الدقيقة والعوامل المرتبطة بدورة حياته.

1. Introduction

There is a shortage in the Iraqi arachnid diversity especially the study of pseudoscorpion fauna. Till today, two taxonomic records only have been published. In Babylon Province, middle of Iraq, *Minniza babylonica* was identified and this marked as the first recorded pseudoscorpion in Iraq. [1] described *Strobilochelifer grandimanus* from Basrah Province, south of Iraq. Later, *Strobilochelifer grandimanus* recognized as a junior synonym of *Strobilochelifer spinipalpis* (Redikorzev, 1918) [2]. In spite of these early and excellent contributions, there aren't any comprehensive investigations and surveys or ecological researches along many past decades. As a result, information about the Iraqi pseudoscorpions diversity, distribution, habitat preferences, and seasonal patterns remains limited.

Recent field surveys in Dhi Qar Governorate revealed *Diplotemnus balcanicus* (Redikorzev, 1928) for the first time in Iraq. This discovery also marks the initial national record for both the family Atemnidae and the genus *Diplotemnus*. While this taxonomic identification confirms the species' presence and characteristics in Iraq, information about its distribution, abundance, seasonal activity, and habitat preferences within the country are still unknown. Therefore, collecting quantitative ecological data is essential to understanding how this species has established itself and its local distribution within the Iraqi pseudoscorpion fauna.

Pseudoscorpions are tiny, mostly solitary arachnids measuring between 0.5 and 10 mm in length. Their small size and limited movement abilities hinder their capacity for long-distance dispersal. Despite this, they have adapted to a wide array of terrestrial habitats around the globe [3]; [4]. They mainly reside in hidden microhabitats such as soil, leaf litter, crevices under stones, tree bark, decaying wood, caves, and nests of birds and mammals. Some species are also found in agricultural areas and environments altered by humans [5]; [6].

The presence and abundance of pseudoscorpions are shaped by environmental and habitat factors such as temperature, humidity, vegetation, organic material, and microhabitat features. Leaf litter and tree bark offer stable conditions of temperature and moisture, protect against drying out, and host diverse communities of small arthropods that serve as prey. Seasonal variations in these environmental factors can affect their movement, feeding, reproduction, and how easily they are detected during field surveys [4]; [7]; [8]; [9].

D. balcanicus is widely scattered, though discontinuous, across parts of Europe, northern Africa, and Asia. It has been found in various natural and human-related microhabitats such as caves, under stones and tree bark, bat guano, rodent and bird nests, and residential buildings [4]; [5].

These findings of this study suggest significant ecological adaptability of the *D. balcanicus* (Redikorzev, 1928); however, detailed data on its seasonal abundance and spatial distribution are limited, especially in arid and semi-arid environments. Therefore, this study aimed to assess and investigate the seasonal abundance and distribution of *D. balcanicus* within four agricultural locations in Province of Dhi Qar, south of Iraq, and identifying its main microhabitats. This research shows the first quantitative ecological insights on *D. balcanicus* in Iraq, which will enhance the understanding of the ecology and distribution of the Iraqi's relatively unknown pseudoscorpion species.

2. Materials and Methods

2.1 Study area and sampling design

This study carried out within Dhi Qar Governorate, south of Iraq, during July 2025 to June 2026. Twelve sampling locations were chosen within four main stations located in the cities of (Al-Nasr, Al-Rifai, Qalat Sukkar, and Al-Shatrah) (see Figure 1) with three sites per station representing key agricultural habitats found in the northern and central parts of the province. Dhi Qar governorates located within the Mesopotamian alluvial plain with a climate of an arid desert, summer is very hot (reach nearly 50°C) and dry. Winter is milder and precipitation remains low and irregular. The soil in northern Dhi Qar is mainly consists of recent alluvial sediment types with sandy clay and loamy textures with varying characters such as organic matter content, calcium carbonate content, bulk density values, and hydraulic conductivity [10], [11].

The selected stations included agricultural and rural habitats along Al-Gharraf River and its irrigation system. Al-Nasr and Al-Rifai stations featured date-palm groves, fruit orchards, and dense vegetation. In contrast, Qalat Sukkar covered date-palm groves, seasonal crops, vegetables, and fields of wheat and barley. Al-Shatrah Station was mostly made up of large agricultural fields, date-palm groves, fruit trees, and irrigation channels. Sampling took place once a month at each station during the study, with efforts standardized to four person-hours per station each time.



Figure 1. The study area. (A) Location of Dhi Qar Province, south of Iraq within Iraq. (B) Map of Dhi Qar Province.

2.2 Sample collection method and preservation

Specimens were collected manually by searches and litter sieving. Manual searches included surface soil, decaying organic matter, inspecting leaf litter, beneath tree bark, and the bases of date-palm fronds. Loose bark parts and detached palm-frond bases were shaken over a white cloth sheet, and visible samples were carefully transferred with a fine brush or forceps. Leaf litter, decomposing material, and surface soil, were sieved by shaking over a white cloth sheet, then examined, pseudoscorpions collected using a fine brush. Additional samples were processed with Berlese–Tullgren funnels, where heat and light push small arthropods downward toward ethanol-filled containers. Each container was labeled with sampling information, including sampling location, station name, collection date, habitat type, microhabitat, and collection method. Specimens were stored in a dry, cool environment for laboratory analysis and identification.

2.3 Identification and Environmental Variables

Specimens were examined under a Ma Ant X60 stereomicroscope. Identification relied on external diagnostic and morphological features such as carapace shape, body colour, and size, number of eyes and placement, pedipalp structure and proportions, cheliceral shape, abdominal tergites, galea form, , structure of leg, and the number and arrangement of trichobothria on the chelal fingers (both movable and fixed). Identification as *Diplotemnus balcanicus* (Redikorzev, 1928) was confirmed by comparing these diagnostic and morphological features with the previous published descriptions, illustrations, redescrptions, and diagnostic data, especially those from [12], [13].

At each station, a portable digital thermo-hygrometer was used to measure the relative humidity and air temperature simultaneously. For each sampling event, three readings of each environmental variable were taken then the average was used to represent the conditions at that time.

2.4 Statistical analysis

Monthly, seasonal, and spatial changes in *D. balcanicus* abundance were summarized by using the specimen counts and percentages. Relative abundance was computed using the following eq. $RA (\%) = n_i / N \times 100$, where (n_i) is the individuals number in a given season, month, or station, and (N) is the total number of the collected specimens. Monthly data were grouped into the four seasons, summer (June, July, August), autumn (September, October, November), winter (December, January, February), and spring (March, April, May). Spearman's correlation investigated the relationships between the abundance and the environmental factors (temperature and relative humidity). Correlations were based on the total monthly abundance and the mean environmental values in four stations, with separate analyses for each station. Significance was tested at $p < 0.05$.

3. Results

3.1 Abundance Seasonal variations

A total of 90 *D. balcanicus* individuals were collected from all stations during July 2025 to June 2026. Monthly abundance fluctuated clearly, with no individual's presence in January and the abundance's peak of 15 individuals in October. 7 individuals (7.78%) were recorded in July: 2 from Al-Nasr, 2 from Al-Rifai, 2 from Qalat Sukkar, and only 1 from Al-Shatrah station. The count decreased to five (5.56%) in August, as 2 from Al-Rifai and only one from each of the other stations. Abundance then rises in autumn, reaching 13 individuals (14.44%) in September and the abundance peak of 15 individuals (16.67%) in October. In November, numbers slightly dropped to 12 (13.33%), with 5 from Al-Nasr, 3 from Qalat Sukkar, and 2 individuals from each of Al-Rifai and Al-Shatrah stations (Table 1; Figure 2).

During winter, a significant decrease in abundance was observed. In December, only 2 individuals (2.22%) were found, only 1 specimen from Al-Rifai and 1 from Qalat Sukkar stations while no individuals were recorded from Al-Nasr or Al-Shatrah stations. In January, *D. balcanicus* was disappeared across all four sampling stations. In February, only 1 individual (1.11%) was noted from Al-Shatrah station. Abundance rose again in spring, with seven individuals (7.78%) in March, 11 (12.22%) in April, and nine (10.00%) in May, with April showing the highest spring count. In June, eight individuals (8.89%) were recorded, two from each station. Overall, autumn had the highest abundance, with 40 individuals (44.44%), followed by spring with 27 (30.00%), summer with 20 (22.22%), and winter with only three (3.33%).

The seasonal abundance of *D. balcanicus* varied across the four stations. At Al-Nasr, 13 individuals were observed in autumn, six in spring, five in summer, and none in winter. Al-Rifai recorded eight individuals in both autumn and spring, six in summer, and one in winter. At Qalat Sukkar, the counts were ten in autumn, seven in spring, five in summer, and one in winter. Al-Shatrah had nine in autumn, six in spring, four in summer, and one in winter. Autumn was the peak season at Al-Nasr, Qalat Sukkar, and Al-Shatrah, while Al-Rifai saw equal numbers in autumn and spring. Overall, *D. balcanicus* was most commonly found during autumn and spring, present at all stations in summer, and occasionally recorded in winter.

3.2 Variation in abundance across sampling stations

The number of *Diplothemnus balcanicus* across the four sampling sites showed slight variation. Al-Nasr Station hosted the most, with 24 individuals, accounting for 26.67% of the total. Both Al-Rifai and Qalat Sukkar had 23 individuals each, representing 25.56%, while Al-Shatrah had only 20 individuals, making up 22.22%. The difference between the highest and lowest counts was just four individuals. The species was found at all four locations, suggesting a fairly even distribution across the agricultural habitats studied.

At Al-Nasr, monthly abundance varied from zero individuals in December, January, and February to a peak of five in November. The counts included four individuals in both September and October, three in April, two in July, May, and June, and one in August and March. At Al-Rifai, the highest numbers appeared in September, October, April, and May, with three individuals each. Two individuals were noted in July, August, November, March, and June, while only one was found in December. No individuals were recorded in January or February. Qalat Sukkar reached its peak in October with four individuals, followed by three in September, November, and April. In July, March, May, and June, two were recorded, with one in August and December, and none in January or February.

Al-Shatrah station recorded the lowest overall abundance ratio among the studied stations. 4 individuals was its peak monthly count in October, with 3 individuals in September. Counts of 2 were recorded in November, March, April, May, and June, while only 1 individual was found in July, August, and February. No individuals were observed in both December and January. The species was present at all four study stations during the period from July to November and again from March to June period. During December, the species was found at Al-Rifai and Qalat Sukkar, and in February, only found at Al-Shatrah station. These findings indicate that *D. balcanicus* was not confined to a single location but was present across all the four studied agricultural stations.

3.3 Relationship between abundance and environmental factors

Throughout the study duration, relative humidity and air temperature showed notable and clear fluctuations. Station temperatures ranged from 16.2°C in January to 44.8°C in July, while relative humidity varied between 8% in July and 52% in November. Averaged across four stations, July had the highest mean temperature at 44.38°C with seven individuals collected, whereas January recorded the lowest at 16.75°C with no observations. Mean relative humidity ranged from 9.00% in July to 46.75% in January.

The highest abundance occurred in October with 15 individuals at an average temperature of 33.55°C and humidity of 13.50%. September followed with 13 individuals at 34.70°C and 21.25% humidity, and November had 12 individuals at 26.63°C and 41.00% humidity. In December, only two individuals were found at 18.75°C and 41.00% humidity; January had none at 16.75°C and 46.75%; and February saw one individual at 30.20°C and 17.25% humidity. In spring, numbers increased from seven in March to 11 in April before decreasing to nine in May. Spearman's correlation indicated a weak positive relationship between monthly abundance and mean air temperature, but this was not statistically significant (see figures). A weak, non-significant negative relationship was observed between abundance and relative humidity. Station-level analyses showed similar trends: positive but non-significant correlations with temperature, and negative but non-significant ones with humidity. Overall, the fluctuations in abundance over time did not show a straightforward correlation with temperature or humidity alone. These temporal variations in abundance cannot be simply explained by monotonic relationships with either environmental factor.

Table 1- Monthly And relative abundance of *Diplothemnus balcanicus* across four sampling stations along with their environmental Factors .

Month	Al-Nasr	Al-Rifai	Qalat Sukkar	Al-Shatrah	Total, n (%)	Mean temperature (°C)	Mean relative humidity (%)
July	2	2	2	1	7 (7.78)	44.38	9.00
August	1	2	1	1	5 (5.56)	36.03	14.50
September	4	3	3	3	13 (14.44)	34.70	21.25
October	4	3	4	4	15 (16.67)	33.55	13.50
November	5	2	3	2	12 (13.33)	26.63	41.00
December	0	1	1	0	2 (2.22)	18.75	41.00

January	0	0	0	0	0 (0.00)	16.75	46.75
February	0	0	0	1	1 (1.11)	30.20	17.25
March	1	2	2	2	7 (7.78)	27.68	39.25
April	3	3	3	2	11 (12.22)	27.75	39.75
May	2	3	2	2	9 (10.00)	37.05	26.25
June	2	2	2	2	8 (8.89)	39.48	10.50
Total	24	23	23	20	90 (100.00)	—	—

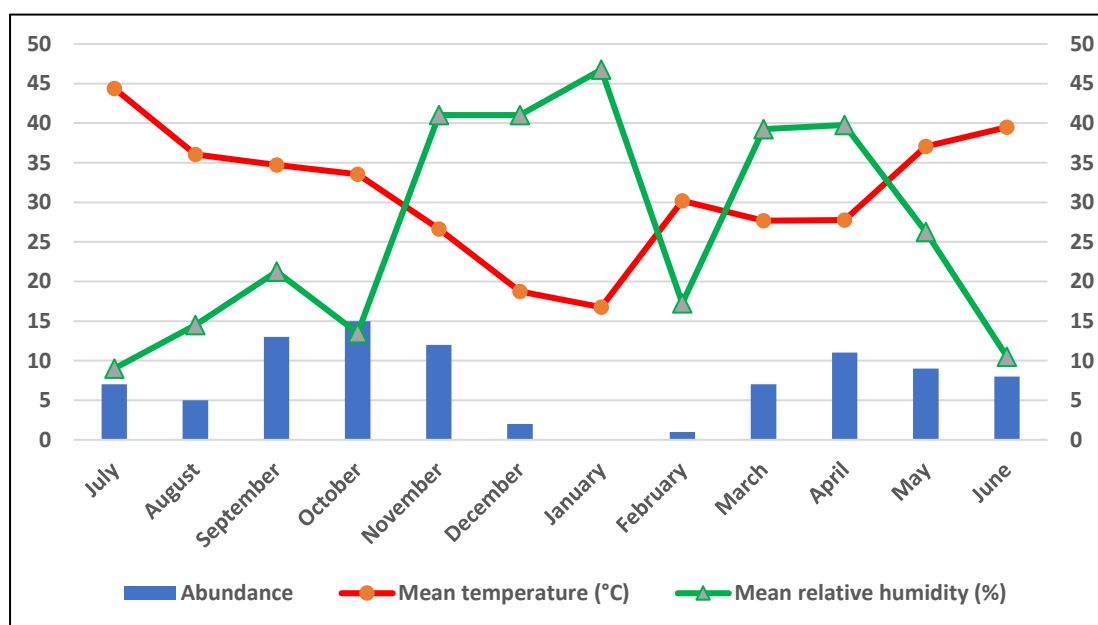


Figure -2 Monthly variation in the abundance of *Diplothemnus balcanicus* across four sampling stations in Dhi Qar Province, southern Iraq, from July 2025 to June 2026, in relation to mean air temperature and relative humidity.

4. Discussion

This study identified a distinct seasonal pattern in the collection of *D. balcanicus* in Dhi Qar Province, with the highest numbers in autumn (44.44%) and spring (30.00%), and only 3.33% in winter. The autumn and spring peaks align with the bimodal activity pattern observed in *Pselaphochernes scorpioides*, which is most active during these seasons [14].

This suggests that *D. balcanicus* may also exhibit increased surface activity or microhabitat movement during these times. However, because we did not examine the life stages or reproductive status of the specimens, we cannot confirm whether these peaks correlate with reproduction or developmental stages. The near absence in winter contrasts with year-round activity reported for some temperate pseudoscorpions [14]; [15], indicating that activity patterns vary by species, region, climate, and habitat. Unlike other tropical studies, such as [16], who found higher abundance in rainy seasons but differing responses between two locations, and [17], who observed no seasonal change, the present findings likely reflect species- and region-specific behaviors rather than universal patterns.

The seasonal abundance pattern does not show a direct or strict correlation with air temperature and relative humidity alone. The highest abundance was observed in October, with an average temperature of 33.55 °C and humidity at 13.50%. November also showed high counts despite being more humid and cooler. In contrast, only 1 individual appeared in February, despite an average temperature of 30.20 °C. These findings imply that abundance is not directly influenced by temperature or humidity. Previous studies also showed that pseudoscorpion responses to environmental factors different among species, locations and habitats [16]; [17]; [18]. Note that this study recorded the ambient local conditions during collection time, not microclimates within litter, soil, or under bark. Needed further research measuring substrate temperature, soil moisture and litter, as well as prey availability to clarify the environmental factors influencing seasonal patterns and distribution.

The monthly data underscore that abundance cannot be explained by temperature or humidity alone. For example, October included 15 individuals under environmental conditions of 33.55 °C and 13.50% humidity, and November had a similar or higher number despite lower temperature and increased humidity. Conversely, only 1 individual was appeared in February despite a mean temperature of 30.20 °C, similar to months with higher abundance. [16] noted that pseudoscorpion species respond differently to environmental condition gradients, likely due to their specific biological and ecological needs. [17] showed that pseudoscorpion assemblages vary across habitats such as soil, tree trunks, termite nests, and canopies, highlighting habitat position as a key factor over general climate condition. The observed seasonal variation might involve additional factors like substrate moisture, prey abundance, microhabitat availability, or life cycle stages; exploring these factors requires targeted testing, which cannot be confirmed solely from the current information.

Spatial variation among sampling stations was low. Al-Nasr station yielded 24 individuals (26.67%), Al-Rifai and Qalat Sukkar stations yielded 23 individuals (25.56%) each, and Al-Shatrah station had 20 individuals with a ratio of (22.22%). Only 4 individuals separated the highest and lowest station totals despite the same monthly sampling effort. This moderate similarity disagreed with [19], who reported pseudoscorpions being more abundant in older, unmanaged field margins with more litter than in recently cleared or frequently mown areas. It also differs from [12], who found higher numbers of *Neochelanus michaelsoni* in the forests Nothofagus compared to open peatlands grasslands and. These differences likely stem from habitat distinctions: previous studies compared structurally different or differently managed habitats, whereas the four stations here were all primarily agricultural lands, date-palm groves, orchards, or irrigation channels. The similar totals across stations suggest that none offered a significant advantage based on the measured variables, though data on vegetation, litter depth, and substrate would help verify this [8]; [19].

The presence of *D. balcanicus* at all 4 sites during most months aligns with its wide geographical and ecological distribution. [12] identified and study the species in Asia, southern Europe, and northern Africa, clarifying its taxonomy by synonymizing several taxa, including *D. insolitus* and *D. vachoni*, with *D. balcanicus*. [13] summarized records from various habitats, like bat guano, nests, caves, beneath stones and bark, and buildings. Compared with isolated or small samples from parts of its range, the collection of 90 individuals over a year indicates the species is not simply an accidental occurrence in Dhi Qar but likely has established populations within the agricultural areas. However, since

microhabitat data were not quantified, researchers cannot determine which habitat components support its persistence [12]; [13].

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References

- [1] M. Beier, "Neue Pseudoskorpione aus West-, Zentral-und Ostasien," *Annln Naturhist. Mus. Wien*, vol. 53, pp. 74-81, 1943.
- [2] V. Mahnert, M. Sharaf, and A. S. Aldawood, "Further records of pseudoscorpions (Arachnida, Pseudoscorpiones) from Saudi Arabia," *Zootaxa*, vol. 3764, pp. 387-393, 2014.
- [3] P. Weygoldt, *The Biology of Pseudoscorpions*: Harvard University Press, 1969.
- [4] E. Bedoya-Roque and E. Tizo-Pedroso, "Techniques for collection and sampling of pseudoscorpions (Arthropoda: Arachnida)," in *Measuring Arthropod Biodiversity: A Handbook of Sampling Methods*, ed: Springer, 2020, pp. 341-363.
- [5] M. S. Harvey, "Order Pseudoscorpiones. In: Zhang, Z.-Q.(Ed.) Animal Biodiversity: An Outline of Higher-level Classification and Survey of Taxonomic Richness (Addenda 2013)," *Zootaxa*, vol. 3703, pp. 34–35-34–35, 2013.
- [6] J. Zaragoza, "Orden Pseudoscorpiones," *Revista IDE@-SEA*, vol. 20, 2015.
- [7] T. Ranius, V. Johansson, and L. Fahrig, "Predicting spatial occurrence of beetles and pseudoscorpions in hollow oaks in southeastern Sweden," *Biodiversity and Conservation*, vol. 20, pp. 2027-2040, 2011.
- [8] M. V. Lencinas, G. Kreps, R. Soler, P. L. Peri, A. Porta, M. Ramírez, *et al.*, "Neochelanops michaelsoni (Pseudoscorpiones: Chernetidae) as a potential bioindicator in managed and unmanaged Nothofagus forests of Tierra del Fuego," *Journal of Arachnology*, pp. 406-412, 2015.
- [9] R. F. Moura, E. Tizo-Pedroso, and K. Del-Claro, "Colony size, habitat structure, and prey size shape the predation ecology of a social pseudoscorpion from a tropical savanna," *Behavioral Ecology and Sociobiology*, vol. 72, p. 103, 2018.
- [10] R. A. Fahed and A. H. Arooj, "The Effectiveness of Strategic Plans for Agricultural Financing in Promoting and Developing The Agricultural Sector in Iraq For The Period (2008-2018)," *Economic Sciences*, vol. 18, 2023.
- [11] T. S. Hurayga, H. K. Chlaib, R. S. Beedeh, and B. H. Kazim, "Nfluence of the physiography location on characteristics of the sedimentary plain soils in Al-Rifai district, Dhi qar province," *Euphrates Journal of Agriculture Science*, vol. 10, pp. 258-276, 2018.
- [12] J. Novak and M. S. Harvey, "The identity of pseudoscorpions of the genus Diplotemnus (Pseudoscorpiones: Atemnidae) from Europe and Asia," *North-Western Journal of Zoology*, vol. 11, 2015.
- [13] K. Krajčovičová, M. Červená, P. Gajdoš, and J. Christophoryová, "Diplotemnus balcanicus (Redikorzev, 1928)(Pseudoscorpiones, Atemnidae) rediscovered in Slovakia after 65 years," *Check List*, vol. 17, pp. 347-351, 2021.
- [14] V. Belozarov, "Seasonal aspects of the life cycles of pseudoscorpions (Arachnida, Pseudoscorpiones)," *Entomological Review*, vol. 93, pp. 634-652, 2013.
- [15] S. Vanin and M. Turchetto, "Winter activity of spiders and pseudoscorpions in the South-Eastern Alps (Italy)," *Italian Journal of Zoology*, vol. 74, pp. 31-38, 2007.
- [16] E. Villarreal, N. Martínez, and C. R. Ortiz, "Diversity of Pseudoscorpiones (Arthropoda: Arachnida) in two fragments of dry tropical forest in the colombian Caribbean region," *Caldasia*, vol. 41, pp. 139-151, 2019.

- [17] L. D. Battirola, "Vertical and time distribution of Pseudoscorpiones (Arthropoda: Arachnida) in a floodplain forest in the Brazilian Pantanal," *Rev. biol. trop*, pp. 445-459, 2017.
- [18] J. Adis and V. Mahnert, "Vertical distribution and abundance of pseudoscorpions (Arachnida) in the soil of two different Neotropical primary forests during the dry and rainy season," *Memoirs of the Queensland Museum, Nature*, vol. 33, pp. 431-440, 1993.
- [19] J. R. Bell, S. Gates, A. J. Haughton, D. W. Macdonald, H. Smith, C. P. Wheeler, *et al.*, "Pseudoscorpions in field margins: effects of margin age, management and boundary habitats," *Journal of Arachnology*, pp. 236-240, 1999.