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# Temporal Distribution, Abundance, Diversity, Guild Composition of Spiders (Arachnida: Araneae) from Different Habitats, Upper Egypt

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**Abstract**: The spider fauna of Egypt, especially in Upper Egypt, is poorly studied. This work seeks to enhance the classification of spider guilds through various taxonomic levels and improve our understanding of their ecological diversity in the region. This study focuses on shaded trees (*Ficus nitida*) located in Sohag University, Sohag Governorate, Egypt. The study analyzed spider's community at the different habitats was 423 spiders, which were classified into 34 species, 32 genera, 15 families and one Infra-order, Araneomorphae, 12 guilds and two foraging groups. The most species-rich families were Gnaphosidae, Salticidae, Theridiidae, Oecobiidae and Oonopidae. In terms of temporal distribution, certain families were present throughout all seasons, while others had specific seasonal occurrences. Each season had different compositions regarding guilds, families and species. The hackled-band weavers (web-building spiders) were the most abundant guild; Dictynidae was the most abundant family and Nigma conducens were the most abundant species. On the other hand, the litter stalkers (hunting spiders) were the most abundant guild; Oonopidae was the most abundant family and *Dysderina scutata* was the most abundant species. The seasonal fluctuation in the number of individuals varied among families in both habitats. The occurrence of spiders correlated with temperature fluctuations, with higher rates in spring and autumn and lower rates in winter and summer. The study highlights how environmental factors, habitat types, and collection methods influence spider distribution and diversity across habitats and seasons.
**Keywords:** Spider, habitat, diversity, guild structure, temporal distribution.

## 1. Introduction

Similar to numerous other invertebrates, spiders (Arachnida: Araneae) that have established themselves in various land and aerial environments receive limited attention from conservation experts and the general population. However, the growing accessibility of information has allowed scientists to gain a deeper comprehension of spiders' essential function in ecosystems, surpassing previous knowledge. Consequently, there is now a greater need to enhance conservation efforts for these fascinating creatures. In comparison to other categories of animals, particularly vertebrates, invertebrates experience comparable or sometimes even greater levels of extinction and have a similar ratio of species that are at risk of extinction [1]. They require immediate safeguarding and monitoring [2,3]. However, when it comes to preservation efforts, invertebrates are frequently disregarded. Even though invertebrates are extremely abundant and diverse worldwide, playing a critical role in the functioning of ecosystems, they are often overlooked [4,5]. The majority of attention and research in the field of biodiversity conservation is currently dedicated to a small number of widely recognized groups of vertebrate animals. These groups include taxa such as birds and mammals [6-11]. Spiders are a varied group of animals that can be found in a wide range of habitats and ecosystems [12,13]. They have a broad distribution, from the poles to the heart of continents and from sea level to elevations of up to 5000 meters [14]. While spiders can live in different environments, most of them prefer terrestrial ecosystems. They tend to favor moist areas like underground tunnels, under rocks, and near water sources. Interestingly, some spiders even inhabit coastal areas and get submerged in the water twice a day [15]. These spiders have attained such a vast range of diversity due to their exceptional adaptability and distinct physical and behavioral characteristics [16].

In many ways, trees are model habitats for the study of community ecology. The arboreal habitats are easily defined and clearly limited. Individuals in the arboreal community are all more or less tropically interlinked, and they are unified in their dependence on the tree. Except for migrating individuals, the arboreal community is spatially discrete [17,18]. Groups of competitors or groups of species that significantly overlap their niche requirements and exploit the same environmental resources in a similar way were later called guilds [19-22]. Grouping organisms in guilds describes part of the community structure and can be valuable in comparative descriptions of different communities [23]. Diverse assemblages of different spiders' functional groups should be successful in controlling a large variety of different insect pests. The concept of functional groups categorizes species that utilize the same resource in similar ways [24]. Trees are also structurally complex, providing

great niche diversification [25,26], their appearance encourages potential colonists [27,28] and they are a stable resource [29,30] for these exploiters with relatively short generation spans. These attributes, coupled with the wide geographical distribution of many tree species [31], account for the extraordinary species richness of arboreal communities.

Comparing the biodiversity in different habitats and assessing how disruptions impact the diversity of species; Sohag is one of the Egyptian governorates with rich floral and faunal diversity but, till date, a comprehensive investigation on the diversity and distribution of spiders has been comparatively limited compared to other regions in the country [32-35]. So, the present study aims at 1) Studying the biodiversity, distribution, occurrence, and guild composition of spiders from two ecologically different habitats. 2) Recording the seasonal fluctuation of the spider population. 3) Making a checklist of species recorded from these habitats to document the spider fauna of this area and add some findings to the spider fauna of Upper Egypt.

## 2. Materials and methods

Sohag Governorate is situated in the southern part of Egypt. It is located between the coordinates 26° 54' 15" N, 31° 24' 15" E and 26° 11' 55" N, 32° 04' 22" E. This governorate covers a portion of the Nile Valley and has a total area of approximately 11,022 km$^2$ (Figure. 1a). It is characterized by a desert climate, and the year showed two distinct periods: a cool winter from November to April and a hot summer from May to October [36]. Sohag University, which was selected to conduct the present study, is located between latitudes 26º 33'48.4"N and 26º 33' 58.4"N and longitudes 31º 42' 25"E and 31º 42' 32.9"E (Figure. 1b & c).

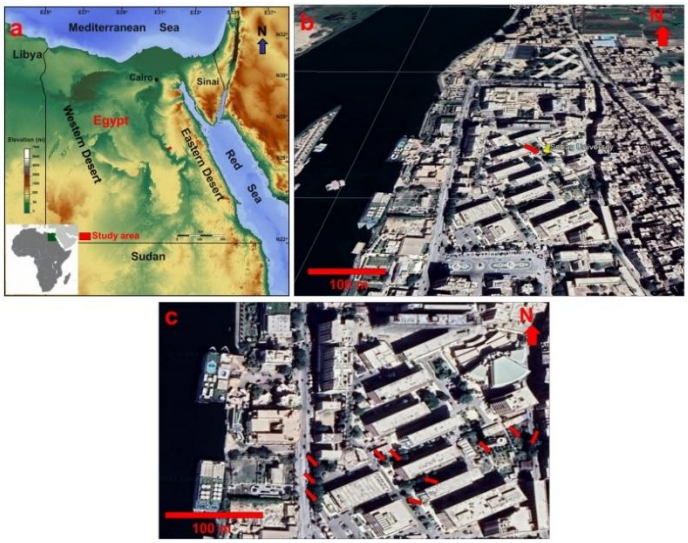



**Figure. 1.** (a): Map of Egypt showing the location of Sohag Governorate. (b &c): Google Earth map showing site of collection, Arrows refer to the sampling points.

Two habitats were chosen to conduct this study during one year (October, 2022 - May, 2023). Aerial spider inhabiting trees *Ficus nitida* (foliage and branches) located between buildings and gardens and terrestrial spider inhabiting leaf litter under the same trees. Consequently, two sampling methods were employed. Randomly, 10 trees were thoroughly examined seasonally using shaking and beating method which is suitable for collecting aerial spiders. In this method, a white cloth sheet (2.5 x 2 m$^2$) was laid on the ground beneath the branches of the tree. The branches above the white sheet and under the four sides of each tree were shaken vigorously with hand for one minute and then beaten five times with thick large stick to dislodge spiders. This was followed by quick collecting of spider in labelled plastic jars before they escape (Figure. 2a).

For the terrestrial ones, random ten sampling points were selected using modified visual searching and quadrate methods. The ground spiders that were found around each tree or under stones and between grasses and leaf litter in an area of 25 X 25 cm$^2$ were pushed to get inside plastic bags (Figure. 2b).


**Figure. 2.** Images showing sampling methods; a) a white cloth sheet is placed below a tree to be assessed (beating trays method); b) visual searching and quadrate method.

In the laboratory, both males and females from each species were isolated, photographed, and stored in labeled containers filled with 70% ethyl alcohol. By using dissecting microscope, the anatomical structures specific to each species were carefully extracted using small scissors and sharp needles. The specimens were immersed in clove oil or lactic acid to remove any debris and then placed on slides using Hoyer's media (50 ml distilled water, 30 gm Gum Arabic, 200 gm chloral hydrate and 20 ml glycerin) for permement preservation. The species were identified according to the keys and descriptions of references [37-40]. The confirmation of spider identification was done by

personal communication with Mr. Hisham El-Hennawy (the Egyptian expert in the identification of Egyptian spiders).

## 3. Results and Discussion:

### 3.1. Community structure:

The spiders community at the different habitats was 423 spiders:146 in terrestrial habitat and 277 in aerial habitat which were classified into 34 species, 32 genera, 15 families and one Infra-order, Araneomorphae, 12 guilds and two foraging groups: web-building and hunting spiders. These families are: Araneidae, Cheiracanthiidae, Dictynidae, Filistatidae, Gnaphosidae, Linyphiidae, Lycosidae, Oecobiidae, Oonopidae, Philodromidae, Pholcidae, Salticidae, Theridiidae, Thomisidae and Uloboridae (Table S**1** and Figure **S1-S15**).

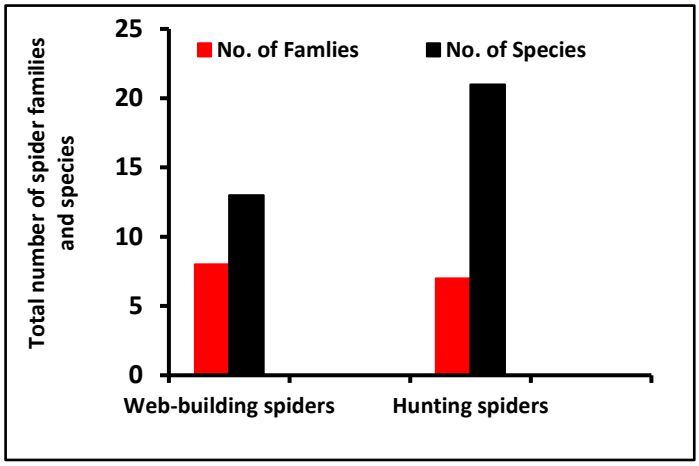
### 3.2. Habitat variables:

By examining two different habitats, it was revealed that the number of spider families and species in the aerial habitat was greater than that in the terrestrial ones. During the four-season study period, a total of 146 spiders from 10 families, 22 genera, and 23 species were recorded in the Leaf litter habitat. On the other hand, the aerial habitat recorded a total of 277 spiders belonging to 14 families, 22 genera, and 24 species during the same study period.

Spiders groups and guilds: In the current study, spiders collected from both foliage and leaf litters were pooled. This approach is due to the fact that aerial and terrestrial spiders may be temporarily present in both environments for activities such as mating, resting in shading areas, laying egg sacs, pursuing prey, or escaping predators. Additionally, their presence can be accidental, influenced by factors like irrigation and environmental conditions; for instance, aerial spiders, especially those living on leaves, may fall to the ground when strong winds occur. So, all the recorded spiders in the two different habitats were pooled to be classified to guild structure. According to the foraging strategy of spiders, they can be categorized into two main groups: the web-building and the hunting spiders (each represented by six guilds 50% of the total collected). The two groups can be further divided into guilds depending on their web characters and feeding activities (Table S**2**). The Web-building spiders (represented by eight families) represents 53.3% of the total collected, included: the orb-weavers (families: Araneidae and Uloboridae), hackled-band weavers (family: Dictynidae), sheet-web weavers (family: Linyphiidae), cob-web spiders (family: Theridiidae), sensing web weavers (families: Filistatidae and Oecobiidae) and scattered line weavers (family: Pholcidae). Hunting spiders (represented by seven families) constitutes 45.7% of the total collected spiders and included: nocturnal around runners (family: Gnaphosidae), nocturnal hunters (family: Lycosidae), agile hunters (family: Salticidae), ambushers hunters (families: Philodromidae and Thomisidae), swift hunters (family: Cheiracanthiidae) and litter stalkers (family: Oonopidae) (Table S**2**).

Although the number of species of the hunting spiders (represented by 21 species 61.8% of the total collected) at the study site was higher than that of the web building ones (represented by 13 species 38.3% of the total collected), the number of families of the web building spiders at the study site was higher than that of the hunting ones. Web-building spiders were represented by 8 families and 13 species, while the Hunting spiders were represented by 7 families and 21 species (Table S**2** and Figure **3**).

**Figure 3:** Number of spider families and species in the two investigated foraging groups; (web-building and hunting spiders) at the lemon trees site.




The web-building spiders were represented by 209 individuals representing 49.4% of the total collected ones at the studied site. The hackled-band weavers were the most abundant and represented by 107 inds., Ca. 51.20% of the total collected spiders, followed by the cob-web weavers (42 inds., Ca. 20.10%), orb-weavers (24 inds., Ca. 11.48%), sensing-web weavers (21 inds., Ca. 10.05%), sheet-web weavers (12 inds., Ca. 5.74%) and scattered line weavers (3 inds., Ca. 1.44%). It is also visible from Table **S 2** that, each of the four guilds: hackled-band weavers, sheet-web weavers, cob-web weavers and scattered line weavers were represented by only one family for each of them. These were Dictynidae, Linyphiidae, Theridiidae and Pholcidae; respectively. While the orb-weavers and sensing web weavers were represented by two families. These were Araneidae and Uloboridae (orb-weavers) and Filistatidae and Oecobiidae (sensing web weavers). Among the five families of the web-building spiders, family Dictynidae was the most abundant (107 inds., Ca. 51.20%) of the total collected ones, followed by Theridiidae (42 inds., Ca. 20.10%), Oecobiidae (19 inds., Ca. 9.09%), Uloboridae (13 inds., Ca. 6.22%), Linyphiidae (12 inds., Ca. 5.74%), Araneidae (11 inds., Ca. 5.26%), Pholcidae (3 inds., Ca. 1.44%) and Filistatidae (2 inds., Ca. 0.96%) (Table S**2** and Figure **4**).

On the species level; the web-building spiders comprised 13 species. The most abundant was *Nigma conducens* that was represented by 107 individuals, Ca. 51.20% of the total collected spiders, followed by *Euryopis episinoides* (21 inds., Ca. 10.05%), *Uloborus walckenaerius* (13 inds., Ca. 6.22%), *Sengletus extricates* (12 inds., Ca. 5.74%), *Cyrtophora citricola* (11 inds., Ca. 5.26%), Theridion spinitarse (9 inds., Ca. 4.31%), *Uroctea* sp. (8 inds., Ca. 3.83%), *Theridion melanostictum* (7 inds., Ca. 3.35%), *Oecobius putus* (6 inds., Ca. 2.87%), *Dipoena braccata* and *Oecobius templi* (5 inds., Ca. 2.39% each), *Nita elsaff* (3 inds., Ca. 1.44%) and *Filistata* sp. (2 inds., Ca. 0.96%) (Table S **2** and Fig. **5**).

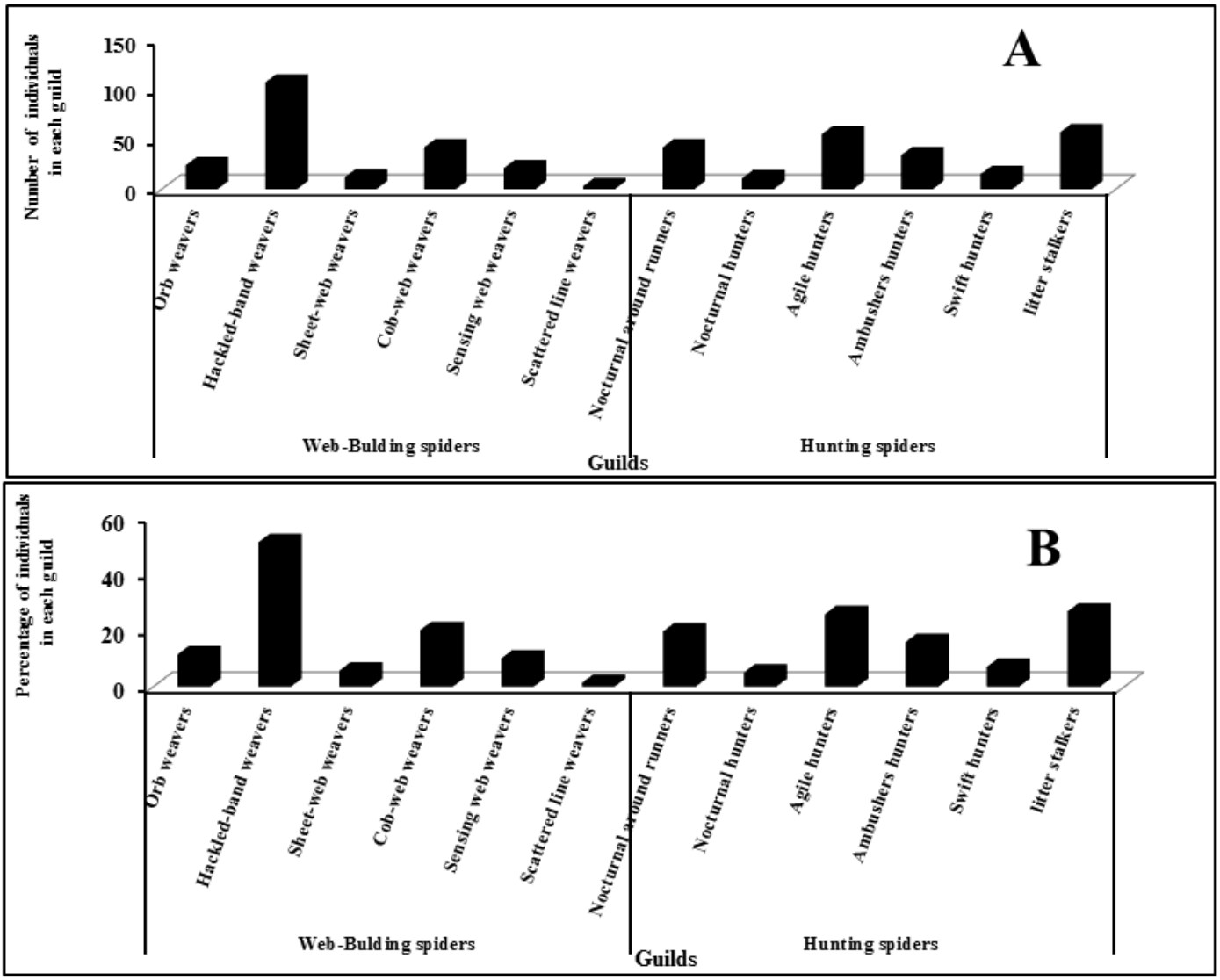



**Figure. 4.** Numbers (A) and percentages (B) of the investigated individuals in each guild at the sampling site.

On the other hand, the hunting spiders were represented by 214 individuals representing 50.6% of the total collected ones at the studied site. The litter stalkers were the most abundant and represented by 57 individuals, Ca. 26.64%, followed by the agile hunters (55 inds., Ca. 25.70%), nocturnal around runners (42 inds., Ca. 19.63%), ambushers hunter (34 inds., Ca. 15.89%), swift hunters (15 inds., Ca. 7.01%) and nocturnal hunters (11 inds., Ca. 5.14%). It is also clear from Table S **2** that, all guilds were represented by only one family except for ambushers hunters were represented by two families (Philodromidae and Thomisidae).

Among the seven families of the hunting spiders, family Oonopidae was the most abundant (57 inds., Ca. 26.64%), followed by Salticidae (55 inds., Ca. 25.70%), Ganophosidae (42 inds., Ca. 19.63%), Thomisidae (19 inds., Ca. 8.88%), Philodromidae and Cheiracanthidae (15 inds., Ca. 7.04% for each) and Lycosidae (11 inds., Ca. 5.14%) (Table S**2** and Fig. **4**).

On the species level, hunting spiders comprised 21 species. The most abundant species, *Dysderina scutata* that was represented by 26 individuals, Ca. 12.15% of the total collected ones, followed by *Synaphosus syntheticus* (23 inds., Ca. 10.75%), *Opopaea santschii* (20 inds., Ca. 9.35%), *Hasarius adansoni* (18 inds., Ca. 8.41%), *Thomisus spinifer* (16 inds., Ca. 7.48%), *Cheiracanthium isiacum* and *Heliophanillus fulgens* (15 inds., Ca. 7.01% each), *Afraflacilla spiniger* and *Pulchellodromus glaucinus* (12 inds., Ca. 5.61% each), *Orchestina pavesii* (11 inds., Ca. 5.14%), *Trachyzelotes lyonneti* (8 inds., Ca. 3.74%), *Wadicosa fidelis* (7 inds., Ca. 3.27%), *Plexippus paykulli* (6 inds., Ca. 2.80%), *Poecilochroa pugnax, Trochosa urbana* and *Phlegra lineata* (4 inds., Ca. 1.87% each), *Heser nilicola, Odontodrassus aravaensis, Thanatus albini* and *Ozyptila sp.* (3 inds., Ca. 1.40% each) and *Berlandina venatrix* (1 inds., Ca. 0.47%) (Table S **2** and Fig. **5**).

Seasonal fluctuations in number of species of the web-building and hunting spiders groups: Monthly fluctuation in number of species in each recorded family is shown in (Table S **3**; Fig. **6**):

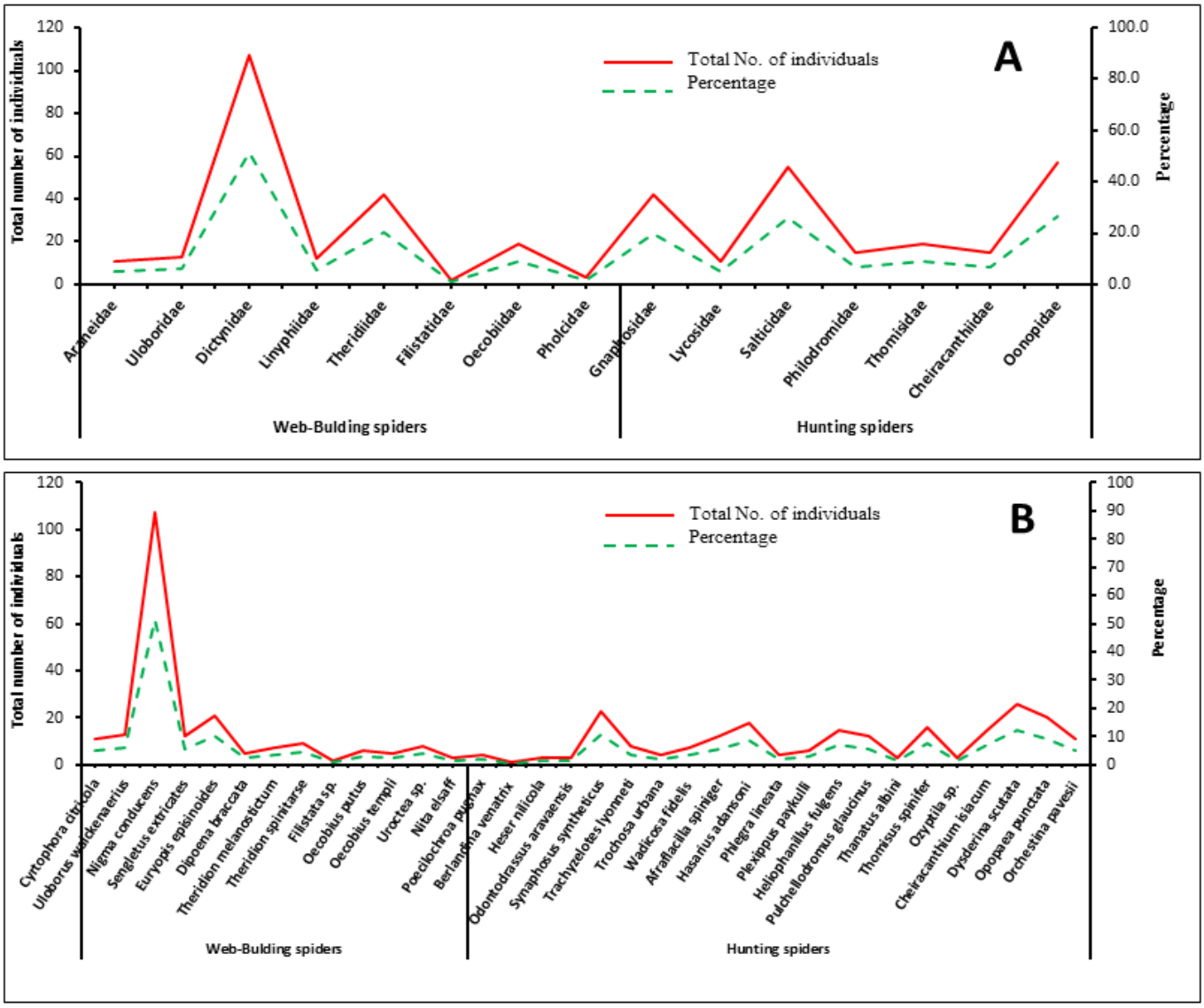



**Figure. 5.** Number and percentage of individuals at the studied site A) in each recorded family, B) in each recorded species.

Generally, the most species-rich family was Gnaphosidae (hunting spiders) which has six species constituting 17.65% of the total collected ones, followed by Salticidae (hunting spiders) which has five species constituting 14.71%, Theridiidae (web-building spiders) which has four species constituting 11.76%, Oecobiidae and Oonopidae (web-building and hunting spiders, respectively) which have three species each constituting 8.82%, Lycosidae, Philodromidae and Thomisidae (hunting spiders) which have two species each constituting 5.88%. The rest of the families were represented by only one species.

Table S3 shows that 6 families of the web-building spiders were represented by one species only. These were Araneidae, Uloboridae, Dictynidae, Linyphiidae, Filistatidae and Pholcidae. The species of Araneidae, Uloboridae, Dictynidae and Linyphiidae families were recorded during all the seasons, while that of Pholcidae was recorded during autumn and spring. The single species of family Filistatidae was present in sporadic and recorded only in summer. Family Oecobiidae was represented by the three species: *Oecobius putus*, *Oecobius templi* and *Uroctea* sp. The three species of the family Oecobiidae were recorded together during all seasons except during summer, where only *Uroctea* sp. was recorded. Family Theridiidae was represented by the four species: *Euryopis episinoides*, *Dipoena braccata*, *Theridion melanostictum* and *Theridion spinitarse*.

The four species of the family Theridiidae were recorded together during autumn and spring, *Euryopis episinoides* and *Theridion spinitarse* were recorded during all seasons, while *Dipoena braccata* and *Theridion melanostictum* were recorded during all season except during summer for the former and winter for the later (Table S3).

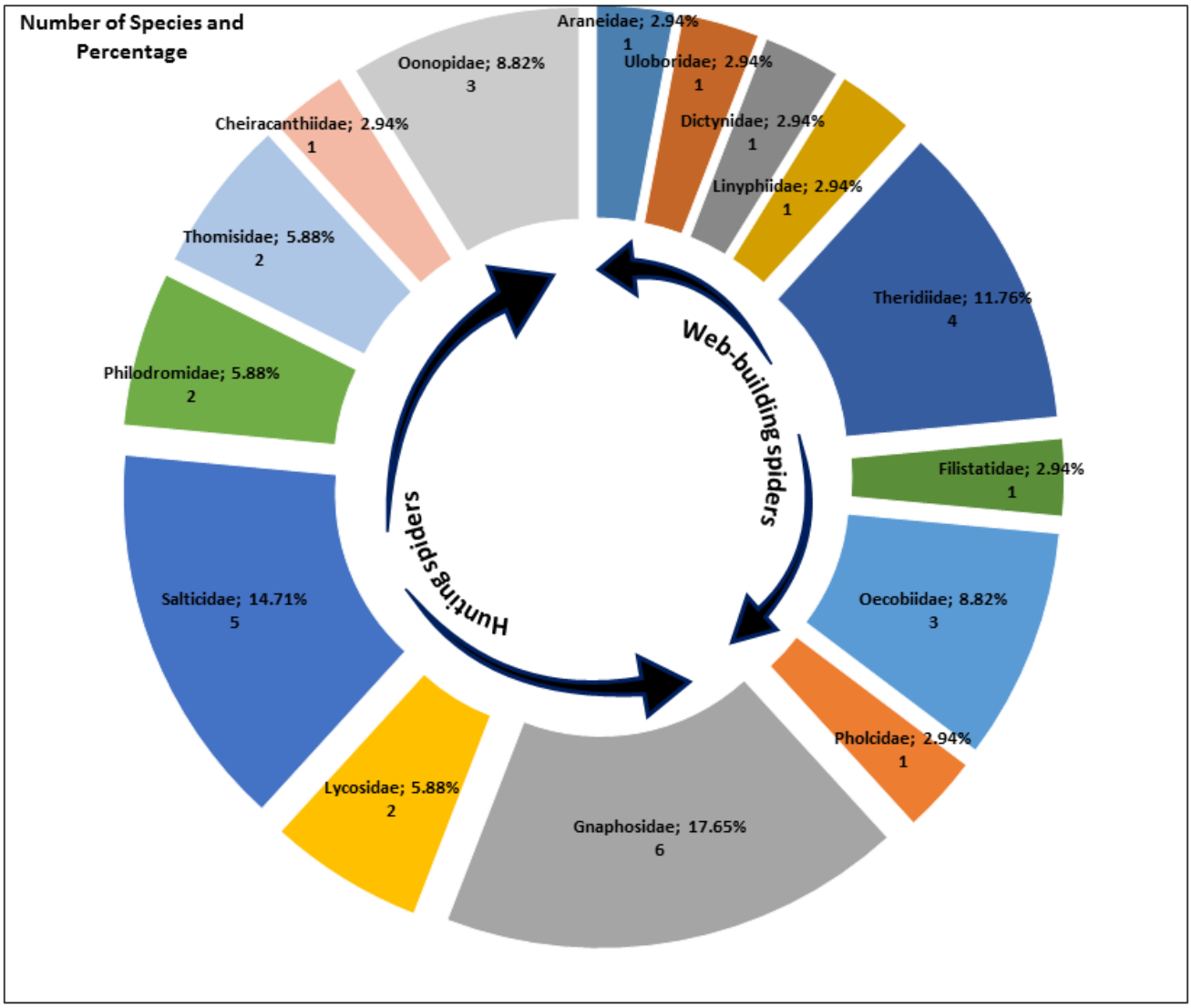



**Figure. 6.** Number of species in each recorded family and their percentages at the studied site.

*Heliophanillus fulgens*, *Phlegra lineata* and *Plexippus paykulli*.

On the other hand, hunting spiders, one family (Cheirchanthidae) of the hunting spiders was represented by one species only and was recorded during all the seasons. Three families were represented by two species. These were Lycosidae, Philodromidae and Thomisidae. Family Lycosidae was represented by the *Trochosa urbana* and *Wadicosa fidelis*. They were recorded during all seasons except during autumn for the former and summer for the latter. Family Philodromidae was represented by the *Pulchellodromus glaucinus* and *Thanatus albini*. The former was recorded during all seasons and the latter was recorded only during autumn and summer. Family Thomisidae was represented by the *Thomisus spinifer* and *Ozyptila* sp., they were recorded during all seasons except for *Ozyptila* sp. that was absent during summer. The family Oonopidae was represented by the three species: *Dysderina scutata*, *Opopaea santschii* and *Orchestina pavesii*. The three species of the family Oonopidae were recorded together during all seasons. Family Salticidae was represented by the five species: *Afraflacilla spiniger*, *Hasarius adansoni*, The five species of the family Salticidae were recorded together only during summer. *Hasarius adansoni* and *Heliophanillus fulgens* were recorded during all seasons, while *Afraflacilla spiniger* was absent during summer; *Phlegra lineata* absent during winter and *Plexippus paykulli* absent during autumn. Family Gnaphosidae was represented by the six species: *Berlandina venatrix*, *Heser nilicola*, *Odontodrassus aravaensis*, *Poecilochroa pugnax*, *Synaphosus syntheticus* and *Trachyzelotes lyonneti*. The six species of the family Gnaphosidae were not recorded together. *Synaphosus syntheticus* and *Trachyzelotes lyonneti* were recorded during all seasons, while *Poecilochroa pugnax* was absent during winter; *Odontodrassus aravaensis* absent during winter and spring, *Heser nilicola* absent during autumn and summer and *Berlandina venatrix* absent during all seasons except for summer (Table S 3).

**3.3. Seasonal fluctuations in the number of individuals in the different recorded families at the studied site:**

Data in Table S4 revealed that, the highest abundance of spiders was in spring (126 inds., Ca. 29.79%), followed by that in autumn (105 inds., Ca. 24.82%), while the abundance in summer and winter was nearly similar, represented by 97 and 95 inds., Ca. 22.93%, 22.46%; respectively.

The abundance of the web-building spiders was high in spring (80 inds., Ca. 38.28%), followed by that in winter (53 inds., Ca. 25.36%), while that in autumn (44 inds., Ca. 21.05%) and summer was represented by 23 ind., Ca. 15.31. On the other hand, the abundance of the hunting spiders was high in spring (80 inds., Ca. 38.28%), followed by those in winter and autumn (53 and 44 inds., Ca. 25.36%, 21.05%; respectively), while that in summer was represented by 32 individuals, Ca. 15.31%. The collected numbers of individuals of Filistatidae and Pholcidae were few; therefore, their fluctuation cannot be figured or detected (Table S4).

During the present study, 34 species were recorded belonging to 15 families that represent 36.58% and 11% of the total families reported from Egypt and worldwide, respectively. The study of Egyptian spiders diversity remains incomplete because of the restricted and sporadic research efforts in this particular area. According to El-Hennawy [37], there are 405 different spider species classified under 204 genera and 41 families across various regions of Egypt. By comparing Upper Egypt Governorates; [41] recorded 21 families from Sohag Governorate including 29 genera and 30 species. [42] recorded 20 families from Assiut Governorate including 45 genera and 45 species. While in Qena Governorate, [43] surveyed 14 families including 23 genera and 23species.

According to the [40], there are more than 52765 species belonging to 4427 genera and 136 families in the world. As research progresses, new species being discovered and the reclassification of existing ones as synonyms inevitably lead to fluctuations in the species count within families. As a result, the total number of species can never be reflecting the present status with total accuracy. However, numerous species may have gone unnoticed by humans thus far, with many samples stored in collections, waiting for identification and classification. It was estimated that, only one third to one half of the total number of existing species have been described [44].

In our current investigation, we have identified 34 spider species from 32 genera and 15 families. In regard to the present research and the available studies on Sohag Governorate, all of the documented families were previously recorded. Additionally, the current investigation has added 19 genera and 19 species (including 4 unidentified species): *Filistata* sp., *Berlandina venatrix, Heser nilicola, Odontodrassus aravaensis, Synaphosus syntheticus, Trachyzelotes lyonneti, Trochosa urbana, Wadicosa fidelis, Oecobius temple, Uroctea* sp., *Dysderina scutata, Opopaea santschii, Orchestina pavesii, Nita elsaff, Hasarius adansoni, Phlegra lineata, Euryopis episinoides, Dipoena braccata,* and *Ozyptila* sp. to those previously recorded in Sohag Governorate.

Based on the present results and comparing with the others carried out worldwide and in Egypt, one can conclude that, the number of genera and species differs. This study coincides with the hypothesis of [45-47] about the differences in the diversity and abundance of spiders. These differences may appear as a result of variation in spider's geographical distribution as well as variation in climatic conditions which cause variation in vegetation types. Moreover, spiders may be affected by natural enemies, the abundance of preys, types of collection methods and human impacts [48, 49]. The diversity of spiders in Upper Egypt is affected by the different environmental factors (temperature, humidity and wind speed). [50, 51], explain how environmental factors affect the distribution and diversity of spiders in Upper Egypt. He recorded that population of spiders reached high numbers in autumn while the lowest number was recorded in winter. [52] recorded that, the highest abundance of spiders was in summer and the lowest was in winter. On the other hand [53] reported that, the spider community composition at the family level is mostly related to relative humidity followed by temperature, while at the species level it is mostly related to wind speed followed by temperature.

Spiders live in well-defined environments with limitations set by both physical and biological factors [54]. They can be grouped into specific functional groups, guilds, based on the relative distribution and predatory methods [55]. Guilds are ecological groupings of organisms which exploit single or similar resources by a similar manner [19]. The present study classifies spiders into two main groups, web-building and hunting spiders which can be further divided into many guilds based upon gross differences in foraging behavior within the resident spider communities. In the present study, the number of species of the hunting spiders at the study site was higher than that of the web building ones. Web-building species are stationary predators, which wait for food to come into their webs, i.e., they feed on moving preys. In contrast, hunting spiders are more active and representatives of various hunting spider families found to feed on both moving and motionless preys [56, 57]. They are actively seeking out suitable food due to their higher mobility and have better chances of finding suitable food than web-weavers in the agroecosystem.

In the present study, spiders were divided into twelve guilds. Other studies classified them into many guilds based on spider foraging strategy, habitat preference, circadian activity and prey range that make the number of recognized guilds varies [1, 58]. In the present study, the hackled-band weavers (web-building spiders group) were the most abundant guild; Dictynidae was the most abundant family and *Nigma conducens* was the most abundant species. On the other hand, the litter stalkers (hunting spiders group) were the most abundant guild; Oonopidae was the most abundant family and *Dysderina scutata* was the most abundant species. This because most species of the family Dictyninae are arboreal, constructing webs on foliage, flowers, branches, and dried plant stalks [59]. Oonopidae found in a wide variety of habitats, including foliage, under bark, and even in caves, deserts, bird and termite nests, and the webs of other spiders [60].

The results of the present study indicated that, each season had different compositions regarding guilds, families and species. The data on guilds seasonal abundance showed that, the

abundance of both web-building and hunting spiders in the present study was high in spring. Seasonal fluctuations in number of families of the two studied guilds (web-building and hunting spider) showed that, all families were recorded during all the seasons except for Filistatidae and Pholcidae families. The high abundance of the families Araneidae, Linyphiidae, Gnaphosidae and Cheiracanthiidae was in autumn, for families Dictynidae, Theridiidae, Oecobiidae and Pholcidae was high in spring, and for families Uloboridae, Salticidae, Philodromidae and Thomisidae was in summer. The high abundance of family Oonopidae was in autumn and spring.

On the species level, the temporal distribution of captured species revealed that, 16 species (see table S**3**) were recorded during all the period of investigation. This coincided with [**61**] who suggested that, these species are competitive under a wider range of conditions and use more prey types than the other collected spider species.

Seasonal fluctuations in abundance of spider populations were reported in many areas [**62-65, 43**] and attributed to variation in vegetation (type, density, architecture and flowering season), some physical factors (temperature, relative humidity and degree of shadows offered by vegetation) and some biological factors (inter- and intra-competition). Also, shading provided by the trees is important because it affects the microclimatic conditions of the grasses around and under the trees [**66**].

Temperature and humidity are two important physical factors for spiders, which have different ranges of physiological tolerances; therefore, these factors alter greatly the abundance and richness of spider species [**67, 43**]. In the present study, the area during the autumn and spring seasons characterized by increasing the plants growth providing more suitable micro and macro habitats for spiders. This was associated with high temperature and low relative humidity forming suitable climatic conditions for the abundance and diversity of insects (available preys) which may explain the high abundance of the present spiders in terms of species and numbers. [**68**] reported that, high summer abundance spiders can be attributed to high temperature and relative humidity in this season that make spiders active, as well as, to the canopy and flowering of trees that increase the available preys. While the low abundance in winter suggests the influence of spiders by the severe climatic conditions where low temperature decreases the activity of some spiders. Some spiders enter a stage of dormancy, especially hunting spiders [**69**], while others hibernate [**68**] as well as most of their arthropod prey do [**70**].

The variations of abundance and diversity of some hunting spiders may probably be due to the method of collection. [**71**] reported that, the diversity of hunting spiders, both in terms of abundance and species diversity are positively associated with the number of stones on the surface of the soil near trees, most likely due to their need for shelter in the early stages of development and as places where food and shelter can be found as well as places for reproduction in case of adult ground hunters.

Comparing the present study with the other results obtained in other different Governorates of Egypt we can suggest that, there are clear differences in the diversity and in the relative abundance of taxa between these studies and the present study. These differences may be attributed to the effect of one or more of the following variables: time and type of study, environmental factors in sites of collection, habitat type, methods of collection, natural enemies, types and nature of crops, the abundance of prey and human effects.

## 4. Conclusion

In conclusion, due to the importance of spiders, which play a crucial role in pest control in different habitats, influencing pest populations and vegetation quality through their diversity, distribution, and seasonal changes, highlighting environmental monitoring importance. The study gives baseline information on spider community, guild structure, diversity and distribution in the two different habitats. The study may offer new information on the dispersal, abundance and classification of various recorded spider families, genera, and species. Additionally, it is advised to conduct further research in order to discover unidentified species within Sohag Governorate. This can be achieved by exploring new habitats and implementing novel techniques for specimen collection.

## CRediT authorship contribution statement:

**SME** conceived the ideas and designed methodology. **TAA, EMA and SMT** collected the field data and analyzed the data, photographed the specimens and analyzed data. **TAA** contributed critically to the drafts. **SME** was responsible for organizing, writing, and revision of the manuscript and gave final approval for publication. **SME and NFA** were responsible for final revision of the manuscript. The published version of the work has been reviewed and approved by all the authors.

## Data availability statement

All data analyzed in this manuscript is included in the published article.

## Declaration of competing interest

No potential conflict of interest was reported by the authors.

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## Ethical approval

Specimens' collection and handling were approved by the Committee for Scientific Research Ethics (CSRE), Faculty of Science, Sohag University, Sohag, Egypt **(No. CSRE -15-24)**.

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