

RESEARCH ARTICLE

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Taxonomical Study of Spiders (Order, Araneae) from Different Localities of Iraq

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Abstract

This study represents the first molecular and morphological work on spiders of Iraq. Specimens were collected from different localities in seven provinces during June 2018-July 2019 in different climate conditions. Using both molecular and morphological approaches, eight families representing 17 genera and nine species were identified. Eight genera: *Cryptachaea* Archer, 1946; *Micaria* Western, 1851; *Ozyptila* Simon, 1864; *Paramicromerys* Millot, 1946; *Tegenaria* Latreille, 1804; *Trachyzelotes* Lohmander, 1944; *Uroctea* Dufour, 1820 and *Zelotes* Gistel, 1848; and five species: *Cryptachaea riparia* (Blackwall, 1834); *Tegenaria pagana* C. L. Koch, 1840; *Trachyzelotes jaxartensis* (Kroneberg, 1875); *Pardosa amentata* (Clerck, 1757) and *Oecobius putus* O. Pickard-Cambridge, 1876 were first recorded for the Iraqi spider fauna. Identification keys for distinguishing families and genera based on the main characteristics were constructed.

Molecular-identification was performed for specimens that were difficult to identify by morphological methods, and to confirm the results of the morphological identification. DNA was extracted from 28 spiders' specimens; PCR-amplified the mtDNA fragment of 710bp of the Cytochrome C Oxidase Subunit I (COI) gene using the primers

LCO 1490 Forward / HCO-700ME Reverse. The results of DNA sequences showed 16 samples successful in sequencing.

Sixteen local sequenced specimens were submitted to GenBank and edited and combined with COI gene sequences that are associated in GenBank using the neighbor-joining method and the phylogenetic tree was drawn. Eight species of 16 genera belonging to eight families were confirmed by molecular barcoding. The DNA sequences and associated information about the specimens (collection and locality date) deposited in GenBank.

Keywords: Araneae, Fauna, Iraq, New records, Spider.

Introduction

Spiders (Order: Araneae) are members of the class Arachnida, which also includes mites, ticks, and scorpions; arachnids regards the second largest group of the phylum Arthropoda after the class Insecta. They are the largest order of arachnids and ranked seventh in the diversity of total species among all other orders of organisms. At least 48,000 spider species, and 113 families have been recorded by taxonomists (Sebastain and Peter, 2009; Bradley, 2013; Platnik, 2018).

The occurrence of spiders is frequently related to the environmental factors, for instance, such as vegetation structure and soil humidity as well as all types of human pressure, and management regimes. Spiders are used to study the relationships between the organism and habitat due to their sensitive response to the environmental and structural changes (Hendrickx *et al.*, 2007).

According to Dunlop and Penny (2011); the order of Aranea Clerck, 1757 divided into two suborders Mesothelae and Opisthothelae based on the articulation of chelicerae. The first known as a primitive spider, the second is modern or derived with two infraorders, Mygalomorphae

and Araneomorphae, the phylogenetic scheme adopted in this study considers the most accepted classification of spiders is based on Coddington (2005). Araneomorphs, or called “True spiders” represent over 90% of spiders, and can be distinguished from the primitive spiders by the sideways (diaxial) articulation of their chelicerae. Paraxial and Diaxial chelicera orientations are also referred to orthognath and labidognath respectively (Coddington, 2005).

The order Araneae is one of the most diverse groups of organisms on earth with over 30.000 described spider species worldwide (Coddington and Levi, 1991). The information about taxonomy of spider species and their distribution in our region is limited, lack of knowledge about this group makes other studies in different fields like ecology and biogeography very difficult (Wunderlich, 2011).

The Egyptian spider fauna is incompletely known due to scarcity of studies on this group, particularly in Upper Egypt. So, the key for identifying terrestrial spiders at Qena Governorate is a part of a comprehensive study conducted in the region by Obuid- Allah *et al.* (2015). Fauna of Arabia mainland and Yemen which defined by Knoflach and Harten (2002). Spiders of the Gnaphoside genus *Pteroticha* Kulczynski, 1903 which occurring in the United Arab Emirates are surveyed on the basis of a large collection, six species of this genus were recognized, four of which are described as new to science (Zamani, 2018).

Spider fauna of Palestine were studied and a revision of the subfamily Gnaphosidae in Israel, with a description of 11 new species from the family Salticidae (Levy, 1995 and 2013). Number of previous literature on the Iranian spiders were recently summarized by Mozaffarian and Marusik (2001) and Mirshamsi *et al.* (2013); new faunistic records of the jumping and crab spiders from Iran by Logunov *et al.* (2006). Checklist of spiders from Iran by Sahra (2006); on the other hand, Tabrizi and Hedayati (2014) conducted a study on

the spiders from several metropolis parks in Tehran; also Hosseini *et al.* (2015) worked on cave-dwelling spider fauna of different locations in Iran.

Iraqi spider fauna were poorly studied in spite of a broad variety of habitats in this country, only 33 species of spiders were known until now compared with adjacent Turkey region with over 1000 species (Bayram *et al.*, 2008) and 668 species from Iran (Zamani *et al.*, 2018). During the last century, Iraqi spider fauna hadn't been studied. Few families were recorded in Ninawa, Salahaddin and Baghdad by Reimoser (1913). One genus of the family Salticidae in an unknown locality by Dalmás (1921); and one from the family Theraphosidae by Hassan in 1950 (Zamani and El-Hennawy, 2016).

Venomous bites and stings in the British military in Iraq, Afghanistan and Cyprus recorded by authors (Lamb *et al.*, 2008). A suspected case of systemic envenomation syndrome in a soldier returning from Iraq was studied by (Peterson, 2006). A probability of *Latrodectus* widow spider lead for the first recorded red-back spider in Baghdad by Abdul-Rassoul *et al.* (2012). In northern Iraq, Samir and Sherwan (2012) presented a study in which they first recorded of three jumping spiders in Erbil by. Spider fauna of Iraq were mentioned by (Moradmand *et al.*, 2015) with spiders studied of Iraq and Afghanistan as an important fauna of the Middle East, Iraqi new species of the genus *Enoplognatha* Hippa and Oksala, 1982 by Al-Hadlag and Najim (2015). A new spider record of the family Themosidae by (Demir *et al.*, 2017). From spiders of Iraq, Kurdistan; one species, *Pterotricha arzhantsevi* is described as new to science by Fomichev *et al.* (2018).

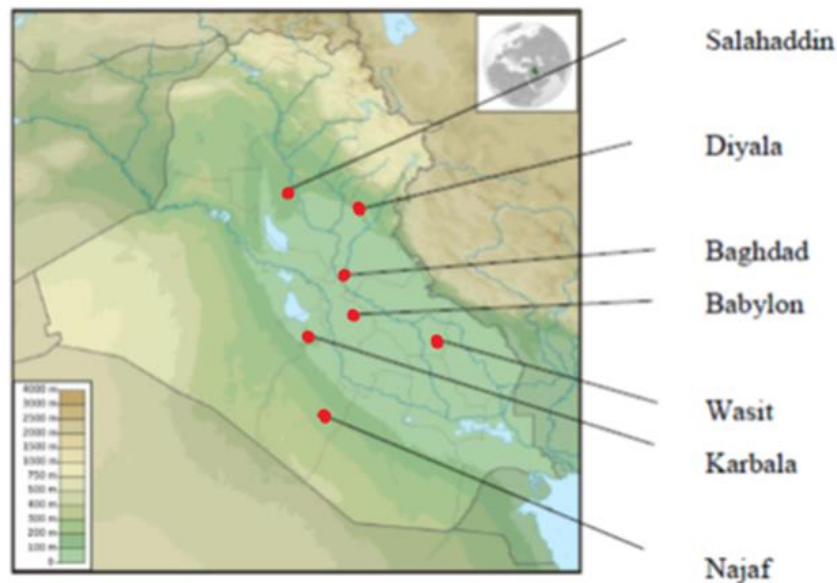
Ali *et al.* (2018) recently provided the first taxonomic and molecular study for the phylogenetic relationship to the genus *Latrodectus* (widow spider) represented by *L. thoracicus* Nicolet, 1849 and *L. pallidus* O. Pickard-Cambridge, 1872 in addition to *Asagena*

phlalerata (Panzer, 1801), these three species are recorded in Iraq for the first time; while Najim and AL-Hadlag (2020) recorded the widow spider *Latrodectus dahli* Levi, 1959 for the first time from Iraq.

Materials and Methods

Study areas

To find out the differences in the diversity of spider fauna this study was based on the spider specimens collected from different geographical locations in Iraq, which included provinces: Baghdad, Babylon, Karbala, Wasit, Salahaddin, Diyala and Najaf. Spiders were collected from gardens, buildings, lands, W.C. human structures of some camping, houses...etc; Map (1) showing the study localities.



Map (1): Showing collecting sites of the study localities

Specimens' collection

According to Churchill and Arthur (1999), the specimens were collected by different methods as follows:

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- (1) Direct hand picking: collection of spiders from many spider webs from buildings and surface, dwelling spiders were captured by using plastic containers.
- (2) Beating Net: spider was collected by a cloth sheet from which the specimens were transferred alive into plastic containers having pores in their corks for aeration and brought to the laboratory for studies.
- (3) Kerchief method: was used for running and wandering spiders, especially those belonging to the families Lycosidae and Salticidae. An open kerchief will be thrown over the running spider, which is then carefully caught in the folds of kerchief.
- (4) Other methods for instance:
 - a) Small spiders which live under the bark of trees, or indoor in the corner of walls were collected with a fine wet brush dipped in alcohol.
 - b) Ground spiders usually lived in burrows in the ground were collected by keeping a large glass bottle against the burrow and allowing the spiders to crawl into it.

Spiders preparing for morphological study

Collected specimens were preserved in 75-85% ethanol alcohol solution; before the spider permanent preservation- they were prepared for photographing properly by transferring them into Petri dish containing Isopropyl alcohol and kept covered undisturbed for about 2 or 3 hours in order to allow the relaxation of body muscles. Body parts like legs, abdomen, and palps were arranged in a lifelike manner with the help of forceps and brush; the spiders were then kept in alcohol in a closed pair of Petri dish overnight before transferring to tubes for permanent preservation. The glass vial containing preserved specimens were stoppered by a good seal to prevent evaporation of alcohol. This was the method which used for the preserving most specimens collecting tube enclosed a label indicating the name of the

collector, place of collection, the date of collection and the habitat of collection (Zhan *et al.*, 2019).

Some specimens were kept alive in the laboratory separately to avoid the cannibalism (spiders are highly cannibalistic individual) in containers with small holes for aeration, and small wet cotton balls for humidity, and fed with flies and mosquito for the biological purposes.

Photography: Live photographs of some spiders were taken by using stereo microscope and photographed with an Olympus digital camera (7.1 megapixels).

Identification: It was done on the basis of morphometric characters of various body parts with the help of keys (Namkung *et al.*, 2002; Jocqué and Dippenaar-Schoeman, 2007; Perveen and Khan, 2015; Aharon *et al.*, 2017).

Spiders preparing for molecular study

DNA was extracted from 28 specimens by using Geneaid DNA extraction kit depending on the standard recommended procedure of the manufacturer with some modification. Spider legs were separated from bodies, then preserved in 95% isopropyl alcohol, the legs were washed several times by distill water to remove excess alcohol (Hedin and Maddison, 2001). Usually the legs, which were separated are the fourth left if the spider size is big, or both third and fourth of medium size, and in tiny spiders the whole body was taken except the abdomen (Bork, 2015).

The gene mitochondrial Cytochrome Oxidase subunit I (COI) was amplified, and sequenced directly with an automated sequencer; specific primers were used to get and amplify the partial (COI), the forward LCO 1490 5'(GGT CAA CAA ATC ATA AAG ATA TTG G)3' (Folmer *et al.*,1994) with the reverse HCO-700ME 5'(TCA GGG TGA CCA AAA AAT CA) 3' (Bork, 2015). To confirm the

morphological identification of the 28 specimens, and for identifying specimens that it was difficult to diagnose it by morphological method, the PCR product of mitochondrial Cytochrome Oxidase subunit I (COI) gene was sent to be sequenced by Macrogen Company, Korea by using forward primer LCO 1490 on the partial sequence and using Sanger sequencing method. Homology search was performed using Basic Local Alignment Search Tool (BLAST) program online using blastn (nucleotide) algorithms (a process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer) which are available at the National Center Biotechnology Information (NCBI) online at (<http://www.ncbi.nlm.nih.gov>) to be combined with other sequences. ExPASy program was used in protein analysis information.

After the sequencing run, 16 local specimens sequencing of nucleotides submitted to Genbank and reported with accession numbers.

Results and Discussion

(I) Morphological identification

This study is the first recorded spider fauna for seven provinces in Iraq: Baghdad, Diyala, Salahaddin, Karbala, Najaf, Babylon and Wasit. More than 135 spiders' specimens were collected from different sampling sites in these provinces at wet and dry seasons between June 2018 and July 2019. The localities of spider collecting were from cultivated land, open field land, roadside area, man-made structures, buildings indoor and outdoor houses and temporary camping.

The obtained information of morphological and molecular work consists of eight families from different localities in the studying providence area, with 17 genera and nine species, with seven not identified species. Families of Gnaphosidae, Pholcidae and Salticidae were the highest diverse (three genera) for both. Two genera from the

families Oecobiidae, Theridiidae and Lycosida, families of Agelenidae, Thomisidae, with only one genus (Tab. 1).

Table (1): Families, genera and species included in the study.

Families	Genus	Species
Salticidae	<i>Plexippus</i> Koch, 1846 <i>Plexippoides</i> Prošzynski, 1984 <i>Sitticus</i> Simon, 1901	<i>P. paykulli</i> Koch, 1846 <i>Plexippoides</i> sp. <i>Sitticus</i> sp.*
Pholcidae	<i>Paramicromerys</i> Millot, 1946 <i>Nita</i> Huber & El-Hennawy, 2007 <i>Artema</i> Walckenaer, 1837	<i>Paramicromerys</i> sp.* <i>N. elsaff</i> Huber & El-Hennawy, 2007 <i>A. atlanta</i> Walckenaer, 1837
Gnaphosidae	<i>Zelotes</i> Gistel, 1848 <i>Micaria</i> Westring 1851 <i>Trachyzelotes</i> Lohmander, 1944	<i>Zelotes</i> sp. <i>Micaria</i> sp.* <i>T. jaxartensis</i> (Kroneberg, 1875)*
Lycosidae	<i>Wadicosa</i> Zyuzin, 1985 <i>Pardosa</i> C. L. Koch, 1847	<i>W. fidelis</i> O. Pickard - Cambridge, 1872 <i>P. amentata</i> (Clerck, 1757)
Agelenidae	<i>Tegenaria</i> Latreille, 1804	<i>T. pagana</i> C. L. Koch, 1840
Oecobiidae	<i>Uroctea</i> Dufour, 1820 <i>Oecobius</i> Lucas, 1846	<i>Uroctea</i> sp. <i>O. putus</i> O. Pickard- Cambridge 1876*
Thomisidae	<i>Ozyptila</i> Simon, 1864	<i>Ozyptila</i> sp.*
Theridiidae	<i>Cryptachaea</i> Archer, 1946 <i>Latroductus</i> Walckenaer, 1805	<i>C. riparia</i> (Blackwall, 1834)* <i>Latroductus</i> sp.

(* These species identified by molecular study only)

The character of eye arrangement can be an important key factor when identifying spiders to families, and sometimes to genera, but are almost never useful for identifying to species (Pl. 1).

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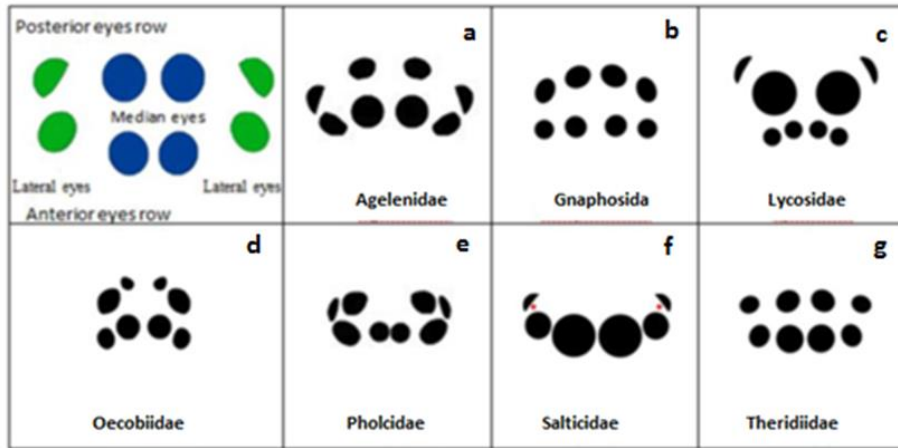


Plate (1): Diagram of spider eyes arrangement in families included in this study; (a) Agelenidae, (b) Gnaphosidae, (c) Lycosidae, (d) Oecobiidae, (e) Pholcidae, (f) Salticidae, (g) Theridiidae [according to Morehouse *et al.* (2017)].

Identification key to the spider families:

- 1- Legs with two claws..... 2
 - Legs with three claws 3

- 2- Some eyes distinctly larger than others (anterior median eyes the largest, posterior median eyes the smallest or minute and may be difficult to recognize), spinnerets short.....Salticidae
 - All eyes appear close in size, spinnerets long and cylindrical.....Gnaphosidae

- 3- Some eyes clustered or grouped, anterior median eyes grouped or closer than poster median eyes; posterior median eyes same in size with other eyes; legs conspicuously thin and long..... Pholcidae in part
 - Eyes distinctly separated 4

- 4-Eyes arranged into three rows, anterior row has four small eyes, the second row has two large eyes, and the posterior row has two medium-sized..... Lycosidae

- Eyes arranged into two rows.....5
- 5- Posterior median eyes are the smallest..... Oecobiidae
 - Posterior median eyes close in size with other eyes.....6
- 6- The row of the posterior eyes is often in a straight line, the eyes of each row often equidistant, tarsi IV with ventral comb of serrated hairs..... Theridiidae
 - The row of the posterior eyes conspicuously curved, the eyes of each row not equidistant, Tarsi IV without ventral comb of serrated hairs.....Agelenidae

Taxonomy

Order: Araneae

Infraorder: Araneomorphae

1) Family: **Salticidae** Blackwall, 1841

Identification features: Very small to medium sized, most characteristic feature is the ocular clad on the cephalothorax delimited by eight eyes arranged in three or four rows (Pl. 1). Cephalothorax with anterior cephalic region formed of a broad rectangular ocular clad often covered by thoracic region in continuation with cephalic part in most but remains clearly separated by a constriction in some. Cephalothorax remains connected to abdomen by a pedicel not visible in most. Sternum variable in size and shape; legs usually long and stout ending in hairy tuft and having two claws, but in some genera it's elongated and clearly visible. Abdomen generally small, oval or round, but in some elongated, usually covered with hairs forming attractive color patterns and designs, especially on the dorsal side; spinnerets consist of two pairs and almost similar, situated at the posterior end of abdomen. Epigyne situated on the ventral side of abdomen towards the anterior end. It's highly variable and sometimes complex in structure.

Identification Key to male genera of Salticidae:

- 1- Palpus plumose and recognized by dot-like red spot surrounded by white color; carapace dark brown almost all its parts; abdomen pale or light-yellow with dark bands alternative strips..... *Plexippoides*
- Palpus not plumose without red spot; abdomen and carapace with broad median light longitudinal streak, posteriorly with a pair of lateral spots and a few chevrons, extended anteriorly by light thoracic streak, in some forms reaching eyes *Plexippus*

Genus: *Plexippus* C. L. Koch, 1846

Species: *Plexippus paykulli* (Audouin, 1826)

Synonyms:

Plexippus ligo C. L. Koch, 1846

Plexippus punctatus Karsch, 1878

Menemerus crassus Hogg, 1922

Sandalodes magnus Berland, 1933

Apamamia bocki Roewer, 1944

Plexippus quadriguttatus Mello-Leitão, 1946

Materials examined: 1♀ Diyala, Baqubah, 14.x.2018, a garden round a house; 2♂♂, 1♀ Baghdad, Abu Nuaas, 2.xii.2018, garden, park with playground.

Description: Male (Pl. 2A): Total body length 7.0-7.5 mm, carapace length 2.2-2.5 mm, width 2.0-2.2 mm, abdomen 4.2-4.5 mm, width 2.0-2.2 mm. Carapace mostly black with a white strip on each side and one down middle, lateral stripes joining in front across the clypeus (portion of spiders' face). Abdomen color: a pair of white spot occurs near the posterior tip of abdomen; coloration one of the most important characters to show the difference between a male and female. Palpus in female appears as ordinary appendages on their dorsal surface, but on the ventral view it has swollen distal extremities.

Female (Pl. 2B): Total body length 8.5-9.0 mm, carapace length 3.1-3.3mm, width 2.9-3.1mm, abdomen 5.3-5.5mm oval-shaped, but posterior end narrowing, width 1.50-1.65 mm. carapace darker brown, particularly in the ocular area, with a dark orange median strip on the slope of thoracic. First and second legs stronger and thicker than third and fourth, it's olive-brown, sternum oval black clothed with hairs; cephalothorax-longer than wide convex-clothed, with fine gray and black hairs. Abdomen color: dark brown to black. Female significantly larger than male.

Global distribution: Africa and Southeast Asia and spread to other parts of the world (World Spider Catalogue, 2019), Iraq (Ahmed and Ahmed, 2013).

Habitat: It is usually associated with buildings and maybe found near light sources catching insects (Edwards, 1979).

Remarks: The females resemble to many species of Salticidae while males (in contrast) look different from one to another and more colorful. This species doesn't spin a web, but crafts a retreat of silken strands.



Plate (2): Species of *Plexippus paykulli*; (A) Male, (B) Female.

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Genus: *Plexippoides* Prószyński, 1984

Synonyms:

Menemerops Prószyński, 1992

Materials examined: 2♀♀, 1♂ Najaf, Al-Haydaria, 16.viii.2018, in farm landscapes.

Description: Male (Pl. 3A- C): total body length 8.5mm, carapace length 4.6 mm, width 1.4mm, abdomen length 4mm, width 1.5mm; legs pale-yellow with dark strips, length of legs: I 8.7mm, II 9mm, III 8.9mm, IV 9mm. Abdomen color: in alive specimens their colors seem to be pale or light-yellow with dark bands alternative strips clothed with many hairs. Carapace dark brown, palpus plumose recognized by dot-like red spot surrounded by white color.

Female (Pl. 3D): Total body length 8.5-8.8mm, carapace length 4.5-4.8mm, width 2.8-3.0mm, abdomen length 2.2-2.4mm and dorsoventrally flattened, first legs longer than second with spines and seems to be stout or stronger than other legs. Leg I: 8.9-9.0 mm; leg II: 6.5-6.8mm; leg III: 8.7-9.0mm; leg IV: 7.0-7.1mm. Eyes arranged into two rows along the carapace, mostly black with a white stripe on each side and one down the middle cephalothorax, that comparatively strong and solid, usual body colors are brown to gray-brown and black. Lateral stripes joining in front across the clypeus. Abdomen color: elongated at life appears to be striped with black alternating to white, but when preserved in alcohol it appeared with dark strips with rather brown with gray-brown hairs around the eyes and the ocular area. Epigyne very clear with dark colored hairs at middle of abdominal ventral side.

Global distribution: Central Asia, Egypt, Sudan, Africa, recorded also in Middle East, Iran, and the species *P. gestroi*, Iraq (Fomichev *et al.*, 2018; World Spider Catalogue, 2019).

Habitat: Usually outdoors on leaves, treatrunks, and other surface structures where insects are likely to be found including outer walls of houses and buildings.

Remarks: There are spiders with very similar appearance especially the females; the mature males are more colorful.

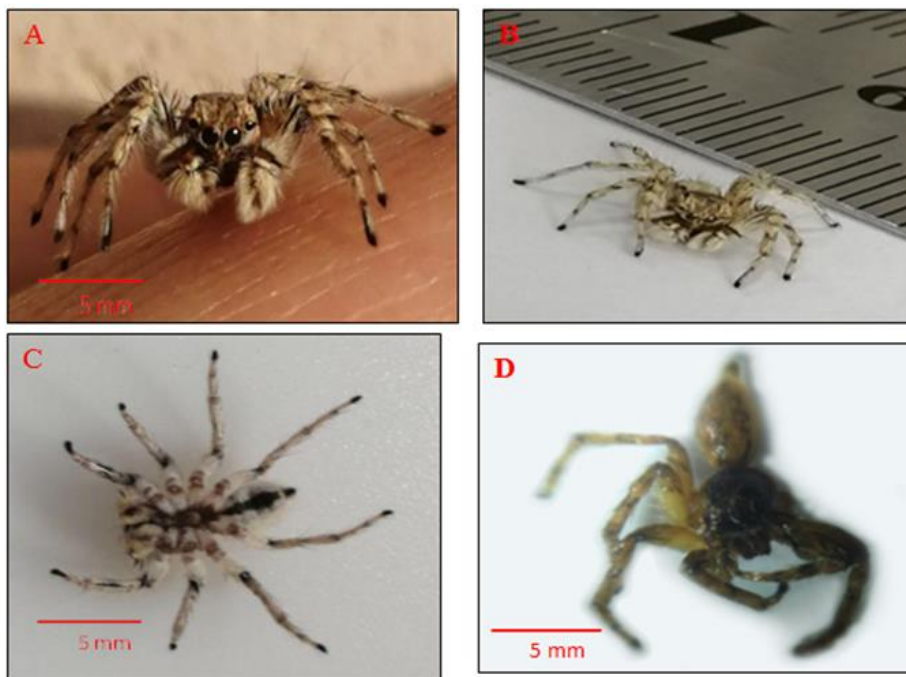


Plate (3): *Plexippoides* sp.; (A) ♂ with plumose pedipalp, (B) ♂ dorsal view, (C) ♂ ventral view, (D) ♀ dorsal view

2) Family: **Pholcidae** C. L. Koch, 1850

The family of Pholcidae comprises a large number of mainly tropical, web-weaving spiders and is among the most diverse and dominant spider groups in the world (Lissner, 2011). The phylogeny of this family has so far been investigated exclusively using morphological data for the family analyzed in a phylogenetic context. (Bruvo-Madaric *et al.*, 2005). According to the world spider catalogue (2019), this family has 94 genera with over 1800 species shows very

high ecological plasticity and can be found everywhere from desert to humid tropical forests and most of them are distributed and recorded in Asia, Africa and Europe (Huber, 2005).

Identification features: These spiders having 8 eyes (rarely 6) and 3 tarsal claws, anterior medials smallest or absent in six-eyed species, secondary eyes arranged in two triads; and with high, often concave clypeus of about the same height as the chelicerae and the usually very long legs with long and flexible tarsi. Carapace subcircular with head region often raised; sternum convex often with sinuous sides, broadly truncated at rear; chelicerae relatively weak and fused along the greater part of length. Chelicerae in male armed with teeth-like outgrowths; shape of abdomen varies from globose to elongate cylindrical shaped. The most common colors of abdomen range between pale gray and darker brownish-gray; internal female genitalia protected by sclerotization epigyne; male palp very complex with swollen palp segments.

Identification key to species of Pholcidae:

- 1-Tiny spider (length not longer than 3 mm), modified distinguished clypeus with strong hairs and clearly visible embolus, absence of spigots *Nita elsaff*
- Spiders longer than 10 mm, the longest leg in all spiders, modified swollen palp segments; epiandrous spigots present..... .. *Artema atlanta*

Genus: *Nita* Huber & El-Hennawy, 2007

Species: *Nita elsaff* Huber & El-Hennawy, 2007

Materials examined: 1♀ from house attic in Baghdad, Karada, 30.xi.2018, 1♂ from the same house, Baghdad, Karada, 2.xii.2018, 1♀, 1♂ in the same web from Baghdad, Arasaat, window edge of a new house, 4.xii.2018.

Description: Female (Pl. 4A), total length 2.8-3.0mm, abdomen color clearly white-creamy with a little pale-yellow strip on the middle-abdomen which clothed with heavy hairs.; legs cylindrical shaped, and relatively equal length 5 or 6 times longer than the body, thin and fragile with the length of about 5.8 - 6.5mm with flexible and pseudo segments like all most pholcids members. In general, the female specimen lacks a distinguishable feature, unmodified clypeus (Huber and El-Hennawy, 2007).

Male (Pl. 4B): Total length 2.5-2.7 mm, carapace width 0.90-0.95 mm, legs about 8.5-10.0 mm, length of tibia variable in each leg, the first leg longest leg I: 10.0-10.5 mm, leg II: 8.0-8.5 mm, leg III: 8.9-9.2 mm, and leg IV: 9.8-10.0mm. Coloration mostly pale ochre-yellow, carapace with light brown stripe frontally until ocular area, modified distinguished clypeus with strong hairs in the middle, chelicera distinctively sclerotized with a pair of apophyses; anterior portion of the palp with a clearly visible embolus (Pl.4 C). Close up view of spider head x10 shows 8 eyes arranged in two groups of three closely clustered eyes and two pairs in the middle, usually as in all cellar spiders. Legs without spines and curved hairs and eight seta like spines on the tarsus with few vertical hairs, all legs have prolateral trichobothrium but there are some ventro-lateral trichobothrium on the 1st leg only; femur, patella, and tibia unmodified, gray abdomen clothed with smooth hairs.

Global distribution: Egypt, Uzbekistan (Huber and El-Hennawy, 2007) and Iran (Zamani, 2017); Iraq (Baker *et al.*, 2019)

Habitat: Present and found in irregular webs, lives mostly inside buildings near the ground with antiquated man objects.

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Plate (4): *Nita elsaff*; (A) Female, (B) Male, (C) Embolus in male.

Genus: *Artema* Walckenaer, 1837

Species: *Artema atlanta* Walcknaer, 1837

Synonyms:

Pholcus sisypoides Doleschall, 1857

Artema convexa Blackwall, 1858

Pholcus rotundatus Karsch, 1879

Artema sisypoides (Doleschall, 1857)

Artema kochii Kulczyński, 1901

Crossopriza sex-signata Franganillo, 1926

Coroia magna González-Sponga, 2005

Materials examined: Salahaddin, Balad: 2♀♀, 1♂ with juvenile from a building in a farm coordinates of specimens' locality area, the

elevation 52m (171 ft) height, temp 41°C in the summer 7.ix.2018; 1♂ specimen from Karbala, 31.x.2018.

Description: The largest spider in the family. Female (Pl.5B): Total body length 11.2-12.0 mm, cephalothorax length 5.0-5.5 mm, width 3.5-3.8 mm, rounded abdomen 6.0-6.5-mm in length, 2.0-2.4mm width; first leg usually longest, with measurements: leg I 32-35mm, leg II 28-30 mm, leg III 30.2-32.5mm, leg IV 31.8-33.2mm; circular shaped carapace bright brown with a black line runs along from ocular area to the abdomen. Eight eyes grouped close together on an elevated prominence arranged in two groups of three eyes each and a pair of small anterior median eyes between them; thin and extremely long and slender legs with black strip-like rings (Huber and Warui, 2012); seta lacking; abdomen with conical shaped and the marking on body specimens can vary somewhat and that of some other pholcid genera (Beatty *et al.* 2008); this species characterized by variable colors, spots and dark lines (Al-Abbad *et al.*, 2019). Epigyne as half circle ended with a spinneret and two pairs of book lungs.

Male (Pl.5A): Total body length 8.5-8.8mm, cephalothorax length 3.3-3.5mm, width 2.8-3.0mm, abdomen length 3.0-3.5 mm, leg measurements: leg I 22.0-21.5mm, leg II 19.5-19.8mm, leg III 19.8-20.0mm, leg IV. 20.0-20.8mm. Carapace circular-brown to yellow with dark and a slightly low area in the center. Cordate shaped sternum with bright color. Abdomen color is dark brown, chelicerae with a palpus on an adult male, with grossly swollen palpal large and strong pedipalps with sexual modification in all its segments (Huber, 2000). Femur (the first obvious segment next to the spider's body) when compared with other pholcids and this characteristics useful for identification purposes.

Remarks: This species is the biggest of all Pholcid species, with a pantropical distribution (Gao and Li, 2010). This is the second *Artema* species that have been recorded from Iraq (Al-Abbad *et al.*, 2019),

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after the recently described *Artema doriae* (Thorell, 1881) from Dhi Qar and Basrah provinces, Southern Iraq (Al-khazali and Najim, 2018).

Global distribution: Found in every continent except Antarctica, in Asia Middle East and Africa, mainly tropical and subtropical regions (Gao and Li, 2010).

Habitat: Hang in their messes and irregular-shaped webs in stores and dark places in houses and man structural, undisturbed areas such as attics and cellars (its common name) (Aharon *et al.*, 2017).

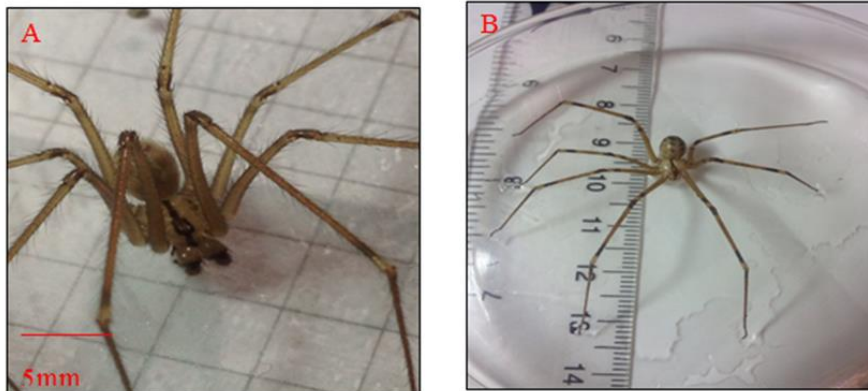


Plate (5): *Artema atlanta*; (A) Dorsal view of male showing swollen pedipalps, (B) Dorsal view of female.

3) Family: **Gnaphosidae** Pocock, 1898

This family with 158 genera and 3057 species; the genus of *Zelotes* with 400 species (World Spider Catalogue, 2019); family commonly named as ground spiders.

Identification features: Small to large dwelling-hunter spiders, with a flattened and elongate abdomen; carapace is ovoid and rather low being smoothly convex; head not sharply set off from the thoracic region. Gnaphosids are fairly easily recognized by their cylindrical and parallel spinners, they have 8 eyes in 2 rows. Sternum with ovoid shaped, pointed posteriorly; chelicerae are robust; also characterized

by having 2 tarsal claws. Legs stout and in some species there are small brushes of more and less stiff hairs present distally on metatarsus IV. Female palp with small spines and a finely toothed claw; carapace sometimes with erect, curved setae; abdomen often with dense coverage of short smooth hairs. Many species uniformly colored with grayish-brown or blackish colors. Most males have a scutum at the anterior end. Spiracle is situated close to the spinners; female having rather large epigyne with sclerotized structures; male palps usually with a large tibial apophysis.

Subfamily: **Zelotinae**

Genus: *Zelotes* Gistel, 1848

Synonyms:

Scotophinus Simon, 1905

Zavattarica Caporiacco, 1941

Materials examined: 1♀, 5♂♂ and one juvenile from Baghdad, Karrada; 1♂, 1♀ from Karbala, Abassia, around house, all in 10.x.2018.

Description: In Female, the total body length 7-9mm, elongated-heart shaped olive-brown to dark brown (ground-beetle mimic), carapace with the length of 3.0-3.5mm, and 2.0-2.2mm width, cephalothorax end with ocular area that consist of two rows of four pairs of kidney-shaped or angular the posterior median eyes point to opposite direction often oval with long brown to dark bristles near eyes (Pl.6). Abdomen becoming narrower towards the end with the length of 3.7-3.9mm, width 2.0-2.2mm, ended with four wide-set and cylindrical spinnerets, abdomen coated with fine gray or metallic hairs. Legs brown to dark olive and get lighter in color to the end and relatively long, with approximately of 4.0-4.8mm, stout with spiny hairs; body with white or metallic scaly hairs and legs clothed by white or metallic scaly hairs (Pl. 6).

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Male: Total body length 5.0-7.0mm, very similar to females and identified by their characteristic pedipalp which is relative- long and show an elongated terminal apophysis with dirty white or pale olive color with the length of 2.5mm. Sternum is mostly clear and uniform less color than dorsal side and aren't clothed with hairs; chelicerae have fangs and knee-shaped towards down; one pair of eyes pearly, white and located upwards.

Global distribution: *Zelotes* has a Palearctic distribution and was recorded in Middle-East: Syria, Palestine, Turkey, in Central Asia and Africa (World Spider Catalogue, 2019).The present study recorded this genus for the first time in Iraq.

Habitat: The members reside under the stones, roadside area and houses backyards.

Remarks: Adult of both sexes has been recorded. Juvenile or immature specimens with three pairs of legs, the first leg is not complete but the coxa is found (Pl. 6). Difficult to distinguish, very fast hide. It is an active, nocturnal hunter, fast running dwelling-catching a variety of ground arthropods, doesn't have a web; the wide-set and cylindrical spinnerets on this spider makes it clearly identified as a member of the family Gnaphosodae (Bradley, 2012).



Plate (6): Members of *Zelotus* sp.; (A) Male, female and juvenal, (B) Male, ventral view show the pale abdomen, (C) Carapace with pedipalps.

4) Family: **Lycosidae** Sandvell, 1833

This family contains 124 genera and 2888 species; the common name "wolf spiders", small to large hunters with long legs and oval bodies.

Identification features: having 8 eyes and 3 tarsal claws; all eyes dark in color and arranged in three rows in a unique characteristic fashion (Pl. 1). Carapace length longer than wide with head region narrowed and high; usually densely covered with hairs and often with longitudinal median or lateral bands or both. Sternum oval to shield shaped (scutiform); with relatively strong chelicerae and toothed cheliceral furrow and prominent lateral condyle. Labium wide as long;

legs spinose and provided with 3 tarsal claws, usually with scopulae for adhesion, trochanters notched. Abdomen oval, always covered with thick hairs, tracheal spiracle situated just in front of the spinners; epigyne well sclerotized median septum which may be large and plate-like. Male palp with a tibial apophysis; tip of palp in male may have one or more claws.

Commonly found running on the ground or over stones; males move their pedipalps in steady pattern and females attach the egg-sac to her abdomen spinnerets.

Identification key to genera of Lycosidae

- 1- Cephalothorax and abdomen at the same level, in male short embolus with a proximal conical protrusion, and palp with an anterior retrolateral process pointing to the ventral..... *Wadicosa*
- Cephalothorax relatively high, chelicera much smaller than in most other Lycosids..... *Pardosa*

Genus: *Wadicosa* Zyuzin, 1985

Species: *Wadicosa fidelis* (O.Picard-Cambridge, 1872)

Synonyms:

Wadicosa armillata (Schenkel, 1936)

Wadicosa galerita (L. Koch, 1875)

Wadicosa indistinctepicta (Strand, 1907)

Wadicosa kraepelini (Roewer, 1959)

Wadicosa pararmillata (Schenkel, 1963)

Wadicosa pilota (Pocock, 1903)

Materials examined: 1♂ Baghdad, Karrada, 14.xi.2018, roadside; 1♀ Al-Jadriyah, 10.iii.2019 from a garden. 2 juvenile from Karbala, 30.xi.2018.

Description: Male (Pl. 7A), total body length 6.5mm, coloration variable varying between dark brown to olive-brown; heart-shaped

carapace 4.0 mm length, 3.0 mm width, narrowing to the front with a brush like strong hairs on a median horn like anterior to the ocular area. Eyes arranged in three rows with a curve in the anterior row considerably shorter than second row which is shorter than the third (Pl. 1). Anterior median eyes AME clearly larger than anterior lateral eyes ALE; chelicera with dark color; legs follow the formula of (IV-I-II-III) which means the arrangement of the legs are due to their measurements from the longest leg IV 9.0 mm; I 8.5 mm; II 8.5 mm and III 7.8 mm. The characteristic feature of this genus that distinguishes it than other genera is the male palp with an anterior retrolateral process pointing to the ventral (Obuid-Allah *et al.*, 2014). Length of abdomen 3mm, width 2mm, colored olive brown to dark color, with alternated dark and light stripes of brown and yellowish bands.

Female (Pl. 7B), total length 8.2 mm, often lighter than the male in coloration, carapace 3.5 mm, brownish yellow with dark brown or black stripes on both sides, high of cephalothorax and abdomen at the same level, legs measurements follow the formula (IV-I-II-III) leg I 9.5 mm; leg II 9.4mm; leg III 8.5 mm; leg IV 10 mm. Eyes with three rows like males' eye arrangement; legs color dark yellow with small black spines. Abdomen with 4.0 in length and 2.8 mm in width, with an egg sac attached to its spinnerets, abdomen color alternate blackish and yellowish pattern of bands with numerous long light hairs, abdomen ends with spinnerets for both sexes, ventral side shows a light-colored margin to the side of the abdomen and a regular sternum.

Global distribution: According to World Spider Catalogue (2019), this species distributes North Africa, Southern Europe, Middle East, Central Asia, China, Japan, and Caucasus. Iraq (Fomichev *et al.*, 2018).

Habitat: lives in burrows in ground, between stones and under leaf layers in dry places, roadsides and land area.

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Remarks: High variation in coloration between Baghdad and Karbala specimens; one female specimen collected with her egg-sac attached to its abdomen. Differs with Pisauridae (nursery web spiders) which hold their egg-sac with their jaws. Active dwelling hunter which doesn't build webs.



Plate (7): *Wadicosa fidelis*; (A) ♂ dorsal view, (B) ♀ with lighter color.

Genus: *Pardosa* C. L. Koch, 1847

Species: *Pardosa amentata* Clerck, 1757 (spotted wolf spider)

Synonyms:

Pardosa postuma (O. Pickard-Cambridge, 1905)

Materials examined: 1♂, 1♀, Karbala, Kulaini, 28.x. 2018, from grassland and waste ground.

Description: Male (Pl.8A), total body length 3.0 mm, carapace length 1.2 mm, width 0.8 mm, abdomen length 2mm, width 1mm. Carapace brownish to dark brown with spots marking, cordate shaped which is squared off at the sides, with a pair of large eyes and four smaller eyes with excellent frontal vision. Legs color strips of alternation area of brown and dark brown with black seta on tibia. Leg measurements: leg I 5.8 mm; leg II 5.7 mm; leg III 5.7mm; leg IV 6.3mm. Abdomen with dark brownish to olive or blackish color with long palpus black-hairs on the end.

Female (Pl.8 B), total length 5mm, carapace length 2 mm, width 1.3 mm, abdomen length 2.8 mm, width 1.2 mm. Carapace is dark yellow to brown with black strips to the side, and lighter midline the promosa narrowed in front. Cephalothorax relatively high, chelicera small. Legs color alternating between dark brown and light-yellow or woody color, with many seta hairs. Leg measurements: leg I 8.3mm; leg II 8.4mm; leg III 7.7mm; leg IV 8.8 mm. Abdomen color is dark yellow with brown bands and abdomen attached to spinnerets.

Global distribution: widespread distribution in central Europe and found in all regions of the world (World Spider Catalogue, 2019). Iran (Zamani, 2018). The present study recorded this species for the first time in Iraq.

Habitat: grasslands, roadsides and gardens.

Remarks: Doesn't weave a web but chase their prey specimens same to be smaller in size than the world described.



Plate (8): *Paradosa mentata*; (A) Male, (B) Female.

5) Family: **Agelenidae** C. L. Koch, 1837

This family commonly named as funnel web weavers; with 82 genera and 1307 species (World Spider Catalogue, 2019).

Taxonomical study of spiders

Identification features: These spiders having 8 eyes and 3 tarsal claws; spiders of the family with often very long, two-segmented posterior spinnerets, which candle toward the tip. The long spinners are visible from above; carapace often having the head (cephalic region) narrow and very obviously separated from the wider thoracic region; eyes equal in size and arranged in 2 rows of Quadruple rows. Sternum is heart-shaped and sometimes with patterns which may aid species identification. Labium as wide as long. Abdomen oval shaped and tapering posteriorly usually with species-specific color patterns dorsally in various shades of brown and gray. Both carapace and abdomen are often densely covered with plumose hairs, but this is only visible when using a lens or stereomicroscope; epigyne often large; palp of male has a tibial apophysis.

Genus: *Tegenaria* Latreille, 1804

Species: *Tegenaria pagana* C. L. Koch, 1840

Materials examined: 1♂, 1♀, Baghdad, Al-Saydia, 15.xii.2018, in a house fast running, under furniture.

Description: Male (Pl. 9 A, C), total body length 7.0 mm, carapace length 3.0 mm, width 2.5 mm, abdomen length 2.8mm short oval shaped, width 2mm. Legs relatively longer than females, leg measurements: leg I 14.7mm; leg II 13.8 mm; leg III 13.9 mm; leg IV 14.7mm. Carapace length 3mm yellow-brown with wide thoracic region, darker margin and dark lines, cephalic region narrower and clearly separated from the carapace; both sex do not differ in coloration or markings, with mainly dark brown. Sternum regular with characteristic markings in yellowish colors both the same in male and female. Legs relatively long with yellowish color and brown spots or patches; abdomen with bright median part and bright spots with gray hairs. Palpus 3.0 mm thick and short embolus (needle-sharp tip).

Female (Pl. 9 B, D): Total body length 9.0 mm, carapace length 5.0mm, width 1.5 mm, abdomen oval with spots and two pale lines

with the length 5.0mm, width 2.0mm. Carapace elongated heart-shaped with brownish cephalothorax covered with pale-gray hairs and two pale-yellow longitudinal stripe. Ocular area with 2 rows of eyes, relatively equal in size, and don't have the ability to reflect the light like those of lycosides in dark, chelicerae strong dark colored. Legs having many fine gray hairs, only discernible as plumose at high magnification, legs measurement: leg I 14mm; leg II 13.2 mm; leg III 13.2 mm; leg IV 13.3mm. Abdomen color ranges from yellowish to pale-flesh color with dark-gray patches. Male with similar markings as the females but slimmer.

Global distribution: Europe, Central Asia, Northern Africa, Iran (Zamani, 2014), also in Turkey and Middle East. The present study recorded this species for the first time in Iraq.

Original habitat: mostly under rocks, but it is a common in the people's homes living in sheds and barns.

Remarks: extremely fast and active but not aggressive; build a flat sheet web with funnel-shaped.

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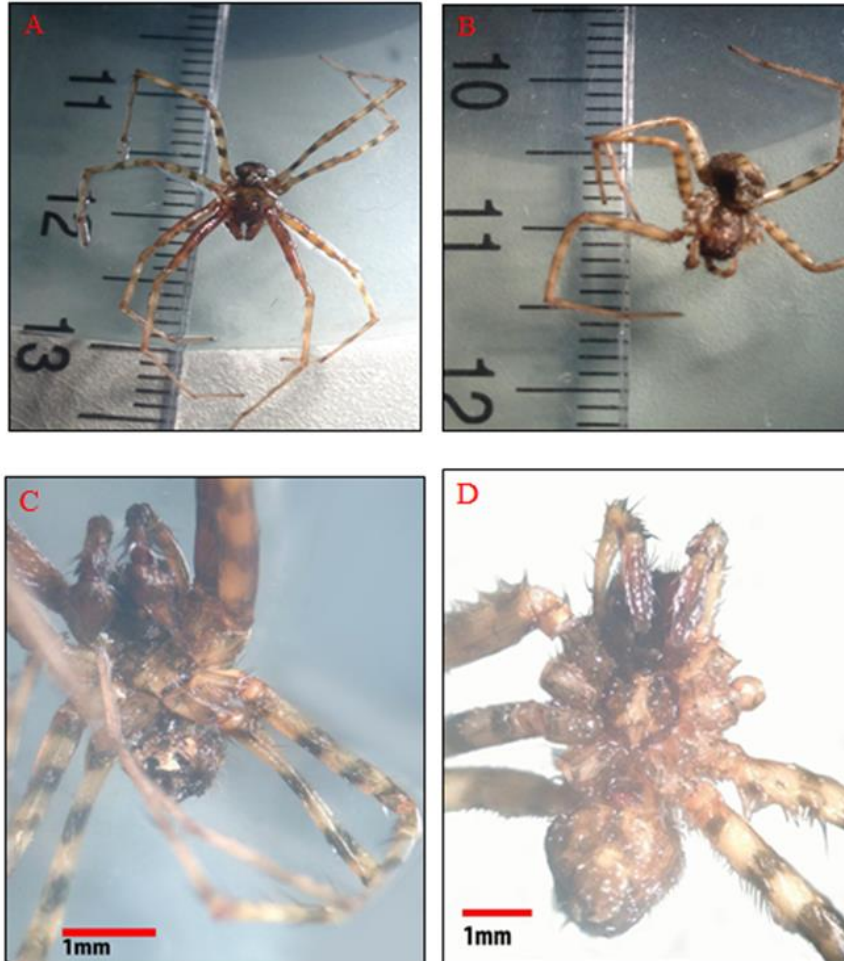


Plate (9): *Tegenariapagana*; (A) ♂ dorsal view, (B) ♀ dorsal view, (C) ♂ with pedipalps, (D) ♀ with epigynum, both with a light mark on sternum,

6) Family, **Oecobiidae** Backwall, 1862

The disc web spider is a family of araneomorph spiders, including about 6 genera and 144 described species (World Spider Catalogue, 2019).

Identification features: small to moderate sized spiders (about 2 to 20 mm), depending on the species, larger ones tend to be desert-dwelling, their most distinctive character is that their legs are unusually evenly

placed around prosoma; other spiders have some legs directed clearly forward and the rest clearly backward, or all forward. Typical color patterns range from dark-patterned cream in some smaller species, to a small number of symmetrically-placed, visible round, light spots (commonly yellow or white) on a background that may be from a dull orange color to black; carapace is rounded and bears a compact group of six to eight eyes medially situated near the front of its dorsal surface. The genus *Oecobius* is cribellate while the genus *Uroctea* is ecribellate; original habitat for these spiders, is on the walls or along window edges with small, star-shaped webs which they build.

Genus: *Uroctea* Dufour, 1820

This genus contains 18 species, it is sometimes placed in its own family, Urocteidae, and their tent-like web is very similar the ones *Oecobius* builds, but *Uroctea* species do not have a cribellum according to world spider catalogue (Levi and Levi, 1968). *Uroctea* includes species that are remarkable for their size, which can reach over ten times more than the size of the largest species of *Oecobius*.

Materials examined: 1 ♂ in house, Karrada, 12.iv.2019; 1♂, 1♀ near house door (still alive), 16.viii.2019; 1♂, 1♀ in the house, Karrada, 23.x.2018; 1♀ Zewea'a, collected from roadside, 25.x.2018.

Description: Male (Pl. 10 A, B), total body length 7.5mm, carapace length 3mm, width 3.2mm, abdomen length 4.3 mm, width 2.7 mm. Both male and female are of the same color and feature for the cephalothorax and abdomen. Carapace color, pale-yellow creamy white with dark gray or black ocular area (Pl. 10 D), that consist of 8 eyes, black borders of four two pairs, middle pair relatively large and the other three pair arranged around it in square shape. Abdomen black or dark gray with two longitudinal paramedian yellowish U-shape stripes meet at the end hind region with clear spigot (cylindrical structure at the tip of a spinneret). Chelicera and legs-yellowish gray, sternum pale yellow cephalothorax and the abdomen clothed with

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dark-gray hairs; pedipalp with large, ventrally hyaline apophyses, in front of the first leg with swollen bulb; leg measurements: leg I: 9.1mm; leg II: 9.4mm; leg III: 8.3mm; leg IV: 9.9mm.

Female (Pl. 10 A, C), total body length 8 mm, carapace length 3 mm, width 2.7 mm, abdomen length 5.2 mm, width 2.5 mm; male relatively similar to female but the carapace wider and shorter. Female legs measurements, leg I: 9.2 mm; leg II: 9.3mm; leg III: 8.0mm; leg IV: 10.1mm.

Global distribution: widely distributed species, Mediterranean, Eastern Asia, Eurasia, and Africa. The genus *Uroctea* is recorded in Middle East and in Arabian Peninsula (World Spider Catalogue, 2019). Iraq, Family recorded by (Fomichev *et al.*, 2018). The present study recorded this species and genus for the first time in Iraq.

Habitat: Most specimens were collected from houses, roadsides, and backyards under big objects like plant pots and blocks or stones.

Remarks: Legs of this genus like other Oecobiids point forwards then curve backwards; fast running spider.

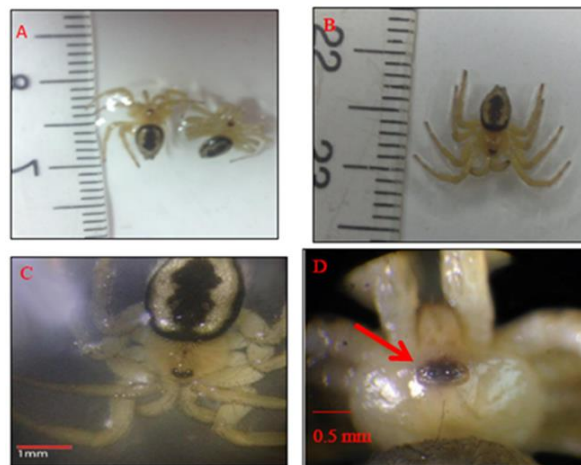


Plate (10): *Uroctea* sp.; (A) ♀ left, ♂ right, (B) ♂dorsal view, (C) ♀ dorsal view, (D) Ocular area.

7) Family **Theridiidae** Carl Jakob Sundevall, 1833

A large family of araneomorph spider also known as the tangle-web spiders or comb-footed spiders; globally diverse family includes over 3000 species in 124 genera (World Spider Catalogue 2019).

Identification features: having 8 eyes and 3 tarsal claws. They are often referred to as comb-footed spiders because tarsus IV of most species possess a row of slightly curved serrated bristles.. Other important diagnostic characters for the family that they do not have labium; and they have few or no spines on their legs. The carapace is very variable in shape among species, sometimes modified in males into strange lobes. In some species the carapace is nearly circular and appears small moderately to the size of the abdomen. The sternum is triangular to shield-shaped (scutiform). Eyes sometimes subequal and sometimes of very different sizes. They are arranged in 2 rows of 4, the eyes of each row often equidistant. Chelicerae usually small and weak. The legs are between long to very long, lacking spines on femora, tibia, and metatarsus. Abdomen very variable in shape from oval to round, sometimes globular or protruding up. The coloration of the abdomen is also very variable as are the patterns. The tracheal spiracle is situated just in front of the spinners. Epigynum usually well sclerotized. Anterior edge of the male palpal tibia is often widened and provided with a row of long setae.

Genus: ***Latrodectus*** Walckenaer, 1805

Globally, 32 species are described (World Spider Catalogue, 2019).

Material examined: 1♀ Baghdad, Karrada, 5.xii.2018, old bookshop store hanged with untidy web.

Description: Female (Pl. 11), total body length 6mm, cephalothorax 2.0 mm length, 1.0 mm width; abdomen 4.0mm length, and 2.4mm width, small cephalothorax comparing with the big colored abdomen, but both are shiny black color, the abdomen with a large dorsal red marking from the middle of the central line to the end of it. Specimen

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lacks the reddish markings on the ventral side which are hour-glass shaped, long cylindrical legs with different lengths, first leg I usually the longest while the third leg is the shortest. Leg measurements: leg I: 8.0mm; leg II: 5.7 mm; leg III: 3.2 mm; leg IV: 7.8 mm (Pl. 11). Four pairs of eyes arranged in two rows of four with all eyes about the same size, there is just one eyed diameter between the lateral eyes pair. Sternum relatively small but regular; epigynum not clear.

Male: unknown, uncollected, very rarely found (Breene and sweet, 1985).

Global distribution: (World Spider Catalogue, 2019) worldwide native to North America, Canada, Europe and North Africa to Asia, South East Asia, New Zealand, Japan, United Arab Emirates and Iran. Iraq (Abdul-Rassoul *et al.*, 2012).

Habitat: Among dry twigs, in old book store.

Remarks: Immature female spider specimen varies in color and marking; males are small and rarely noticed.

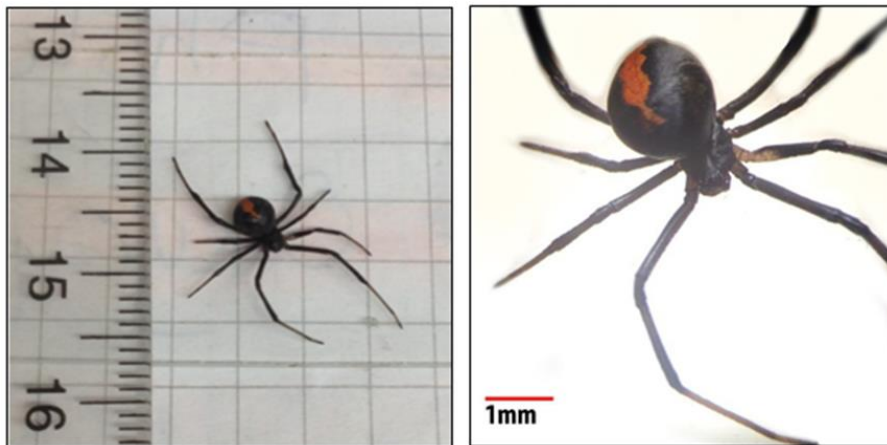


Plate (11): *Latrodectus* sp.; female.

(II) Molecular identification

The current study represented the first molecular study for the spider fauna of Iraq; genera and species that have been recorded for this study were sequenced and submitted in the GenBank. The molecular study was originally used for identifying specimens that it was difficult to diagnose it by morphological method and to improve the morphological diagnosis.

A total of 28 samples were identified by detecting COI of mitochondrial DNA, and tested by a conventional PCR and specific primer (LCO 1490 F/ HCO 700 R). The results showed 28/28 successful DNA amplification 100%. For amplifying the highly conserved sequences of the mitochondrial DNA-COI gene. We obtained 1 kb fragment of the mitochondrial cytochrome c oxidase subunit 1 gene (COI) by using two primer combinations: the forward “LCO 1490” (GGTCAACAAATCATAAAGATATTGG) (Folmer *et al.*, 1994) with the reverse “HCO 700ME” (TCAGGGTGACCAAAAATCA) (Bork, 2015).

Sequencing analysis

Consequently, 16 local sample specimens were analyzed and compared with a reference sample available in the GenBank database National Center Biotechnology Information (NCBI) (Appendix II). The PCR product of cytochrome c oxidase I gene (COI) which was subjected and sequenced in Korea, aligned and combined with an origin sequence on the GenBank, by partial sequences of (SANGER). After using Basic Local Alignment Search Tool (BLAST) program which is available at the NCBI, the result of sequencing appeared approximately more than 90% compatibility with reference. The phylogenetic analyses of the obtained sequences closely matched the query sequences downloaded from the GenBank. Some of these sequences were found to be described in the GenBank as belonging to taxa that are phylogenetically distant from their local recorded distribution. The value of a very close to zero or zero means that these

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sequences are identical as in Table (2). Sample number 17 (*Plexippus paykulli*), and sample number 25 (*Tegenaria pagana*) with 100% identity by 641 score and 0.0 expect, and 640 score and 0.0 expect respectively, these two samples had the position of 639 in GenBank query. The genus and species *Tegenaria pagana* (family: Agelenidae) is a new record for Iraqi spider Fauna,

Table (2): Sequencing ID in GenBank, score, expect, and compatibility of mitochondrial DNA sequences for 16 COI variable region gene of spiders.

Specimen no.	Genus-Species	GenBank local sample no.	GenBank association no.	Score/expect	Identity	Position in GenBank
6	<i>Plexippus paykulli</i>	MK871337	KY587583.1	576 / 0.0	99%	1 to 585
8	<i>Plexippoides</i>	MK871338	KY587586.1	367 / 0.0	90%	1 to 522
9	<i>Zelotes</i>	MK871339	KP648275.1	461 / 0.0	91%	1 to 621
11	<i>Sitticus</i>	MK871340	KY587585.1	445 / 0.0	90%	1 to 627
16	<i>Paramicromerys</i>	MK871341	JX023594.1	303/1e-155	98%	1 to 327
17	<i>Plexippus paykulli</i>	MK871342	KY587583.1	641 / 0.0	100 %	1 to 639
18	<i>Uroctea</i>	MK871343	KY017820.1	411 / 0.0	89%	1 to 624
19	<i>Oecubius putus</i>	MK871351	KT383735.1	409 / 0.0	92%	1 to 603
20	<i>Wadicosa fidelis</i>	MK871344	MF467651.1	477 / 0.0	98%	1 to 501
23	<i>Paradosa amentata</i>	MK871352	KY268918.1	532 / 0.0	95%	1 to 627
24	<i>Trachyzelotes jaxartensis</i>	MK871350	JN817230.1	403 / 0.0	99%	1 to 405
25	<i>Tegenaria pagana</i>	MK871346	KY778783.1	640 / 0.0	100 %	1 to 639
26	<i>Cryptachaea riparia</i>	MK871349	KT894355.1	386 / 0.0	91%	1 to 525
27	<i>Ozypila</i>	MK871347	MG047805.1	505 / 0.0	93%	1 to 630
28	<i>Nita elsaft</i>	MK871348	JX023601.1	531 / 0.0	95%	1 to 621

The comparison of the studied sequence specimens with deposit (COI) gene copies of the same species in the NCBI database showed high identity (90-100%) with the same sixteen reference species with accession number (Tab. 2). While the specimen *Uroctea* which is collected from Baghdad showed identity (89%) when compared with (*Uroctea* sp. South Africa KY017820) this probably because of the polymorphism of their nucleotide as proof by the alignment matrix, thus GenBank is providing this specimen in different accession number.

The local specimen *Paramicromerys* is compared with (JX023594.1 *Paramicromerys* sp. Comoros, this species is recorded only in Madagascar according to World Spider Catalogue in Jun 2019 which contains 14 species. This result may be misidentified to the species name in GenBank, which is in fact related to another spider species of *Spermophora* (Family: Pholcidae) (Huber, 2005). Existence of synonyms is so great in spiders that if a complete revision is made, the total number of spider existing now may get reduced (Platnik, 2018).

Nita elsaff specimen (28) with identity of 95% and score of 531 having an expect of 0.0, is recorded as the fourth global distributed after Egypt, Uzbekstain and Iran. Notice that Huber and El-Hennawey recorded this genus (*Nita*) for the first time in 2007 followed by Zamani (2017) in Iran. In general, Pholcidea family is a genera-rich family that made its species identification using molecular characteristics an approach in alpha taxonomy (Astrin *et al.*, 2006).

On the other hand the two families Lycosidae and Agelenidae share many similar features and have a rich-genera distribution, giving a useful and an identical classification by using the molecular method which gave 98%, 100% compatibility for each *Wadicosa fidelis* and *Tegenaria pagana*.

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The specimen (*Trachyzelotes jaxartensis*) giving identity 99% with the score 403 and 0.0 expect, this genus and species was recorded for the first time to the Iraqi spider fauna, belonging to the family Gnaphosidae that also represented by the specimen (9) genus *Zelotes* with identity of 91% which also seems to be a new record species to Iraq.

Due to their tiny size, and limited numbers for each of the specimens (24 and 19), molecular procedure was the rapid way available to identify these specimens, as well as for specimen number (27) (*Ozyptila*) an example of a single and immature male, lacking the main morphological characteristics (pedipalp) seemed to be very difficult or impossible to be identified morphologically.

Phylogenetic tree

Analysis of data obtained was represented by the similarity matrix of local specimen isolates of COI gene. The distance comparison also provided with the phylogenetic tree (Diag. 1)

The phylogenetic tree (Diag. 1) shows that the local isolate specimen 6 (*Plexippus paykulli*) (MK871337) and specimen 17 (MK871342) with the same genus compared with *P. paykulli* (KY587583.1) from Pakistan, with 99%, 100% identity. Also *Plexippoides* local specimen (MK871338) is associated with Pakistan (KY587586.1). On the other hand, *Sitticus* specimen 11 (MK871340) is associated with (KY58758501) with identity of 90% to the local isolate sample (MK871338.1) which is the sister clade to the sample of Pakistan (KY587585.1) *Sitiicus* species. This is as a reason of the wide diversity of their family (Salticidae).

Specimen (9) *Zelotes* sp. (MK871339) and the specimen 24 *Trachyzelotes jaxartensis*(MK871350) from the family Gnaphosidae is compared with (KP648275.1) from Canada and also *Micaria* (MK871345.1) local isolate sample from Karbala. The local isolate

specimen 24 with the GenBank number (MK871350) is associated with (JN817230.1) from South Korea. Sample 18 *Uroctea* (Mk871343) and specimen 19 *Oecubius putus* (MK871351) is compared with (KY017820.1), (KT383735.1) from South Africa and India. These two specimens are belong to the Oecobiidae family specimen 20 (*Wadicosa fidelis*) (MK871344) associated with (MF467651.1) from China and sample 23 *Pardosa amentata* (MK871352) associated with (KY268918.1) from Canada which may be recorded as a synonym of *Pardosa groeniandi*. *Nita elsaff* (MK871348) is associated in the GenBank with (JX023601.1) which is the sample of Egypt. The local specimen *Tegenaria pagana* (MK871346) compared with (KY778783.1) from China. The Agelenidae family presented a worldwide distribution for this genus and species which is recorded in Iraq for the first time. Specimen 26 *Cryptachaea riparia* (MK871349) associated with *C. veruculata* from New Zealand (KT894355.1).

The last specimen of 27 *Ozyptila* (MK871347) compared with (MG047805.1) from Canada represented by the species *Ozyptila praticola*.

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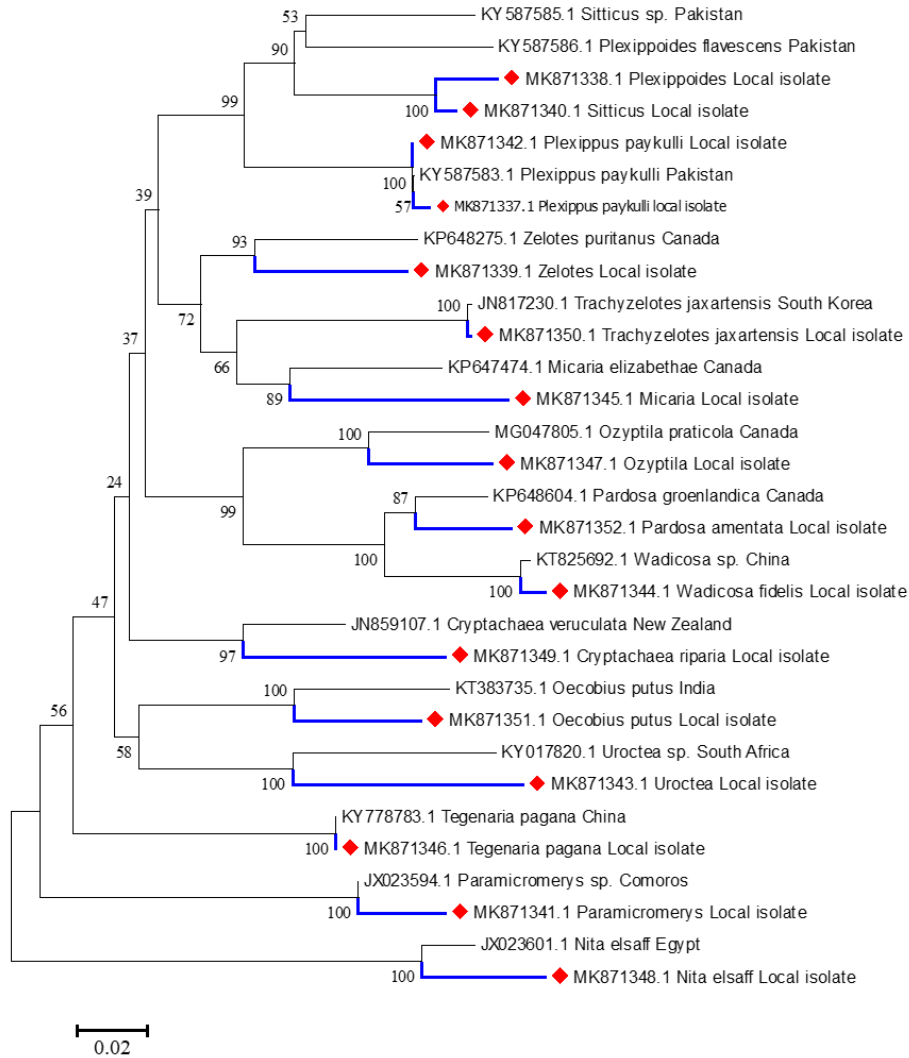


Diagram (1): Phylogenetic tree constructed of Cytochrome Oxidase I gene sequences in spiders from different provinces in Iraq with their accession numbers in GenBank; local samples with red marks, a measure of distance between taxa is indicated by the scale bar below the tree.

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دراسة تصنيفية لبعض أنواع العناكب رتبة *Araneae* من مناطق مختلفة
من العراق

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الخلاصة

تعد هذه الدراسة الاولى من الناحية المظهرية و الجزيئية معا لبعض انواع العناكب في العراق. تم جمع (135 عينة) من مناطق مختلفة في سبع محافظات عراقية للمدة حزيران 2018 - تموز 2019 في ظروف مناخية مختلفة. تم إجراء التشخيص والوصف المظهري بناءً على مفاتيح مختارة والعديد من المقالات. لكل من الدراستين الجزيئية والمظهرية، سجلت ثماني عائلات تمثل 17 جنساً و 9 أنواع. تم تسجيل ثمانية أجناس شملت: *Micaria* Westring, 1851؛ *Cryptachaea* Archer, 1946؛ *Paramicromerys* Millot, 1946؛ *Ozyptila* Simon, 1864؛ *Trachyzelotes* Lohmander, 1944؛ *Tegenaria* Latreille, 1804؛ *Uroctea* Dufour, 1820 و *Zelotes* Gistel, 1848، وخمسة أنواع ضمت: *Cryptacha riparia* (Blackwall, 1834)؛ *Tegenaria*؛ *Trachyzeptes jaxartensis*؛ *pagana* C. L. Koch, 1840؛ *Paradosa amentata* (Clerck, 1757)؛ (Kroneberg, 1875) و *Oecobius putus* O. Pickard-Cambridge, 1876 لأول مرة لمجموعة العناكب العراقية؛ كما صممت مفاتيح تشخيصية لتمييز العائلات و الأجناس و الانواع بناءً على الصفات التشخيصية.

تم إجراء التشخيص الجزيئي للعينات التي كان من الصعب تحديدها بالطرق المظهرية، كذلك تأكيد نتائج التشخيص المظهري. تم استخلاص

الحمض النووي DNA من 28 عينة من العناكب، واجراء تفاعل البلمرة المتعدد بتضخيم جزء mtDNA البالغ 710 قاعدة نيتروجينية من جين Cytochrome C Oxidase Subunit I (COI) باستخدام البادئات LCO 1490 Forward / HCO-700ME Reverse و قد تم تشخيص 16 نموذجا استنادا لمعرفة تسلسل القواعد النيتروجينية للحمض النووي لها .

تم ايداع ستة عشر تسلسلات للقواعد النيتروجينية لجين COI لعينات محلية إلى بنك الجينات العالمي GenBank بعد ان تم مقارنتها مع عينات قياسية مخزونة في بنك الجينات من مناطق العالم المختلفة باستخدام طريقة ربط الجوار وتم رسم شجرة النشوء والتطور. تم تأكيد ثمانية أنواع من 16 جنساً تنتمي إلى 8 عائلات عن طريق التشفير الشريطي الجزيئي. و اخيرا تم ايداع تسلسلات للقواعد النيتروجينية لجين COI و المعلومات المرتبطة به حول العينات (تاريخ التجمع والموقع وغيرها من المعلومات) في بنك الجينات . GenBank