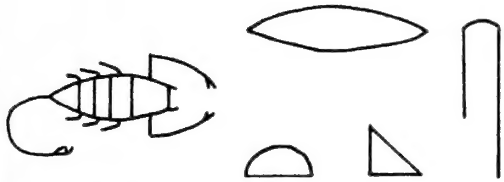

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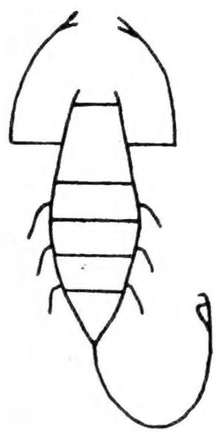

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A new species of genus *Eresus* from Algeria (Araneida : Eresidae)

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Abstract

A new species of the spider genus *Eresus*, family Eresidae, is described and named *Eresus algericus*. It is the fifth species of that genus described from Algeria.

Keywords: Spiders, Eresidae, *Eresus algericus*, Algeria, North Africa, Taxonomy, new species.

Introduction

During my work in revising the species of the north African eresid genus *Dorceus* C.L. Koch, 1846, a misidentified specimen (as *Dorceus fastuosus*) was examined in the Oxford University Museum of Natural History to find that it belongs to genus *Eresus* (El-Hennawy, 2002).

Among the 18 species and 7 subspecies of genus *Eresus* Walckenaer, 1805, four species were recorded from Algeria (Roewer, 1954; Platnick, 2003): *E. albopictus* Simon, 1873b, *E. cinnaberinus latefasciatus* Simon, 1910, *E. semicanus* Simon, 1908, *E. solitarius* Simon, 1873a. The specimen of UMO is completely different. Also, it is not matching with any of the known descriptions of *Eresus* species. Therefore, it is necessary to describe it as new species.

The description only depends on a single specimen deposited in the Oxford University Museum of Natural History, United Kingdom (UMO), formerly known as Hope Entomological Collection (HECO).

All measurements were taken in millimetres.

Abbreviations used: ALE = anterior lateral eye; AME = anterior median eye; Id = eyes inter-distances; L = length; PLE = posterior lateral eye; PME = posterior median eye; TL = total length; W = width.

Eresus algericus new species
(Figs. 1-4. Table 1)

Type Material: Holotype: Male: Algeria: unknown locality, (UMO) B.510, t.-, Lord Walsingham, 1903.

Diagnosis: Male of this species is recognized by the shape of the terminal element of conductor of the palpal organ.

Etymology: The species name is a noun in apposition taken from the type locality.

Description: Male (Holotype): TL 10.79; Cephalothorax L 6.06; Cephalic part: L 3.90, W 4.15; dark (blackish) reddish brown, covered by black hairs, with two white hair spots just behind the posterior median eyes. Thoracic part: L 2.16, W 3.65; dark (blackish) reddish brown, covered by black hairs, with thick band of white hairs on the outer border. Cephalothorax L : W anteriorly = 1.46; L : W posteriorly = 1.66.

Eyes: posterior medians (PME) largest; three times larger than anterior medians (AME); posterior laterals (PLE) less than double the diameter of the AME; AME and ALE equal. Eye measurements (diameters and interdistances): AME 0.16, ALE 0.16, PME 0.48, PLE 0.26, AM-AM 0.36, AL-AL 2.96, PM-PM 0.72, PL-PL 2.60, AM-AL 1.16, AM-PM 0.16. (Id PME : Id AME = 2.00; Id PLE : Id ALE = 87.84).

Chelicerae: with strong big boss; covered by dense black hairs, especially beside the fang; there is one tooth against the fang. Sternum (L 3.32) and coxae: reddish brown, covered by sparse black hairs. Labium (L 1.60) and maxillae (L 1.60): reddish brown, covered by sparse black hairs, except the distal extremity is white.

Pedipalps: covered by black hairs, except two prolateral parts on patellae and tibiae, covered by white hair; no apophyses. Palpal organ (Figs. 1-3): terminal element of conductor is hook-like shaped.

Legs: covered by black hairs, except the distal parts of patellae, tibiae, and metatarsi which are covered by white hairs, and a few white hairs dorsally on the femora. Metatarsus IV: without calamistrum.

Table 1: Legs measurements (mm)

Leg	I	II	III	IV
Femur	3.40	3.60	3.60	4.60
Patella	1.80	1.68	1.80	2.32
Tibia	2.60	2.20	2.00	3.20
Metatarsus	3.00	2.40	2.52	3.32
Tarsus	1.80	1.48	1.60	1.60
Total length	12.60	11.36	11.52	15.04

Relative length of legs 84 : 76 : 77 : 100. Leg formula IV-I-III-II.
L leg I : L cephalothorax = 2.08.

Spination pattern: ventrally: several on tarsi I-IV, nearly pro- & retro-laterally; few on metatarsi I-IV; some on tibiae (distal ends); none elsewhere.

Abdomen: L 5.98; covered by black hairs; its outer border with white hairs from above except a small area at the front of the abdomen. There are four small oval spots without hair in the anterior half of the abdomen, followed by two transverse lines of white hair; the anterior line is intersected by a small area of black hair in the middle; the posterior line is entire (Fig. 4); ventrally covered by black hairs, except the place of the bipartite cribellum and the creamy white large area above the book-lungs.

Female: Unknown.

Distribution: Only known from Algeria, without definite locality.

Figs. 1-3: *Eresus algericus* n.sp. Right male palp.

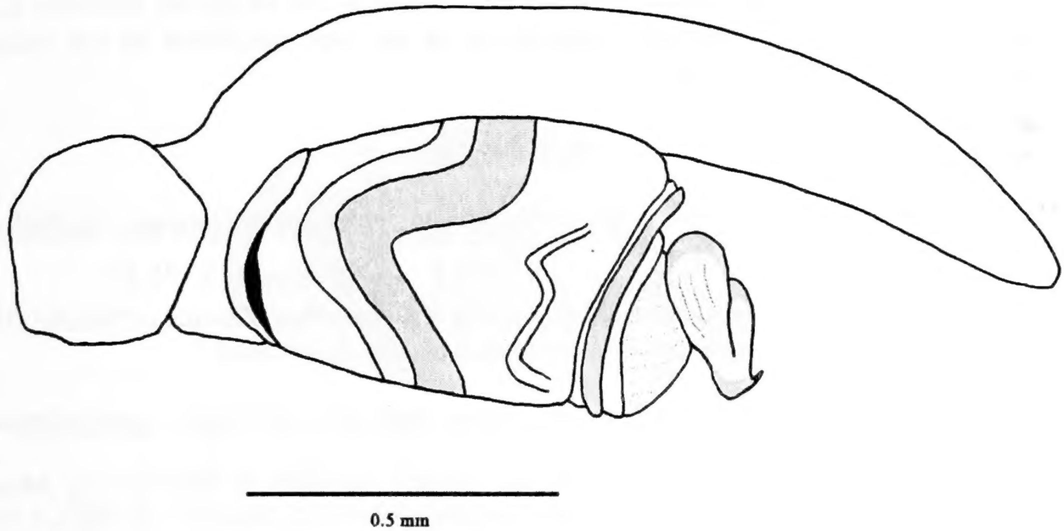
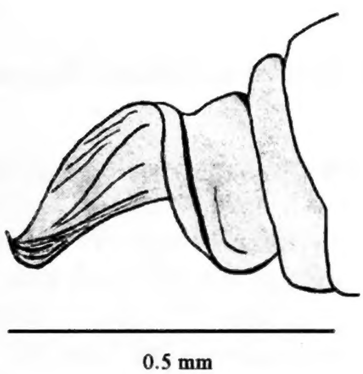


Fig. 1. Retrolateral view.



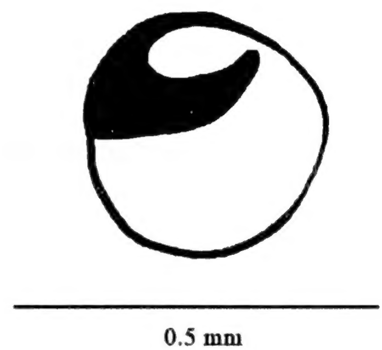


Fig. 2. Prolateral view of tip of conductor. Fig. 3. Ventral view of tip of conductor.

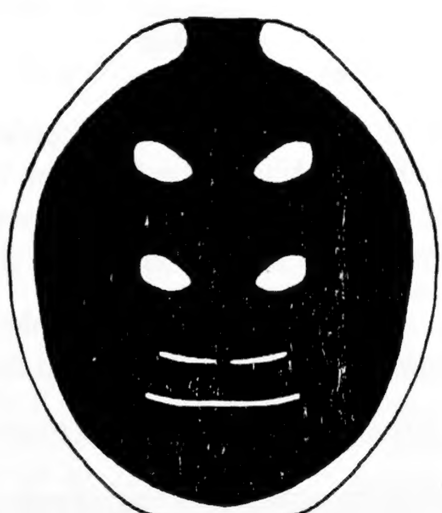


Fig. 4. *Eresus algericus* n.sp. Abdominal pattern.

Acknowledgments

I wish to express my sincere and grateful thanks to Dr. Malgosia Atkinson (UMO, Oxford) who kindly admitted for examination of the type specimen in the collection during my visit in 1997.

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Serket (2004) vol. 9(1): 5-9.

Studies on some biological aspects of *Theridion melanostictum* O.P.-Cambridge, 1876 (Araneida: Theridiidae)

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Abstract

The theridiid spider *Theridion melanostictum* was reared in laboratory at 28°C and 70-80% R.H., feeding on the two-spotted spider mite *Tetranychus urticae* or the green aphid *Brevicoryne brassicae*. The female had five spiderling instars while the male had only four. The life cycle of *T. melanostictum* was longer when the spider fed on *T. urticae* (about 57.9 and 63 days) than feeding on *B. brassicae* (about 43.6 and 59.7 days for male and female respectively). The female longevity and total number of egg sacs/female were higher when feeding was on *B. brassicae* than when it was on *T. urticae*, with an average of 4.5 and 2.8 egg sacs/female respectively. It was observed that the female daily rate of food consumption was greater than that of the male. Notes on feeding and mating behaviour are included.

Keywords: Life cycle, Fecundity, Feeding, Spiders, Theridiidae, *Theridion melanostictum*, Egypt.

Introduction

Biological control involves the use of natural enemies to control pests, but it is not possible to characterize a universal effective natural enemy for biological control (Huffaker *et al*, 1977). Putman (1967) and Helle & Sabelis (1985) reported that members of Theridiidae and Linyphiidae are the most effective spider families as predators of mites especially *Panonychus ulmi* and species of genus *Bryobia*. Family Theridiidae includes 2208 species which belong to 80 genera (Platnick, 2003). This family is represented in Egypt by 25 species of 10 genera, one of these species is *Theridion melanostictum* O.P.-Cambridge, 1876 (El-Hennawy, 2002). In Egypt, Rahil (1988) studied the biology of the theridiid spider *Steatoda triangulosa* (Walckenaer, 1802) in relation to relative humidity, temperature and prey and Hussein, *et al.* (2003) studied some biological aspects of another theridiid, *Anelosimus aulicus* (C.L. Koch, 1838). *T. melanostictum* is the third theridiid species studied in Egypt. Its life cycle and food consumption of two kinds of prey in addition to some biological aspects were studied and recorded in this work. This study may be the first step to get use of this species in a biological control program.

Material and Methods

Females of *Theridion melanostictum* O.P.-Cambridge, 1876 with egg sacs were collected by hand from vegetable crops using camel hair brush. Each female was placed in a glass container (5 cm diameter x 9 cm depth) covered by a piece of muslin cloth hold by rubber band. The newly hatched spiderlings were transferred to separate tubes (1.5 cm diameter x 16 cm length) and daily supplied with food until completing their development. The containers and tubes were kept in an incubator at 28±1°C and 60–70% R.H. Some biological aspects and the consumption rate of prey types were studied under these conditions.

Two kinds of prey were daily used in feeding two separate groups of spider individuals. Castor oil plant leaves, highly infested with the two-spotted spider mite *Tetranychus urticae* (Koch, 1836), were collected to infest potted beans *Phaseolus vulgaris*. Also, green aphids, *Brevicoryne brassicae* (Linnaeus, 1758), were collected from infested cabbage leaves. Mites of different stages and aphid nymphs were daily picked up, counted and introduced to spiders as continuous source of food.

Results and Discussion

Feeding behaviour

The spider always wrap the prey by its silk threads after biting it. It stays for a few minutes before attacking another prey. It takes about 4 minutes to feed on an individual of *T. urticae*, and about 7 minutes for *B. brassicae*. Sometimes the spider wrap several preys with silk and store them to feed on them after some time.

Mating behaviour

When a male of *T. melanostictum* found a female after her last moult, he moved around her and made a silk web. Courtship lasted a few minutes. Then the female stopped moving and the male moved towards her and began mating which continued for about 12 minutes using his right palpal organ. After that, the male moved away from the female. After a few minutes, he approached again to continue mating process using his left palpal organ. At last, the male moved away, and sometimes he attacked a prey or more, before being attacked by the female.

Oviposition

The female deposits eggs inside spherical transparent egg sacs among silken threads in hidden places such as neglected parts of plants and litter. Pre-oviposition period, before the beginning of laying eggs, lasted 13-14 days when feeding was on *T. urticae* and 10-11 days when prey was *B. brassicae*. The female constructed 2-5 egg sacs during her oviposition period which lasted from 9 to 27 days when feeding was on *T. urticae* and constructed 4-5 egg sacs during 19-25 days when prey was *B. brassicae*. The number of eggs/egg sac was 13-37 in the first case and 17-37 in the second one. The post-oviposition period lasted 8-27 days in the first case and 12-15 days in the second one (Table 1).

Feeding on *B. brassicae* slightly increased the number of eggs/egg sac and the number of egg sacs/female than when the prey was *T. urticae*. This means that *B. brassicae* as prey increased the fecundity of *T. melanostictum* female. This is something similar to what mentioned by Hussein, *et al.* (2003) that feeding *Anelosimus aulicus* on a mixed diet of the black aphid *Aphis craccivora* Koch, 1854 and the mite *T. urticae* increased the fecundity of the female spider than feeding only on aphids, although they found that the mite alone was not suitable for rearing *A. aulicus*.

Table 1: Fecundity of *Theridion melanostictum* female, feeding on *Tetranychus urticae* or *Brevicoryne brassicae*.

Developmental period of female (days)	*Tetranychus urticae*			*Brevicoryne brassicae*		
	Range	Mean	S.D.	Range	Mean	S.D.
Pre-oviposition	13-14	13.8	0.1	10-11	9.5	0.2
Oviposition	9-27	14.3	2	19-25	21.3	1.1
Post-oviposition	8-27	16	2	12-15	13.8	0.3
Number of eggs / egg sac	13-37	23.2	2.9	17-37	28.7	2.6
Number of egg sacs / female	2-5	2.8	0.4	4-5	4.5	0.2

Incubation period

The transparent egg sac of *T. melanostictum* becomes dark yellow before hatching. The incubation period was 13-14 days at 28±1°C and 60-70% R.H. (Table 2) regardless of the kind of the prey the mother fed on.

Table 2: Duration of different stages of *Theridion melanostictum*, feeding on different stages of *Tetranychus urticae* or *Brevicoryne brassicae*.

Developmental Stage	*Tetranychus urticae*						*Brevicoryne brassicae*					
	Male			Female			Male			Female		
	Range	Mean	S.D.	Range	Mean	S.D.	Range	Mean	S.D.	Range	Mean	S.D.
Incubation period	13-14	13.4	0.0	13-14	13.8	0.0	13-14	13.4	0.0	13-14	13.8	0.0
1st spiderling	12-13	12.5	0.2	12-13	12.5	0.1	7-8	7.6	0.2	8-9	8.4	0.2
2nd spiderling	12-14	13.3	0.3	11-12	11.5	0.2	6-7	6.6	0.2	7-10	8.4	0.2
3rd spiderling	11-12	11.5	0.2	9-11	9.6	0.2	5-6	5.8	0.2	6-7	6.7	0.1
4th spiderling	7-8	7.2	0.2	8-9	8.3	0.1	10-11	10.2	0.2	9-11	10.7	0.2
5th spiderling	--	--	--	7-9	7.3	0.2	--	--	--	9-11	10.7	0.2
Total spiderling instars	42-47	44.5	0.2	47-54	49.2	0.2	28-32	30.2	0.2	39-48	45.9	0.2
Life cycle	55-61	57.9	0.2	60-76	63	0.1	41-46	43.6	0.4	52-62	59.7	0.2
Adult Longevity	25-44	39.6	1.9	34-51	43.2	1.5	42-47	44.8	0.9	52-65	59.8	0.3
Life span	80-105	97.5	0.5	94-127	106.2	1.4	83-93	88.4	0.9	104-127	119.5	0.4

Spiderlings development

The female of *T. melanostictum* passed through five spiderling stages, while male only passed through four stages before reaching the adult stage regardless of the kind of the prey (Table 2). Feeding on *T. urticae*, the 1st and 2nd spiderling instars were longer than other instars while the last instar was the shortest one. On the contrary, the last instar was the longest one and the 3rd instar was the shortest instar in case of feeding on *B. brassicae* (Table 2).

The mean of life cycle of *T. melanostictum* was longer when spider fed on *T. urticae* (57.9 and 63 days for male and female respectively) than when feeding was on *B. brassicae* (43.6 and 59.7 days for male and female).

Sex ratio

During one generation of *T. melanostictum*, the male : female ratio was 1 : 1.4 when feeding was on *T. urticae* and the ratio was 1 : 1.9 after feeding on *B. brassicae*.

Adult longevity

Adult longevity also differed according to sex and food type. Adult male longevity was 39.6 and 44.8 days while that of female lasted 43.2 and 59.8 days when fed on *T. urticae* and *B. brassicae* respectively.

Although the life cycle of *T. melanostictum* was shorter when fed on *B. brassicae* than when fed on *T. urticae*, the adult longevity was longer when feeding was on *B. brassicae* (Table 2).

Food consumption

Feeding on *T. urticae*, the mean daily rate of 1st spiderling was 6.3 and 6.2 individuals per male and female respectively. The mean daily rate of male 2nd-4th spiderlings was 11.4-12.8 individuals while it was 12.6-13.9 individuals for the female 2nd-5th spiderlings. The mean total number of consumed individuals was 453.6 and 567.4 for the total spiderlings of male and female respectively. The mean total number of consumed *T. urticae* individuals during longevity of adult male was 286.2, while that of female was 560.7 individuals (Table 3).

Table 3: Food consumption of *Theridion melanostictum* feeding on different stages of *Tetranychus urticae* (Number of consumed individuals).

Developmental stage	Male						Female					
	Daily rate			Total			Daily rate			Total		
	Range	Mean	S.D.	Range	Mean	S.D.	Range	Mean	S.D.	Range	Mean	S.D.
1st spiderling	2-10	6.3	4.4	71-80	75.7	1.39	2-11	6.2	7.6	68-80	73.8	2.8
2nd spiderling	9-15	12.8	4.9	120-161	157	5.5	10-17	12.6	17.3	113-171	157.3	3.7
3rd spiderling	11-16	11.4	10.9	65-90	80	3.5	9-17	12.9	10.6	82-136	116.8	4.3
4th spiderling	11-17	12.8	7.9	127-152	140.9	3.1	12-17	13.6	24.9	101-129	122.4	11.4
5th spiderling	--	--	--	--	--	--	12-19	13.9	11.1	82-105	97.1	2.2
Total spiderling instars	33-58	43.3	2.7	383-483	453.6	3.6	45-81	59.2	12.3	446-621	567.4	4.6
Adult Longevity	29-36	32.4	0.7	216-322	286.2	5.2	37-53	44.4	3.7	439-649	560.7	12.2

When feeding was on *B. brassicae*, the mean daily rate of 1st spiderling was 2.2 and 2.4 individuals per male and female respectively. This rate gradually increased with age. It was 4.2-6.1 individuals for the male 2nd-4th spiderlings and 4.5-7.5 individuals for the female 2nd-5th spiderlings. The mean total number of consumed individuals was 141.1 and 228.7 individuals for the total spiderlings of male and female respectively. The mean total number of consumed *B. brassicae* individuals during longevity of adult male was 115.2, while that of female was 263.6 individuals (Table 4).

Table 4: Food consumption of *Theridion melanostictum* feeding on nymphs of *Brevicoryne brassicae* (Number of consumed individuals).

Developmental stage	Male						Female					
	Daily rate			Total			Daily rate			Total		
	Range	Mean	S.D.	Range	Mean	S.D.	Range	Mean	S.D.	Range	Mean	S.D.
1st spiderling	1-4	2.2	1.7	15-21	16	1.1	1-4	2.4	1.7	14-24	17.2	0.4
2nd spiderling	4-7	4.2	7.4	18-29	24.9	2.1	3-7	4.5	5.4	22-41	31.5	3.4
3rd spiderling	3-8	5.4	4.5	24-40	32.6	3.2	4-9	5.9	5.4	28-47	35.9	1.7
4th spiderling	4-9	6.1	2.1	62-78	67.6	2.7	5-9	6.8	11	57-88	68.3	2.7
5th spiderling	--	--	--	--	--	--	6-12	7.5	6.6	65-93	75.8	2.6
Total spiderling instars	12-28	17.9	0.8	119-168	141.1	7.1	19-41	27.1	2.1	186-293	228.7	3.1
Adult Longevity	19-32	28.3	2.1	114-123	115.2	1.8	35-47	41.4	0.9	243-308	263.6	7.3

It is evident that the adult female *T. melanostictum* consumed prey much more than the male. This maybe due to his smaller size and shorter longevity than female.

Acknowledgment

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Spider studies in Egypt
A review

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Abstract

The first scientific record of spiders in Egypt was that of Linnaeus (1758). It was succeeded by several records and taxonomic studies by Forskål, Savigny & Audouin (in *Description de l'Égypte*), Koch, Pickard-Cambridge, Simon, and Denis. Thereafter, in 1950, the native araneologist Hassan was the first Egyptian in this field. At the end of the 1990's, a new era began with ecological studies on spiders by several scientists to extend the scope of spider studies in Egypt beyond the boundaries of taxonomy. This review includes 6 parts: I. The beginnings, II. The first Egyptian and his successor, III. Universities theses, IV. Ecological and applied research, V. Artificial works, and VI. Bibliography.

Keywords: Spiders, Review, Egypt.

I. The Beginnings

Although spiders were well known to people in Egypt since ancient times, we cannot find any scientific publication on Egyptian spiders before 1758. *Aranea flavissima* was the first spider species to be scientifically recorded from Egypt by Carolus Linnaeus, 1707-1778. His very brief description (1758), in the 10th edition of his "Systema Naturae" p.622 [22. Aranea abdomine oblongo flavissimo laevi. *M. L. U. Habitat in* Aegypto. *Hasselqvist. Thorax fulvus. Pedes glabri.*], is not enough to identify such a species as Simon (1910) stated.

The second scientific record of spiders from Egypt was that of the Swedish Petrus Forskål, 1732-1763, who visited Egypt in 1761-1762 with a Danish expedition to Yemen and described four spider species from the region of Cairo : *Aranea citricola*, *A. insidiatrix, A. rivulata* and *A. trifasciata*. His descriptions were more detailed and, at least, enough for identification. His work was published after his death, during the expedition, by Carsten Niebuhr in Copenhagen (1775).

The third and most important study of Egyptian arachnids was the work of Marie-Jules-Cesar-Lelorgne de Savigny, 1777-1851, who accompanied the French military expedition of Napoleon in Egypt (1799-1801). His work was completed by his student Victor Audouin, 1797-1841, because of his professor's blindness. That work appeared in 1825 under the title "*Explication sommaire des planches d'Arachnides de l'Égypte et de la Syrie, publiée par Jules-César Savigny, membre de l'Institut; offrant un exposé des caractères naturels des genres, avec la distinction des espèces.*" *Histoire naturelle, t. I, no.4.*, a volume of the great book entitled: "*Description de l'Égypte ou Recueil des observations et des recherches qui ont été faites en Égypte pendant l'Expédition de l'armée française.*". This work was reprinted in 1827 in a smaller format. It was included in volume 22 of that second edition, which was always referred to by most authors and researchers.

The work of Savigny and Audouin included nine plates (112 figures) of drawings of arachnids.

- Plates 1-7: spiders (81 species of 30 genera classified in 20 groups) = 71 species + 6 synonyms + 5 nomina dubia (in the most recent classification).
- Plate 8 : figs. 1-3 scorpions : 3 species of *Scorpio* = 3 spp.; figs. 4-6 pseudoscorpions : 3 *Chelifer* spp. = 2 spp. + 1 n.d.; figs. 7-10 solpugids : 4 *Solpuga* spp. = 3 spp. + 1 syn.
- Plate 9 : figs. 1-3 opilionids : 3 *Phalangium* spp. = 1 sp. + 2 n.d.; figs. 4-13 acarids : 10 spp. of 3 genera = 6(+2) spp. + 1 syn. + 1 n.d.

Every figure group of a species includes a habitus drawing and minor details drawings.

The text and the nine plates were edited and reprinted by El-Hennawy in *Serket*, 3(2-4) (Audouin, 1993). The exact date of publication and the authority of the scientific names dealt with in the work of Audouin (1825) were discussed in detail by El-Hennawy (2000a).

The fourth step was that of the German Ludwig Carl Koch, 1825-1908, who recorded 15 species of spiders from Cairo, Egypt in his "*Aegyptische und Abyssinische Arachniden*" (1875), 7 of them as new species.

The fifth step was the "*Catalogue of a collection of spiders made in Egypt, with descriptions of new species and characters of a new genus*" (1876) of the English Rev. Octavius Pickard-Cambridge, 1828-1917, who previously studied a collection of Arachnida from Sinai (1870), and spiders of Palestine and Syria (1872a) including records from Egypt, and new gnaphosoid species from Egypt and other countries (1874), in addition to a description of a new linyphiid spider from Alexandria (1872b).

The Rev. Pickard-Cambridge visited Egypt in 1864, in his way to Jerusalem (a holy pilgrimage trip). He devoted his time and life to the study of spiders in his country, England, and wished to broaden the geographical scope of his interest by studying the spiders of Palestine (the Holy Land) and Egypt. Cambridge's Catalogue included 164 species from Alexandria to Assuan (63 of them as new species). The total spider species number raised to 226.

The French Eugène Simon, 1848-1924, who is the father of arachnology in the modern times, recorded and described new species of spiders, scorpions, sun-spiders and pseudoscorpions from Egypt in several papers during the period 1880-1910. Two of his works (1908 & 1910) about Eresidae spiders and scorpions were published in the bulletin of the entomological society of Egypt.

Jacques Denis, 1902-1972, continued the French activity by scattered records in different papers (1935-1965), through his studies of North African spiders, in addition to his remarkable work on spiders of Siwa Oasis (1947b) which was also published by the entomological society of Egypt. In this work, he recorded 89 species, 25 of them as new species.

II. The first Egyptian and his Successor

The first Egyptian araneologist, Abbas Ibrahim Hassan was a professor of zoology in Cairo University when he described *Chaetopelma shabati* Hassan, 1950 as a new species of Theraphosidae from Cairo. He deposited the type material of this species in the British Museum of Natural History (London). He published another paper about the Oecobiidae of Egypt (1953). Thereafter, he went to Syria to continue his pedagogical activity and to stop publishing works about spiders. He prepared unpublished list of 318 Egyptian spider species, a long work on Egyptian jumping spiders (Salticidae) and a few short papers. One of his works "Feeding and feeding apparatus of *Chaetopelma shabati*", prepared for publication in 1953, was revised and published in *Serket* in 1988.

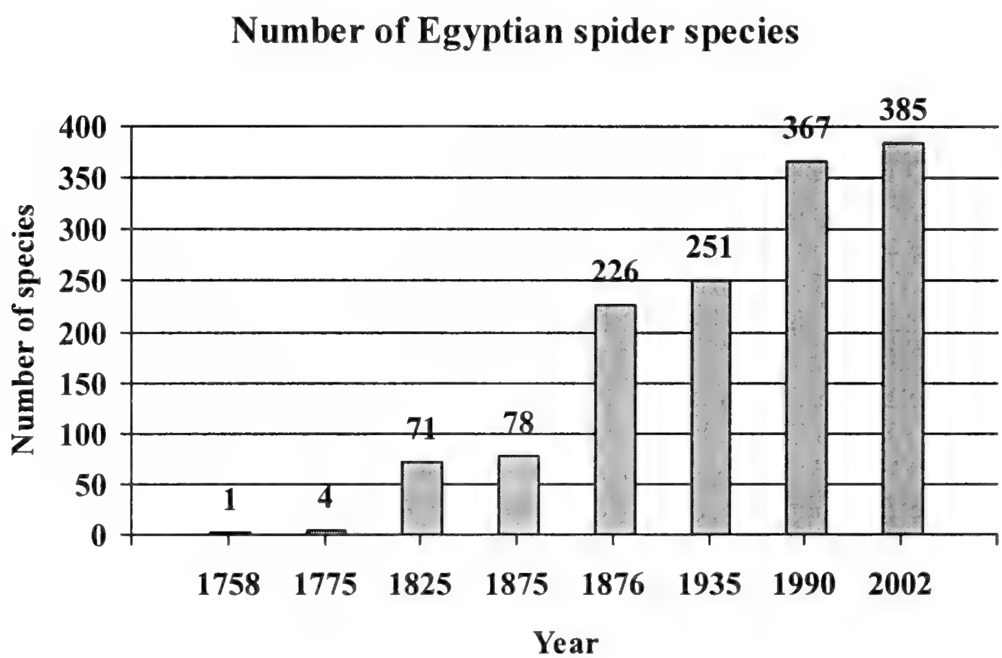

Fig. 1. Number of Egyptian spider species (1758-2002).

In 1982, Hisham K. El-Hennawy presented his first paper on a pompilid wasp (Hymenoptera: Pompilidae) and an eresid spider to the first Egypt's National Conference of Entomology, Cairo 1982 (published 1985). A year later, he presented his second paper to the 9th International Congress of Arachnology, Panama 1983 (published 1986). In August 1987, he began publishing ***SERKET***, the Arachnological bulletin of the Middle East and North Africa. Thirty two issues of eight volumes were published till now dealing with arachnids of different orders, Araneida, Opilionida, Pseudoscorpionida, Scorpionida, Solpugida, and pompilid enemies of spiders. He was the author of most of the published material. Other authors of different countries enriched *Serket* with their works. His bulletin did not prevent him from publishing through international arachnological congresses (Panama, 1983; Geneva, 1995; Edinburgh, 1997 & South Africa, 2001).

The study of Egyptian spiders is the main topic in his works (1985-2002). In addition to his new locality records and other works, he published a list of Egyptian spider genera (1987b), an annotated checklist of Egyptian spider species (1990a), the distribution of spider genera in Egypt (1992) and recently a list of Egyptian spiders, revised in 2002 (2002c). [The increase in the number of discovered species of spiders from Egypt is plotted in Fig. (1).] One of his topics is the study of spiders in protected areas of Egypt, e.g. Wadi El-Raiyan (1991a) and coastal protected areas on Aqaba gulf (2003). He also published a book (in Arabic) on the Egyptian Arachnids (El-Hennawy, 2002f). His work on the first record of Amblypygi from Egypt (El-Hennawy, 2002e) tells us that there are many species and genera of spiders and other arachnids to be discovered in Egypt. In addition to identifying thousands of specimens studied in universities theses and other works, he also encouraged the study of biological aspects of different spider species (see part IV of this work) and participated in some of them (El-Hennawy & Mohafez, 2003 and Sallam & El-Hennawy, 2003).

III. Universities Theses

There were two unsuccessful trials to prepare M.Sc. theses in Cairo University (Faculty of Science) in the 1950's and 1960's. After a long period of quiescence, a "diapause", the universities began to activate the study of spiders again.

[The researchers in the field of agriculture in Egypt used to say "true spiders" for spiders to distinguish between them and mites, which are widely studied in their field of work. Hence, this erroneous term is found in the titles of their theses and papers.]

1. In 1988, Ashraf Rahil presented his M.Sc. thesis: "Ecological and biological studies on the spiders at Fayoum" to Faculty of Agriculture, Cairo University (El-Fayoum). He collected spiders of 11 families (20 genera and 22 species) from El-Fayoum governorate associated with two field crops (cotton and cucumber) and studied biology of two spider species of families Clubionidae and Theridiidae.

2. In 1988 also, Mostafa El-Mehalawy presented his M.Sc. thesis: "Some studies on spider families of Al-Gharbia governorate" to Faculty of Science, Tanta Uinversity. He collected spiders of six genera from El-Gharbia governorate. He erroneously recorded *Oecobius teliger* Cambridge, 1872 (Family Oecobiidae) as new species from Egypt.

Both Rahil and El-Mehalawy did not continue their studies on spiders for Ph.D. degree.

3. In 1996, Gihan Sallam presented her M.Sc. thesis: "Studies on true spiders in Giza governorate" to Faculty of Agriculture, Cairo University. Her study included a survey of spiders in Giza governorate (August 1992 - December 1994) among fruit trees *(i.e.* apple, pear, grape, peach, olive, citrus, guava, and mango), field crops *(i.e.* cotton, maize and soybean) and ornamental plants *(i.e.* dadhi, mulberry, diafla, and daisy). She recorded 25 species of 18 families (Shereef *et.al.*, 1996). The thomisid *Xysticus tristrami* (Cambridge, 1872) was recorded in Egypt for the first time below apple trees. Salticidae and Clubionidae were the most abundant families. Biological aspects of *Cheiracanthium* sp. (Miturgidae) and *Plexippus paykulli* (Audouin, 1825) (Salticidae) were studied at 25°C and 60-70% R.H., feeding on *Ceratitis capitata* adults and *Spodoptera littoralis* larvae (1-4 stages) respectively (Rakha *et.al.*, 1999; Shereef *et.al.*, 1999).

4. In 2002, Sallam presented her Ph.D. thesis: "Studies on true spiders in Egypt" to Faculty of Agriculture, Cairo University. Her work can be summarized in: A survey of spiders was carried out in four governorates of both Lower Egypt (El-Qalyubia and El-Sharqia) and Middle Egypt (El-Fayoum and Beni-Suef) during the period from

August 1996 to December 1998. Most of the collected species, of 17 families (23 genera and 25 species), were recorded from the four governorates for the first time. The relationship between spiders abundance, temperature and relative humidity in the four governorates was studied in association with the cultivated plants, i.e. olive, orange, grape and apple. The highest population of spiders was recorded during summer extended to autumn (Sallam, 2002b). The biological aspects of *Thomisus spinifer* Cambridge, 1872 were studied under laboratory condition at 25°C and 60-70% R.H. The spiderling instars 1-3 were reared on the red spider mite *Tetranychus urticae*, while other spiderling instars and adults were reared on the adults of the fruit fly *Ceratitis capitata*. The fungicides were slightly harmful (25-50 %) to spiders. The organophosphorus compound *Malathion* was obviously harmful (>75%) to spiders. The mineral oil *KZ* was moderately harmful (50-75%) on the population density of spiders. The acaricides *Vertimec*, *Ortus* and *Cascade* were harmful (>75%) to spiders, while *Challenger* was moderately effective (50-75%) against spiders.

5. In 2000, Mohamed El-Erksousy presented his Ph.D. thesis: "Studies on some true spiders in Egypt" to Faculty of Agriculture, Al-Azhar University (Cairo). [Note. His M.Sc. was on mites.] He carried out a two years survey of spiders (1996-1998) in 12 governorates in Upper Egypt (El-Giza, El-Fayoum and Beni-Suef), Lower Egypt (El-Qalyoubia, El-Gharbiya, El-Menofyia, El-Beheira, Sharkia, Kafr El-Sheikh, El-Dakahlia and Suez Canal) and Cairo to record 37 species of 18 families on different crops. Spider populations in cotton and clover crops were studied (1997-1998) in El-Beheira and El-Fayoum governorates. The seasonal fluctuations of spiders were studied in El-Beheira and Beni-Suef governorates to record the incease of spiders by increasing hygrothermic conditions. The highest population was in June-August while the lowest population was in April-May. The effect of pesticide application, for cotton pests control, on spider population was studied to find that the percentage reduction in spider final population varied greatly according to their families. The life cycle of *Crustulina conspicua* (Theridiidae) was studied under laboratory conditions (26°C, 60-70% R.H.), feeding on the spider mite *Tetranychus urticae*.

6. In 2000 too, Mohamed Mohafez presented his M.Sc. thesis: "Studies on true spiders in Sohag governorate" to Faculty of Agriculture, Al-Azhar University (Cairo). His work included a survey of spiders on 10 different crops in seven districts of Sohag governorate during two successive years. Collected spiders were classified into 19 families (Metwally *et.al.*, 2002a). He studied the population density and seasonal fluctuation of spider species in relation with different crops during two years (Metwally *et.al.*, 2002b). He also studied the biological aspects of *Hersilia caudata* Savigny, 1825 (Hersiliidae) under laboratory conditions, 26-28°C and 60-70% R.H. Both mating and feeding behaviours were described (Metwally *et.al.*, 2001).

7. In 2003, Naglaa Ahmed presented her M.Sc. thesis: "Studies on some arthropods inhabiting cucurbits and beans." to Faculty of Agriculture, Cairo University. She surveyed spiders and other arthropods inhabiting fields of four legume and five cucurbit crops. Their seasonal abundance was also studied in El-Qanater agricultural research station. Sixteen families of spiders were recorded (33 genera and 36 species) during survey. She studied the life cycle of *Anelosimus aulicus* (C.L. Koch, 1838), family Theridiidae, under laboratory conditions (Hussein *et.al.*, 2003). Different instars were reared on *Tetranychus urticae*, *Aphis craccivora* or on a mixture of both of them. Prey consumption was calculated for different stages. Effect of different diets on fecundity of the spider was studied. Mating behaviour was also described.

8. In the same year, El-Sayed Hamada presented his M.Sc. thesis: "Studies on true spiders associated with some vegetable crops." to Faculty of Agriculture, Menoufia

University. He collected spiders of 14 families from ten vegetable crops at Gharbia governorate during two successive years by two methods of collecting (pitfall traps and picking up with the hands). The most dominant family was Lycosidae followed by Linyphiidae and Philodromidae (Abo-Taka *et.al.*, 2003a). He also reared the linyphiid spider *Erigone dentipalpis* (Wider, 1834) and the theridiid spider *Theridion melanostictum* O.P.-Cambridge, 1876 under laboratory conditions, feeding on the two-spotted spider mite *Tetranychus urticae* and the green aphid *Brevicoryne brassicae*. The rate of prey consumption was recorded (Abo-Taka *et.al.*, 2003b and 2004). The effects of three different pesticides were studied in the field and laboratory.

9. And also in 2003, Mamdouh Ibrahim presented his M.Sc. thesis: "Studies on some true spiders associated with certain fruit trees in Ismailia governorate" to Faculty of Agriculture, Al-Azhar University (Cairo). His work included a survey of spiders of 22 families on different fruit trees in six regions in Ismailia governorate during two successive years. In the same time, he studied the population density and frequency occurrence of spider species in fields of Mango trees at Serabium locality. He also studied the biology of two spider species, the liocranid *Mesiotelus tenuissimus* (L.Koch, 1866) and the philodromid *Philodromus glaucinus* Simon, 1870, under laboratory conditions.

IV. Ecological and Applied Research

In the 1960's, spiders were increasingly mentioned in numerous studies by Ahmad H. El-Kifl as important creatures among the soil fauna (e.g. El-Kifl, 1969). He was a pioneer in the agricultural studies of soil fauna in Egypt. A few researchers continued in the same field to mention spiders mostly as a group and sometimes identified to families (e.g. Negm *et.al.*, 1976).

Near the end of the 1990's, a good cooperation between ecology and taxonomy, or say between applied and pure trends of science, yielded the first published paper in this field in Egypt. Prof. Dr. Samir Ghabbour encouraged this new trend of research and had his important role in the first work which was entitled: "Spider populations associated with different crops in Menoufiya governorate, Nile Delta, Egypt." (Ghabbour *et.al.*, 1999). In that work, a survey on spiders in 18 different agricultural crops in the southern Nile Delta was carried out in 1996, using pitfall traps. In summer crops, density of spider individuals was 2.28±1.29 per trap, compared with 2.38±1.69 in winter crops. Highest densities in summer crops were in tomato, eggplant, and cucurbit cultivations, while in winter occurred in caraway, cabbage and onion cultivations. Sweet potatoes had the lowest density. Densities in spring varied from 0.4/trap in taro to 6.55/trap in caraway cultivations. It appeared that plants with a dense foliage covering the ground (sweet potatoes and taro), constrain the movement of roaming spiders. Ten spider families were recorded in winter crops compared to twelve in summer. Lycosidae was dominant in both seasons, constituting about 80%, followed by Linyphiidae, Philodromidae, Gnaphosidae and Tetragnathidae. Males were trapped in higher numbers than females. Juveniles constituted 23-26% of the trapped samples, while subadults were more abundant in winter. Female lycosids carrying egg sacs had two peaks; one in spring and one in summer, but none was observed in winter. Correspondence analysis had shown that *Zelotes* complex was more associated with cabbage, and a group of *Lycorma* ferox, Thanatus albini,* Dictynidae, and Clubionidae, with peas, while *Erigone dentipalpis,* Philodromidae, Tetragnathidae and *Dysdera* spp. were more associated with caraway. On summer, *Prinerigone vagans, E. dentipalpis,* Linyphiidae, Philodromidae and Salticidae were more associated with potato and Soya bean crops, while *L. ferox, T. albini, Zelotes* complex and *Trachyzelotes* sp. were more associated with cotton. [**Lycorma* = *Hogna* in recent taxonomic works]

One of the three authors of that, mentioned above, work published another related work on: "Seasonal abundance and daily activity patterns of spider fauna in some vegetable crops in Menoufiya governorate, Egypt." (Hussein, 1999). In his work, diversity, seasonal abundance and diurnal-nocturnal activity of spider population under 8 vegetable crops were studied in an agro-ecosystem in Menoufyia governorate, Southern part of Nile Delta, Egypt. A Total of 516 individuals were caught using pitfall traps during the study period. Six species belonging to six families were identified. Lycosidae was the dominant family, 86.42% of the populations, followed by Philodromidae, Linyphiidae and Gnaphosidae, while Theridiidae and Salticidae were the rare families in occurrence. *Thanatus albini* (Philodromidae) was the dominant species (5.43%). The peak of activity (19 ind/hr) and higher values of diversity (9 species) were recorded in summer, while the lowest were in winter (0.08 ind/hr and 3 species respectively). *Lycorma ferox* (Lycosidae) is active only in night-time as well as *Setaphis subtilis* (Gnaphosidae) which showed major activity (75%) during night against 25% on daytime. *Erigone dentipalpis* (Linyphiidae) and *T. albini* are completely active in daytime, Lycosidae (except *L. ferox),* Linyphiidae (except *E. dentipalpis)* showed major activity on daytime (91.10, 84.21%, respectively). The 3 different daytime parts (the early, mid day and the later third) showed similar values of activity, diversity, as well as the nocturnal activity in summer, while winter recorded the lowest values and notable fluctuations between night and daytime. The high abundance of spiders in August seems to be a result of a combination of 3 factors, dense vegetation cover, high temperature and enough relative humidity.

The third work, which was published before the two mentioned above, was a study on the "Biodiversity of spiders in the western desert of Egypt in relation to agriculture and land reclamation" (Hussein *et.al.*, 1998). Spider biodiversity was studied in 5 locations in the Western Desert of Egypt : Siwa Oasis, Wadi Natron, Wadi El-Raiyan, Tahrir Province and the New Valley. Siwa Oasis was considered as a base for comparison for its richness and high variety abundance of spider fauna. Each of the studied areas was characterized by certain spider species. The agro-ecosystems of Nile Delta are characterized by 10 families of spiders different from those of the studied locations. *Latrodectus tredecimguttatus* (Theridiidae) of the genus of the black widow spider, was first recorded from the Western Desert of Egypt. Presence and densities of *Thanatus albini* (Philodromidae) and *Lycorma* sp. (Lycosidae) could be considered as indicators for changes in the desert ecosystem due to human activities.

Hussein (2001a) published his work on "Soil pricking" as a new, easy, simple, and inexpensive agricultural method, without chemicals application, to intensify spider efficiency as biological control agent. It aims saving enormous efforts for mass rearing of spiders as biological control agents against various pests. Pricking the previously irrigated soil to 7-8 cm depth using a stick (of 1/2 inch diameter) to create holes with 50-60 cm distance in between. These holes encourage the wandering spiders to reside in the pricked hole, spinning nets on the external edge of holes, catching preys in the area and on surrounding plants. Applying this method led to intensification and increasing the spider population to 76% and 107% in cucurbits and lettuce, respectively during 1998, and 86% and 85% in cucurbits and peanut fields, respectively in 1999 season. Intensifying spiders population led to reduction of different pests e.g. aphids, jassids, phytophagous mites, white fly, lepidopteran larvae and *Nizara viridula* with considerable reduction rate 39.64%, 49.45%, 16.67%, 50.48%, 33.33% and 21.14% respectively. Moreover no harmful effects for the natural enemies of insect pests were observed e.g. *Coccinella* sp.

In the same year, Hussein (2001b) published his study on the effects of mulching and holing on spider behaviour. He found that spiders behaviour was considerably affected in holing area and that the established webs increased to 19%, 52%, 76% and 85% after 2, 4, 6 and 8 weeks respectively.

Hussein *et.al.* (2002) studied the effect of the mineral oil *CAPL 1* on spiders. An experiment of completely randomized design was carried out along two seasons, 1999 and 2000, to clarify effect of the mineral oil *CAPL 1* in comparison with *vertimec* pesticide on the population density of soil fauna. Results showed that 6 families of spiders were occurred in the tomato plantation in Berma village, Gharbia governorate. The dominant family of spiders was Lycosidae (74.1% of the total spider populations) and the rarest family was Theridiidae. Density of the spiders increased in the mineral oil plots with 25% and 40% during 1999 and 2000 respectively. A preliminary test was carried out in the laboratory to determine whether the oil is attractive or not to the spiders. Results of this test were positive.

Continuing the study of biological aspects of Egyptian spider species, El-Hennawy & Mohafez (2003) studied the life history of the eresid *Stegodyphus dufouri* (Audouin, 1825) under laboratory conditions, feeding on different kinds of prey for different instars of spiderlings. Some spiderlings were reared together (communal rearing). The second generation was also kept together for more observation. Behavioural observations were reported on this spider both in nature and laboratory. These observations lead to a conclusion that the behaviour of this species is a step on the way to social life.

Also, Sallam & El-Hennawy (2003) studied some biological aspects of the titanoecid *Nurscia albomaculata* (Lucas, 1846) which was found in greenhouses in Dokki, Giza. Its life cycle was studied in laboratory. Different instars were reared on different stages of larvae of cotton leaf worm. Food consumption was also studied, in addition to some biological and ethological aspects.

V. Artificial Works

Depending on the general ignorance of spiders classification and biology, some researchers found the climate appropriate to publish "artificial" works on spiders. I could not add those **false** works to the bibliography at the end of this work, but I have to discuss them here briefly.

1) Abdel-Rahman, S.I., Ibrahim, A.A. & El-Erksousy, M.H. (2001) Laboratory studies on the web-weaver spider *Dictyna latens* (Fabricius) (Araneida : Dictynidae), as a predator on two prey species: *Spodoptera littoralis* (Boisd.) and *Tetranychus urticae* Koch. *Proc.1st integrated pest management conf.*: 179-182.

The authors did not tell us how they could identify their species *Dictyna latens*. Indeed, this species is not recorded till now from Egypt. Hence, the published data are dubious

2) El-Erksousy, M.H., Shoeib, A.A. & Dahi, H.F. (2002) Studies on biological control using the spider *Anelosimus oulicus* (Theridiidae). *Proc.2nd Int.conf.plant protection research inst.*: 1-2.

The authors reared their species, of 5 spiderling instars, feeding on the cotton leaf worm, *Spodoptera littoralis* (Boisd.). They recorded that their spider fed on about 10 larvae per day during the 5th instar, and that feeding needs 2-3 minutes per prey !!

The name of the spider is misspelled everywhere in the paper as *A.* ***oulicus*** instead of *A.* ***aulicus*** !!.

3) Fawzy, M.M.H. & El Erksousy, M.H.M. (2002) Description of new comb-footed spider *Theridion egyptium* sp.n. in Egypt (Araneae: Theridiidae). *Proc.1st conf.central agric.pesticide lab.*: 831-835.

The authors described the male and female of a new species without comparing their specimens with specimens, descriptions or drawings of other species of the same genus, and without consulting any specialist in Egypt or any other country. They prepared slides of their specimens as in case of mites. This yielded very ambiguous drawings in addition to their poor quality (Fig. 2). The work is merely a grouping of mistakes. It is enough to mention here that one of their drawings (Fig. 3) included a cribellum, while any beginner in the field of araneology must know that this organ is neither found in genus *Theridion* nor any other genus of family Theridiidae.

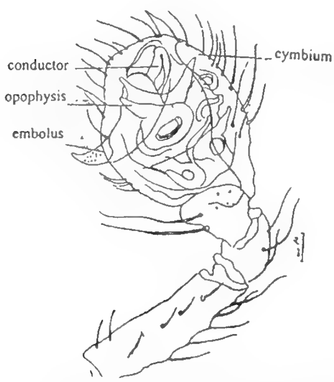

Fig. (4). *Theridion egyptium* n.sp Diagram of male palpal organ.

Fig. 2. Fourth figure in Fawzy & El Erksousy (2002).

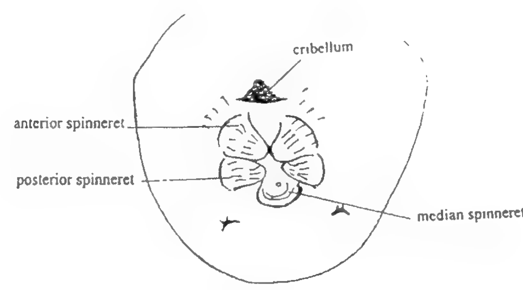

Fig. (3). *Theridion eygptium* n.sp Anal part of spider showing spinnerets.

Fig. 3. Third figure in the same work.

4) El-Erksousy, M.H., Mousa, G.M. & Gomaa, W.O. (2002) The spider *Theridion egyptium* Fawzy and Elerksousy as a biological control agent on cotton aphid, *Aphis gossypii* Glover. *Proc.2nd Int.conf.plant protection research inst.*: 25-26.

The authors said that their spider had only two spiderling instars after emerging from the egg until reaching maturity, while five instars are the minimum known number in spiders (Foelix, R.F. 1996. *Biology of Spiders*. Second Edition. Oxford University Press & Georg Thieme Verlag, New York, Oxford. 330 pp.: p.222). Also, they mentioned that the life cycle was about 40 days.

5) El-Erksousy, M.H. (2002) Biological studies on the spider *Theridion egyptium* Fawzy And Elerksousy. *Proc.2nd Int.conf.plant protection research inst.*: 40-42.

Feeding on the two-spotted spider mite *Tetranychus urticae*, the life cycle of the spider was about 43 days. But also, there were only two spiderling instars as in the predecessor paper.

Note. Some works were published in obscure periodicals, so they were not available to the author to be included in this review.

VI. Bibliography

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Review of spiders of genus *Eresus* in Egypt
(Araneida : Eresidae)

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Abstract

The type material specimens of Egyptian *Eresus* species were examined, redescribed, and photographs and drawings of genitalia were prepared. All Egyptian *Eresus* species were reviewed. *Eresus pharaonis* Walckenaer, 1837 and *Eresus semicanus* Simon, 1908 are redescribed. *Eresus petagnae* Audouin, 1825 is considered *nomen dubium*. *Eresus pulchellus* Lucas, 1864 of Nubia and *Eresus albo-marginatus* Lucas, 1864 of Senegal are considered *nomina nuda*. *Eresus walckenaeri* Brullé, 1832 is considered a doubtful record from Egypt.

Keywords: Eresidae, *Eresus*, Egypt, Taxonomy, Spiders.

Introduction

Genus *Eresus* Walckenaer, 1805 is an old world eresid genus. Its 18 species and 7 subspecies are distributed in Europe, Mediterranean countries, North Africa, West Asia to China, and Senegal ? (Platnick, 2004).

The first record of *Eresus* from Egypt was that of Audouin (1825). He described two species under the names *E. petagnae* and *E. dufourii*. The second of them was later transferred to genus *Stegodyphus* by Simon (1885) and redescribed by Kraus & Kraus (1988). *E. petagnae* was recorded and mentioned several times by Simon (1873 & 1884) and Cambridge (1876).

After seven years, Brullé (1832) recorded *E. theisii* from Turkey, Syria, Egypt in addition to Greece. Walckenaer (1837) described his new species *E. pharaonis* depending on a single specimen from Egypt. In 1864, Lucas described *E. pulchellus* from Nubia. It may be from Egypt or Sudan ?

In 1908, Simon described *E. semicanus* from Alexandria, Mariout and Suez. He reviewed the known species of family Eresidae and described new species from Egypt.

Two years later, Simon (1910) reviewed and redescribed Egyptian eresids among North African spiders of different families.

All descriptions mentioned above lack measurements and drawings of genitalia. The most recent list of Egyptian spiders does not include more than the old records mentioned above (El-Hennawy, 2002). The absence of new material make the review of these species difficult. Therefore, it was necessary to re-examine and redescribe the type material of Egyptian *Eresus* species to partly fill this gap.

Methods

The available type material of the known species were examined. Drawings of the right palp of a male specimen and epigyna and vulvae of female specimens were prepared in addition to their photographs. Measurements of different species were taken in millimetres.

Abbreviations used: ALE = anterior lateral eye; AME = anterior median eye; L = length; MOQ = median ocular quadrangle; PLE = posterior lateral eye; PME = posterior median eye; TL = total length; W = width.

Material from the following collections were examined: MNHN = Muséum National d`Histoire Naturelle, Paris, France; UMO = Oxford University Museum of Natural History, United Kingdom (HECO = Hope Entomological Collection).

Description of Egyptian *Eresus* Species

Genus ***Eresus*** Walckenaer, 1805

Eresus: Greek ἐρείσω = to attach, to tie up, fasten (Simon, 1864: 299)

Eresus pharaonis Walckenaer, 1837
(Figs. 1A-1E. Table 1)

Eresus pharaonius Walckenaer, 1837: 396.
Erythrophora pharaonis Simon, 1864: 300.
Eresus pharaonis Simon, 1908: 83-84; 1910: 298.

Etymology: *pharaonis*: Greek Φαραώ = Pharaoh, ancient Egyptian king [of the Pharaoh, or Pharaonic]
Material examined: MNHN: *Eresus pharaonis* Walck./ Aegyptus, bottle no.471 (tube no. AR 839) 1♀ (with epigynum separated), 1 j.
Description: Female (MNHN B.471 - t. AR 839): TL 30. Cephalothorax: integument crimson red, covered by creamy white hairs mixed with light brown hairs. Cephalic area gradually inclined into thoracic area. Cephalothorax: L 13 ?. Cephalic part: L 9.52, W 9.52; square. MOQ slightly protruding forwards. Eye measurements: AME 0.20, ALE 0.24, PME 0.37, PLE 0.24, AM-AM 0.34, AL-AL 6.97, PM-PM 0.82, PL-PL 5.86, AM-AL 3.19, AM-PM 0.29. Thoracic part: L 3.48 ?, W 8.84. Chelicerae: crimson red, covered anteriorly by dense orange brown hairs. Sternum L 6.97; Labium L 2.29; Maxilla L 3.65. Sternum, Coxae: yellowish brown. Maxillae, Labium: crimson red. All covered by dense creamy white hairs. Legs and Pedipalps: orange-brown covered by dense creamy white hairs. Tarsi and metatarsi of legs I, II and tarsi and tibiae of pedipalps darker. Spination: spines only on ventral side of tarsi, metatarsi and distally on tibiae; rare on I & II, very few on III & IV. Pedipalp with a claw.

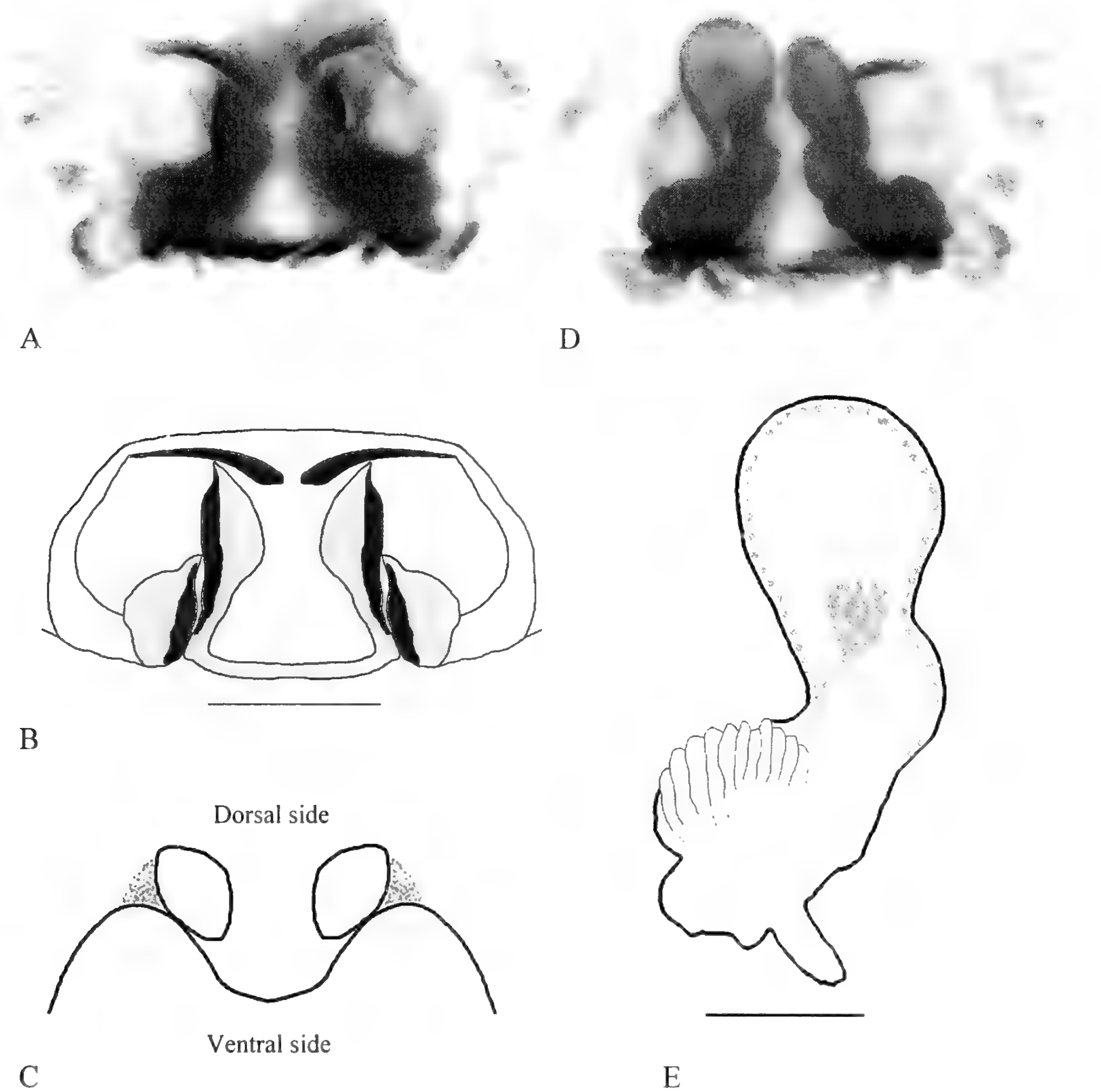


Fig. 1. *Eresus pharaonis* Walckenaer, 1837 ♀ (MNHN).
A, B. Epigynum, ventral view: A. Photograph, B. Schematic drawing.
C. Transverse section of epigynum and vulvae. D. Vulvae photograph, dorsal view.
E. Left vulva, dorsal view. Scale = 0.5 mm (B), 0.25 mm (E).

Table 1. Leg measurements of *Eresus pharaonis* female (MNHN).

Leg	I	II	III	IV
Femur	6.80	5.85	4.76	6.80
Patella	3.67	3.40	3.26	4.08
Tibia	3.40	2.99	2.72	4.08
Metatarsus	3.67	3.40	2.72	4.08
Tarsus	2.31	1.90	1.50	1.63
Total length	19.85	17.54	14.96	20.67

Abdomen: L 19; oval, stout; yellowish white, covered by brown hairs, with 8 sigilla; abdominal pattern absent. Cribellum: bipartite.

Genitalia: (Figs. 1A-1E) Epigynum has two depressions. The anterior chitinous ridge consists of two separate parts. Vulvae are almost confined between the two depressions. Spermathecae are elongated behind the anterior ridge.

The juvenile specimen is lighter in colour. TL 9.11.

Male: unknown.

Distribution: Egypt: collected by M. Bové, without definite locality (Walckenaer, 1837). Endemic Species, only recorded from Egypt (Roewer, 1954 & Platnick, 2004).

Note on colouration. The colours of this specimen had changed during more than 160 years in alcohol. Therefore, it is necessary to refer to the first description of Walckenaer (1837), from which the following text is extracted and translated: "Cephalothorax and legs brown black. Posterior slope side of cephalothorax rounded, brown and covered by reddish hairs. Clypeus has long hairs which prolong over chelicerae. The chelicerae are hairy, reddish toward their extremities. Maxillae long, reddish, and very hairy. Sternum flat, red in the middle, provided with furry hairs on the sides. Legs brown black, short, robust, with swollen femora, garnished by furry hairs. Abdomen reddish brown, with some reddish festooned stripes on the posterior part."

Eresus semicanus Simon, 1908

(Figs. 2A-4B. Tables 2-4)

Eresus petagnae Cambridge, 1876: 554 (misidentification).
Eresus semicanus Simon, 1908: 83; 1910: 294-295, f.5.

Etymology: *semicanus*: Latin *semi-* (*semis*) = half- (one half) + *canus* = white, hoary [half hoary]

Material examined: MNHN: *Eresus semicanus* E.S./ Alexandrie, bottle no.471 (tube no. AR 836) 1♂, 3♀, 16j (with two palps and one epigynum separated). UMO: *Eresus petagnae*, B. 507 t. 9, 2♀, 3j Aleyra (Alexandria).

Description: Male (MNHN B.471 - t. AR 836): TL 9.25. Cephalothorax: integument crimson red, covered by light brown hairs. Cephalic area steeply inclined into thoracic area. Cephalothorax: L 4.76 ?. Cephalic part: L 3.57, W 4.16; rectangular. Eye measurements: AME 0.15, ALE 0.14, PME 0.27, PLE 0.17, AM-AM 0.17, AL-AL 3.29, PM-PM 0.41, PL-PL 2.81, AM-AL 1.43, AM-PM 0.08. Thoracic part: W 3.65. Chelicerae: crimson red, covered by long dense light brown hairs. Sternum L 2.81; Labium L 1.27; Maxilla L 1.85. Maxillae, Labium: crimson red; Sternum, Coxae: orange brown; all covered by light brown hairs. Sternum and first coxae darker. Pedipalps: orange-brown covered by light brown hairs with whitish hairs at joints; patella and tibia without apophyses; cymbium without processes. Palpal organ (Figs. 2A-2B): tip of conductor bifid (divided). Legs: colouration like pedipalps. Spination: spines only on ventral side of tarsi, metatarsi and distally on tibiae; few on I, II & III, numerous on IV. Leg I: metatarsus 0-0-2. Leg II: tarsus 0-2-4; metatarsus 0-1,1-4; tibia 0-0-2. Leg III: tarsus 0-2-4; metatarsus 0-2-4; tibia 0-0-2. Leg IV: tarsus 0-1,1-4; metatarsus 2-2-2-2-4; tibia 0-0-2.

Abdomen: L 5.17; covered by light brown hairs, with 2 wide longitudinal bands of whitish hairs dorsally.

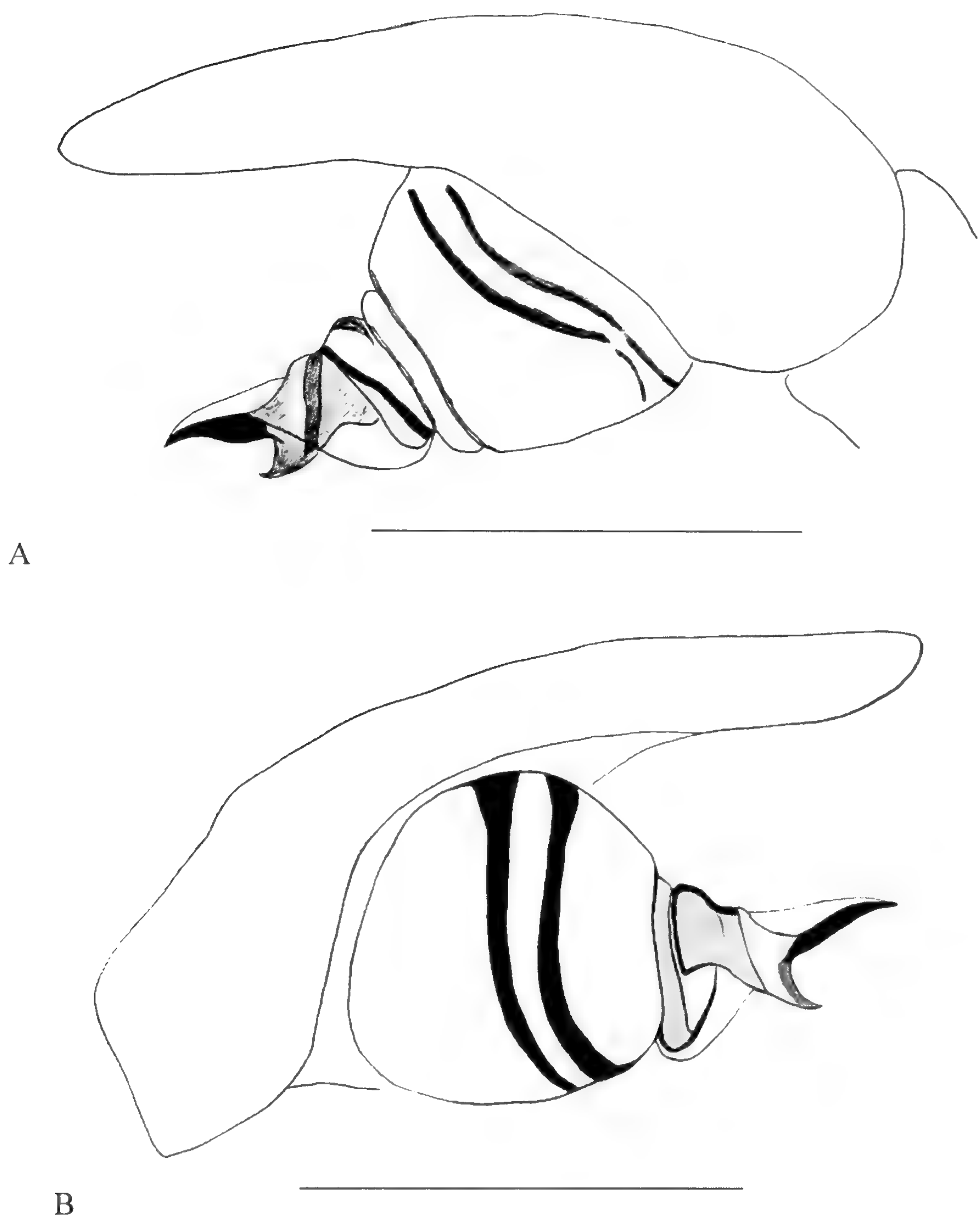


Fig. 2. *Eresus semicanus* Simon, 1908 ♂ (MNHN).
Male palp: A. Prolateral view. B. Retrolateral view. Scale = 0.5 mm.

Table 2. Leg measurements of *Eresus semicanus* male (MNHN).

Leg	I	II	III	IV
Femur	3.55	3.02	2.65	3.55
Patella	1.80	1.75	1.27	1.85
Tibia	2.23	1.75	1.54	2.44
Metatarsus	2.23	1.96	1.59	2.17
Tarsus	1.38	1.17	0.85	1.09
Total length	11.19	9.65	7.90	11.10

Female (MNHN B.471 - t. AR 836): TL 13.19. Cephalothorax: integument crimson red, covered by white hairs mixed with light brown hairs. Cephalic area gradually inclined into thoracic area. Cephalothorax: L 5.03 ?. Cephalic part: L 4.25, W 4.42; almost square. Eye measurements: AME 0.14, ALE 0.17, PME 0.31, PLE 0.20, AM-AM 0.17, AL-AL 3.44, PM-PM 0.46, PL-PL 3.07, AM-AL 1.48, AM-PM 0.10. Thoracic part: W 4.25. Chelicerae: crimson red, covered by dense white hairs mixed with light brown hairs. Sternum L 3.34; Labium L 1.43; Maxilla L 2.12. Maxillae, Labium: crimson red; Sternum, Coxae: orange brown; all covered by creamy white – light brown hairs. Pedipalps: orange-brown covered by light brown hairs with whitish hairs at joints of legs; tarsi and tibiae darker; tarsus with claw. Legs: colouration like pedipalps; tarsi, metatarsi (specially of legs I, II) darker. Spination: spines only on ventral side of tarsi, metatarsi and distally on tibiae; few on legs I & II, numerous on III & IV.

Table 3. Leg measurements of *Eresus semicanus* female (MNHN).

Leg	I	II	III	IV
Femur	2.91	2.38	2.38	3.44
Patella	1.85	1.75	1.48	2.12
Tibia	1.85	1.59	1.38	2.33
Metatarsus	1.75	1.59	1.32	1.96
Tarsus	1.17	0.95	0.66	1.01
Total length	9.53	8.26	7.22	10.86

Abdomen: L 9.38; creamy white, covered by light brown hairs, with 8 bare sigilla. Cribellum bipartite.

Genitalia (Figs. 3A-4B): Epigynum has a trapezoidal chitinous plate. There is a wide depression between an anterior semi-circular chitinous ridge and the chitinous plate. Vulvae resemble those of *Stegodyphus* (Kraus & Kraus, 1988). The MNHN specimen has vulvae tapering forwards more than in UMO specimen. Spermathecae as depicted in Figs. 3C, 4B.

Measurements of the other two females and a distinguished juvenile (MNHN):

	TL	Abdomen L	Cephalothorax L	Cephalic part L ,	W
♀1	12.65	9.66	4.35	3.54	3.81
♀2	10.88	6.80	4.35	3.54	3.81
j	14.28	10.06	5.03	4.62	4.76

Female (UMO B. 507 - t. 9): Different Measurements: TL 17.93 [the smaller female TL 14.61]. Cephalothorax: L 8.30. Cephalic part: L 5.81, W 5.81; square. Eye measurements: AME 0.20, ALE 0.22, PME 0.40, PLE 0.22, AM-AM 0.32, AL-AL 4.40, PM-PM 0.60, PL-PL 4.24, AM-AL 2.00, AM-PM 0.08. Thoracic part: L 2.49, W 5.56. Sternum L 4.20; Labium L 2.40; Maxilla L 2.40. Abdomen: L 13.78.

Table 4. Leg measurements of *Eresus semicanus* female (UMO).

Leg	I	II	III	IV
Femur	4.00	3.48	3.60	4.80
Patella	2.20	2.20	2.20	2.80
Tibia	2.40	2.08	1.80	3.00
Metatarsus	2.08	2.00	1.60	2.60
Tarsus	1.20	1.20	0.92	1.08
Total length	11.88	10.96	10.12	14.28

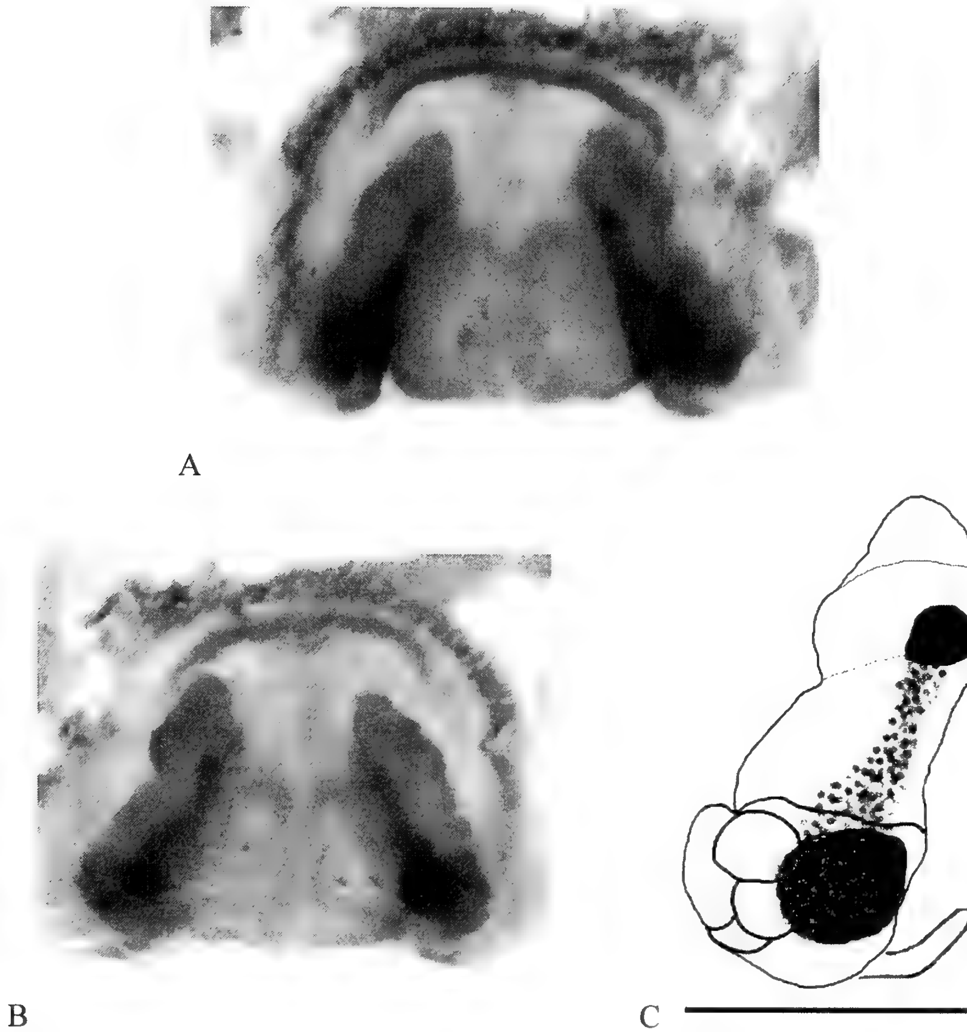


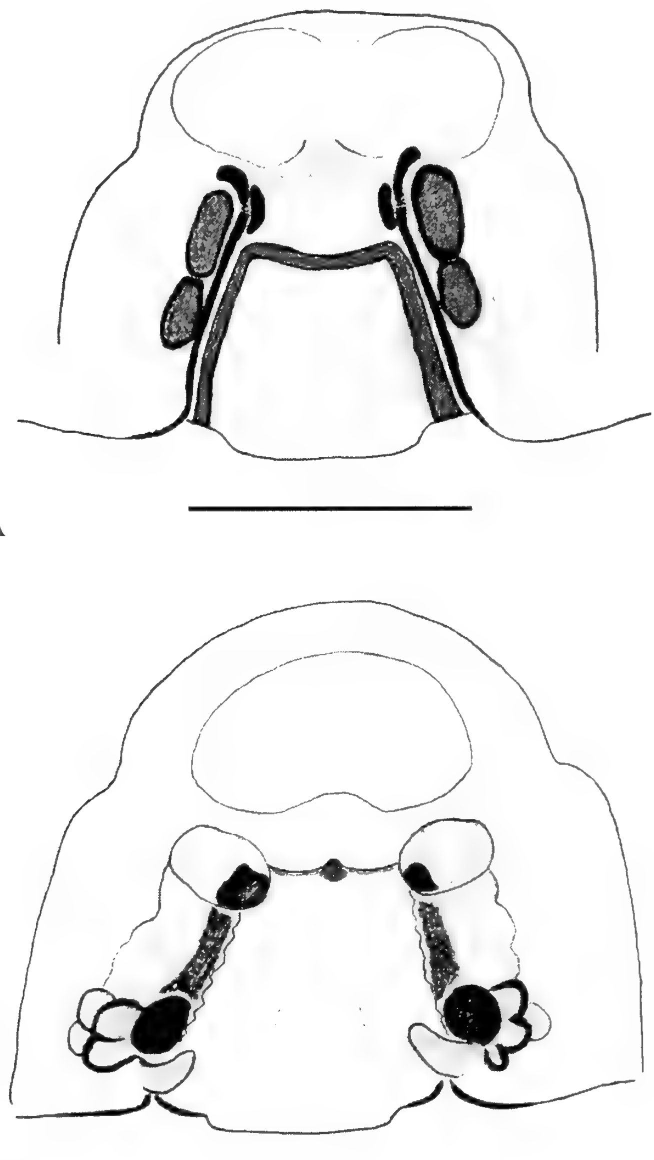
Fig. 3. *Eresus semicanus* Simon, 1908 ♀ (MNHN).
A. Epigynum photograph, ventral view. B. Vulvae photograph, dorsal view.
C. Left vulva, dorsal view. Scale = 0.25 mm.

Distribution: Egypt: Alexandria (about 31°11'08"N 29°53'30"E), Mariout, Suez (Simon, 1908 & 1910). This species is only recorded from Algeria and Tunisia by Roewer (1954: 1295) and Platnick (2004). The following note corrects this distribution.
Note. The female specimen of *E. semicanus* (MNHN) from Birine, Algeria, bottle no.471 (tube no. AR 842) and the female and juvenile specimens of *E. petagnae* (MNHN) from Djerba, Tunisia, bottle no.471 (tube no. AR 835) do not belong to this species. They belong to another species which may be undescribed yet.

Note on colouration. The colours of this species' specimens had changed during more than 90 years in alcohol. Therefore, it is necessary to refer to the description of Simon (1908 & 1910), from which the following translation is adopted:
Male: Cephalothorax black, covered by blackish grey hairs, mixed on the rear of cephalic part with very short red hairs and on the thoracic part with long white scattered hairs (thoracic part sometimes with marginal red hairs). Abdomen black, pubescent, covered by black hairs, decorated above by two large bands or by two sets of spots formed of mixed white and red hairs, and below by white hairs. Chelicerae black with sparse white hairs. Legs black, covered by black hairs; femora, patellae, tibiae and

metatarsi apically with wide white rings. Pedipalp small, black; femur and patella apically with white rings, the process of bulb unequally bifid. Posterior median eyes nearly six times larger than the anteriors.

Female: Black. Cephalothorax covered by black hairs and sprinkled with very small white points formed of very short thick hairs, depressed and acute. Clypeus and chelicerae, at least in their basal half, densely covered by white or pale yellow hairs. Abdomen with short black silky pubescence, mixed of some white hairs, sigilla with fine white borders. Legs black, decorated by white hairs at the joints.



A

B

Fig. 4. *Eresus semicanus* Simon, 1908 ♀ (UMO).
A. Epigynum, ventral view. B. Vulvae, dorsal view. Scale = 0.5 mm.

Species Inquirendae

Eresus petagnae Audouin, 1825

Eresus petagnae Audouin, 1825: 151, pl.4, f.11; 1827: 375-376, pl.4, f.11. Simon, 1873: 357. Cambridge, 1876: 554. Simon, 1884: 326.

This species is recorded from Egypt and Syria (Palestine ?) by Roewer (1954: 1295) and Platnick (2004) depending on some of the following references:

1. Audouin (1825 & 1827) stated in his brief diagnosis that "this species is analogous to *Eresus frontalis* Walckenaer because of the arrangement and size of eyes, but it essentially differs by lesser number of deep points on dorsal side of the abdomen; they are only six. The other differences may be in colours." His drawn specimen seems juvenile as Simon (1910: 294) stated. It may be *E. semicanus*, *E. pharaonis*, or perhaps *Dorceus quadrispilotus* Simon, 1908 (Simon, 1910).
2. Walckenaer (1837: 397) considered *E. petagnae* and *E. theis* synonyms to *E. imperialis*. (= *E. cinnaberinus frontalis* Latreille, 1819 in Platnick, 2004).
3. Simon (1873) said that "This species seems to be fairly common in Egypt and Syria. M. Ch. de la Brûlerie brought to me a fairly great number of specimens, but no one exactly adult."
4. Cambridge (1876) found adult and immature females of this species under stones near Alexandria. "But for M. Simon's opinion (... 1873, p. 357), I should have considered this species to have been identical with *Eresus imperialis* Duf. (= *E. frontalis*, Latr.)" (= *E. cinnaberinus frontalis* Latreille, 1819 in Platnick, 2004).
[The specimens of Cambridge are deposited in UMO. They are 2 females and 3 juveniles. They belong to *E. semicanus* Simon, 1908.]
5. Simon (1884) mentioned that *E. petagnae* is widely distributed in Egypt and Syria.
6. Simon (1908: 83) stated that the Egyptian species *Eresus semicanus* Simon, 1908 is also found in Tunisia at the isle of Djerba and that it is the species which he wrongly spoke about under the name of *Eresus petagnae* in 1884, p.326 (line 12) ?.
[These specimens of Djerba (MNHN) do not belong to *E. semicanus* but to an undescribed species.]

The first description is brief and based as most of the other following descriptions on juvenile specimens. The adult material of Cambridge (1876) and Simon (1884) belong to other species. *Eresus petagnae* has to be considered *nomen dubium*.

Eresus pulchellus Lucas, 1864

Eresus pulchellus Lucas, 1864: 29. Simon, 1908: 81; 1910: 289. Roewer, 1954: 1296. Platnick, 2004.

Lucas (1864) proposed three names of new *Eresus* species: *E. siculus* from Sicily (= *Eresus walckenaeri* Brullé, 1832), *E. pulchellus* from Nubia, and *E. albo-marginatus* from Senegal. The three names were accompanied by very short diagnoses with a note that their descriptions will be published later. He based his diagnosis of *E. pulchellus* on a female specimen collected by M. P.-E. Botta from Nubia, as follows: "Very small, distinguished from known species by the yellowish longitudinal stripe which goes over its abdomen dorsally along its length. Length 10 mm."

Simon (1908: 81 & 1910: 289) said that *E. pulchellus* is probably the male of *Stegodyphus niloticus*. (= *S. dufouri* (Audouin, 1825)). This species is mentioned by Roewer (1954: 1296) from Nubia and by Platnick (2004) from Egypt. The absence of description and the unavailability of specimens of this species make it impossible to state the true identity of this species. It has to be considered *nomen nudum*. Also, *E. albo-marginatus* Lucas, 1864 of Senegal has the same situation.

Doubtful Record

Eresus walckenaeri Brullé, 1832

This species is recorded by Roewer (1954: 1296) from East Mediterranean countries and Turkestan and by Platnick (2004) as a Mediterranean species. Pavesi (1878: 389) mentioned that the distribution of *Eresus theisii* Brullé is Turkey, Syria, Egypt in addition to Greece. He stated that all the eresid species mentioned in his work, including *E. Petagnae* and *E. Theisii* are very similar, if not identical.

[*E. theïs* Brullé, 1832 = *E. walckenaeri* Brullé, 1832 (Platnick, 2004)]

There is no definite locality of this species from Egypt in literature and no available specimens of it from Egypt in the consulted collections. It is here considered a doubtful record from Egypt.

Acknowledgments

I wish to express my sincere and grateful thanks to my friends: Dr. Christine Rollard (MNHN, Paris) who permitted loan of *Eresus* specimens. Dr. Samir Ghabbour (Cairo) brought the specimens of Paris Museum to me. Dr. Malgosia Atkinson (UMO, Oxford) kindly admitted for examination of specimens in the collection during my visit in 1997. Dr. Jürgen Gruber (NMW, Vienna) provided me with references required for this work.

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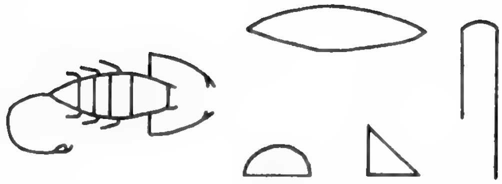
* This is the oldest title of this note which had no original title. It was mentioned in this form in p. 260 of: Tables générales des Annales de la Société Entomologique de France 1861-1880 Paris [1885]. Rédigées par M. Ed. Lefèvre.

It was also mentioned in Roewer's "Katalog der Araneae" (1942, p.17) as: [Note sur trois *Eresus*. *Ann. Soc. ent. Fr.* (4) 4(Bull.): 28-29.] and by Platnick (2004) as: [Sur trois nouvelles especes d'*Eresus*.].



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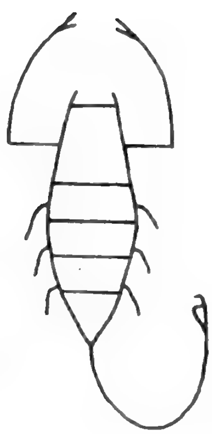

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Life Cycle of *Steatoda paykulliana* (Walckenaer, 1805) in Egypt (Araneida : Theridiidae)

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Abstract

Steatoda paykulliana (Walckenaer, 1805), family Theridiidae, was found among wild plants in Sallant village, near El-Mansoura city, El-Dakahlia Governorate, Egypt. Its life cycle was studied in laboratory. Males reached maturity after 6-7 spiderling instars (200±12.6 days), and females after 6-8 spiderling instars (223±24.7 days). Different instars were reared on different stages of larvae of cotton leaf worm. Food consumption was studied, in addition to an experiment of food preference. Mating behaviour was briefly described.

Keywords: Life cycle, Feeding, Food preference, Mating behaviour, Spiders, Theridiidae, *Steatoda paykulliana*, Egypt.

Introduction

Family Theridiidae is one of the most important families of spiders. It includes 2208 species of 80 genera distributed all over the world (Platnick, 2003). Six species of genus *Steatoda* Sundevall, 1833 are recorded among 25 species of 10 genera of Theridiidae in Egypt (El-Hennawy, 2002a, 2002b).

Steatoda paykulliana (Walckenaer, 1805) was recorded from Alexandria and southern Sinai (El-Hennawy, 2002a). There are no studies on *S. paykulliana* in Egypt till now, while there is only an unpublished study of *Steatoda triangulosa* (Walckenaer, 1802) by Rahil (1988). Therefore, it is necessary to study its life cycle and to try to know its role in the agroecosystem.

Material and Methods

Adult female of *Steatoda paykulliana* (Walckenaer, 1805) was collected on 28^{th} March 2003 from Sallant village near El-Mansoura city, El-Dakahlia Governorate, Egypt. It was found among wild plants adjacent to cultivated plants. It was reared inside a test tube where she laid an egg sac on 19^{th} April 2003 which was observed till hatching. The hatched spiderlings were individually reared inside translucent plastic containers (3 cm in diameter and 5 cm in length); the upper lid of the container was perforated for ventilation. All obtained spiderlings were reared under laboratory conditions of 26-28°C and 60-70 % R.H. They were fed once every two days on different stages of 1^{st}-4^{th} instars of larvae of cotton leaf worm, *Spodoptera littoralis* (Boisduval, 1833).

After reaching adulthood, 10 couples of a male and a female were reared in separate containers to observe mating behaviour and oviposition.

An experiment of food preference by 16 adult females was achieved on three insect species, i.e. larvae of *Spodoptera littoralis* (Order Lepidoptera, Family Noctuidae), and adults of the Mediterranean fruit-fly *Ceratitis capitata* (Wiedemann, 1824) and the Peach fruit-fly *Bactrocera zonata* (Saunders, 1841) (Order Diptera, Family Tephritidae).

Results and Discussion

Egg sac, eggs and incubation period

The egg sac was spherical in shape, white in colour at first and became dark before hatching. The eggs inside the egg sac were circular and yellow at the beginning, after laying, and became dark before hatching. On 14^{th} May 2003, 58 individuals hatched and emerged from the egg sac through a round pore at the tip of the egg sac, they were reared under laboratory conditions. The incubation period of eggs of *S. paykulliana* lasted for 25 days.

Spiderlings

During rearing the 58 spiderlings of *S. paykulliana*, 4 individuals escaped before reaching maturity, 14 individuals died before adulthood, 40 individuals reached adult stage.

The spiderlings passed through 6-7 instars for males and 6-8 instars for females during their development (Table 1). Twenty percent of males became adult after six moults, while the eighty percent moulted seven times. Most females (52.27%) reached maturity after seven moults, while 8.60% only moulted six times and 39.13% moulted eight times. The longest duration was that of the 5^{th} instar of female and the 6^{th} instar of male. The shortest instar was the 1^{st} through the 3^{rd} ones for both male and female.

In this respect, Rahil (1988) observed that the female of *Steatoda triangulosa* (Walckenaer, 1802) passed through 3-4 instars and the male passed through 2-4 instars at 25°C when they fed on *Musca domestica* (Linnaeus, 1758). Hussein *et al.* (2003) studied some biological aspects of *Anelosimus aulicus* (Koch, 1838) (Theridiidae), feeding on *Tetranychus urticae* Koch, 1836, *Aphis craccivora* Koch, 1854 and a mixture of both of them. *A. aulicus* passed through five spiderling instars before reaching adulthood for both male and female.

Sex ratio

The sex ratio of adults was 1 : 1.35 (male : female) and this differed that of *S. triangulosa* which was 1 : 1.1 (Rahil, 1988).

Table 1: Duration of the different developmental stages of the theridiid spider *Steatoda paykulliana* (Walckenaer, 1805) in Egypt.

Developmental Stage	Duration (Days)					
	Male			Female		
	Range	Mean	S.D	Range	Mean	S.D
1st Instar	7-14	10	1.5	7-16	11	2.1
2nd Instar	5-24	13	6.1	5-26	13	6
3rd Instar	7-22	15	4.5	9-34	16	5.8
4th Instar	17-73	25	14	8-75	27	18
5th Instar	25-70	45	13	37-78	54	11
6th Instar	23-77	53	12	26-60	44	8.9
7th Instar	34-65	48	8.7	22-77	45	18
8th Instar	--	--	--	28-56	45	8.6
Life cycle	189-236	200	12.6	171-294	223	24.7

Food consumption

During the study of food consumption of *S. paykulliana*, different spiderling instars and adults were fed on various instars of *S. littoralis* larvae. Both first and second instars of spiderlings were fed on the first instar of *S. littoralis*. Third and fourth instars of spiderlings were fed on the second instar of prey. Fifth and sixth instars of spiderlings were fed on the third instar of the prey, while the seventh and eighth instars of spiderlings were fed on the fourth instar of the prey. Number of consumed preys by different spiderling instars is in Table 2.

Table 2: Food consumption of the theridiid spider *Steatoda paykulliana* (Walckenaer, 1805) in Egypt, feeding on larvae of *Spodoptera littoralis* (Boisduval, 1833).

Developmental Stage	Number of consumed individuals of prey					
	Male			Female		
	Range	Mean	S.D.	Range	Mean	S.D.
1st Instar	15-30	21	3.38	3.39-29	21.7	6.24
2nd Instar	5-30.5	13.1	7.04	5-32.5	15.3	8.9
3rd Instar	15-35	23.8	5.37	9.05-60.5	28	10.9
4th Instar	31.5-80	45.9	12.1	20-110	44.9	28.2
5th Instar	67.5-120	97.3	13.4	20-170	108	46.7
6th Instar	57.5-135	97.9	19.3	21.6-128	86.7	30.1
7th Instar	70-110	89	12.8	22.6-125	69.2	23.9
8th Instar	--	--	--	15-92.5	48.3	26.5
Life cycle	311-410	370.2	25.4	322-498	384.8	89.4

Food preference

This experiment depended on 16 adult females. It was performed to investigate the feeding preference of the adult female of *S. paykulliana*, using three different preys. The preys were *S. littoralis, C. capitata* and *B. zonata*. The results revealed that:

• 6.25 % of the female spiders immediately attacked larvae and only fed on them.
• 56.25 % of the spiders immediately attacked flies and only fed on them
• 12.50 % of the spiders paralyzed larvae at first without feeding, then attacked flies and fed on them.
• 25% of the spiders did not feed on any of the available preys.

Mating behaviour

The mating behaviour of 10 couples of a male and a female *S. paykulliana* was observed. Mating process was achieved through the following steps:

1. The approach of both the male and the female towards each other until touching of their legs.
2. Rubbing male's pedipalps by each other.
3. More approach between male and female and overlapping of their legs.
4. Pedipalp of the male comes in contact with the cephalothorax of the female trying to reach the epigynum (about 5 times).
5. Male inserts the tip of the left palpal organ inside the epigynum of the female with contracting and relaxing of the male's abdomen (10 minutes).
6. Male leaves the female with rubbing the pedipalps with each other.
7. Female comes near the male which repeats the steps 3-5 but with the right palpal organ (8 minutes).

Notes on mating and devouring

1. 30% of the females mated with males and did not devour them.
2. 30% of the females did not mate with nor devour males.
3. 40% of the females did not mate with males and devoured them one day later.
4. In one case, a male mated two times with two separate different females.

It is obvious that devouring male in this species is not related to mating with female. They may live in the same area for a few days without cannibalism.

Acknowledgment

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Intraspecific diversity of morphological characters of the burrowing scorpion *Scorpio maurus palmatus* (Ehrenberg, 1828) in Egypt (Arachnida: Scorpionida: Scorpionidae)

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Abstract

The general objective of the present study is to examine the intraspecific variations in the morphological characters of the scorpion, *Scorpio maurus palmatus*, populations inhabiting different geographic regions in Egypt. Whereas the specific objective is dealing with the impact of the environmental factors, biotic and abiotic, on the intraspecific variations of this scorpion species. Scorpions were collected from three locations in South Sinai, i.e. Wadi Sahab, Wadi El-Agramia, Wadi Rahaba, which represent the arid area and a region in the Western Mediterranean Coastal Desert (WMCD), which represents the semiarid area. Random soil samples were taken from all sites for physical and chemical analysis as well as the available plants and insects around the scorpions burrows were collected and identified. The depths of the scorpions' burrows were measured and their different shapes were recorded. Several statistical analyses were carried out for the tested parameters to explain the complicated interaction between them. Most of the morphometric measurements (total body length, pedipalp length, pedipalp hand width, number of setae on legs and number of pectinal teeth) revealed highly significant differences within and among populations. Pearson correlation matrix of some morphometric measurements and environmental factors (altitude, soil nature, climate) showed an interaction between them. Discriminat Functions Analysis (DFA) and Hierarchical Cluster Analysis (HCA) showed that WMCD population is highly distinct from the other populations in Sinai. These results indicated that: 1- *Scorpio maurus palmatus* exhibits a general morphological separation between populations, 2- intraspecific diversity in this species may be due to variation in the environmental conditions (biotic and abiotic factors), and 3- total body length, pedipalp length as well as number of setae can be used as good markers to examine intraspecific diversity of most scorpion species.

Keywords: Intraspecific diversity, South Sinai, Western Mediterranean Coastal Desert, Egypt, Scorpions, Scorpionidae, *Scorpio maurus palmatus*.

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Introduction

Scorpions, members of class Arachnida, are very ancient chelicerate arthropods. Order Scorpionida (Scorpiones) includes 1259 described species in 16 living families and 155 genera (Fet *et al*., 2000). Scorpions live in tropical and temperate regions of the world, within 50 degrees North and South of the Equator. They live in forests, savannas, deserts, and some species are even found in mountains over 5000m of altitude. All scorpions are nocturnal, hiding during the day under stones, wood, or tree bark, in termite hills, and other protected places. Some species seem to be attracted by human habitation and live around the human dwellings and even inside of them (Anderson, 1983).

Although, scorpions are one of the oldest and most common animals in the world, they had received little attention from the biological point of view. In Egypt, most of publications dealt with the toxicity of its venom (Omran *et al*, 1992a and b; Omran & Abdel-Rahman 1992 and 1994; Omran & McVean, 2000; Omran, 2003). A few publications dealt with its morphology, anatomy, embryology and histology (Khalil *et al*., 1983a, b and 1985; El-Bakary, 1990 and 1998); systematics and ecology (El-Hennawy, 1987, 1992 and 2002; Moustafa, 1988); and physiology (El-Bakary, 1986).

Scorpions were known to people since ancient eras. The ancient Egyptians documented them in their writings. Modern scientific writings did not mention scorpions until 1825 in the book "*Description de l'Égypte*" and what was recorded by the French scientist Savigny and completed by his student Audouin and contained a description of three species of one family. A few publications followed during the nineteenth and twentieth centuries introducing us to more species of scorpions that live in Egypt. The list of Egyptian scorpions currently includes 24 species classified under 13 genera of four different families, Buthidae, Diplocentridae, Euscorpiidae and Scorpionidae, (El-Hennawy, 2002).

Genus *Scorpio* belongs to subfamily Scorpioninae, Family Scorpionidae. It is recorded from North Africa, Middle East to Iran and Arabia. It is now generally accepted that there is only one species in this genus: *Scorpio maurus* (Linnaeus, 1758) which includes 18 subspecies (Fet *et al*., 2000). *Socrpio maurus palmatus* (Ehrenberg 1828) is mainly recorded in Egypt from near Alexandria, Wadi Natrun, Cairo, El-Faiyum and Sinai (El-Hennawy, 1992, 2002). A good full description of *S. m. palmatus* is included in the work of Levy and Amitai (1980). It was chosen to study the intraspecific diversity of scorpions' morphology in Egypt in this study. It is found on browned sandy soils, loess and alluvial soils and in stony desert. It burrows and can move stones heavier than itself. Each scorpion lives alone in a burrow, but concentrations of hundreds of burrows may be found in certain areas. The burrows have a crescent-shaped opening and run fairly parallel to the ground for about 10 cm after which it runs downwards for 20 to 70 cm. The bottom is slightly enlarged. The animal leaves the burrow at night or stands at the entrance with the pincers slightly raised. Parturition occurs in August-September with 8-13 young scorpions. *S. m. palmatus* preys small and large arthropods. It does not sting readily and the sting is not very painful to humans (Levy & Amitai, 1980). Males have been observed (Rosin & Shulov, 1961) to produce sounds by rapidly striking the posterior half of the mesosoma against the ground. This species prefers areas of high precipitation, dense vegetation and deep soil. Apparently, these factors also provide them with a suitable microclimate for maintaining optimal water and thermal balance (Warburg *et al*., 1980).

The general objective of the present study is to examine the intraspecific variations in the morphological characters of the scorpion, *Scorpio maurus palmatus*, populations inhabiting different geographic regions in Egypt. Whereas the specific objective is dealing with the impact of the environmental factors, biotic and abiotic, on the intraspecific variations of this scorpion species.

The study area

The present study was carried out in two different geographical regions in Egypt (Fig. 1). The first was located in the southern part of Sinai Peninsula, which represents the arid area and is geographically separated from the rest of the Egyptian land by the Suez Canal and the Gulf of Suez. Three locations in this region were chosen as separate wadis (valleys) near Saint Catherine (Wadi Sahab 28°42'33"N 33°47'16"E 910m Altitude, Wadi El-Agramia 28°45'39"N 33°54'39"E 1225m Alt., and Wadi Rahaba 28°25'154"N 33°59'54"E 1676m Alt.). The second region was located in the Western Mediterranean Coastal Desert (WMCD), west of Alexandria, which represents the semi arid area (30°55'91"N 29°35'27"E 30.5m Alt.).

A. Sinai Peninsula

1. Locations and Geography

Sinai Peninsula (Fig. 1) is a triangular plateau (61000 km^2) occupying the north-eastern corner of Egypt (Said, 1990). South Sinai area is about 28400 km^2, 46% of the total area of Sinai Peninsula (South Sinai Governorate, 1997). The study area (Fig. 2) was located between latitudes 28°10' and 29°10' N, and longitudes 33°15' and 34°39' E. It covers three main areas representing different vegetation types, altitudinal variation, landform and climatic variations. These areas are: 1- Wadi El-Agramia in the centre of South Sinai, 2- Wadi Sahab in the west, and 3- Wadi Rahaba in the east (Fig. 2).

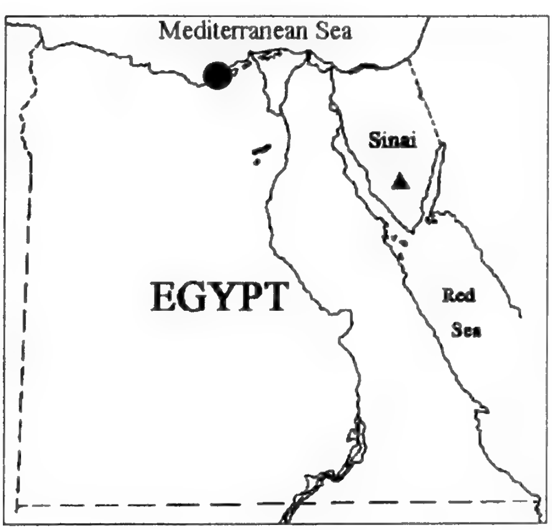

Fig. 1. The study area. ▲ South Sinai, ● Western Mediterranean Coastal Desert.

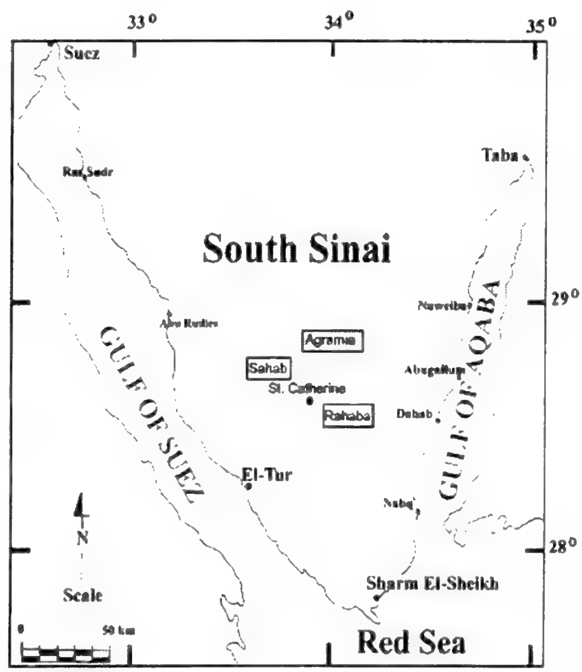

Fig. 2. Location map of South Sinai showing the study areas (Wadi Sahab, Wadi El-Agramia and Wadi Rahaba) around St. Catherine.

2. Geology and Geomorphology

The northern part of Sinai is almost entirely covered by sedimentary rocks, mostly limestone. In the southern part, the basement rocks occupy about 7000 km^2 surface area, forming a triangular mass of mountains with its apex at Ras Mohammad to the south. The Sinai massif contains much granite and other magmatic and metamorphic rocks (Hammad, 1980). The Sinai massive is dissected by numerous incised wadis. The highest peak, Gebel (Mountain) Catherine attains an altitude of 2641m above sea level. Due to the Massif Mountains in the centre, South Sinai has a wide range of altitudinal variation (Said, 1990). The altitudinal gradient decreases from St. Catherine area going eastward till Gulf of Aqaba and westward till Gulf of Suez.

The study area has two main landform types: Wadis and Plains. The term wadi designates a dried riverbed in a desert area. A wadi may be transformed into a temporary watercourse after heavy rain. Wadi bed is covered with alluvial deposits with different thickness and structure from location to another. The soil is usually composed of the same composition as the parent rocks and varied in texture from fine silt or clay to gravels and boulders (Kassas, 1952 and Kassem, 1981). In general, the depth of alluvial deposits and smoothness has a negative relation with the altitude. Plains are flat expanses of desert where deep alluvial deposits are found. The desert plains represent a very late stage in the arid erosion cycle (Kassas, 1952).

2.1. Wadi El-Agramia (Fig. 2) is one of the most important physiographic features of St. Catherine area. It is located about 30 km to the northeast of St. Catherine city and covers an area of about 25 km^2. It is a gravel-stream wide plain with surface cobbles and about 10% of the basal area. The area has two main localities; Agramia plain, and Wadi Hargos. The altitude of the area ranges between 1000 to 1500m above sea level. Geographically, the exposed rocks in the area are granitoids with some basic to intermediate dykes. Separate granitic outcrops are sporadically distributed over the general slope of the study area and towards the entrance of Wadi Hargos (Shendi, 1992).

2.2. Wadi Rahaba (Fig. 2) lies in the south of St. Catherine as a part of Wadi Nasb Basin. It is filled with alluvial deposits of gravelled and coarse sandy soil surface. The plain is surrounded by granitic hills. Nasb Basin starts from south of St. Catherine and runs eastward to Dahab city on the Gulf of Aqaba. This basin includes Wadi El-Asbaiya, Wadi Rasis, Wadi Talat El-Ghofra, Wadi Rahaba, Wadi Nasb and Wadi Zahara. The nature of soil surface starts rocky (about: 80% coarse sand and gravel, 20% cobbles). At the end of the basin, the soil surface is covered mainly by fine and coarse sand (Abd El-Wahab, 2003).

2.3. Wadi Sahab (Fig. 2) lies at about 40 km to the west of St. Catherine area, and 15 km of Feiran Oasis. It is a tributary of Wadi Feiran. Wadi Sahab is relatively flat and broad, on its bed there are no big boulders as those found in steep wadis. On the surface there are little stones. The soil may be considered to be sandy soil because sand constitutes the greatest part of soil at all depths (El-Naggar, 1991).

3. Climate

According to UNEP (1992), arid and semiarid environments occupy about 37% of the land on earth. Sixty four percent of the global dry lands and 97% of hyper arid desert are concentrated in Africa and Asia. South Sinai is characterized by an arid to extremely arid climate (Danin, 1986). Available meteorological data (rainfall, temperature, relative humidity, wind speed, and evaporation) of number of stations in South Sinai mainly collected from the Meteorological Authority, Water Research Centre, El-Tur Meteorological Station, and Saint Catherine Research Centre are summarized in Table (1).

Table 1. Available meteorological data of some stations in South Sinai, Egypt, compiled from different sources.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
St. Catherine 1979-1992 *												
Rainfall (mm)	5..9	1.9	6	0.5	0.4	0.0	0.0	0.1	0.0	0.7	0.9	2.7
Rel. Humidity (%)	49.8	43.3	39.4	28.6	24.9	27.2	28.8	30.1	28.1	31.9	34.2	42.7
M. Max. Temp. (°C)	14.3	15.1	17.7	24.4	28.3	30.8	31.8	28.7	27.7	26.1	20	16.3
M. Min. Temp. (°C)	1.4	1.4	4.6	9.0	12.5	16.3	17.5	16.2	13.6	11.5	6.8	4.3
Average Temp. (°C)	7.9	8.3	11.2	16.7	20.4	23.5	25	22.5	21	18.8	13.4	10.3
Evap. mm/day	5.7	7.2	9.3	12.6	15.2	17.7	16.2	13.7	11.7	10.4	7.2	6.1
El-Tur 1998-2002 **												
Wind speed (km/h)	11.2	12.1	12	14.6	14.5	17.2	14.6	15.8	15.3	12.4	9.8	9.8
Rel. Humidity (%)	42.7	46	48	51.8	62.9	66.5	67.4	67.1	65.6	65	57.7	47.1
M. Max. Temp. (°C)	19.4	21.2	24.3	26.9	29.7	30.6	33.3	33.4	31.8	28.8	25.5	22.6
M. Min. Temp. (°C)	11.5	12.8	15.4	18.5	22.1	23.9	26.2	26.9	26	22.3	15.5	12.5
Average Temp. (°C)	15.4	17	19.8	22.7	25.9	27.3	29.8	30.2	29	26	20.5	17.6

Evap. = evaporation, M. = mean, Max. = maximum, Min. = minimum, Rel. = relative, Temp = temperature - * Abd El-Wahab (2003) ** El-Tur Meteorological Station

3.1 Temperature

Due to the wide range of altitude, South Sinai is characterized by a wide range of variation in air temperature. The lowest monthly mean minimum temperature ranges between 1.4°C at St. Catherine and 15.8°C at Sharm El-Sheikh, while the highest monthly mean maximum temperature varies between 30.8 and 35.8°C. St. Catherine is the coolest area in Sinai and Egypt as a whole due to its high elevation (1500-2641m asl). The low elevation wadis are warmer. Climatic data clarify the aridity situation of the study area and give an obvious note about climatic changes in St. Catherine and El-Tur areas.

3.2. Relative humidity and Evaporation

In St. Catherine area, the relative humidity (Table 1) ranges between 24.9% in May and 49.8% in January. The evaporation there is greater during summer than winter, with maximum of 17.7 mm in June and minimum of 5.7 mm in January.

3.3. Precipitation

Most of the precipitation in South Sinai occurs during winter and spring. Considerable precipitation occurs as a result of convective rains that are very local in extent and irregular in occurrence. Precipitation may occur as snow on the high peaks of South Sinai Mountains. The mean annual rainfall is 42.59 mm at Saint Catherine. The annual rainfall of Saint Catherine decreased from 60.4 mm in 1930's to 42.6 mm in 1990's (Abd El-Wahab, 2003). Rainfall in South Sinai is characterized by extreme variability in both time and space. The rainfall data in the historical past and recently revealed the occurrence of climatic cycles manifested by periods of rainy years alternating with droughty ones, with a general trend toward more aridity (Fig. 3). The spatial variability is extent in that one locality may have amount of rainfall that resulted in floods, and at the same time there is no rainfall in another locality a few kilometres distant. Rainfall data recorded from two different stations at St. Catherine demonstrates this variability. The first station (1550m above sea level) recorded 72.6 and 119 mm for the years 1993 and 1994 respectively, while the other station (1350m above sea level) recorded 47.2, and 48.1 mm for those years respectively (Abd El-Wahab, 2003).

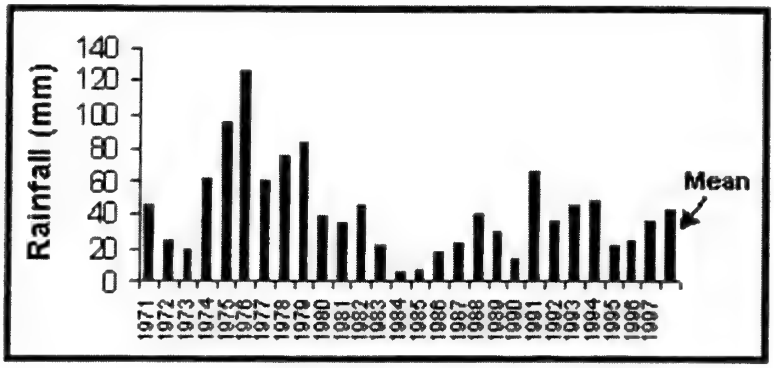

Fig. 3. Annual rainfall of St. Catherine (1971-1997).
Mean annual rainfall was 42.59 mm.

4. Vegetation and Flora

The Sinai Peninsula has the geographical importance of being the meeting place of Africa and Asia. Therefore, its flora combines elements from these two continents, Sahara-Arabian, Irano-Turanua, Mediterranean and Sudanian elements (McGinnies *et al.*, 1968; Zohary, 1973; and Moustafa, 1990). In general, the vegetation is characterized by sparseness of plant cover of semi shrubs, restricted to wadis or growing on slopes of rocky hills and in sand fields and paucity of trees (Danin, 1986). However the lower altitudes support vegetation only in wadis, while that of the upper altitudes have a diffuse pattern (Danin, 1978). The vegetation of St. Catherine area is characterized by the dominance of four families: Compositae, Labiatae, Leguminosae, and Cruciferae (Moustafa, 1990).

B. Western Mediterranean Coastal Desert (WMCD)

1. Location and Geography

The second study area was the Western Mediterranean Coastal Desert. Scorpions were collected from Bahig village near Burg El-Arab city which belongs to Alexandria Governorate (Fig. 1). It is bordered from the east by Alexandria city and from the west by El-Hammam city. The Mediterranean Sea coast represents the northern border of the study area. The WMCD is a distinct northern part of the Western Desert. This desert extends from Alexandria westward about 600 km to Sallum and varies in width from 15 to 30 km in the eastern and central sections to a few kilometres in the west, south of the cliffs at Sallum. Various names applied to this region such as Marmarica (Hassib, 1951), Mareotis District (Kassas, 1955), Western Mediterranean Coastal Region (Täckholm, 1956), and Qattara littoral (Meigs, 1966). This coastal desert differs from the Sinai littoral in the fact that it is calcareous rather than siliceous, it has a higher rainfall and relative humidity, low wind speed and temperature as well as it has the richest flora in Egypt other than that of the Gebel Elba area (Tadros, 1953 and MD-MD, 1994).

2. Geology and Geomorphology

At various intervals west of Alexandria, dunes of white oolitic sand form the coastline. Usually paralleling the sandy coast is a series of two valleys containing salt marshes alternating with limestone ridges (Shata, 1955). A few relatively short wadis drain the annual runoff from the coastal desert. During heavy rains, they become torrents carrying large quantities of soil into the sea. With the introduction of irrigation water via canals from the Nile Delta, the coastal area as far west as El-Hammam is rapidly being changed. The most remarkable feature in the study area is the presence of a number of alternating ridges and depressions running parallel to the coast in the east-west direction. These ridges are formed from limestone with a hard crystallized crust and vary in altitude and lithological features according to the geological age (Ayyad, 1993)

3. Climate

3.1. Temperature and relative humidity

According to Tornwhite climatic classification methodology the WMCD region is classified as a semi-arid area. The annual mean temperature is 19.3°C and the annual mean relative humidity is 63.4%. Available meteorological data (rainfall, temperature, relative humidity, wind speed, and evaporation) of Alexandria Governorate, mainly collected from El-Dabaa Meteorological Station and Alexandria-Nouzha Meteorological Station, are summarized in Table (2).

3.2. Precipitation

The annual rainfall of Alexandria is 109 mm (Table 2). The WMCD from Sallum to the Nile Delta receives an average winter rainfall of 70-200 mm each year. The amount of rainfall decreases to about 80 mm at Port Said and to about half that of Alexandria at El-Arish in northern Sinai (Migahid et *al*., 1955). A considerable amount of dew is precipitated on the WMCD during the rainless part of the year and is reported to be of significance to shallow rooted plants (Migahid & Ayyad, 1959).

Table 2: Available Meteorological data of Alexandria Governorate and WMCD, Egypt, compiled from different sources.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1982-1994*												
Rainfall (mm)	127	72	57	1.1	12	2	0	16	12	58	168	159
Rel. Humidity (%)	62	60	58	60	59	67	69	71	65	65	68	57
M. Max. Temp. (°C)	18.1	18.9	20.3	22.7	25.5	27.8	29.2	19.9	28.7	27	22.4	19.7
M. Min. Temp. (°C)	8.1	8.4	9.7	11.8	14.5	18.2	20.2	21	19.7	16.8	13.3	10
Average Temp. (°C)	12.7	13.4	15	17.7	20	23.2	25	25.4	24.2	21.8	18.2	14.6
Wind Speed (km/h)	11.9	11.2	11.5	10.7	9.3	10	9.9	9	8.6	8.2	9.4	11.1
1998-2002**												
Wind speed (km/h)	6.8	7.9	8.6	8.1	8.5	9.7	9.3	9.1	7.9	7.5	6.6	7.1
Rel. Humidity (%)	65.7	61.4	61.1	61.5	69.5	75.5	75.7	75.8	71.9	69	68.6	56.2
M. Max. Temp. (°C)	17.5	21	21.9	24	25.8	27.6	30.5	31.7	30.6	31.8	24.4	20.5
M. Min. Temp. (°C)	9.1	9.4	10.9	13.8	17.5	21.5	23.5	24	22.1	18.4	14.4	10.6
Average Temp. (°C)	13.3	14.6	16.3	18.9	21.5	24.5	27.2	28	27	24	19.6	15.7

M. = mean, Max. = maximum, Min. = minimum, Rel. = relative, Temp = temperature
* El-Dabaa Meteorological Station (MD-MD, 1994) ** Alexandria-Nouzha Meteorological Station

3.3. Wind

The annual mean wind speed is about 12.6 km/hr (Table 2). Wind velocity is greater on the coast than inland; especially in winter (Migahid *et al*., 1955) along with salt spray, which is a major limiting factor suppressing development of vegetation on exposed ridges and cliffs near the seacoast.

4. Vegetation and Flora

The four phytogeographical zones of WMCD have been defined by Kassas (1955) as follows: (1) Littoral oolitic sand dunes, (2) Sublittoral and inland oolitic limestone ridges 3 km apart, (3) Salt marsh between the two rocky ridges, and (4) Inland plains. Grazing and cutting for fuel have completely removed the vegetation from extensive areas around towns and villages and affected it elsewhere. In areas developed to agriculture, native plants have been reduced to a few species (Boulos, 2002).

Material and Methods

The present work has been designed to investigate the intraspecific diversity of the morphological characters of *Scorpio maurus palmatus* (Ehrenberg, 1828) in Egypt. This scorpion species was chosen for the following reasons: (1) it is distributed in both arid and semiarid habitats, (2) it lives alone and not in communities inside burrows along its life cycle, and (3) the unique structure of its venom as well as its pharmacological properties. The scorpions were collected from two different geographical locations in Egypt. The first was the southern region of Sinai Peninsula, which represents the arid area and the second area that represents the semiarid area, was the western Mediterranean coastal desert (WMCD).

Samples collecting: Scorpions were collected from the study areas, i.e. WMCD, Wadi. Sahab, Wadi El-Agramia and Wadi Rahaba, during August-September, 2001. They were collected during daytime by observing, surveying and locating the location of their burrows followed by excavation of the inhabitants (Williams, 1968a). The captive scorpions were kept alive in separate suitable plastic containers, in order to avoid cannibalism. At the same time, the depths of the scorpion's burrows were measured and their different shapes and designs were also drawn. The scorpion specimens' species from all sites were identified according to the key of El-Hennawy (1987). Random soil samples were taken from all sites for physical and chemical analysis. In addition, the available plants and insects around the scorpion's burrows were collected and identified in Faculty of Science, Suez Canal University, Ismailia, Egypt.

Preservation of scorpion samples: For taxonomic and morphological studies, scorpions were treated according to Williams (1968b), as follows:

1. Killing: Heat shock is accomplished by dropping living specimens into hot water (90-99°C) until the metasoma straightens out.
2. Fixation: Immediately after killing, specimens were rinsed and left for 12-48 hours in the following fixative: a. Formalin, commercial strength: 12 parts, b. Isopropyl alcohol 99%: 30 parts, c. Glacial acetic acid: 2 parts, d. Distilled water: 56 parts.
3. Permanent storage: Specimens were rinsed in 50% isopropyl alcohol for an hour and transferred to 70% isopropyl alcohol for permanent storage in a dark place to avoid fading.

Morphometric measurements of scorpions

Ten adult individuals of each sex were collected from each location (WMCD, Wadi Sahab, Wadi El-Agramia. and Wadi Rahaba) for morphological analysis. Maturity was determined by body size and secondary sexual characteristics. In males, the length of the genital papillae was the primary indicator of maturity; sexually mature males manifested a pronounced papilla compared with immature (Polis & Farley, 1979). For females, the smallest gravid individual offspring in each population was used as a crude measure of maturity; all larger females were considered mature.

We analyzed 10 meristic (countable) and 29 continuous characters. The following meristic characters were measured: number of pectinal teeth (right and left), denticles of the sixth row on the fixed pedipalp finger (right and left), sixth row denticles of the movable pedipalp finger (right and left), number of setae on the first and second right legs, and the third leg (right and left). The continuous measured characters were: total body length, carapace length, pedipalp length (from base to the tip of the fixed finger), pedipalp hand (length and width), fourth right leg femur length, mesosoma length, metasoma length, metasomal segments from 1-5 (length, width and height), telson (length and width), pectinal teeth length (right and left), and marginal lamellae length of pecten (right and left). Scorpion mensuration was standardized by Stahnke (1970), and the continuous measurements were taken with a vernier calliper of 0.05 mm accuracy and eye piece micrometer (1/100 mm graduation). All measurements are in millimetres.

Analysis of the environmental factors: In an attempt to reveal a relationship between environmental factors and diversity of scorpions morphology, the following measurements were taken. Surface soil samples (0-30cm depth) were collected from the four locations in tightly plastic containers (5 replicas from each site) and transferred to the laboratory. Soil samples were air-dried, thoroughly mixed and sieved through a 2 mm sieve to exclude large particles that are less reactive (Robertson *et al.*, 1999).

Physical analysis of soil

1. Grain size analysis: The air-dried samples were disaggregated by hand and then split using a cone and quarter technique. About 50 grams of the prepared samples were taken for mechanical analysis using standard sets of sieves. All samples were shacked in Ro-Shaker for 15 minutes. The collected sieve fractions were accurately weighed and grain-size parameters were statistically calculated (Folk, 1974).

2. Total moisture content: The actual moisture content of the soil fluctuates depending upon the composition of the soil, topographic location, and climatic variation. A soil sample is weighed in a tarred aluminium container, placed in an oven, and dried at 105°C. Then the sample is reweighed, and the content of moisture is expressed as percentage of the oven dry weight (Wilde *et al.*, 1972).

Chemical analysis of soil

1. Soil pH is a measure of hydrogen ion activity in the soil solution. Soil pH is probably the single most informative measurement that can be made to determine soil characteristics. It can be used to make a rough estimate of availability of some essential nutrients (Thomas, 1996). Soil pH was measured electrometrically, using pH meter model HI 8014 Hanna Ins. Italy, in soil suspension of ratio 1 : 5 soil to water. The soil-water mixture was first shaken for 2 hours then pH was measured (Jackson, 1974).

2. Electrical Conductivity and Total Dissolved Salts

Electrical conductivity (EC) is a numerical expression of the ability of an aqueous solution to carry an electric current. It is generally related to the total solute concentration and can be used as a quantitative expression of dissolved salt concentration (Rhoades, 1996). Soil EC was measured in soil water extract 1 : 5 using conductivity meter model HI 8033 Hanna Ins. Estimation of total dissolved salts (TDS) in (mg/L) was calculated by multiplying values of EC obtained by 640 (Westerman, 1990).

3. Soil Organic Matter (SOM)

Soil organic matter influences many soil properties, including (i) the capacity of soil to supply nitrogen, phosphorus, and trace metals to plants, (ii) infiltration and retention of water, (iii) degree of aggregation and overall structure that affect air and water relationships, (iv) cation exchange capacity, (v) soil colour. SOM was measured using loss-ignition method carried out at high temperature. This method gives quantitative oxidation of organic matter (Nelson & Sommers, 1996).

Data Analysis

Data were statistically analyzed using SPSS software (Statistical Package for Social Science, Version 11.01) (Dancey and Reidy, 2002). Tabulation and graphics of data were done using Microsoft Excel XP. Descriptive statistics analyses including mean, standard error (Zar, 1984) were applied to all the morphometric measurements of scorpions and environmental factors in each locality to have a preliminary description about the status of the morphological characters of the scorpions from the different locations.

1. Variation within population

To explain variation within each population of scorpions (sexual dimorphism), comparison between all the morphological characters of males and females in each location was done. Student's unpaired *t*-test was used to reveal this hypothesis.

2. Variation among populations

One-way ANOVA was carried out to test this hypothesis for all morphological characters (variables) of scorpions. ANOVA was applied to find out if there is a significant difference between males from different sites (site is a covariate) and between females from separate sites as well. In addition, One-way ANOVA was used to test variation in the environmental factors between different sites. Duncan's multiple range post ANOVA test, was carried out to determine which means differ within different areas for those variables showing significant F ratio. Two-way factorial ANOVA design using General Linear Model (GLM) was used to examine the effect of site as a covariant and sex as the other covariant in the diversity of scorpion's morphology.

3. Association between morphological characters and environmental factors

Linear correlation coefficient (r) also called Pearson product moment correlation coefficient was applied to find out the relationship between morphometric measurements (meristic and continuous) of scorpions and environmental factors.

4. Canonical Discriminant Functions Analysis (DFA)

Discriminant Functions Analysis (DFA), a multivariate technique, allows input of several variables to investigate the morphometric relationship among several populations. It maximizes among-group distances while shrinking within-group dispersion to resolve patterns among groups (Albrecht, 1980 and Reyment *et al.*, 1984).

5. Similarities in the morphometric measurements between scorpion populations

Hierarchical cluster analysis was carried out to measure the similarity distance in the morphometric measurements among scorpion populations.

Results

Habitat Characteristics

Nature of soil

Results in Table (3) illustrate physical and chemical properties of soil samples collected from the study areas (WMCD, Wadi Sahab, Wadi El-Agramia and Wadi Rahaba). Statistical analysis of various soil parameters revealed high significant difference between localities. Soil physical properties: moisture, cobble sand, pepple sand and very fine sand showed high values of *F* ratio with high significance between different localities. The same results were observed in the soil chemical properties; total dissolved salts and electrical conductivity (Table 3).

Generally, soil of the study areas Wadi Sahab, Wadi El-Agramia and Wadi Rahaba were light or yellowish brown in colour, sandy, characterized by low content of silt and clay, alkaline (pH 7.4-8.1), non-saline to slightly saline (EC 0.08-0.11), low content of soil organic matter (SOM 0.4-0.66%) and low content of soil moisture (Moisture 0.47-0.53%). On the other hand, soil from WMCD was yellowish brown or dark brown and it has high contents of soil organic matter, soil moisture, total dissolved salts, silt and clay when compared with those from South Sinai.

Scorpions' burrows

Burrows of *S. m. palmatus* have different structures (Fig. 4). Maximum scorpion burrow depth was recorded in Wadi Sahab (88±6.6 cm) while the minimum depth was recorded in WMCD (12±1.2). There was a significant difference in the depth of scorpions burrows between sites (P<0.01) (Table 3).

Table 3: Descriptive and statistical analysis of chemical and physical properties of soil samples from the different study locations.

Variables (n = 5)		WMCD	South Sinai			ANOVA
			Sahab	El-Agramia	Rahaba	$F_{1,3}$
Soil pH		6.9 ± 0.032[a]	7.4 ± 0.2	8.1 ± 0.06	8.1 ± 0.04	21*
Total dissolved salts (mg/l)		4.6 ± 0.19	0.06 ± 0.01	0.08 ± 0.01	0.05 ± 0.03	520*
Electrical conductivity (u-mohs)		7 ± 0.01	0.09 ± 0.05	0.11 ± 0.02	0.08 ± 0.06	660*
Total organic matter (%)		1.2 ± 0.019	0.4 ± 0.03	0.66 ± 0.01	0.53 ± 0.02	30.1*
Soil Moisture (%)		4.4 ± 0.7	0.47 ± 0.07	0.5 ± 0.07	0.53 ± 0.02	194*
Soil Texture						
Sand (%)	**Cobble (%)**	12.3 ± 0.18	8.5 ± 0.18	14.1± 0.23	4.2 ± 0.13	480*
	Pepple (%)	6.8 ± 0.85	24.4 ± 0.16	22.4 ± 0.24	13 ± 0.07	333*
	Very coarse (%)	8.2 ± 0.5	27.4 ± 0.22	21.5 ± 1.4	20.1 ± 0.15	99.2*
	Coarse (%)	14.6 ± 0.8	19.6 ± 0.25	11.5 ± 0.31	22.8 ± 0.14	105*
	Medium sand (%)	17.1 ± 1.02	11.1 ± 0.15	10.5 ± 0.28	18.1 ± 0.13	37.3*
	Fine sand (%)	22.1 ± 2.4	4.8 ± 0.1	8.1 ± 0.38	10.6 ± 0.14	37.4*
	Very fine sand (%)	11.3 ± 0.18	1.34 ± 0.06	4.6 ± 0.19	4.7 ± 0.09	810*
Silt (%)		3.7 ± 0.8	0.78 ± 0.04	2.2 ± 0.2	1.9 ± 0.06	7.2*
Clay (%)		2.6 ± 0.6	1.2 ± 0.14	6.1 ± 0.11	4.3 ± 0.39	24.8*
Burrow depth (cm / n=20)		12.0 ± 1.2	88.0 ± 6.6	35.0 ± 5.4	26.0 ± 3.6	49.5*

* = ***F*** ratio is significant at P<0.01 a = Mean ± Standard error

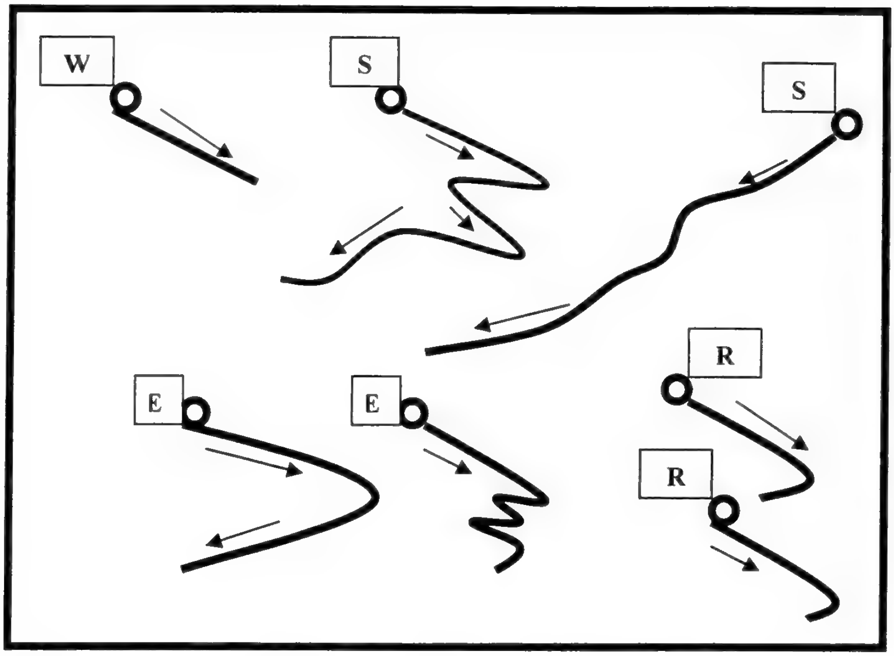

Fig. 4. Variation in the burrow shapes of the scorpion *Scorpio maurus palmatus.* Circles represent burrow entrances. W = WMCD, E = El-Agramia, R = Rahaba, S = Sahab.

Collected insects and plants: Available insects and plants around the scorpions' burrows were collected. Variation in insects populations and plants species among study areas was also found. The identified insects from the WMCD were *Eleodes* sp. and *Phytomiger* sp. (Order Coleoptera), whereas *Adesmia* sp., (Order Coleoptera) was collected from the other locations (Wadi Sahab, Wadi El-Agramia and Wadi Rahaba). Collected plants from WMCD were *Atriplex* sp. and *Mesembryanthemum* sp. while *Ochradenus baccatus* and *Anabasis articulata* were gathered from Wadi Sahab. *A. articulata* was collected from Wadi El-Agramia, and *Zilla spinosa*, *A. articulata* and *Fagonia mollis* were collected from Wadi Rahaba.

Morphological analysis of the scorpion *S. m. palmatus*

Colouration: Generally, colouration of *S. m. palmatus* showed different grades of the yellow colour, where the body was light olive to yellow, legs lighter, fingers and fifth segment of metasoma with telson partially darker, and legs with a dark spot at base of femur. Colour of scorpions that were collected from South Sinai area was slightly different from that collected from WMCD. The fingers and fifth segment of metasoma in WMCD population was lighter than that of South Sinai populations.

Morphometric measurements

Variation within population

Scorpion morphometric measurements (continuous and meristic) are summarized in Tables (4, 5). At first, there was a difference in the sex ratio relative abundance between males and females in all locations (Table 4). It was noticed that in El-Agramia, most of the morphometric measurements revealed significant differences between males and females. These variables are total body length, carapace length, mesosoma length, pedipalp length, pedipalp hand length, 4th leg femur length, 2nd metasomal segment length and width, 3rd metasomal segment length, telson length, number of right and left pectinal teeth, number of 1st, 2nd and 3rd right leg setae. On the other hand, number of pectinal

Table 4: Descriptive and statistical analysis of the continuous morphometric measurements of the scorpion *S. m. palmatus* collected from different studied locations.

Character		WMCD		South Sinai					
				W. Sahab		W. El-Agramia		W. Rahaba	
		♂	♀	♂	♀	♂	♀	♂	♀
Sex ratio		1	2.5	1	3.6	1	2.8	1	3.1
Total body L		52.7 ^{a}± 1.2	52.5 ± 1.8	48 ± 1.8	50 ± 1.1	39.7 ± 0.76	43.1* ± 0.6	42.3 ± 1.1	43 ± 1.2
Carapace L		8.1 ± 0.2	8.2 ± 0.2	7.4 ± 0.2	7.7 ± 0.1	6.1 ± 0.1	6.6* ± 0.11	6.4 ± 0.14	6.7 ± 0.2
Pedipalp L		28.1 ± 0.5	28.9 ± 0.7	24 ± 1	26 ± 0.6	20.1 ± 0.5	22.2* ± 0.7	22.4 ± 0.3	23.4 ± 0.5
Pedipalp hand	**L**	13.6 ± 0.32	14.4 ± 0.4	12 ± 0.7	12 ± 0.25	8.9 ± 0.27	10.4* ± 0.36	10.9 ± 0.30	11.7 ± 0.33
	W	7.5 ± 0.22	7.6 ± 0.28	5.9 ± 0.33	6.2 ± 0.21	4.7 ± 0.21	5.2 ± 0.11	5.3 ± 0.21	5.0 ± 0.15
4th Leg femur L		7 ± 0.2	7.2 ± 0.31	7.3 ± 0.25	7.5 ± 0.16	6.1 ± 0.2	6.7* ± 0.19	6.4 ± 0.13	6.7 ± 0.10
Mesosoma L		16.3 ± 0.42	17.3 ± 0.7	15 ± 0.5	16 ± 0.5	12.1 ± 0.5	13.9* ± 0.3	13.6 ± 0.6	14.4 ± 0.6
Metasoma L		28.2 ± 0.7	27 ± 0.7	25 ± 1.1	26 ± 0.5	21.3 ± 0.62	22.4 ± 0.3	22.3 ± 0.34	21.8 ± 0.6
1st metasomal segment	**L**	3.2 ± 0.1	3.1 ± 0.08	2.8 ± 0.2	2.7 ± 0.1	2.4 ± 0.08	2.4 ± 0.06	2.5 ± 0.07	2.3* ± 0.06
	W	4.2 ± 0.12	4.1 ± 0.1	3.3 ± 0.15	3.3 ± 0.08	2.8 ± 0.06	3.0 ± 0.13	3.0 ± 0.06	2.7* ± 0.12
	H	2.9 ± 0.06	2.9 ± 0.09	2.3 ± 0.07	2.5* ± 0.06	2.1 ± 0.04	2.1 ± 0.05	2.2 ± 0.10	2.1 ± 0.09
2nd metasomal segment	**L**	3.6 ± 0.13	3.4 ± 0.12	3.1 ± 0.16	3.1 ± 0.09	2.6 ± 0.1	2.8* ± 0.06	2.7 ± 0.09	2.7 ± 0.14
	W	3.9 ± 0.10	3.8 ± 0.12	3.1 ± 0.15	3 ± 0.04	2.5 ± 0.05	2.8* ± 0.07	2.6 ± 0.06	2.3 ± 0.1
	H	2.8 ± 0.05	2.7 ± 0.1	2.1 ± 0.08	2.3 ± 0.07	1.9 ± 0.07	1.9 ± 0.07	2.1 ± 0.12	2.01 ± 0.10
3rd metasomal segment	**L**	4.0 ± 0.11	3.8 ± 0.09	3.6 ± 0.14	3.6 ± 0.08	2.9 ± 0.1	3.1* ± 0.05	3.1 ± 0.06	3.0 ± 0.11
	W	3.6 ± 0.1	3.5 ± 0.1	2.7 ± 0.14	2.8 ± 0.08	2.3 ± 0.07	2.5 ± 0.07	2.3 ± 0.07	2.4 ± 0.12
	H	2.6 ± 0.06	2.5 ± 0.06	2.2 ± 0.11	2.2 ± 0.01	1.8 ± 0.09	1.8 ± 0.05	2.0 ± 0.1	1.8 ± 0.06
4th metasomal segment	**L**	4.7^a ± 0.14	4.6 ± 0.11	4.4 ± 0.19	4.4 ± 0.11	3.6 ± 0.09	3.7 ± 0.07	3.7 ± 0.05	3.7 ± 0.12
	W	3.2 ± 0.1	3.1 ± 0.10	2.5 ± 0.11	2.5 ± 0.07	2.2 ± 0.08	2.2 ± 0.11	2.2 ± 0.06	2.0 ± 0.06
	H	2.4 ± 0.05	2.3 ± 0.05	2.0 ± 0.11	1.9 ± 0.03	1.6 ± 0.04	1.7 ± 0.04	1.9 ± 0.08	1.7 ± 0.11
5th metasomal segment	**L**	6.2 ± 0.2	5.8*±0.24	5.8 ± 0.25	6.0 ± 0.12	5.1 ± 0.15	5.2 ± 0.12	5.2 ± 0.09	5.2 ± 0.17
	W	2.4 ± 0.07	2.2 ± 0.08	1.9 ± 0.08	2.1 ± 0.04	1.7 ± 0.06	1.8 ± 0.06	1.8 ± 0.06	1.7 ± 0.07
	H	2.0 ± 0.04	1.9 ± 0.08	1.5 ± 0.09	1.7 ± 0.04	1.4 ± 0.04	1.5 ± 0.03	1.6 ± 0.06	1.4 ± 0.03
Telson	**L**	6.3 ± 0.14	6.1 ± 0.16	5.4 ± 0.28	5.9 ± 0.13	4.7 ± 0.16	5.0 * ± 0.06	4.8 ± 0.08	4.7 ± 0.2
	W	2.5 ± 0.09	2.3 ± 0.11	2.0 ± 0.1	2.0 ± 0.09	1.8 ± 0.06	1.8 ± 0.06	1.7 ± 0.09	1.9 ± 0.06
Marginal Lamellae L of Pecten	**R**	4.7 ± 0.16	4.4 ± 0.14	3.9 ± 0.17	3.7 ± 0.13	3.3 ± 0.12	3.4 ± 0.06	3.6 ± 0.08	3.4 ± 0.09
	F	4.8 ± 0.13	4.3 ± 0.16	3.8 ± 0.16	3.7 ± 0.13	3.3 ± 0.09	3.4 ± 0.06	3.6 ± 0.09	3.4 ± 0.08
Pectinal teeth length	**R**	0.75 ± 0.02	0.6 ± 0.03	0.6 ± 0.02	0.6 ± 0.03	0.57 ± 0.03	0.54 ± 0.02	0.59 ± 0.01	0.52 ± 0.03
	F	0.7 ± 0.02	0.65 ± 0.01	0.6 ± 0.02	0.5 ± 0.01	0.56 ± 0.02	0.51 ± 0.02	0.59 ± 0.01	0.5 ± 0.02

a = Mean ± SE (n=10), * = Significant difference using Student's unpaired *t*-test ($p<0.05$),
L = length , W = width, H = height, R= Right, F = left.

Variation among populations

Tables 6 and 7 summarize the continuous and meristic morphometric measurements of the scorpion *S. m. palmatus* collected from different locations. One–way ANOVA for males from all locations revealed highly significant difference in all continuous characters and some meristic characters. The meristic characters that did not reveal significant difference were the number of denticles of 6th row on fixed and movable fingers of right and left pedipalps. The same result was obtained for females but the meristic characters that did not show significant differences were the number of denticles of 6th row on only left fixed and movable fingers of pedipalp.

Table 5: Descriptive and statistical analysis of the meristic (countable) characters of the scorpion *S. m. palmatus* collected from the four different studied locations.

Character		WMCD		South Sinai					
				Sahab		El-Agramia		Rahaba	
		♂	♀	♂	♀	♂	♀	♂	♀
No. of pectinal teeth	R	10.9[a] ± 0.23	10* ± 0.14	10 ± 0.33	9.8 ± 0.29	10.3 ± 0.15	9.3* ± 0.3	9.8 ± 0.2	8.9* ± 0.23
	F	10.7 ± 0.42	10.1 ± 0.27	10.4 ± 0.16	9.7* ± 0.21	10.2 ± 0.2	9.3* ± 0.33	10 ± 0.14	8.8* ± 0.24
No. of Setae on leg	1st R	16.7 ± 0.47	15.7 ± 0.36	16.7 ± 0.47	17.2 ± 0.44	16.7 ± 0.47	15* ± 0.47	18.4 ± 0.45	18.3 ± 0.21
	2nd R	18.3 ± 0.42	18.5 ± 0.40	18.6 ± 0.56	19.3 ± 0.63	17.6 ± 0.26	16.7* ± 0.44	20.1 ± 0.37	20.2 ± 0.46
	3rd R	19.9 ± 0.37	18.8 ± 0.57	21.9 ± 0.51	21.5 ± 0.47	17.8 ± 0.44	19.4* ± 0.63	21.5 ± 0.52	21.9 ± 0.37
	3rd F	20.2 ± 0.53	19 ± 0.51	22.7 ± 0.33	22.2 ± 0.44	18.9 ± 0.43	19.5 ± 0.58	21.6 ± 0.70	22.5 ± 0.5
No. of denticles of 6th row on pedipalp's fingers									
fixed	R	7.0 ± 0.29	6.7 ± 0.21	7.3 ± 0.26	8.4* ± 0.4	7.6 ± 0.45	7.8 ± 0.44	8.1 ± 0.54	8.1 ± 0.34
	F	7.3 ± 0.36	6.7 ± 0.26	7.7 ± 0.39	8.3 ± 0.49	7.5 ± 0.42	7.9 ± 0.5	8.3 ± 0.3	7.9 ± 0.37
movable	R	3.6 ± 0.22	3.3 ± 0.15	3.3 ± 0.15	4.0 ± 0.21	3.0 ± 0	3.3 ± 0.15	3.4 ± 0.16	3.6 ± 0.16
	F	3.5 ± 0.16	3.3 ± 0.21	3.2 ± 0.13	3.4 ± 0.22	3.3 ± 0.15	3.1 ± 0.17	3.3 ± 0.15	3.6 ± 0.16

a = Mean ± SE (n=10), * = Significant difference using Student's unpaired *t*-test ($p<0.05$) R = right, F = left

Table 6: The statistical output of the continuous morphometric measurements of the scorpion *S. m. palmatus* collected from the four different studied locations.

Character			Males from all locations	Females from all locations
			ANOVA $F_{1,3}$	ANOVA $F_{1,3}$
Total body L			19.7**	15.1**
Carapace L			24.8**	17.2**
Pedipalp L			23.7**	19.7**
Pedipalp hand		L	19.6**	22.8**
		W	26.3**	35.2**
4th Leg femur L			7.2**	3.50*
Metasomal segment	1st	L	13.5**	18.8**
		W	33.5**	29.8**
		H	24.6**	22.6**
	2nd	L	12.8**	10.2**
		W	38.2**	43.3**
		H	19.6**	10.0**
	3rd	L	18.4**	20.3**
		W	30.5**	24.3**
		H	12.7**	38.4**
	4th	L	14.9**	14.7**
		W	28.5**	26.9**
		H	16.9**	18.0**
	5th	L	7.9**	5.80*
		W	17.3**	13.8**
		H	16.6**	15.2**
Telson		L	17.7**	19.4**
		W	13.4**	5.50*
Marginal Lamellae L of Pecten		R	17.2**	15.1**
		F	24.9**	14.1**
Pectinal teeth length		R	11.9**	4.01**
		F	11.7**	8.1**

* = *F* ratio is significant at $P<0.05$, ** = *F* ratio is significant at $P<0.01$, L = length, W = width, H = height.

Table 7: The statistical output of the meristic (countable) characters of the scorpion *S. m. palmatus* collected from the four different studied locations.

Character			Males from all locations ANOVA $F_{1,3}$	Females from all locations ANOVA $F_{1,3}$
No. of pectinal teeth	R		4.01*	3.9*
	F		1.30	4.16*
No. of Setae on leg	1st R		3.50*	14.7*
	2nd R		6.2*	8.4*
	3rd R		6.2**	8.4**
	3rd F		15.6**	12.4**
No. of denticles of 6th row on pedipalp's fingers	fixed finger	R	1.33	4.2*
		F	1.32	2.7
	movable finger	R	2.52	3.7*
		F	0.69	1.13

* = *F* ratio is significant at the 0.05 level. ** = *F* ratio is significant at P< 0.01 level. R = right, F = left.

Variables showing significant *F* ratio were supported with Duncan's multiply range test to determine which means differ within different areas. Means that do not differ from one another are displayed in separate column or subset. In males (Table 8), total body length, pedipalp length, and number of 3rd left and right legs setae revealed a remarkable significant difference between locations (P<0.01). While in females, pedipalp length and pedipalp hand length (Table 9B) showed this remarkable significant difference (P<0.01).

Table 8 (A, B): Output of Duncan's multiply range test, showing variation in the morphometric measurements between males of *S. m. palmatus* collected from the four different studied locations. Means for groups in homogeneous subsets are displayed.

(A)	N	Total Body Length (mm)			Pedipalp Length (mm)			
		Subset for alpha = .05						
		1	2	3	1	2	3	4
El-Agramia	10	39.7700			20.1800			
Rahaba	10	42.3100				22.4300		
Sahab	10		47.9900				24.6200	
WMCD	10			52.7300				28.1600
Sig.		0.179	1.000	1.000	1.000	1.000	1.000	1.000

(B)	N	No. of the 3rd left leg setae			No. of the 3rd right leg setae		
		Subset for alpha = .05					
		1	2	3	1	2	3
El-Agramia	10	18.9000			17.8000		
WMCD	10	20.2000	20.2000			19.9000	
Rahaba	10		21.6000	21.6000			21.5000
Sahab	10			22.7000			21.9000
Sig.		0.085	0.065	0.143	1.000	1.000	0.552

The two-way factorial ANOVA model (Site + Sex) for the scorpion morphometric measurements (Table 10) revealed a highly significant site effect (P<0.01) in all morphological characters and significant sex effect in the following characters: right and left pectinal teeth length, 4th leg femur length, pedipalp hand length, pedipalp length, mesosoma length and carapace length (P<0.05). The interaction between sex and site revealed a highly significant difference for all morphological characters of *S. m. palmatus* scorpions (P<0.01).

Table 9 (A, B): Output of Duncan's multiply range test, showing variation in the morphometric measurements between females of *S. m. palmatus* collected from the four different studied locations. Means for groups in homogeneous subsets are displayed.

(A)	N	Total Body Length(mm)	
		Subset for alpha = .05	
		1	2
Rahaba	10	43.0300	
Agramia	10	43.1200	
Sahab	10		49.9800
WMCD	10		52.5500
Sig.		0.959	0.152

(B)	N	Pedipalp Length (mm)			Pedipalp hand Length (mm)			
		Subset for alpha = .05						
		1	2	3	1	2	3	4
El-Agramia	10	22.2200			10.4400			
Rahaba	10	23.4000				11.7300		
Sahab	10		26.5400				12.9900	
WMCD	10			28.9800				14.4100
Sig.		1.00	1.00	1.00	1.000	1.000	1.000	1.000

Table 10: The statistical output (2-Way Factorial ANOVA) of the interaction between sex and location of some morphometric measurements of the scorpion *S. m. palmatus* collected from different studied locations using General Linear Model (GLM).

Character		Sex ANOVA (F ratio)	Location ANOVA (F ratio)	Interaction ANOVA (F ratio)
Total body L		2.2	72.0**	793**
Carapace L		5.9*	88.2**	865**
Pedipalp L		6.1*	67.**	609**
Pedipalp hand	L	5.2*	45.1**	358**
	W	0.72	112**	507**
4th Leg femur L		3.8*	13.7**	519**
Mesosoma L		7.1*	32.5**	369.1**
Metasoma L		0.03	77.4**	848**
1st metasomal segment	L	1.1	70.3**	631**
	W	0.24	119**	644**
	H	0.43	80.6**	572**
2nd metasomal segment	L	0.02	55.5**	483**
	W	0.02	159**	725**
	H	0.49	52.7**	451**
3rd metasomal segment	L	0.14	82**	822**
	W	0.74	111**	541**
	H	2.4	78**	606**
4th metasomal segment	L	0.17	69.2**	811**
	W	1.4	123**	656**
	H	0.85	51**	449**
5th metasomal segment	L	0.07	27.8**	604**
	W	1.7	64**	593**
	H	0.01	45.3**	454**
Telson	L	0.55	87**	721**
	W	0.62	38**	347**
Marginal Lamellae L o Pecten	R	1.7	51**	564**
	F	2.6	60**	635**
Pectinal teeth length	R	8.2*	31.4**	477**
	F	10.7*	39.9**	557**

* = *F* ratio is significant at the 0.05 level, ** = *F* ratio is significant at the 0.01 level.
L = length, W = width, H = height, R = right, F = left.

Relationships between morphological characters and environmental factors

As a first step, we conducted a multiple correlation analysis (Pearson product moment correlation), entering all morphometric measurements of scorpions (continuous and meristic) and all environmental variables (altitude, soil physical properties, soil chemical properties and scorpion burrow depth). Because of the very large number of tests carried out, only the most significant of these are presented in Table (11).

Pearson correlation matrix of some morphometric measurements and environmental factors indicated the obvious interaction between them. Total body size and pedipalp length showed a significant negative correlation with a number of environmental factors such as altitude (r = -0.67, -0.67), soil pH (r = -0.73, -0.73), pebbles sand (r = -0.33, -0.4), very coarse sand (r = -0.32, -0.4), clay (r = -0.62, -0.6) and scorpion burrow depth (r = -0.24, -0.36). At the same time, they showed highly significant positive correlation with soil total dissolved salts (r = 0.58, 0.64), soil electrical conductivity (r = 0.59, 0.64), soil moisture (r = 0.51, 0.54) and total organic matter (r = 0.47, 0.52) respectively.

Significant negative correlation was also recognized between number of right and left pectinal teeth and altitude (r = -0.41, -0.40), soil pH (r = -0.28,-0.28) respectively. Number of 1st, 2nd, and 3rd right legs setae and number of 3rd left leg setae were also significantly correlated with altitude (r = 0.35, 0.20, 0.26, 0.28), cobble sand (r = -0.52, -0.63, -0.56, -0.5), coarse sand (r = 0.55, 0.58, 0.63, 0.62) and very fine sand (r = -0.32, -0.29, -0.54, -0.59) respectively.

Table 11: Correlation between environmental factors and some morphometric measurements of the scorpion *S. m. palmatus* collected from different locations using Pearson Correlation.

Environmental factor	TBL	PEDL	NRP	NLP	N1RLS	N2RLS	N3RLS	N3LLS
Altitude (m)	-0.67**	-0.67**	-0.41**	-0.40**	0.35**	0.20*	0.26*	0.28**
pH	-0.73**	-0.73**	-0.28*	-0.28*	0.15	-0.01	0.02	-0.02
Total dissolved salts	0.58**	0.64**	0.37**	0.31**	-0.20*	-0.08	-0.27*	-0.33*
Electrical conductivity (u-mohs)	0.59**	0.64**	0.35*	0.29*	-0.20*	-0.08	-0.27**	-0.33**
Total organic matter (%)	0.47**	0.52**	0.31*	0.30*	-0.27**	-0.19	-0.39**	-0.41**
Moisture (%)	0.51**	0.54**	0.33*	0.30*	-0.17	-0.09	-0.26*	-0.28**
Cobble (%)	0.08	0.02	0.28*	0.22*	-0.50**	-0.60**	-0.56**	-0.50**
Pepple (%)	-0.33**	-0.40**	-0.15	-0.10	-0.07	-0.17	0.10	0.18
Very coarse (%)	-0.32**	-0.40**	-0.25*	-0.17	0.17	0.10	0.37**	0.44**
Coarse (%)	-0.04	0.01	-0.25*	-0.17	0.55**	0.58**	0.63**	0.62**
Medium sand (%)	0.31**	0.44**	0.09	0.06	0.20	0.30**	0.05	-0.03
Fine sand (%)	0.41**	0.50**	0.26*	0.19	-0.12	-0.01	-0.27*	-0.35*
Very fine sand (%)	0.15	0.20	0.24*	0.15	-0.32**	-0.29**	-0.54**	-0.59**
Silt (%)	0.18	0.27*	0.19	0.10	-0.13	-0.09	0.38**	-0.45**
Clay (%)	-0.62**	-0.60**	-0.18	-0.22*	-0.08	-0.24*	-0.36**	-0.36**
Burrow depth (cm)	-0.24*	-0.36**	-0.10	-0.05	-0.12	-0.20	0.07	0.16

* Correlation is significant at P< 0.05 (2-tailed), ** at P< 0.01 (2-tailed). TBL = total body length, PEDL = pedipalp length, NRP = number of right pectinal teeth, NLP = number of left pectinal teeth, N1RLS, N2RLS, N3RLS = number of 1st, 2nd, and 3rd right leg setae, N3LLS = number of 3rd left leg setae

Canonical Discriminant Functions Analysis

A. Males: Canonical Discriminat Functions Analysis (DFA) was used to detect variation in the morphometric measurements among sites. For males (Fig. 5), the four sites were very distinct along the first and the second axes. Along the first axis, WMCD has positive values and Wadi El-Agramia, Wadi Rahaba have negative values with Wadi Sahab being in between. Positive values along this axis were correlated most with total body length, carapace length, pedipalp length, telson width, number of right pectinal teeth, and negative values being associated with mesosoma length, metasoma length and 4th leg femur length. Along the second axis, Wadi Rahaba has positive values and Wadi El-Agramia has negative ones, while WMCD and Wadi Sahab are in between. Positive values along this axis were associated with carapace length, mesosoma length, metasoma length, pedipalp length, number of 2nd right leg setae with negative values of total body length, 4th leg femur length and number of right pectinal teeth.

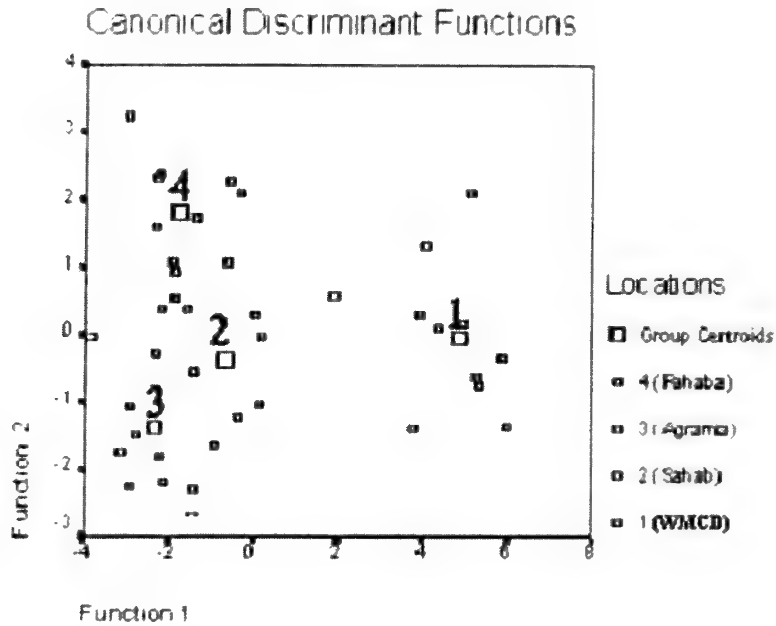

Fig. 5. Canonical Discriminant Functions Analysis (DFA) of *S. m. palmatus* males.

B. Females: The female DFA plot (Fig.6) was slightly congruent to the male plot. Also, the four sites were very distinct along the first and the second axes in females plot. Along the first axis, WMCD has a positive value against negative ones for Wadi Sahab and Wadi Rahaba, with Wadi El-Agramia being in between. Positive values along this axis were mainly correlated to carapace length, mesosoma length, metasoma length, pedipalp length, pedipalp hand length, marginal lamellae length of right pecten, right pectinal teeth length, 1st and 2nd metasomal segment length and width. Negative values being associated with total body length, pedipalp hand length, marginal lamellae length of left pecten, left pectinal teeth length, and 5th metasomal segment height.

Along the second axis, Wadi El-Agramia has a positive value while WMCD and Wadi Sahab have negative values. Positive values correlated with carapace length are: mesosoma length, pedipalp length, 5th metasomal length, 1st metasomal segment length, 2nd metasomal segment length, width and height. Negative values are associated with total body length, metasoma length, pedipalp hand length and width, 1st metasomal segment width and height, and 3rd metasomal segment length and height. Data plotted in Figs. 5, 6 and 7 (Hierarchical Cluster Analysis) revealed the following: 1- a significant discrimination between the four sites, 2- WMCD and Wadi Sahab were congruent to each other, 3- Wadi El-Agramia and Wadi Rahaba are also similar to each other, and 4- within population, males were similar to females.

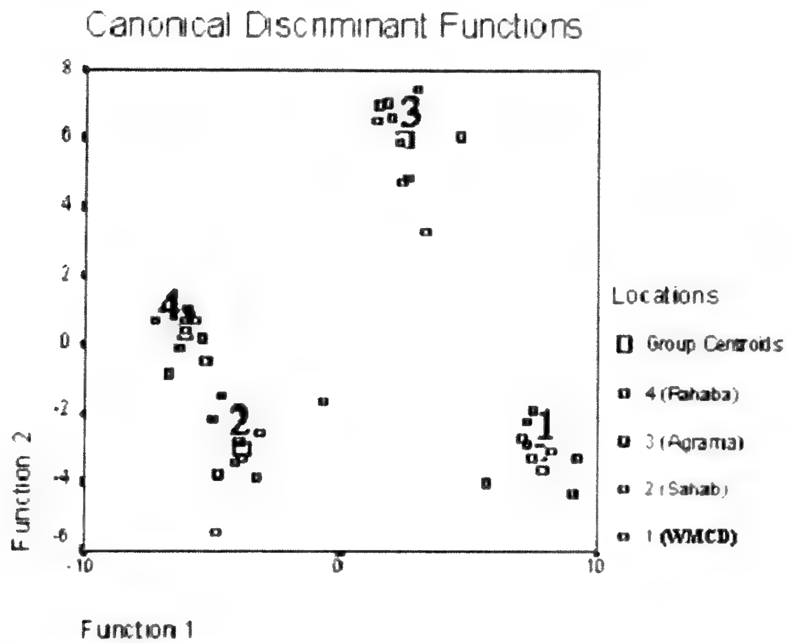

Fig. 6. Canonical Discriminant Functions Analysis (DFA) of *S. m. palmatus* females.

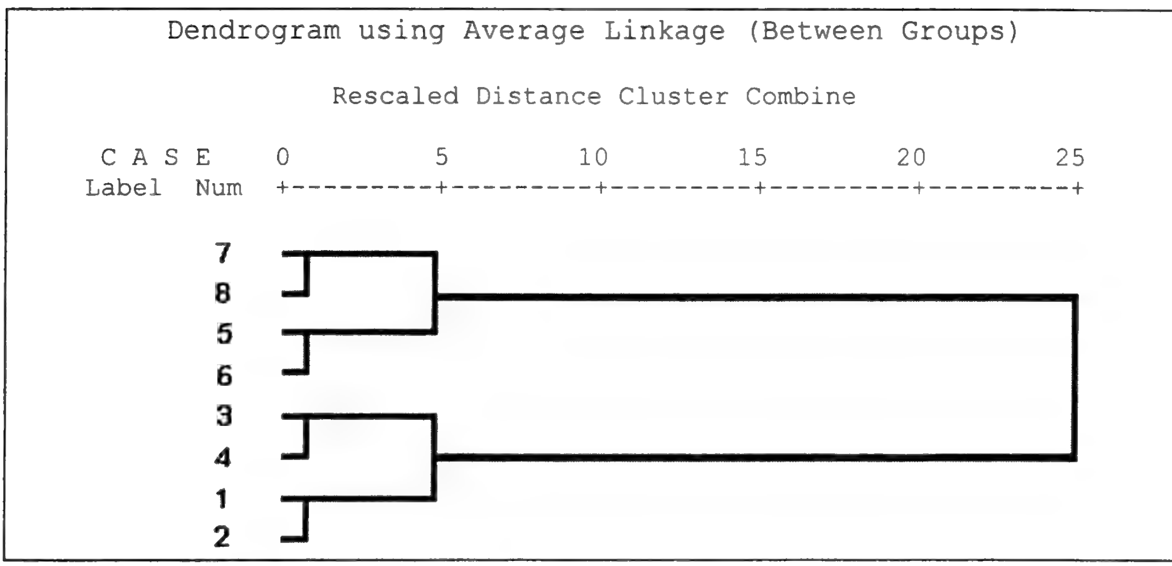

Fig. 7. Hierarchical Cluster Analysis.

1 = Males, 2 = Females of WMCD; 3 = Males, 4 = Females of W. Sahab;
5 = Males, 6 = Females of W. El-Agramia; 7 = Males, 8 = females of W. Rahaba.

Discussion

Although numerous scorpion species are found in Egypt, intraspecific variation and diversity in the Egyptian scorpions has never been studied before. In the current study, not only intraspecific variation in scorpion's morphology was examined but also environmental and ecological factors that may contribute influence and/or cause this variation. Because *Scorpio maurus palmatus* is distributed in two different habitats, arid and semiarid, in Egypt and even it exists in dense population in some areas it lives solitarily in burrows at high altitude and at the sea level, it was taken as a model to study intraspecific variation.

As members of populations, individual organisms are part of communities that over time evolve to suit the environment which they inhabit, providing that these stay constant long enough for adaptation to occur. An individual species can live only within a certain tolerance of environmental factors; the effect of too much or too little of any factor may inhibit growth or even prove fatal (Leeming, 2004). Many physical factors influence the spatial distribution of scorpions, including temperature, precipitation, soil or rock characteristics, stone or litter cover and environmental physiognomy (Polis & McCormick, 1986).

In the present study, coordinates of the study areas and data in Tables 1, 2 and 3 revealed three main important points; 1) the four different localities studied, i.e. WMCD, Wadi Sahab, Wadi El-Agramia and Wadi Rahaba, are spatially isolated, 2) each locality has its different habitat features and 3) the scorpion *S. m. palmatus* is adapted to survive in these different environments. Leeming (2004) reported that animal species are adapted to conditions in their local environments. Many animal species adapt to gradual geographic changes in climate. Such adaptation is often expressed in the phenotype as a measurable change in size, colour, or other traits.

Scorpions are almost associated with deserts. The extreme physical and climatic conditions of the desert environments have engendered in them a number of interrelated morphological, behavioural and physiological adaptations (Hadley, 1972). Burrowing is a major adaptation of many scorpion species for survival in extreme environments. Differences in micro-habitat influence burrow depth and morphology. Koch (1977) found that the burrows of many species of Australian scorpions varied in relation to average rainfall. Burrows are deeper and more spiralled in arid central areas than in wetter coastal areas. Burrow depth for *Opisthophthalmus* scorpions in southern Africa varied with soil type (Eastwood, 1978). Hardness and physical characteristics of the soil are important for many species (Polis & McCormick, 1986). In this study, significant variation in both climatic factors (temperature, relative humidity and rainfall) and nature of soils (soil hardness and texture, soil organic matter and soil moisture) could be the main reasons in the highly significant difference of scorpions burrows depths and shapes among locations. The maximum depth and very complicated structure of burrows were recorded in Wadi Sahab (Table 3, Fig. 4). This may be due to the soil of Wadi Sahab is characterized by the high content of sand and low content of silt, clay, and organic matter as well as the low level of soil moisture when compared with the other areas. Scorpions such as *Opisthophthalmus* sp. and *Scorpio maurus* protect themselves from desiccation in different ways. They shelter in burrows, where temperature and humidity of the burrow can be regulated, the deeper the burrow the cooler the ambient temperature inside the burrow (Leeming, 2004).

Among the studied specimens of *S. m. palmatus*, there are intraspecific colour variants among populations manifested in the degree of darkness in fingers and fifth metasomal segment of South Sinai populations which is more obvious and characteristic than scorpions of WMCD area. This variation may be attributed to the adaptation of the animal species to gradual geographic changes in climate. Such adaptation is often expressed in the phenotype as a measurable change in size, colour, or other trait. This finding is in agreement with Leeming (2004).

Sexual dimorphism in scorpions was reviewed by Kraepelin (1907), Koch (1977), Farzanpay & Vachon (1979) and Ali *et al.* (2001). Secondary sexual characteristics may be placed in the following categories (modified by Koch, 1977): 1) differences in body size, 2) differences in the shape of body structures, 3) the presence of a feature in one sex but not in the other, 4) stronger development of features in one sex than in the other, 5) differences in the texture of the body surface, and 6) higher meristic in one sex than in the other. In general, females are larger than males (Koch, 1977). Sexual dimorphism in body size appears to be extremely common among scorpions, although in many taxa the differences are not significant. The shape of structures may often be variable between the sexes. Dimorphism is commonly expressed by elongation of the pedipalp and/or metasoma in males (Polis & Sisson, 1990). Finally, the sexes may differ in meristic characters, such as pectinal tooth counts. Males tend to have more pectinal teeth than females. Behavioural and ecological differences also exist between males and females (Polis, 1990). Data in Tables (4 and 5) reveal significant differences in most of the morphometric measurements (length of: total body, carapace, mesosoma, pedipalp, 4th leg femur, 2nd and 3rd metasomal segments, telson and number of: right and left pectinal teeth, 1st, 2nd and 3rd right legs' setae) between males and females in El-Agramia Plain. This variation could be attributed to the sexual dimorphism phenomena in scorpions. The question here is: why only in El-Agramia ? The main reasons that might in the answer are: 1) El-Agramia Plain is one of the most important physiographic features of St. Catherine area (Shendi, 1992) and 2) the characteristic local diversity manifested in the habitat heterogeneity of this wadi system (Semida *et al.*, 2001 and Abd El-Meniem *et al.*, 2003). Local diversity is generated and maintained by a complex of factors, such as altitude, latitude, productivity, climatic variability, age of ecosystem, predation, competition, spatial heterogeneity or the stage of the biological succession (Fjeldsa & Lovett, 1997). Local diversity is then a complex function of regional diversity and faunistic turnover among localities (Caley & Schulter, 1997).

Variation between males and females were not only found in the morphometric measurements but also exist in the sex ratio relative abundance (Table 4). Difference in sex ratio relative abundance could be attributed to the mortality rate of males, which may be higher than females. This difference produces the heavily skewed sex ratio (♂ : ♀ = 1: 2.5, 1: 3.6, 1: 2.8, 1: 3.1) observed for scorpions that were collected from WMCD, Wadi Sahab, Wadi El-Agramia and Wadi Rahaba respectively. Differential mortality is attributed to several behavioural differences between males and females. Mature males are often vagrant and mobile during mating season. This characteristic high activity predisposes them to a disproportionately higher incidence of cannibalism, predation by other scorpion species or by vertebrate and invertebrate predators, starvation, and thermal death. This mobility also makes it likely that mature males feed less and construct more temporary burrow than females or young males. These findings were observed by Polis & Sisson (1990) and Ali *et al.* (2001).

Species vary in morphological and genetic patterns across their geographical ranges. These patterns can provide insight into how factors such as natural selection and population subdivision can mould populations. Investigations of morphological variation among geographic races have provided insights into mechanisms of character divergence and speciation (Myers, 2001). In this work, we focused on possible factors responsible for, and the ecological implications of, the dramatic variation in adult body size, pedipalp length, number of pectinal teeth and number of leg setae in the desert scorpion *S. m. palmatus*.

Body size is a fundamental trait affecting virtually every aspect of an organism's biology. Size influences the metabolic and structural characteristics of individuals and their ability to accommodate cold, heat, water, and other environmental stresses (Colder, 1984). Size also influences ecological interactions by affecting an individual's status as potential competitor, predator, or prey (Ebenman & Persson, 1988). Most species do not contain adults of uniform size. Researchers study size differences to gain ecological and evolutionary insights, but discovering the cause of variance, even within a single species, is confounded by the many environmental and selection factors acting now and in the past to shape this character (Myers, 2001).

This is the first study of the intraspecific variation in the adult body size and its relative measurements of *Scorpio maurus palmatus* in Egypt. Total body length in both males and females revealed high significant differences between the four locations (Table 6). Duncan's multiply range test supports this result (Table 8 and 9). The largest scorpions (males and females) are found in WMCD population (30m above sea level) while the smallest are females of Wadi Rahaba population (1676m above sea level) and males of Wadi El-Agramia population (1225m above sea level). Difference in body size among populations could be attributed to difference in the size of available prey; large ones are more efficiently handled by large predators (Case & Cody, 1983). It is important to mention that the size of the captive preys (beetles) which were collected from WMCD is larger than the preys of St. Catherine area. Consequently, this factor indicated that why scorpions of WMCD population recorded the highest adult body size in both males and females. Myers (2001) found that high feeding rates and prey availability are the most consistent environmental factors associated with large size in scorpions.

Distance and altitude are other important environmental factors in the variation of scorpion's body size. The significant negative correlation between total body length and altitude (Table 10) accords with McCormick & Polis (1986) who found a 20% difference in body size among adult *Paruroctonus mesaensis* separated by only 15 km.

Finally, the significant difference between scorpions of WMCD population and South Sinai populations total body length may be due to the difference in climatic factors (especially: precipitation, humidity, wind speed and temperature) between these regions. Scorpions in Wadi El-Agramia and Wadi Rahaba may suffer from sub-optimal growth conditions due to the prolonged cold season compared to conditions in Wadi Sahab and WMCD. Also, strong winds in St. Catherine (South Sinai) area cause dryness the upper soil layer, destroy seedlings, shorten leaf and flowering periods by increasing transportation, and suppress animal activity. These observations coincide with those of Warburg & Elias (1998). Warburg *et al.* (1980) reported that *Scorpio maurus* is by far the most characteristic species of the Mediterranean region. This species prefers areas of high precipitation, dense vegetation and deep soil. Apparently these factors also provide them with a suitable microclimate for maintaining optimal water and thermal balance.

Interestingly the sense organs (leg sensory hairs or leg setae) of specimens revealed high significant differences among our populations. The large number in the sensory hairs of scorpions at high altitudes (positive significant correlation coefficient, Table 10) may be due to special adaptation of these animals. Sensory hairs large numbers in scorpions increase their ability to receive low frequency waves in warm dry air, which has poor wave-carrying qualities, or vibrations in densely packed sand. Brownell & Farley (1979) found that the tarsal sensory hairs are stimulated by substrate vibrations along with the slit sensilla. These setae respond best to compressional waves, and the receptors consist of a single bundle of cell bodies below each hair socket, which give rise to dendritic processes terminating on a cuticular fold at the base of each shaft. Our observations explaining sensory adaptations in scorpions were in agreement with Fet *et al.* (1998).

Canonical Discriminant Functions Analysis (DFA) and Hierarchical Cluster Analysis (HCA) plots (Figs. 5-7) show that populations close in geographical distance exhibit similar coordinate in the DFA and HCA graphs. In the males, three populations (Wadi Sahab, Wadi El-Agramia and Wadi Rahaba) cluster, indicating that overall morphological distances are not very large. On the other hand, WMCD population is highly distinct from the other populations in St. Catherine area. These results indicate that morphological differentiation among populations may result from local environmental conditions (Dillon, 1984).

In the females plots, interestingly even within St. Catherine area, a distinct morphological distance between population of Wadi Sahab and Wadi El-Agramia was found. At the same time, El-Agramia is closely related to population of Wadi Rahaba than the other locations. In the population of sand scorpion, *P. mesaensis*, the morphological analysis showed a geographical association among regional sites. A positive association was found among genetic, morphological and geographical distance matrices. However, the morphological distance matrix showed a higher correlation value with geographical distance than genetic distance. The local environmental conditions may affect scorpion morphology more than genetic structure among populations (Yamashita & Polis, 1995).

Accordingly, it can be concluded that: 1) *Scorpio maurus palmatus* exhibits a general morphological separation between populations, 2) intraspecific diversity in this species may be due to variation in the environmental conditions (biotic and abiotic factors), 3) site and sex as covariates (using General Linear Model Analysis) play an essential role in the intraspecific variation of scorpion's morphology and 4) total body length, pedipalp length and number of setae on legs can be used as good markers to examine intraspecific diversity of most scorpion species.

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Oecobius amboseli Shear & Benoit, 1974, a new record from Egypt (Araneida : Oecobiidae)

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Abstract

Oecobius amboseli Shear & Benoit, 1974 (Family Oecobiidae) is recorded from Cairo, Egypt. The male of this species is described for the first time.

Keywords: Male description, Spiders, Oecobiidae, *Oecobius amboseli*, Egypt.

Introduction

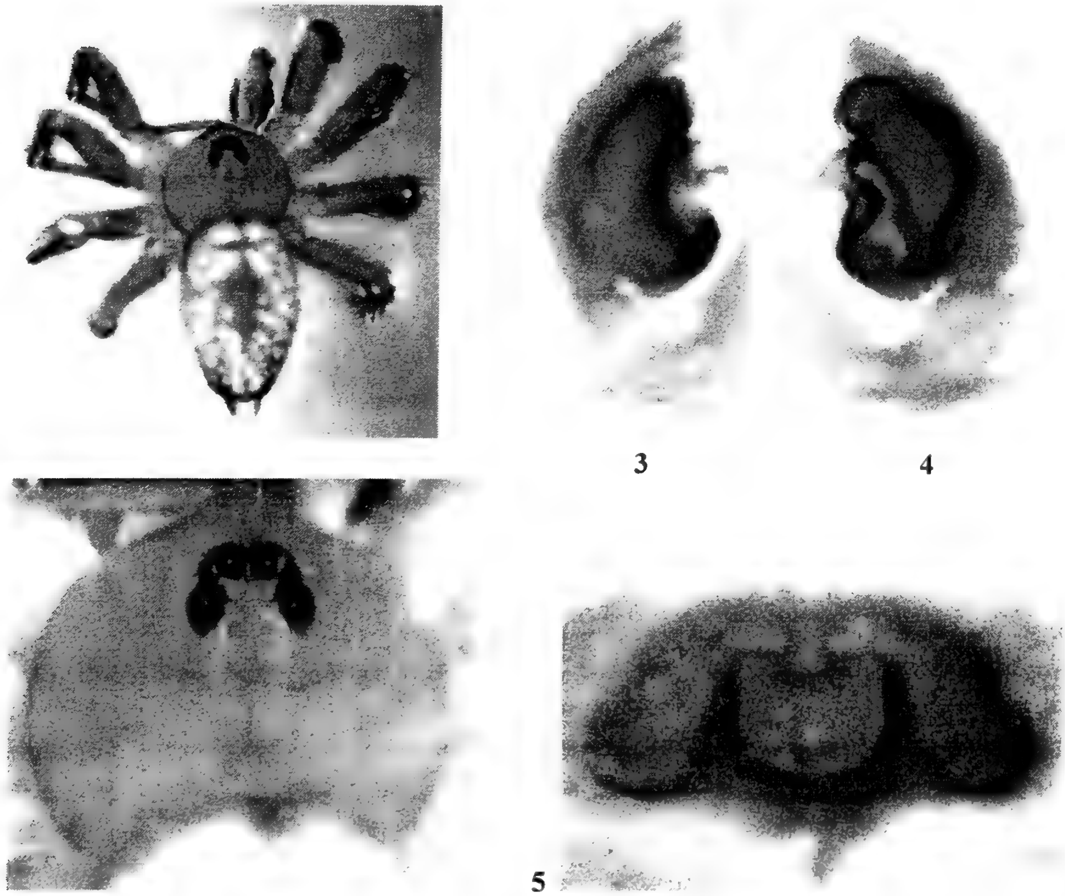
There are 78 species and one subspecies of genus *Oecobius* Lucas, 1846 recorded from our world (Platnick, 2004). Only four species of them were recorded from Egypt (El-Hennawy, 2002), i.e. *O. maculatus* Simon, 1870, *O. navus* Blackwall, 1859, *O. putus* O.P.-Cambridge, 1876, and *O. templi* O.P.-Cambridge, 1876. Hassan (1953) described all these species, partly under synonymous names. The discovery of other *Oecobius* species is expected in Egypt.

In 1990, I found a male and a female of an *Oecobius* species, which is different from the Egyptian species. The female's epigynum is very similar to that of the Kenyan *O. amboseli* Shear & Benoit, 1974; a species, which has only a unique female holotype (MRAC no. 141741) from Massai Amboseli Reserve, Kenya, collected by P.L.G. Benoit, 8 September 1972, and the male is wanting. The Massai Amboseli Reserve is located at the foot of Mt. Kilimanjaro, on the border of Kenya with Tanzania. After few years, Dr. David Penney collected one male and two females of *O. amboseli* from Uganda. Through comparing the Egyptian specimens with the Ugandan material, it becomes possible to confirm the identification and to describe the male of this species for the first time.

Abbreviations used: ALE = anterior lateral eye; PLE = posterior lateral eye; PME = posterior median eye.

Material from the following collections were examined: ACE = Arachnid Collection of Egypt, Cairo, Egypt; MRAC = Musée Royal de l'Afrique Centrale, Tervuren, Belgium.

All measurements are in mm.



Figs. 1-5: *Oecobius amboseli* Shear & Benoit, 1974. 1, 2. Male. 1. Habitus; 2. Carapace, dorsal view. 3, 4. Male palp. 3. Prolateral view; 4. Retrolateral view. 5. Female epigynum, ventral view.

Oecobius amboseli Shear & Benoit, 1974
(Figs. 1-11)

Material examined

I. Egypt: One male was collected from the building of the Criminal Investigation Laboratory, Bab El-Khalq, Cairo, Egypt [30°02'44"N 31°15'09"E Alt. 39m] on 1st January 1990 (ACE 19900101.1), and two females were collected from the same building on 7th January 1990 (ACE 19900107.1) and 8th May 1999 (ACE 19990508.1). All of them were found walking on the wall. [Note: *O. templi* is dominant in this locality.]

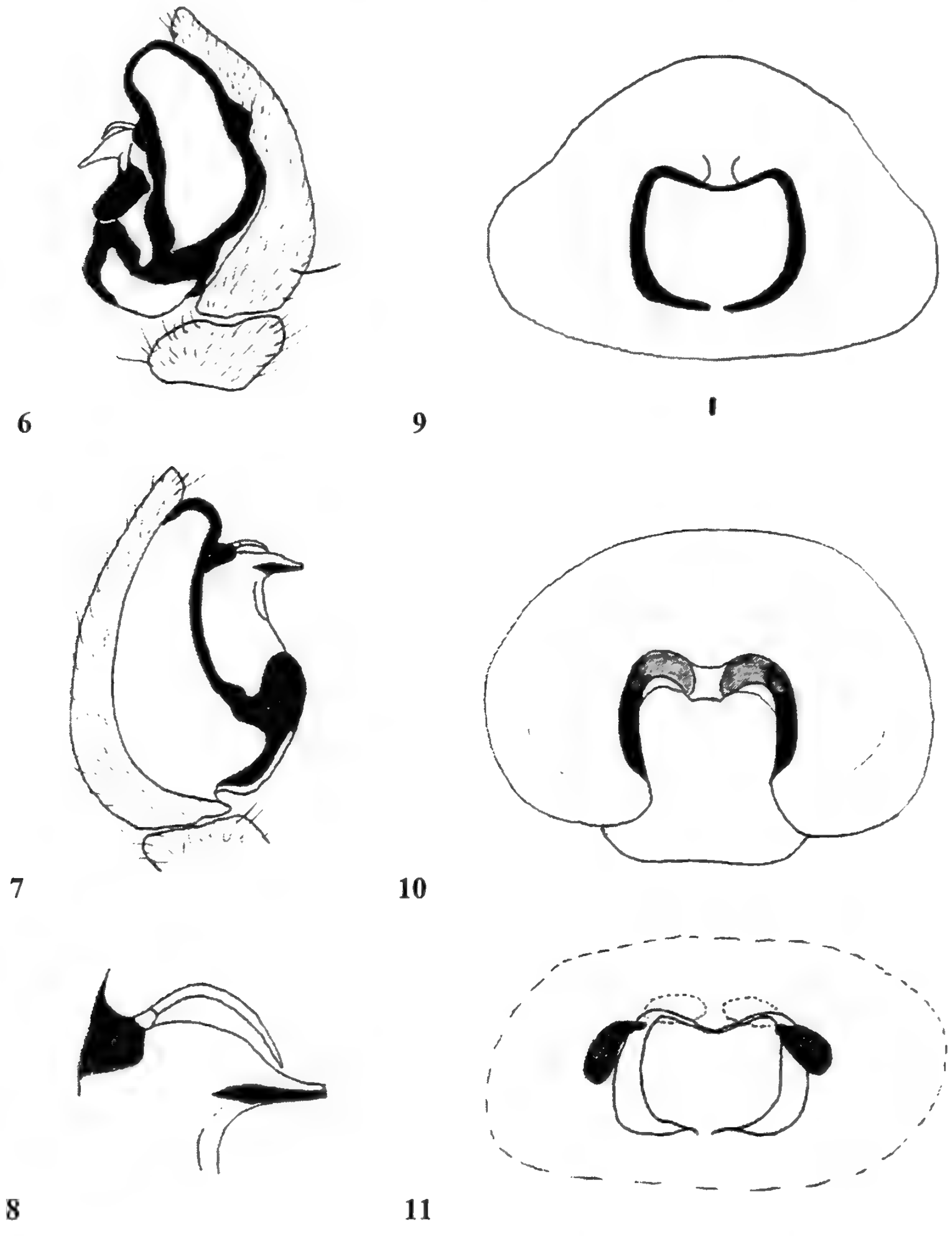
A female was collected from the building of Faculty of Science, Ain Shams University, Cairo, Egypt [30°04'46"N 31°17'07"E Alt. 46m] on 28th June 1987 (ACE 19870628.1), and a male from the same building on 16th April 1991 (ACE 19910416.1). They were collected from their nests. [Note: *O. putus* is dominant in this locality and *O. templi* is found too.]

The five specimens were collected by the author and deposited in the Arachnid Collection of Egypt (ACE) in Cairo, Egypt.

II. Uganda: One male and two females of: *Oecobius amboseli*; Det. Penney D. 1995; Loc. Uganda, Rubaga, Kampala, outside walls of building; Rec. Penney D., VII. 1994; Mus.R.Afr.Centr. 215071.

Diagnosis

Oecobius amboseli can be distinguished from the other known *Oecobius* species by genitalic characters: the finely pointed median apophysis and its position with the embolus of the male palpal organ (Figs. 6-8), and the very simple epigynum distinguished by a large central fossa and widely separated vulvae of the female (Figs. 9-11).



Figs. 6-11: *Oecobius amboseli* Shear & Benoit, 1974. 6-8. Male palp. 6. Retrolateral view; 7, 8. Prolateral view (8. detail). 9-11. Female. 9. Epigynum, ventral view; 10. Epigynum, proventral view; 11. Vulvae, dorsal view.

Description

The Egyptian specimens are in concordance with the characters of genus *Oecobius* (Shear, 1970, p.135) and the description of the holotype of *Oecobius amboseli* (Shear & Benoit 1974, pp. 717, 719).

Male (ACE 19900101.1). Total length: 1.87. Carapace (Fig. 2) yellowish-brown with blackish border and blackish tinctures in front and behind eyes with a distinctly projecting sub-triangular clypeus; a few setae are present in the ocular area and behind it; 0.68 long, and 0.87 wide. Eyes: anterior row almost straight, posterior row procurved, ALE and PME light, PLE largest, ALE smallest, PME irregularly subtriangular, separated by their diameter. Sternum heart-shaped, with wide base separating between the coxae of the fourth legs. Legs yellowish-brown, lighter than carapace, densely covered by hairs, leg I: Femur 0.85, Patella 0.31, Tibia 0.65, Metatarsus 0.61, Tarsus 0.44, Total length 2.86. Length of Patella-Tibia I : Width of carapace 1.103. Abdomen (Fig. 1) spindle-shaped with white irregular patches among light brown ones densely covered by long hairs, 1.22 long, and 0.82 wide. Palpal organ (Figs. 3, 4, 6, 7) characterized by its finely pointed median apophysis and its position with the embolus of the male (Fig. 8).
Colour variation: ♂ (ACE 19910416.1): carapace and legs yellowish-white.

Female (ACE 19900107.1). As male, except for the following: Total length 2.27. Carapace with three black patches on each side attached to the blackish border and a broad blackish area behind eyes extending to the posterior edge of the carapace in a narrower shape, 0.78 long, 0.92 wide. Leg I: Femur 0.88, Patella 0.32, Tibia 0.66, Metatarsus 0.65, Tarsus 0.48, Total length 2.99. Length of Patella-Tibia I : Width of carapace, 1.065. Abdomen with a few dark brown patches, 1.53 long, 1.19 wide. Epigynum is very simple, distinguished by a large central fossa (Figs. 5, 9, 10) and widely separated vulvae (Fig. 11).
Colour variation: ♀ (ACE 19870628.1): carapace and legs yellow, without black patches.

Acknowledgments

I am grateful to Dr. David Penney (Manchester) and Dr. Rudy Jocqué (MRAC, Tervuren) who permitted the loan of the Ugandan specimens.

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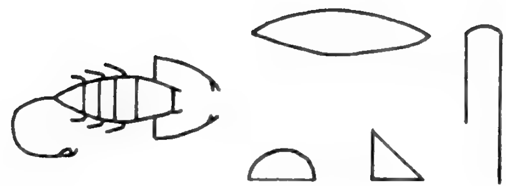

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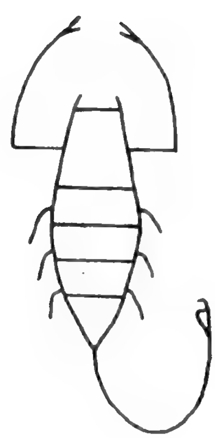

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Arachnids in Mediterranean protected areas of Egypt

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Abstract

This is a preliminary study of four orders of class Arachnida, i.e. Araneida, Pseudoscorpionida, Scorpionida and Solpugida, in four Egyptian protected areas on the Mediterranean Sea, i.e. Omayed, Burullus, Zaranik and Ahrash [Rafah] protectorates. Scattered collecting sites were randomly chosen in every protectorate. Several taxa were identified, mostly of spiders (27 species and 36 genera of 27 families), followed by six scorpion species and a minority of pseudoscorpions and sun-spiders. There were many unidentifiable species and genera. The studied areas need a seasonal survey and more detailed studies. An ethological observation on the cannibalism in the scorpion *Androctonus australis* is included.

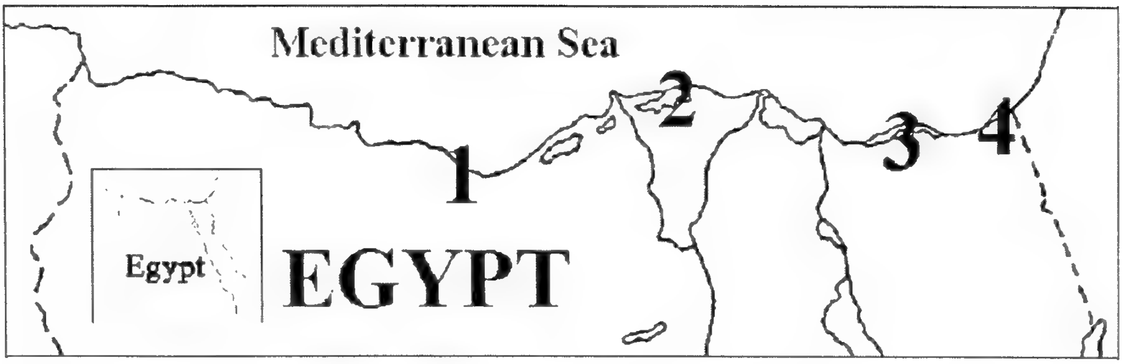
Keywords: Arachnida, Spiders, Scorpions, Pseudoscorpions, Sun-spiders, Protected areas, Mediterranean, Egypt.

Introduction

Most studies in protected areas in the world are devoted to vertebrate animals. Invertebrate animals are mostly neglected, in spite of their huge number of species/individuals and their great influence on the surrounding habitats. Arachnids, especially spiders, constitute a considerable ratio of invertebrates with great ecological importance. They have a very important role, as predators, in biological balance.

A preliminary study of arachnids in four protected areas on the Mediterranean sea had been achieved during 2000-2004. It is not a survey of every living species in these areas. The recorded species may be the most common species. This study was preceded by a similar study on protected areas on Aqaba gulf (El-Hennawy, 2003).

Identification of spiders is very difficult in a poorly studied arachno-fauna as in Egypt. Juvenile specimens are useless and unidentifiable, even to genus level. In few cases, individual juvenile spiders were kept alive until they reached maturity and became identifiable. The brief description of each of the four protectorates is adopted from MSEA (2001) and Rashid (2002).



Map 1. Mediterranean protected areas of Egypt. 1 = Omayed, 2 = Burullus, 3 = Zaranik, 4 = Ahrash [in Rafah].

Methods

A preliminary survey of spiders, scorpions, pseudoscorpions and sun-spiders had been achieved in four protected areas on the Mediterranean Sea (El-Omayed, El-Burullus, El-Zaranik and El-Ahrash [Rafah] Protectorates) during 2000-2004 (Map 1). The four areas were unequally visited. El-Omayed was visited twice; 15-18 August 2000 and 8-11 October 2000. El-Burullus was visited once; 3-8 September 2000. El-Zaranik was visited ten times; 9-12 August 2000, 2-5 October 2000, 5-8 November 2000, 3-6 July 2001, 24-27 October 2001, 11 November 2001, 13-16 September 2002, 4-7 May 2003, 23-26 April 2004, and 1-4 June 2004. El-Ahrash was visited twice; 7 November 2000 and 25 October 2001.

Different sites were selected and surveyed as scattered places in each protectorate. The aim was to discover different areas and habitats and to know what species are there existing. Those sites are mentioned with their longitudes and latitudes, and sometimes the altitude, in the 'Results' section before the tables of collected spider specimens.

The collecting methods were: 1. Collecting with the hands, 2. Pitfall trapping, 3. Light attracting, 4. Beating net, 5. Sweeping net, and 6. Ultra-Violet light collecting for scorpions. The identification of specimens was executed in the light of the available taxonomical knowledge, taking in consideration that the group of Arachnida is poorly studied in this geographical area. Indeed, it is the first study of arachnids in the Mediterranean protected areas of Egypt.

Results

Results are here arranged within smaller sections, each deal with the spiders, scorpions, pseudoscorpions and sun-spiders of one protected area. A list of identified spider species, alphabetically arranged, is presented at the 'Discussion' section with authors and dates to avoid mentioning them inside the tables.

A. Omayed protectorate

El-Omayed was declared as protected area by the Prime Ministerial Decree No. 671 for 1986, adjusted by Prime Ministerial Decree No. 90 for 1996. Its area is about 700 km^2. Type: Desert area and vital peripheral.

The Omayed protected area encompasses a very small segment of the Mediterranean coastal desert of Egypt, a distinct habitat type and one of the richest terrestrial biological diversity in Egypt. This is the only protected area encompassing this habitat type in Egypt, and includes biological components not found in other protected areas in the country. The area has a high floral diversity and a good vegetation cover. There are around 170 species of wild plants growing in different ecosystems, on sand dunes and among inland hills. About 70 species of them can be used for medical and therapeutical purposes like squall, wormwood, plantain and sorrel. There are also 60 species that can be used for different purposes including fuel like buckthorn and boxthorn, as source of oils like Ghoul Henna, for landscaping like Dirs Eshshayib, for manufacturing ropes and roofs like reed, and for pasturing like Tafwa. There are about 40 species of plants that have important environmental roles such as detaining sand and building new layers. A very rich fauna is also present, including several endangered, endemic and restricted range species. Important faunal elements include the endangered Four-toed Jerboa *Allactaga tetradactyla*, the endemic Pallid Gerbil *Gerbillus perpallidus*. There are also 14 species of wild birds recorded from the area. The endangered Egyptian Tortoise *Testudo kleinmanni* is known from the region.

Collecting Sites:

1. Visitors Centre: 30°44'38"N 29°09'59"E Alt. 110m
2. North west of Core Zone: 30°46'06"N 29°11'41"E Alt. 31m
3. West of Core Zone (100 m south of site [2])
4. El-Gabbasat 1: 30°44'52"N 29°11'25"E Alt. 90m
5. El-Gabbasat 2: 30°44'50"N 29°11'25"E Alt. 90m
6. Southern border of the Protectorate: 30°44'02"N 29°11'00"E Alt. 103m
7. Dry low area with small adjacent sand dunes: 30°48'29"N 29°11'32"E Alt. 16m
8. Khashm El-A'eish west of Visitors Centre: 30°44'18"N 29°08'24"E Alt. 90m
9. Northern Slope of Khashm El-A'eish
10. Eastern border of the Protectorate: 30°46'20"N 29°17'16"E - 30°45'95"N 29°17'24"E Alt. 53m
11. Military watching point upon Khashm El-A'eish: 30°45'32"N 29°12'22"E

I. Order **Araneida**

Spiders of fourteen families were collected from the eleven studied sites. The identification of the collected specimens with their numbers, sites and months of collecting are included in Table 1.

Table 1: Spiders collected from Omayed protectorate.
* = Specimens collected by other colleagues on February 1998.

Family	Species	Specimens	Sites	Months
Agelenidae	*Benoitia lepida*	1♂, 6♀, 5j	2,7,9	Aug, Oct
Clubionidae	*Clubiona* ? sp.	1♂	1	Oct
Dysderidae	*Dysdera* sp. *	1♂	9	Feb
Filistatidae	? sp. *	1♀	9	Feb
Gnaphosidae	*Micaria* sp.	1♀	10	Oct
	Poecilochroa senilis	2♂	2	Aug
	Pterotricha schaefferi	1♂, 5♀, 1s♂, 12j	1-5,7,8,10,11	Aug, Oct
	Zelotes ? sp.	1s♀, 4j	3,8-10	Oct
	? sp. (~ 5 spp.)	9j	3,5,8,10	Aug, Oct
Lycosidae	? sp. (3 spp.)	1♂, 1♀, 9j	1-5,8,10	Aug, Oct
Oecobiidae	*Oecobius* sp.	1j	1	Aug
Oxyopidae	*Oxyopes* sp.	1♂, 8♀	2,4	Aug
Philodromidae	*Thanatus* sp.	1j	10	Oct

Salticidae	*Menemerus animatus* *Mogrus fulvovittatus* ? sp. (~ 4 spp.)	1♂ 1♀ 9j	1 3 1,5,6,8,11	Aug Aug Aug, Oct
Sicariidae	*Loxosceles* sp.	9j	5-8,10	Aug, Oct
Theridiidae	*Steatoda ephippiata*	1♀	5	Aug
Thomisidae	*Thomisus* sp. *Xysticus* sp.	3j 1s♂, 4j	3,4,6 6-8,11	Aug, Oct Aug, Oct
Zodariidae	? sp.	3s♂, 1s♀	4,7-9	Aug, Oct

II. Order **Pseudoscorpionida**

Six specimens, 3♂, 3♀, of *Olpium kochi* Simon, 1881, Family Olpiidae, were collected on August from collecting sites 3 and 7, and one male specimen of the same species was collected on October from collecting site 10. Most specimens were found under stones. Only one specimen was found under bark and another walking on sand.

III. Order **Scorpionida**

Four scorpion species of family Buthidae were recorded during this preliminary survey; 1. *Androctonus australi*s, 8 specimens from sites 1,3-6 on August and 29 specimens from sites 2,3,5,8-11 on October. 2. *Buthacus leptochely*s, 6 specimens from sites 1-3,6 on August and 1 specimen from site 8 on October. 3. *Leiurus quinquestriatu*s, 1 specimen from site 1 on August and 1 specimen from site 8 on October. 4. *Orthochirus innes*i, 5 specimens from sites 7,8 on August and 3 specimens from sites 5,8,10 on October.

All specimens were almost found under stones and sometimes under cement paper bag (collecting sites 2 and 3) except a specimen of *A. australis* was found at night inside a building and two specimens of *B. leptochelys* were collected using Ultra Violet light at night (in collecting site 1 on August).

Ethological observation: When two big scorpions of *A. australis* were kept together, each one firmly grasped the metasoma of the other between the fifth metasomal segment and telson using its pedipalps and did not release it for hours. Leaving them together overnight, one killed the other by amputating the two pedipalps and the first and second pairs of legs, and devouring a small part of the prosoma including the victim's chelicerae. The same behaviour was repeated by two small scorpions of the same species when they were kept together as an experiment.

B. Burullus Protectorate

Lake Burullus was declared as protected area by the Prime Ministerial Decree No. 1444 for 1998. Its area is about 460 km^2. Type: Wetlands protected area.

Lake Burullus, the second largest natural lake in Egypt, has a wide diversity of various wetland habitats, ranging from fresh water swamps and reed beds in the south, to salt marshes and mudflats in the north. Sand dunes, rich in flora, dominate the sand bar separating the lake from the sea. The marine environment is represented along with sandy beach habitat, and the exchange between the brackish lake and marine waters provide a unique ecotonal zone where many marine and aquatic organisms proliferate. Burullus is by far the least disturbed and polluted of the Delta wetlands and its environs still retain some aspects of wilderness, which have been lost throughout most of the Delta. About 135 plant species have been recorded from this area. Because of its relative isolation, Burullus is also an important breeding site for several water birds and wetland species.

About 35 species of birds are known to breed at Burullus. The Mediterranean shore of the lake is of potential importance for breeding endangered marine turtles, *Carreta carreta* and *Chelonia mydas*. The Jungle Cat *Felis chaus* is known to exist in considerable numbers.

Collecting Sites:

1. West of Borg El-Burullus: 31°34'34"N 30°57'51"E
2. West of El-A'aqula: 31°31'39"N 30°49'00"E
3. Near El-Maqsaba: 31°29'47"N 30°46'06"E
4. Near Mastaroah: 31°28'30-55"N 30°41'02-15"E
5. Near El-Tolombat: 31°30'51"N 31°03'51"E
6. Near Shabab El-Kharrigeen: 31°26'14"N 30°30'31"E
7. El-Kom El-Akhdar Island: 31°26'58"N 30°49'24"E
8. Desheema Island: 31°25'00"N 30°40'09"E

I. Order **Araneida**

Spiders of nine families were collected from the eight sites studied during September 2000. The identification of the collected specimens with their numbers and sites of collecting are included in Table 2.

Table 2: Spiders collected from Burullus Protectorate.

Family	Species	Specimens	Sites
Agelenidae	*Lycosoides* sp.	2j	7
Araneidae	*Agalenatea* ? sp.	2♀	4
	Argiope lobata	1♀	6
	Argiope trifasciata	1♀	5,7
	Cyclosa insulana ?	2s♂, 1♀, 2j	4
	? sp. (2 spp.)	1♀, 1j	5,7
Eresidae	*Stegodyphus lineatus*	3♀, 1j	7
Gnaphosidae	*Pterotricha conspersa*	1♂, 5♀, 8j	1,2,4,8
	? sp	1j	4
Lycosidae	? sp.	1♀	8
Miturgidae	*Cheiracanthium canariense*	3♀	7
Philodromidae	? sp.	1 j	3
Salticidae	*Mogrus fulvovittatus*	5♀	1,3,4
	? sp. (3 spp.)	1♂, 1♀, 6j	1,2,7
Theridiidae	*Steatoda paykulliana*	1s♀	2
	? sp. (2 spp.)	2j	7

II. Order **Pseudoscorpionida**

Only one male specimen of *Olpium kochi*, Family Olpiidae, was collected from collecting site 2 (west of El-A'aqula village). It was found under cement paper bag, directly on sand.

III. Order **Scorpionida**

Seven specimens of only one species, *Androctonus amoreuxi*, of Family Buthidae were collected on September from collecting site 2 (west of El-A'aqula village). All scorpions were almost found under cement paper bags and carton paper, sometimes hidden among paper layers.

IV. Order **Solpugida**

Only one juvenile specimen of *Biton* sp., Family Daesiidae, was collected from collecting site 7 (El-Kom El-Akhdar Island). It was found under a stone among plants.

C. Zaranik Protectorate

Zaranik was declared as protected area by the Prime Ministerial Decree No. 1429 for 1985. Its area is about 250 km^2. Type: Wetland protected area of importance for birds.

Zaranik is internationally renowned as an important bottleneck and staging area for hundreds of thousands of migrant Palaearctic water birds. More than 270 species of birds have been recorded in the area, including Pelican, Herons, Crested Lark, Quail, White Stork and Falcons. Three globally threatened bird species occur regularly: Corncrake *Crex crex*, Pallid Harrier *Circus macrourus* and Black-winged Pratincole *Glareola nordmanni*. Large numbers of Flamingo *Phoenicopterus ruber* also winter at Zaranik. Two species of threatened marine turtles are known to breed locally: Loggerhead Turtle *Carreta carreta* and Green Turtle *Chelonia mydas*. The endangered *Dermochelys coriacea* has also been recorded. Islets and littoral dunes fringing the southern margins of the Zaranik Lagoon and adjacent "sabkha" (marshy area) are thought to hold small populations of the threatened Egyptian Tortoise *Testudo kleinmanni*. The threatened Fennec Fox *Vulpes zerda* and the rare Sand Cat *Felis margarita* also occur in small numbers. Lake Bardawil and the Zaranik Lagoon are important artisan and commercial fishery.

Collecting Sites:

1. Visitors Centre: 31°04'34"N 33°27'57"E
2. North east of Visitors Centre: 31°04'39"N 33°28'08"E Alt. 24m
3. North west of Visitors Centre: 31°04'39"N 33°27'47"E Alt. 22m
4. Fishers Village: 31°08'05"N 33°28'18"E
5. Sand Bar between lake and sea: 31°08'32"N 33°28'39"E
6. Islet 1: 31°09'03"N 33°27'15"E
7. Islet 2: 31°08'25"N 33°28'03"E
8. El-Mahasna Island: 31°10'06"N 33°20'54"E
9. El-Matli Island: 31°06'34"N 33°26'22"E
10. El-Flousiyat Island 1: 31°07'04"N 33°26'11"E Alt. 15m
11. El-Flousiyat Island 2: 31°07'05"N 33°26'21"E Alt. 13m
12. El-Flousiyat Island 3: 31°07'13"N 33°26'13"E Alt. 16m
13. El-Khoweinat: 31°06'15"N 33°24'33"E Alt. 20m
14. Abu El-Husein: 31°04'26"N 33°30'39"E
15. Abu Madi (Zakar Madi, Abu Aarada): 31°02'48"N 33°23'47"E Alt. 14m
16. Observation centre: 31°07'03"N 33°29'55"E
17. East of main entrance: 31°04'11"N 33°27'43"E

I. Order **Araneida**

Spiders of twenty-three families were collected from the seventeen studied sites. The identification of the collected specimens with their numbers, sites and months of collecting are included in Table 3.

Table 3: Spiders collected from Zaranik Protectorate.
* = Specimens collected by another colleague on August and September 2003.

Family	Species	Specimens	Sites	Months
Agelenidae	*Benoitia lepida*	4♂, 20♀, 1s♂, 1s♀, 12j	1-3,11, 14,15	Apr-Aug, Oct, Nov
Araneidae	*Argiope lobata*	2♀	6,10	Aug, Oct
	Argiope sp.	2j	2	Jun, Aug
	Cyclosa sp.	7j	2,3	May-Jul, Oct
	? sp.	5j	5,6,14	Jul-Oct
Eresidae	*Stegodyphus lineatus*	1♂, 6♀, 2s♀, 4j	2,3,14	Apr, Jun-Aug, Oct
Filistatidae	? sp.	3j	14,15	Sep, Oct
Gnaphosidae	*Micaria* sp. *	1♀	14	Sep
	Pterotricha lesserti	15♂, 3♀, 11j	1-3,5,8, 10,13,17	Apr-Aug, Oct, Nov
	Zelotes sp.	3♂, 5♀, 2s♂, 1s♀, 8j	2,3,6,7,10, 13,14,17	May, Jul, Aug, Sep-Nov
	? sp. (6 spp.)	2♂, 6♀, 1s♀, 18j	1-3,6,10, 14,15,17	Apr-Aug, Oct
Linyphiidae	? sp.	1♀	3	Nov
Liocranidae ?	? sp. (2 spp.)	20♂, 11♀, 2s♂, 9j	1-3,5,14	May, Jul, Aug, Oct, Nov
Lycosidae	? sp. (~ 4 spp.)	11♂, 12♀, 4s♂, 1s♀, 25j	1-8,14, 15,17	Apr, May, Jul, Aug-Nov
Mimetidae	*Mimetus* sp. *	1♂	14	Aug
Miturgidae	*Cheiracanthium canariense*	1♂, 3♀, 2j	2,14,16	Jul, Aug, Nov
	Cheiracanthium sp.	3♀, 5j	2,6,14	Apr, May, Jul-Oct
Nemesiidae ?	? sp.	1j	3	Oct
Oonopidae ?	? sp.	1♂	1	Aug
Oxyopidae	*Oxyopes* sp.	3j	3,14	May, Aug, Sep
Philodromidae	*Ebo* sp.	1♂	3	Aug
	Philodromus ? sp.	3♂, 2j	2,14,17	May, Aug, Sep
	Thanatus sp.	2♂, 1♀, 2j	2,3,14	Jul-Sep
	? sp.	1j	14	Jul
Pholcidae	? sp.	1♂, 4♀, 4j	1,2,3,14	May, Jun, Aug, Sep, Oct
Salticidae	*Heliophanus decoratus*	2♂, 1♀,1j	2,5,6,14	Aug-Oct
	Menemerus animatus	7♂, 3♀, 1s♀, 2j	1,13	Jun-Sep, Nov
	Mogrus fulvovittatus	1♂, 21♀, 2j	2,3,5,7, 11,14,16	Apr-Aug, Oct, Nov
	Myrmarachne tristis *	1♂	14	Aug
	Plexippus paykulli	4♀, 2s♂, 1j	1	Jun, Sep, Nov
	? sp. (~ 4 spp.)	5♀, 1s♂, 14j	1-7,9,10,17	May, Jul-Nov
Scytodidae	*Scytodes* sp.	5j	1,15	May, Oct, Nov
Sparassidae	*Cerbalus psammodes*	2♂	1	Apr, Jun
	? sp.	2j	1,15	May, Nov
Tetragnathidae	? sp. (2 spp.)	1s♂, 7j	1,9	Aug, Oct

Theridiidae	*Latrodectus pallidus* *	1♀	14	Aug
	Paidiscura dromedaria *	1♀	14	Aug
	Steatoda ephippiata	1♀	1	Jul
	Steatoda paykulliana	1s♂, 1s♀, 1j	8	Nov
	Steatoda triangulosa	1♂, 10♀, 2j	1	Apr, Jun, Sep, Nov
	Steatoda sp.	1j	3	May
	Theridion melanostictum	1♂, 1♀	1	Oct
	Theridion sp.	4♀	14	Jul
	? sp. (3 spp.)	4♀, 2s♂, 3j	1,3,8,12-14	May, Jul-Sep, Nov
Thomisidae	*Thomisus onustus*	1♀, 1s♀, 1j	2,3	Jul, Aug
	Thomisus spinifer *	1♂	14	Aug
	Xysticus sp.	1j	10	Aug
Uloboridae	*Uloborus walckenaerius*	2♀, 2j	2,14	Jul, Aug, Oct
Zodariidae	*Lachesana perversa*	2♂	17	May
	Zodarion sp.	1♂, 2♀, 4j	1,15	May, Jul, Sep, Oct

II. Order **Pseudoscorpionida**

Ten specimens, 4♂, 5♀, 1j, of *Olpium koch*i, Family Olpiidae, were collected on May, August, and October from collecting sites 3,4,9,11,13 and 15 from under stones and rarely in pitfall traps. Five female specimens of *Minniza* sp., Family Olpiidae, were collected on October and November from collecting sites 2, 6 and 8 from under stones or wet algae remnants (site 8). Four specimens, 1♂, 2♀, 1j, of *Rhacochelifer* ? sp., Family Cheliferidae were collected on May and November from collecting sites 2,15 and 17 from under stones.

III. Order **Scorpionida**

Two scorpion species of Family Buthidae were recorded during this preliminary survey. 1. *Androctonus bicolo*r, 4 specimens from site 10 on August and 2 specimens from sites 1,10 on October. 2. *Buthacus leptochely*s, 2 specimens on August and 5 specimens on October from sites 1,10. All specimens were found under stones or in big pitfall traps in collecting sites. Only one specimen of *A. bicolor* was found at night inside a building on October.

IV. Order **Solpugida**

Only one male specimen of *Biton ehrenbergi* Karsch 1880, Family Daesiidae, was collected (light attracted) from collecting site 1 on July.

D. Ahrash Protectorate

El-Ahrash (near Rafah) was declared as protected area by the Prime Ministerial Decree No. 1429 for 1985. Its area is about 8 km^2. Type: Developing resources protected area.

An area of high coastal dunes, about 60m of the sea level, that has good vegetation cover. *Acacia* trees have been planted in order to stabilize the dunes and curb sand movement in the region. The vegetation of the area, despite being heavily manipulated by man and contains several introduced elements, provides a good example of how plant life can flourish if unmolested. The vegetation of the area provides grazing and firewood to local inhabitants, but overuse is threatening to degrade and destroy this resource. Several rare, endemic and restricted animals and plants occur in the region, some of which are likely to occur in this protected area, and benefit from its conservation status.

Collecting Site:
-. Visitors Centre: 31°18'21.1"N 34°12'56.6"E Alt. 48m

I. Order **Araneida**

Spiders of five families were collected from the protectorate. The identification of the collected specimens with their numbers and month of collecting are included in Table 4.

Table 4: Spiders collected from Ahrash Protectorate.

Family	Species	Specimens	Months
Araneidae	? sp.	1j	Nov
Gnaphosidae	*Pterotricha lesserti* *Zelotes* sp.	1♀, 1s♂, 6j 1♂, 1j	Oct, Nov Oct, Nov
Philodromidae	*Thanatus* sp.	7j	Nov
Theridiidae	? sp.	1j	Oct
Thomisidae	*Xysticus tristrami*	1♂, 1♀, 1s♀	Nov

Discussion

Arachnids were studied for the first time in the Mediterranean protected areas of Egypt. All species, with few exceptions, were recorded for the first time from these areas (El-Hennawy 2002c).

Spiders: Among the 603 collected spiders, only 27 species and 36 genera could be identified. They belong to 27 families. The identified spider species are alphabetically arranged in the following list:
Argiope lobata (Pallas, 1772)
Argiope trifasciata (Forskål, 1775)
Benoitia lepida (O.P.-Cambridge, 1876)
Cerbalus psammodes Levy, 1989
Cheiracanthium canariense Wunderlich, 1987
Cyclosa insulana (Costa, 1834)
Heliophanus decoratus L.Koch, 1875
Lachesana perversa (Savigny, 1825)
Latrodectus pallidus O.P.-Cambridge, 1872
Menemerus animatus O.P.-Cambridge, 1876
Mogrus fulvovittatus Simon, 1882
Myrmarachne tristis (Simon, 1882)
Paidiscura dromedaria (Simon, 1880)
Plexippus paykulli (Audouin, 1825)
Poecilochroa senilis (O.P.-Cambridge, 1872)
Pterotricha conspersa (O.P.-Cambridge, 1872)
Pterotricha lesserti Dalmas, 1920

Pterotricha schaefferi (Audouin, 1825)
Steatoda ephippiata (Thorell, 1875)
Steatoda paykulliana (Walckenaer, 1805)
Steatoda triangulosa (Walckenaer, 1802)
Stegodyphus lineatus (Latreille, 1817)
Theridion melanostictum O.P.-Cambridge, 1876
Thomisus onustus Walckenaer, 1805
Thomisus spinifer O.P.-Cambridge, 1872
Uloborus walckenaerius Latreille, 1806
Xysticus tristrami (O.P.-Cambridge, 1872)

The percentage of collected specimens of every spider family from the four areas is calculated (Table 5). Gnaphosidae is at the summit of number of individuals collected from the four studied protected areas. At the second position: Salticidae, Lycosidae and Agelenidae in Omayed and Zaranik; Salticidae and Araneidae in Burullus; and Philodromidae in Ahrash.

Table 5. Percentage of collected specimens of every spider family from the four areas.

Family	Omayed	Burullus	Zaranik	Ahrash
Agelenidae	11.32	3.77	9.00	
Araneidae		20.75	3.79	4.54
Clubionidae	0.94			
Dysderidae	0.94			
Eresidae		7.55	3.08	
Filistatidae	0.94		0.71	
Gnaphosidae	33.96	28.30	18.01	45.45
Linyphiidae			0.24	
Liocranidae ?			9.95	
Lycosidae	10.38	1.89	12.56	
Mimetidae			0.24	
Miturgidae		5.66	3.32	
Nemesiidae ?			0.24	
Oecobiidae	0.94			
Oonopidae ?			0.24	
Oxyopidae	8.49		0.71	
Philodromidae	0.94	1.89	2.84	31.82
Pholcidae			2.13	
Salticidae	10.38	24.53	16.35	
Scytodidae			1.18	
Sicariidae	8.49			
Sparassidae			0.95	
Tetragnathidae			1.89	
Theridiidae	0.94	5.66	8.29	4.54
Thomisidae	7.55		1.18	13.64
Uloboridae			0.95	
Zodariidae	3.77		2.13	

Mygalomorph spiders appeared once in Zaranik; only one juvenile Nemesiidae ?. The most significant species are those of the gnaphosid genus *Pterotricha*. Three species of this genus are represented in the four areas; *P. schaefferi* in Omayed, *P. conspersa* in

Burullus, and *P. lesserti* in both Zaranik and Ahrash. Also, the theridiid genus *Steatoda* is represented by three species in three areas; *S. ephippiata* in Omayed, *S. triangulosa* in Zaranik, and *S. paykulliana* in both Burullus and Zaranik. *S. ephippiata* is recorded in Egypt only from Mid Sinai (El-Hennawy 2002a, 2002b). This record from Omayed widens its range of distribution in Egypt from East to West.

Cerbalus psammodes, Family Sparassidae, is a new record from Egypt. *Latrodectus pallidus*, Family Theridiidae, is here recorded for the first time from North Sinai. It is known from Nabq protectorate, South Sinai (El-Hennawy 2002a, 2003). The first Egyptian male *Mimetus* specimen, Family Mimetidae, was collected from Zaranik. *Cheiracanthium canariense*, Family Miturgidae, was discovered for the first time from Egypt during this study (El-Hennawy 2002a). This species was only known from Canary Islands.

Zaranik has the highest diversity of spider species. This is related to the diversity of insects. El-Moursy et al. (2001) recorded 187 species and subspecies, belonging to 49 families of 15 orders, of insects from Zaranik protectorate. There are many other unidentified species of insects there.

Pseudoscorpions: Three species of pseudoscorpions were recorded during this study from three areas. *Olpium kochi* Simon 1881, Family Olpiidae, is the mostly encountered species in Omayed, Burullus and Zaranik. *O. kochi* is known in Egypt from Wadi Natron, Cairo, Assuan and Wadi El-Raiyan (El-Hennawy 1988, 1991). The second olpiid species, *Minniza* sp., and *Rhacochelifer* ? sp. of Family Cheliferidae were only found in Zaranik.

Scorpions: Six scorpion species were encountered during the survey. All of them belong to Family Buthidae (Table 6).

Table 6: Scorpions recorded from three protectorates with the number of specimens.

Species	Omayed	Burullus	Zaranik
Androctonus amoreuxi (Audouin 1825)		7	
Androctonus australis (Linnaeus 1758)	37		
Androctonus bicolor Ehrenberg 1828			6
Buthacus leptochelys (Ehrenberg 1829)	7		7
Leiurus quinquestriatus (Ehrenberg 1828)	2		
Orthochirus innesi Simon 1910	8		

Genus *Androctonus* Ehrenberg 1828 is represented in this study by three species, each of them in only one protected area. *A. amoreuxi* is only found in Burullus. This species is widely distributed in Egypt and is already recorded from many regions including Baltim near Burullus Lake (El-Hennawy 1992). *A. australis* is only found in Omayed. It is known from Mersa Matrouh and Sallum, west of this area. *A. bicolor* is only found in Zaranik. It is known before from Mersa Matrouh to Alexandria and Sinai. *Buthacus leptochelys* is found in both Omayed and Zaranik. It is known from the Mediterranean coastal strip including Alexandria to Port Said and Sinai. Both *Leiurus quinquestriatus* and *Orthochirus innesi* are only found in Omayed. *L. quinquestriatus* is recorded from Mersa Matrouh and *Orthochirus* species are known from the region of Sallum. Omayed has the highest diversity of scorpions among the four studied areas. The ethological observation recorded between two *A. australis* scorpions means that there is no specific tolerance in this species while the seven specimens of *A. amoreuxi* from Burullus were kept together without cannibalism for about a week.

Sun-Spiders: Sun-spiders were only recorded from Burullus and Zaranik. The same genus, *Biton* Karsch 1880, was recorded. This genus is widely distributed in Egypt and *Biton ehrenbergi* Karsch 1880 is known in Egypt from Cairo, El-Fayum, Luxor, and Elephantine (Assuan) (El-Hennawy 1998). It is its first record from northern Sinai. This study leads us to state that it is necessary to make continuous seasonal survey of all arachnid species in the coastal protected areas of Egypt to elucidate their importance in their environment. A thing that enables the monitoring of these species in relation to the environmental changes which affect them in these areas.

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Anagraphis pallens Simon, 1893, a new record from Turkey (Araneae : Prodidomidae)

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Abstract

Anagraphis pallens Simon, 1893 is the first record of Family Prodidomidae in Turkey.

Keywords: Arachnida, Spiders, Prodidomidae, *Anagraphis pallens*, Turkey.

Introduction

Prodidomidae had been formerly dealt with as a part of the Gnaphosidae due to gross morphological similarities (i.e., enlarged, well-separated spinnerets), but it was revalidated to family rank by Platnick (1990) based on more refined spinneret spigot morphology. The eye pattern almost creates a circle due to the extremely procurved nature of the posterior eye row intersecting with the straight anterior eyes. The anterior median eyes of most prodidomids are darkly pigmented whereas the other six eyes are not. Other characteristics that help in distinguishing these spiders are protruding, geniculate chelicerae and unarmed tarsal claws (Vetter, 1996).

In Prodidomidae, 160 species belonging to 26 genera have been described (Platnick, 2005). In fact, no prodidomid species have been hitherto recorded in Turkey (Bayram, 2002). In the present paper, *Anagraphis pallens* Simon, 1893 is reported as a new record for the Turkish araneofauna.

Material and Methods

The present study is based on material deposited in the collections of the Arachnology Museum of Niğde University (NUAM). Four males and two females were examined in this study. The specimens were preserved in 70% ethanol. The identification and drawings were made by means of a SZX9 Olympus stereomicroscope with a camera lucida. The sketches of Levy (1999) helped in identification. All measurements are in millimetres.

Results

Material examined: 4 ♂♂ and 1 ♀ were recorded from Niğde province in the Central Anatolia of Turkey (34°36'E, 37°55'N). They were collected under stones on 19.VI.2001. An additional female was collected from Kayseri province (35°10'E, 38°36'N) on 24.VI.2001 by pitfall trapping.

Figs. 1-2: *Anagraphis pallens* Simon, 1893

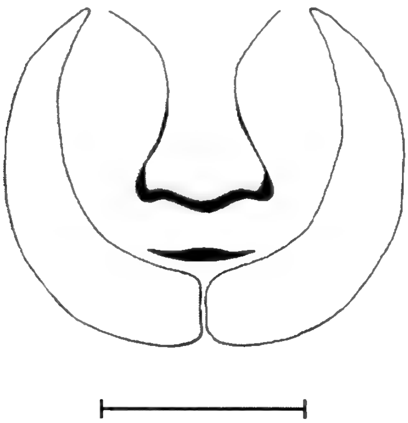

Fig. 1. Female epigynum, ventral view.

Fig. 2. Male palp, retrolateral view.
(Scale line = 0.2 mm)

Description: Medium-sized, light-coloured spiders. Carapace with a distinct fovea. Anterior lateral eyes slightly larger than all other eyes or equal to posterior lateral eyes. Anterior spinnerets larger than posterior spinnerets. Epigynum and male palp (Figs. 1-2) resemble the description of Levy (1999) and Chatzaki *et al.* (2002).
Male (NUAM 51/0002-5): Body length 4.90-7.00; carapace length 2.10-3.00, width 1.60-2.10; length of legs: I 7.64-10.73, II 6.41-9.01, III 6.11-8.58. IV 8.25-11.58; leg I segments length: coxa 0.71-1.00, trochanter 0.33-0.47, femur 1.72-2.42, patella 0.89-1.25, tibia 1.69-2.37, metatarsus 1.30-1.82, tarsus 1.00-1.40.
Female (NUAM 38/0003 & NUAM 51/0006): Body length 6.90-9.80; carapace length 2.90-3.60, width 2.20-3.00; length of legs: I 10.06-11.44, II 8.45-9.60. III 8.04-9.15, IV 10.86-12.35; leg I segments length: coxa 0.93-1.06, trochanter 0.43-0.49, femur 2.27-2.58, patella 1.17-1.33, tibia 2.23-2.53, metatarsus 1.71-1.95, tarsus 1.32-1.50.
Distribution: South Africa, Libya, Malta, Syria, Israel and Crete (Levy, 1999; Chatzaki *et al.*, 2002).

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A new species of genus *Eresus* from Algeria and Tunisia (Araneida : Eresidae)

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Abstract

A new species of the spider genus *Eresus*, family Eresidae, is described from Algeria and Tunisia and named *Eresus jerbae*.

Keywords: Spiders, Eresidae, *Eresus jerbae*, Tunisia, Algeria, North Africa, Taxonomy, new species.

Introduction

Among the 16 species and 7 subspecies of genus *Eresus* Walckenaer, 1805 (Roewer, 1954; Platnick, 2005), four species were recorded from Algeria: *E. albopictus* Simon, 1873b, *E. algericus* El-Hennawy, 2004a, *E. cinnaberinus latefasciatus* Simon, 1910, and *E. solitarius* Simon, 1873a; and only *E. cinnaberinus* (Olivier, 1789) was recorded from Tunisia (Simon, 1910).

During my work on reviewing the spiders of genus *Eresus* in Egypt (El-Hennawy, 2004b), I examined specimens from Muséum National d`Histoire Naturelle, Paris (MNHN) to find that there are misidentified specimens as *E. petagnae* from Tunisia and *E. semicanus* from Algeria. These specimens are not matching with any of the known descriptions of *Eresus* species. They belong to another species, which is described below as a new species. The description only depends on the material deposited in MNHN.

All measurements were taken in millimetres.

Abbreviations used: ALE = anterior lateral eye; AME = anterior median eye; Id = eyes inter-distances; L = length; PLE = posterior lateral eye; PME = posterior median eye; TL = total length; W = width.

Eresus jerbae new species

(Figs. 1-4. Tables 1-2.)

Type Material: Holotype: Female. Tunisia: Djerba (Ltr.), (MNHN) bottle no. 471 (tube no. AR 835), misidentified as *Eresus petagnae*.
Other Material: 1♀, 2j Tunisia, Djerba (Ltr.), (MNHN) bottle no. 471 (tube no. AR 835) misidentified as *Eresus petagnae*; 1♀ Algeria, Birin (G. Seurat 1913), (MNHN) bottle no. 471 (tube no. AR 842) misidentified as *Eresus semicanus*.

Diagnosis: Female of this species is similar to the female of *Eresus semicanus* Simon, 1908. Its genitalia is differentiated by the presence of two small depressions adjacent to the anterior extremities of the vulvae (Figs. 1-2; white arrows) instead of the single wide depression of *E. semicanus* (El-Hennawy, 2004b).

Etymology: The species name is a noun in apposition taken from the type locality.

Description: Female (Holotype): TL 13.06; Cephalothorax L 3.67; Cephalic part: L 2.72, W 2.97; Thoracic part: W 2.80. Crimson red, covered by creamy white hairs mixed with light brown hairs in the cephalic area, hairs generally less in density in the thoracic area. Cephalic area gradually inclined into thoracic area. Cephalothorax L : W anteriorly = 1.24; L : W posteriorly = 1.31.

Eyes: posterior medians (PME) largest; 2½ times larger than anterior medians (AME); posterior laterals (PLE) less than 1½ the diameter of the AME; ALE and PLE equal. Eye measurements (diameters and interdistances): AME 0.10, ALE 0.14, PME 0.25, PLE 0.14, AM-AM 0.14, AL-AL 2.28, PM-PM 0.31, PL-PL 2.01, AM-AL 0.97, AM-PM 0.07. (Id PME : Id AME = 2.21; Id PLE : Id ALE = 0.88).

Sternum (L 2.12) and coxae: lighter than cephalothorax. Labium (L 0.95), maxillae (L 1.32) and chelicerae: like cephalothorax; covered by light brown hairs mixed with white hairs. Chelicera with strong boss and a black tooth against the fang; its internal edge is black.

Legs and pedipalps: orange-brown covered by creamy white hairs. Tarsi, metatarsi and tibiae of legs I, II partly darker. Tarsi and tibiae of pedipalps darker. Pedipalp with a claw.

Table 1: Legs measurements (mm)

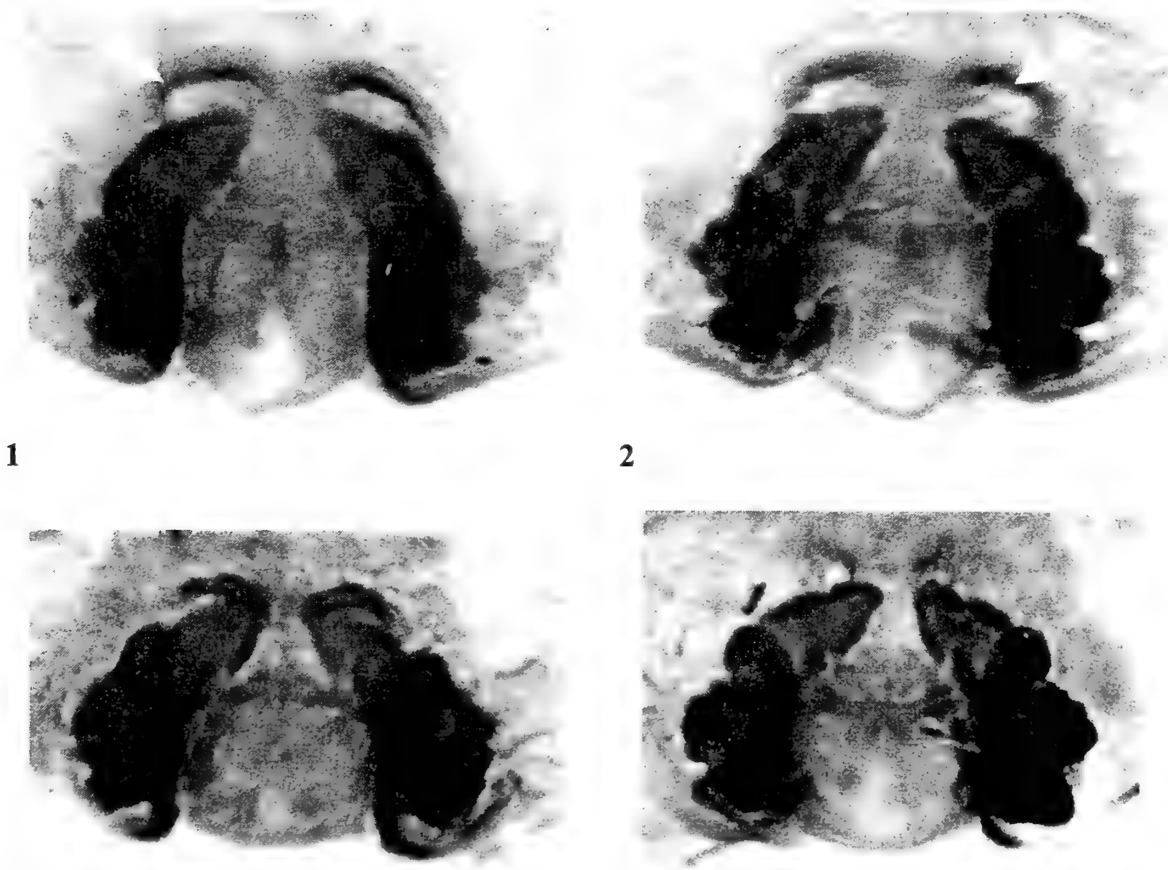
Leg	I	II	III	IV
Femur	2.12	1.85	1.59	2.54
Patella	1.22	1.17	1.17	1.38
Tibia	1.22	1.01	0.90	1.59
Metatarsus	1.01	0.95	0.85	1.27
Tarsus	0.85	0.79	0.48	0.58
Total length	6.42	5.77	4.99	7.36

Relative length of legs 87 : 78 : 68 : 100. Leg formula IV-I-II-III.
L leg I : L cephalothorax = 1.75.

Spination pattern: spines only on ventral side of tarsi and metatarsi, and distally on tibiae; few on legs I & II, numerous on legs III & IV.

Abdomen: L 10.61; yellowish white, covered by light brown hairs. Cribellum: bipartite.

Genitalia: Epigynum of this species is similar to that of the female of *E. semicanus* Simon, 1908. It has two small depressions adjacent to the anterior extremities of the vulvae (Figs. 1-2; white arrows) instead of the wide single depression between the chitinous ridge and chitinous plate of *E. semicanus* (El-Hennawy, 2004b).



1 2

3 4

Figs. 1-4: *Eresus jerbae* n.sp. **1-2.** Holotype ♀ (Jerba Island, Tunisia). **3-4.** Paratype ♀ (Birine, Algeria). **1, 3.** Epigynum, ventral view. **2, 4.** Vulvae, dorsal view.

Measurements of Other Material:

A. 1♀ Tunisia, Djerba (Ltr.), (MNHN) bottle no. 471 (tube no. AR 835) misidentified as *Eresus petagnae*.

TL 13.06; Cephalothorax L 4.49; Cephalic part: L 3.65, W 4.16; Abdomen L 9.38

B. 1♀ Algeria, Birin (G. Seurat 1913), (MNHN) bottle no. 471 (tube no. AR 842) misidentified as *Eresus semicanus*.

TL 13.87; Cephalothorax L 5.44; Cephalic part: L 3.91, W 4.25; Thoracic part: W 3.65. Cephalothorax L : W anteriorly = 1.28; L : W posteriorly = 1.49.

Sternum L 2.97; Labium L 0.90; Maxillae L 1.64. Abdomen L 9.79

Eye measurements (diameters and interdistances): AME 0.14, ALE 0.17, PME 0.30, PLE 0.17, AM-AM 0.17, AL-AL 3.18, PM-PM 0.48, PL-PL 2.86, AM-AL 1.24, AM-PM 0.09. (Id PME : Id AME = 2.82; Id PLE : Id ALE = 0.90).

Table 2: Legs measurements (mm)

Leg	I	II	III	IV
Femur	2.91	2.38	2.12	3.18
Patella	1.38	1.43	1.22	1.85
Tibia	1.59	1.38	1.32	2.01
Metatarsus	1.59	1.32	1.17	1.75
Tarsus	1.01	0.95	0.58	0.85
Total length	8.48	7.46	6.41	9.64

Relative length of legs 88 : 77 : 66 : 100. Leg formula IV-I-II-III.
L leg I : L cephalothorax = 1.56.

Male: Unknown.

Distribution: Algeria: Birine, about 125 km south of Alger (Algiers). **Tunisia:** Jerba island (about 33°47'31"N 10°53'51"E).

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Survey and populations of spiders and other arthropods in cucurbit and legume fields in Al-Kanater (Egypt)*

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Abstract

Survey on spiders and other arthropods inhabiting fields of four legume and five cucurbit crops, as well as seasonal abundance of spiders were investigated at Al-Kanater Agricultural Research Station during one year to find 16 spider families, of about 33 genera and 33 species. Spring showed the greatest number of spider taxa (29) followed by 22 in summer, while autumn recorded the lowest number (15). Other associated arthropods included three classes, 10 orders and about 40 genera, i.e. one order of Crustacea, three of Chilopoda (Myriapoda), and six of Insecta which included about 40 species in more than 33 genera and 22 families.

Keywords: Survey, Seasonal abundance, Spiders, Insecta, Chilopoda, Crustacea, Egypt.

Introduction

Spiders as predators play an important role in agroecosystems. They are considered a biocontrol agent against economic pests of various agricultural crops. Therefore, survey on spiders and other arthropods inhabiting fields of four legumes (peas, kidney bean, cowpea and broad bean) and five cucurbits (squash, cucumber, sweet squash, muskmelon, watermelon and watermelon intercropped with maize) crops as well as its seasonal abundance were investigated at Al-Kanater Agricultural Research Station during one year (October 2000 - August 2001). Kidney bean, squash and cucumber were subjected to survey twice a year in an agricultural rotation as summer and winter crops, while other crops were surveyed once. Watermelon was surveyed as monoculture and when intercropped with maize.

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* This article is a part of M.Sc. Thesis of the last author (NA).

Material and Methods

This study was carried out at Al-Kanater Agricultural Research Station, including nine vegetable crops of two botanical families. Four belong to Leguminosae and these are peas, *Pisum sativum* (from 11 November to 27 March), kidney bean, *Phaseolus vulgaris* (from 11 October to 14 February and from 20 March to 10 July), cowpea, *Vigna sinensis* (from 16 May to 21 August) and broad bean, *Vicia faba* (from 10 January to 29 May). The other five crops belong to Cucurbitaceae. They are squash, *Cucurbita pepo* (from 3 October to 13 December and from 10 April to 10 July), cucumber, *Cucumis sativus* (from 3 October to 29 November and from 10 April to 10 July), sweet squash, *Cucurbita maschata* (from 17 April to 10 July), musk melon, *Cucumis melo* var. *reticulat*a (from 29 May to 17 July) and watermelon, *Citrullus vulgaris* (from 17 April to 10 July). Watermelon was also intercropped with maize (from 8 May - 17 July).

Pitfall traps of plastic cups, each 8 cm in diameter and 11 cm deep were used to survey spiders and associated soil arthropods inhabiting investigated fields (Southwood, 1987). Six traps were used for every investigated vegetable crop, lasted for 48 hour/week and regularly applied for each crop depending on its duration. Captured arthropods were carefully stored for identification (Identification of spiders is the responsibility of the second author (HE)). Population of the spider families were assessed as percentage of the entire captured spiders in each crop. The family percentage less than 5% was categorized as rare (r); that of 5-33% = low occurrence (l); that of 33-66% = medium occurrence (m); and that of more than 66% was described as high occurrence (h).

A list of identified spider species, alphabetically arranged, is presented at the end of 'Results' section with authors and dates to avoid mentioning them inside the tables.

Results

Occurrence of spiders in the studied crops

The family Lycosidae proved to be the dominant among spider families where it had high occurrence (h) in fields of 11 of the 13 investigated vegetable crops (Table 1). This coincides with Hussein (1999) who reported that Lycosidae comprised 86.42% of the whole spider population in 8 vegetable crop fields. This may be due to the ecological abiotic and biotic factors in such vegetable crops that fit the requirements of members of this family, e.g. temperature, relative humidity, shelter, leaf texture and abundance and diversity of the pest prey species. However, the family Lycosidae recorded low occurrence in winter squash only (5.3%). This may be due to the cold temperature during winter season when large leaf area of squash plants completely shades the soil from sun.

The family Linyphiidae showed the second rank in occurrence. It recorded medium occurrence (m) in one crop (broad bean) and low occurrence (l) of the whole spider populations in 9 crops, i.e. winter and summer kidney bean, peas, winter and summer cucumber, winter and summer squash, muskmelon and sweet squash. It constituted 33.33% of the whole spider population in the broad bean field.

The family Theridiidae occurred in low percentages in only three fields of studied crops averaging 5.78, 6.52 and 5.69% in winter kidney bean, winter squash and summer squash respectively while it was rare in the other ten crops (Table 1).

It is worth noting that families Lycosidae, Linyphiidae, Philodromidae and Theridiidae occurred in all the 13 studied crop fields where Lycosidae were found in high percentage followed by Linyphiidae. This may be due to the fitness of the habitat of the vegetable crops for these spider families.

Table 1: Relative abundance of spider families in different studied vegetable crops during the study period.

Crops / Families	Legume Crops					Cucurbit Crops							
	Winter Kidney Bean	Peas	Broad Bean	Summer Kidney Bean	Cow Pea	Winter Cucumber	Winter Squash	Summer Cucumber	Summer Squash	Sweet Squash	Watermelon	Watermelon Intercropped	Muskmelon
Agelenidae	r	-	r	-	-	-	-	-	-	-	-	-	-
Araneidae	-	-	r	-	-	-	-	r	r	-	-	-	r
Dictynidae	-	-	r	-	-	-	-	-	-	-	-	-	r
Dysderidae	r	-	-	-	-	-	-	-	-	-	r	-	-
Gnaphosidae	r	r	r	r	r	r	-	r	r	r	r	r	r
Linyphiidae	l	l	m	l	r	l	l	l	l	l	r	r	l
Lycosidae	h	h	m	h	h	h	l	h	h	h	h	h	h
Miturgidae	r	-	-	r	r	-	-	-	-	-	-	-	-
Philodromidae	r	r	r	r	r	l	l	r	r	r	r	l	r
Pisauridae	r	-	r	-	-	-	-	-	-	-	-	-	-
Salticidae	-	r	r	r	r	r	-	r	-	r	r	r	r
Scytodidae	-	-	-	-	-	-	-	-	r	r	-	-	-
Sicariidae	-	-	r	r	-	-	-	-	-	-	-	-	-
Tetragnathidae	r	r	r	-	-	-	-	-	-	-	-	-	-
Theridiidae	l	r	r	r	r	r	l	r	l	r	r	r	r
Titanoecidae	-	-	-	-	-	-	-	r	r	-	-	-	-

r = rare (< 5%), l = low (5–33%), m = medium (33-66 %), h = high occurrence (> 66%).

The family Philodromidae was also found in low percentage, i.e. 5.67, 5.0 and 5.48 in 3 crops (winter cucumber, winter squash and watermelon intercropped with maize), while being rare in the other crops (Table 1). The other recorded families appeared in rare numbers associated with some crops and disappeared from others. Of these, the family Gnaphosidae which only disappeared from winter squash while Salticidae disappeared from winter kidney bean and winter and summer squash. It seems that there is a possible relation between squash and salticid spider disappearance.

The families Agelenidae, Dictynidae, Dysderidae, Pisauridae, Scytodidae, Sicariidae and Titanoecidae were found in only two crops from total 13 crops. Along the study period, two of these rare families Agelenidae and Pisauridae occurred only in winter kidney bean and broad bean while Scytodidae and Titanoecidae only appeared in summer season, titanoecids inhabited summer cucumber and summer squash and the scytodids occurred in summer squash and sweet squash (Table1).

Table 2: Occurrence of spider families, genera and species in legumes in Al-Kanater Agricultural Research Station.

Taxa	Winter Kidney Bean				Peas				Broad Bean				Summer Kidney Bean				Cowpea			
	♂	♀	J	TN	♂	♀	J	TN	♂	♀	J	TN	♂	♀	J	TN	♂	♀	J	TN
Agelenidae																				
Lycosoides sp.	1			1																
Tegenaria sp.									1			1								
Araneidae *									1			1								
Dictynidae *									1	2		3								
Dysderidae *Dysdera* sp.		1		1																
Gnaphosidae *					2	1	1	4	1			1							1	1
Micaria sp.	2			2	2		1	3							2	2	6			6
Setaphis subtilis	1			1	1			1					1			1				
Zelotes sp.									1	1		2	3			3	6	1	1	8
Linyphiidae *	7	2	1	10	15	13	2	30	16	8	5	29	5	9	2	16	2	4	3	9
Erigone dentipalpis					6	1		7	19	5		24	24	1		25	5			5
Gnathonarium dentatum	3			3					2	1		3	1			1				
Prinerigone vagans	2			2	8	1		9	4	1		5	10	1		11	1			1
Lycosidae *			34	34	1		34	35			22	22			30	30			85	85
Hogna ferox	1		1	2	3		1	4		1		1	4	1		5	9	1		10
Pardosa injucunda	1			1			1	1						2	2	2	2			2
Wadicosa fidelis	56	16		72	34	8	3	45	18	9		27	27	8	35	35	137	47		184
G1	11	1		12	50	17		67	30	7		37	117	21		138	69	25		94
G2									8			8	4	1		4	3			3
Miturgidae																				
Cheiracanthium sp.		1		1									1			1	1			1
Philodromidae																				
Thanatus albini	4			4	4			4	5	1		6	6	3	2	9	10	2	1	13
Pisauridae *									1			1								
Salticidae *					2	1		3	2			2	4	2	1	7	10	1		11
Menemerus sp.													1			1				
Sicariidae *Loxosceles* sp.									1	1		2	1			1				
Tetragnathidae *	1			1	2			2	6			6								
Theridiidae *		1	1	2													1			1
Steatoda erigoniformis	8			8	3	1		4	3			3	7			7	11	1		12
Total	112	24	37	173	133	43	43	219	119	37	27	183	218	48	35	301	263	83	91	447
Average	7.46	3.42	9.25	8.65	9.5	5.38	6.1	12.88	6.6	3.08	13.5	8.71	12.8	5.33	8.75	15.05	18.2	9.2	18.2	24.8
S.D.	13.5	5.15	14.28	16.4	14.06	6.08	11.4	18.8	7.89	2.75	8.5	10.53	27.8	6.2	12.27	29.9	35.6	15.25	33.4	46.8

Using total of 50, 162, 114, 96 & 84 pitfall traps in winter kidney bean, peas, broad bean, summer kidney bean and cowpea respectively.
J = Juveniles could not be identified to more than family level. * = Only identified to family level. TN = total number

Table 3: Occurrence of spider families, genera and species in cucumber and squash in Al-Kanater Agricultural Research Station.

Taxa	Winter Cucumber				Winter Squash				Summer Cucumber				Summer Squash			
	♂	♀	J	TN	♂	♀	J	TN	♂	♀	J	TN	♂	♀	J	TN
Araneidae *										1		1		1		1
Gnaphosidae *	1			1												
Micaria sp.										1		1				
Setaphis subtilis		1		1										1		1
Synaphosus sp.										1		1				
Zelotes sp.									1	2		3		1	1	2
Linyphiidae *		4		4	1	3		4	6	10	8	24	5	11	2	18
Erigone dentipalpis	1	1		2	1	13		14	8	14		22	6	6		12
Gnathonarium dentatum													1			1
Prinerigone vagans						1		1	1	3		4		8		8
Lycosidae *		1	37	38			7	7		1	67	68		2	51	53
Hogna ferox										1	1	2		6		6
Pardosa injucunda					1	3		4	2	9		11		12	38	50
Wadicosa fidelis	10	23	5	33	4	6		10	3	8		11		1	4	5
G1	15	36		51		2		2	45	133		178		19	61	80
G2									2	6		8		6	30	36
Miturgidae																
Cheiracanthium sp.					1			1								
Philodromidae																
Thanatus albini	1	5	2	8					1	9	8	18	2	4	1	7
Salticidae *		1		1						3	2	5				
Scytodidae *Scytodes* sp.														1		1
Theridiidae *						1		1	1		1	2		1	1	2
Steatoda erigoniformis		1		1		2		2		8	1	9		15		15
Titanoecidae *										1		1		1		1
Total	28	74	39	141	8	31	7	46	73	210	87	369	51	190	58	299
Average	5.6	7.4	19.5	12.8	1.6	3.8	7	4.6	6.08	11.6	10.8	16.7	6.37	10.5	9.6	14.2
S.D.	5.8	11.5	17.5	17.6	1.2	3.7	0	4.2	11.9	29.6	21.36	37.9	5.91	15.8	18.4	21.2

Using total of 42, 42, 78 & 78 pitfall traps in winter cucumber, winter squash, summer cucumber and summer squash respectively.
J = Juveniles could not be identified to more than family level. * = Only identified to family level. TN = total number.

Table 4: Occurrence of spider families, genera and species in the other cucurbits in Al-Kanater Agricultural Research Station.

Taxa	Sweet Squash				Watermelon				Watermelon intercropped with maize				Muskmelon			
	♂	♀	J	TN	♂	♀	J	TN	♂	♀	J	TN	♂	♀	J	TN
Araneidae *					1	1	2	4								
Dictynidae *						1		1								
Dysderidae *Dysdera* sp.													1			1
Gnaphosidae *	1			1												
Micaria sp.					1			1	2			2				
Zelotes sp.	1	1		2	2		1	3	3			3		1		1
Linyphiidae *	9	2	4	13	8	12	4	24						1		1
Erigone dentipalpis	15			15	7	2		9	5	1		6	1			1
Gnathonarium dentatum		1		1					1	1		2				
Prinerigone vagans	5			5	4			4	2			2				
Lycosidae *		2	85	87	1	2	82	85			61	61	29	2	29	31
Hogna ferox	7	2	2	11	7	5		12	3			3	4			4
Pardosa injucunda	7	4	3	14	4	3		7								
Wadicosa fidelis	5	3		8	28	14		42	67	21		88	37	16		53
G1	207	116		323	138	133		271	70	31		101	31	11		42
G2	9	4	1	14	3	2		5	1			1	3	1		4
Philodromidae																
Thanatus albini	6	1	2	9	7	4	7	18	10	1	5	16	5			5
Salticidae *	7	2	2	11	7	5		12	4			4	1	1	2	4
Plexippus paykulli										1		1				
Scytodidae *Scytodes* sp.	1			1												
Theridiidae *						1	1	2							1	1
Kochiura aulica					1			1								
Steatoda erigoniformis	15		1	16	11			11	2			2		1		1
Total	293	138	100	531	230	185	97	512	170	56	66	292	83	30	32	149
Average	18.3	12.5	12.5	27.9	16.16	11.56	16.16	0.32	13.07	9.3	33	18.25	10.37	6	10.6	11.46
S.D.	48.9	32.7	27.4	71.95	29.5	31.53	29.5	0.8	23.7	12.1	28	32.17	14.21	6.18	15.88	18.03

Using total of 71, 71, 59 & 42 pitfall traps in sweet squash, watermelon, watermelon intercropped with maize and muskmelon respectively.
J = Juveniles could not be identified to more than family level. * = Only identified to family level. TN = total number.

Occurrence of spider taxa in legume crops

Results proved the occurrence of about 30 spider species and genera collected from legume fields, i.e. about 17, 15, 20, 19 and 17 species and genera from winter kidney bean, peas, broad bean, summer kidney bean and cowpea respectively (Table 2).

The highest occurrence was recorded for the unidentified lycosid genus one G_1 (67, 94 and 138 individuals in peas, cowpea and summer kidney bean respectively) followed by *Wadicosa fidelis*: 45, 72 and 184 individuals for peas, winter kidney bean and cowpea respectively.

The rarest taxa of spiders were *Lycosoides* sp. and *Dysdera* sp. in winter kidney bean, Araneidae and *Tegenaria* sp. in broad bean, *Cheiracanthium* sp. in winter and summer kidney bean, Pisauridae in broad bean, *Menemerus* sp. in summer kidney bean and *Loxosceles* sp. in broad bean and summer kidney bean. No females of *Steatoda erigoniformis* were obtained by the traps during the study period in broad bean, winter and summer kidney bean while one female was recorded in peas and another in cowpea.

Occurrence of spider taxa in cucumber and squash

Spiders of about 25 species and genera were collected from cucumber and squash in winter and summer. Identification of these spiders with their age structure and population are included in Table (3).

During the winter season, about 14 species and genera were collected. Six of them were recorded in both crops while four taxa were only collected from cucumber, of which only one individual of *Setaphis subtilis* and 8 individuals of *Thanatus albini* were recorded. Four taxa were only collected from squash, three of them, i.e. *Prinerigone vagans*, *Cheiracanthium* sp. and an unidentified theridiid, recorded the same lowest occurrence of one individual while the fourth, *P. injucunda*, was recorded by 4 adult individuals. The highest occurred taxa in cucumber and squash were the lycosid G_1 and *Erigone dentipalpis* which recorded 51 and 14 individuals respectively.

During the summer season, about 21 species and genera were recorded. Fifteen of them were collected from both cucumber and squash. Three taxa were only collected from cucumber, i.e. *Micaria* sp., *Synaphosus* sp. and unidentified salticids that were represented by 1, 1 and 5 individuals respectively. Other three taxa were only recorded from squash, each by one individual, i.e. *S. subtilis, G. dentatum* and *Scytodes* sp. The highest populations were recorded for the lycosid G_1 by 178 and 80 individuals in cucumber and squash respectively.

Total number of spiders' populations in winter and summer cucumber (141 and 369) were higher than in squash (46 and 229 individuals) respectively.

Occurrence of spiders in the other cucurbit crops

About 24 spider species and genera were recorded in the other cucurbits, of which about 16, 18, 14 and 13 species and genera collected from sweet squash, watermelon, watermelon intercropped with maize and muskmelon respectively (Table 4).

G_1 of the family Lycosidae recorded the highest occurrence in sweet squash, watermelon and watermelon intercropped with maize 323, 271 and 101 individuals respectively. The highest occurrence in muskmelon was recorded by 53 individuals of *W. fidelis*. The lowest populations were for an unidentified gnaphosid, *G. dentatum* and *Scytodes* sp. in sweet squash, an unidentified dictynid, *Micaria* sp. and *Kochiura aulica* in watermelon, an unidentified lycosid G_2 and *Plexippus paykulli* in watermelon intercropped with maize and *Dysdera* sp., *Zelotes* sp., an unidentified linyphiid, *E. dentipalpis*, an unidentified theridiid and *S. erigoniformis* in muskmelon. These recorded the same number of one individual per each.

Table 5: Seasonal abundance of spiders in the studied crops.

Taxa	Autumn	Winter	Spring	Summer
	T	T	T	T
Agelenidae *Lycosoides* sp.	-	0.08	-	-
Tegenaria sp.	-	0.08	-	-
Araneidae *	-	-	0.02	0.10
Dictynidae *	-	-	0.04	0.02
Dysderidae *Dysdera* sp.	-	0.05	-	0.05
Gnaphosidae *	0.08	0.05	0.14	-
Micaria sp.	0.04	0.10	0.08	0.65
Setaphis subtilis	0.09	0.05	0.07	-
Synaphosus sp.	-	-	0.20	-
Zelotes sp.	-	-	0.02	0.92
Linyphiidae *	0.63	1.68	4.11	0.44
Erigone dentipalpis	0.86	0.79	2.72	0.08
Gnathonarium dentatum	-	0.10	0.10	0.04
Prinerigone vagans	0.33	0.62	1.57	0.18
Lycosidae *	4.00	1.45	5.72	9.77
Hogna ferox	0.04	0.05	0.38	0.79
Pardosa injucunda	0.24	0.05	0.69	1.47
Wadicosa fidelis	5.81	4.37	3.92	19.26
G1	4.10	3.79	18.74	14.17
G2	-	-	1.21	1.17
Miturgidae *Cheiracanthium* sp.	-	0.10	0.21	-
Philodromidae *Thanatus albini*	0.73	0.28	1.80	2.24
Pisauraidae *	-	0.08	0.05	-
Salticidae *	-	-	0.38	1.34
Menemerus sp.	-	-	-	0.02
Plexippus paykulli	-	-	-	0.02
Scytodidae *Scytodes* sp.	-	-	-	0.04
Sicariidae *Loxosceles* sp.	-	-	0.21	-
Tetragnathidae *	-	1.09	-	-
Theridiidae *	0.04	0.10	0.08	0.06
Kochiura aulica	-	-	-	0.02
Steatoda erigoniformis	0.45	0.29	0.77	1.81
Titanoecidae	-	-	0.02	-
Total	17.44	15.25	43.25	54.69
Average	1.14	0.69	1.47	2.19
S.D.	1.80	1.15	3.50	4.73

* = Individuals only identified to family level. T = Total number / trap.

Seasonal abundance of spiders in the studied crops

About 33 species of 33 genera and 16 families were recorded throughout the four seasons of the year. *Hogna ferox,* G1, *W. fidelis* and *P. injucunda* (Family Lycosidae), *E. dentipalpis, P. vagans* and *G. dentatum* (Family Linyphiidae), *S. erigoniformis* (Family Theridiidae) and *T. albini* (Family Philodromidae) were the most abundant during this study (Table 5). *S. erigoniformis* was recorded for the first time from Qalyubiya governorate. However, it was previously recorded from Alexandria and Nile Delta without definite locality (El-Hennawy, 2002).

Table 6: Taxonomic list of arthropod fauna associated with spiders in investigated vegetable fields.

Class *	Order	Family	Species
Crustacea	Isopoda		
Insecta	Coleoptera	Anobiidae	*Ptinus* sp.
		Anthicidae	*Anthicuc crinitus*
		Carabidae	*Dichirotrichus* sp. *Tachys lucasi*
		Chrysomelidae	*Chaetocenema latipennis* *Hypocassida subferruginea*
		Cicindelidae	*Cicindela melancholica*
		Curculionidae	*Sitona* sp. *Temnorhinus* sp.
		Dermestidae	*Attagenus pubescens*
		Elateridae	*Drasterius bimaculatus*
		Histeridae	*Saprinus* sp.
		Mycetophagidae	
		Nitidulidae	*Carpophilus* sp.
		Scarabaeidae	*Aphodius nanus* *Onthophagous aerarius* *Pentodon algerinum* *Psammodius porcicollis* *Rhyssemus goudoti* *Tropinota squalida*
		Tenebrionidae	*Gonocephalum* sp. *Scleron orientale* *Zophosis oculosis*
	Collembola		
	Dermaptera	Labiduridae	*Labidura riparia*
	Hemiptera	Cydinidae	
		Lygaeidae	*Emblethis* sp. *Geocoris acuticeps* *Heterogaster* sp.
		Pentatomidae	*Eusarcoris inconspicuus*
	Hymenoptera	Formicidae	*Camponotus aegyptiacus* *Cataglyphis niger* *Monomorium* sp. *Pheidole megace*
	Orthoptera	Gryllidae	*Acheta domestica*
			Gryllus bimaculatus
Chilopoda, Myriapoda	Geophilomorpha	Geophilidae	
	Lithobiomorpha	Lithobiidae	
	Scutigeromorpha	Scutigeridae	

* There are different taxonomic opinions in the classification of these higher taxa.

Spring season showed the occurrence of the highest number (25) of spider taxa, followed by summer season (23), while winter recorded 21 taxa and autumn recorded the lowest number of taxa (14). This shows the high diversity of spider taxa during spring and summer. Three taxa including *Lycosoides* sp., *Tegenaria* sp. of the family Agelenidae and unidentified individuals of Tetraganthidae occurred only in winter, while titanoecids, *Loxosceles* sp. and *Synaphosus* sp. were recorded in spring.

Spiders found in the different crops showed the high occurrence of 11 taxa comprising lycosid unidentified juveniles, G_1, *W. fidelis* and *P. injucunda*; unidentified individuals of Linyphiidae, *P. vegans* and *E. dentipalpis*; unidentified individuals of Theridiidae and its *S. erigoniformis*; *T. albini* of the family Philodromidae; and *Micaria* sp. of the family Gnaphosidae. This may be attributed to their tolerance to variance in weather conditions and other ecological, biotic and abiotic variables. On the other hand, *K. aulica* of the family Theridiidae, *Scytodes* sp. of the family Scytodidae and *Menemerus* sp. and *P. paykulli* of the family Salticidae were only collected in summer in few numbers.

Survey of other arthropod fauna

Concerning arthropod fauna other than spiders, members of ten orders of the three classes, or higher taxa, Crustacea, Insecta and Chilopoda (Myriapoda) were collected with association of spiders in pitfall traps. These arthropods were presented by orders Isopoda (Crustacea), Coleoptera, Collembola, Dermaptera, Hemiptera, Hymenoptera and Orthoptera (Insecta) and Geophilomorpha, Lithobiomorpha and Scutigeromorpha (Chilopoda, Myriapoda) (Table 6).

Surveyed orders included more than 22 families of which 33 genera and 23 species were identified. The most abundant species recorded during this study were: Collembola, *Acheta domestica* (Order Orthopetra), *Camponotus aegyptiacus, Cataglyphis niger, Monomorium* sp. and *Pheidole megace* (Order Hymenoptera), *Labidura riparia* (Order Dermaptera), *Anthicuc crinitus*, *Drasterius bimaculatus*, *Gonocephalum* sp. and *Zophosis oculosis* (Order Coleoptera).

In conclusion, this study is considered a primary investigation of the occurrence of spiders and other associated arthropods in legume and cucurbit crops in the southern part of Nile Delta. However, other studies are still needed to clarify the role of these arthropods as predators of agricultural pests.

List of identified spider species

Erigone dentipalpis (Wider, 1834)
Gnathonarium dentatum (Wider, 1834)
Hogna ferox (Lucas, 1838)
Kochiura aulica (C.L.Koch, 1838)
Pardosa injucunda (O.P.-Cambridge, 1876)
Plexippus paykulli (Audouin, 1825)
Prinerigone vagans (Savigny, 1825)
Setaphis subtilis (Simon, 1897)
Steatoda erigoniformis (O.P.-Cambridge, 1872)
Thanatus albini (Audouin, 1825)
Wadicosa fidelis (O. P.-Cambridge, 1872)

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Spider populations associated with different types of cultivation and different vegetable crops in Fayoum Governorate (Egypt)

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Abstract

This is a study of the effects of 3 cultivation types and 10 agricultural vegetable crops on spider populations. It was carried out in Fayoum (Middle Egypt) by pitfall traps. Highest densities of spider individuals were in cabbage monoculture (52), and pepper/eggplant intercropping (45). The lowest densities of spiders were found in garlic crop rotation (11) and tomato monoculture (13).

Keywords: Spiders, Intercropping, Monoculture, Crop rotation, Fayoum, Egypt.

Introduction

Spiders play an important role as predators in regulating insect pests in the agricultural ecosystem. They are classified into about 40,000 species distributed all over the world in almost every kind of habitat. The population densities and species abundance of spider communities in agricultural fields can be as high as in natural ecosystems (Turnbull, 1973).

Crop diversity also leads to an availability of alternative prey, which may increase spider diversity as well as reducing territory size of spiders, leading to a stable population of spiders at high densities (Provencher & Vickery, 1988). To conserve and enhance spider populations, agricultural systems should be manipulated in ways beneficial to the needs of the spiders. The structural complexity of the environment is directly related to spider density and diversity. Highly varied habitats provide a greater array of microhabitats, microclimatic features, alternative food sources, retreat sites, and web attachment sites. All of which encourage colonization and establishment of spiders (Riechert & Lockley, 1984; Young & Edwards, 1990; and Rypstra *et al.*, 1999).

A strong relationship between spider density and habitat structure has been demonstrated by correlations and experimental manipulations. Measures that increase the structural complexity of the habitat, such as intercropping, mulching and conservation tillage, are known to enhance spider density and diversity (Rypstra *et al.*, 1999).

In Egypt, spiders represent a considerable ratio, 36.34%, of the total soil fauna, collected by pitfall traps, in different agroecosystems in Fayoum, Middle Egypt (Ghabbour & Mikhail, 1993), while their ratio is only 4.44% in the newly reclaimed desert ecosystem west of the Nile Delta (Hussein, 1993).

This work studies the effect of different types of cultivation, i.e. intercropping, monoculture and crop rotation, of different vegetable crops on the activity density and biodiversity of spiders in Fayoum (Middle Egypt).

Material and Methods

Study Area. The locality of the experiment was Sennouras village, Fayoum Governorate, during the period of May 15 until the end of October 2003. The study area consists of ⅓ feddan (1 feddan = 4200m^2) divided into five plots and cultivated with different types of cultivation.

Plot (1): Cultivated with tomato (*Lycopersicon esculentum*) intercropped with squash (*Cucumis cucurbita*), from May to August, while tomato continued alone, i.e. monoculture, until the 1st November.

Plot (2): Cultivated with tomato intercropped with pumpkin (*Cucurbita moschata*) from May to August, followed by tomato and squash until the 1st of November as crop rotation.

Plot (3): Cultivated with cowpea (*Vigna unguiculata*), monoculture, followed by garlic (*Allium sativum*) as crop rotation.

Plot (4): Cultivated with green pepper (*Capsicum frutescens*), intercropped with eggplant (*Solanum melongena*) from May to August followed by spinach (*Spinacia oleracea*) and radish (*Raphanus sativus*) as crop rotation.

Plot (5): Cultivated with cabbage (*Brassica capitata*) as monoculture.

Sampling method. The samples of spiders were collected from the study area by the pitfall trap method as described by Southwood & Henderson (2000). Four traps/week were regularly applied for each crop. Obtained spiders were preserved in 75% ethyl alcohol and classified to species level as much as possible. A list of identified spider species, alphabetically arranged, is presented after table (3) with authors and dates to avoid mentioning them inside the tables and text.

Frequency and Abundance values. The frequency values of the most abundant species were classified into three classes according to the system adopted by Weis Fough (1984). "Constant" species were considered as those found in more than 50% of samples, “accessory species” were those found in 25-50% of samples, and “accidental species” were those found in less than 25% of the samples. On the other hand, the classification of dominance, abundance, values was done according to Weigmann (1973) system (El-Shahawy and El-Basheer, 1992) in which the species were divided into five groups based on the values of dominance in the sample, i.e. percentage of individuals; Eudominant species (>30%), dominant (10-30%), subdominant (5-10%), resident (1-5%) and subresident species (<1%).

Results and Discussion

1- Effect of intercropping

Four families were recorded from the intercropping cultivation. The total number of obtained spiders was 28, 30, and 44 from the three plots of tomato/squash, tomato/pumpkin and pepper/eggplant respectively (Table 1). The highest number of spiders was obtained in August. It was: 15, 16, and 15 from the intercropping tomato/squash, tomato/pumpkin and pepper/eggplant respectively.

Lycosidae was the predominant family of spiders with the ratios 89.29, 83.33 and 68.9% in intercropping tomato/squash, tomato/pumpkin and pepper/eggplant respectively (Table 4). It was considered a constant family according to the system adopted by Weis Fogh (1984) and it was eudominant family according to Weigmann's system (1973). Ghabbour *et al.* (1999) indicated that Lycosidae was the predominant family (79.06%) of spider fauna in different crops. In addition, Ahmed (2003) indicated that Lycosidae represented most of the spider population recording 83.77% with very high occurrence.

Linyphiidae was considered an accidental family and a resident in tomato intercropping squash and tomato/pumpkin but it was a dominant family in pepper/eggplant intercropping. Coll & Bottrell (1995) studied the effect of intercropping bean/maize cultivation to report that spiders of families Linyphiidae and Araneidae were more abundant in dicultures.

In this study, the number of spiders collected from the plot cultivated with pepper intercropping eggplant is more than other plots. Wallwork (1976) explained that spider populations are separated by different preferences for microclimatic conditions, although these preferences may vary within a species, during the reproductive period. In addition, soil texture may have an important influence on the distribution patterns of spiders that deposit their cocoons in the soil.

Table 1: Spider families, genera and species, affected by different types of intercropping vegetables.

Taxa	Tomato / Squash					Tomato / Pumpkin					Pepper / Eggplant				
	Sex and age structure				Tn	Sex and age structure				Tn	Sex and age structure				Tn
	♂	♀	Sa	J		♂	♀	Sa	J		♂	♀	Sa	J	
Linyphiidae *			1s♂		1			1s♂		1	1			2	3
Erigone dentipalpis												1			1
Prinerigone vegans			1s♀	1	2				1	1			1s♂	3	4
Lycosidae *	2			5	7				13	13				5	5
Wadicosa fidelis	5	4	2s♂, 3s♀	3	17	7			1	8	10	3	4s♂, 4s♀	2	23
Lycosidae (one genus)			1s♂		1	1	2	1s♀		4	2		1s♂		3
Philodromidae *Thanatus* sp.											1	1		1	3
Thanatus albini							1	1s♀	1	3					
Theridiidae *											1				1
Kochiura aulica											1				1
Total	7	4	8	9	28	8	3	3	16	30	16	5	10	13	44

* = Individuals only identified to family level; J = juvenile; Sa = subadult; Tn = total number.

2- Effect of monoculture

Seven families were recorded from the monoculture cultivation. The total number of obtained spiders was 29, 52, 13 from the three plots of kidney bean, cabbage and tomato respectively (Table 2).

Cabbage's microclimate was very important factor for the high population density of spiders. Vlijm & Kessler-Geschiere (1967) explained that microclimate seems to be an important factor in determining distribution patterns. Some spider species, at least, show narrow tolerances of environmental temperature and relative humidity. However, these preferences may change with the seasons and with the completion of mating. In addition, Ghabbour *et al.* (1999) concluded that, the differences of number might be due to shade of plants and available humidity expressed as water requirements for each crop in addition to density of plants/acre. This directly affects abundance of spiders' prey and governs occurrence of birds and other spiders' natural enemies.

Lycosidae was the predominant family with the ratios 68.96, 84.62 and 69.23% in monoculture cultivation of kidney bean, cabbage and tomato respectively (Table 4). It was considered a constant and eudominant family. Dictynidae was dominant in kidney bean and Philodromidae was dominant in tomato monocultures. Both Linyphiidae and Miturgidae were resident in kidney bean and cabbage. Thomisidae was subdominant (7.69%) in monoculture tomato while it disappeared from kidney bean and cabbage. However, some vegetables positively affect the biodiversity and activity of some families and another type of vegetables has negative effects. The population density is dependant on the total number of pests that invested plants.

Table 2: Spider families, genera and species, affected by different types of monoculture vegetables.

Taxa	Kidney Bean					Cabbage					Tomato				
	Sex and age structure				Tn	Sex and age structure				Tn	Sex and age structure				Tn
	♂	♀	Sa	J		♂	♀	Sa	J		♂	♀	Sa	J	
Dictynidae *		2		3	5										
Linyphiidae *									1	1					
Gnathonarium dentatum		1			1										
Lycosidae *				4	4	2			8	10				3	3
Wadicosa fidelis	5	4	1s♂	1	11	12	9	2s♂	7	30	2	2			4
Lycosidae (one genus)	3	2			5	1	3			4	2				2
Miturgidae *Cheiracanthium* sp.	1				1				1	1					
Cheiracanthium isiacum											1				1
Philodromidae *Thanatus* sp.									1	1	1				1
Thanatus albini						2	1		1	4		1			1
Salticidae *									1	1					
Theridiidae *				1	1										
Kochiura aulica	1				1										
Thomisidae *Thomisus spinifer*											1				1
Total	10	9	1	9	29	17	13	2	20	52	7	3	0	3	13

* = Individuals only identified to family level; J = juvenile; Sa = subadult; Tn = total number.

3- Effect of crop rotation

Six families were recorded from the crop rotation cultivation. The total number of obtained spiders was 11, 19, and 14 from the three plots of garlic, radish/spinach and tomato/squash respectively (Table 3). The lowest number of individuals and diversity of spider species was found in the plot cultivated by garlic after cowpea, i.e. Plot 3. Crop rotation generally decreases the individual pest infestation, especially in garlic.

Lycosidae constituted a higher population than other families. This result is agreed with Ghallab *et al.* (In press) and Edwards & Lofty (1969) that crop rotation decreases species diversity to an even greater extent. Rizk *et al.* (2002) explained the result that chemical composition of plants is of great importance in guiding the insect in the selection process. In addition, spiders, in this study, might be affected with volatile garlic deterrents.

Lycosidae was the predominant family with the ratios 63.64, 68.4 and 57.14% in crop rotation cultivation of garlic, radish/spinach and tomato/squash, respectively (Table 4). It was considered a constant eudominant family. Philodromidae was dominant in the three plots. Other dominant families were Theridiidae in garlic and Dictynidae in tomato/squash.

Table 3: Spider families, genera and species, affected by different types of crop rotation vegetables.

Taxa	Garlic					Radish / Spinach					Tomato / Squash				
	Sex and age structure				Tn	Sex and age structure				Tn	Sex and age structure				Tn
	♂	♀	Sa	J		♂	♀	Sa	J		♂	♀	Sa	J	
Dictynidae *									1	1	1	1			2
Linyphiidae *Prinerigone vegans*						1				1					
Lycosidae *				3	3				5	5				5	5
Wadicosa fidelis	2	1	1s♂		4	3	3	1s♂		7		2			2
Lycosidae (one genus)						1				1	1				1
Miturgidae *Cheiracanthium* sp.													1s♂		1
Philodromidae *Thanatus* sp.				1	1				3	3				3	3
Thanatus albini	1				1										
Theridiidae *				2	2										
Kochiura aulica						1				1					
Total	3	1	1	6	11	6	3	1	9	19	2	3	1	8	14

* = Individuals only identified to family level; J = juvenile; Sa = subadult; Tn = total number.

List of identified spider species

Erigone dentipalpis (Wider, 1834)
Cheiracanthium isiacum O.P.-Cambridge 1874
Gnathonarium dentatum (Wider, 1834)
Kochiura aulica (C.L.Koch, 1838)
Prinerigone vagans (Savigny, 1825)
Thanatus albini (Audouin, 1825)
Thomisus spinifer O.P-Cambridge 1872
Wadicosa fidelis (O. P.-Cambridge, 1872)

Conclusion

This study indicated that the diversity of the spider fauna in a given site is often related to the structural diversity of the habitat. Indirectly, the surface vegetation affects spider population density and biodiversity, which is influenced by microclimate of the plant. Where growth dependent on a mosaic of microclimatic conditions is produced with shaded areas interspersed with more open exposed area. These variations in sun and shade have a marked effect on the horizontal distribution patterns of many pests affected directly on the growth rate of spiders.

Acknowledgment

The authoresses express sincere thanks to Col. H.K. El-Hennawy who identified spiders.

Table 4: Spider families, abundance and frequency in intercropping, monoculture, and crop rotation vegetables.

Family	Frequency	Intercropping Vegetables									Monoculture Vegetables									Crop rotation Vegetables								
		Tomato + Squash			Tomato + Pumpkin			Pepper + Eggplant			Kidney Bean			Cabbage			Tomato			Garlic			Radish + Spinach			Tomato + Squash		
		Total	%	Abundance	Total	%	Abundance	Total	%	Abundance	Total	%	Abundance	Total	%	Abundance	Total	%	Abundance	Total	%	Abundance	Total	%	Abundance	Total	%	Abundance
Dictynidae	A	0	-	-	0	-	-	0	-	-	5	17.24	D	0	-	-	0	-	-	0	-	-	1	5.3	Sd	2	14.3	D
Linyphiidae	A	1	3.57	R	1	3.33	R	5	11.11	D	1	3.45	R	1	1.92	R	0	-	-	0	-	-	0	-	-	0	-	-
Lycosidae	C	25	89.29	Ed	25	83.33	Ed	31	68.9	Ed	20	68.96	Ed	44	84.62	Ed	9	69.23	Ed	7	63.64	Ed	13	68.4	Ed	8	57.14	Ed
Miturgidae	A	0	-	-	0	-	-	0	-	-	1	3.45	R	1	1.92	R	1	7.69	Sd	0	-	-	0	-	-	1	7.14	Sd
Philodromidae	A	2	7.17	Sd	1	3.33	R	6	13.33	D	0	-	-	5	9.62	Sd	2	15.38	D	2	18.18	D	4	21.1	D	3	21.4	D
Salticidae	A	0	-	-	0	-	-	2	4.44	R	0	-	-	1	1.92	R	0	-	-	0	-	-	1	5.3	Sd	0	-	-
Theridiidae	A	0	-	-	3	10.0	Sd	1	2.22	R	2	6.89	Sd	0	-	-	0	-	-	2	18.18	D	0	-	-	0	-	-
Thomisidae	A	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-	1	7.69	Sd	0	-	-	0	-	-	0	-	-
Total		28			30			45			29			52			13			11			19			14		

Frequency: A = Accidental (found in < 25 % of the samples), C = Constant (found in > 50 % of the samples). [The same for all crops]
Abundance: R = Resident (1-5 %), Sd = Subdominant (5-10 %), D = Dominant (10-30 %), Ed = Eudominant (> 30 %).

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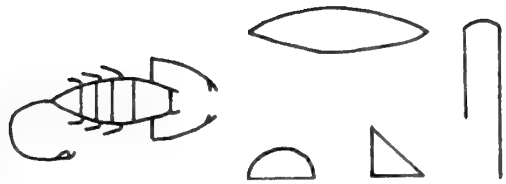

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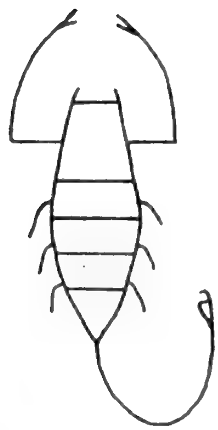

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A Checklist of the spiders of Turkey

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Abstract

This checklist of Turkish spiders comprises 613 species and 2 subspecies. Their distribution in Turkey is presented. Four species, i.e. *Alopecosa aculeata*, *Clubiona marmorata*, *Eresus sandaliatus*, and *Nigma walckenaeri*, are here recorded for the first time from the Turkish araneofauna. Drawings of external genitalia of the four species are presented.

Keywords: Spiders, Araneae, New record, Checklist, Turkey.

Introduction

The araneological activity in Turkey can be divided into three periods. In the first period (1846-1964), araneological records have been mainly based on visits of earlier researchers, such as Rossi (1846), Ausserer (1871), Pickard-Cambridge (1874), Simon (1875, 1878, 1879, 1884), Pavesi (1876, 1878), Kulczyński (1903, 1915), Nosek (1905), Strand (1907), Reimoser (1913, 1919, 1920), Dalmas (1920, 1921), Rouzsky (1925), Fage (1931), Giltay (1932), Spassky (1932), Bristowe (1935), Caporiacco (1935), Charitonow (1936), Drensky (1936), Bonnet (1955, 1956, 1957, 1958, 1959), Roewer (1960), Wiehle (1963), and Guy (1966).

A more detailed study of the araneofauna of Turkey was carried out by Sevinç Karol (1964, 1965, 1966a, 1966b, 1966c, 1966d, 1966e, 1967a, 1967b, 1968, 1969), in the second period (1964-1969). The first araneological checklist was published by her. She reported 302 species belonging to 119 genera in a review of all literature at that time (Karol, 1967b).

After Karol, new generation of foreign araneologists appeared and made further contributions of new species and new records to the araneofauna of Turkey (Lehtinen & Saaristo, 1972; Alicata, 1974; Deltshev, 1980; Millidge, 1981; Deeleman-Reinhold & Deeleman, 1988). The Italian arachnologist Paolo Marcello Brignoli mainly concentrated on cave-dwelling species and published many papers on Turkish spiders (Brignoli 1968, 1972, 1978a, 1978b, 1979a, 1979b). Other publications of variable importance included data on Turkish spiders were those of Wunderlich (1978, 1980, 1984, 1994, 1995a, 1995b, 1995c), Levy & Amitai (1981), Hippa & Oksala (1982, 1983), Platnick & Murphy (1984), Hippa *et al.* (1986), Wesołowska (1986), Griswold (1990), Maurer (1992), Ovtsharenko *et al.* (1992), Schmidt & Smith (1995), Levy (1996, 2004), Saaristo & Tanasevitch (1996), Saaristo (1997), Bosmans (1997), Bosmans & Van Keer (1999), Deltshev (1999, 2000), Logunov & Marusik (1999), Senglet (2001), Azarkina (2002, 2004), Buchar & Thaler (2002), Gasparo (2002), Lehtinen (2002), Prószyński (2003), Muster & Thaler (2004).

Since 1987, Abdullah Bayram, who is the second Turkish araneologist after Sevinç Karol, started the study of several spider genera of Turkey. He published many contributions to the araneofauna of Turkey with ecological notes, i.e. Bayram (1987, 1994, 1996), Bayram & Allahverdi (1994), Bayram & Göven (2001), Bayram & Özdağ (2000), Bayram & Ünal (2000), Bayram & Varol (1996, 1999, 2000, 2003), Bayram, Varol & Tozan (2000), Bayram *et al.* (2002a, 2002b). In 2002, he revised Karol's checklist (1967b) and reported 520 species belonging to 162 genera from Turkey (Bayram, 2002). But, this second checklist do not include several important revisions and faunistical records, i.e. Levy & Amitai (1981), Hippa & Oksala (1983), Deeleman-Reinhold & Deeleman (1988), Wunderlich (1994), Bosmans & Van Keer (1999). In addition, other Turkish araneologists have recently contributed to the study of spiders of Turkey (Varol, 2001; Topçu & Demir, 2004; Tanasevitch, Kunt & Seyyar, 2004; Tanasevitch, Topçu, & Demir, 2004; Topçu *et al.* 2005).

This paper presents up-to-date review of the araneofauna of Turkey. It is derived from: 1) a critical incorporation of all available records from the literature concerning the distribution of spiders of Turkey, 2) a revision of all of the existing material in NUAM (Arachnology Museum of Niğde University). The species available in NUAM were marked by an asterisk in Table (1). This checklist also contains four new records for the araneofauna of Turkey with drawings of their external genitalia (Figs. 2-5), and a list of all publications on Turkish spiders, published between 1846 and 2005.

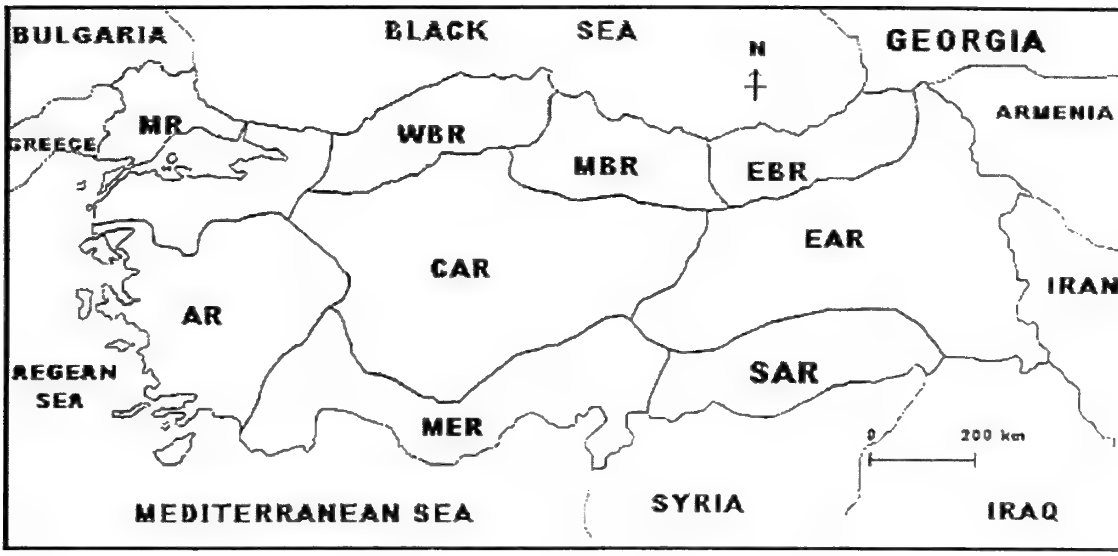
Geographical regions of Turkey

The lands of Turkey are located at a point where the three continents making up the old world, Asia, Africa and Europe, are near to each other. The lands of Turkey are geographically located in the northern half of the hemisphere at a point that is about halfway between the equator and North Pole, at a longitude of 36-42°N and latitude of 26-45°E. Because of its geographical location the mainland of Turkey has zoogeographical significance.

Turkey is generally divided into seven regions: the Black sea region, the Marmara region, the Aegean region, the Mediterranean region, Central Anatolia (Anatolian plateau) region, the East and Southeast regions. The uneven North Anatolian terrain running along the Black sea resembles a narrow but long belt. The land of this region is approximately 1/6 of Turkey's total land area.

The Marmara region covers the area encircling the Sea of Marmara, including the entire European part of Turkey, as well as the northwest of the Anatolian Plain. The Aegean region extends from the Aegean coast to the inner parts of western Anatolia. In general, the mountains in the region fall perpendicularly into the sea and the plains run from east to west. In the Mediterranen region, located in the South of Turkey, the western and central Taurus Mountains suddenly rise up behind the coastline. The Central Anatolian region is exactly in the middle of Turkey and gives the appearance of being less mountainous compared with the other regions. The Eastern Anatolia region is Turkey's largest and highest region. About three fourths of it is at an altitude of 1.500-

2.000 metres. Eastern Anatolia is composed of individual mountains as well as of whole mountain ranges, with vast plateaus and plains. There are numerous inactive volcanoes in the region, including Nemrut, Süphan, Tendürek and Turkey's highest peak, Mount Ağrı, which is 5.165 metres. The southeast Anatolia region is notable for the uniformity of its landscape, although the eastern part of the region is comparatively more uneven than its western areas (Map 1). The abbreviations used in the paper of the geographical areas are as follows: WBR = West Black Sea Region, MBR = Middle Black Sea Region, EBR = East Black Sea Region, MR = Marmara Region, AR = Aegean Region, MER = Mediterranean Region, CAR = Central Anatolia Region, EAR = East Anatolia Region, and SAR = Southeast Anatolia Region.



Map 1. Geographical regions of Turkey.

Results

The spider fauna of Turkey is represented by 613 species and 2 subspecies, included in 43 families: Ctenizidae 1, Nemesiidae 2, Theraphosidae 1, Filistatidae 1, Sicariidae 1, Scytodidae 1, Leptonetidae 3, Pholcidae 16, Segestriidae 3, Dysderidae 42, Palpimanidae 2, Mimetidae 1, Eresidae 3, Oecobiidae 1, Uloboridae 3, Nesticidae 2, Theridiidae 31, Theridiosomatidae 1, Anapidae 1, Linyphiidae 56, Tetragnathidae 10, Araneidae 33 (+ 1 subspecies), Lycosidae 63, Pisauridae 1, Oxyopidae 5, Zoropsidae 1, Agelenidae 41, Cybaeidae 3, Hahniidae 4, Dictynidae 7, Amaurobiidae 14, Phyxelididae 1, Titanoecidae 3, Miturgidae 5, Liocranidae 4, Clubionidae 5, Zodariidae 13, Prodidomidae 1, Gnaphosidae 73 (+ 1 ssp.), Sparassidae 6, Philodromidae 22, Thomisidae 56, and Salticidae 71 (Fig. 1).

This number is established after a critical review of all available records from the literature concerning the spiders in the Turkey and a revision of all existing materials in NUAM. The number of species is low compared with the number of species recorded from other countries, i.e. Bulgaria 985 (Deltshev & Blagoev, 2001), Germany 925 (Koponen, 1993), Russia 1974 (Mikhailov, 2000), because of lack of araneological studies. The zoogeographic classification of the spiders has been made on the basis of literature data reflecting their current distribution (Platnick, 2005). In the zoogeographic categories, Palearctic species are dominant (represented by 179 species), followed by 109 Turkish endemic species (and subspecies) that are only known from Turkey (17.8 %). Many of the endemic species are mainly distributed in caves in the Mediterranean region.

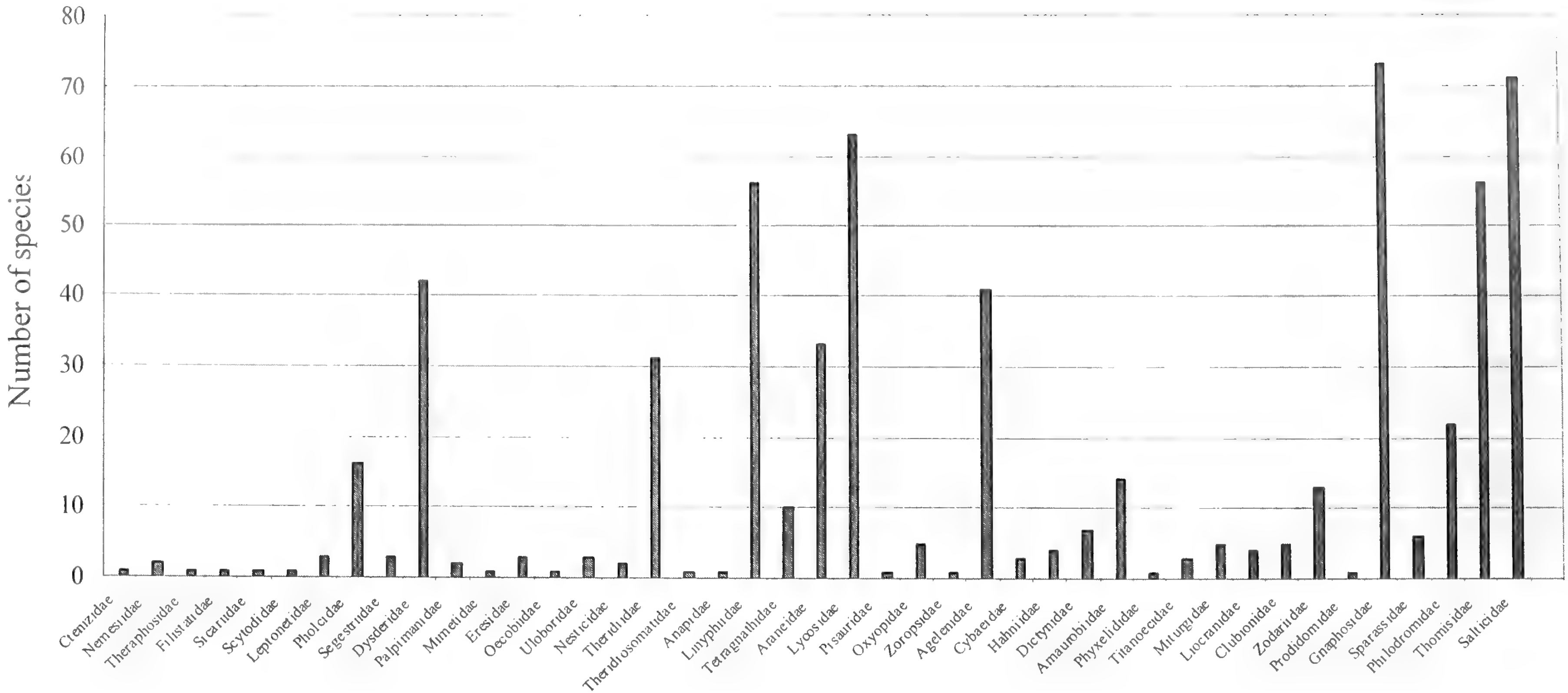


Fig. 1. Number of spider species per family in Turkey.

Table 1: Checklist of the spiders of Turkey.

SPECIES	DISTRIBUTION	RECORDS
Ctenizidae		
Cyrtocarenum cunicularium (Olivier, 1811)	Mediterranean	MR, AR
Nemesiidae		
Brachythele varrialei (Dalmas, 1920)	Eastern European	AR
Raveniola micropa (Ausserer, 1871)	Turkey	MER
Theraphosidae		
Chaetopelma gracile (Ausserer, 1871) *	Mediterranean	MER
Filistatidae		
Filistata insidiatrix (Forskål, 1775) *	Mediterranean-Asian	MER, EAR, SAR
Sicariidae		
Loxosceles rufescens (Dufour, 1820) *	Cosmopolitan	MR, AR, MER, EAR
Scytodidae		
Scytodes thoracica (Latreille, 1802) *	Holarctic	MER, CAR, EAR, SAR
Leptonetidae		
Cataleptoneta aesculapii (Brignoli, 1968)	Turkey	MER
Cataleptoneta sbordonii (Brignoli, 1968) *	Turkey	MER
Leptonetela deltshevi (Brignoli, 1979)	Turkey	MBR
Pholcidae		
Artema atlanta Walckenaer, 1837	Pantropical	AR
Holocnemus pluchei (Scopoli, 1763) *	Mediterranean	MR, AR, MER, CAR, EAR, SAR
Hoplopholcus asiaeminoris Brignoli, 1978 *	Turkey	MR, MER, CAR
Hoplopholcus cecconii Kulczyński, 1908	Asia Minor-Levantine	MR, CAR
Hoplopholcus figulus Brignoli, 1971	Balkans-Asia Minor	EBR
Hoplopholcus forskali (Thorell, 1871)	Eastern European	Turkey [1]
Hoplopholcus labyrinthi (Kulczyński, 1903)	Eastern Mediterranean	AR
Hoplopholcus longipes (Spassky, 1934) *	Pontic	EBR
Hoplopholcus minotaurinus Senglet, 1971	Eastern Mediterranean	AR
Hoplopholcus minous Senglet, 1971	Eastern Mediterranean	AR
Hoplopholcus patrizii (Roewer, 1962)	Turkey	MER
Pholcus opilionoides (Schrank, 1781) *	Holarctic	MR, MER, EAR

SPECIES	DISTRIBUTION	RECORDS
Pholcus phalangioides (Fuesslin, 1775) *	Cosmopolitan	MBR, MR, AR, MER, CAR, EAR, SAR
Pholcus spasskyi Brignoli, 1978	Turkey	SAR
Pholcus turcicus Wunderlich, 1980	Turkey	EBR
Spermophora senoculata (Dugès, 1836)	Holarctic	EAR, SAR
Segestriidae		
Ariadna insidiatrix Savigny, 1825	Mediterranean	MR
Segestria bavarica C.L.Koch, 1843	European-Asian	Turkey
Segestria florentina (Rossi, 1790)	European-Asian	AR
Dysderidae		
Dasumia mariandyna Brignoli, 1979	Turkey	WBR
Dysdera anatoliae Deeleman-Reinhold, 1988	Turkey	CAR
Dysdera argaeica Nosek, 1905	Turkey	CAR
Dysdera asiatica Nosek, 1905	Turkey	CAR
Dysdera crocata C.L.Koch, 1838 *	Cosmopolitan	MR, MER, SER
Dysdera enguriensis Deeleman-Reinhold, 1988	Turkey	CAR
Dysdera erythrina (Walckenaer, 1802) *	Europe - Pontic	MR, CAR
Dysdera gruberi Deeleman-Reinhold, 1988	Turkey	CAR
Dysdera hamulata Kulczyński, 1897	Eastern European	SAR
Dysdera hattusas Deeleman-Reinhold, 1988	Turkey	CAR
Dysdera kollari Doblika, 1853	Balkans-Ukraine	AR
Dysdera lata Wider, 1834	Mediterranean to Georgia	CAR, EAR
Dysdera longimandibularis Nosek, 1905	Turkey, Cyprus	CAR
Dysdera longirostris Doblika, 1853	Eastern European	EAR, SAR
Dysdera mixta Deeleman-Reinhold, 1988	Turkey	CAR
Dysdera ninnii Canestrini, 1868	Middle East-European	Turkey
Dysdera rubus Deeleman-Reinhold, 1988	Eastern Mediterranean	CAR
Dysdera sultani Deeleman-Reinhold, 1988	Eastern Mediterranean	CAR
Dysdera taurica Charitonov, 1956 *	Eastern European	EAR, SAR
Dysdera westringi O.P.-Cambridge, 1872	Eastern Mediterranean	MR, AR, CAR
Dysdera yozgat Deeleman-Reinhold, 1988	Turkey	CAR
Dysderocrates regina Deeleman-Reinhold, 1988	Turkey	CAR
Harpactea agnolettii Brignoli, 1978	Turkey	MER

SPECIES	DISTRIBUTION	RECORDS
Harpactea babori (Nosek, 1905)	Turkey	MR
Harpactea colchidis Brignoli, 1978	Turkey	EBR
Harpactea diraoi Brignoli, 1978	Turkey	MER
Harpactea dobati Alicata, 1974	Turkey	MER
Harpactea galatica Brignoli, 1978	Turkey	CAR
Harpactea isaurica Brignoli, 1978	Turkey	MER
Harpactea korgei Brignoli, 1979	Turkey	WBR
Harpactea lazonum Brignoli, 1978	Turkey	EBR
Harpactea lyciae Brignoli, 1978	Turkey	MER
Harpactea medeae Brignoli, 1978	Turkey	EBR
Harpactea mithridatis Brignoli, 1979	Pontic	MBR
Harpactea osellai Brignoli, 1978	Turkey	MER
Harpactea pisidica Brignoli, 1978	Turkey	MER
Harpactea sanctaeinsulae Brignoli, 1978	Turkey	MER
Harpactea sbordonii Brignoli, 1978	Turkey	MER
Harpactea sturanyi (Nosek, 1905)	Balkans-Asia Minor	CAR
Harpactea vignai Brignoli, 1978	Turkey	AR
Harpactocrates troglophilus Brignoli, 1978 *	Turkey	MER, CAR
Hygrocrates lycaoniae (Brignoli, 1978)	Eastern Mediterranean	MER
Palpimanidae		
Palpimanus gibbulus Dufour, 1820 *	Mediterranean, Central Asia	AR, MER, CAR, SAR
Palpimanus uncatus Kulczyński, 1909	Eastern Mediterranean	MR
Mimetidae		
Ero aphana (Walckenaer, 1802) *	Palearctic	MER, CAR
Eresidae		
Eresus cinnaberinus (Olivier, 1789) *	Palearctic	MER, CAR
Eresus sandaliatus (Martini & Goeze, 1778) *	European	New record [2]
Eresus walckenaeri Brullé, 1832 *	Mediterranean	MR, AR
Oecobiidae		
Uroctea durandi (Latreille, 1809) *	Mediterranean	MER
Uloboridae		
Hyptiotes paradoxus (C.L.Koch, 1834) *	Palearctic	AR, MER

SPECIES	DISTRIBUTION	RECORDS
Uloborus plumipes Lucas, 1846	Old World	MR
Uloborus walckenaerius Latreille, 1806 *	Palearctic	AR, CAR
Nesticidae		
Carpathonesticus borutzkyi Reimoser, 1930	Pontic	WBR
Nesticus cellulanus (Clerck, 1757)	Holarctic	WBR, MER, EAR, SAR
Theridiidae		
Achaearanea simulans (Thorell, 1875)	Palearctic	SAR
Achaearanea tepidariorum (C.L.Koch, 1841) *	Cosmopolitan	MBR
Crustulina scabripes Simon, 1881 *	Mediterranean	CAR
Dipoena coracina (C.L.Koch, 1837)	European	CAR
Enoplognatha afrodite Hippa & Oksala, 1983	Southern Europe	AR
Enoplognatha gemina Bosmans & Van Keer, 1999	Mediterranean	AR
Enoplognatha latimana Hippa & Oksala, 1982 *	Holarctic	MER
Enoplognatha macrochelis Levy & Amitai, 1981	Eastern Mediterranean	AR, CAR
Enoplognatha mandibularis (Lucas, 1846)	Palearctic	WBR, MR
Enoplognatha mediterranea Levy & Amitai, 1981	Eastern Mediterranean	MR
Enoplognatha ovata (Clerck, 1757)	Holarctic	MBR
Enoplognatha parathoracica Levy & Amitai, 1981	Eastern Mediterranean	MR
Enoplognatha quadripunctata Simon, 1884	Mediterranean	MR, CAR
Enoplognatha thoracica (Hahn, 1833)	Holarctic	EAR, SAR
Euryopis flavomaculata (C.L.Koch, 1836) *	Palearctic	CAR, AR
Euryopis orsovensis Kulczyński, 1894	Balkans-Asia Minor	CAR
Euryopis quinqueguttata Thorell, 1875	European-Asian	CAR
Kochiura aulica (C.L.Koch, 1838) *	European-Mediterranean-Asian	CAR
Latrodectus pallidus O.P.-Cambridge, 1872 *	Palearctic	MER, CAR, EAR
Latrodectus tredecimguttatus (Rossi, 1790) *	Mediterranean-Asian	MR, MER, CAR, EAR, SAR
Steatoda albomaculata (De Geer, 1778) *	Cosmopolitan	MR, CAR, AR
Steatoda bipunctata (Linnaeus, 1758) *	Holarctic	MBR, EAR, SAR, AR
Steatoda castanea (Clerck, 1757) *	Palearctic	CAR
Steatoda dahli (Nosek, 1905)	Eastern Mediterranean, Central Asia	CAR, EAR
Steatoda grossa (C.L.Koch, 1838) *	Cosmopolitan	MR, EAR, SAR
Steatoda paykulliana (Walckenaer, 1805) *	European-Mediterranean-Asian	MR, AR, CAR, EAR, SAR

SPECIES	DISTRIBUTION	RECORDS
Steatoda phalerata (Panzer, 1801) *	Palearctic	CAR, EAR, SAR
Steatoda triangulosa (Walckenaer, 1802) *	Cosmopolitan	MR, AR, CAR , EAR, SAR
Theridion adrianopoli Drensky, 1915	Balkans-Mediterranean	MR
Theridion impressum L.Koch, 1881 *	Holarctic	MR, CAR
Theridion sisyphium (Clerck, 1757)	Palearctic	EAR, SAR
Theridiosomatidae		
Theridiosoma gemmosum (L.Koch, 1877) *	Europe to Central Asia, North America	MR
Anapidae		
Zangherella apuliae (Caporiacco, 1949)	Mediterranean	MR
Linyphiidae		
Bathyphantes gracilis (Blackwall, 1841)	Holarctic	CAR
Centromerus turcicus Wunderlich, 1995	Turkey	WBR
Centromerus unicolor Roewer, 1959	Turkey	MER
Dicymbium nigrum (Blackwall, 1834)	Palearctic	MR
Diplocephalus cristatus (Blackwall, 1833)	Holarctic	EAR
Diplocephalus latifrons (O.P.-Cambridge, 1863)	European-Asian	EAR
Diplocephalus turcicus Brignoli, 1972	Eastern Mediterranean	MER, CAR
Erigone dentipalpis (Wider, 1834) *	Holarctic	EAR, AR
Erigonoplus ayyildizi Tanasevitch, Topçu & Demir, 2004 *	Turkey	MER
Frontinellina frutetorum (C.L.Koch, 1834) *	Palearctic	MR, CAR
Gnathonarium dentatum (Wider, 1834)	Palearctic	MR
Gonatium cappadocium Millidge, 1981	Turkey	CAR
Gongylidiellum murcidum Simon, 1884	Palearctic	MR
Gongylidiellum orduense Wunderlich, 1995	Turkey	MBR
Gongylidium rufipes (Linnaeus, 1758)	Palearctic	MER
Hilaira herniosa (Thorell, 1875)	Holarctic	SAR
Lepthyphantes leprosus (Ohlert, 1865) *	Holarctic	MER, CAR, EAR, SAR, AR
Lessertia dentichelis (Simon, 1884)	Holarctic	AR
Linyphia hortensis Sundevall, 1830 *	Palearctic	CAR
Linyphia tenuipalpis Simon, 1884	European-Asian	MR
Linyphia triangularis (Clerck, 1757) *	Palearctic	EAR, SAR, AR
Mansuphantes korgei (Saaristo & Tanasevitch, 1996)	Turkey	WBR

SPECIES	DISTRIBUTION	RECORDS
Megalepthyphantes collinus (L.Koch, 1872)	Palearctic	EAR, SAR
Megalepthyphantes turkeyensis Tanasevitch, Kunt & Seyyar, 2004 *	Turkey	MER
Meioneta innotabilis (O.P.-Cambridge, 1863)	European-Asian	EAR
Meioneta rurestris (C.L.Koch, 1836)	Palearctic	CAR
Microlinyphia pusilla (Sundevall, 1830) *	Holarctic	EAR, SAR
Microneta viaria (Blackwall, 1841)	Holarctic	EAR, SAR
Midia midas (Simon, 1884)	European	EAR, SAR
Mughiphantes cornutus (Schenkel, 1927)	Palearctic	CAR
Mughiphantes triglavensis (Miller & Polenec, 1975)	Eastern European	MR
Neriene furtiva (O.P.-Cambridge, 1871) *	Palearctic	MR, AR
Obscuriphantes obscurus (Blackwall, 1841)	Palearctic	EAR, SAR
Oedothorax apicatus (Blackwall, 1850)	Palearctic	EAR
Oedothorax fuscus (Blackwall, 1834)	Palearctic	CAR
Oedothorax gibbosus (Blackwall, 1841)	Palearctic	CAR
Oedothorax retusus (Westring, 1851)	Palearctic	CAR
Palliduphantes byzantinus (Fage, 1931)	Eastern Mediterranean	MR, EAR
Pelecopsis parallela (Wider, 1834)	Palearctic	SAR
Prinerigone vagans (Audouin, 1825)	Palearctic	CAR
Sintula cristatus Wunderlich, 1995	Turkey	WBR
Stemonyphantes abantensis Wunderlich, 1978	Turkey	WBR
Stemonyphantes montanus Wunderlich, 1978	Turkey	WBR
Tallusia bicristata Lehtinen & Saaristo, 1972	Turkey	WBR
Tapinocyba korgei Wunderlich, 1995	Turkey	MBR
Tapinopa gerede Saaristo, 1997	Turkey	WBR
Taranucnus setosus (O.P.-Cambridge, 1863)	Palearctic	MR, AR
Tenuiphantes tenebricola (Wider, 1834)	Palearctic	CAR
Tenuiphantes tenuis (Blackwall, 1852)	Palearctic	MR, AR
Tenuiphantes wunderlichi (Saaristo & Tanasevitch, 1996)	Turkey	MBR
Tenuiphantes zimmermanni (Bertkau, 1890) *	European	CAR, EAR, SAR
Trichopterna cito (O.P.-Cambridge, 1872)	Palearctic	EAR
Troglohyphantes gladius Wunderlich, 1995	Turkey	MBR
Troglohyphantes pisidicus Brignoli, 1971	Turkey	MER

SPECIES	DISTRIBUTION	RECORDS
Walckenaeria abantensis Wunderlich, 1995	Turkey	MBR
Walckenaeria atrotibialis (O.P.-Cambridge, 1878)	Holarctic	AR
Tetragnathidae		
Meta bourneti Simon, 1922	European, North African	MR, MER
Metellina merianae (Scopoli, 1763) *	European	WBR, MR, MER, CAR
Metellina orientalis (Spassky, 1932)	Eastern Palearctic	Turkey
Metellina segmentata (Clerck, 1757)	Palearctic	EAR, SAR
Pachygnatha degeeri Sundevall, 1830 *	Palearctic	MER, EAR, SAR
Pachygnatha listeri Sundevall, 1830	Palearctic	EAR
Tetragnatha extensa (Linnaeus, 1758) *	Holarctic	MR, CAR
Tetragnatha montana Simon, 1874 *	Palearctic	MR, EAR, SAR
Tetragnatha obtusa C.L.Koch, 1837 *	Palearctic	AR, CAR
Tetragnatha striata L.Koch, 1862	European-Asian	CAR
Araneidae		
Aculepeira armida (Savigny, 1825)	Palearctic	EAR
Aculepeira ceropegia (Walckenaer, 1802) *	Palearctic	MER, CAR
Aculepeira talishia (Zawadsky, 1902)	Western Asian	CAR, EAR
Agalenatea redii (Scopoli, 1763) *	Palearctic	MR, MER
Araneus alsine (Walckenaer, 1802)	Palearctic	MBR, EAR, SAR
Araneus angulatus Clerck, 1757 *	Palearctic	MBR, MR
Araneus circe (Savigny, 1826)	Palearctic	MR, AR, CAR
Araneus diadematus Clerck, 1757 *	Holarctic	MBR, MR, CAR, SAR
Araneus ishisawai Kishida, 1920	Eastern Palearctic	CAR, EAR
Araneus marmoreus Clerck, 1757 *	Holarctic	MBR
Araneus quadratus (Clerck, 1757)	Palearctic	AR
Araneus stella (Karsch, 1879)	East Palearctic	CAR
Araniella cucurbitina (Clerck, 1757) *	Palearctic	MR, CAR, EAR, SAR
Argiope argentata (Fabricius, 1775)	Palearctic	AR, MER
Argiope bruennichi (Scopoli, 1772) *	Palearctic	MBR, MR, CAR
Argiope lobata (Pallas, 1772) *	Old World	MR, CAR, EAR, SAR, AR
Cyclosa conica (Pallas, 1772) *	Holarctic	CAR
Gibbaranea bituberculata (Walckenaer, 1802) *	Palearctic	MER, CAR

SPECIES	DISTRIBUTION	RECORDS
Gibbaranea gibbosa (Walckenaer, 1802)	European-Asian	EAR, SAR
Gibbaranea ullrichi (Hahn, 1835) *	European-Asian	CAR
Hypsosinga pygmaea (Sundevall, 1831) *	Holarctic	MER
Hypsosinga pygmaea nigriceps (Kulczyński, 1903)	Turkey	MR
Hypsosinga sanguinea (C.L.Koch, 1844) *	Palearctic	MR
Larinioides cornutus (Clerck, 1757) *	Holarctic	MR, AR, MER, CAR, EAR, SAR
Larinioides ixobolus (Thorell, 1873)	Palearctic	CAR
Larinioides patagiatus (Clerck, 1757)	Holarctic	EAR, SAR
Larinioides sclopetarius (Clerck, 1757)	Holarctic	CAR
Larinioides suspicax (O.P.-Cambridge, 1876)	European-Asian	MR, CAR
Mangora acalypha (Walckenaer, 1802) *	Palearctic	MR
Neoscana adianta (Walckenaer, 1802) *	Palearctic	MBR, MR, CAR
Neoscana subfusca (C.L.Koch, 1837)	Old World	MR
Nuctenea umbratica (Clerck, 1757) *	European-Asian	MBR
Singa lucina (Savigny, 1825)	Mediterranean-Asian	MER
Zilla diodia (Walckenaer, 1802) *	European-Asian	MER
Lycosidae		
Allocosa cambridgei (Simon, 1876)	Turkey, Syria	CAR
Alopecosa accentuata (Latreille, 1817) *	Palearctic	EAR, SAR
Alopecosa aculeata (Clerck, 1757) *	Holarctic	New record [3]
Alopecosa albofasciata (Brullé, 1832)	Mediterranean-Asian	EBR, MR, AR, MER, CAR
Alopecosa cuneata (Clerck, 1757) *	Palearctic	EAR, SAR
Alopecosa cursor (Hahn, 1831) *	Palearctic	CAR, EAR, SAR
Alopecosa fabrilis (Clerck, 1757) *	Palearctic	MR, AR
Alopecosa pentheri (Nosek, 1905)	Mediterranean-Asian	MR, CAR
Alopecosa pulverulenta (Clerck, 1757) *	Palearctic	MR, EAR, AR
Alopecosa schmidti (Hahn, 1835)	Palearctic	MR
Alopecosa solitaria (Herman, 1879) *	European-Asian	EAR
Alopecosa taeniopus (Kulczyński, 1895)	European-Asian	CAR
Alopecosa trabalis (Clerck, 1757)	European-Asian	Turkey
Arctosa cinerea (Fabricius, 1777) *	Palearctic, Congo	EAR, SAR
Arctosa fulvolineata (Lucas, 1846)	Palearctic	EAR

SPECIES	DISTRIBUTION	RECORDS
Arctosa leopardus (Sundevall, 1833) *	Palearctic	MR, EAR, SAR
Arctosa perita (Latreille, 1799) *	Holarctic	MR, AR
Arctosa personata (L.Koch, 1872) *	Mediterranean	EAR
Arctosa simoni Guy, 1966	Turkey	MR,CAR
Arctosa variana C.L.Koch, 1847	Mediterranean-Asian	MR
Geolycosa vultuosa (C.L.Koch, 1838) *	European-Asian	MR, CAR
Hogna graeca (Roewer, 1951)	Eastern Mediterranean	AR
Hogna radiata (Latreille, 1817) *	European-Asian, Central Africa	MR, AR, MER, CAR
Lycosa narbonensis Walckenaer, 1806 *	Mediterranean	MER, CAR, SAR
Lycosa piochardi Simon, 1876	Eastern Mediterranean	CAR, SAR
Lycosa praegrandis C.L.Koch, 1836 *	Eastern Mediterranean-Asian	MR, AR, MER, CAR, EAR
Lycosa tarantula (Linnaeus, 1758)	Southeastern Europe, Mediterranean, Near East	MER, CAR, SAR
Ocyale neatalanta Alderweireldt, 1996	West Africa to Myanmar	SAR
Pardosa agrestis purbeckensis O.P.-Cambridge, 1895 *	Palearctic	CAR, EAR
Pardosa agricola (Thorell, 1856) *	European-Asian	MER, CAR, EAR, SAR
Pardosa albatula (Roewer, 1951)	European	EAR
Pardosa amentata (Clerck, 1757)	European-Asian	MR, CAR, EAR, AR
Pardosa atomaria (C.L.Koch, 1847)	Balkans, Mediterranean	MR
Pardosa bifasciata (C.L.Koch, 1834)	Palearctic	MR, CAR, EAR
Pardosa cincta (Kulczyński, 1887)	Central, Eastern Europe	EAR, SAR
Pardosa consimilis Nosek, 1905	Turkey	CAR
Pardosa hortensis (Thorell, 1872) *	Palearctic	CAR, AR
Pardosa ilgunensis Nosek, 1905	Turkey	CAR
Pardosa incerta Nosek, 1905	Asian	AR, CAR
Pardosa lugubris (Walckenaer, 1802)	Palearctic	CAR
Pardosa monticola (Clerck, 1757) *	Palearctic	EAR, SAR
Pardosa morosa (L.Koch, 1870) *	European-Asian	EAR, SAR, AR
Pardosa nebulosa (Thorell, 1872)	Palearctic	EAR
Pardosa nigra (C.L.Koch, 1834)	Palearctic	AR, MER
Pardosa nigriceps (Thorell, 1856)	European	CAR
Pardosa paludicola (Clerck, 1757)	Palearctic	EAR
Pardosa palustris (Linnaeus, 1758) *	Holarctic	CAR

SPECIES	DISTRIBUTION	RECORDS
Pardosa prativaga (L.Koch, 1870)	European-Western Asian	EAR
Pardosa proxima (C.L.Koch, 1847) *	Palearctic	MR, EAR, SAR, AR
Pardosa pullata (Clerck, 1757) *	European-Asian	MER, CAR, AR
Pardosa riparia (C.L.Koch, 1833)	Palearctic	MR, CAR
Pardosa schenkeli Lessert, 1904	Palearctic	EAR
Pardosa tatarica (Thorell, 1875)	Palearctic	Turkey
Pardosa trailli (O.P.-Cambridge, 1873)	European	EAR
Pardosa wagleri (Hahn, 1822) *	Palearctic	MER, EAR
Pirata hygrophilus Thorell, 1872	Palearctic	EAR
Pirata piraticus (Clerck, 1757)	Holarctic	EAR, SAR
Trochosa hispanica Simon, 1870 *	Mediterranean-Asian	MR, SAR
Trochosa robusta (Simon, 1876) *	Palearctic	EAR
Trochosa ruricola (De Geer, 1778)	Holarctic, Bermuda	AR
Trochosa terricola Thorell, 1856 *	Holarctic	MR, EAR
Xerolycosa miniata (C.L.Koch, 1834) *	Palearctic	EAR
Xerolycosa nemoralis (Westring, 1861)	Palearctic	EAR
Pisauridae		
Pisaura mirabilis (Clerck, 1757) *	Palearctic	MR, CAR, EAR, SAR, AR
Oxyopidae		
Oxyopes globifer Simon, 1876	Mediterranean-Asian	CAR
Oxyopes heterophthalmus (Latreille, 1804) *	Palearctic	AR, SAR
Oxyopes lineatus Latreille, 1806 *	Palearctic	MR, MER, EAR, SAR, AR
Oxyopes nigripalpis Kulczyński, 1891 *	Mediterranean	MER, CAR, AR
Oxyopes pigmentatus Simon, 1890	Israel, Yemen	SAR
Zoropsidae		
Zoropsis beccarii Caporiacco, 1935	Turkey	CAR
Agelenidae		
Agelena gracilens C.L.Koch, 1841 *	European-Asian	MR, EAR
Agelena labyrinthica (Clerck, 1757) *	Palearctic	MR, CAR, EAR, SAR
Agelena orientalis C.L.Koch, 1837	European-Asian	AR, CAR
Agelescape affinis (Kulczyński, 1911)	Turkey, Syria	MER, EAR, SAR
Agelescape gideoni Levy, 1996	Asia Minor-Levantine	EAR

SPECIES	DISTRIBUTION	RECORDS
Agelescape livida (Simon, 1875)	Mediterranean	CAR
Lycosoides coarctata (Dufour, 1831) *	Mediterranean	MR, EAR
Lycosoides flavomaculata Lucas, 1846	Mediterranean	SAR
Maimuna cariae Brignoli, 1978	Turkey	MR, MER
Maimuna vestita (C.L.Koch, 1841)	Eastern Mediterranean	MR, AR
Tegenaria agnolettii Brignoli, 1978	Turkey	MER
Tegenaria agrestis (Walckenaer, 1802)	Holarctic	MR
Tegenaria anhela Brignoli, 1972	Turkey	MER
Tegenaria argaeica Nosek, 1905	Bulgaria, Turkey	CAR
Tegenaria atrica C.L.Koch, 1843	European	MR, MER, CAR
Tegenaria averni Brignoli, 1978	Turkey	MER
Tegenaria bithyniae Brignoli, 1978	Bulgaria, Turkey	MER
Tegenaria boitanii Brignoli, 1978	Turkey	MER
Tegenaria comnena Brignoli, 1978	Turkey	MER
Tegenaria cottarellii Brignoli, 1978	Turkey	MER
Tegenaria domestica (Clerck, 1757) *	Cosmopolitan	MER, SAR
Tegenaria elysii Brignoli, 1978	Turkey	MER
Tegenaria faniapollinis Brignoli, 1978	Turkey	MER
Tegenaria ferruginea (Panzer, 1804)	European, Azores	MR, CAR
Tegenaria forestieroi Brignoli, 1978	Turkey	MER
Tegenaria hamid Brignoli, 1978	Turkey	CAR
Tegenaria karaman Brignoli, 1978	Turkey	CAR
Tegenaria longimana Simon, 1898	Pontic	MR, CAR
Tegenaria lyncea Brignoli, 1978	Turkey	CAR
Tegenaria mamikonian Brignoli, 1978	Turkey	CAR
Tegenaria maronita Simon, 1873	Eastern Mediterranean	MER
Tegenaria melbae Brignoli, 1972	Turkey	SAR
Tegenaria nemorosa Simon, 1916	European	CAR
Tegenaria pagana C.L.Koch, 1840 *	Holarctic	AR, MER, SAR
Tegenaria parietina (Fourcroy, 1785) *	Holarctic	MR, CAR, MER
Tegenaria pasquinii Brignoli, 1978	Turkey	MER
Tegenaria percuriosa Brignoli, 1972	Turkey	MER, CAR

SPECIES	DISTRIBUTION	RECORDS
Tegenaria rhodiensis Caporiacco, 1948	Eastern Mediterranean	MR
Tegenaria tekke Brignoli, 1978	Turkey	EBR
Tegenaria vignai Brignoli, 1978	Turkey	EBR
Tegenaria xenophontis Brignoli, 1978	Turkey	EBR
Cybaeidae		
Argyroneta aquatica (Clerck, 1757) *	Palearctic	New record [4]
Cybaeus abchasicus Charitonov, 1947	Pontic	EBR
Cybaeus brignolii Maurer, 1992	Turkey	CAR
Hahniidae		
Cryphoeca brignolii Thaler, 1980	European	SAR
Cryphoeca pirini (Drensky, 1921)	Bulgaria, Turkey	MR
Cryphoeca silvicola (C.L.Koch, 1834)	Palearctic	SAR
Cryphoeca thaleri Wunderlich, 1995	Turkey	WBR
Dictynidae		
Cicurina cicur (Fabricius, 1793)	European-Asian	CAR
Cicurina paphlagoniae Brignoli, 1978	Turkey	EBR
Dictyna arundinacea (Linneaus, 1758) *	Holarctic	CAR, EAR, SAR
Dictyna civica (Lucas, 1850)	Holarctic	EAR, SAR
Dictyna latens (Fabricius, 1775) *	European-Asian	MR, CAR, EAR
Emblyna annulipes (Blackwall, 1846)	Holarctic	EBR
Nigma walckenaeri (Roewer, 1951) *	Palearctic	New record [5]
Amaurobiidae		
Amaurobius erberi (Keyserling, 1863)	European, Canary Is.	MR
Amaurobius ferox (Walckenaer, 1830) *	Holarctic	MR, EAR, SAR
Callobius claustrarius (Hahn, 1833)	Palearctic	EAR, SAR, AR
Coelotes arganoi Brignoli, 1978	Turkey	EBR
Coelotes atropos (Walckenaer, 1830)	European	MR, MER, WBR
Coelotes coenobita Brignoli, 1978	Turkey	WBR
Coelotes luculli Brignoli, 1978	Turkey	WBR
Coelotes rhododendri Brignoli, 1978	Turkey	WBR
Coelotes terrestris (Wider, 1834)	Palearctic	MR, SAR
Coelotes vignai Brignoli, 1978	Turkey	EBR

SPECIES	DISTRIBUTION	RECORDS
Paracoelotes armeniacus (Brignoli, 1978)	Turkey	EBR
Paracoelotes cottarellii (Brignoli, 1978)	Turkey	EBR
Urocoras nicomedis (Brignoli, 1978)	Turkey	EBR
Urocoras phthisicus (Brignoli, 1978)	Turkey	EBR
Phyxelididae		
Phyxelida anatolica Griswold, 1990	Eastern Mediterranean	[6]
Titanoecidae		
Nurscia albomaculata (Lucas, 1846) *	European-Asian	MR, CAR, EAR, SAR
Titanoeca incerta (Nosek, 1905)	Balkans-Asia Minor	CAR
Titanoeca schineri L.Koch, 1872 *	Palearctic	CAR
Miturgidae		
Cheiracanthium elegans Thorell, 1875	European-Asian	CAR, EAR
Cheiracanthium erraticum (Walckenaer, 1802) *	Palearctic	SAR
Cheiracanthium mildei L.Koch,1864 *	Holarctic	CAR, EAR, SAR
Cheiracanthium pelasgicum (C.L.Koch, 1837)	Palearctic	MR, CAR
Cheiracanthium punctorium (Villers, 1789) *	European-Asian	MR, CAR
Liocranidae		
Apostenus fuscus Westring, 1851	European	EAR
Liocranum rupicola (Walckenaer, 1830)	European-Asian	EAR
Mesiotelus annulipes (Kulczyński, 1897)	Balkans-Asia Minor	MR
Mesiotelus tenuissimus (L.Koch, 1866)	Palearctic	Turkey
Clubionidae		
Clubiona corticalis (Walckenaer, 1802)	European-Asian	EAR
Clubiona lutescens Westring, 1851 *	Holarctic	EAR, SAR
Clubiona marmorata L.Koch, 1866 *	European	New record [7]
Clubiona neglecta O.P.-Cambridge, 1862 *	Palearctic	CAR, EAR, SAR
Clubiona reclusa O.P.-Cambridge, 1863	Palearctic	EAR, SAR
Zodariidae		
Lachesana blackwalli (O.P.-Cambridge, 1872)	Eastern Mediterranean	MER
Palaestina expolita O.P.-Cambridge, 1872	Eastern Mediterranean	MER
Zodarion abantense Wunderlich, 1980	Pontic	WBR
Zodarion cyprium Kulczyński, 1908	Eastern Mediterranean, Ukraine	MER

SPECIES	DISTRIBUTION	RECORDS
Zodarion frenatum Simon, 1884	Eastern Mediterranean	AR
Zodarion gallicum (Simon, 1873)	European-Mediterranean	CAR
Zodarion germanicum (C.L.Koch, 1837) *	European	CAR
Zodarion graecum (C.L.Koch, 1843)	Eastern European-Mediterranean	AR, MER
Zodarion korgei Wunderlich, 1980	Turkey	WBR
Zodarion morosum Denis, 1935	Eastern European	CAR
Zodarion rubidum Simon, 1914 *	European	CAR
Zodarion thoni Nosek, 1905 *	Eastern European-Asian	CAR
Zodarion turcicum Wunderlich, 1980	Balkans-Asia Minor	WBR
Prodidomidae		
Anagraphis pallens Simon, 1893 *	Eastern Mediterranean, South Africa	CAR
Gnaphosidae		
Aphantaulax trifasciata (O.P.-Cambridge, 1872)	Palearctic	CAR, AR
Aphantaulax trifasciata trimaculata Simon, 1878	France, Turkey	CAR
Berinda ensiger (O.P.-Cambridge, 1874)	Eastern Mediterranean	AR
Berlandina plumalis (O.P.-Cambridge, 1872) *	West Africa to Central Asia	CAR
Berlandina pulchra (Nosek, 1905)	Turkey	CAR
Drassodes difficilis (Simon, 1878)	France, Turkey	CAR
Drassodes lapidosus (Walckenaer, 1802) *	Palearctic	MR, MER, CAR, EAR, SAR
Drassodes lutescens (C.L.Koch, 1839)	Mediterranean to Pakistan	MER, CAR, EAR, SAR
Drassodes pubescens (Thorell, 1856) *	Palearctic	CAR, MER, EAR, SAR
Drassodes similis Nosek, 1905	Turkey	CAR
Drassodes villosus (Thorell, 1856) *	Palearctic	CAR, EAR
Drassyllus lutetianus (L.Koch, 1866)	European-Asian	EAR, SAR
Drassyllus praeficus (L.Koch, 1866) *	European-Asian	CAR, EAR, SAR
Drassyllus pumilus (C.L.Koch, 1839) *	European-Asian	CAR, EAR
Drassyllus pusillus (C.L.Koch, 1833) *	Palearctic	CAR, AR
Drassyllus villicus (Thorell, 1875)	European	EAR
Drassyllus vinealis (Kulczyński, 1897)	Palearctic	CAR
Gnaphosa bicolor (Hahn, 1833)	European, Georgia	EAR, SAR
Gnaphosa bithynica Kulczyński, 1903 *	Eastern Mediterranean	MR, CAR
Gnaphosa corticola Simon, 1914	France, Turkey	CAR

SPECIES	DISTRIBUTION	RECORDS
Gnaphosa dolosa Herman, 1879	Palearctic	MR
Gnaphosa lapponum (L.Koch, 1866)	European-Asian	EAR
Gnaphosa leporina (L.Koch, 1866)	Palearctic	EAR
Gnaphosa lucifuga (Walckenaer, 1802) *	Palearctic	MR, CAR, EAR, SAR
Gnaphosa lucifuga minor Nosek, 1905	Turkey	CAR
Gnaphosa lugubris (C.L.Koch, 1839)	European-Asian	EAR, SAR, AR
Gnaphosa microps Holm, 1939	Holarctic	MR
Gnaphosa modestior Kulczyński, 1897	Eastern European-Asian	EAR
Gnaphosa opaca Herman, 1879 *	European-Asian	CAR
Gnaphosa petrobia L.Koch, 1872	European	CAR, EAR
Gnaphosa steppica Ovtsharenko, Platnick & Song, 1992	Asian	CAR
Gnaphosa tigrina Simon, 1878	Mediterranean to Russia	EAR
Haplodrasus dalmatensis (C.L.Koch, 1866) *	Palearctic	CAR, EAR
Haplodrassus macellinus (Thorell, 1871)	Mediterranean	CAR
Haplodrassus signifer (C.L.Koch, 1839) *	Holarctic	MR, CAR, EAR, SAR, AR
Haplodrassus umbratilis (L.Koch, 1866) *	European-Asian	CAR
Micaria albovittata (Lucas, 1846) *	Palearctic	CAR, EAR, SAR
Micaria coarctata (Lucas, 1846)	Mediterranean-Asian	MR, EAR
Micaria dives (Lucas, 1846)	Palearctic	EAR
Micaria pulicaria (Sundevall, 1831)	Holarctic	EAR, SAR
Micaria rossica Thorell, 1875 *	Holarctic	CAR, EAR, SAR
Nomisia aussereri (L.Koch, 1872) *	Palearctic	MR, AR, CAR
Nomisia exornata (C.L.Koch, 1839) *	European-Asian	AR, CAR
Nomisia orientalis Dalmas, 1921	Turkey	AR
Nomisia ripariensis (O.P.-Cambridge, 1872) *	Mediterranean-Asian	MER, CAR
Poecilochroa variana (C.L.Koch, 1839)	European-Asian	EAR
Pseudodrassus ricasolii Caporiacco, 1935	Turkey	CAR
Pterotricha conspersa (O.P.-Cambridge, 1872)	Eastern Mediterranean	MER
Pterotricha kochi (O.P.-Cambridge, 1872)	Eastern Mediterranean	CAR
Pterotricha lentiginosa (C.L.Koch, 1837) *	Mediterranean, Ukraine	MER, CAR, EAR
Scotophaeus scutulatus (L.Koch, 1866) *	Palearctic	CAR
Synaphosus palearcticus Ovtsharenko, Levy & Platnick, 1994	Mediterranean-Asian	CAR, EAR

SPECIES	DISTRIBUTION	RECORDS
Trachyzelotes barbatus (L.Koch, 1866)	Mediterranean-Asian	CAR
Trachyzelotes malkini Platnick & Murphy, 1984 *	Mediterranean, Ukraine	CAR
Trachyzelotes pedestris (C.L.Koch, 1837)	European-Asian	CAR
Zelotes apricorum (L.Koch, 1876)	European-Asian	CAR
Zelotes atrocaeruleus (Simon, 1878)	Palearctic	CAR
Zelotes aurantiacus Miller, 1967	European-Western Asian	EAR
Zelotes caucasius (L.Koch, 1866) *	European-Asian	CAR, EAR, SAR
Zelotes cingarus (O.P.-Cambridge, 1874)	Mediterranean-Asian	CAR
Zelotes clivicola (L.Koch, 1870)	Palearctic	EAR
Zelotes electus (C.L.Koch, 1839) *	European-Asian	CAR, EAR, SAR
Zelotes gracilis (Canestrini, 1868)	European-Western Asian	EAR
Zelotes latreillei (Simon, 1878) *	Palearctic	EAR, SAR
Zelotes longestylus Simon, 1914	France, Turkey	CAR
Zelotes longipes (L.Koch, 1866) *	Palearctic	MER, CAR, EAR
Zelotes oblongus (C.L.Koch, 1833)	European	EAR
Zelotes olympi (Kulczyński, 1903)	Turkey	MR
Zelotes petrensis (C.L.Koch, 1839)	European-Asian	EAR
Zelotes segrex (Simon, 1878)	Palearctic	MR
Zelotes similis (Kulczyński, 1887)	European	EAR
Zelotes strandi (Nosek, 1905)	Turkey	MR
Zelotes subterraneus (C.L.Koch, 1833) *	Palearctic	CAR
Sparassidae		
Eusparassus dufouri Simon, 1932	Mediterranean	AR, MER
Eusparassus walckenaeri (Audouin, 1825)	Mediterranean to Afghanistan	AR, MER
Heteropoda variegata (Simon, 1874)	Mediterranean	MER
Micrommata ligurina (C.L.Koch, 1845)	Mediterranean-Asian	AR
Micrommata virescens (Clerck, 1757) *	Palearctic	AR, MER
Olios argelasius (Walckenaer, 1805)	Mediterranean	MR, CAR
Philodromidae		
Paratibellus oblongiusculus (Lucas, 1846) *	European-Asian	CAR
Philodromus aureolus (Clerck, 1757) *	Palearctic	MR
Philodromus bonneti Karol, 1968	Turkey	MR

SPECIES	DISTRIBUTION	RECORDS
Philodromus buchari Kubcová, 2004	European	MER
Philodromus cespitum (Walckenaer, 1802)	Holarctic	SAR
Philodromus collinus C.L.Koch, 1835	European-Asian	MR, MER
Philodromus fuscolimbatus Lucas, 1846 *	European-Asian	MR, MER
Philodromus glaucinus Simon, 1870	Mediterranean-Asian	AR
Philodromus histrio (Latreille, 1819)	Holarctic	EAR
Philodromus krausi Muster & Thaler, 2004	Turkey	MBR
Philodromus lividus Simon, 1875	European-Mediterranean	MR
Philodromus longipalpis Simon, 1870	European-Asian	MR
Philodromus lunatus Muster & Thaler, 2004	Balkans-Asia Minor	AR, CAR
Philodromus margaritatus (Clerck, 1757)	Palearctic	SAR
Philodromus poecilus (Thorell, 1872) *	Palearctic	CAR
Thanatus formicinus (Clerck, 1757) *	Holarctic	EAR, SAR, AR
Thanatus lineatipes Simon, 1870	Mediterranean, Georgia	AR
Thanatus okayi Karol, 1966	Turkey	MR
Thanatus pictus L.Koch, 1881 *	Palearctic	CAR
Thanatus striatus C.L.Koch, 1845 *	Holarctic	EAR, SAR, AR
Thanatus vulgaris Simon, 1870 *	Holarctic	AR, CAR
Tibellus oblongus (Walckenaer, 1802) *	Holarctic	EAR, AR
Thomisidae		
Coriarachne depressa (C.L.Koch, 1837)	Palearctic	AR, MER
Diaea livens Simon, 1876 *	European-Asian, U.S.A.	MR, MER
Heriaeus buffoni (Audouin, 1825)	Mediterranean	MR
Heriaeus hirtus (Latreille, 1819)	Europe to Georgia	MR
Heriaeus melloteei Simon, 1886 *	Palearctic	CAR
Heriaeus orientalis Simon, 1918	Greece, Turkey, Ukraine	MR
Heriaeus pilosus Nosek, 1905	Turkey	CAR
Heriaeus setiger (O.P.-Cambridge, 1872) *	Palearctic	AR
Heriaeus simoni Kulczyński, 1903	Palearctic	MR, MER
Misumena vatia (Clerck, 1757) *	Holarctic	MR
Ozyptila ankarensis Karol, 1966	Turkey	CAR
Ozyptila atomaria (Panzer, 1801)	Palearctic	EAR, SAR

SPECIES	DISTRIBUTION	RECORDS
Ozyptila claveata (Walckenaer, 1837) *	Palearctic	AR
Ozyptila clavidorsa Roewer, 1959	Turkey	SAR
Ozyptila conostyla Hippa, Koponen & Oksola, 1986	Asia Minor-Asian	CAR
Ozyptila praticola (C.L.Koch, 1837) *	Holarctic	MR, EAR
Ozyptila rauda Simon, 1875	Palearctic	WBR
Ozyptila sanctuaria (O.P.-Cambridge, 1871)	European	EAR
Ozyptila simplex (O.P.-Cambridge, 1862) *	Palearctic	MER
Ozyptila spirembola Wunderlich, 1995	Turkey	WBR
Pistius truncatus (Pallas, 1772) *	Palearctic	MR
Runcinia grammica (C.L.Koch, 1837) *	Palearctic, St. Helena, South Africa	MR, AR, MER
Synema globosum (Fabricius, 1775) *	Palearctic	MR, AR, MER, CAR
Synema plorator (O.P.-Cambridge, 1872)	Eastern European-Asian	MR
Thomisus citrinellus Simon, 1875	Mediterranean, Africa, Seychelles	MBR
Thomisus onustus Walckenaer, 1805 *	Palearctic	MR, AR, MER, CAR, EAR, SAR
Xysticus acerbus Thorell, 1872 *	European-Asian	MR, SAR
Xysticus audax (Schrank, 1803) *	Palearctic	MR, MER
Xysticus bifasciatus C.L.Koch, 1837 *	Palearctic	CAR, AR
Xysticus bufo (Dufour, 1820)	Mediterranean	MR, AR
Xysticus cribratus Simon, 1885	Mediterranean to China, Sudan	CAR
Xysticus cristatus (Clerck, 1757) *	Palearctic	EAR, SAR, AR
Xysticus erraticus (Blackwall, 1834) *	European-Asian	EAR, SAR
Xysticus ferrugineus Menge, 1876 *	Palearctic	CAR
Xysticus ferus O.P.-Cambridge, 1876	Eastern Mediterranean	AR
Xysticus gallicus Simon, 1875	Palearctic	CAR
Xysticus graecus C.L.Koch, 1837	Eastern Mediterranean-Asian	MR, CAR
Xysticus gymnocephalus Strand, 1915	Eastern Mediterranean	CAR
Xysticus kempeleni Thorell, 1872 *	European-Asian	MER, CAR
Xysticus kochi Thorell, 1872 *	European-Asian, Mediterranean	MR, CAR, EAR, SAR
Xysticus lalandei (Audouin, 1825)	Eastern Mediterranean	MR, CAR
Xysticus lanio C.L.Koch, 1835 *	Palearctic	MR, MER, SAR
Xysticus lineatus (Westring, 1851) *	Palearctic	MER
Xysticus luctator L.Koch, 1870	Palearctic	CAR

SPECIES	DISTRIBUTION	RECORDS
Xysticus luctuosus (Blackwall, 1836) *	Holarctic	CAR
Xysticus ninnii Thorell, 1872 *	Palearctic	CAR
Xysticus pseudolanio Wunderlich, 1995	Turkey	WBR, EBR
Xysticus pseudorectilineus (Wunderlich, 1995)	Turkey	MER
Xysticus rectilineus (O.P.-Cambridge, 1872)	Eastern Mediterranean	CAR
Xysticus robustus (Hahn, 1832) *	European-Asian	EAR, SAR, AR
Xysticus sabulosus (Hahn, 1832) *	Palearctic	MR
Xysticus striatipes L.Koch, 1870 *	Palearctic	CAR
Xysticus thessalicus Simon, 1916	Balkans-Eastern Mediterranean	CAR
Xysticus tristrami (O.P.-Cambridge, 1872)	Eastern Palearctic	CAR
Xysticus ulmi (Hahn, 1831) *	Palearctic	CAR
Xysticus viduus Kulczyński, 1898 *	Palearctic	MER
Salticidae		
Aelurillus concolor Kulczyński, 1901	Asian	CAR
Aelurillus v-insignitus (Clerck, 1757)	Palearctic	CAR
Afraflacilla epiblemoides (Chyzer, 1891)	Central, Eastern Europe	MER
Ballus chalybeius (Walckenaer, 1802) *	Palearctic	CAR
Carrhotus xanthogramma (Latreille, 1819) *	Palearctic	MR, MER
Chalcoscirtus parvulus Marusik, 1991	Asian	AR
Euophrys frontalis (Walckenaer, 1802) *	Palearctic	CAR
Euophrys fucata (Simon, 1868)	Turkey	MR
Euophrys rufibarbis (Simon, 1868) *	Palearctic	CAR
Evarcha arcuata (Clerck, 1757) *	Palearctic	EBR, AR
Evarcha falcata (Clerck, 1757) *	Palearctic	EAR, SAR, AR
Evarcha jucunda (Lucas, 1846) *	Mediterranean	MR, AR
Evarcha pulchella (Thorell, 1895)	Asian	MR
Habrocestum latifasciatum (Simon, 1868) *	Eastern Mediterranean	AR, MER
Habrocestum nigristernum Dalmas, 1920	Turkey	AR
Habrocestum papilionaceum (L.Koch, 1867) *	Eastern Mediterranean	AR
Hasarius adansoni (Audouin, 1825) *	Cosmopolitan	MR, MER
Heliophanillus fulgens (O.P.-Cambridge, 1872)	Eastern Mediterranean	MER
Heliophanus aeneus (Hahn, 1832) *	Palearctic	MBR, CAR

SPECIES	DISTRIBUTION	RECORDS
Heliophanus auratus C.L.Koch, 1835 *	Palearctic	MR
Heliophanus dubius C.L.Koch, 1835 *	Palearctic	CAR
Heliophanus edentulus Simon, 1871 *	Mediterranean	CAR
Heliophanus equester L.Koch, 1867 *	European-Asian	MR, AR
Heliophanus flavipes (Hahn, 1832) *	Palearctic	CAR
Heliophanus kochii Simon, 1868 *	Palearctic	MER
Heliophanus lineiventris Simon, 1868 *	Palearctic	MER
Heliophanus melinus L.Koch, 1867 *	Palearctic	MBR, AR, MER
Heliophanus mordax (O.P.-Cambridge, 1872) *	European-Asian	MBR, MER
Heliophanus patagiatus Thorell, 1875	Palearctic	EAR, SAR
Heliophanus simplex Simon, 1868	Palearctic	MBR
Heliophanus tribulosus Simon, 1868	European-Asian	AR, MER
Icius hamatus (C.L.Koch, 1846) *	Palearctic	CAR
Leptorchestes berolinensis (C.L.Koch, 1846)	European-Asian	MR, CAR
Leptorchestes mutilloides (Lucas, 1846)	Southern Europe, Algeria, Turkey	MR, CAR
Marpissa muscosa (Clerck, 1757) *	Palearctic	CAR, EAR, SAR
Marpissa nivoyi (Lucas, 1846)	Palearctic	AR, MER, AR
Marpissa radiata (Grube, 1859) *	Palearctic	EAR, SAR
Menemerus semilimbatus (Hahn, 1829) *	Canary Is. to Azerbaijan, Argentina	MR, AR, SAR
Mogrus neglectus (Simon, 1868)	Mediterranean-Asian	MR
Myrmarachne formicaria (De Geer, 1778)	Palearctic	MR, CAR
Myrmarachne tristis (Simon, 1882)	Eastern Mediterranean to India	MR
Pellenes diagonalis (Simon, 1868) *	Eastern Mediterranean	MR, MER
Pellenes flavipalpis (Lucas, 1853)	Eastern Mediterranean	MR
Pellenes nigrociliatus (Simon, 1875)	Palearctic	EAR, SAR
Philaeus chrysops (Poda, 1761) *	Palearctic	EBR, MR, AR, MER, CAR, EAR
Phlegra bresnieri (Lucas, 1846)	European-Asian, Tanzania	MR, CAR
Phlegra dunini Azarkina, 2004	Asian	SAR
Phlegra fasciata (Hahn, 1826) *	Palearctic	MR, MER, CAR, AR
Phlegra lineata (C.L.Koch, 1846)	Southern Europe, Mediterranean	CAR
Plexippoides gestroi (Dalmas, 1920) *	Eastern Mediterranean	AR, MER
Plexippus paykulli (Audouin, 1825) *	Cosmopolitan	AR, MER

SPECIES	DISTRIBUTION	RECORDS
Pseudeuophrys erratica (Walckenaer, 1826)	Palearctic	EAR, SAR
Pseudeuophrys lanigera (Simon, 1871)	European	CAR
Pseudeuophrys obsoleta (Simon, 1868) *	Palearctic	MER
Pseudicius encarpatus (Walckenaer, 1802)	European-Asian	MER, EAR
Pseudicius kulczynskii Nosek, 1905 *	Eastern Mediterranean	CAR
Saitis tauricus Kulczyński, 1905	Bulgaria, Greece, Turkey,Ukraine	MR
Salticus cingulatus (Panzer, 1797)	Palearctic	EAR, SAR
Salticus marenzelleri Nosek, 1905	Turkey	CAR
Salticus mutabilis Lucas, 1846	Europe, Azores, Turkey, Georgia, Argentina	MR
Salticus scenicus (Clerck, 1757)	Holarctic	EAR, SAR, AR
Salticus zebraneus (C.L.Koch, 1837) *	Palearctic	CAR
Sitticus caricis (Westring, 1861)	Palearctic	EAR
Sitticus pubescens (Fabricius, 1775) *	European-Asian, U.S.A.	MER
Sitticus terebratus (Clerck, 1757)	Palearctic	CAR
Synageles dalmaticus (Keyserling, 1863)	Mediterranean	MR, AR
Synageles hilarulus (C.L.Koch, 1846)	Palearctic	CAR
Synageles subcingulatus (Simon, 1878)	European-Asian	MER, CAR
Synageles venator (Lucas, 1836) *	Palearctic, Canada	MER
Thyene imperialis (Rossi, 1846)	Old World	MR, EAR
Yllenus albocinctus (Kroneberg, 1875)	Turkey to China	CAR

* = representedl in NUAM (Arachnology Museum of Niğde University).

1 Brignoli (1979a)

2 New record for Turkey. 1♀ (NUAM 01/0006) was collected from Adana province (34°54´E, 37° 20´N) on 27.V.2001.

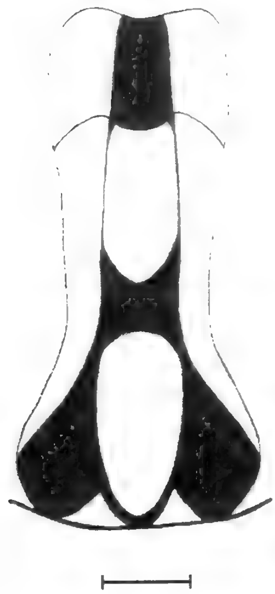
3 New record for Turkey. 1♀ (NUAM 01/0027) was collected from Adana province (34°52´E, 37°26´N) on 26.VI.2002.

4 This species is recorded from Turkey by Rouzsky (1925). But exact locality is unknown, so our findings (4 females, NUAM CYB 42/0001-4; Konya province, Beyşehir district, 31°23´E, 37°31´N) confirm the presence of the species in Turkey.

5 New record for Turkey. 1♂ (NUAM DIC 01/0006) was collected from Adana province on 09.VI.2002.

6 K. Lindberg collected one holotype and two paratypes of *Phyxelida anatolica* Griswold, 1990 from Hatay province in Turkey on 22.VI.1953. These specimens were determined as *Amaurobius fenestralis* by Roewer (misidentification, not *Amaurobius fenestralis*) (Griswold, 1990).

7 New record for Turkey. 1♀ (NUAM CLB 51/0005) was collected from Niğde province (34°36´E, 37°55´N) on 18.V.1996.



2

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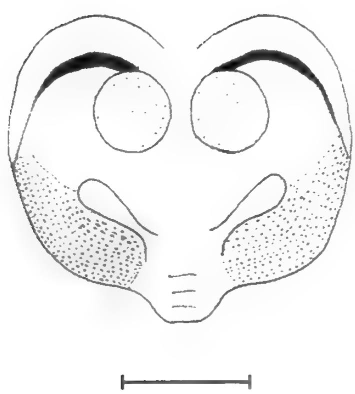
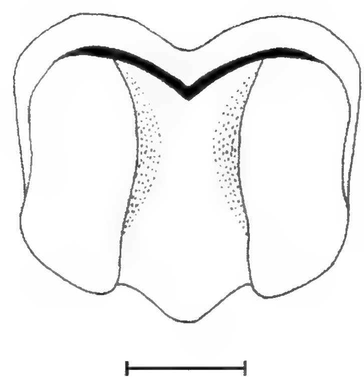


3



4

Figs. 2-5: **2-4**. ♀ epigynum, ventral view; **5**. ♂ palp, ventral view. (Scale line = 0.2 mm)
2. *Alopecosa aculeata* (Clerck, 1757), Family Lycosidae
3. *Clubiona marmorata* L.Koch, 1866, Family Clubionidae
4. *Eresus sandaliatus* (Martini & Goeze, 1778), Family Eresidae
5. *Nigma walckenaeri* (Roewer, 1951), Family Dictynidae

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Redescription of *Pardosa iniqua* (O.P.-Cambridge, 1876) (Araneida : Lycosidae) from Egypt

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Abstract

The female holotype of the very rare Egyptian lycosid spider *Pardosa iniqua* (O.P.-Cambridge, 1876) is redescribed.

Keywords: Spiders, Lycosidae, *Pardosa iniqua*, Egypt, Taxonomy, redescription.

Introduction

Among more than fifty species of family Lycosidae recorded from Egypt (El-Hennawy, 2002), *Pardosa iniqua* (O.P.-Cambridge, 1876) is the most rare lycosid species in the Egyptian fauna. There is only one female specimen of this species deposited in the collection of the Rev. O. Pickard-Cambridge in Oxford University Museum of Natural History, U.K. (OUMNH) [Hope Entomological Collection (HECO)]. No other material of this species is available until now. Therefore, this redescription depends on the single specimen deposited in OUMNH. This specimen was previously described twice, by the author of the species (O.P.-Cambridge, 1876) and by Roewer (1959) (Platnick, 2005).

Abbreviations used: ALE = anterior lateral eye; AME = anterior median eye; d = dorsal; Id = eyes inter-distances; L = length; p = prolateral; PLE = posterior lateral eye; PME = posterior median eye; r = retrolateral; TL = total length; v = ventral; W = width. All measurements were taken in millimetres.

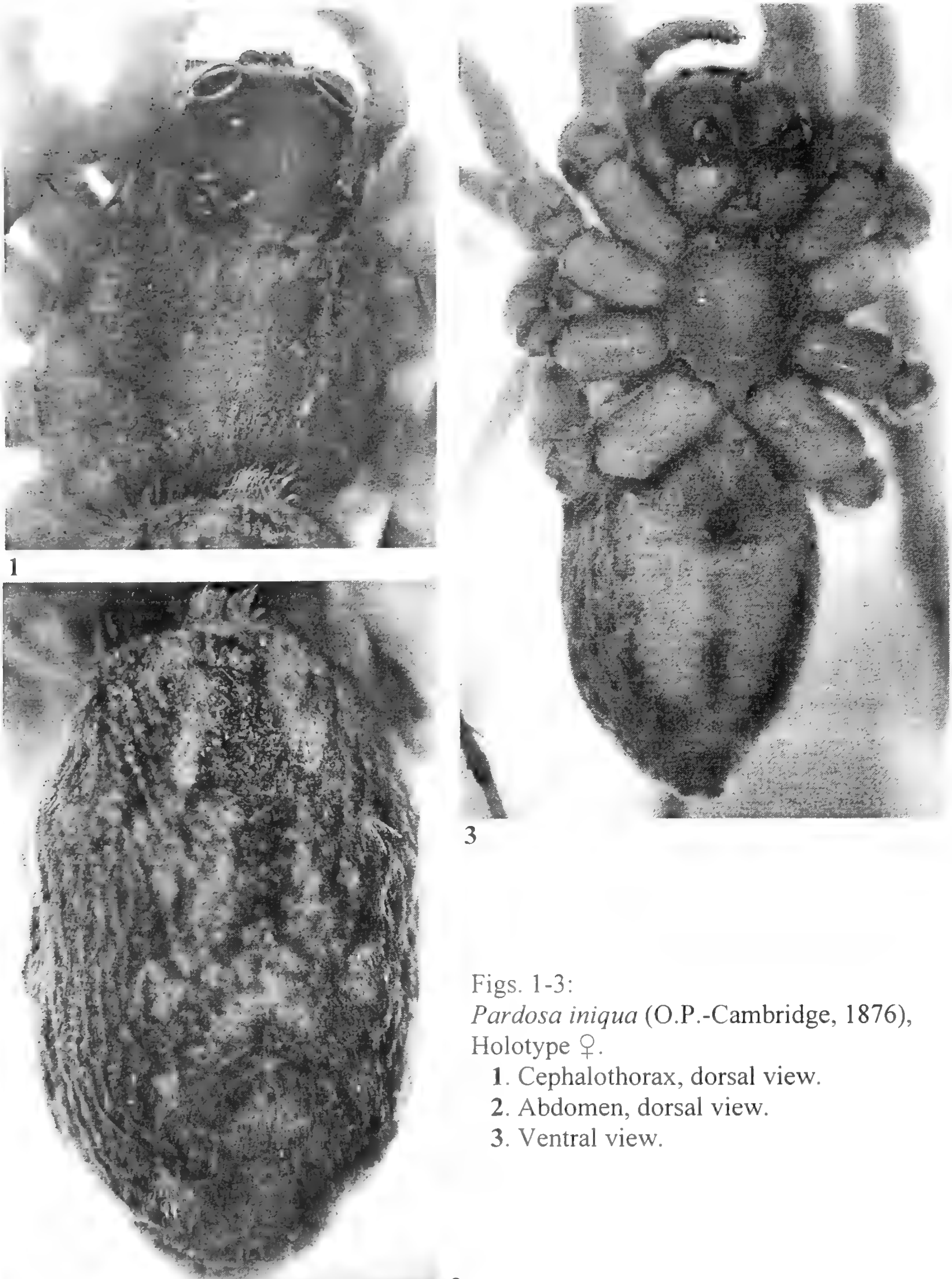
Pardosa iniqua (O.P.-Cambridge, 1876)
(Figs. 1-6. Table 1.)

Type Material: Holotype: Female. Egypt: Alexandria, (OUMNH) B.1573, t.8.

Description: Female (Holotype): TL 8.25; Cephalothorax L 3.32, W 2.81.

Cephalothorax brown, covered by short white hairs.

Eyes: posterior medians (PME) largest; 2.8 times larger than anterior medians (AME), and 1.4 times larger than posterior laterals (PLE); their interdistance (Id PME) equals their diameter. Eye measurements (diameters and interdistances): AME 0.17, ALE 0.14, PME 0.48, PLE 0.34, AM-AM 0.14, PM-PM 0.48, PL-PL 0.85, AM-AL 0.10, AL-PM 0.10, PM-PL 0.61. (ALE = Id AME; Id AM-AL = Id AL-PM)



Figs. 1-3:
Pardosa iniqua (O.P.-Cambridge, 1876), Holotype ♀.
1. Cephalothorax, dorsal view.
2. Abdomen, dorsal view.
3. Ventral view.

Sternum (L 1.85): brown with a yellow leaf-like design in the middle that does not reach the end of the sternum.

Labium (L 0.26), maxillae (L 0.69).

Legs: brown yellow with blackish patches on femora. Pedipalp: with a toothed claw. Relative length of legs 75 : 71 : 74 : 100. Leg formula IV-I-III-II.
L leg IV : L cephalothorax = 3.8.

Leg spination: I femur d1-1-0, p0-0-1, r0-0-1; patella p0-1-0, r0-1-0; tibia v2-2-2; metatarsus p0-1-1, v2-2-2. II femur d1-1-1, p0-1-1, r0-1-1; patella p0-1-0, r0-1-0; tibia p1-0-1, v2-2-2; metatarsus p0-1-1, v2-2-2. III femur d3-3-3-3; patella d1-0-0, p0-1-0, r0-1-0; tibia d3-0-3, v2-2-2; metatarsus d2-2-2, v2-2-2. IV femur d2-1-2 ; patella d1-0-0, p0-1-0, r0-1-0; tibia d3-0-3, v2-2-2; metatarsus d2-2-2, v2-2-2.

Table 1: Legs measurements (mm)

Leg	I	II	III	IV
Femur	2.72	2.55	2.55	3.40
Patella	1.27	1.19	1.19	1.27
Tibia	2.13	1.87	1.87	2.55
Metatarsus	1.96	2.04	2.29	3.66
Tarsus	1.40	1.27	1.36	1.70
Total length	9.48	8.92	9.26	12.58

Abdomen: L 4.93, dorsally blackish brown, covered by short white hairs mixed with brown and white setae sparsely scattered in the anterior third of the abdomen. There are long white hairs on the anterior front of the abdomen, denser in the middle. Abdominal pattern: pale whitish patches arranged as described by Cambridge (1876). Ventrally: yellow with median longitudinal brown patch and both sides of the abdomen are blackish brown mixed with yellow patches.

Genitalia: Epigynum small, its length is 0.11 of the abdomen's length (Fig. 3). Epigynum and vulvae as in Figs. 4-6. [Note the difference between Figs. 4-5 and the schematic drawing of Roewer (1959) (Fig. 7) of the same specimen.]

Male: Unknown.

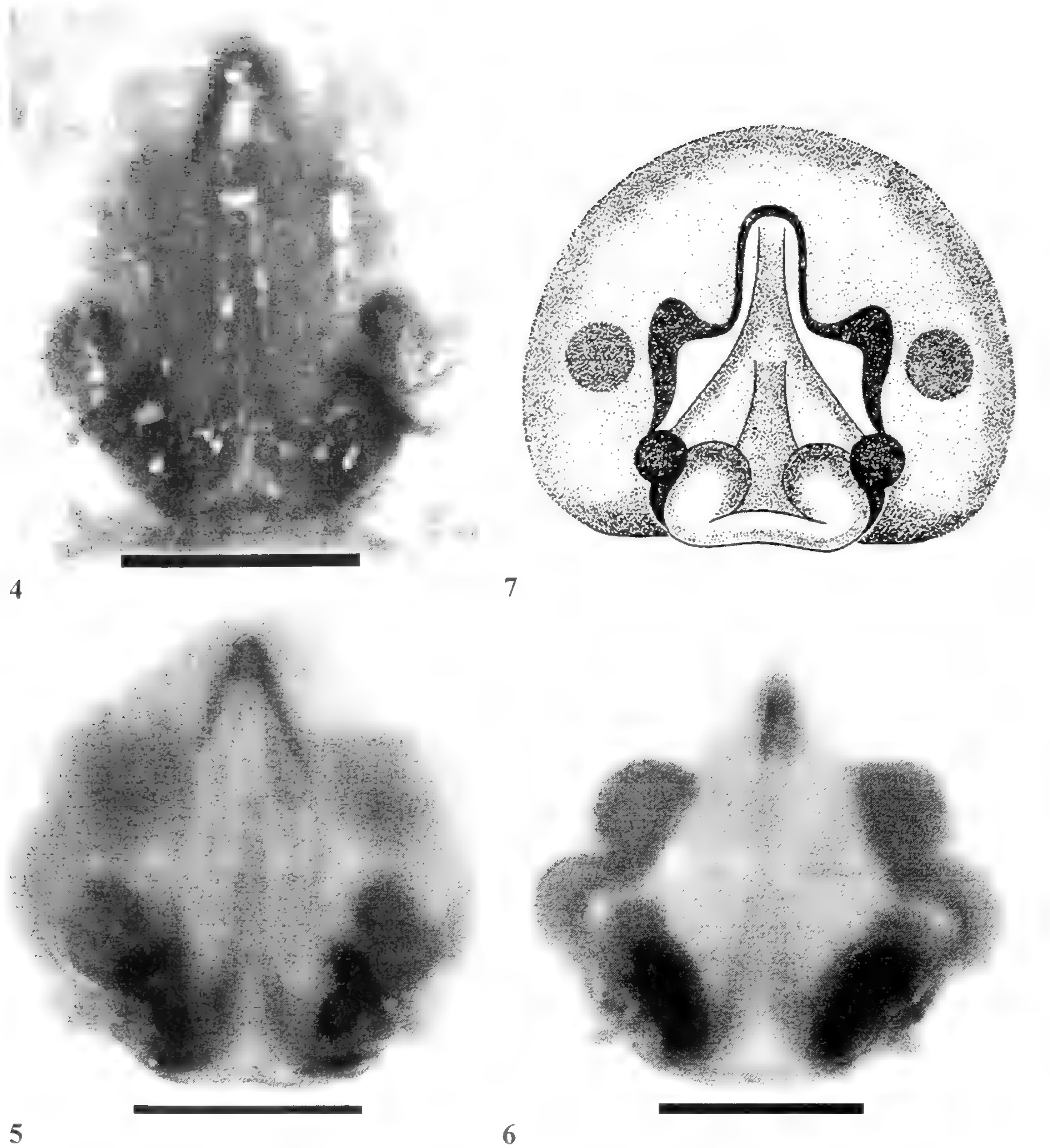
Distribution: Egypt: only from Alexandria (about 31°11'08"N 29°53'30"E).

Addendum from Cambridge (1876)

The described specimen of *Pardosa iniqua* was collected in 1864 and described by Cambridge (1876, pp.605-606). Roewer (1959) redescribed the same specimen after about a century of preservation in alcohol. Now, after 140 years of preservation, its colours are faded. Therefore, the original description of O.P.-Cambridge must be referred to, to know the real colouration of the specimen.

"The sides of the cephalothorax are rather depressed; a broad, longitudinal, brownish yellow band, radiating at the thoracic junction, occupies the middle; and the lateral margins have a broken band of the same colour, the intermediate spaces forming two broad brown bands; the ocular area is black-brown; and the whole has a dense clothing of yellowish grey pubescence. The *legs* are yellow, the femora banded with black-brown, and the femoral and base of the tibial joints slightly marked with a similar colour. The *falces* are brownish yellow, blackish near their base in front, and marked obliquely towards the extremities with a dusky brown band. The *sternum* is black-brown, with a broad, irregularly edged, yellow, longitudinal central band, which does not, however, reach the hinder extremity.

The *abdomen* is dull blackish brown above, all the normal characteristic markings being much obscured; the normal central marking on the fore part is bifid at its hinder extremity, and has an angular point, directed backwards, near the middle of each side; the hinder part has two nearly parallel longitudinal rows, each of three or four rather conspicuous pale spots, furnished with whitish hairs; and between them is an indistinct series of yellowish angular bars or chevrons; the sides are marked with black-brown spots and broken lines, which are more thinly dispersed towards the underside, which is yellow, margined with black-brown, and divided by a longitudinal central dark brown bar."



Figs. 4-7: *Pardosa iniqua* (O.P.-Cambridge, 1876), Holotype ♀. **4-5**. Epigynum, ventral view. **6**. Vulvae, dorsal view. Scale = 0.27 mm **7**. Epigynum, Roewer's Fig.7 (1959).

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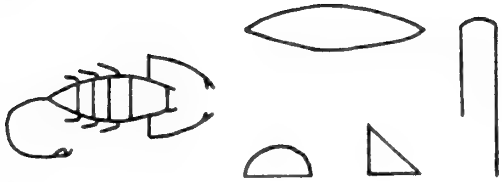

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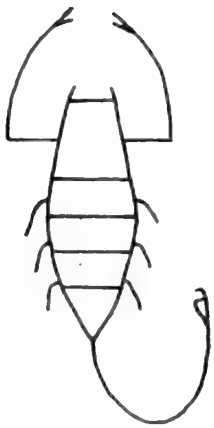

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Distribution of the "*Euscorpius carpathicus*" complex (Scorpiones: Euscorpiidae) in Turkey

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Abstract

This study presents old and new distributional localities and some morphplogical information concerning "*carpathicus* complex" of the genus *Euscorpius* Thorell, 1876 (Scorpiones: Euscorpiidae) in Turkey. Also taxonomic affinities of the taxa are discussed.

Keywords: Scorpiones, Euscorpiidae, *Euscorpius*, *carpathicus* complex, Turkey, distribution, morphology, taxonomy.

Introduction

Although several studies were made about Turkish *Euscorpius* Thorell (Birula, 1898, 1917a, 1917b; Hadži, 1930; Schenkel, 1947; Vachon, 1951, 1966; Tolunay, 1959; Kinzelbach, 1975, 1982; Bonacina, 1980; Fet, 1986, 1987, 1993, 1997; Lacroix, 1995; Kritscher, 1993; Crucitti & Malori, 1998; Fet *et al.*, 2003a), the species composition and taxonomic rank of most populations are still not clear (Fet & Braunwalder, 2000; Fet *et al.*, 2004).

Birula (1898) described *E. ciliciensis* Birula, 1898 from the Middle Taurus of Turkey. *E. ciliciensis* were considered either subspecies of *E. germanus* (Vachon, 1951, 1966) or a taxon belonging to *E. carpathicus* s.str. (Kinzelbach, 1975). Bonacina (1980) reestablished *E. mingrelicus* (Western Balkans and Anatolia to the Caucasus) as a "good" species and limited *E. germanus* (C.L. Koch) to the Alpine regions of Italy and described *E. m. phrygius* as a new subspecies from Turkey (Western Anatolia). Bonacina (1980) used the ratio of et-est/est-dsb and gave the ratio ca. 1 in *E. germanus* and between 1.5 and 3 in *E. mingrelicus*. Fet (1986) confirmed that *E. ciliciensis* type material of Birula belongs to "*E. mingrelicus* complex". Fet (1993) analyzed the morphological features of *E. m. mingrelicus* from Georgia and Russia. Lacroix (1995) described three new subspecies of *E. mingrelicus* excluding the three existing subspecies (viz. *E. m.*

mingrelicus, *E. m. ciliciensis* and *E. m. phrygius*) and limited the nominotypic ssp. *E. m. mingrelicus* to the Transcaucasia. Of these, *E. m. legrandi* was described from Bolu, *E. m. uludagensis* from Uludağ (Bursa) and *E. m. ollivieri* from along the coast of Black Sea between Zonguldak and Artvin. According to the latest treatment, six subspecies of *E. mingrelicus* are found in Turkey (Fet & Braunwalder, 2000, Fet *et al*., 2004). But taxonomic status of these subspecies is still unclear and questionable.

E. carpathicus was reported from different localities by Hadži (1930), Schenkel (1947), Vachon (1951), Tolunay (1959), Kinzelbach (1975) and Crucitti & Malori (1998). Fet & Braunwalder (2000) discussed current problems in taxonomy and biogeography of the scorpions of the Aegean area. Fet *et al*. (2003a) presented first DNA phylogeny of the genus *Euscorpius* including specimens collected both close to the type locality and another population from western Anatolia. Fet *et al*. (in press) discovered that presence of low genetic divergence accros the range of *E. italicus*.

Recent studies about *E. carpathicus* complex were based mainly on morphometric character sets and DNA analysis. Fet & Soleglad (2002) elevated the Balkan population to the species level as *E. hadzii*, verifying species status of *E. koschewnikowi* from Greece, and also quoted some Italian subspecies of *E. carpathicus* to species *E. sicanus*. Gantenbein *et al*. (2001) elevated the Balearic Island subspecies *E. c. balearicus* to species level as *E. balearicus*. Fet (2003) elevated subspecies of *E. c. tauricus* to species status as *E. tauricus*. Fet *et al*. (2003b) elevated *E. c. sicanus* known from Italy, Malta and Greece to species level as *E. sicanus* and limited the distribution of *E. carpathicus* to Romania.

The purpose of this study is to present details on morphological features (total length, number of patellar trichobotria (ventral and external series), number of pectinal plates and ratio of et-est / est-dsb) of two different forms, along with old and new distributional localities of *Euscorpius carpathicus* complex from Turkey.

Material and Methods

The specimens collected between the years 1998 and 2005 from different localities in Turkey were studied (Fig. 1). Specimens were investigated and measured with the stereomicroscope Olympus SZX9 equipped with 0.1 mm accuracy micrometric ocular. Total length was measured with 0.5 mm accuracy calipers. Scorpions were identified according to diagnostic external morphological features such as total length, carination of metasoma and number and position of the trichobothria on the pedipalp and the ratio of the distances between trichobothria et-est and est-dsb on the fixed finger of pedipalp. Diagnosis of each form is based on the material examined. The specimens were collected from different localities of Turkey and were preserved in 70% alcohol. A total of 56 pooled specimens were analysed. Trichobothrial formulae were given according to standard techniques (Fet, 1993, 2000).

Abbreviations

Dp: Number of pectinal tooth.
V: Number of trichobothria on the ventral aspect of pedipalp patella.
Te: The same on the external aspect including the following et, est, em, esb, eb_a, eb,
et: terminal; **est**: subterminal; **em**: median; **esb**: suprabasal; $\mathbf{eb_a}$: basal "a"; **eb**: basal.
et-est/est-dsb: The ratio of distance between the trichobothria et (external terminal)-est (external subterminal) and est (external subterminal)-dsb (dorsal suprabasal) on the fixed finger of pedipalp chela.

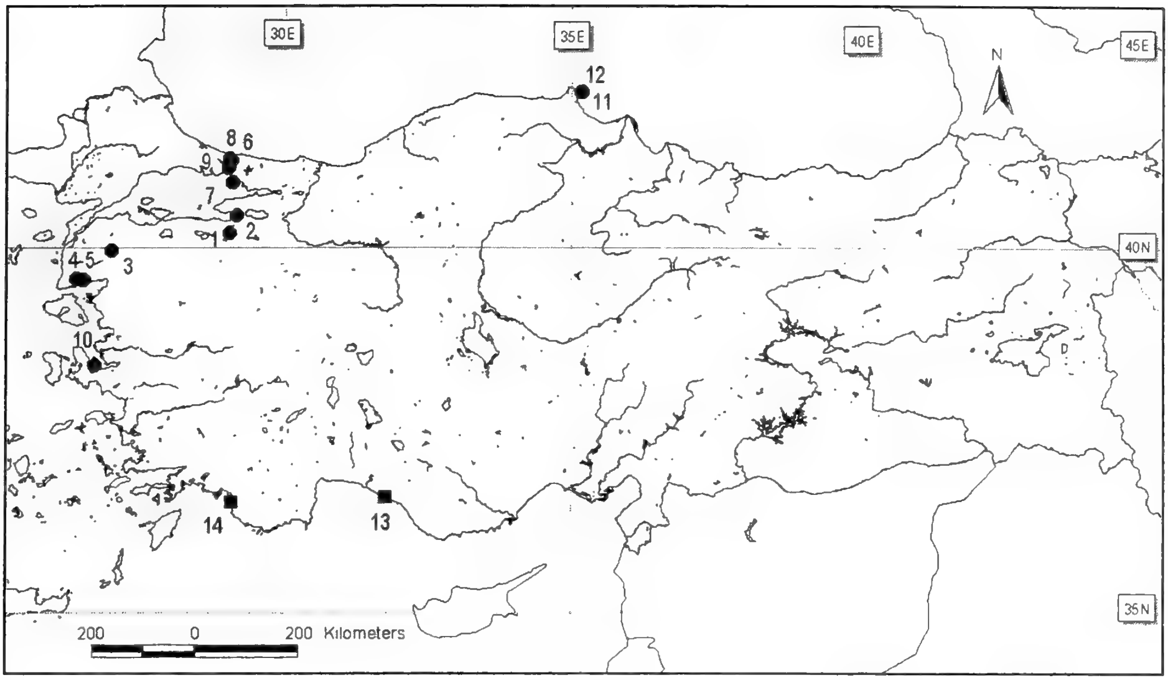

Fig. 1. Map of sampling localities. ***Euscorpius* sp. 1**: 1. Bursa, 2. Gemlik, Umurbey, 3. Çanakkale: Ayvacık, 4. Ayvacık, Hemdemtepe, 5. Çan, Terzialan; 6. İstanbul, 7. Büyükada, 8. Sarıyer, 9. Üsküdar, Çengelköy; 10. İzmir: Urla, Menteş; 11. Sinop, 12. Ada vicinity. ***Euscorpius* sp. 2**: 13. Antalya: Alanya, Avsallar; 14. Muğla: Fethiye, Kelebekler Valley.

Results and Discussion

According to the scored morphological features, all studied specimens were given in phenotypic groups. Below records of each group (with the original detailed trichobothrial scores, mean value of et-est/est-dsb and number of pectinal plates) were given. Number of scored pedipalps was given in brackets.

Family: Euscorpiidae Laurie, 1896
Genus: *Euscorpius* Thorell, 1876
Subgenus: *Euscorpius* Thorell, 1876

***Euscorpius* sp. 1 ("*carpathicus* complex") (cf. *E. koschewnikowi* and cf. *E. carpathicus* subgroup A1 sensu Fet, 2000)**

Material Examined: (total 52 specimens; 30 ♀♀, 22 ♂♂): Bursa: Centrum, 17.VIII.2005: 2 ♂♂ (2005/33); Gemlik, Umurbey, 14.VII.2003: 1 ♀ (2003/234). Çanakkale: Ayvacık, 08.IX.2003: 1 ♀ (2003/19); Ayvacık, Hemdemtepe picnic site, 08.IX.2003: 1 ♂, 3 ♀♀ (2003/19.1-4); Çan, Terzialan Vil., 07.VII.2003: 1 ♀, 1 ♂ (2003/12. 1-2). İstanbul: exact locality unknown, –.II.1999: 1 ♂ (1999/33); İstanbul: Adalar, Büyükada, 01.VII.2004 1 ♀ with 23 juv. (2004/53), ibid., 3 ♀♀ (2004/57. 1-3), 01.VIII.2004: 10 ♀♀, 13 ♂♂ (2004/35. 1-23); Sarıyer, 25.VII.2002: 3 ♂♂, 1 ♀ (2002/75.1-4); Üsküdar, Çengelköy, 16.IX.2001: 1 ♀ (2001/28). İzmir: Urla, Menteş Military Area, 18.VI.2004: 4 ♀♀ (2004/101. 1-4). Sinop (Centrum): Balatlar Church, 17.IX.2003: 1 ♂, 1 ♀ (2003/37.1-2), 23.VII.2004: 1 ♀ (2004/57); Ada vicinity, 14.IX.2003: 2 ♀♀ (2003/41.1-2).

Morphology: Total length generally was up to 30-35 mm in adults, but up to 38 mm in the largest specimens, collected from Bursa, Çanakkale, and Sinop (Fig. 2). Mean value of et-est/est-dsb was 1.33 ± 0.21 (Range: 1.27 - 1.40). Pedipalps, especially manus, were very well developed and large. Cutting edges of pedipalp fingers had a very strong basal scallop in adult males, and were contiguous in females; movable finger had a well developed median lobe in adult males. Colouration changed from medium brown to orange brown; pedipalps and carapace are the darkest; carinae of pedipalps were darker, and chelicerae, mesosoma, legs and telson were lighter and yellowish brown. Metasoma was relatively thin and sylindirical in shape, but not smooth. Dorsal carinae of metasomal segments I-IV were very sparsely and finely granulose; ventromedian and ventrolateral carinae of segment V had moderate granules and intercarinal spaces bears dense and fine granules.

Trichobothrial counts of pedipalp patella: Among the 52 examined specimens, the measurements were as follows (in parenthesis, number of scored pedipalps): external: eb: 2 (1), 4 (103), eb_a: 2 (1), 4 (103), esb: 2 (104), em: 3 (3), 4 (101), est: 3 (1), 4 (103) and et: 4 (2), 5 (28), 6 (74), and V: 6 (1), 7 (26), 8 (77).

Pectinal tooth counts were scored as follows; in females one specimen lack of pectines, 6-7 (1), 7-7 (19), 7-8 (7), 8-8 (2). In males, 8-8 (2), 8-9 (6), 9-9 (12), 9-10 (2).

Fig. 2. Adult male (left) and female (right) *Euscorpius* sp. 1 ("*carpathicus* complex") from Turkey. Male from İstanbul (2004/35-1), female from Sinop Ada vicinity (2003/41).

Comments: This species was recorded by Hadži (1930) from İstanbul and Crimea. In this study, the specimens collected from İstanbul under the name *E. c. oligotrichus,* were reported with a total length up to 30.5 mm, V: 7-9, Te: 24 and number of pectinal plates: 9-10 in males. Detailed trichobothrial analysis of *E. carpathicus* from the Crimea were given by Fet (1997) and it was elevated to species rank as *E. tauricus* according to DNA analysis by Fet (2003). Schenkel (1947) recorded one female from Havza (Samsun), Tolunay (1959) from Sinop and Vachon (1951) from İstanbul. Kinzelbach (1975) recorded this species from Çanakkale, Trakya, Eğridir (Isparta), Borçka (Artvin), Amasya, the Middle Taurus, Denizli and İstanbul with the name *E. carpathicus* s.str. First DNA phylogeny of the genus *Euscorpius* including specimens collected close to the type locality of *E. ciliciensis* Birula, and also from western Anatolia suggest that the closest taxa to the analyzed Anatolian populations are European species *E. gamma* Caporiacco, 1950 and *E. germanus* (C.L. Koch, 1837) but not the "*E. carpathicus*" species complex (Fet *et al.*, 2003a).

E. carpathicus was traditionally treated as one species widespread from Baleares to Crimea (Fet *et al.*, 2000). "*E. carpathicus* complex" is a complicated species complex and currently under revision using both morphological and molecular techniques (Fet & Soleglad, 2002; Fet *et al.*, 2003b; Gantenbein *et al.*, 2001). Currently Fet & Soleglad (2002) restricted the scope of *E. carpathicus* (Linnaeus, 1767) s.str. to Southwestern Romania and seven subspecies were revalidated as full species in this complex. One of them is *E. koschewnikowi* Birula, 1900 from northeastern Greece.

I compared my specimens with *E. koschewnikowi* and found some differences: In another study (Fet & Soleglad, 2002) the trichobothrium V4 was seen to be situated on the external surface, removed from the exteroventral carina of *E. koschewnikowi*. In this study, in all specimens given as cf. *E. carpathicus* or cf. *E. tergestinus,* V4 was situated on the ventral surface, internally from the exteroventral carina. As for the metasomal segments, all segments are considered to be longer than wide in both sexes of *E. koschewnikowi* (Fet & Soleglad, 2002) but in studied specimens from Turkey, while in males all segments (I-V) were longer than wide, in all females segment I was wider than long and in all the other segments (II-V) were longer than wide. Number of pectinal plates of *E. koschewnikowi* were given as 6-7 in females and 8 in males (Fet & Soleglad, 2002). Most of my male specimens have pectines with 9 teeth. Only one male from Ayvacık (Çanakkale) and one of total 13 males from Büyükada (İstanbul) have pectinal plates with 8-8 teeth. Also Çanakkale specimens are respectively small, adults were only up to 25 mm, and had more reduced metasomal carination and relatively less developed pedipalps. Teruel *et al.* (2004) reported *Euscorpius* sp.1 ("*carpathicus* complex") from Bulgaria with v: 6-7, et: 5, Dp in females: 7-7 and in males: 8-8. This occurred quite rarely in my examined specimens.

Fet (2000) separated a group named *E. carpathicus* subgroup A1 belonging to "*carpathicus* complex" with modal trichobotrial formulae as V: usually 7 to 8 and et from 5 to 6 from Bulgaria and Greece that corresponds to hybrid subspecies *E. c. candiota* Birula, 1903 evaluated by Kinzelbach (1975). Trichobothrial features of my specimens conform with that of *E. carpathicus* subgroup A1 stated by Fet (2000).

Euscorpius sp. 2 ("_carpathicus_ complex") (cf. _E. tergestinus_ and cf. _E. carpathicus_ subgroup A3 sensu Fet, 2000)

Material Examined (4 specimens; 3 ♂♂, 1 ♀): Antalya: Alanya, near Avsallar, 15.IX.1996: 1 ♂ (1996/37), 20.VII.1998: 1 ♂ (1998/18); Muğla: Fethiye, Ölüdeniz, Faralya, Kelebekler (Butterflies) Valley, 23.VIII.2004: 1 ♂, 1 ♀ (2004/38.1-2).

Morphology: Total length was up to 25 mm, pedipalps, carapace, metasomal segments were brown, mesosoma was light brown, telson and legs were yellowish light brown (Fig. 3). Pedipalps were moderately developed, scalloping of fingers was prominent especially in males. Dorsal internal and ventral internal carinae of femur and patella were well developed. Internal surface of femur bears serrulated to crenulated rows of granules. Dorsal carinae of segments I-IV were distinctly granulate, with moderately developed granules and could be seen on ¼ proximal part of segment V. Ventromedian and ventrolateral carinae of segment V were distinctly and moderately granulated. Ventrolateral carinae could be seen also on ¼ distal portion of the segment IV.

Trichobothrial counts of pedipalp patella: Among the four examined specimens, these measurements were as follows (in parentheses, number of scored pedipalps): external: eb: 4, eb_a: 4, esb: 2, em: 4, est: 4 and et: 6 in all 8 pedipalp patella. Ventral, V: 10 (3), 9 (4) and 8 (1). There are no differencies in counts of external series. Mean value of the ratio of et-est/est-dsb (in 8 patella) was measured as 1.2.

Pectinal tooth counts were scored as follows; in females: 6-7(1); in males: 9-9(1), 10-10(1), 8-9(1).

Fig. 3. Adult male (left) and female (right) *Euscorpius* sp. 2 ("*carpathicus* complex") from Turkey. Male and female (2004/38. 1-2) from Fethiye (Muğla).

Comments: Kinzelbach (1975) notified a species with the name *E. mesotrichus* with Tv: 10-14. This species was recorded from Şile (İstanbul) (TPT: 11) and on the coast of Black Sea and Adalar (Prinkipos) Islands in the Marmara Sea (TPT: 10-13). Kinzelbach (1982) recorded *E. mesotrichus* from Korikos (Mersin: Kızkalesi) and Ephesus (İzmir: Selçuk). The occurence of this form in İstanbul was also suspected by Fet & Braunwalder (2000). According to my recent findings, *E. carpathicus* s.l. with V= 9-10 occurs only along the South and Southwestern coast of Turkey and *E. carpathicus* s.l. with V= 7-8 (8 in 74% in scored pedipalp patella) is found in Aegean, Marmara and Black Sea regions (Fig. 1). Also Crucitti & Malori (1998) recorded *E.* cf. *carpathicus* from Antalya (Güzelsu, Adiller, Manavgat) and Konya (Çamlık) with TIT (V): 6-13 and em: 3 (2), 4 (8).

Currently Fet & Soleglad (2002) applied the name *E. tergestinus* to most of the western populations of former *E. carpathicus* (France, Italy, Slovenia, and Croatia) and the name *E. sicanus* to many Greek populations; at least several more forms of the "*carpathicus* complex" were considered as present across the Balkans, all on Aegean islands and in southern Turkey (Fet *et al.*, 2004). The most important feature separating *E. sicanus* from *E. tergestinus* and another related species, e.g., *E. balearicus*, is its external patellar series eb (and in some populations, also series eb_a) has 5 trichobothria. All specimens examined of *E. tergestinus* and *E. balearicus* possess only 4 trichobothria in these series (Fet *et al.*, 2003b). But in the specimens collected from Turkey, series eb and eb_a always had 4 trichobothria. V4 was situated on the external surface in a dimple in *E. tergestinus* (Fet & Soleglad, 2002); however, V4 situated on the ventral surface, inner side of the exteroventral carina in all studied specimens.

Fet (2000) separated a group named *E. carpathicus* subgroup A3 belonging to the "*carpathicus* complex" with modal trichobotrial formulae as V: usually 8-10 and et from

6 to 7 from Aegean Islands (Greece). Trichobothrial features of my specimens conformed with those of *E. carpathicus* subgroup A3 of Fet (2000).

It will be possible to conclude whether some features of *E. carpathicus* sp. 2 (e.g. carination of pedipalps and metasomal segments, trichobothrial formulae, number of pectinal plates) conform with that of *E. tergestinus* and trichobothrial formulae conform with *E. carpathicus* subgroup A3, only after analysis of both morphology and DNA of all populations from Balkans to Turkey. Based on the results of my study, it seems fit to keep these as *E. carpathicus* sp. 1 and sp. 2 from "*carpathicus* complex". Further morphological and DNA analysis (Fet *et al.*, in press) will depict the relationships of *E. carpathicus* populations from Turkey with other Balkan and Greek populations more clearly, as well as the position of Turkish populations in the "*carpathicus* complex".

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Distribution and Systematic Status of *Euscorpius italicus* (Herbst, 1800) (Scorpiones: Euscorpiidae) in Turkey

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Abstract

In this study, the systematic status of *Euscorpius italicus* (Herbst, 1800) was investigated based on morphological features of 156 specimens (77 females, 79 males) collected from the Marmara, Karadeniz, and north-eastern Anatolia area in northern Turkey, specifically. New data on the distribution of *E. italicus* in Turkey are presented, including one record in Kars Province in the north-eastern part of the country, which has a naturally disjunctive distribution. Turkish material was compared to the European samples with respect to trichobothrial features, pectinal teeth numbers and the ratio of et-est/est-dsb. It was established that the European and Anatolian populations had similar features and *Euscorpius italicus awhasicus* was not a valid subspecies.

Keywords: Distribution, Systematics, *Euscorpius italicus*, *Polytrichobothrius*, Euscorpiidae, Scorpiones, Turkey.

Introduction

The scorpion genus *Euscorpius* Thorell, 1876 of Family Euscorpiidae is widely distributed across the Western Palaearctic. Its range includes North Africa and south and central Europe, the Balkans and throughout Turkey to the Caucasus (Fet & Sissom, 2000). This genus consists of more than 15 species divided into four subgenera: *Alpiscorpius*, *Euscorpius*, *Polytrichobothrius*, and *Tetratrichobothrius*. *Polytrichobothrius* Birula, 1917, consists of two species (Fet *et al.*, 2004). *Euscorpius italicus* (Herbst, 1800) has a naturally disjunctive geographic distribution divided in two unequal parts: it is found in southern Europe (mainly in Italy, Slovenia, Croatia, Montenegro, Albania, and north-western Greece) and in a narrow coastal strip along the Black Sea coast of northern Turkey from İstanbul in the west to Georgia and Southern Russia in the east (Krasnodar Region) (Fet & Sissom, 2000; Fet & Kovařík, 2003). *Euscorpius italicus* was also found by Nordmann in the Caucasus on the shores of the Black Sea. Later Nordmann called this species *Scorpio awhasicus*, regarding it as a "species not yet described". Kessler mentioned this species under the name *Scorpio awhasicus* but defined its relation to *Scorpio italicus* (Herbst) (Birula, 1917a).

Until now *E. italicus* has been named as *E. i. awhasicus* (Nordmann, 1840) several times by Birula (1917a, 1917b), Vachon (1951), Tolunay (1959), Kinzelbach (1985), Crucitti (1999) from Tekirdağ, Kocaeli, Ordu, Giresun, Rize, Trabzon on the Northern Coastal Region and from Çorum (Kargı) on the inner parts of Turkey. In these studies, the Anatolian, as well as the Caucasian populations were classified as *E. i. awhasicus*. Birula (1917a) examined the specimens from Caucasus, Italy, Anatolia and the Balkans and stated that they did not differ from each other in any feature (number of pectinal teeth and ventral trichobothria of pedipalp, patella and chela), and that the Caucasian form could not be separated from the type specimens even as a local race. He suggested that *Scorpius naupliensis* C.L.Koch, 1842 should be considered as a local race of the species because of its fine granulation of the patella. Vachon (1981) studied the specimens from Italy, Switzerland, Greece and Turkey (İstanbul, n = 1) and listed all forms of the species as synonyms but noted that the different trichobothrial features of the Peloponnesian specimens. Kinzelbach (1975), who had previously synonymized all known subspecies to the nominated subspecies, later suggested *E. i. awhasicus* to be a valid subspecies (Kinzelbach, 1985). Bonacina (1982) showed the overall variations in the number of ventral chelal and patellar trichobothria of the Italian specimens. Currently no valid subspecies of *E. italicus* are recognized (Fet & Sissom, 2000). Gantenbein *et al.* (2002) who elevated *Euscorpius naupliensis* (C.L.Koch, 1837) to species status, examined six specimens of *E. italicus* from Turkey and classified the Turkish samples of *E. italicus* together with the European specimens. Fet *et al.* (in press) demonstrated an extremely low genetic divergence across the geographic range (Switzerland, Italy, Greece, Turkey, and Slovenia) of the species.

The distribution of *E. italicus* in Turkey along Black Sea Coast is less well documented. Only a few coastal sites are known between İstanbul and Rize and several taxonomic problems remain unresolved concerning the status of some Italian, Greek, Turkish and Caucasian populations (Gantenbein *et al.*, 2002).

In this study, the Turkish populations of *E. italicus* were studied for the first time with respect to meristic morphological features (number of patellar ventral and external trichobothria, chelal ventral trichobothria, pectinal teeth counts and ratio of et-est / dsb) and the new distributional records of *E. italicus* from Turkey are presented including one record in Kars Province in north-eastern part of the country, which has a naturally disjunctive distribution. Results only belong to material examined were given in tables and distributional records were plotted on a map.

Populations outside the main geographic range are assumed to have been introduced by human beings (Gantenbein *et al.*, 2002). Such populations of *E. italicus* have also been reported from other places closer to the main range of the species, but still disjunctive: Yemen (Birula, 1937), south-western Romania (Vachon, 1981); and Switzerland (Braunwalder, 2001), and Iraq (Fet & Kovařík, 2003).

This paper aims to elucidate the systematic status of *E. italicus* and to present data on the distribution of this species in Turkey. In addition, some data on the biology of this species in the eastern part of its distributional range is provided.

Material and Methods

A total of 260 specimens of *E. italicus*: 77 ♀♀, 79 ♂♂ adults, 7 subadults, 20 and 11 juveniles completed the first instar, and 28, 29 and 9 newborn embryos were collected from different localities in northern Turkey between 1998 and 2005 (Fig. 1). I also examined 156 adult specimens of *E. italicus* for trichobotrial features, pectinal teeth numbers and the ratio of et-est / est-dsb.

Measurements were taken with a stereomicroscope (Olympus SZX9) equipped with a micrometric ocular piece (0.1 mm accuracy). Trichobothrial scores were taken according to the standard convention (Gantenbein *et al.*, 2002). The nomenclature used follows that of Vachon (1981), Bonacina (1982) and Gantenbein *et al.* (2002).

All specimens are preserved in 75% alcohol at the Department of Biology, Niğde University (ZDNU).

Abbreviations

Dp: Number of pectinal teeth.

Chela Ventral: Number of trichobothria on the ventral, ventroexternal carina and external aspect of pedipalp chela.

Tv: Number of trichobothria on the ventral aspect of pedipalp patella.

Te: The number of trichobothria on the external aspect including et, est, em, esb$_a$, esb, eb$_a$, eb, (**et**: terminal; **est**: subterminal; **em**: median; **esb$_a$**: suprabasal "a"; **esb**: suprabasal; **eb$_a$**: basal "a"; **eb**: basal).

et-est/est-dsb: The ratio of the distance between the trichobothria et (external terminal)-est (external subterminal) and est (external subterminal)-dsb (dorsal suprabasal) on the fixed finger of pedipalp chela.

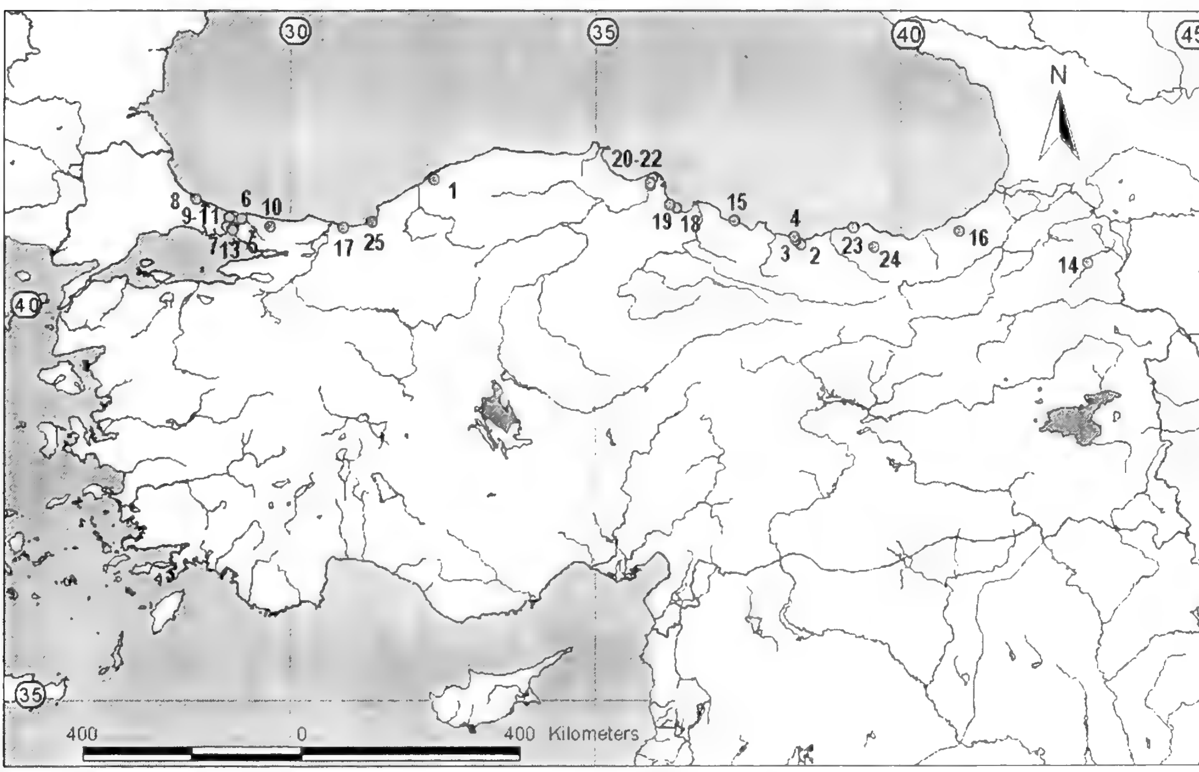


Fig. 1. Localities of examined material of *Euscorpius italicus* (Herbst, 1800). Explanation in text.

Results

Material examined: – *Bartın*: Amasra (centre) [*1a*], 03.XI.2003: 1♀ (2003/186), Amasra Castle [*1b*], 04.XI.2003: 1 ♂ (2003/230). – *Giresun*: Kemaliye Köyü [*2*], 20.VIII.2001: 1♂ (2001/86); Bulancak, İnece Village, Davutlu Quarter [*3*], 01.VIII.2003:

1♂, 1♀ (2003/32.1-2), 25.VII.2004: 1♀, 2♂♂, (2004/62.1-3), Samugüney Village [*4*], 20.II.1996: 1♀, 2♂♂ (1996/41.1-3), 21.II.1996: 4♂♂, 2♀♀ (1996/184), 20.VIII.2001: 1♂ (2001/86), 30.VIII.2001: 1♀ (2001/50), 01.III.2002: 1♂ (2002/1), 02.VIII.2003: 1♀, 1♂ (2003/21.1-2). – *İstanbul* [*11a*], 25.XI.2002: 5♂♂, 3♀♀ (2002/74.1-8), 23.X.2005: 2♀♀, 2♂♂ (2005/100.1-4); Beykoz [*5*], -.VII.2001: 1♀ (2001/121), 15.XI.1996: 1♀ (1996/48), 30.IX.2003: 1♂ (2003/42), Arnavutköy [*6*], 15.VIII.1997: 3♀♀ (1997/19.1-3), Çengelköy, Military Buildings [*7*], 18.VIII.2001: 1♂ (2001/30); Çatalca, Ormanlı Village [*8*], 07.IX.2003: 1♂ (2003/1); Sarıyer, Bahçeköy [*9*], -.VIII.2004 1 ♀ (2004/34); Şile, Tekeköy [*10*], 10.VIII.2004: 1♂ (2004/71); Şişli [*11b*], 07.XI.2005: 1♂ (2005/109); Üsküdar, Çamlıca [*12*], 15.VIII.2003: 1♂ (2003/191), 20.I.2004: 1♂ (2004/23), 04.VII.2003: 1♀, 3♂♂ (2003/190.1-4), Kısıklı, Çakaldağ Village [*13*], 08.V.2005: 1♀ (2005/9). – *Kars*: centrum, near Faculty of Science-Arts and Kars Castle [*14*], 15.IV.2002: 1♀, 1♂ (2002/118.1-2). – *Ordu*: Ünye [*15a*], 11.IX.2002: 1♀, 2♂♂ (2002/124.1-3), Çınarlık Quarter [*15b*], 1♂ (2004/01). – *Rize*: Çamlıhemşin, Şenyuva-Ülkü villages [*16*], 20.VIII.2003: 2♂♂ (2003/134.1-2). – *Sakarya*: Kocaali, Dere Quarter [*17*], 12.VIII.2002: 1♂ (2002/44). – *Samsun*: Fatih Quarter [*18a*], 20.VIII.2003: 2♀♀, 1♂ (2003/35.1-3), 14.VII.2002: 2♂♂ (2002/69.1-2), Kadıköy Quarter [*18b*], 13.IX.2003: 1♀, 1♂ (2003/36.1-2), Alanlı Village [*19a*], 27.VIII.2003: 5♀♀, 2♂♂ (2003/40.1-7), between Alanlı-Birkut Villages [*19b*], 27.VIII.2003: 2♀♀, 1♂ (2003/39.1-3); Bafra (centre) [*20a*], 17.VII.2005: 5♀♀, 6♂♂ (2005/104.1-11); 23.VIII.2005: 13♀♀, 8♂♂ (2005/66.1-21), Yaka Quarter [*20b*], 02.VII.2005: 9♀♀, 9♂♂ (2005/101.1-18), Karpuzlu Village [*21*], 24.VIII.2005: 7♀♀, 5♂♂ (2005/102.1-12), Koşu Village [*22*], 26.VIII.2005: 6♀♀, 6♂♂ (2005/103.1-12). – *Trabzon*: Beşikdüzü [*23*], 06.VIII.2003: 1♂ (2003/140); Maçka, Ocaklı Village [*24*], 06.VII.2005: 1♀ (2005/42). – *Zonguldak*: Alaplı, Kocaman Forest Station [*25*], 01.XII.2004: 1♀, 1♂ (2004/72.1-2).

Morphology: In females, pectinal teeth number varied between 8 and 10. The number of pectinal teeth according to the counted pectines of 77 females were as follows: 8-8 (in 30 specimens or 39%), 9-9 (21 or 27.3%), 8-9 (10 or 13%), 9-8 (9 or 11.7%), 7-8 and 8-10 (2 or 2.6%), 5-9, 9-10 and 7-7 (1 or 1.3%).

In males, pectinal teeth number varied between 9 and 12. The number of pectinal teeth according to the counted pectines of 79 males were as follows: 10-10 (in 46 specimens or 59%), 10-11 (13 or 16.7%), 11-11 (9 or 11.5%), 9-10 (7 or 9%), 11-12 (2 or 2.6%), 9-9 and 10-12 (1 or 1.3%).

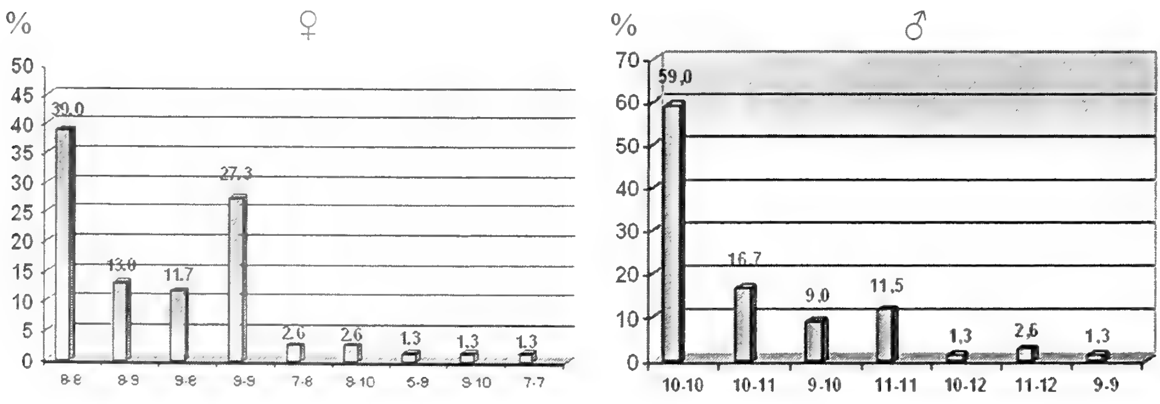


Fig. 2. Percentage of pectinal teeth counts of 77 females and 79 males of *Euscorpius italicus* (Herbst, 1800).

Based on the 312 samples scored, in the pedipalp patella the number of eb, eb_a, em and est trichobothria did not show much variation. These numbers were generally fixed at certain characteristic values. For instance, although the eb series varied between 3 to 5, predominantly eb was equal to 4 (296 specimens or 94.9% of 312 samples). The same was valid also for eb_a. It varied between 4 and 7 but predominantly the eb_a value was 6 (295 specimens or 94.6%). The em series varied between 3 to 6, but predominantly em was 5 (303 specimens or 97.1%). Finally est varied between 3 to 5, and predominantly est was 4 (306 specimens or 98.1%).

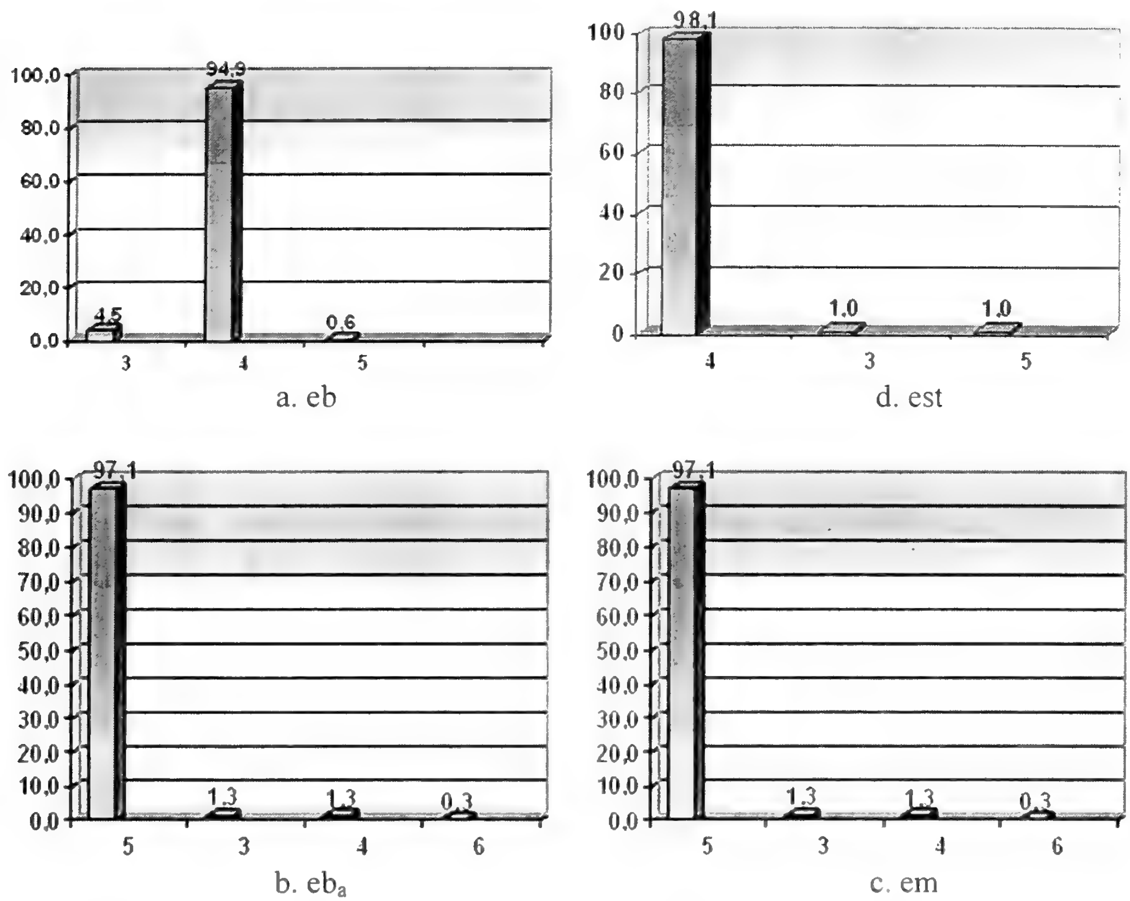


Fig. 3. Statistical data for pedipalp patella trichobothrial counts of *Euscorpius italicus* (Herbst, 1800). a: eb = external basal, b: eb_a = external basal "a", c: em = external median, d: est = external subterminal (number above each column refers to percentage value in total number of patellae).

As a result of examination of a total of 312 patellae belonging to 156 specimens, the number of ventral patellar trichobothria varied from 9 to 14; 188 patellae (60.3%) of scored pedipalps had 12 trichobothria, 70 patellae (22.4%) had 13 trichobothria and 42 patellae (13.5%) had 11 trichobothria. The rest of the trichobothria categories were found with relatively lower frequencies. Only 2 patellae (0.6%) had 9 trichobothria, 3 patellae (1%) had 10 trichobothria, and 7 patellae (2.2%) had 14 trichobothria.

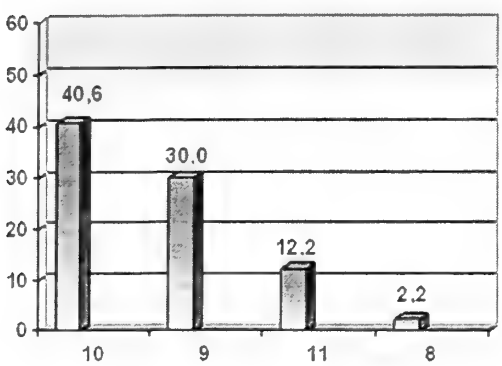
Number of esb_a trichobothria in the external patellar series varied from 4 to 11; 130 patellae (41.7%) of the scored patellae had 7 trichobothria, 82 patellae (26.3%) had 8 trichobothria, 41 patellae (13.1%) had 6 trichobothria, and 37 patellae (11.9%) had 9 trichobothria. Four categories had frequencies lower than 5%; 13 patellae (4.2%) had 10 trichobothria, 7 patellae (2.2%) had 5 trichobothria, and finally there was one patella (0.3%) with 4 trichobothria and another with 11 trichobothria.

The number of et trichobothria in the external patellar series varied from 4 to 9; 218 patellae (69.9%) had 7 trichobothria, 55 patellae (17.6%) had 8 trichobothria, 35 patellae (11.2%) had 6 trichobothria and only 2 patellae (0.6%) had 4 trichobothria, one patella (0.3%) with 5 trichobothria and another with 9 trichobothria. Variability and statistical distribution of pedipalp trichobothria are shown in Figs. (3-4).

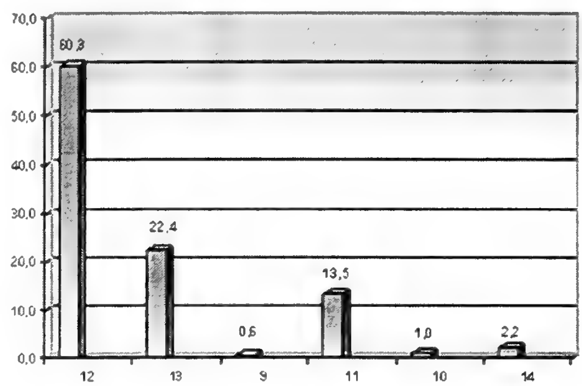
In our analysis of 156 specimens, the number of ventral trichobothria of chela ranged between 8 and 11. Ventral trichobothria of chela are located on both the ventral and external aspect of the manus. In most specimens, one trichobothrium is found on the ventroexternal carina (rarely 2 or 3). For 156 samples, 18 different configurations were determined in terms of the numbers found on the external, ventro-external carina and ventral surface of the manus. The percentage of 98.59% of these samples exhibited trichobothria situated on the ventro-external carina and on the external surface, 85.44% had one, and 7.51% had two trichobothria.

The following seven configurations were dominant accounting for 82.71% of the samples: (external + ventro-external carina + ventral)

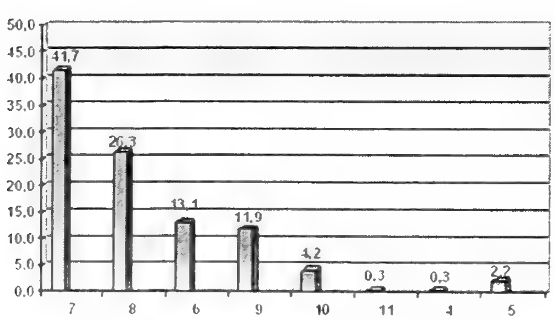
1+1+8 = 10,	30.98%	1+2+8 = 11,	5.12%	2+1+8 = 11,	2.81%
1+1+7 = 9,	25.75%	0+2+7 = 9,	4.22%		
1+2+7 = 10,	9.61%	1+1+9 = 11,	4.22%		



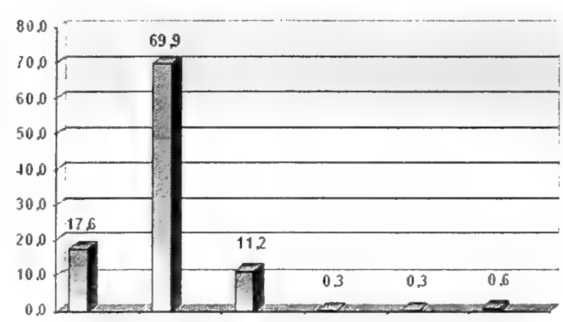
a. Chela ventral



b. Patella ventral



c. esb_a



d. et

Fig. 4. Statistical data for pedipalp patella trichobothrial counts of *Euscorpius italicus* (Herbst, 1800). a: chela ventral, b: patella ventral, c: esb_a = external suprabasal "a", d: et = external terminal (number above each column refers to percentage value in total number of patellae).

A total of 41 females and 43 males were measured to determine whether or not the ratio of et-est/est-dsb reflected a difference between European and Turkish populations of *E. italicus*. The mean value of the ratio of chelal fixed finger trichobothria et-est/est-dsb was determined to be 0.99±0.12 (Range: 0.77-1.30) for females and 0.89±0.13 (Range: 0.66-1.35) for males.

The new distributional record of *E. italicus* from Turkey was given from Kars Province in north-eastern part of the country, which has a naturally disjunctive distribution. But the specimens from Kars Province (one male and one female) (2002/118.1-2) had no morphometric differences from the other specimens from Turkey. Trichobothrial formulae (chela ventral, patella ventral, eb, eb_a, esb, esb_a, em, est, et) of female (2002/118.1) 11-10, 12-12, 44, 66, 22, 77, 55, 44, 77; the same of male (2002/118.2) 9-10, 12-12, 44, 66, 22, 76, 55, 44, 46. The pectinal teeth number of female was 8-8 and for male it was 10-10.

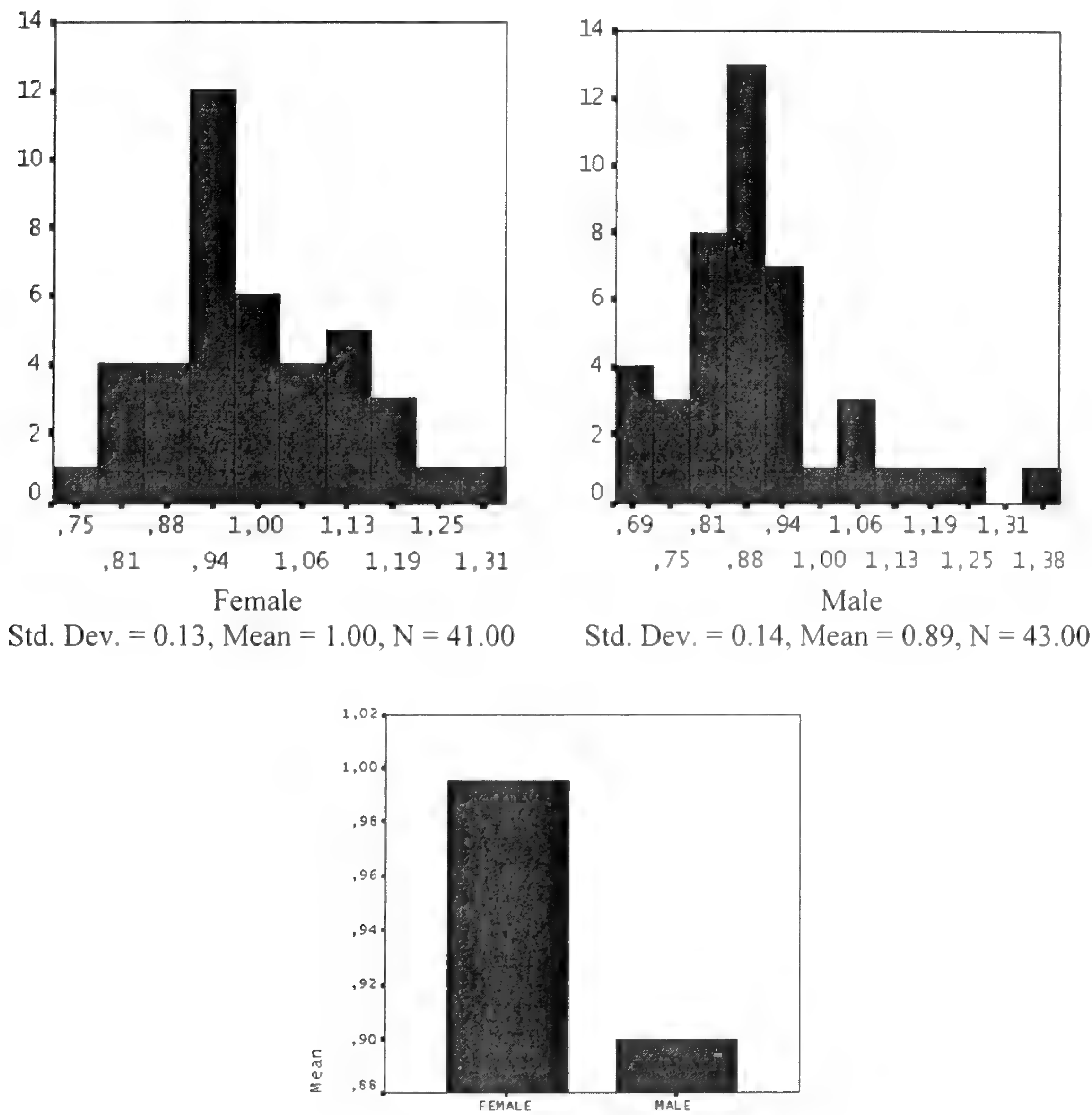


Fig. 5. The ratio of et – est / est – dsb trichobotria.

Discussion

The statistical data on pectinal teeth and trichobothria from the Turkish specimens fall within the limits of those known for *E. italicus* that were indicated by Gantenbein *et al.* (2002).

As a result of the statistical analysis of *E. italicus* populations from Turkey, only differences in the number of esb_a series were determined in comparison with the European populations. Gantenbein *et al.* (2002) indicated that the number of esb_a series for European populations was predominantly 9 but in Turkish populations this number is predominantly 7. The numbers of all other trichobothria showed similar values.

Gantenbein *et al.* (2002) denoted that this ratio in European population of *E. italicus* for females as 0.983±0.085 (Range: 0.83-1.15), for males as 0.825±0.111 (Range: 0.69-1.07). My results conform that of European population indicated by Gantenbein *et al.* (2002).

According to the diagnostic criteria given by Gantenbein *et al.* (2002), especially the trichobothrial numbers and patterns, and ratio of et-est/est-dsb, it is clear that the Turkish populations of *E. italicus* belong to the nominotypic form. This supports the notion that *E. i. awhasicus* is not a valid subspecies, as stated by Fet & Sissom (2000) and Gantenbein *et al.* (2002).

In Kars province, the presence of two adult specimens indicated a reproducing population and this population has been introduced by human beings. The closest known populations of *E. italicus* are those in Artvin and Rize in Eastern Karadeniz Region, which is the likely source of introduction.

My data shows a wide variation in the number of ventral and chelal trichobothria of *E. italicus* in Turkey and provided distribution records from Turkey. This also provides some data on the biology of this species at the eastern part of its distributional range.

Acknowledgments

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Cave dwelling spiders (Araneae) of Turkey

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Abstract

In this study, a faunistic list of 61 species of cave dwelling spiders of Turkey has been constructed depending on previous literature records of the spider fauna of Turkey.

Keywords: Spiders, Araneae, Caves, Turkey.

Introduction

The geological differences and formations of Turkey have contributed its bio-variety at an important rate. According to the data of M.T.A. (Directorate of the Institute of Mineral Research), the caves, covering 2/5 of Turkey, also nestle many species of spiders that had settled underground during the previous geologic ages and insulated from the outside for a long time.

Cave dwelling spiders, as zoogeographic agents, are important for biospeleology (Brignoli, 1979). The first study on fauna of cave dwelling spiders of Turkey belongs to the French biospeleologist Fage (1931), who revised cave dwelling spiders and described *Palliduphantes byzantinus* (Linyphiidae) as a new species dwelling in Yarımburgaz cave in İstanbul.

Roewer (1959) had a detailed study on arachnids collected from Greece, Crete, Anatolia, Iran and India by Dr. Kunt Lindberg. In his study, Roewer recorded 37 species belonging to 17 families from the caves of Turkey. In another study, Roewer (1962) described *Hoplopholcus patrizii* (Pholcidae) as a new species and recorded *Pachygnatha degeeri* (Tetragnathidae) from a cave in Antalya. Wiehle (1963) collected only one specimen of *Carpathonesticus borutzkyi* to record it from Turkey.

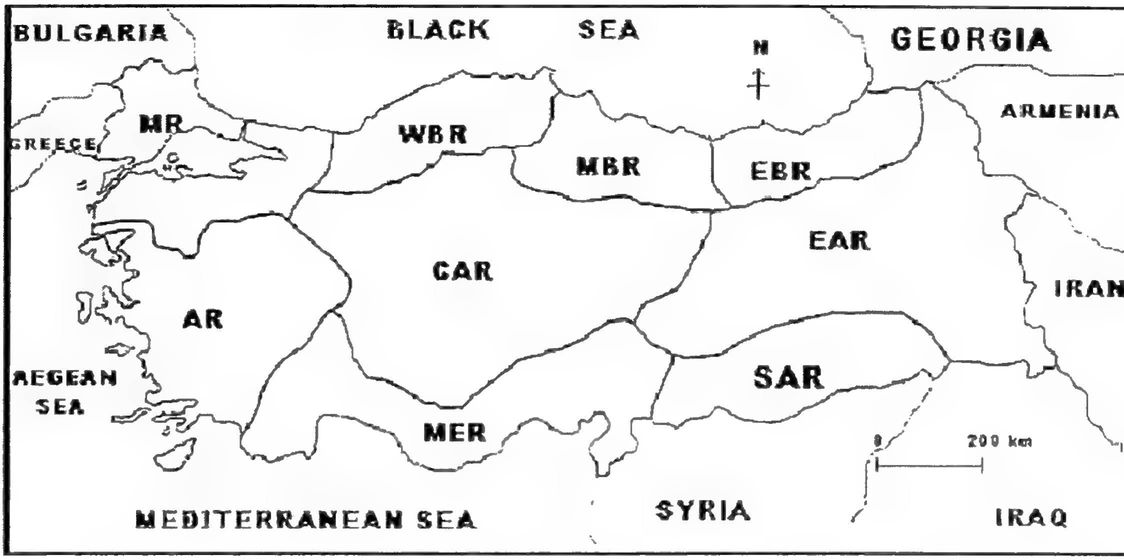
In her study called "Turkish Spiders. I. Preliminary List", Karol (1967) talked about cave dwelling spiders recorded by different arachnologists and attributed to the authors of these records.

Aygen (1971) and Başar (1971) mentioned records from some caves of different Turkish cities. They only talked about morphological and behavioural features of the spiders but they did not inform about the species of the spiders.

Brignoli (1968, 1971, 1972, 1978a, 1978b, and 1979) gave broad information about systematical and biogeographical features of cave dwelling spiders of Europe, Aegean Islands and Turkey. He recorded 18 spider species that belong to different families from the caves of Turkey and described them as new to science.

Deeleman-Reinhold & Deeleman (1988) recorded 4 species belonging to family Dysderidae from the caves of Turkey, including *Dysderocrates regina* as new species.

Deltshev (1972-1995, in Platnick, 2006) studied cave dwelling spiders of the Balkans and Aegean Islands. Deltshev (1996, 2000) stated that endemic spiders in Balkans often dwell high mountain peaks and caves. He claimed in his studies that some endemic spiders of the Balkans might be related to the North part of Turkey.



Map 1. Geographical regions of Turkey. WBR = West Black Sea Region, MBR = Middle Black Sea Region, EBR = East Black Sea Region, MR = Marmara Region, AR = Aegean Region, MER = Mediterranean Region, CAR = Central Anatolia Region, EAR = East Anatolia Region, and SAR = Southeast Anatolia Region.
[WBR: Zonguldak; MR: Bursa, İstanbul, Yalova; MER: Adana, Antalya, Burdur, Hatay, Isparta, Kahramanmaraş, Mersin; CAR: Karaman, Kayseri, Konya; EAR: Bitlis, Diyarbakır, Elazığ; SAR: Gaziantep, Mardin.]

Results and Discussion

Family Theraphosidae Thorell, 1870
Chaetopelma gracile (Ausserer, 1871)
Distribution in Turkey: Kahramanmaraş, Güvercinlik, Lor Cave (Roewer, 1959).

Family Filistatidae Ausserer, 1867
Filistata insidiatrix (Forskål, 1775)
Distribution in Turkey: Hatay, Antakya, Suadiye, Mağaracık (Roewer, 1959).

Family Sicariidae Keyserling, 1880
Loxosceles rufescens (Dufour, 1820)
Distribution in Turkey: Kahramanmaraş, Elbistan, Culundu Cave (Roewer, 1959).

Family Leptonetidae Simon, 1890
Cataleptoneta aesculapii (Brignoli, 1968)
Distribution in Turkey: Antalya, Alanya, Damlataş Cave (Brignoli, 1968, 1978).

Cataleptoneta sbordonii (Brignoli, 1968)
Distribution in Turkey: Burdur, İnsuyu Cave (Brignoli, 1968, 1978); Antalya, Döşemealtı, Yağca Village, Mustanini Cave (Brignoli, 1978).

Family Pholcidae C.L. Koch, 1851
Holocnemus pluchei (Scopoli, 1763)
Distribution in Turkey: Elazığ, Harput, Buzluk Cave; Kahramanmaraş, Güvercinlik, Lor Cave (Roewer, 1959).
Hoplopholcus patrizii (Roewer, 1962)
Distribution in Turkey: Antalya, Dağ Cave (Roewer, 1962); Antalya, Döşemealtı, Karain Cave (Brignoli, 1972).
Pholcus opilionoides (Schrank, 1781)
Distribution in Turkey: Bursa, İnkaya Village, Suini Cave (Roewer, 1959).
Pholcus phalangioides (Fuesslin, 1775)
Distribution in Turkey: Hatay, Samandağ, Mağaracık, Büyük Cave; Diyarbakır, Lice, Korkha Cave (Roewer, 1959).
Pholcus spasskyi Brignoli, 1978
Distribution in Turkey: Diyarbakır, Lice, Korkha Cave (Brignoli, 1972).

Family Dysderidae C.L. Koch, 1837
Dysdera crocata C.L. Koch, 1838
Distribution in Turkey: Hatay, Antakya, Narlıca Cave (Roewer, 1959; Deeleman-Reinhold & Deeleman, 1988).
Dysdera hamulata Kulczyński, 1897
Distribution in Turkey: Hatay, Antakya, Narlıca Cave; Mardin, A Cave near Mardin (Deeleman-Reinhold & Deeleman, 1988).
Dysderocrates regina Deeleman-Reinhold, 1988
Distribution in Turkey: Antalya, Akseki, Altınbeşik-Düdensuyu Cave; Konya, Gerikini Cave (Deeleman-Reinhold & Deeleman, 1988).
Harpactea agnolettii Brignoli, 1978
Distribution in Turkey: Isparta; İnönü Cave (Brignoli, 1978).
Harpactea pisidica Brignoli, 1978
Distribution in Turkey: Isparta, Eğirdir, a cave near Anamas (Brignoli, 1978).
Harpactea sanctaeinsulae Brignoli, 1978
Distribution in Turkey: Konya, Beyşehir Gölü, Hacı Akif Adası, Hacı Akif Cave (Brignoli, 1978).
Harpactocrates troglophilus Brignoli, 1978
Distribution in Turkey: Isparta, Anamas, Zindan Cave (Brignoli, 1978).
Hygrocrates lycaoniae (Brignoli, 1978)
Distribution in Turkey: Konya, Çamlık, Körükini Cave (Deeleman-Reinhold & Deeleman, 1988).

Family Uloboridae Thorell, 1869
Uloborus plumipes Lucas, 1846
Distribution in Turkey: Hatay, Antakya, Narlıca Cave (Roewer, 1959).

Family Nesticidae Simon, 1894
Carpathonesticus borutzkyi Reimoser, 1930
Distribution in Turkey: Zonguldak, Ereğli, a cave near Ereğli (Wiehle, 1963); Zonguldak, Kapuz Cave (Brignoli, 1972).
Nesticus cellulanus (Clerck, 1757)
Distribution in Turkey: Hatay, Antakya, Narlıca Cave; Zonguldak, Ereğli, Ilıksu Cave; Elazığ, Harput, Buzluk Cave; Bitlis, Ahlat, Sultan Seyit Cave (Roewer, 1959).

Family Theridiidae Sundevall, 1833

Latrodectus pallidus O.P.-Cambridge, 1872

Distribution in Turkey: Kahramanmaraş, Afşin, Guezeu Cave (Roewer, 1959).

Family Linyphiidae Blackwall, 1859

Centromerus unicolor Roewer, 1959

Distribution in Turkey: Hatay, Antakya, Narlıca Cave (Roewer, 1959).

Diplocephalus turcicus Brignoli, 1972

Distribution in Turkey: Burdur, İnsuyu Cave; Isparta, Anamas, Zindan Cave; Konya, Beyşehir Gölü, Hacı Akif Adası, Hacı Akif Cave (Brignoli, 1972).

Gongylidium rufipes (Linnaeus, 1758)

Distribution in Turkey: Hatay, Antakya, Narlıca Cave (Roewer, 1959).

Lepthyphantes leprosus (Ohlert, 1865)

Distribution in Turkey: Diyarbakır, Lice, Korkha Cave; Bitlis, Ahlat, Sultan Seyit Cave (Roewer, 1959).

Megalepthyphantes collinus (L. Koch, 1872)

Distribution in Turkey: Elazığ, Harput, Buzluk Cave; Bitlis, Ahlat, Sultan Seyit Cave; Bitlis, Adilcevaz, Kon Cave (Roewer, 1959).

Palliduphantes byzantinus (Fage, 1931)

Distribution in Turkey: İstanbul, Yarım Burgaz Cave (Fage, 1931); Bitlis, Adilcevaz, Kon Cave (Roewer, 1959).

Troglohyphantes pisidicus Brignoli, 1971

Distribution in Turkey: Konya, Beyşehir Gölü, Hacı Akif Adası, Hacı Akif Cave (Brignoli, 1971).

Family Tetragnathidae Menge, 1866

Meta bourneti Simon, 1922

Distribution in Turkey: Yalova, I. ve II. Soğucak Cave; Bursa, İnkaya Village, Suini Cave (Roewer, 1959).

Metellina merianae (Scopoli, 1763)

Distribution in Turkey: Bursa, Ayvaini Cave; Hatay, Antakya, Narlıca Cave (Roewer, 1959).

Pachygnatha degeeri Sundevall, 1830

Distribution in Turkey: Antalya, Dağ Cave (Roewer, 1962).

Family Lycosidae Sundevall, 1833

Hogna radiata (Latreille, 1817)

Distribution in Turkey: Yalova, Soğucak Village, V. Soğucak Cave (Roewer, 1959).

Pardosa agricola (Thorell, 1856)

Distribution in Turkey: Gaziantep, Arapdede Cave (Roewer, 1959).

Trochosa terricola Thorell, 1856

Distribution in Turkey: Bursa, İnkaya Village, Kuşini Cave (Roewer, 1959).

Family Agelenidae C.L. Koch, 1837

Agelena labyrinthica (Clerck, 1757)

Distribution in Turkey: Mardin, Midyat, Derömer Cave (Roewer, 1959).

Agelescape affinis (Kulczyński, 1911)

Distribution in Turkey: Hatay, Harbiye, Büyük Cave; Bitlis, Ahlat, Sultan Seyit Cave (Roewer, 1959).

Tegenaria agnolettii Brignoli, 1978

Distribution in Turkey: Antalya, Döşemealtı, Mustanini Cave (Brignoli, 1978).

Tegenaria anhela Brignoli, 1972
Distribution in Turkey: Antalya, Döşemealtı, Karain Cave (Brignoli, 1972, 1978).
Tegenaria atrica C.L. Koch, 1843
Distribution in Turkey: Kayseri, Araplı, Harmankaya Cave (Roewer, 1959).
Tegenaria averni Brignoli, 1978
Distribution in Turkey: Mersin, Silifke, Cennet Cave (Brignoli, 1978).
Tegenaria domestica (Clerck, 1757)
Distribution in Turkey: Hatay, Antakya, Narlıca Cave (Roewer, 1959).
Tegenaria elysii Brignoli, 1978
Distribution in Turkey: Mersin, Silifke, Dilek Cave; Mersin, Silifke, Cennet Cave (Brignoli, 1978).
Tegenaria faniapollinis Brignoli, 1978
Distribution in Turkey: Hatay, Harbiye, Harbiye Cave (Brignoli, 1978).
Tegenaria ferruginea (Panzer, 1804)
Distribution in Turkey: Bursa, İnkaya Village, Suini Cave (Roewer, 1959).
Tegenaria forestieroi Brignoli, 1978
Distribution in Turkey: Karaman, Taşkale, Asarini Cave; Isparta, İnönü Cave; Antalya, Akseki, Dikmen Cave; Konya, Seydişehir, Ferzen Cave; Konya, Seydişehir, Tınaztepe Cave; Konya, Çamlık, Körükini Cave; Konya, Hadim, Suçıktığı Cave (Brignoli, 1978).
Tegenaria karaman Brignoli, 1978
Distribution in Turkey: Konya, Seydişehir, Ferzen Cave (Brignoli, 1978).
Tegenaria melbae Brignoli, 1972
Distribution in Turkey: Diyarbakır, Lice, Korkha Cave (Roewer, 1959).
Tegenaria pagana C.L. Koch, 1840
Distribution in Turkey: Hatay, Antakya, Narlıca Cave; Diyarbakır, Lice, Korkha Cave (Roewer, 1959).
Tegenaria percuriosa Brignoli, 1972
Distribution in Turkey: Isparta, Anamas, Zindan Cave (Brignoli, 1972, 1978); Isparta, Barla, Barla Cave (Brignoli, 1978); Konya, Beyşehir Lake, Hacı Akif Island, Hacı Akif Cave (Brignoli, 1978).

Family Amaurobiidae Thorell, 1870
Coelotes atropos (Walckenaer, 1830)
Distribution in Turkey: Zonguldak, Ereğli, a cave in Ova Village (Roewer, 1959).
Coelotes terrestris (Wider, 1834)
Distribution in Turkey: Bursa, İnkaya Village, Suini Cave (Roewer, 1959).

Family Phyxelididae Lehtinen, 1967
Phyxelida anatolica Griswold, 1990
Distribution in Turkey: Hatay, Samandağ, Mağaracık, Büyük Cave (Roewer, 1959).

Family Gnaphosidae Pocock, 1898
Drassodes lutescens (C. L. Koch, 1839)
Distribution in Turkey: Kahramanmaraş, Alikaya Cave (Roewer, 1959).

Family Sparassidae Bertkau, 1872
Eusparassus dufouri Simon, 1932
Distribution in Turkey: Adana, Haruniye, Sepulcrale Cave (Roewer, 1959).
Heteropoda variegata (Simon, 1874)
Distribution in Turkey: Adana, Pozantı, Şekerpınar, Akköprü Cave (Roewer, 1959).

Family Philodromidae Thorell, 1870

Philodromus collinus C.L. Koch, 1835

Distribution in Turkey: Bursa, İnkaya Village, Suini Cave; Hatay, Antakya, Narlıca Cave (Roewer, 1959).

Philodromus histrio (Latreille, 1819)

Distribution in Turkey: Bitlis, Adilcevaz, Kon Cave (Roewer, 1959).

Family Thomisidae Sundevall, 1833

Ozyptila rauda Simon, 1875

Distribution in Turkey: Zonguldak, Ereğli, İnsırtı, Ercole Cave (Roewer, 1959).

Xysticus audax (Schrank, 1803)

Distribution in Turkey: Hatay, Antakya, Atik (Roewer, 1959).

Family Salticidae Blackwall, 1841

Carrhotus xanthogramma (Latreille, 1819)

Distribution in Turkey: Hatay, Antakya, Narlıca Cave (Roewer, 1959).

Topçu *et al.* (2005) recorded 613 species of spiders, belonging to 43 families, that reported by different authors up to now from Turkey. Many of the known records are from the West Black Sea Region and Mediterranean region which are covered by karstic formations, involving caves.

Unlike Roewer's publications which contained faunistic records, Brignoli's publications contain zoogeographic comments and are the most important ones of all the existing studies. According to Brignoli, the presence of *Carpathonesticus borutzkyi* Reimoser, 1930 and *Pholcus spasskyi* Brignoli, 1978, indicates the relation between Anatolia and the Caucasian region.

Aegean originated species such as: *Cataleptoneta aesculapii* (Brignoli, 1968), *Cataleptoneta sbordonii* (Brignoli, 1968) and *Hoplopholcus patrizii* (Roewer, 1962) point out the relation of Anatolia with Greece and the presence of family Nesticidae in Mediterrenean Region, of Turkey, points out its relation with the Arabian Peninsula through Lebanon in the past.

Brignoli, in his article called "Terzo contributo alla conoscenza dei ragni cavernicoli di Turchia" (1972), claimed that data in Roewer's publications are suspicious. Thus, a spider specimen collected from the Great Cave in Hatay–Samandağ was misidentified as *Amaurobius fenestralis* (Ström, 1768) by Roewer (1959). This specimen, deposited in Gothenburg Zoology Museum, had been examined during Griswold's revision study (1990) and described as a new species called *Phyxelida anatolica* Griswold, 1990 (Family Phyxelididae).

Among the 61 cave dwelling species, here recorded, *Troglohyphantes pisidicus* Brignoli, 1971 (Linyphiidae), *Cataleptoneta aesculapii* (Brignoli, 1968), *Cataleptoneta sbordonii* (Brignoli, 1968) (Leptonetidae) are troglobiont, with eyes completely disappeared or reduced. These species are endemic like the species of family Agelenidae that recorded from the caves of Turkey and illuminate the zoogeographic past of Turkey.

The number of examined caves on an araneological base are restricted in Turkey. However, cave dwelling spiders are sensitive creatures like other cave organisms. Anthropological effects such as: opening the cave for tourism and pollution in underground water affect cave dwelling spiders like other cave organisms. For example, during our recent studies, we did not encounter the species *Cataleptoneta aesculapii* that was described by the great Italian arachnologist Brignoli (1968) from the Damlataş Cave in Alanya.

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A new record for the Turkish spider fauna: *Oecobius cellariorum* (Dugès, 1836) (Araneae: Oecobiidae)

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Abstract

The characteristic features and drawings of *Oecobius cellariorum* (Dugès, 1836), which is recorded for the first time from Turkey, are given in this study.

Keywords: *Oecobius cellariorum,* Oecobiidae, Araneae, New record, Turkey.

Introduction

Oecobiid spiders are characterized by the presence of cribellum and calamistrum, in addition to a two-jointed anal tubercle fringed with long and curved hairs. The family Oecobiidae is represented by six genera and 102 species in the world. The genus *Oecobius* includes 79 species, and occurs all over the world (Platnick, 2006). Although most species of *Oecobius* have been collected only in a few localities, the genus is best known by some widespread and synanthropic species (Santos & Gonzaga, 2003). Five species are known from Europe: *Oecobius cellariorum* (Dugès, 1836), *O. navus* Blackwall, 1859, *O. maculatus* Simon, 1870, *O. rhodiensis* Kritscher, 1966 and *O. machadoi* Wunderlich, 1995 (Roberts, 1995; Heimer & Nentwig, 1991; Nentwig *et al.*, 2003; Platnick, 2006). The following species are known from the Middle East: *O. cellariorum*, *O. navus*, *O. maculatus*, *O. affinis* O.P.-Cambridge, 1872, *O. albipunctatus* O.P.-Cambridge, 1872, *O. teliger* O.P.-Cambridge, 1872, *O. trimaculatus* O.P.-Cambridge, 1872, *O. putus* O.P.-Cambridge, 1876, *O. templi* O.P.-Cambridge, 1876, *O. amboseli* Shear & Benoit, 1974, *O. alhoutyae* Wunderlich, 1995, and *O. cambridgei* Wunderlich, 1995 (Platnick, 2006). However, no *Oecobius* species have been recorded in Turkey, so far. Only an unidentified specimen of *Oecobius* is known from the Marmara Region in the list of Turkish spiders (Karol, 1967; Bayram, 2002).

This paper deals with the characteristic features of *Oecobius cellariorum*, and adds a species to the spider fauna of Turkey.

Material and Methods

Two males and eight females of *Oecobius cellariorum* were collected in the campus of Uludağ University. All of them were collected inside buildings. The specimens were preserved in 70% ethanol and deposited in the Zoological Museum of the Department of Biology. The identification was made by means of a Zeiss Stemi SR Stereo microscope using the keys of Roberts (1995), Heimer & Nentwig (1991) and Nentwig *et al.* (2003). The drawings were made by means of a camera lucida attached to the microscope. More confirmation depended on comparisons with descriptions and drawings of Shear (1970, Figs. 3, 4, 13, 28, 48, 49) and Wunderlich (1994, Figs. 17-20).

Results

Family: Oecobiidae Blackwall, 1862
Genus: *Oecobius* Lucas, 1846
Species: *Oecobius cellariorum* (Dugès, 1836)
Synonyms:
Clotho cellariorum Dugès, 1836: Observations sur les aranéides. *Ann. sci. nat., Zool.* (2) **6:** 161 (D).
Oecobius domesticus Lucas, 1846.
Oecobius cellariorum Simon, 1875.
Oecobius texanus Bryant, 1936.
Oecobius shaanxiensis Qiu & Zheng, 1981.
Oecobius shensiensis Qiu, 1981.
Oecobius sinensis Yin & Wang, 1981.

Description (Figs. 1-3)

Measurements, total length of the body: 2-2.1 mm in male, 2.1-2.3 mm in female. In both sexes, carapace is wider than long and more or less circular with the front slightly pointed. Carapace is pale yellow and bordered by a thin black line. Cephalic region is slightly higher. Eyes are closely grouped over a dark spot on the anterior margin. The anterior medians and posterior laterals are dark and have dark ridges. The anterior laterals and posterior medians are light in colour. The posterior medians are irregular in shape. In addition, the anterior median and posterior lateral eyes are clearly larger than the rest (Fig. 1). Clypeus is long and pale yellow. Chelicerae are pale. In the centre of the thoracic region, a dark pattern is present. Sternum is heart shaped, wider than long, and shiny light yellow in colour. Legs are long, light yellow in colour, with some dark annulations, and with many thick spines. An abdominal pattern is present in male and female specimens as illustrated in Fig. (1). Abdomen is oval, rounded at the front and narrowed near the posterior point. Dorsum appears whitish yellow in colour. The cardiac region is dark, and some dark patches are located around it. Male has a slimmer abdomen than female. Venter of the abdomen is yellowish light brown in colour. Epigynum without scapus and wrinkled at anterior and posterior sides (Fig. 2). Male palpal organ is distinctive (Fig. 3).

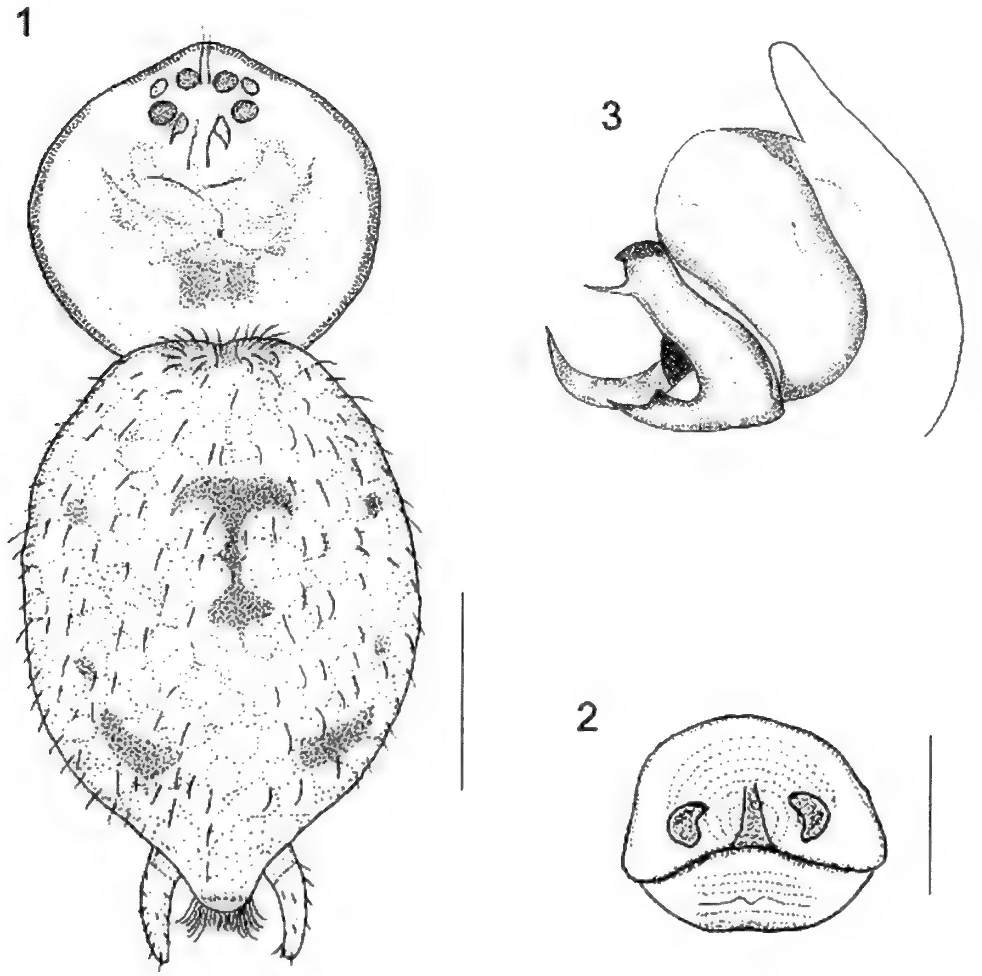
Material Examined

Two males and eight females were collected in the campus of Uludağ University, 107 m, Bursa (40°13′21″N, 28°51′56″E): 3♀♀, 15.08.2004; 2♀♀, 04.08.2005; 2♂♂, 13.08.2005; 3♀♀, 10.09.2005). All specimens were collected inside buildings.

Habitat and distribution

Oecobius cellariorum is common especially in buildings. All specimens were found in the buildings of the campus. This species builds its web on wall corners. The specimens were collected in their circular sheet webs. Star shaped webs are small and about 25-30 mm in diameter. They run very quickly when disturbed.

Oecobius cellariorum is a cosmopolitan, but not a common, species. It had been recorded from some places in the Nearctic, Neotropic, Palearctic, Australasia, and even Antarctic ecozones (Tyschchenko, 1971; Brignoli, 1983; Platnick, 2006).



Figs. 1-3: *Oecobius cellariorum* (Dugès, 1836). 1-2. Female. 1. dorsal view. 2. epigynum. 3. Male palpus, retrolateral view. Scale bars: (1) 0.5 mm, (2-3) 0.25 mm.

Discussion

Male and female specimens are similar in general body shape. Only, male has slimmer abdomen. The colour, design and other characters are similar to those of European specimens (Nentwig *et al.*, 2003). However, body sizes of our specimens are slightly smaller than those specimens. In our specimens, the body length is 2-2.1 mm in male, and 2.1-2.3 mm in female, while in European specimens it is 2.2 mm for males, and 2.5-2.9 mm for females. In addition, no significant differences have been determined in genital structures. The palp and epigyne resemble those of European specimens.

In *Oecobius*, 5 species from Europe, and 12 species from the Middle East are known. *O. affinis* and *O. albipunctatus* are known from Syria. Also, 5 species are known from Egypt, i.e. *Oecobius amboseli*, *O. maculatus*, *O. navus*, *O. putus*, and *O. templi* (El-Hennawy, 2004). These species maybe present in Turkey as well but studies on spiders are still new in Turkey. Similarly, *O. navus* is a cosmopolitan species and very common especially in the Palearctic region.

Published articles show that *Oecobius cellariorum* is dependent on buildings (Guarisco, 1999; Santos & Gonzaga, 2003). All of the specimens were found in the buildings in the campus. The buildings are surrounded by some forest trees.

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White widow, *Latrodectus pallidus* (Araneida: Theridiidae), in Jordan and Egypt

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Abstract

The theridiid "White Widow" spider, *Latrodectus pallidus* O.P.-Cambridge, 1872, is recorded from Amman, Jordan and Wadi Kid on Aqaba gulf, southern Sinai, Egypt. It is mainly described from Jericho, Palestine. Its record from Alexandria, Egypt, in 1872, is not true. After excluding doubtful records, the distribution of *L. pallidus* is mainly "Near Eastern and eastern Mediterranean". The westernmost, Cape Verde Is., and southernmost, Yemen, records denote the wide distribution of this species. Other records include Russia, Iran, and Turkey.

The design of the nest of this species is previously described. It was found among vegetation. In this work, the nests (webs) were found among rocks and inside small stony caves. The name "White Widow" is used instead of the current common name of *L. pallidus*, i.e. "Pale widow".

Keywords: Araneida, Theridiidae, *Latrodectus pallidus*, Jordan, Egypt, distribution.

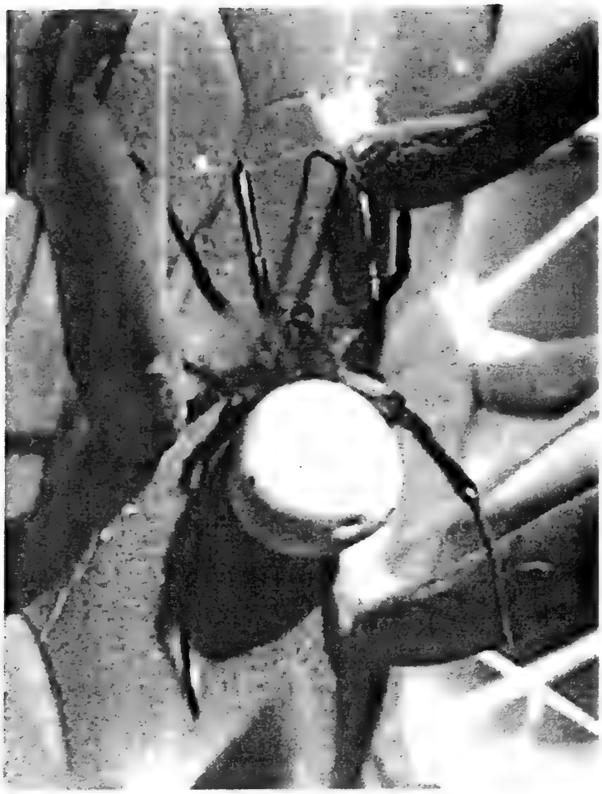
Introduction

Among the 86 genera (2227 species) of family Theridiidae, genus *Latrodectus* Walckenaer, 1805 includes 31 species distributed in: North Africa, southern Africa and Madagascar; Mediterranean to Southeast Asia, Australia and New Zealand; Asia (Saudi Arabia, Yemen, Socotra, Kuwait, Iran); North and South America; and Spain (southern Europe) (Platnick, 2006).

A female specimen of the theridiid "White Widow" spider, *Latrodectus pallidus* O.P.-Cambridge, 1872 was found near Abu Nusseir, Amman (Jordan) on 1st November 1988 (Fig. 1). Her "nest" was examined and photographed (Fig. 2).

A juvenile theridiid spider was found at the entrance of an empty small stony cave on November 1994 in Kherieza, Wadi Kid, in Nabq protectorate on Aqaba gulf, southern Sinai (El-Hennawy, 2003). It was reared until reaching maturity to be a male *Latrodectus pallidus* (Fig. 3).

The distribution of this species and its web situation are discussed.



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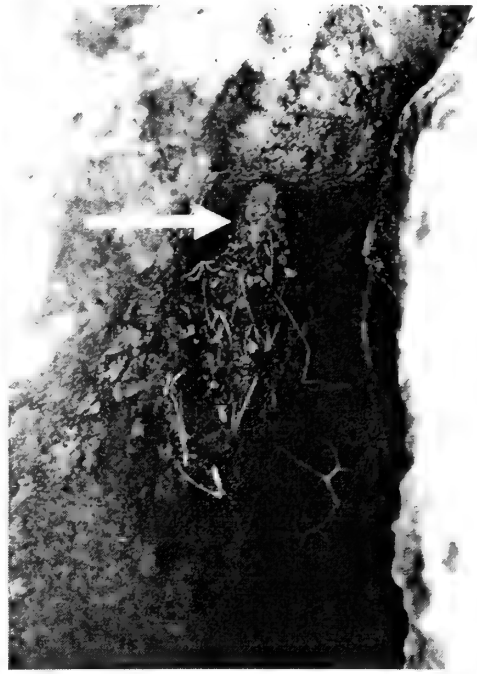

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Fig. 1. *Latrodectus pallidus* O.P.-Cambridge, 1872 ♀, found near Abu Nusseir, Amman, Jordan. Fig. 2. Her web "Nest", between two rocks.

The First Record - 1872

The Reverend Octavius Pickard-Cambridge described *Lathrodectus pallidus* as a new species in his "General list of the spiders of Palestine and Syria, with descriptions of numerous new species and characters of two new genera" (1872). He described the female of this species (pp.287-288). The following passages are extracted from his description:

"The colour of the *cephalothorax* is yellow-brown, that of the *palpi* and *legs* yellowish; the tarsi, metatarsi, tibiae, and genua of the latter, as well as the digital joints of the former, being deeply suffused with dark yellow-brown." ... "The *abdomen* is of a creamy-white colour with four deep-red-brown spots forming an oblong about the centre of the upper-side; the two foremost spots are smaller and nearer together than the hinder ones." ... "Adult and immature females were found in irregular snares spun among low plants on the plains of the Jordan; while the only situation in which *L. erebus* was found was beneath stones. In a similar situation the latter species was also found, not unfrequently, at Alexandria (Egypt) in 1864."

In 1876, Pickard-Cambridge only recorded *L. erebus* from Egypt. Females of this species "were found under stones among the ruins of an old building at Alexandria." He did not mention *L. pallidus*. [Note: *L. erebus* Savigny, 1825 (In: Audouin, 1825 & 1827) = *L. tredecimguttatus* (Rossi, 1790)]

Hence, the distribution of *L. pallidus* began by "the plains of the Jordan" as a new species "of the spiders of Palestine". The type material, 2♀♀, were collected from Jericho (Levy & Amitai, 1983). The hurried reading of the last paragraph of Pickard-Cambridge's description of *L. pallidus* led to the wrong result that it is also found in Egypt (Roewer, 1942; El-Hennawy, 1990 & 2002b).

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Fig. 3. *Latrodectus pallidus* O.P.-Cambridge, 1872 ♂, found in Kherieza, Wadi Kid.
Fig. 4. Stony caves of *L. pallidus* in Kherieza, Wadi Kid, in Nabq protectorate on Aqaba gulf, southern Sinai, Egypt.

The Two Subspecies

Caporiacco (1933) described the subspecies *Latrodectus pallidus immaculatus* from Gialo Oasis, Cufra in Libya. Levi (1959, p.38) stated that there is some doubt that *L. p. immaculatus* Caporiacco, 1933 from Libya is *L. pallidus*; it could be *L. geometricus*. Lotz (1994, p.43) stated that the type material of this subspecies is "not found". Due to this, Platnick (1997 & 2006) considered *L. p. immaculatus* a *nomen dubium*.

Brignoli (1983, p.386) and Platnick (1993, p.208) said that: *L. pallidus pavlovskii* Charitonov, 1954 (Turkestan) = *L. pallidus* O. Pickard-Cambridge, 1872 (Levi, 1959).

The Distribution

Levi (1959) mentioned that *L. pallidus* is recorded from Russia, Syria, Palestine, Iran, Egypt, Libya (Caporiacco, 1933), a doubtful record. And later (Levi, 1966, p.431), he said that: "*L. pallidus* is Near Eastern and eastern Mediterranean in distribution." It is also recorded from Turkey (Levy & Amitai, 1983), and "presumably in Syria, Jordan and Egypt (Sinai) but there are no explicit records" (Levy, 1998). Schmidt, et al. (1994) and Schmidt & Krause (1995) recorded *L. pallidus* from Cape Verde Islands. Knoflach & van Harten (2002, pp.351-353) recorded *L. pallidus* from Yemen too and said that "Its presence in Yemen is not surprising, but is based only on old museum specimens" (p.330).

Distribution of *Latrodectus pallidus* in different catalogues:

1. Roewer, 1942 (p.425): Tripoli, Egypt, Syria, Persian Gulf and *L. pallidus immaculatus* Cufra Oasis (Libya).
2. Platnick, 1989 (p.198) & 1993 (p.209): Libya to USSR.
3. Platnick, 1997 (p.277) & 2006: Cape Verde Is., Libya to Russia, Iran.

The record of *Latrodectus pallidus* from Kherieza (28°10'N 34°21'E), Wadi Kid, in Nabq protectorate on Aqaba gulf, southern Sinai is the first explicit record from Egypt (El-Hennawy, 2002a, 2002b, 2003). The published record from Alexandria is not true. There is another record, 1♀ on August among stones, from northern Sinai, Abu El-Husein (31°04'26"N 33°30'39"E) - Zaranik Protectorate (El-Hennawy, 2005).

Being collected from Jericho (Palestine), it is not unexpected to find it in Amman (Jordan). It is another explicit record.

After excluding Alexandria (Egypt) and Libya from its distribution, it is obvious that *Latrodectus pallidus* is mainly "Near Eastern and eastern Mediterranean in distribution" as Levi (1966) stated before. The westernmost, Cape Verde Is., and southernmost, Yemen, records denote the wide distribution of this species, with many question marks ??? (Fig. 5).

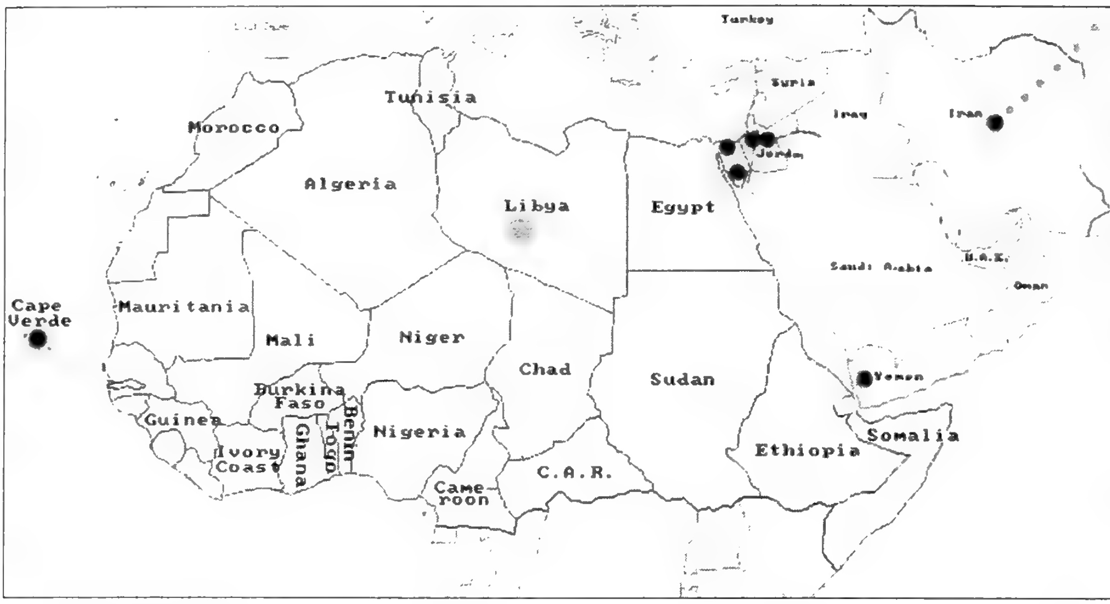

Fig. 5. Distribution map of *Latrodectus pallidus* O.P.-Cambridge, 1872 in the world.

The Web and its Situation

As summarized by Lotz (1994, p.43) according to Szlep (1965) "This species is found only in the desert which has some vegetation. ... the retreat situated up to 60 cm above ground level ... between twigs of the shrubs. ... it has, in addition to the retreat, a special catching web." Its "clearly outlined coned retreat tapers obliquely above the catching web." (Levy & Amitai, 1983, p.59).

Knoflach & van Harten (2002, pp.328, 352) added: The web consists of a tube- to bell-shaped retreat spun of dry silk and the catching web containing the partially sticky catching threads (Szlep, 1965). The retreat and catching web are connected by an irregular, three-dimensional bridge layer. *L. pallidus* builds an elaborate retreat, which is 10-12 cm long. The web is constructed at a height of 30-60 cm between the twigs of shrubs (Szlep, 1965). From the retreat a bridge web leads 10-15 cm downwards to the comparatively small catching area. The catching web mainly consists of long (ca. 20 cm) vertical catching threads, which arise from a fine-meshed platform and reach the ground. At the bottom they are covered with viscid droplets for a distance of 2-5 cm (Szlep, 1965).

The female *Latrodectus pallidus* of Abu Nusseir, Amman (Jordan) was found inside her nest between two rocks (Fig. 2). Its retreat was vertically straight and attached to an irregular snare below it. It was about 35 cm up of the ground. There were carcasses of beetles, mostly of family Tenebrionidae, on the ground surface under the web and attached to it.

The webs of *Latrodectus pallidus* in Wadi Kid, southern Sinai were found inside small stony caves (Fig. 4). It is obvious that webs of this species are not necessarily related to vegetation.

Colouration and Common Name

"The *abdomen* is of a creamy-white colour" O.P.-Cambridge (1872). "The abdomen looks leathery, possibly due to the white coloration" Levi (1959, p.38). The male has "black spots … on the pearly-white background" (Levy & Amitai, 1983, p.62).

Knoflach & van Harten (2002, p.330) said that *L. pallidus* is characterized "by its pale yellow colour". Hence, its "Common name: Pale widow" p.351.

The preserved museum specimens are really pale but alive ones have beautiful leathery white or light yellowish colour. The "White Widow" is something famous among amateurs now (e.g. www.arachnoboards.com). In fact, it is not fair to call *L. pallidus* a widow like the famous and dangerous "Black Widow". It may be called "White Bride" !!

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Biology, mass rearing and observations on the behaviour of *Kochiura aulica* (C. L. Koch, 1838) (Arachnida: Araneida: Theridiidae)

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Abstract

A stock culture of 150-200 individuals of *Kochiura aulica* (C.L. Koch, 1838) (Arachnida: Araneida: Theridiidae) was collected from olive trees in Giza governorate, Egypt. *K. aulica* adults were reared in plastic containers (1750 cc). All rearing units were supplied three times a week by adult fruit flies, *Drosophila melanogaster* Meigen, 1830. The newly hatched spiderlinges were reared on fruit fly adults until reaching adulthood.

Life cycle of *K. aulica* was studied individually and in groups under laboratory conditions (28±1°C and 75±10% R.H.), feeding on cotton leaf worm, *Spodoptera littoralis* (Boisduval, 1833), second larval stage. Also, adult fruit flies were only used in group rearing.

Incubation period averaged 13 days in individual and group rearing. Life cycle in individual rearing was 36.83 & 39.78 days for female and male, respectively. Life cycle in group rearing was 51.74 and 51.96 days, feeding on *S. littoralis* and *D. melanogaster* respectively. Egg sacs per female per day during the first 20 days of oviposition period in individual rearing was 3.00 egg sacs while in group rearing it was 0.91 & 1.66 egg sacs, feeding on *S. littoralis* and *D. melanogaster* respectively.

K. aulica showed a degree of sociality under laboratory conditions (in spite of lack to mothers brood care). It was high tolerance between individuals in all stages with no cannibalism. Egg sacs were laid and spread over rearing containers and were not attacked by other females. Newly hatched spiderlings aggregated in containers and showed cooperation in catching and feeding on available prey. This quasi-social behaviour seemed to be a survival strategy.

Mass rearing of *Kochiura aulica* was successful along more than two years.

Keywords: Spiders, Theridiidae, *Kochiura aulica*, Mass rearing, Social behaviour.

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* This article is a part of the Ph.D. Thesis of the last author (NA).
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Introduction

Among the 110 families of spiders, Theridiidae is the fifth among six families which number of species exceeds 2000. Family Theridiidae includes 2227 species of 86 genera (Platnick, 2006). Genus *Kochiura* was described, in 1950. by Archer when he removed *Anelosimus* Simon, 1891 from the synonymy of *Theridion* Walckenaer, 1805. Now, it includes 8 species; 7 from South America and only *K. aulica* from Cape Verde Is. and Canary Is. in west Africa to Azerbaijan in Asia.

K. aulica was mainly described as *Theridion aulicum* by C.L. Koch in 1838, transferred to *Kochiura* by Archer in 1950, then to *Anelosimus* by Levi in 1956, and restored to *Kochiura* again by Agnarsson (2004). This species is considered a solitary species on the contrary of many permanent-social *Anelosimus* species, e.g. *A. eximius* (Keyserling, 1884) (Avilés, 1997). During our study, we found that the behaviour of this species is quasi-social. Hence, we decided to begin group or mass rearing of it. This may be the first step to get benefit of *K. aulica* as insect pests' predator, i.e. a biological control agent.

Material and Methods

Stock culture and mass rearing of *K. aulica*

The stock culture of *K. aulica* was collected from olive trees located in Giza governorate. Specimens' collecting began in July 2003, by collecting many of the spider nests containing a mixture of spiderlings, adults and egg sacs. About 150-200 adult individuals of *K. aulica*, in the ratio of 2♀ : 1♂, were transferred to 1750 cc plastic container to form a rearing unit. The central part of the container's cover was replaced by organza textile to facilitate ventilation.

All rearing units were supplied thrice a week by adult fruit flies, *Drosophila melanogaster* Meigen, 1830 (Diptera: Drosophilidae). The cotton leaf worm, *Spodoptera littoralis* (Boisduval, 1833) (Lepidoptera: Noctuidae), was also used as prey for both individual and group rearing. Egg sacs were collected, by means of a soft brush, from the stock culture before feeding and were transferred to glass tubes of 5 cm diameter and 10 cm height until hatching. The newly hatched spiderlings were counted and each 50 individuals were transferred to a small glass container, 250 cc, covered by muslin or organza and fed on adult fruit flies. As the new hatch reached the third spiderling instar, the contents of each 3-4 containers were transferred to larger glass containers, 7 cm diameter and 20 cm height, covered by muslin or organza and were fed in the same way until reaching adulthood. Adults were then transferred to plastic containers for mating and egg laying. Rearing continued since July 2003 until February 2006.

Production of *Drosophila melanogaster*

Laboratory strain of *D. melanogaster* was obtained as adults from the Faculty of Agriculture, Ain-Shams University, Cairo, Egypt. All stages were kept in 500 cc glass jars covered by muslin and cultured on artificial diet under laboratory conditions (28±1°C and 70±10% R.H.). The used diet consisted of: 100 g corn flour, 100 g can sugar, 20 g dried yeast, and 1000 ml water to be boiled for 5-10 min. Five grams of agar was separately ripped in 250 ml water in a water bath and added to the previous mixture. Traces of methyl-4-hydroxy-benzoate and ascorbic acid were added. The prepared diet was then poured down inside the glass jars to form a layer of 4-5 cm in depth. Jars were left to cool down to room temperature before introducing adult fruit flies.

Production of *Spodoptera littoralis*

Laboratory strain of *S. littoralis* was obtained as egg masses and larvae from the Economic Entomology and Pesticides Department, Faculty of Agriculture, Cairo University. All stages were kept in glass jars (20 cm height and 12.5 cm diameter) covered by muslin and cultured under room temperature.

Larvae were reared on leaves of castor-oil plant, *Ricinus communis* (L.), which were washed in running water and dried before being placed in rearing jars. Larvae faeces were removed and *R. communis* old leaves were replaced by new ones every two days. As larvae reached the fifth larval stage, saw dust was placed in the jars to absorb any excess moisture and to allow pupation at the end of larval stage. Pupae were collected and put in separate jars under the same conditions.

The newly emerged males and females were allowed to mate. The rearing jars were lined with paper to provide an egg laying site and daily provided with cotton pads moistened with 10% honey solution for the nutrition of the adults. Egg masses laid on the paper were daily removed and transferred to clean jars. Second larval stage produced from these egg masses were used as prey for *K. aulica* in both individual and group rearing.

Life cycle of *Kochiura aulica*

A. Individuals rearing

Life cycle of *K. aulica* was studied individually under laboratory conditions (28±1°C and 75±10% R.H.), feeding on *S. littoralis*. Bottomless clear plastic containers (30 cc) were prepared by covering both ends with organza textile. One end was fixed while the other was removable. These units were designed to be used in experiments with controlled humidity. Twenty newly hatched spiderlings were reared individually; each one in its container and fed three times a week. Replicates were put in larger containers containing over-saturated NaCl solution (Winston & Bates, 1960) and were monitored for moulting, survival and reaching maturity. Life cycle duration was recorded in addition to number of egg sacs and sex ratio (males/total).

B. Groups rearing

Life cycle of *K. aulica* was studied in groups under the same laboratory conditions on two kinds of prey, i.e. *D. melanogaster* adults and *S. littoralis* second larval stage. Bottomless clear plastic containers (300 cc) were prepared in the same way as in individuals rearing. Thirty newly hatched spiderlings were reared together in each container as one group. Each group was fed three times a week. The experiments were replicated 15 times on *D. melanogaster* and 20 times on *S. littoralis*. Replicates were put in larger containers containing over-saturated salt solution for humidity control. Units were monitored for moulting, survival and reaching maturity. Life cycle duration, sex ratio and number of egg sacs were recorded per groups.

Egg sacs were collected before feeding and were transferred into glass tubes (5 cm in diameter and 10 cm in height) and incubated under the same conditions until hatching. Observations during oviposition period were terminated in case of feeding on *S. littoralis* (Fig. 1) because of lack of prey at the mid of the experiment. They were also terminated after a period that equals the spider's generation time as suggested by Abou-Setta & Childers (1991) for reaching the maximum value for intrinsic rate of increase for fauna which lave a long period of oviposition.

Results

Mass rearing of *K. aulica*

The study of the life cycle of *K. aulica* in groups acted as a small scale of mass rearing to compare the quality of this type of rearing with individuals rearing. Obtained results indicated that incubation period averaged 13 days in the two types of rearing, feeding on *S. littoralis*. Total spiderlings duration in individuals rearing (23.83 & 26.78 days for females and males) was shorter than in groups (38.93 & 38.63 days, feeding on *S. littoralis* and *D. melanogaster*, respectively). On the other hand the average number of egg sacs per female in groups rearing during the first 20 days was less than in individuals rearing (0.91 compared with 3.00) (Table 1, Fig. 1). The survival, i.e. proportion of individuals reached maturity, of *K. aulica* reared in groups ranged between 0.4 and 0.83 compared with individuals rearing, i.e. 0.94 (Table 1).

Table 1: Biological results of rearing *Kochiura aulica* under different circumstances.

Prey type	*Drosophila melanogaster* (groups)		*Spodoptera littoralis* (groups)		*Spodoptera littoralis* (individuals rearing)			
					male		female	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Incubation period	13.03	1.10	13.00	0	13	0	13	0
Spiderlings duration	38.93	7.29	38.63	4.36	26.78	2.99	23.83	3.97
Life cycle	51.96	7.29	51.74	4.36	39.78	2.99	36.83	3.97
Fecundity ratio 1-20	1.66	0.75	0.91	0.61	-	-	3.00	0.63
Fecundity ratio 1-40	4.16	1.31	-	-	-	-	8.17	1.84
Sex ratio (♂♂/total)	0.38	0.09	0.39	0.09	0.59			
Survival ratio	0.65	0.08	0.65	0.13	0.94			

Fecundity ratio = Number of egg sacs per female per day, 1-20/1-40 = during the first 20/40 days of female's oviposition period, Survival ratio = proportion of individuals reached maturity.

Effect of prey on life cycle of *K. aulica* reared in groups

Total developmental duration averaged 38.93 and 38.63 days for spiders reared in groups feeding on *D. melanogaster* and *S. littoralis* respectively (Table 1). Survival in the first case ranged between 0.57 and 0.87 (0.65 ± 0.08) and ranged between 0.4 and 0.83 (0.65 ± 0.13) in the second case (Table 1).

Effect of prey on reproduction

Average number of egg sacs per female per day during the first 20 days of oviposition period was 1.66 and 0.91 for spiders reared in groups feeding on *D. melanogaster* and *S. littoralis* respectively while the average became 4.16 during the first 40 days with feeding on *D. melanogaster* (Table 1). The comparison of numbers of egg sacs per female per day under different circumstances is illustrated in Fig (1).

Effect of rearing method on sex ratio

Sex ratio (males/total) of *K. aulica* which reared in groups was 0.38 and 0.39 when fed on *D. melanogaster* and *S. littoralis* respectively compared with 0.59 in case of individuals rearing.

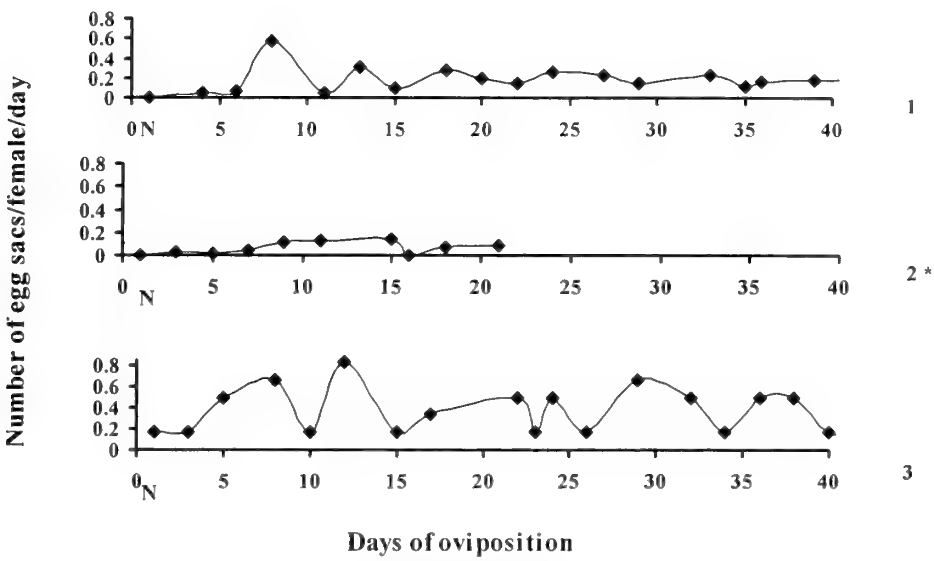


Fig. 1. Number of egg sacs per female of *Kochiura aulica* per day during the oviposition period. N = First egg sac. 1, 2. Groups rearing. 3. Individuals rearing.
1. Feeding on *Drosophila melanogaster*. 2, 3. Feeding on *Spodoptera littoralis*.
* = Observations were terminated because of lack of prey.

Notes on the behaviour of *K. aulica* under laboratory conditions

A degree of sociality was observed in *K. aulica* behaviour under laboratory conditions. The behaviour reported herein is for adults and spiderlings as well.

Quasi-social behaviour in adults

1. High degree of tolerance between individuals occurred when large numbers (150-200) of field-collected individuals were reared in a small container (1750 cc). No cannibalism was observed, not only when they were fed three times a week, but also under starvation for 15 days.
2. When a small prey, i.e. adult *Drosophila* sp. or *S. littoralis* second instar larva, was introduced to a group of adult spiders, catching prey and feeding accrued by single individual and in some cases two individuals shared the same prey. When a relatively larger prey, as adult fruit fly *Ceratitis capitata* (Wiedemann, 1824), was introduced, more than one individual cooperated in capturing it and later many of them fed on it (Fig. 2).
3. Egg sacs laid by females were spread out all over rearing containers and were not attacked by other females. Even more, females prevented some males from coming near maturing egg sacs, but they did not kill them.

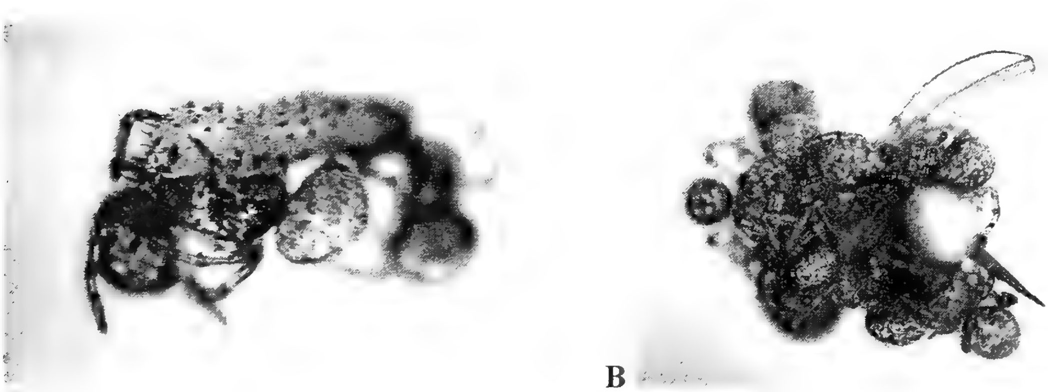
Quasi-social behaviour in spiderlings

1. When large numbers of newly hatched spiderlings (50) were transferred to a small container (250 cc), they aggregated in the upper part of it, and made a common web.

2. Whenever a prey was available, more than one cooperated in catching it regardless of its size. As it was captured, more individuals fed on it at the same time to the degree that in some cases they covered the prey's body (Fig. 3).
3. The individuals divided themselves into small groups during feeding according to the prey's size. After feeding, spiderlings went back to make one group again.
4. Presence of less than three first instar spiderlings was not enough to catch an adult *D. melanogaster*.
5. Reaching the third instar, spiderlings began to disperse in the whole container and hunted individually or in small groups according to prey's size.

A **B**

Fig. 2. *Kochiura aulica*, adults cooperate in attacking a *Ceratitis capitata* fruit fly. A. At the beginning. B. After a few minutes.



A **B**

Fig. 3. *Kochiura aulica*, juveniles cooperate in attacking: A. *Spodoptera littoralis*, larva, B. *Drosophila melanogaster*, fruit fly.

Discussion

Mass rearing method

Observing the quasi-social behaviour of *K. aulica* under laboratory conditions led to the idea of mass rearing of this species. Tolerance among individuals in all stages was the main character. Egg sacs and newly hatched spiderlings did not need mother brood care. Newly hatched spiderlings cooperated in catching and feeding on available prey. Used mass rearing method was easy and inexpensive because the fruit fly *D. melanogaster* can be reared on artificial diet with high reproduction rate. *D. melanogaster* was used as a common prey in rearing of many spider species (Jackson, 1974).

In the used method, 150-200 adults/plastic container (1750 cc) with sex ratio of 2♀: 1♂ (i.e. 8.75-11.66 cc per individual) were fed three times a week on the fruit fly adults. Dinter (2004) stated that rearing of spiders is very time-consuming and laborious, because of cannibalism and the need to supply living prey. In his mass rearing method for *Erigone atra*, he used a plastic container (12x16.5x5 cm) for every 20-40 adults, i.e. 24.77-49.55 cc per individual. These individuals were fed on Collembola as a continuous available prey. In addition *D. melanogaster* was added once a weak. In Dinter's method, in his larger containers, 59.3% reached adulthood compared with 65% in this method.

Life cycle of *K. aulica*

Obtained results of spiderlings duration seem to be the shortest compared with published results for *K. aulica*, i.e. 26.78 and 23.83 days for male and female, respectively, reared individually feeding on *S. littoralis* second stage larvae.

K. aulica was reared individually by Rahil & Hanna (2001) under laboratory conditions (27±1°C and 57.7% R.H.) feeding on 3rd and 4th larvae of the coleopteran *Tribolium confusum*. They reported 32.62 and 33.33 days for male and female respectively. El-Erksousy *et al.* (2002) reared *K. aulica* under laboratory conditions (26±2°C and 60-70% R.H.) feeding on *S. littoralis* larvae and reported 44.2 and 47.2 days for male and female, respectively. Hussein *et al.* (2003) reared *K. aulica* at room temperature, during different seasons feeding on the acarine *Tetranychus urticae,* the aphid *Aphis craccivora* and mixed diet of them. They recorded 57.1 and 62.45 days for male and female during summer feeding on mixed diet, 60.83 and 69 days for male and female during summer feeding on *A. craccivora.* They recorded the longest duration during winter feeding on *A. craccivora* and the mixed diet as 185, 160.8 and 190, 167.93 days for male and female, respectively. Mohafez (2004) reared *K. aulica* at room temperature on *Achroia grisella* and reported 62.43 and 64.1 days for male and female, respectively.

Egg incubation period in the used method was 13 days compared with a range between 9.6 and 12.8 days in the published papers of Rahil & Hanna (2001), El-Erksousy *et al.* (2002), Hussein *et al.* (2003), and Mohafez (2004).

These results may reveal that constant temperature and humidity during rearing had an evident effect on life cycle duration. Also, the kind of prey affected life cycle duration.

Obtained results indicate that juveniles of *K. aulica* which were reared individually developed faster than those reared in groups. These results are in agreement with Thomas & Parker (2000). Life history durations of *K. aulica* in groups fed on *D. melanogaster* or *S. littoralis* were approximately similar. Rearing in groups reduced the males' percentage and decreased the number of egg sacs per female. This result is in agreement with Smith & Hagen (1996).

Quasi-social behaviour

K. aulica appeared to have tolerance and cooperation among its individuals. Tolerance in spiders is considered as a degree of sociality (Darchen & Delage-Darchen, 1986; Riechert *et al.*, 1986; Rypstra, 1986; Seibt & Wickler, 1988; Rypstra & Tirey, 1989; Foelix, 1996; Avilés & Salazar, 1999; El-Hennawy & Mohafez, 2003). *K. aulica* individuals cooperated in capturing any available prey. More than three first instar spiderlings were required to subdue an adult *D. melanogaster.* This quasi-social behaviour seemed to be survival strategy. Amir *et al.* (2000) said that "Social spiders cooperate in capturing prey which is then consumed by a group of individuals. By cooperating, they can handle larger prey than most similar-size solitary species." and "In social spiders many individuals can feed on the same prey". Foelix (1996) stated that "Prey catching in *Agelena consociata* is also communal. ... When prey falls on the sheet web, its movements attract the attention of all spiders in the vicinity. If the prey is small ... only a single adult spider rushes in, grasps the victim, bites it ... If a larger prey ... mostly adult spiders attack it". This means that *K. aulica* shows a degree of sociality in spite of having no sign of mother's brood care, the thing which is considered necessary to sociality (Foelix, 1996). This case of sociality suggests that tolerance is the first degree of sociality. These results are in agreement with Kullmann *et al.* (1972) and El-Hennawy & Mohafez (2003).

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Life history of *Cheiracanthium isiacum* O.P.-Cambridge, 1874 (Arachnida: Araneida: Miturgidae) in Egypt

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Abstract

Cheiracanthium isiacum O.P.-Cambridge, 1874 was reared under laboratory conditions, 26-28°C and 60-70% R.H. After incubation period of 19 days, there were 7 spiderling instars before reaching adult male and 8 instars before reaching adult female. The second instar spidrling was the longest period, 21.1 and 20.90 days for male and female, respectively, while the third spiderling instar was the shortest period, 14.4 and 14.3 days for male and female, respectively. The total period of spiderlings was shorter for male (119.6 days) than female (133 days). Adult longevity and life span were shorter for male than for the female. The female produced 4.72 egg sacs, each one contained 87-130 eggs. A mixture of larvae of *Spodoptera littoralis* and *Galleria mellonella* was used for feeding all spiderling instars until reaching adult stage. The food consumption of different spiderling instars was recorded. Feeding *C. isiacum* on *Drosophila melanogaster* flies and *Tetranychus urticae* mites was not successful and spiders did not reach adult stage.

Keywords: Spiders, Miturgidae, *Cheiracanthium isiacum*, life history, Egypt.

Introduction

Individuals of *Cheiracanthium isiacum* O.P.-Cambridge, 1874, family Miturgidae, are found on different plants in several governorates in Egypt, e.g. on mango, grapes, citrus, and guava, in Sohag, Giza, and Fayoum governorates. They are always found on the middle of trees and they live in association with different insects and mites infesting orchards.

In Egypt, Rahil (1988) studied the biology of *Cheiracanthium jovium* Denis, 1947 under different temperatures, relative humidity, and prey. Incubation period, hatching percentage, number of moults, oviposition and post-oviposition periods, mating behaviour and sex ratio were observed.

Rakha *et al.* (1999) also studied the biological aspects of *Cheiracanthium jovium* at 25°C and 60-70% R.H. They mentioned that female spider, during its limited oviposition period, deposited about 300-350 eggs in one sac. The incubation period averaged 14.1 days. Females had 8-9 spiderling instars before reaching maturity and the developmental duration averaged 230.6 days. Pre-oviposition and post-oviposition periods were 70 and 77.1 days, respectively. Thus, the total female life span averaged 387.6 days. Male passed through 7-8 spiderling instars with developmental period averaged 169.7 days.

Material and Methods

Adult females and gravid female spiders of *Cheiracanthium isiacum* O.P.-Cambridge, 1874 were collected and reared under laboratory conditions, 26-28°C and 60-70% R.H. Spiders were kept in translucent plastic containers (3cm diameter x 5cm height), and supplied with prey. Rearing continued until gravid females laid their eggs.

For individual rearing, newly hatched spiderlings were kept together until the first moulting. After that, they were transferred to separate single rearing smaller cells (1 x 5 cm). A mixture of the larvae of the cotton leaf moth *Spodoptera littoralis* (Boisduval, 1833) and the greater wax moth *Galleria mellonella* (Linnaeus, 1758) was used for feeding all spiderling instars until reaching adult stage. First instar spiderlings of *C. isiacum* were fed together, a communal or group feeding, on 1st and 2nd instar larvae of both *S. littoralis, G. mellonella*. The 2nd and 3rd instar spiderlings were fed on 2nd and 3rd instar larvae, 4th instar spiderlings were fed on 4th instar larvae, 5th- 8th instar spiderlings were fed on biggest size of larvae. The adults also were fed on the same prey along their longevity.

The adult fruit flies, *Drosophila melanogaster* Meigen, 1830, and the two-spotted spider mites, *Tetranychus urticae* (Koch, 1836), were also used for feeding in two separate experiments to evaluate their efficiency as prey to *C. isiacum*.

Table 1: Duration of different stages of *Cheiracanthium isiacum* O.P.-Cambridge, 1874.

Developmental stage	Prey	Duration (days)			
		Male		Female	
		Mean	S.D.	Mean	S.D.
1st spiderling instar	Mixture of larvae of *Spodoptera littoralis* and larvae of *Galleria mellonella*	17.2	0.42	18.8	0.6
2nd spiderling instar		21.1	1.37	20.9	1.30
3rd spiderling instar		14.4	2.50	14.3	2.90
4th spiderling instar		16.7	2.11	15.2	1.6
5th spiderling instar		17.4	2.27	17.18	2.22
6th spiderling instar		18.2	0.89	17.54	3.1
7th spiderling instar		16.2	1.78	15.63	1.28
8th spiderling instar		---	---	14.5	2.06
Total instars		119.6	6.14	133	5.19
Life cycle		138.6	6.14	152	5.19
Adult longevity		30.8	12.26	152.27	22.30
Life span		169.4	12.46	304	30.20

Results

Spiderlings emerge from the egg sac after incubation period of 19 days. The spiderlings moult 7 times to reach adult male and 8 times to reach adult female (Table 1). The first spiderlings stayed with their mother for 5-10 days. They did not feed during their first days. The duration period of first spiderling averaged 17.2 and 18.8 days for male and female, respectively. When the first spiderling became full grown, it stopped feeding before moulting to the second spiderling which had the longest period, i.e. about 21.1 and 20.90 days for male and female, respectively. The third spiderling instar was the shortest period with the values of 14.4 and 14.3 days for male and female, respectively. The total period of spiderlings was shorter for male (119.6±6.14 days) than female (133±5.19 days).

Adult longevity is also different according to sex. Generally, male lived a shorter period than female. Adult male longevity ranged from 14-50 days with an average of 30.8 days, while that of the female's longevity ranged from 116-183 days with an average of 152.27 days. The life span is evidently shorter in case of males than females. It was 169.4±12.46 and 304±30.20 days for male and female, respectively (Table 1).

Table 2: Fecundity of the female spider *Cheiracanthium isiacum*.

Parameters		Mean	S.D.
Pre-oviposition	Days	12.90	2.58
Oviposition		75.45	11.78
Post-oviposition		64.45	24.22
Eggs / egg sac	Eggs	106	19.09
Total number of eggs / female during longevity		424	19.09

Oviposition and fecundity

About 20 days after copulation, the female laid her eggs inside an egg sac (a cocoon). The female produced 4-6 egg sacs (average: 4.72) during her oviposition period. The period between each two egg sacs ranged 13-32 days (average: 18.6 days). The oviposition period was 53-93 days (average: 75.45 days). The post-oviposition period was 11-92 days (average: 64.45 days). Number of eggs in each egg sac ranged 87-130 eggs with an average of 106 eggs. The total number of eggs/female was about 424 eggs (Table 2). In case of the females reared and developed in the laboratory, the number of eggs/egg sac was 18-35 eggs (average: 23.83 eggs), and the average of total number of eggs/female was 143 eggs. This elucidates the effect of laboratory rearing on the fecundity of *C. isiacum* females.

Table 3: Daily rate of food consumption of *Cheiracanthium isiacum* in laboratory.

Developmental stage	Prey	Male		Female	
		Mean	S.D.	Mean	S.D.
1st spiderling instar	Mixture of larvae of *Spodoptera littoralis* and larvae of *Galleria mellonella*	Communal (group) feeding			
2nd spiderling instar		3.6	1.8	4.72	2.36
3rd spiderling instar		5.1	2.55	5.90	2.92
4th spiderling instar		6.4	3.2	7.8	3.9
5th spiderling instar		6.6	3.3	7.0	3.5
6th spiderling instar		7.0	3.5	7.63	3.81
7th spiderling instar		4.3	2.15	5.81	2.90
8th spiderling instar		---	---	6.36	6.36

Food consumption

The communal or group feeding of the 1st instar spiderlings of *C. isiacum*, on a mixture of the larvae of both *S. littoralis* and *G. mellonella*, did not permit the calculation of the daily rate of consumption. The daily rate of consumption of larvae by 2nd-8th instar spiderlings is recorded in table (3). The average number of consumed larvae and the daily rate of consumption increased during 4th-6th instars, to drop again in the 7th instar. *C. isiacum* is quick in attacking its prey, seizing it after the head or at its other end of the body. Feeding on one larva needs about 2-3 minutes.

Feeding on other kinds of prey

Two groups of 1st instar spiderlings of *C. isiacum* were reared feeding on the fruit flies, *Drosophila melanogaster*, and the spider mites, *Tetranychus urticae*. All individuals of the first group died during the 1st instar except two spiderlings only which reached the 3rd instar. The size of adult *D. melanogaster* flies may be not suitable, as prey, to the 1st instar spiderlings which are smaller than them.

The spiderlings of the second group, feeding on *T. urticae*, were in a better situation. The periods of 4th to 6th instars became longer (Table 4) and the mortality increased since the 3rd instar to reach 60% in the 6th instar. All individuals died before reaching adulthood. It was not possible to count the number of mites consumed because uncountable colonies of *T. urticae* on castor oil leaves were used for feeding.

Table 4: Duration of immature stages of *Cheiracanthium isiacum*, feeding on *Tetranychus urticae* mites.

Stages	Prey	Duration of different stage			
		Male *		Female	
		Mean	S.D.	Mean	S.D.
1st spiderling instar	Spider mite *Tetranychus urticae*	17.16	0.40	18.28	0.48
2nd spiderling instar		18.5	1.64	20.14	1.34
3rd spiderling instar		15.33	2.58	13.85	2.96
4th spiderling instar		17.33	3.72	23.0	3.05
5th spiderling instar		23.0	1.67	21.14	4.22
6th spiderling instar		20.33	1.63	20.14	1.95
7th spiderling instar		---	---	14.57	2.29
All individuals died before reaching adulthood.					

* Subadult males had inflated pedipalps in 6th spiderling instar.

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The author is indebted to Col. Hisham K. El-Hennawy (Arachnid Collection of Egypt, Cairo) who identified the *Cheiracanthium isiacum* and revised the manuscript of the work.

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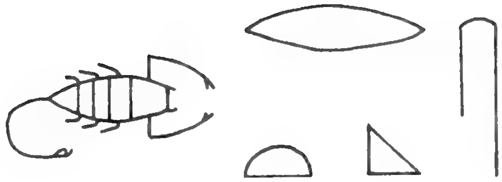

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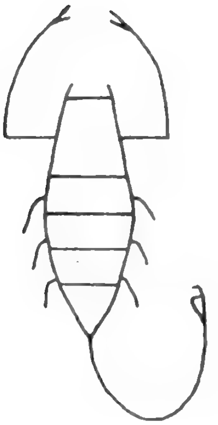

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A contribution to the gnaphosid spider fauna of Turkey (Araneae: Gnaphosidae)

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Abstract

Two species of family Gnaphosidae are reported from Turkey for the first time. They are *Gnaphosa montana* (L. Koch, 1866) and *Zelotes solstitialis* Levy, 1998. The morphological characters and geographical distribution of the two species are presented.

Keywords: Spiders, Araneae, Gnaphosidae, New records, Turkey.

Introduction

Gnaphosid spiders are generally characterized by having barrel-shaped anterior spinnerets that are one spinneret diameter apart. In Gnaphosidae, 1975 species belonging to 116 genera have been described all over the world (Platnick, 2006). This family is the most abundant and one of the most diverse of all spider families in Turkey. Until now, 87 gnaphosid species belonging to 20 genera were recorded from Turkey (Ovtsharenko *et al.*, 1992, Topçu *et al.*, 2005, 2006, Özdemir *et al.*, 2006, Seyyar *et al.*, 2006, Varol *et al.*, 2006).

In this study, we report two ground spider species as new records from Turkey. For each species, the collected material, localities (with GPS co-ordinates), genitalia drawings and general distribution are given.

Material and Methods

In this study, most of specimens were obtained from pitfall traps and under stones in central parts of Turkey. Examined specimens are deposited in the Arachnology Museum of Niğde University (NUAM). The specimens were preserved in 70% ethanol. The identification and drawings were made by means of a SZX9 Olympus stereomicroscope with camera lucida. For the identification of the species, the works of Chatzaki *et al.* (2003), Levy (1998), Ovtsharenko *et al.* (1992) and Heimer & Nentwig (1991) were consulted. Length of leg includes coxa and trochanter. All measurements are in millimetres.

Results

Gnaphosa montana (L. Koch, 1866)
Material examined: TURKEY: Niğde province, İtulumaz Mountain (1400-1920 m.) (37°57'N, 34°42'E), 22.VII.2004. Depository: NUAM GNA 51/0117-120 (2♂♂, 4♀♀). Collected from under stones.
Male: Body length 9.4-10.2; carapace length 3.2-4.1, width 2.2-2.8; length of legs: I 7.1-8.7, II 6.2-6.9, III 5.9-6.2, IV 8-9.4; leg I: coxa 0.75-0.9; trochanter 0.3-0.5; femur 1.8-2.1; patella 0.75-0.9; tibia 1.5-1.9; metatarsus 1.1-1.3; tarsus 0.9-1.1.
Female: Body length 12.3-14.8; carapace length 5.3-6.4, width 3.7-4.8; length of legs: I 15.15-15.5, II 12.15-12.35, III 11.35-11.7, IV 16.6-17; leg I: coxa 1.8-1.95; trochanter 0.8-0.95; femur 3.2-3.6; patella 1.75-1.85; tibia 2.8-2.95; metatarsus 2.15-2.3; tarsus 1.92-2.
Description: Carapace reddish-brown. Distal leg segments more brightly reddish, eye area and chelicerae darker. Sternum elliptic. Abdomen with grey hairs. Epigynum and male palp (Fig. 1) resemble the description of Ovtsharenko *et al.* (1992).
World distribution: Palearctic (Platnick, 2006).

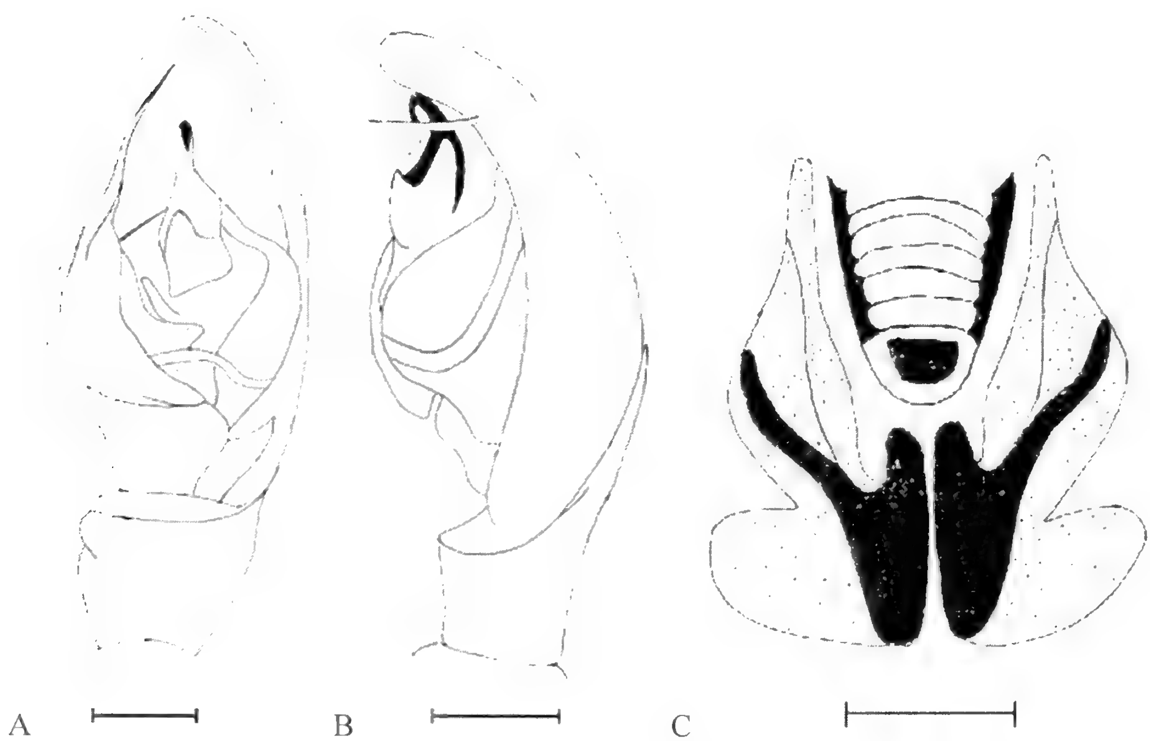
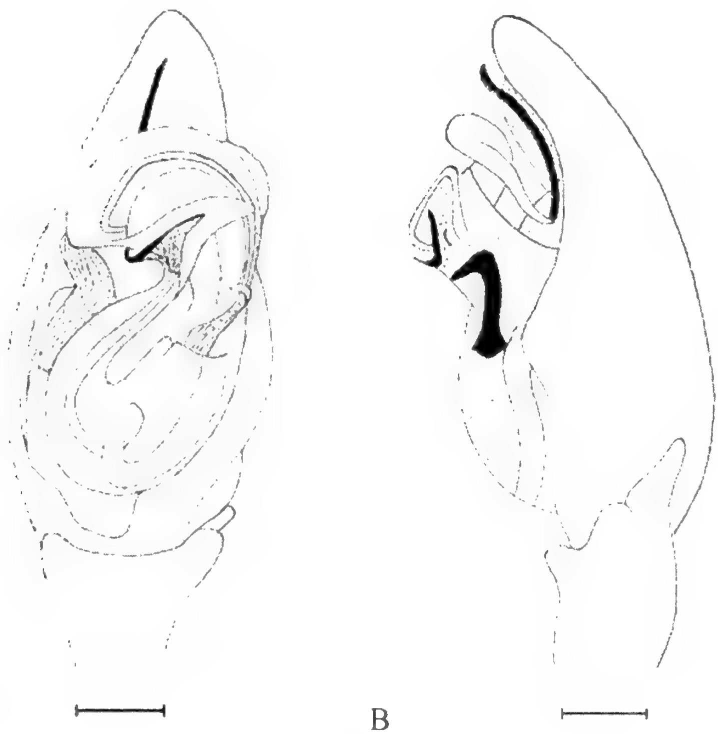


Fig. 1. *Gnaphosa montana* (L. Koch, 1866). A-B. Male palp. A. ventral view. B. retrolateral view. C. Epigynum, ventral view. Scale line = 0.2 mm.

Zelotes solstitialis Levy, 1998
Material examined: TURKEY: Niğde province, (37°58'N, 34°40'E), 03.VII.2004. Depository: NUAM GNA 51/056-58 (3♂♂). Collected by pitfall traps.
Male: Body length 7-7.8; carapace length 3-3.5, width 1.9-2.3; clypeus length 0.1-0.15; length of legs: I 11.2-12.1, II 9.8-10.4, III 9-9.6, IV 12.8-13.8; leg I: coxa 1.2-1.4, trochanter 0.3-0.5, femur 2.4-2.7, patella 1.3-1.5, tibia 2-2.3, metatarsus 1.7-2, tarsus 1.5-1.7.

Description: Carapace dark brown to black, flattened or slightly elevated at middle with short distinct fovea. Posterior median eyes the largest. Chelicerae with 4-5 promarginal teeth. Opisthosoma greenish brown, spindle-shaped, anterior spinnerets longest. Sternum oval. Labium longer than wide with dark edges. Legs light brown. Male palp (Fig. 2) resembles the description of Levy (1998) and Chatzaki *et al.* (2003).
World distribution: Crete, Israel (Platnick, 2006).



A B

Fig. 2. *Zelotes solstitialis* Levy, 1998. A-B. Male palp. A. ventral view. B. retrolateral view. Scale line = 0.2 mm.

Discussion

Zelotes solstitialis is close to *Z. caucasius* (L. Koch, 1866), but due to the fact that: 1. the male of *Z. solstitialis* has no prolateral tegular apophysis, 2. the gathering point of cymbium and embolus is wide, and 3. the presence of a ventral lobe of tibial apophysis, it can be distinguished from *Z. caucasius*. Our *Z. solstitialis* samples are similar to the samples of Crete and Israel but their bodies are bigger. The recording of this species from Turkey widens its distribution. The morphometric measurements and other characteristic features of our *G. montana* samples are not different from European specimens.

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Mitigating scorpion-sting syndrome in the Middle East: understanding the substratum preferences of *Androctonus crassicauda* (Olivier, 1807) (Scorpiones: Buthidae)

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Abstract

Hundreds of medical and toxicological reports have been published concerning the venom of medically important scorpion genera (e.g. *Androctonus* and *Leiurus*) and the treatment of their stings. Two particular studies (Radmanesh, 1998; Al-Sadoon & Jarrar, 2003) reported over 100,000 scorpion-sting cases in Iran and Saudi Arabia in a five-year period. This "scorpion-sting syndrome" is significant and counter-productive for human well-being and economic growth. Therefore, a better understanding of scorpion habits and preferences allows the design of mitigating strategies, which should reduce envenomation in underdeveloped/developing communities in the Middle East. A substratum-based study was devised to interpret the refuge and roaming preferences of *Androctonus crassicauda* (Olivier, 1807). Observations (n = 570) of 15 *A. crassicauda* specimens were recorded in north-central Iraq during the summer of 2004. Each scorpion was given a choice between either a sandy or rubble-like substratum, which mimicked those found in Iraqi communities. Two main results were obtained: *A. crassicauda* is (1) ~2.5 times more likely to choose already-made burrows in the sandy substratum, and (2) ~2.0 times more likely to roam atop sandy substratum than atop open-framework rubble. Consequently, four strategies are suggested to militate against infestation in households and community common areas.

Keywords: Scorpiones, Buthidae, *Androctonus crassicauda*, sting, Middle East.

Introduction

Scorpion-sting syndrome is a threat to human welfare and productivity in many countries (see Hutt & Houghton, 1998 for review); for example, Mexico reports over 200,000 cases per annum (Lourenço & Cuellar, 1995; Jimenez-Ferrer *et al.*, 2005) and other countries report from a couple hundred cases per annum to a few thousand (Table 1). In the Middle East (e.g., Saudi Arabia and Iran) there are two studies presenting over 100,000 sting cases, which were reported during a five-year period (Radmanesh, 1998; Al-Sadoon & Jarrar, 2003; Table 1). Presumably, most of these scorpion-sting cases occur because of ignorance of scorpion habits and preferences by the hard-working people who must cohabitate with them.

Table 1: Representative list of scorpion-sting cases from 12 countries around the world. Cases are based on published reports; reported numbers are minima.

List of Scorpion-sting Syndrome reports					
Country	**Occurrence**	**Reference**	**Country**	**Occurrence**	**Reference**
Algeria	1,300	Balozat, 1964	Mexico	>200,000	Dehesa-Davila *et al.*, 1994
Australia	>45	Isbister, 2004	Morocco	40,000	Ghalim et al., 2000
Colombia	>130	Otero *et al.*, 2004	Saudi Arabia	72,168	Al-Sadoon & Jarrar, 2003
India	38	Bhattacharyya *et al.*, 1992	Trinidad	175	Waterman, 1950
Iran	>36,463	Radmanesh, 1998	Tunisia	>275	Goyffon *et al.*, 1982
Libya	900*	WHO, 1981	Turkey	>152	Ozkan & Kat, 2005

*per 100,000 people.

One of the Middle East's more problematic genera, *Androctonus* spp., are medically important (Ismail *et al.*, 1994) and a common pest. Al-Sadoon & Jarrar (2003) reported that about half of the scorpion-sting cases in Saudi Arabia, were from a "black scorpion" (likely *Androctonus* spp.). Because of *Androctonus* spp. abundance and toxicity, it is crucial to understand their habits, in order to mitigate the danger they pose to communities. In recent years, there has been a push toward understanding the toxicology of scorpion venom and the treatment of scorpion-sting syndrome by means of antivenin (serotherapy) and/or local herbal/plant remedies (Ismail, 1995 & Hutt & Houghton, 1998, respectively for reviews). Although these studies are crucial to patient care, there is, however, another approach to this problem, which will prevent scorpion-sting syndrome – behavioural studies. By better understanding a scorpion's habits (e.g., it's substratum preferences – where do they prefer to hide and roam?) we can minimize/reduce sting cases; thereby, reducing strain on community healthcare systems. If we know where scorpions hide and roam we can eliminate them and/or avoid them.

In order to implement either/both of these techniques, a complimentary practice is required – community education. Education can decrease scorpion-sting syndrome by means of a three-step program (Stewart, 2006b): 1) Educate communities about scorpion-sting syndrome and its threat to their welfare and productivity; 2) Educate about *Androctonus* spp. (and other harmful species) habits and preferences; and 3) Equip them with appropriate equipment to locate and eradicate scorpions (i.e. ultraviolet light source).

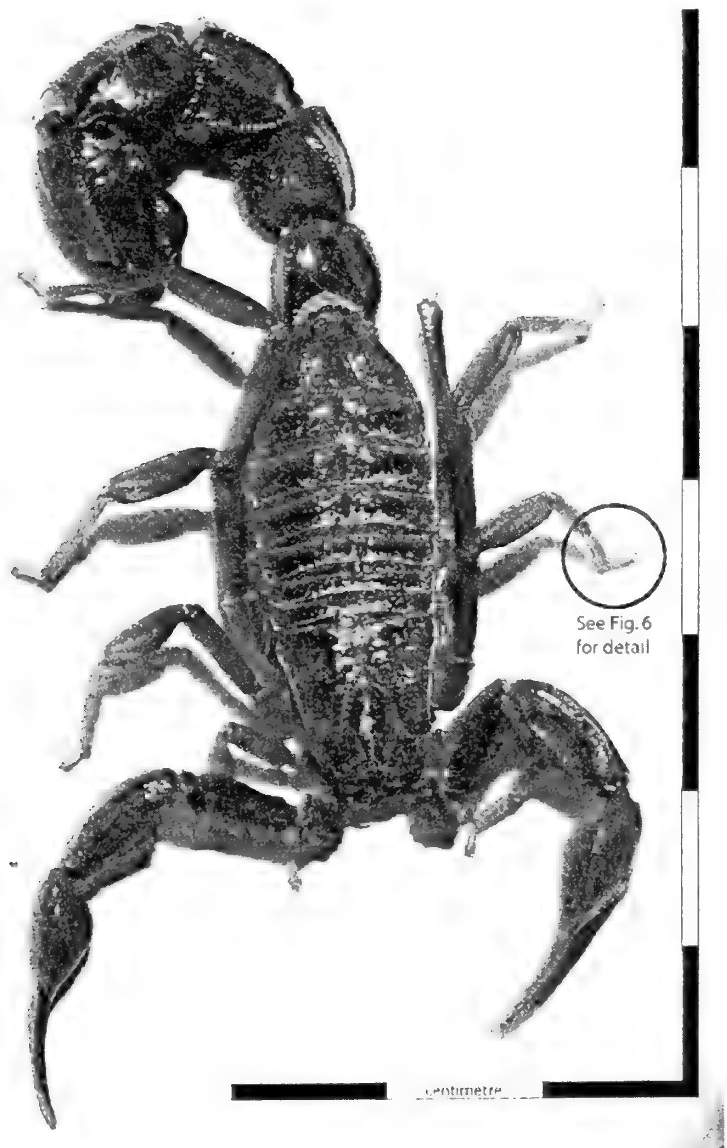

Fig. 1. Photograph of *Androctonus crassicauda* (Olivier, 1807). Circled section is shown in schematic detail in Fig. 6. Scale bar is in centimetres.

Methods

Species studied. *Androctonus crassicauda* (Olivier, 1807) (Buthidae) is a medically important species (i.v. LD_{50} in mice of 0.32±0.02 mg/kg; Ismail *et al.*, 1994), which inhabits the Palaearctic region, primarily the Middle East (with congenerics also found in North Africa; Fet & Lowe, 2000). Adults of this species vary in colour from light brown to reddish black and can reach lengths greater than 10 centimetres (Fig. 1). Described as a generalist desert species (Fet *et al.*, 1998), it has been noted as an anthropotolerant (Crucitti & Cicuzza, 2001) and is commonly found "in the ruins of old, neglected buildings. ..." (Birula, 1917; quoted from a Nakhichevan native in modern Azerbaijan).

Fig. 2. Map of Iraq showing study location (~50 kilometres north of Samarra) marked by red circle.

Experiment. In northern Iraq (Fig. 2) during the summer of 2004, 15 adult *A. crassicauda* specimens were located by a 5-LED shortwave ultraviolet light (385nm, 4.0mW) during evening Nautical and Astronomical Twilights (i.e. when the sun was greater than 12 degrees below the horizon) in and around derelict structures. Specimens were found sitting in crevices or pre-made "burrows" at the wall-substratum interface and roaming within one metre of outside walls or resting vertically on the wall face (not greater than 0.5 metre up). Pre-made "burrows" appeared to be interstices or the opportunistic use of removed-animal refuges. The substratum was densely packed silts and sands with areas adjacent walls being broken and fissured. Specimens were of undetermined age and varied from 25 to 40 millimetres in length (pro and mesosoma; Fig. 1). Each scorpion was placed into a terrarium (50cm x 20cm x 15cm), which comprised 50% sand-based substratum and 50% rubble-based (open-framework) substratum. Each section (sand or rubble) was given one "pre-made" burrow (to replicate a removed-animal refuge) with the rubble section also having natural interstices, which the scorpion could also use as a refuge. Atmospheric and substratum environmental conditions were also measured by means of thermometers (shielded atmospheric and substratum) and a hygrometer (Table 2).

Table 2: Environmental data showing maxima, minima and means for atmospheric temperature and humidity and burrow and substratum temperatures.

	Temperatures and Humidity (°C)				
	Ambient Air	**Sandy substratum**	**Rubbly substratum**	**Burrow**	**Humidity (%)**
Mean	31.9	31.8	32.3	31.3	18.0
Max	40.6	37.6	38.9	36.6	30.0
Min	25.0	26.2	26.6	26.0	8.0

Observations of scorpion activity were completed by means of low-intensity red light (when necessary) at 0730, 1630, 2130 and 2330 hrs. During the morning and afternoon times (0730 and 1630hrs, respectively) there were zero observations of active scorpions (active = ambulation or motionless state with body raised above substratum with tarsi and pectines touching substratum; in or out of burrow; Stewart, 2006a). Activity levels increased to a notable level during the 2130 and 2330 hour time frames. One observation was made per specimen per time period (e.g., 2130hrs) with four possible options (Table 3): The scorpion was either 1) Active in sandy substratum pre-made burrow; 2) Active atop sandy substratum; 3) Active in rubble substratum interstice or pre-made burrow or 4) Active atop rubble substratum. Subsequent to any specimen's experimental use, it was released back to its captured location.

Results

In northern Iraq, 570 observations were recorded during the summer of 2004 regarding *A. crassicauda*'s substratum preferences. The division of observations into either in-burrow or atop substratum was entirely related to scorpion's choice of active location. Of these 570 substratum observations, 386 were in-burrow (henceforth considered burrow preference) and the remainder (184) were atop substratum (henceforth considered roaming preference) (Table 3). Student's t-tests were performed to determine difference significance between sand- and rubble-based substrata for both burrow and roaming preferences. For burrow preference, pre-made burrows in sandy substratum were chosen 268 times; whereas, the rubble-based burrows were selected 118 times. Burrow data suggest that *A. crassicauda* is ~2.3 times more likely to use pre-made burrows in a sandy substratum ($\rho = <0.05$). For substratum roaming preferences, being active on the sand was observed 122 times versus 62 times on the rubble. This relationship suggests that *A. crassicauda* is ~2.0 times more likely to be out and active atop a sandy substratum ($\rho = <0.05$).

Table 3: Substratum preference observations showing the 15 specimens (Greek name) and their observed locations during the 2130 and 2330 observational periods. One observation (in burrow or on surface) was possible for each period (2130 and 2330); two possible per day.

	Substratum preference observations			
	Burrow Preference		**Roaming Preference**	
Specimen	**In sandy substratum**	**In rubbly substratum**	**On sandy substratum**	**On rubbly substratum**
omicron	26	0	15	1
pi	23	1	7	1
ro	22	9	5	3
sigma	12	8	9	2
upsilon	33	11	8	3
phi	15	29	0	0
chi	19	10	3	2
psi	19	0	13	10
omega	22	8	11	8
beta2	5	6	7	10
gamma2	17	9	9	6
delta2	13	5	20	8
epsilon2	19	13	8	5
zeta2	15	6	3	2
eta2	8	3	4	1
SUM	**268**	**118**	**122**	**62**
Preference of Sandy over Rubbly Substratum:	***2.3 times*** (ρ = <0.05)		***2.0 times*** (ρ = <0.05)	

Discussion

There are a few plausible reasons for the variation between the sandy and rubbly substratum choices made by the scorpions; for example, environmental factors or mechanical and/or chemical sensory cues. Regarding environmental factors, a scorpion's best defence against changing environment is to use a more climatically equable burrow (Hadley, 1974). Although *A. crassicauda* continually used burrows during this experiment, the burrows' environmental conditions were insignificantly different (~1°C difference for interstitial air and substrata; ρ = >0.05; Table 2). The most likely reason, therefore, may be related to the scorpion's ability to recognize and interpret mechano/chemosensory signals, which are pertinent to its survivability (e.g. locating prey, relocating its burrow, locating mates, etc.).

Fig. 3. Ventral view of *A. crassicauda* showing pectines (in pink circle). Scale bar is 1 centimeter.

The largest receptors of mechanical and chemical information for the scorpion are its pectines (Fig. 3), which are ventromedial appendages specialized for detection of substances (e.g. odours and tastes) and texture on/of the substratum (Gaffin & Brownell, 1997). This sensory information, involving odours, tastes and texture, may assist the scorpion in a variety of ways: navigation, location of potential mates, tactile use for spermatophore placement, prey capture and predatory avoidance (Gaffin & Brownell, 1997). In order to maximize the efficacy of pectines, ambulation on an uninterrupted and predictable substratum is optimal (Fig. 4). The open-framework, rubbly substratum, however, may not be conducive for pecten sweeping/tapping with the substratum during its ambulation (Fig. 5). In order for a scorpion to breach obstacle groupings (e.g. rubble or rock piles) similar to and slightly greater than its body length, it must sacrifice pecten contact with the substratum. The "free-floating" pectines, therefore, will not be able to record necessary information about the scorpion's position or other cues (Fig. 5). As an adaptive technique, it appears that *A. crassicauda* opts for an uninterrupted substratum; thereby, increasing its likelihood of returning to its burrow, locating prey and/or receiving other mechano/chemosensory uses.

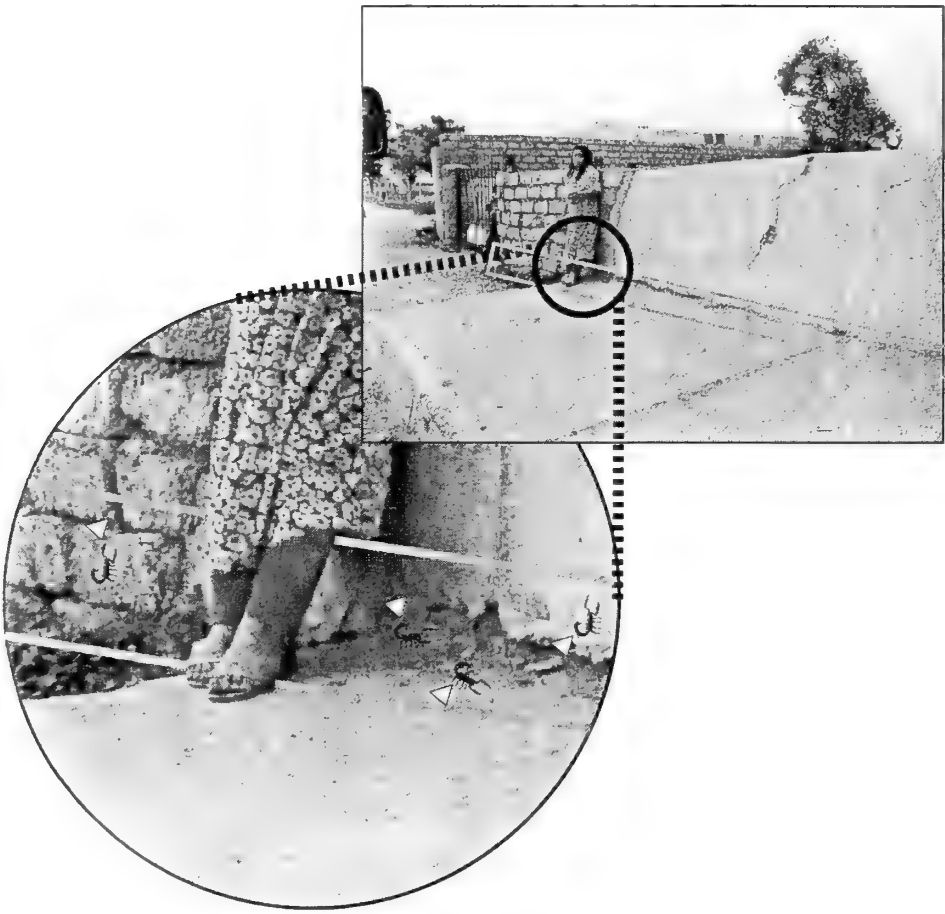

Fig. 4. Photograph of young Iraqi girl standing near a wall showing the main *A. crassicauda* "burrow" and roaming locations. Representative scorpions (also noted by yellow triangles) show the most likely places to find *A. crassicauda*: concrete block interstices and cracked/fissured wall bases, both of which are ubiquitous in underdeveloped/developing communities in the Middle East. Blue blocked area shows probable roaming location.

Another sensory receptor providing location information to the scorpion's brain are their slit sensillae, which are vibration-sensitive portions of their basitarsi near the tarsal joint on each of eight legs (Fig. 6). Slit sensillae can sense vibrational stimuli and are mostly responsive to small amplitude accelerations of the tarsi resting on the substratum (Brownell & van Hemmen, 2001). Together, all eight of these accelerometers make an array capable of determining direction and distance to a set of surface waves (esp., Raleigh Waves). Because of the rapidity of wave propagation through solids (i.e., rocks), scorpions can only detect and interpret Raleigh Waves travelling more slowly through uncompacted or poorly compacted/porous solids (e.g. sand, concrete, cinder blocks or stucco). Because of the decreased velocities in these substrata (approximately 40-120 metres sec^{-1} for sand), Brownell (1977) suggested that a scorpion can grasp prey in one movement (<20 centimetres distant) and is able to detect and orient toward prey up to 50 centimetres distant (corroborated by Stewart (2006a), personal observations of *A. crassicauda*). Two aspects of surface wave propagation may affect *A. crassicauda* preference for substratum. In a non-sandy (e.g. rock-based) substratum, surface wave velocities are too fast to be resolved by the array of slit sensillae, which are too closely spaced. Because Brownell (1977, 2001) "resolved" a scorpion's ability to detect surface waves to less than 50 centimetres, this may be another reason for the reduction in use of the rubbly substratum. While a scorpion is ambulating a rubbly rock pile, the area of any piece of rubble may be too small to allow both a warning of predators and prey from a reaction-safe distance.

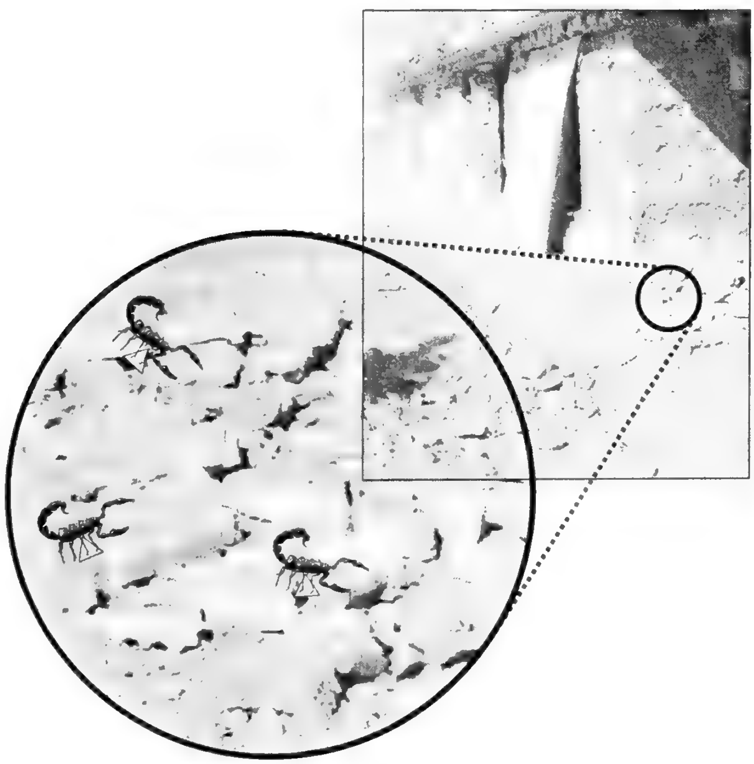

Fig. 5. Unlikely location for *A. crassicauda*. Photograph of a deteriorating building in Iraq; indicative of living conditions in underdeveloped/developing communities. Note the significant amount of rubble accumulating at the base of the building. Circular blow-up shows hypothetical situations where a scorpion is breaching rubble. Note that in certain situations (noted by the hypothetical scorpions) the ventromedial section (pectines; noted by yellow triangles) will be "free-floating" and unable to record information about the substratum.

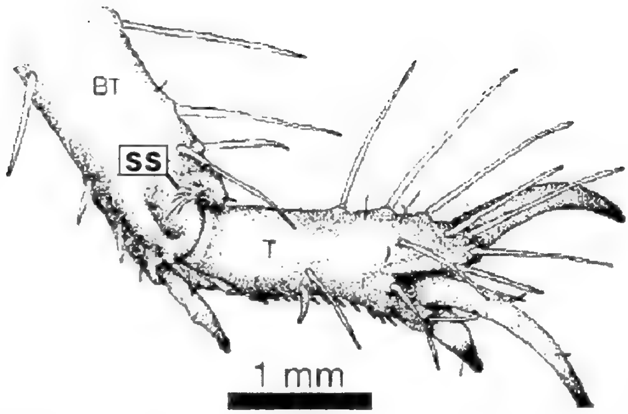

Fig. 6. Schematic diagram of the tarsus (T) showing location of slit sensilla (SS) and basitarsus (BT) (modified from Brownell & van Hemmen, 2001).

Regardless of sensory cue (mechanical or chemical) it appears that *A. crassicauda* is specially adapted toward uninterrupted, continuous substrata; such as, sandy, silty substrata (natural) or cinder blocks, concrete and stucco substrata (anthropogenic). For chemical cues, these substrata ensure a continuous transmission of sensory cues via the pectines. These substrata, moreover, have slower/detectable Raleigh Wave velocities, which allow the slit sensilla to interpret distal prey/predator location information. Lastly, although the anthropogenic substrata are theoretically detectable by the scorpion's slit sensillae, it appears that a reaction-safe distance is imperative to scorpion substratum choice.

Conclusions

Understanding a scorpion's habits, associated with its sensory capabilities (i.e. mechano/chemosensory), can help mitigate "scorpion-sting syndrome" in the Middle East, North Africa and elsewhere by reducing human-scorpion contact. Eradication and/or avoidance of dangerous scorpions' stings will increase human welfare and productivity, which in turn, will decrease community/national monetary support for hospital care of scorpion stings. This is not to suggest that medical and toxicological reports should become useless, for there will always be scorpion stings. It does, however, allow medical professionals to investigate other community/national health issues and concerns. In order to fully affect the mitigation of scorpion-sting syndrome by *A. crassicauda*, the following mitigating strategies are presented to national and community education systems:

1. Ensure all wall-floor conjointments are sealed
2. Fill cracks/interstices at concrete/sand interfaces and repair deteriorated cinder-block-wall joints
3. Reduce refuges by removing crumbled stucco/wall-covering piling at wall bases, rubbish and loose materials
4. Use an ultraviolet light to locate scorpions in small crevices/cracks (primarily in a sandy substratum) in building foundation/walls.

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A list of Egyptian spiders (revised in 2006)

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This list includes names of spider species, recorded from Egypt, with their distribution localities. It is preceded by a table which includes names of recorded spider families (40) followed by number of recorded genera (193) and species (385) within parentheses. A few species maybe considered *nomina dubia* and some records are not certain. The verification and corrigenda will be available in a detailed work revising different spider families of Egypt. This work is a trial to bring the author's "Annotated checklist of Egyptian spider species" of 1990 and "A list of Egyptian spiders (revised in 2002)" to be up to date. The recorded localities are plotted on a map. [Abbreviations used: ? = unknown locality (only Egypt), * = Endemic species, Prot. = Protectorate]

Keywords: Spiders, Araneae, Egypt.

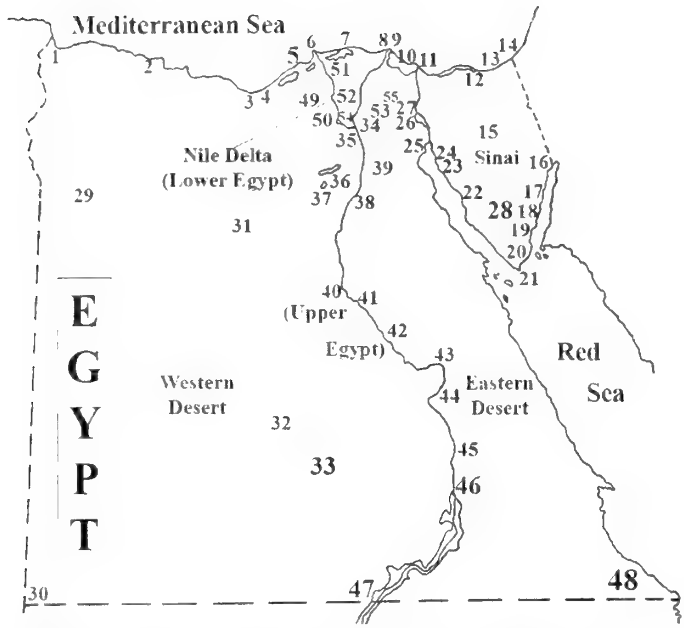
Order Araneida (Araneae, Aranei)
Suborder Opisthothelae
Infraorder Mygalomorphae

Nemesiidae	1 (1)	Theraphosidae	1 (3)

Infraorder Araneomorphae

Agelenidae	5 (7)	Liocranidae	1 (2)	Scytodidae	1 (5)
Araneidae	15 (22)	Lycosidae	20 (44)	Segestriidae	2 (2)
Cithaeronidae	1 (1)	Mimetidae	1 (1)	Selenopidae	1 (1)
Clubionidae	1 (1)	Miturgidae	2 (9)	Sicariidae	1 (1)
Corinnidae	1 (1)	Oecobiidae	2 (7)	Sparassidae	6 (13)
Ctenidae	1 (1)	Oonopidae	4 (5)	Synaphridae	1 (1)
Dictynidae	5 (6)	Oxyopidae	2 (6)	Tetragnathidae	2 (5)
Dysderidae	1 (7)	Palpimanidae	1 (3)	Theridiidae	10 (24)
Eresidae	3 (6)	Philodromidae	3 (18)	Thomisidae	10 (25)
Filistatidae	2 (3)	Pholcidae	5 (5)	Titanoecidae	2 (2)
Gnaphosidae	21 (48)	Pisauridae	4 (4)	Uloboridae	1 (2)
Hersiliidae	2 (2)	Prodidomidae	3 (3)	Zodariidae	5 (8)
Linyphiidae	8 (8)	Salticidae	35 (72)		

TOTAL : 40 Families, 193 genera, 385 species



Map of Egypt.
1-55. Recording localities.

1- El-Sallum. 2- Marsa Matruh. 3- El-Omayed Prot. 4- El-Hammam. 5- Alexandria, Edko, Mariout. 6- Rosetta. 7- El-Burullus Prot. 8- Ras El-Barr. 9- Damietta. 10- El-Manzalah (lake). 11- Port Said. 12- El-Zaranik Prot. 13- El-Arish. 14- Rafah. 15- Mid Sinai. 16- Taba. 17- Abu Galoum Prot. 18- Dahab and Wadi Yah'med. 19- Nabq Prot. 20- Sharm El-Sheikh. 21- Ras Mohammed Prot. 22- En Higiya (north east of Abu Zneima). 23- Ras Sedr. 24- Ain-Musa. 25- Suez. 26- Fayed. 27- Ismailia. 28- St. Catherine, Mount Serbal, Wadi Esla. 29- Siwa Oases. 30- El-Uwaynat. 31- El-Baharia Oases, El-Bawitti. 32- Dakhla Oases. 33- New Valley. 34- Cairo (Heliopolis, Zenhum and Helwan), Wadi Degla (El-Maadi). 35- Giza, Pyramids, Saqqarah, Dahshur. 36- El-Fayum, Kom Osheem. 37- Wadi El-Raiyan. 38- Beni Suef. 39- Wadi Rishrash. 40- Manfalut. 41- Assiut. 42- Sohag. 43- Qena. 44- Luxor. 45- Gebel Silsilis. 46- Aswan, Elephantine and Philoe island; Fatira (Kom Ombo). 47- Wadi-Halfa, Nubia. 48- El-Shalateen, Bir El-Gahliya, Wadi De'eeb. 49- Wadi Natron. 50- El-Tahrir Province. 51- Kafr El-Sheikh. 52- El-Menoufeia, Shebin El-Kom. 53- El-Aasher-Min-Ramadan City (65 km east of Cairo). 54- Nile Barrage, Qalyubia. 55- Salahyeh.

Infraorder Mygalomorphae

Family Nemesiidae Simon, 1892
Nemesia cellicola Savigny, 1825 --- Alexandria

Family Theraphosidae Thorell, 1870
Chaetopelma gracile (Ausserer, 1871) --- Alexandria, El-Fayum, Upper Egypt
Chaetopelma olivaceum (C.L.Koch, 1841) --- Cairo
Chaetopelma shabati Hassan, 1950 --- Cairo, El-Fayum *

Infraorder Araneomorphae

Family Agelenidae C.L.Koch, 1837
Benoitia lepida (O.P.-Cambridge, 1876) --- Abu Galoum, El-Omayed, El-Zaranik, New Valley, Siwa Oases, Upper Egypt, Wadi El-Raiyan, Wadi Natron
Benoitia timida (Savigny, 1825) --- Rosetta
Lycosoides coarctata (Dufour, 1831) --- Alexandria, Nile Barrage
Malthonica pagana (C.L.Koch, 1840) --- Cairo
Tegenaria domestica (Clerck, 1757) --- Rosetta
Tegenaria parietina (Fourcroy, 1785) --- Alexandria
Textrix caudata L.Koch, 1872 --- ?

Family Araneidae Simon, 1895
Agalenatea redii (Scopoli, 1763) --- southern Sinai
Araneus circe (Savigny, 1825) --- Alexandria
Argiope bruennichi (Scopoli, 1772) --- ?
Argiope lobata (Pallas, 1772) --- Alexandria, Cairo, El-Burullus, El-Shalateen, El-Zaranik, Nabq, Ras Mohammed, St. Catherine, Wadi El-Raiyan, Wadi De'eeb
Argiope sector (Forskål, 1775) --- Nubia, Port Said, Siwa Oasis, Upper Egypt, Wadi Natron
Argiope trifasciata (Forskål, 1775) --- Alexandria, Cairo, El-Burullus, El-Tahrir Province, Siwa Oasis, Wadi El-Raiyan, Wadi Natron
Cyclosa deserticola Levy, 1998 --- ?
Cyclosa insulana (Costa, 1834) --- El-Burullus (?), Siwa Oasis, Wadi Natron
Cyrtophora citricola (Forskål, 1775) --- Cairo, Abu Galoum, Nabq, Ras Mohammed, Siwa Oasis, Wadi El-Raiyan, Wadi Natron
Gasteracantha sanguinolenta rueppelli (Strand, 1916) --- ? *
Gea nilotica Simon, 1906 --- ? *
Gibbaranea bituberculata (Walckenaer, 1802) --- Alexandria, Cairo
Hypsosinga albovittata (Westring, 1851) --- Alexandria
Larinia acuticauda Simon, 1906 --- Luxor, Siwa Oasis
Larinia chloris (Savigny, 1825) --- Siwa Oasis, Suez, Upper Egypt
Larinioides cornutus (Clerck, 1757) --- Rosetta
Larinioides suspicax (O.P.-Cambridge, 1876) --- Alexandria, Damietta, El-Fayum, Rosetta, Siwa Oasis, Wadi Natron
Neoscona subfusca (C.L.Koch, 1837) --- Alexandria, Siwa Oasis
Nuctenea umbratica (Clerck, 1757) --- Damietta
Singa lucina (Savigny, 1825) --- Alexandria, Rosetta
Singa semiatra L.Koch, 1867 --- ?
Siwa atomaria (O.P.-Cambridge, 1876) --- Aswan, Cairo, Siwa Oasis, Upper Egypt

Family Cithaeronidae Simon, 1893
Cithaeron praedonius O.P.-Cambridge, 1872 --- Alexandria

Family Clubionidae Wagner, 1887
Clubiona listeri Audouin, 1825 --- ? *

Family Corinnidae Karsch, 1880
Castianeira antinorii (Pavesi, 1880) --- Cairo (Giza), Siwa Oasis

Family Ctenidae Keyserling, 1877
Anahita pallida (L.Koch, 1875) --- ?

Family Dictynidae O. P.-Cambridge, 1871
Archaeodictyna anguiniceps (Simon, 1899) --- New Valley, Siwa Oasis, Wadi Natron
Archaeodictyna condocta (O.P.-Cambridge, 1876) --- Alexandria, Cairo, Lower Egypt, Suez
Devade indistincta (O.P.-Cambridge, 1872) --- Mariout, Siwa Oasis, Suez
Dictyna innocens O.P.-Cambridge, 1872 --- Cairo
Lathys humilis meridionalis (Simon, 1874) --- Alexandria
Nigma conducens O.P.-Cambridge, 1876 --- Cairo, Lower Egypt, Elephantine, Philoe island (Aswan), Wadi-Halfa

Family Dysderidae C.L. Koch, 1837
Dysdera crocota C.L.Koch, 1839 --- Alexandria
Dysdera erythrina (Walckenaer, 1802) --- ?
Dysdera lata Wider, 1834 --- Alexandria, Cairo
Dysdera lubrica Simon, 1907 --- Alexandria, Cairo *
Dysdera pharaonis Simon, 1907 --- Alexandria, Mariout *
Dysdera subnubila Simon, 1907 --- Alexandria, Cairo *
Dysdera westringii O.P.-Cambridge, 1872 --- Alexandria

Family Eresidae C.L. Koch, 1851
Dorceus quadrispilotus Simon, 1908 --- Alexandria, Mariout, west of El-Hammam *
Eresus pharaonis Walckenaer, 1837 --- ? *
Eresus semicanus Simon, 1908 --- Alexandria, Mariout, Suez
Stegodyphus dufouri (Audouin, 1825) --- Abu Galoum, Alexandria, Assiut, Aswan, Beni Suef, Cairo, Damietta, El-Baharia Oases, El-Fayum, El-Menoufeia, Giza, Ismailia, Luxor, Nile Barrage, Port Said, Qena, Sinai, Siwa Oasis, Sohag, Suez, Wadi El-Raiyan, Wadi Halfa, Wadi Natron
Stegodyphus lineatus (Latreille, 1817) --- Alexandria, Cairo, Damietta, El-Burullus, El-Shalateen and Bir El-Gahliya, El-Zaranik, Nabq, Ras El-Barr, Siwa Oasis, southern Sinai, Suez
Stegodyphus manicatus Simon, 1876 --- Cairo

Family Filistatidae Ausserer, 1867
Filistata insidiatrix (Forskål, 1775) --- Alexandria, Cairo, Lower Egypt, Siwa Oasis
Filistata puta O. P.-Cambridge, 1876 --- Alexandria
Sahastata nigra (Simon, 1897) --- Cairo, Luxor, Suez

Family Gnaphosidae Pocock, 1898
Aphantaulax albini (Audouin, 1825) --- ?
Aphantaulax cinctus (L.Koch, 1866) --- Alexandria
Berinda ensiger (O.P.-Cambridge, 1874) --- ?
Berlandina plumalis (O.P.-Cambridge, 1872) --- Alexandria, Cairo
Berlandina venatrix (O.P.-Cambridge, 1874) --- Alexandria, Aswan, Cairo, Luxor, Sinai, Siwa Oasis, Wadi Halfa
Drassodes alexandrinus (O.P.-Cambridge, 1874) --- Alexandria *
Drassodes unicolor (O. P.-Cambridge, 1872) --- ?
Haplodrassus dalmatensis (L. Koch, 1866) --- Cairo
Haplodrassus pugnans (Simon, 1880) --- El-Arish
Heser infumatus (O.P.-Cambridge, 1872) --- Cairo
Leptodrassus pupa Dalmas, 1919 --- Suez *
Megamyrmaekion caudatum Wider, 1834 --- ? *
Megamyrmaekion vulpinum (O.P.-Cambridge, 1874) --- Aswan, Cairo
Micaria ignea (O. P.-Cambridge, 1872) --- northern and southern (?) Sinai
Minosia pharao Dalmas, 1921 --- Alexandria, Cairo *
Minosia simeonica Levy, 1995 --- southern Sinai
Minosiella mediocris Dalmas, 1921 --- Cairo, El-Fayum, Siwa Oasis, Suez
Minosiella pharia Dalmas, 1921 --- Cairo
Nomisia aussereri (L.Koch, 1872) --- Alexandria, Cairo

Nomisia recepta (Pavesi, 1880) --- ?
Odontodrassus mundulus (O.P.-Cambridge, 1872) --- Cairo, southern Sinai
Poecilochroa antineae Fage, 1929 --- ? *
Poecilochroa pugnax (O.P.-Cambridge, 1874) --- Alexandria, Cairo, Ismailia, Siwa Oasis, Suez
Poecilochroa senilis (O.P.-Cambridge, 1872) --- Alexandria, El-Omayed
Pterotricha conspersa (O.P.-Cambridge, 1872) --- Cairo, Helwan, Pyramids (Giza), El-Burullus, Ras Mohammed, Siwa Oasis
Pterotricha dalmasi Fage, 1929 --- Nabq, Siwa Oasis
Pterotricha lentiginosa (C.L.Koch, 1837) --- ?
Pterotricha lesserti Dalmas, 1921 --- El-Arish, El-Zaranik, Rafah, Ras Sedr
Pterotricha linnaei (Audouin, 1825) --- ?
Pterotricha procera (O.P.-Cambridge, 1874) --- Alexandria, Cairo
Pterotricha schaefferi (Audouin, 1825) --- Alexandria, Aswan, Cairo, El-Omayed, Suez, Wadi El-Raiyan, Wadi Halfa
Setaphis mollis (O.P.-Cambridge, 1874) --- Alexandria
Setaphis subtilis (Simon, 1897) --- Cairo, Ismailia, Nile Delta, Ras El-Barr, Shebin El-Kom, Sohag, southern Sinai, Wadi El-Raiyan
Synaphosus gracillimus (O.P.-Cambridge, 1872) --- En Higiya (NE of Abu Zneima), Mount Serbal, Wadi Degla, Wadi Rishrash
Synaphosus intricatus (Denis, 1947) --- Siwa Oasis
Synaphosus minimus (Caporiacco, 1936) --- Dahab, Wadi Yah'med, El-Uwaynat
Synaphosus syntheticus (Chamberlin, 1924) --- Cairo (Zenhum, Helwan), Sohag
Talanites fervidus Simon, 1893 --- ?
Talanites ornatus (O.P.-Cambridge, 1874) --- Alexandria *
Trachyzelotes jaxartensis (Kroneberg, 1875) --- Assiut, Luxor
Trachyzelotes lyonneti (Audouin, 1825) --- ?
Urozelotes rusticus (L.Koch, 1872) --- Marsa Matruh, Siwa Oasis
Zelotes fagei Denis, 1955 --- ?
Zelotes laetus (O.P.-Cambridge, 1872) --- Alexandria, Cairo, Lower Egypt
Zelotes listeri (Audouin, 1825) --- southern Sinai *
Zelotes nilicola (O.P.-Cambridge, 1874) --- Alexandria, El-Tahrir Province, Nile Delta
Zelotes scrutatus (O. P.-Cambridge, 1872) --- Alexandria, Siwa Oasis *
Zelotes tenuis (L.Koch, 1866) --- Alexandria

Family Hersiliidae Thorell, 1870
Hersilia caudata Savigny, 1825 --- Cairo to Aswan
Hersiliola simoni (O.P.-Cambridge, 1872) --- Alexandria

Family Linyphiidae Blackwall, 1859
Bathyphantes extricatus (O.P.-Cambridge, 1876) --- Alexandria, Cairo *
Brachycerasphora parvicornis (Simon, 1884) --- Alexandria *
Erigone dentipalpis (Wider, 1834) --- El-Aasher-Min-Ramadan City, Nile Delta
Gnathonarium dentatum (Wider, 1834) --- Nile Delta
Gnathonarium dentatum orientale (O.P.-Cambridge, 1872) --- ?
Meioneta rurestris (C.L.Koch, 1836) --- Alexandria
Microctenonyx alexandrinus (O.P.-Cambridge, 1872) --- Alexandria
Prinerigone vagans (Savigny, 1825) --- Alexandria, Cairo, New Valley, Nile Delta, Wadi Natron

Silometopus curtus (Simon, 1881) --- ?

Family Liocranidae Simon, 1897
Mesiotelus alexandrinus (Simon, 1880) --- Edko *
Mesiotelus tenuissimus (L.Koch, 1866) --- Alexandria, Ismailia, southern Sinai

Family Lycosidae Sundevall, 1833
Allocosa deserticola (Simon, 1898) --- Saqqarah *
Allocosa tarentulina (Savigny, 1825) --- Alexandria
Allocosa tremens (O.P.-Cambridge, 1876) --- Alexandria
Alopecosella pelusiaca (Savigny, 1825) --- El-Manzalah
Arctosa cinerea (Fabricius, 1777) --- Siwa Oasis, southern Sinai, Upper Egypt, Wadi Natron
Arctosa depuncta (O.P.-Cambridge, 1876) --- Alexandria
Arctosa leopardus (Sundevall, 1832) --- Alexandria
Arctosa quadripunctata (Lucas, 1846) --- Siwa Oasis
Aulonia albimana (Walckenaer, 1805) --- ? *
Crocodilosa virulenta (O.P.-Cambridge, 1876) --- Cairo *
Evippa arenaria (Savigny, 1825) --- Rosetta
Evippa praelongipes (O.P.-Cambridge, 1870) --- southern Sinai
Evippa ungulata (O.P.-Cambridge, 1876) --- Aswan, Luxor, Siwa Oasis, Upper Egypt, Wadi El-Raiyan
Evippomma simoni Alderweireldt, 1992 --- Wadi Halfa
Geolycosa urbana (O.P.-Cambridge, 1876) --- Alexandria, Siwa Oasis
Hippasa innesi Simon, 1889 --- Cairo, Suez *
Hippasa partita (O.P.-Cambridge, 1876) --- Alexandria
Hippasa sinai Alderweireldt & Jocqué, 2005 --- Sinai
Hogna alexandria Roewer, 1960 --- Alexandria *
Hogna ferox (Lucas, 1838) --- Nile Delta, Siwa Oasis, Wadi Natron
Hogna peregrina (Savigny, 1825) --- Rosetta *
Hogna radiata (Latreille, 1817) --- Cairo
Hogna sinaia Roewer, 1959 --- Sinai
Hogna truculenta (O. P.-Cambridge, 1876) --- Alexandria
Hyaenosa effera (O.P.-Cambridge, 1872) --- Alexandria, Cairo
Lycosa cingara (C.L.Koch, 1847) --- ? *
Lycosa cretacea Simon, 1898 --- Saqqarah
Lycosa nilotica Savigny, 1825 --- Alexandria, Aswan, Cairo *
Lycosa tarantula (Linnaeus, 1758) --- southern Sinai
Megarctosa argentata (Denis, 1947) --- Siwa Oasis *
Ocyale atalanta Savigny, 1825 --- Wadi Natron
Ocyale pelliona (Savigny, 1825) --- Rosetta
Orinocosa priesneri Roewer, 1959 --- Djebl Bokas (?) *
Orthocosa ambigua (Denis, 1947) --- Siwa Oasis *
Pardosa iniqua (O.P.-Cambridge, 1876) --- Alexandria *
Pardosa injucunda (O.P.-Cambridge, 1876) --- Alexandria, Cairo, Siwa Oasis
Pardosa inopina (O.P.-Cambridge, 1876) --- Alexandria, Wadi Natron
Pardosa inquieta (O.P.-Cambridge, 1876) --- Alexandria *
Pardosa naevia (L. Koch, 1875) --- ? *
Pardosa observans (O.P.-Cambridge, 1876) --- Alexandria *

Pardosa serena (L.Koch, 1875) --- Cairo *
Pirata proximus O.P.-Cambridge, 1876 --- Alexandria *
Trochosa annulipes L.Koch, 1875 --- Cairo
Wadicosa fidelis (O.P.-Cambridge, 1872) --- Alexandria, Aswan, Cairo, Siwa Oasis, Suez, Wadi Natron

Family Mimetidae Simon, 1881
Mimetus monticola (Blackwall, 1870) --- Cairo

Family Miturgidae Simon, 1885
Cheiracanthium annulipes O.P.-Cambridge, 1872 --- Cairo, Philoe island (Aswan), Wadi Natron
Cheiracanthium canariense Wunderlich, 1987 --- El-Burullus, El-Zaranik
Cheiracanthium equestre O.P.-Cambridge, 1874 --- Cairo, Siwa Oasis
Cheiracanthium isiacum O.P.-Cambridge, 1874 --- Cairo, Nile Delta, Siwa Oasis, Sohag, Wadi Natron
Cheiracanthium jovium Denis, 1947 --- Siwa Oasis
Cheiracanthium mildei L.Koch, 1864 --- southern Sinai
Cheiracanthium pelasgicum (C.L.Koch, 1837) --- Beni Suef, Qalyubia, Rafah
Cheiracanthium siwi El-Hennawy, 2001 --- Siwa Oasis *
Cheiramiona dubia (O.P.-Cambridge, 1874) --- Alexandria *

Family Oecobiidae Blackwall, 1862
Oecobius amboseli Shear & Benoit, 1974 --- Cairo
Oecobius maculatus Simon, 1870 --- Giza
Oecobius navus Blackwall, 1859 --- Alexandria, Ismailia, Upper Egypt
Oecobius putus O.P.-Cambridge, 1876 --- Cairo, Giza, Ismailia, Upper Egypt
Oecobius templi O.P.-Cambridge, 1876 --- Cairo, Upper Egypt, Abu Galoum (?)
Uroctea durandi (Latreille, 1809) --- ?
Uroctea limbata (C.L.Koch, 1843) --- Alexandria, Abu Galoum, Nabq, Ras Mohammed

Family Oonopidae Simon, 1890
Dysderina scutata (O.P.-Cambridge, 1876) --- Alexandria, Cairo *
Gamasomorpha arabica Simon, 1893 --- Ain-Musa *
Gamasomorpha margaritae Denis, 1947 --- Siwa Oasis *
Opopaea punctata (O.P.-Cambridge, 1872) --- Ain-Musa, Alexandria
Sulsula pauper (O.P.-Cambridge, 1876) --- Alexandria

Family Oxyopidae Thorell, 1870
Oxyopes heterophthalmus (Latreille, 1804) --- Alexandria, Cairo, Sinai
Oxyopes lineatus Latreille, 1806 --- ?
Oxyopes sinaiticus Levy, 1999 --- Sinai ?
Peucetia arabica Simon, 1882 --- Cairo, Abu Galoum, Nabq, Ras Mohammed, St. Catherine, Siwa Oasis, Suez
Peucetia virescens (O.P.-Cambridge, 1872) --- Dakhla Oases
Peucetia viridis (Blackwall, 1858) --- Dahshur (Giza), Sinai

Family Palpimanidae Thorell, 1870
Palpimanus aegyptiacus Kulczyński, 1909 --- ? *
Palpimanus gibbulus Dufour, 1820 --- Alexandria, Cairo to Luxor, Nubia

Palpimanus uncatus Kulczyński, 1909 --- ? *

Family Philodromidae Thorell, 1870
Philodromus bigibbus (O.P.-Cambridge, 1876) --- Alexandria, Aswan
Philodromus cinereus O.P.-Cambridge, 1876 --- Cairo *
Philodromus clercki Audouin, 1825 --- ? *
Philodromus denisi Levy, 1977 --- Siwa Oasis *
Philodromus glaucinus Simon, 1870 --- Ismailia, Siwa Oasis, Upper Egypt
Philodromus lepidus Blackwall, 1870 --- Aswan, Cairo, Wadi Natron
Philodromus lugens (O.P.-Cambridge, 1876) --- Alexandria *
Philodromus omer-cooperi Denis, 1947 --- Siwa Oasis *
Philodromus sinaiticus Levy, 1977 --- Ras Mohammed *
Philodromus venustus O.P.-Cambridge, 1876 --- Cairo to Manfalut *
Thanatus albini (Audouin, 1825) --- Cairo, El-Tahrir Province, New Valley, Nile Delta, Siwa Oasis, Sohag
Thanatus fabricii (Audouin, 1825) --- Alexandria, Siwa Oasis
Thanatus flavescens O.P.-Cambridge, 1876 --- Cairo *
Thanatus flavus O.P.-Cambridge, 1876 --- Alexandria *
Thanatus formicinus (Clerck, 1757) --- ?
Thanatus fornicatus Simon, 1897 --- Sinai
Thanatus lesserti (Roewer, 1951) --- Cairo
Tibellus vossioni Simon, 1884 --- Siwa Oasis

Family Pholcidae C.L. Koch, 1851
Artema atlanta Walckenaer, 1837 --- Cairo, Siwa Oasis, Sohag, Wadi Natron
Crossopriza semicaudata (O.P.-Cambridge, 1876) --- Cairo to Luxor
Holocnemus pluchei (Scopoli, 1763) --- Alexandria, Cairo, Nabq, Wadi Natron
Micropholcus fauroti (Simon, 1887) --- ?
Pholcus phalangioides (Fuesslin, 1775) --- Alexandria

Family Pisauridae Simon, 1890
Dolomedes hyppomene Savigny, 1825 --- Damietta *
Nilus curtus O.P.-Cambridge, 1876 --- Alexandria *
Pisaura mirabilis (Clerck, 1757) --- ?
Rothus atlanticus Simon, 1898 --- Siwa Oasis

Family Prodidomidae Simon, 1884
Prodidomus amaranthinus (Lucas, 1846) --- Alexandria, Cairo
Zimirina vastitatis Cooke, 1964 --- El-Sallum
Zimiris sp. --- Heliopolis-Cairo (inside a house) [Unpublished record]

Family Salticidae Blackwall, 1841
Aelurillus catherinae Prószyński, 2000 --- St. Catherine *
Aelurillus conveniens (O.P.-Cambridge, 1872) --- Siwa Oasis, Mid Sinai
Aelurillus dorthesi (Audouin, 1825) --- Cairo, Wadi Natron *
Aelurillus hirtipes Denis, 1960 --- Watia Pass (Mid Sinai)
Aelurillus luctuosus (Lucas, 1846) --- Lower Egypt
Aelurillus monardi (Lucas, 1846) --- Cairo, Lower Egypt
Aelurillus sinaicus Prószyński, 2000 --- north of Mid Sinai
Ballus piger O.P.-Cambridge, 1876 --- Upper Egypt *

Bianor albobimaculatus (Lucas, 1846) --- Alexandria, Cairo, Siwa Oasis, Suez
Carrhotus occidentalis (Denis, 1947) --- Siwa Oasis *
Chalcoscirtus catherinae Prószyński, 2000 --- St. Catherine, near Taba
Cosmophasis nigrocyanea (Simon, 1885) --- Siwa Oasis
Euophrys catherinae Prószyński, 2000 --- St. Catherine, southern Sinai *
Euophrys granulata Denis, 1947 --- Siwa Oasis *
Festucula vermiformis Simon, 1901 --- Alexandria, Suez *
Hasarius adansoni (Audouin, 1825) --- Alexandria, Cairo, Ras El-Barr
Heliophanillus fulgens (O.P.-Cambridge, 1872) ---Alexandria, Cairo, Siwa Oasis, Upper Egypt
Heliophanillus lucipeta (Simon, 1890) --- Alexandria, Suez
Heliophanus cupreus (Walckenaer, 1802) --- ?
Heliophanus decoratus L.Koch, 1875 --- Alexandria, Cairo, El-Zaranik, Siwa Oasis, Suez, Wadi Natron
Heliophanus edentulus Simon, 1871 --- Alexandria
Heliophanus glaucus Bösenberg & Lenz, 1894 --- Alexandria, Siwa Oasis
Hyllus plexippoides Simon, 1906 --- ?
Langona alfensis Hęciak & Prószyński, 1983 --- Wadi Halfa
Langona mallezi (Denis, 1947) --- Siwa Oasis *
Langona redii (Audouin, 1825) --- Alexandria, Cairo
Mendoza canestrinii (Ninni, 1868) --- Alexandria
Menemerus animatus O.P.-Cambridge, 1876 ---Alexandria, Cairo, El-Omayed, El-Zaranik, Ras El-Barr, Siwa Oasis, Upper Egypt, Wadi Natron
Menemerus gesneri (Audouin, 1825) --- ?
Menemerus heydeni Simon, 1868 --- Cairo, Upper Egypt
Menemerus hunteri (Audouin, 1825) --- ?
Menemerus illigeri (Audouin, 1825) --- Cairo
Menemerus semilimbatus (Hahn, 1829) --- Cairo
Menemerus soldani (Audouin, 1825) --- Alexandria, Siwa Oasis
Modunda staintoni (O.P.-Cambridge, 1872) --- Upper Egypt, Suez
Mogrus bonneti (Audouin, 1825) --- Alexandria, Siwa Oasis, Upper Egypt, Wadi El-Raiyan, Wadi Natron
Mogrus canescens (C.L.Koch, 1846) --- ?
Mogrus fulvovittatus Simon, 1882 --- El-Burullus, El-Omayed, El-Zaranik, Nabq, Ras El-Barr
Mogrus mirabilis Wesolowska & van Harten, 1994 --- Wadi Halfa
Mogrus sinaicus Prószyński, 2000 --- Ras Mohammed, St. Catherine
Myrmarachne kiboschensis Lessert, 1925 --- Cairo
Myrmarachne tristis (Simon, 1882) --- El-Zaranik, Nabq
Natta horizontalis Karsch, 1879 --- ?
Neaetha aegyptiaca Denis, 1947 --- Siwa Oasis *
Neaetha cerussata (Simon, 1868) --- ?
Neaetha oculata (O.P.-Cambridge, 1876) --- Upper Egypt
Pachypoessa plebeja (L.Koch, 1875) --- Cairo
Paraneaetha diversa Denis, 1947 --- Siwa Oasis *
Pellenes frischi (Audouin, 1825) --- ? *
Philaeus chrysops (Poda, 1761) --- southern Sinai
Phlegra flavipes Denis, 1947 --- Siwa Oasis *

Phlegra memorialis (O.P.-Cambridge, 1876) --- Siwa Oasis, Upper Egypt *
Phlegra pori Prószyński, 1998 --- Mt. Catherina (southern Sinai)
Phlegra proxima Denis, 1947 --- Siwa Oasis *
Plexippoides flavescens (O.P.-Cambridge, 1872) --- St. Catherine
Plexippus paykulli (Audouin, 1825) --- Abu Galoum, Alexandria, Cairo, El-Shalateen, Bir El-Gahliya, El-Zaranik, southern Sinai
Pseudicius spiniger (O.P.-Cambridge, 1872) --- Aswan, Cairo, Upper Egypt
Pseudicius tamaricis Simon, 1885 --- Siwa Oasis, Wadi Natron
Rafalus christophori Prószyński, 1999 --- St. Catherine
Rafalus feliksi Prószyński, 1999 --- north west Wadi Esla *
Salticus druryi Audouin, 1825 --- ?
Salticus mendicus O.P.-Cambridge, 1876 --- Alexandria to Aswan
Salticus mouffeti Audouin, 1825 --- Alexandria
Salticus paludivagus Lucas, 1846 --- Alexandria
Salticus propinquus Lucas, 1846 --- Alexandria, Kafr El-Sheikh
Stenaelurillus werneri Simon, 1906 --- ?
Synageles dalmaticus (Keyserling, 1863) --- Alexandria, Cairo
Synageles repudiatus (O.P.-Cambridge, 1876) --- Alexandria, Siwa Oasis *
Thyene imperialis (Rossi, 1846) --- Aswan, Cairo, El-Tahrir Province, Nabq, New Valley, Sharm El-Sheikh, Siwa Oasis, Upper Egypt
Thyenula ammonis Denis, 1947 --- Siwa Oasis *
Yllenus saliens O.P.-Cambridge, 1876 --- Alexandria, Cairo, El-Uwaynat, Suez, Upper Egypt
Yllenus tschoni (Caporiacco, 1936) --- ?

Family Scytodidae Blackwall, 1864
Scytodes bertheloti Lucas, 1838 --- Wadi Natron
Scytodes immaculata L.Koch, 1875 --- Alexandria, Cairo, El-Fayum, Upper Egypt, Wadi Halfa *
Scytodes obelisci Denis, 1947 --- Luxor *
Scytodes thoracica (Latreille, 1802) --- Cairo, Siwa Oasis
Scytodes velutina Heineken & Lowe, 1836 --- Cairo, Siwa Oasis, Wadi Natron

Family Segestriidae Simon, 1893
Ariadna insidiatrix Savigny, 1825 --- Alexandria, Cairo
Segestria florentina (Rossi, 1790) --- Alexandria, Lower Egypt, south west Sinai

Family Selenopidae Simon, 1897
Selenops radiatus Latreille, 1819 --- Wadi Natron, Nile Valley

Family Sicariidae Keyserling, 1880
Loxosceles rufescens (Dufour, 1820) --- Alexandria, Cairo, Siwa Oasis

Family Sparassidae Bertkau, 1872
Cebrennus aethiopicus Simon, 1880 --- Nubia
Cebrennus castaneitarsis Simon, 1880 --- Sinai
Cebrennus concolor (Denis, 1947) --- Siwa Oasis *
Cerbalus pellitus Kritscher, 1960 --- Fayed *
Cerbalus psammodes Levy, 1989 --- El-Zaranik
Cerbalus pulcherrimus (Simon, 1880) --- Aswan, Wadi Natron

Eusparassus bicorniger (Pocock, 1898) --- ?
Eusparassus dufouri Simon, 1932 --- ?
Eusparassus oraniensis (Lucas, 1846) --- Siwa Oasis
Eusparassus walckenaeri (Audouin, 1825) --- Cairo, El-Shalateen, Bir El-Gahliya, Siwa Oasis, southern Sinai, Upper Egypt, Wadi Natron
Gnathopalystes crucifer (Simon, 1880) --- (Port Said?) ?
Heteropoda variegata (Simon, 1874) --- ?
Olios suavis (O.P.-Cambridge, 1876) --- Siwa Oasis, near Gebel Silsilis (Upper Egypt)

Family Synaphridae Wunderlich, 1986
Synaphris letourneuxi (Simon, 1884) --- ? *

Family Tetragnathidae Menge, 1866
Dyschiriognatha argyrostilba (O.P.-Cambridge, 1876) --- Alexandria *
Tetragnatha chrysochlora (Audouin, 1825) --- ?
Tetragnatha flava (Savigny, 1825) --- Alexandria, Rosetta *
Tetragnatha isidis (Simon, 1880) --- Alexandria
Tetragnatha nitens (Savigny, 1825) --- Alexandria, Cairo, Manzalah, Rosetta, Siwa Oasis, Wadi El-Raiyan, Wadi Natron

Family Theridiidae Sundevall, 1833
Argyrodes argyrodes (Walckenaer, 1842) --- Siwa Oasis
Crustulina conspicua (O.P.-Cambridge, 1872) --- Giza
Enoplognatha deserta Levy & Amitai, 1981 --- St. Catherine
Enoplognatha gemina Bosmans & Van Keer, 1999 --- Alexandria, Cairo
Euryopis albomaculata Denis, 1951 --- ? *
Euryopis campestrata Simon, 1907 --- Cairo *
Euryopis episinoides (Walckenaer, 1847) --- Alexandria, Giza, Ismailia
Euryopis quinqueguttata Thorell, 1875 --- Siwa Oasis
Kochiura aulica (C.L.Koch, 1838) --- Alexandria, Nile Delta, Siwa Oasis, Wadi Natron
Latrodectus pallidus O.P.-Cambridge, 1872 --- Alexandria, El-Zaranik, Nabq
Latrodectus tredecimguttatus (Rossi, 1790) --- Alexandria, El-Tahrir Province, Salahyeh, Mid Sinai, Nabq
Nesticodes rufipes (Lucas, 1846) --- Cairo
Paidiscura dromedaria (Simon, 1880) --- Ismailia, El-Zaranik, Nabq
Steatoda ephippiata (Thorell, 1875) --- El-Omayed, El-Zaranik, Mid Sinai
Steatoda erigoniformis (O.P.-Cambridge, 1872) --- Alexandria, Nile Delta
Steatoda latifasciata (Simon, 1873) --- Mid Sinai, St. Catherine
Steatoda paykulliana (Walckenaer, 1805) --- Alexandria, El-Burullus, El-Zaranik, southern Sinai
Steatoda triangulosa (Walckenaer, 1802) --- Cairo, Wadi Natron, El-Zaranik
Steatoda venator (Savigny, 1825) --- Alexandria *
Theridion melanostictum O.P.-Cambridge, 1876 --- Alexandria, Nile Delta, El-Zaranik
Theridion musivum Simon, 1873 --- Mid Sinai
Theridion nigrovariegatum Simon, 1873 --- Alexandria, Ismailia, Siwa Oasis, Suez
Theridion spinitarse O.P.-Cambridge, 1876 --- Cairo, Luxor
Theridion varians Hahn, 1833--- Alexandria

Family Thomisidae Sundevall, 1833
Firmicus dewitzi Simon, 1899 --- Wadi Natron
Heriaeus buffoni (Audouin, 1825) --- Ras Mohammed
Misumena atrocincta Costa, 1875 --- ? *
Ozyptila judaea Levy, 1975 --- Sinai (near Taba)
Ozyptila subclavata (O.P.-Cambridge, 1876) --- Alexandria
Pistius truncatus (Pallas, 1772) --- ?
Runcinia grammica (C.L.Koch, 1837) --- Alexandria, El-Arish, El-Bawitti, Fatira, Kom Osheem
Synema candicans (O.P.-Cambridge, 1876) --- Alexandria *
Synema diana (Audouin, 1825) --- Cairo to Luxor, Fatira, Kom Osheem, Nabq, Ras El-Barr, Siwa Oasis, Wadi Esla, Wadi Natron
Synema globosum (Fabricius, 1775) --- ?
Synema valentinieri Dahl, 1907 --- Upper Egypt *
Thomisus bidentatus Kulczyński, 1901 --- southern Sinai
Thomisus onustus Walckenaer, 1805 --- El-Zaranik, Kom Osheem, Ras El-Barr, Siwa Oasis, southern Sinai, Wadi El-Raiyan
Thomisus spinifer O.P.-Cambridge, 1872 --- Aswan, Cairo to Luxor, El-Arish, El-Bawitti, Fatira, Nile Delta, Siwa Oasis, Wadi Natron
Tmarus piochardi (Simon, 1866) --- Siwa Oasis
Xysticus bliteus (Simon, 1875) --- Alexandria, Cairo
Xysticus clercki (Audouin, 1825) --- ?
Xysticus cristatus (Clerck, 1757) --- Alexandria
Xysticus ferus O.P.-Cambridge, 1876 --- Alexandria, southern Sinai
Xysticus lalandei (Audouin, 1825) --- Cairo, southwestern Sinai *
Xysticus peccans O.P.-Cambridge, 1876 --- ? *
Xysticus promiscuus O. P.-Cambridge, 1876 --- Alexandria
Xysticus sabulosus (Hahn, 1832) --- ?
Xysticus sinaiticus Levy, 1999 --- ?
Xysticus tristrami (O.P.-Cambridge, 1872) --- Cairo (Giza), Rafah, St. Catherine

Family Titanoecidae Lehtinen, 1967
Nurscia albomaculata (Lucas, 1846) --- Alexandria, Cairo (Giza)
Titanoeca tristis L.Koch, 1872 --- ?

Family Uloboridae Thorell, 1869
Uloborus plumipes Lucas, 1846 --- Cairo to Assiut, Nile Valley, near Red Sea, Siwa Oasis
Uloborus walckenaerius Latreille, 1806 --- El-Zaranik, Siwa Oasis

Family Zodariidae Thorell, 1881
Lachesana perversa (Savigny, 1825) --- Cairo, El-Zaranik
Palaestina eremica Levy, 1992 --- St. Catherine
Ranops expers (O.P.-Cambridge, 1876) --- Alexandria, St. Catherine
Trygetus riyadhensis Ono & Jocqué, 1986 --- St. Catherine
Trygetus sexoculatus (O.P.-Cambridge, 1872) --- Suez, west of southern Sinai
Zodarion cyrenaicum Denis, 1935 --- ?
Zodarion nitidum (Savigny, 1825) --- Alexandria, Cairo, northern Sinai
Zodarion pileolonotatum Denis, 1935 --- Siwa Oasis

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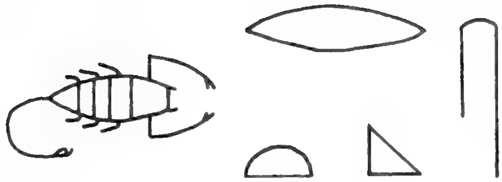

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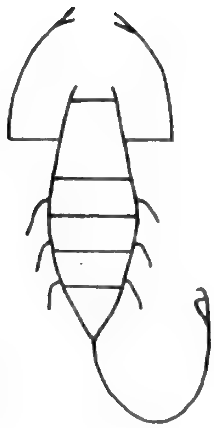

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Contributions to the spider fauna of Turkey: *Arctosa lutetiana* (Simon, 1876), *Aulonia albimana* (Walckenaer, 1805), *Lycosa singoriensis* (Laxmann, 1770) and *Pirata latitans* (Blackwall, 1841) (Araneae: Lycosidae)

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Abstract

This paper reports four lycosid species as new records for the Turkish araneofauna. The characteristic features and egigynum drawings of *Arctosa lutetiana* (Simon, 1876), *Aulonia albimana* (Walckenaer, 1805), *Lycosa singoriensis* (Laxmann, 1770) and *Pirata latitans* (Blackwall, 1841) (Lycosidae: Araneae) are included. Habitat and geographical distribution of the species are presented. The specimens were collected from different locations of Turkey.

Keywords: Spiders, Araneae, Lycosidae, Taxonomy, New records, Turkey.

Introduction

The wolf spiders, Lycosidae, are real hunters that live in a wide variety of terrestrial habitats. Their general appearance varies among genera and they usually have a high frontally narrowed and relatively elongated prosoma. They have eight eyes arranged in three rows. Four small eyes are located above the clypeus, two large eyes above them are looking forwards, and farther back there are also two big eyes that look upwards. Posterior median and lateral eyes are arranged in a trapezium. Therefore, lycosids can look in four directions and have excellent eyesight. Their legs and chelicerae are generally robust.

A total of 63 species grouped in 11 genera were recorded from Turkey (Topçu *et. al.*, 2005). There are some ecological studies on lycosids in Turkey (Bayram, 1993, 1994a, 1994b, 1995a, 1995b, 1995c, 1996, 1997, 2000; Bayram & Luff, 1993a, 1993b; Bayram & Varol, 2001; Bayram *et al.*, 2002; Varol & Bayram, 1995). In Turkey, 7 species of *Arctosa* (i.e. *A. cinerea*, *fulvolineata*, *leopardus*, *perita*, *personata*, *simoni* and *variana*), 4 species of *Lycosa* (i.e. *L. narbonensis*, *piochardi*, *praegrandis* and *tarantula*), 2 species of *Pirata* (i.e. *P. hygrophilus* and *piraticus*), and *Aulonia kratochvili* are recorded until now (Bayram, 2002; Topçu *et. al.*, 2005; Varol *et al.*, 2007).

Material and Methods

The present study is based on the material deposited in the collection of the Arachnological Museum of Kırıkkale University (KUAM). Only four females were examined in this study. The specimens were preserved in 70% ethanol. The identification and drawings were made by means of a SMZ10A Nikon stereomicroscope with a camera lucida. The keys of Heimer & Nentwig (1991), Roberts (1995) and Tyschchenko (1971) were used. All measurements are in millimetres.

Results

1. ***Arctosa lutetiana*** (Simon, 1876)
Material examined: 1♀, Yahşihan (39°50'N 33°30'E, Kırıkkale prov.), 23.IX.2006, from a meadow in the University campus.
Description: Prosoma dark olive brown, laterals have 3-4 grey spots, anteriorly clearly wider than the eye region. Median stripe on prosoma light colour but indistinct. Chelicerae hairy and have three teeth on the basal segments. Anterior median eyes bigger than anterior lateral eyes. Distance between posterior lateral eyes larger than anterior lateral ayes. Legs reddish brown, have many hairs, grey spotted or annulated. Coxae and femora yellowish brown. Tibiae III-IV with only one dorsal spine. Tarsus I with a long bristle proximally. Opisthosoma greenish-brown, with black hairs. Folium furnished anteriorly with a heart shaped white band, posteriorly with 4-5 triangular white spots, and laterally with two yellowish spots.
Female (KUAM-LYC.Arc.lute.01)**:** Body length 7.5; carapace length 3.3; leg I: coxa 0.99, trochanter 0.24, femur 2.11, patella 1.01, tibia 1.45, metatarsus 1.43, tarsus 0.96. Epigynum: Fig. 1a.
World Distribution: Sweden, Middle Europe, South Europe, Russia (Heimer & Nentwig, 1991, Platnick, 2007).

2. ***Aulonia albimana*** (Walckenaer, 1805)
Material examined: 1♀, Perşembe (41°05'N 37°50'E, Ordu prov.), 25.VII.1995, from a cultivated hazelnut (*Corylus avellana* L.) garden.
Description: Prosoma dark brown, with thin white lines at margins, anteriorly narrow, hardly wider than eye region. Rear half of carapace with thin golden brown median line. The head region projects rather than thorax region. Pedipalps black, but palpal patella white. Opisthosoma blackish-brown, with white median line anteriorly, and white spots posteriorly. Legs bright brown but femora I black.
Female (KUAM-LYC.Aul.albi.01)**:** Body length 3.5; carapace length 1.45 mm; leg I: coxa 0.99, trochanter 0.24, femur 1.29, patella 0.57, tibia 1.18, metatarsus 1.01, tarsus 0.68. Epigynum: Fig. 1b.
World Distribution: Palaearctic region; widespread in northern Europe, but commoner in the south of the region (Roberts, 1995; Platnick, 2007).

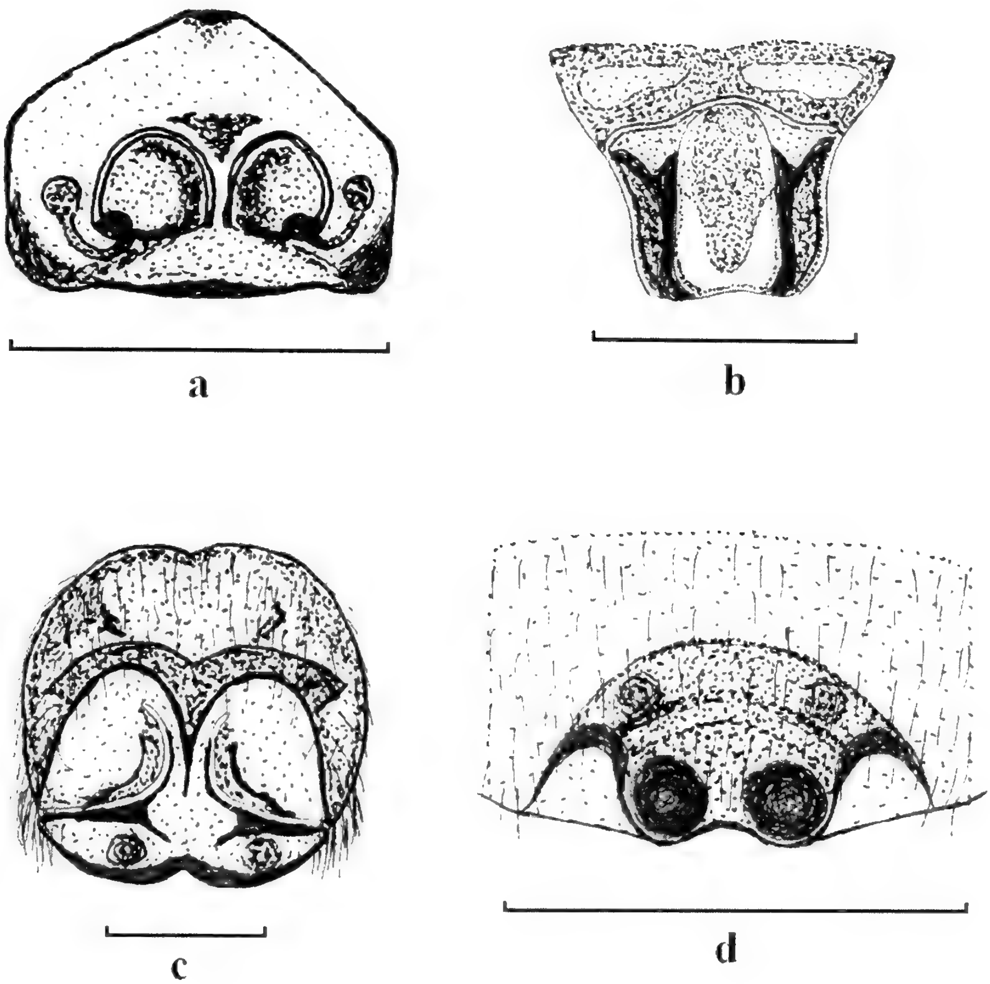

Fig. 1. Female epigynum (ventral view) of: a. *Arctosa lutetiana*, b. *Aulonia albimana*, c. *Lycosa singoriensis*, and d. *Pirata latitans*. Scale = 0.5 mm.

3. ***Lycosa singoriensis*** (Laxmann, 1770)
Material examined: 1♀, Edremit (38°25'N 43°17'E, Van prov.), 14.VI.1995, from a steppe far 1 km from Van Lake.
Description: Prosoma olive brown. In female, basal segments of chelicerae and pedipalps yellowish brown or orange-brown. Median stripe on prosoma bright, small and indistinct, with two dark longitudinal patterns. Laterals of carapace with many radially scattered black bands or spots. Sternum entirely black. Fovea visible. Cephalic region higher than thoracic region. Distance between posterior lateral eyes larger than between anterior lateral eyes. Surroundings of anterior lateral eyes dark. Chelicerae hairy. Legs thick and strong, greyish olive brown. Legs black spotted or annulated, hairy, with dorsal spines. Trochanters ventrally black. Opisthosoma dark olive brown. Folium anteriorly with black pattern, medially often with undulated indistinct dorsal band with white spots, posteriorly with some horizontal white lines. Ventral side of opisthosoma dark.

Female (KUAM-LYC.Lyc.sing.01): Body length 24; carapace length 14; leg I: coxa 4,5, trochanter 1.5, femur 9.5, patella 3.5, tibia 6.5, metatarsus 6, tarsus 4. Epigynum: Fig. 1c.
World Distribution: Palaearctic region: Central Europe, Eastern Europe, Russia, Kazakhstan (Zyuzin, 1985; Platnick, 2007).

4. ***Pirata latitans*** (Blackwall, 1841)
Material examined: 1♀, Çaykara (40°40'N 40°20'E, Trabzon prov.), 22.VII.1995, from a beech (*Fagus orientalis* Lipsky) forest.
Description: Prosoma dark brown or black, anteriorly not clearly wider than eye region. Carapace with a median dark V-shaped mark, but this mark is indistinct due to dark colouration. Lateral sides of carapace with white longitudinal bands. Cephalic region narrow, higher than thoracic region. Distance between posterior lateral eyes larger than between anterior lateral ayes. Legs dark brown. Femora I darker than other femora. Opisthosoma almost uniformly dark brown, but rear half of opisthosoma with paired white spots and some indistinct light bands along the sides.
Female (KUAM-LYC.Pir.lati.01): Body length 5; carapace length 2.04; leg I: coxa 0.57, trochanter 0.26, femur 1.36, patella 0.7, tibia 1.16, metatarsus 1.03, tarsus 0.81. Epigynum: Fig. 1d.
World Distribution: Europe to Azerbaijan (Platnick, 2007).

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Three linyphiid species new to the Turkish araneo-fauna: *Cresmatoneta mutinensis* (Canestrini, 1868), *Ostearius melanopygius* (O.P.-Cambridge, 1879) and *Trematocephalus cristatus* (Wider, 1834) (Araneae: Linyphiidae)

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Abstract

The characteristic features and genitalia drawings of *Cresmatoneta mutinensis* (Canestrini, 1868), *Ostearius melanopygius* (O.P.-Cambridge, 1879) and *Trematocephalus cristatus* (Wider, 1834) (Araneae: Linyphiidae), which are new records to the spider fauna of Turkey, are presented, in addition to the habitat and geographical distribution of the species. The specimens were collected from different parts of Turkey.

Keywords: Spiders, Araneae, Linyphiidae, Taxonomy, New records, Turkey.

Introduction

Linyphiids constitute the most crowded family of spiders. They are generally small in body size. These ecribellate, sheet-web weavers are mostly found on trees and bushes, among lower branches, under fallen leaves, in cellars, caves and cracks of rocks. A total of 56 species grouped into 38 genera are known from Turkey (Bayram, 2002; Topçu *et al.*, 2005). Some taxonomical and ecological articles were published on Turkish spiders during the last two decades (Bayram, 1993, 1996, 2000; Bayram *et al.*, 2000, 2002; Bayram & Göven, 2001; Bayram & Özdağ, 2002; Bayram & Ünal, 2002; Bayram & Varol, 2000, 2003). However, there are no study on the linyphiids of Turkey.

In this study, *Cresmatoneta mutinensis* (Canestrini, 1868), *Ostearius melanopygius* (O.P.-Cambridge, 1879) and *Trematocephalus cristatus* (Wider, 1834) (Araneae: Linyphiidae) are newly recorded from Turkey and the characteristic features and genitalia drawings of the three species are presented. Also, habitat and geographical distribution of the species are included.

Material and Methods

The present study is based on the material deposited in the collection of the Arachnological Museum of Kırıkkale University (KUAM). Five specimens were collected from Giresun, Trabzon and Rize provinces located in the Eastern Black Sea Region in 1995. These specimens were taken from a hazelnut (*Corylus avellana* L.) garden, a cabbage (*Brassica oleracea* L.) field surrounded by blackberry (*Rubus* sp.) and beech (*Fagus orientalis* Lipsky) trees, a hornbeam (*Carpinus betulus* L.) and a beech forest. One specimen was taken from a greenhouse of cucumber (*Cucumis sativus* L.) in the Western Mediterranean Region in 2005.

The specimens were preserved in 70% ethanol. The identification and genitalia drawings were made by means of a SMZ10A Nikon stereomicroscope with a camera lucida. The keys of Heimer & Nentwig (1991), Roberts (1995) and Tyschchenko (1971) were used. All measurements are in millimetres.

Results

1. ***Cresmatoneta mutinensis*** (Canestrini, 1868)

Material examined: 1♀, Değirmendere (41°00'N 39°40'E, Trabzon prov.), 15.VII.1995, from a hornbeam forest; 1♀, Piraziz (40°56'N 38°28'E, Giresun prov.), 22.VII.1995, from a cultivated hazelnut garden.

Description: Prosoma light or orange brown, not clearly wider than ocular area. Cephalic region projects more than thoracic region. Carapace has no patterns but with scattered short prickles. Anterior median eyes smaller and darker than the others. Anterior lateral eyes adjacent to posterior lateral eyes. Distance between anterior median eyes larger than that of posterior median eyes. Chelicerae have the same colour of prosoma, relatively big and long. Sternum entirely brownish. Rear of the prosoma narrowed, with a slender pedicel. Legs yellowish, without spotted nor annulated pattern. Leg I is the longest. All legs very thin and weak, patellae of legs swollen. Opisthosoma olive brown and relatively small. Folium medially often with three dispersed black spots, laterally with three short white stripes and longitudinal black pattern.

Female (KUAM-LIN.Cre.muti.01)**:** Body length 2.7; leg I: coxa 0.26, trochanter 0.13, femur 1.60, patella 0.22, tibia 1.65, metatarsus 1.29, tarsus 0.70. Epigynum: Fig. 1a.

World Distribution: Palaearctic region (Heimer & Nentwig, 1991; Platnick, 2007).

2. ***Ostearius melanopygius*** (O.P.-Cambridge, 1879)

Material examined: 1♀, Fındıklı (41°12'N 41°16'E, Rize prov.), 21.VII.1995, found on ground in a beech forest; 1♂, Finike (36°10'N 30°15'E, Antalya prov.), 30.VI.2005, from a greenhouse of cucumber.

Description: Anterior lateral eyes adjacent to posterior lateral eyes. Anterior median eyes are smaller than the others which are equal in size. Distance between posterior median eyes larger than that of anterior median eyes. Prosoma dark brown. Chelicerae and sternum brown. Opisthosoma brownish while its tip and spinnerets black. All legs brownish. No spots nor annulation patterns on the legs. Epigynum is distinctive (Fig. 1b).

Female (KUAM-LIN.Ost.mela.01)**:** Body length 2.2; leg I: coxa 0.28, trochanter 0.11, femur 0.99, patella 0.26, tibia 0.88, metatarsus 0.79, tarsus 0.59.

Male (KUAM-LIN.Ost.mela.02)**:** Body length 2.0; leg I: coxa 0.37, trochanter 0.17, femur 1.23, patella 0.30, tibia 1.16, metatarsus 1.01, tarsus 0.63. Palpal organ: Fig. 1c.

World Distribution: Cosmopolitan (Heimer & Nentwig, 1991; Platnick, 2007).

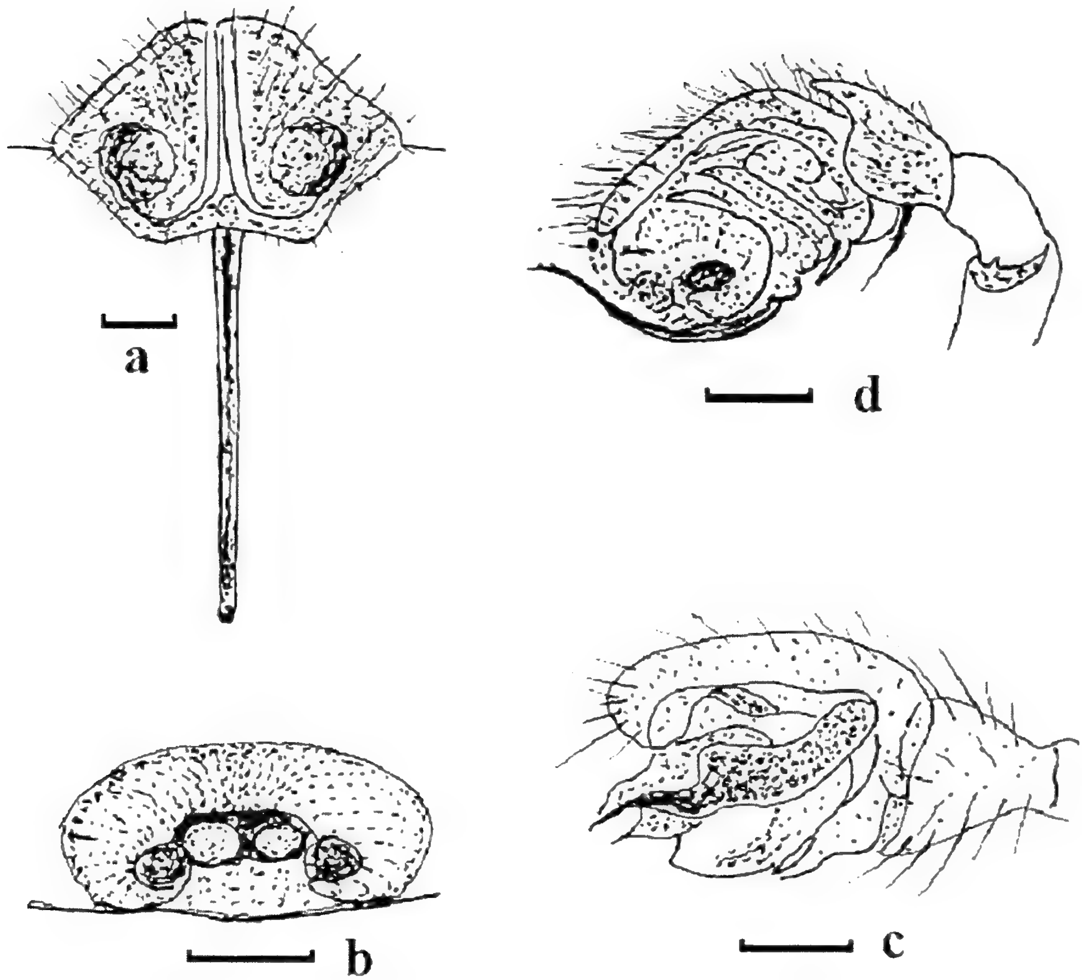

Fig. 1. Female epigynum (ventral view) of: a. *Cresmatoneta mutinensis* and b. *Ostearius melanopygius*. Male palpal organ of: c. *Ostearius melanopygius* and d. *Trematocephalus cristatus*. Scale = 0.5 mm.

3. ***Trematocephalus cristatus*** (Wider, 1834)

Material examined: 2♂♂, Vakfıkebir (41°02'N 39°18'E, Trabzon prov.), 15.VII.1995, found on ground in a cabbage field.

Description: This species has a very distinctive appearance. The high anterior part of the prosoma has a hole with eyes placed on an ocular area in front of it. Ocular area dark brown or black colour. Median eyes quadrangle is widest posteriorly and wider than long. Carapace and sternum yellowish brown. Colour of opisthosoma is the same as ocular area. No patterns on opisthosoma. Tibia, metatarsi and tarsi black.

Male (KUAM-LIN.Tre.cris.02)**:** Body length 2.1; leg I: coxa 0.17, trochanter 0.11, femur 0.63, patella 0.15, tibia 0.61, metatarsus 0.50, tarsus 0.24. Palpal organ: Fig. 1d.

World Distribution: Palaearctic region (Heimer & Nentwig, 1991; Platnick, 2007).

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A contribution to the crab spider fauna of Turkey (Araneae: Thomisidae)

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Abstract

The spider species *Ebrechtella tricuspidata* (Fabricius, 1775) and *Tmarus stellio* Simon, 1875 of family Thomisidae are recorded from Turkey for the first time. The characteristic features of these species are described and illustrated, and data on their distribution are included.

Keywords: Spiders, Araneae, Thomisidae, *Ebrechtella*, *Tmarus*, New records, Turkey.

Introduction

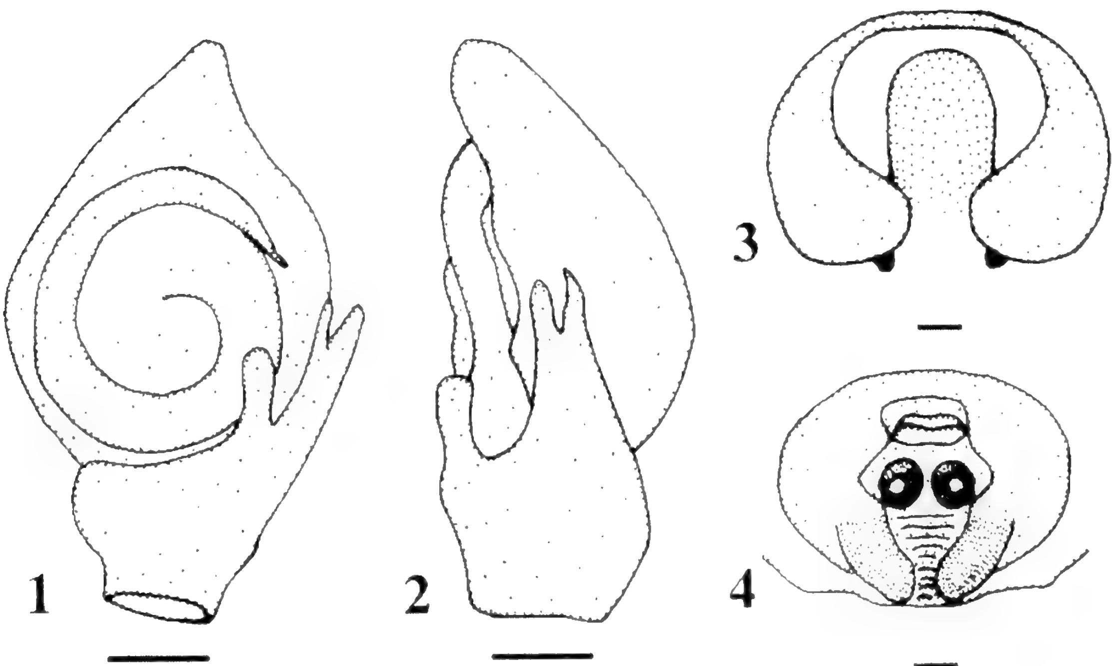
The great diversity of form and colour shown by the Thomisidae relates to their exploitation of a wide variety of habitats and their often remarkable capacity for camouflage, sometimes even to the extent of slowly changing colour. The majority of species are rather crab-like in appearance, have the first two pairs of legs longer than the rest, and can walk sideways, as well as forwards and backwards (Roberts, 1995).

As the fauna of Turkey is concerned, Thomisidae must be regarded as an insufficiently studied family. The thomisid fauna of Turkey consists of 66 species and has recently been a subject of intensive taxonomic and faunistic studies (Karol, 1966a, 1966b, 1966c, 1968; Assi, 1986; Wunderlich, 1995; Bayram *et al.*, 2002, 2007; Topçu & Demir, 2004; Marusik *et al.*, 2005; Logunov & Demir, 2006; Demir *et al.*, 2006).

Misumenops tricuspidatus (*Aranea tricuspidata* Fabricius, 1775) was transferred to genus *Ebrechtella* Dahl, 1907 by Lehtinen (2005). Males of *Ebrechtella* further differ from the males of *Misumenops* F.O.P.-Cambridge, 1900 by their simple (not screwed or otherwise modified) tegulum, simple curved embolus and distally pointed or obtuse ITA (i.e. intermediate palpal apophysis). The embolus tip is finely striated and the large orifice of the ejaculatory duct is situated subdistally (Lehtinen, 2005).

The species of *Tmarus* Simon, 1875 are small to medium-sized spiders, characterized by the shape of the carapace and abdomen. The abdomen often has a tubercle caudo-dorsally which resembles a leaf bud or scar. They live mainly on plants and rest with their bodies and legs pressed against the substratum (Dippenaar-Schoeman, 1985).

Ten species that are belonging to genus *Ebrechtella* and 212 species of genus *Tmarus* have been described through the world (Platnick, 2007). So far, no member of both genera has been recorded from Turkey (Topçu *et al.*, 2005) except the most recent record of *Tmarus piochardi* (Simon, 1866) by Bayram *et al.* (2007). Here, *Ebrechtella tricuspidata* (Fabricius, 1775) and *Tmarus stellio* Simon, 1875 are recorded for the first time from Turkey. Some of their characteristic features are described and illustrated.



Figs. 1-3: *Ebrechtella tricuspidata* (Fabricius, 1775). 1-2. Left male palp, 1. ventral view, 2. retrolateral view. 3. Female epigynum, ventral view. 4. *Tmarus stellio* Simon, 1875, spermathecae, dorsal view. Scale bar = 0.1 mm.

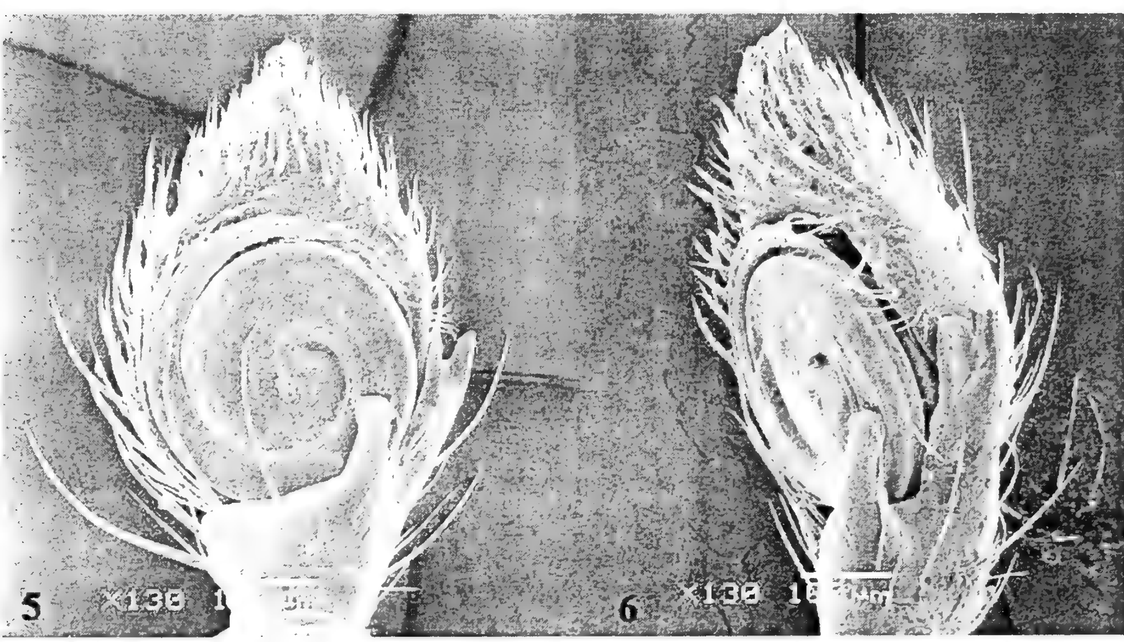
Material and Methods

Most of the specimens were collected in different parts of Turkey by sweeping on plants. The specimens were preserved in 70% ethanol. The present study is based on material deposited in the collections of the Arachnology Museum of Niğde University

(NUAM). All illustrations were made with a Nikon SMZ-U stereomicroscope with drawing tube. Male palp was mounted using a double sided tape on the SEM stubs, coated with gold in a Polaron SC 502 Sputter Coater, and examined with a JOEL JSM 5600 Scanning Electron microscope at 15 kw. All measurements are in millimetres.

Results

Ebrechtella tricuspidata (Fabricius, 1775)
Identification reference: Lehtinen (2005).
Material examined: Turkey: 2♂ 2♀juv. (NUAM), Çankırı province, Ilgaz district, Yenice, 22.09.2004; 1♂ 2♀juv. (NUAM), Ankara province, Kalecik district 04.09.2003; 1♀ 1♀juv. (NUAM), Ankara province, Şereflikoçhisar district, İnebeyli village, 28.05.2003; 2♀ (NUAM), Ankara province, Bala district, Acıöz village, 21.06.2003; 1♀ (NUAM), Yozgat province, Akdağmadeni, Oluközü village, 20.07.2005.
Description: Male. Carapace: 1.38-1.42 long, 1.60-1.62 wide; abdomen: 2.13-2.18 long, 1.50-1.78 wide. Carapace red-brownish, ocular area yellow. Abdomen very light coloured, dorsally with silvery coloured mottles, ventrally cream coloured. Legs yellow. Palpal organ: Figs. 1-2, 5-6.
Female. Carapace: 2-2.06 long, 2.07-2.16 wide; abdomen: 4-4.1 long, 3.20-3.37 wide. Colouration as in male, carapace and abdomen yellow coloured. Epigynum: Fig. 3.
World Distribution: Palaearctic (Platnick, 2007). From south-west Europe (rare) through the whole of Palaearctic Asia to Korea and Taiwan. This species appears more abundant in the eastern part of its range (Lehtinen, 2005).



Figs. 5-6: *Ebrechtella tricuspidata* (Fabricius, 1775), left male palp, 5. ventral view, 6. retrolateral view.

Tmarus stellio Simon, 1875
Identification references: Simon (1932), Logunov (1992).
Material examined: Turkey: 1♀ (NUAM), Ankara province, Kızılcahamam district, 17.06.2003.

Description. Female. Carapace: 1.80 long, 1.75 wide; abdomen: 3.73 long, 3.15 wide. Carapace as wide as long, brown to greyish white, cephalic area mottled with white, ocular area white. Abdomen longer than wide, yellowish white to grey, mottled with brown, ventrally pale yellow, abdominal tubercle small. Legs cream to yellow, spotted with brown. Spermathecae: Fig. 4.
World Distribution: Palaearctic (Platnick, 2007).

Conclusion

With this study, the number of thomisid spiders in Turkey has increased from 66 species that belong to 13 genera to 68 species belonging to 14 genera. The morphometric measurements and other characteristic features of these species are not different from those of European specimens of the same species.

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Scorpions of Kilis Province, Turkey (Arachnida: Scorpiones)

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Abstract

This study is based upon the material of the field studies in Kilis Province, which is located in the southeastern part of Turkey and has not previously studied in detail. In this work, between 7th April and 29th July 2006, a total of 60 scorpion specimens were collected and 7 species belonging to 6 genera and 3 families were studied. They belong to five species of family Buthidae (*Androctonus crassicauda*, *Compsobuthus matthiesseni*, *Leiurus quinquestriatus*, *Mesobuthus eupeus*, *M. nigrocinctus*), one species of Iuridae (*Calchas nordmanni*), and one species of Scorpionidae (*Scorpio maurus*). The species *C. matthiesseni*, *M. eupeus*, *M. nigrocinctus*, *C. nordmanni* and *S. maurus* are recorded for the first time from the province. Furthermore, *C. matthiesseni* is found in the eastern Mediterranean region for the first time. In addition, a key to Kilis scorpion species is presented, ecological notes about these species are provided, and the scorpion fauna of Kilis is compared with that of Gaziantep.

Keywords: Fauna, Scorpions, Buthidae, Iuridae, Scorpionidae, Kilis, Turkey.

Introduction

Kilis is a province of Turkey located in the southern central part of the country along the Syrian border. Kilis Province was a southern part of the province of Gaziantep and became an independent province since 1994. It comprises the southern foothills of the Taurus Mountains west of the Euphrates River and the northern edge of the Syrian Plain. Western and middle parts of Kilis are located in the eastern Mediterranean region while the eastern part of Kilis is located in the southeast Anatolian region.

During the last 50 years, few studies have been carried out and summarized the data of the distributional and biogeographical patterns of the scorpion species which inhabit the Mediterranean region and the southeast Anatolian region (Birula, 1917;

Vachon, 1947, 1951, 1971; Tolunay, 1959; Tulga, 1960; Kinzelbach, 1975, 1980, 1982, 1984, 1985; Levy & Amitai, 1980; Vachon & Kinzelbach, 1987; Kovařík, 1996; Crucitti, 1993, 1998, 1999, 2003; Crucitti & Cicuzza, 2000, 2001; Karataş, 2001; Crucitti & Vignoli, 2002; Karataş & Karataş, 2003; Yağmur, 2005). Few geographical records were the result of scientific expeditions to Kilis Province (Kinzelbach, 1984; Karataş, 2001).

Kilis, Gaziantep and Adıyaman are very important provinces because of the overlapping of the ecogeographic and climatic zones of the Mediterranean region and the southeast Anatolian region of Anatolia. The analysis of the scorpion pattern of these two regions gives an idea to understand the distributional patterns of the Middle East scorpion fauna (Vachon & Kinzelbach, 1987).

The purpose of this study is to introduce the scorpion species which live in Kilis Province as a contribution increasing our knowledge of Turkish scorpion fauna.

Material and Methods

Field work was achieved between 7th April and 29th July 2006. We have collected and examined 60 specimens from 17 different localities in Kilis Province (Figs. 1, 3-7, 9). Scorpions were collected by hand from under stones during the day and with UV light at night between 20.00 – 24.00. All the material mentioned in this work is preserved in 70% alcohol and deposited in the private collection of Ersen Aydın Yağmur (PCEAY). The specimens were identified using an Ivymen ZO2 stereomicroscope.

Results

Five species of family Buthidae and one species of each of family Iuridae and family Scorpionidae were identified. These species can be identified by the following key. *Mesobuthus gibbosus* was not collected from Kilis but it is included in the key because of its near affinity to the collected *Mesobuthus* species.

A key to Kilis scorpion species

1. Sternum triangular, pedipalp patella without ventral trichobothria .... Buthidae ... 3
-. Sternum pentagonal, pedipalp patella with ventral trichobothria 2

2. Manus of pedipalp very broad and about as wide as long, pedipalp patella with three ventral trichobothria .... Scorpionidae, *Scorpio maurus*
-. Manus longer than wide, pedipalp patella with one ventral trichobothrium .... Iuridae, *Calchas nordmanni*

3. Movable finger of pedipalp with three principal distal granules and one terminal granule .... *Androctonus crassicauda*
-. Movable finger of pedipalp with four principal distal granules and one terminal granule 4

4. First two segments of mesosoma with five keels .... *Leiurus quinquestriatus*
-. First two segments of mesosoma with three keels 5

5. Manus of pedipalp narrow, tergal crests of mesosoma exceed posterior margin of tergites, ventrolateral carinae of metasomal segment V without posterior granules enlarged .... *Compsobuthus matthiesseni*

-. Manus of pedipalp broad, tergal crests of mesosoma do not exceed posterior margin of tergites, ventrolateral carinae of metasomal segment V with posterior granules enlarged, often lobate .... *Mesobuthus* ... 6

6. Fourth segment of metasoma with ten keels 7
-. Fourth segment of metasoma with eight keels .... *Mesobuthus eupeus*

7. Fixed finger of pedipalp with 12 oblique granular rows; 13 on movable finger, chela slender [length/width: 5.52±0.35 in males and 5.10±0.39 in females (vid. Yağmur, 2005)] .... *Mesobuthus nigrocinctus*
-. Fixed finger of pedipalp with 11 oblique granular rows; 12 on movable finger, chela coarse [length/width: 4.49±0.09 in males and 4.56±0.09 in females (vid. Yağmur, 2005)] .... *Mesobuthus gibbosus*

Family Buthidae C.L. Koch, 1837

Androctonus crassicauda (Olivier, 1807)

Scorpio crassicauda Olivier, 1807
Type Locality: Kashan, Iran.
Androctonus crassicauda Vachon, 1948

Synonyms:
Buthus crassicauda Simon, 1872
Prionurus crassicauda Pocock, 1895
Buthus (Prionurus) crassicauda Birula, 1896
Buthus (Prionurus) crassicauda crassicauda Birula, 1896

Examined material and stations: 2♂♂, 1♀. Akıncı (Seve) Village, Central District, ca. 36°41'N 37°15'E, 28.v.2006, E.A. Yağmur.

Comments: This species is known from Armenia, Azerbaijan, Bahrain, Egypt (Sinai), Iran, Iraq, Israel, Jordan, Kuwait, Oman, Saudi Arabia, Syria, Turkey, United Arab Emirates and Yemen (Fet & Lowe, 2000; Hendrixson, 2006). It was reported from Diyarbakır (Vachon, 1947), Elazığ, Malatya, Mardin, Şanlıurfa (Vachon, 1951), İçel (Tolunay, 1959), Adıyaman (Crucitti, 1999; Crucitti & Cicuzza, 2001), Kilis (Karataş, 2001), Gaziantep (Yağmur, 2005). *A. crassicauda* was found only in one locality south of Kilis Province (Fig. 1), while Karataş (2001) recorded it from Kilis without definite locality. Yağmur (2005) stated that this species penetrated into middle and eastern part of Gaziantep Province and said that no specimen was collected from the part of province that belongs to the eastern Mediterranean region. The distributional characteristics are similar to Kilis and Gaziantep.

Ecological Notes: This species was generally described as a xerophilic species. According to Amr & Abu Baker (2004), it is a desert adapted species. It has been collected near and inside the village and even in barns, cattle sheds and rooms of farmhouses so it is a strongly anthropotolerant species. The observations and collecting material show us that this species do not live sympatrically with other species, while Yağmur (2005) recorded it with *C. matthiesseni* and *S. maurus* in the same habitat and reported that lowest activity temperature registered for it, in the air, was 15°C.

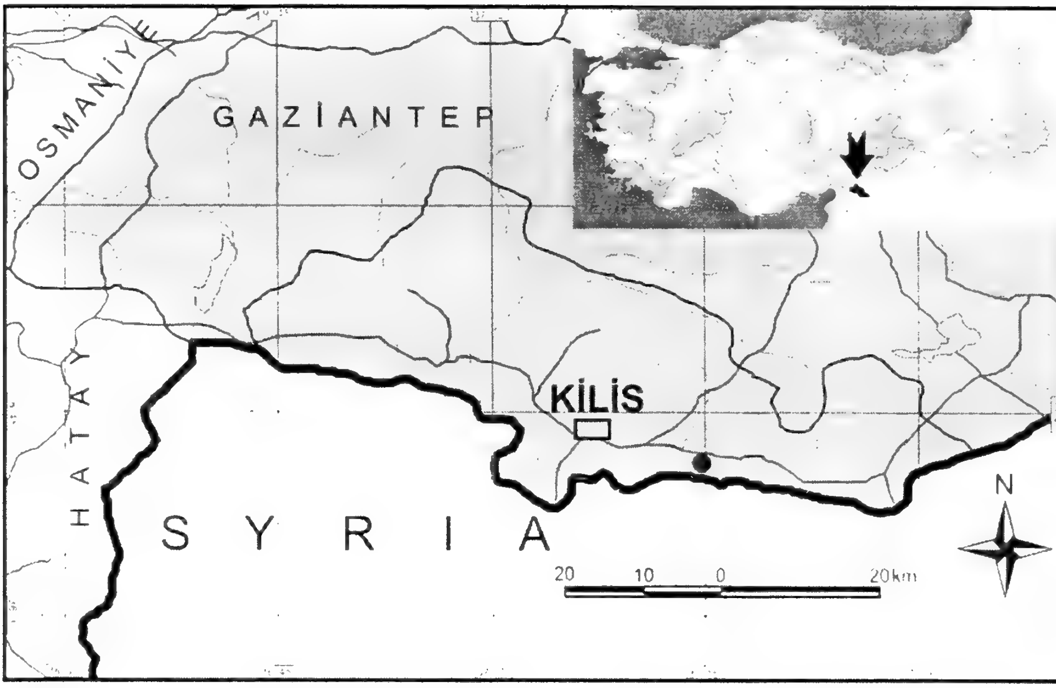

Fig. 1. Map showing *Androctonus crassicauda* specimens' locality in Kilis Province: Akıncı (Seve) Village.

***Compsobuthus matthiesseni* (Birula, 1905)**

Buthus acutecarinatus matthiesseni Birula, 1905
Type Locality: Qum, Markazi Province, Iran.
Compsobuthus matthiesseni Vachon, 1949

Synonyms:
Buthus acutecarinatus matthiesseni Birula, 1910
Buthus acutecarinatus Táborský, 1934
Compsobuthus acutecarinatus matthiesseni Kinzelbach, 1985

Examined material and stations: 2♂♂, 4♀♀. 1♂; Central District, Çörten Village, ca. 36°46'N 37°16'E, 29.iv.2006, E.A. Yağmur. 2♀♀; Musabeyli District, Hasancalı Village, 1 km west, ca. 36°54'N 36°46'E, 27.v.2006, E.A. Yağmur. 1♀; Central District, Konak Village fork in road, the road from Kilis to Gaziantep, 12th km, ca. 36°44'N 37°14'E, 22.iv.2006, E.A. Yağmur. 1♂; Musabeyli District, Küçükahmethöyüğü (Körahmethöyüğü) Village, ca. 37°01'N 36°56'E, 28.v.2006, E.A. Yağmur. 1♀; Elbeyli District, Uzunali Village, 1.5 km northeast, ca. 36°41'N 37°26'E, 30.iv.2006, E.A. Yağmur.

Comments: *C. matthiesseni* (Fig. 2) is known from Iran, Iraq (Sissom & Fet, 1998), Turkey (Kovařík, 1996) and Syria (Kovařík, 2003). The first record of this species was presented by Kovařík (1996) from Diyarbakır. Then it was found in Adıyaman (Crucitti & Vignoli, 2002) and Gaziantep (Yağmur, 2005). This species is distributed in the middle, eastern, northeastern and southeastern parts of Gaziantep (Yağmur, 2005; Yağmur, unpublished data) but there isn't any record from the part that belongs to the eastern Mediterranean region of Gaziantep. *C. matthiesseni* is here recorded for the first time from the eastern Mediterranean region in Turkey (Fig. 3).

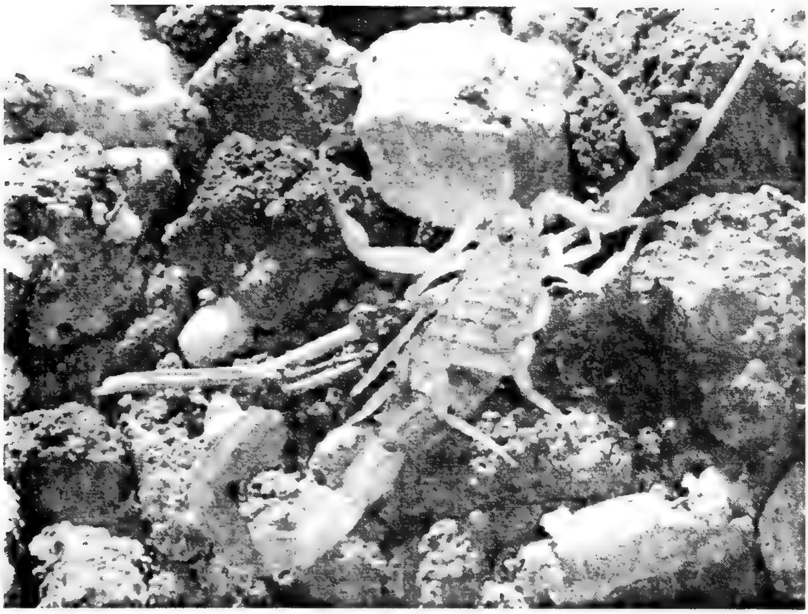

Fig. 2. A picture of *Compsobuthus matthiesseni*.

Ecological notes: It is usually found under stones in steppe areas or on stony ground covered with bushes where it coexist with *C. nordmanni*, *L. quinquestriatus*, *M. nigrocinctus* and *S. maurus*. According to Yağmur (2005), this species shares same habitat with *M. eupeus*, *L. quinquestriatus*, and he noted that lowest activity temperature was 13°C for it. The distributional characteristics of this species are similar in Kilis and Gaziantep.

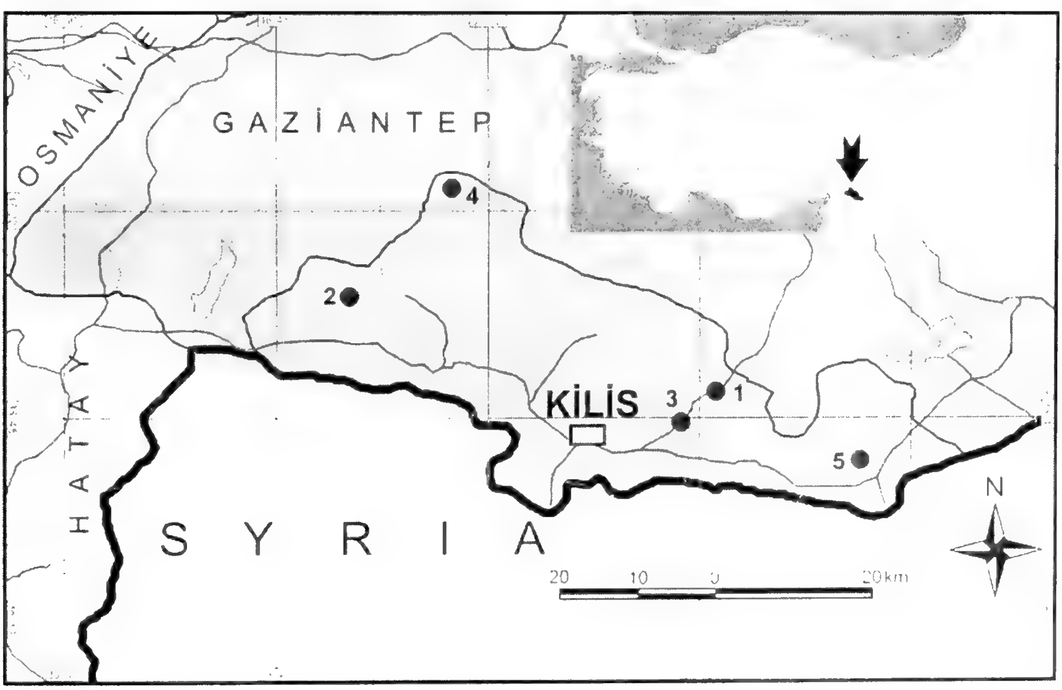

Fig. 3. Map showing *Compsobuthus matthiesseni* specimens' localities in Kilis Province: 1. Çörten Village, 2. Hasancalı Village, 1 km west, 3. Konak Village fork in road (the road from Kilis to Gaziantep, 12th km), 4. Küçükahmethöyüğü Village and 5. Uzunali Village 1.5 km northeast.

Leiurus quinquestriatus (Ehrenberg, 1828)

Androctonus (Leiurus) quinquestriatus Ehrenberg in Hemprich & Ehrenberg, 1828
Type Locality: Upper Egypt and Sinai, Egypt.
Leiurus quinquestriatus Vachon, 1949

Synonyms:
Androctonus (Leiurus) quinquestriatus brachycentrus Ehrenberg in Hemprich & Ehrenberg, 1829
Androctonus (Liurus) quinquestriatus aculeatus Ehrenberg in Hemprich & Ehrenberg, 1831
Androctonus troilus C.L. Koch, 1839
Buthus beccarii Simon, 1882
Buthus voelschowi Werner, 1902
Buthus quinquestriatus libycus Birula, 1908

Examined material and stations: 3♂♂, 13♀♀. 2♀♀; Musabeyli District, Aşağı Kalecik Village, ca. 36°56'N 37°01'E, 22.iv.2006, E.A. Yağmur. 1♀; Elbeyli District, 1.5 km south, ca. 36°39'N 37°28'E, 30.iv.2006, E.A. Yağmur. 2♀♀; Musabeyli District, Hasancalı Village, 1 km west, ca. 36°54'N 36°46'E, 27.v.2006, E.A. Yağmur. 1♀; Musabeyli District, Hasancalı-Yedigöz Villages fork in road, ca. 36°52'N 36°48'E, 27.v.2006, E.A. Yağmur. 3♂♂, 6♀♀; Central District, Küplüce Village, 1 km east, ca. 36°43'N 37°13'E, 29.iv.2006, E.A. Yağmur. 1♀; Musabeyli District, Yuvabaşı Village, 1 km east, ca. 36°52'N 36°57'E, 22.iv.2006, E.A. Yağmur.

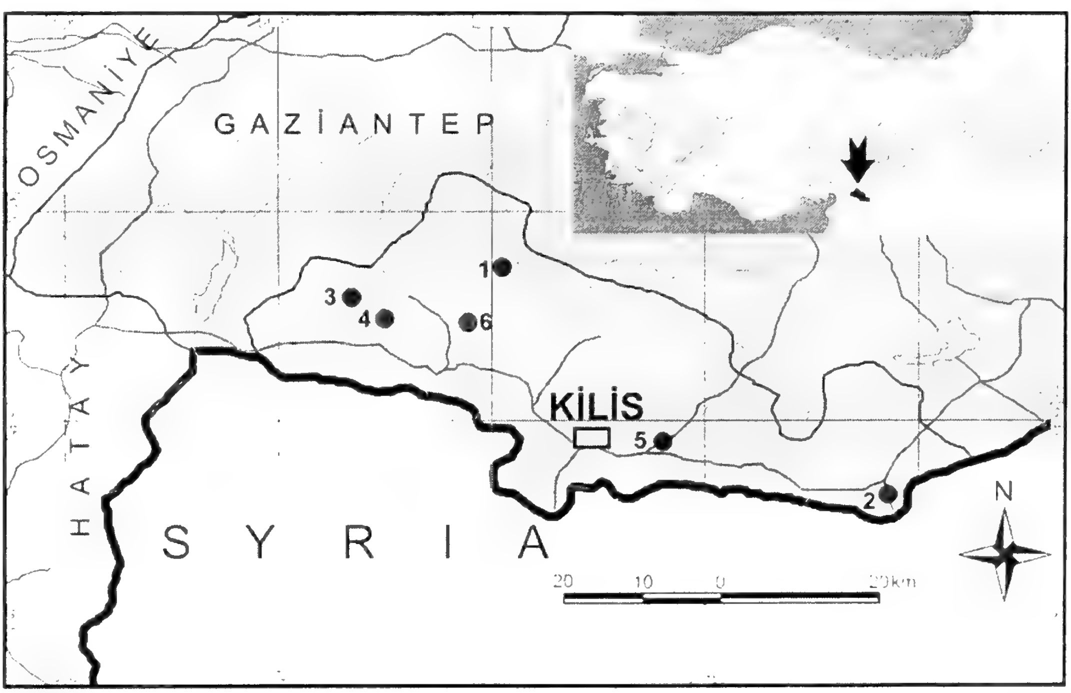

Fig. 4. Map showing *Leiurus quinquestriatus* specimens' localities in Kilis Province: 1. Aşağı Kalecik Village, 2. Elbeyli 1.5 km south, 3. Hasancalı Village, 1 km west, 4. Hasancalı-Yedigöz Villages fork in road, 5. Küplüce Village, 1 km east and 6. Yuvabaşı Village, 1 km east.

Comments: *L. quinquestriatus* is known from Algeria, Chad, Egypt, Ethiopia, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Mali, Niger, Oman, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Tunisia, Turkey, United Arab Emirates and Yemen (Fet & Lowe, 2000). This species was recorded for the first time from Turkey (Adıyaman) by Tulga (1960). Additional records were given from Hatay (Kinzelbach, 1984, Karataş, 2001), Kilis (Kinzelbach, 1984), Mardin (Crucitti & Vignoli, 2002) and Gaziantep (Yağmur, 2005). This species is quite common in the southeastern Anatolian region. Few localities were reported in the eastern Mediterranean region (Kinzelbach, 1984, Karataş, 2001, Yağmur, 2005). The distributional characteristics of this species are similar in Kilis and Gaziantep (Fig. 4).

Ecological notes: The specimens were collected from under stones among steppe vegetation or on stony ground covered with bushes. *C. matthiesseni*, *M. nigrocinctus* and *S. maurus* are inhabitants with *L. quinquestriatus* in the same area. Acording to Yağmur (2005), *C. matthiesseni*, *M. eupeus*, *M. nigrocinctus* and *S. maurus* live within the same habitat patch with *L. quinquestriatus*. He recorded that lowest surface activity temperature was 13°C and vertical distribution was up to 1225 m.

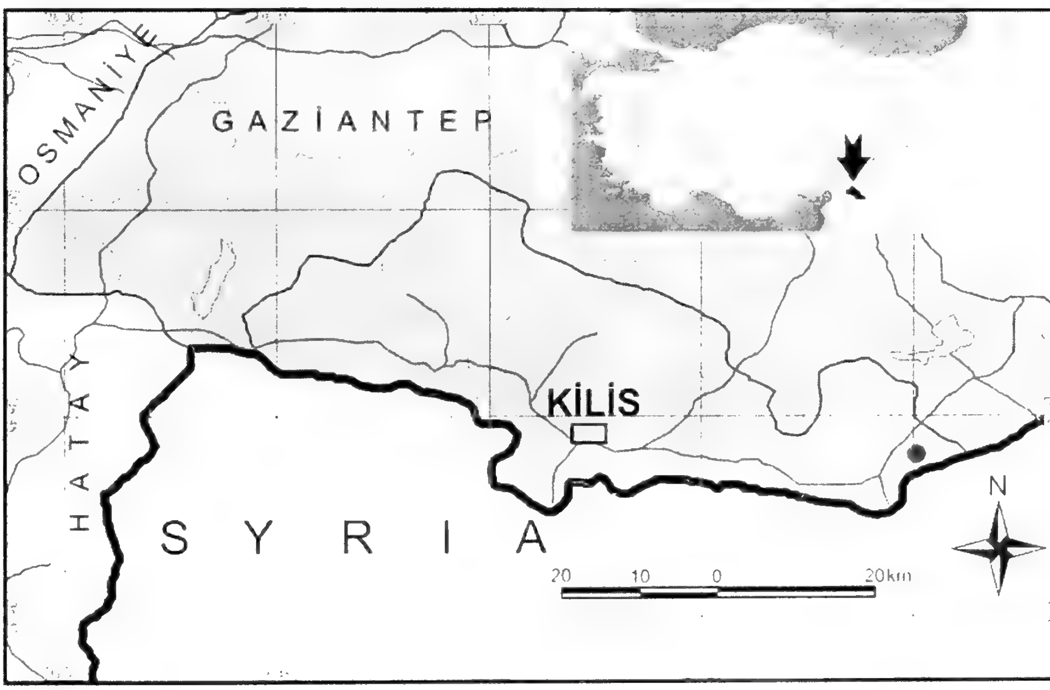

Fig. 5. Map showing *Mesobuthus eupeus* specimens' locality in Kilis Province: Çangallı Village.

Mesobuthus eupeus (C.L. Koch, 1839)

Androctonus eupeus C.L. Koch, 1839
Type Locality: Caucasus.
Mesobuthus eupeus Vachon, 1950

Synonyms:
Androctonus thersites C.L. Koch, 1839
Androctonus ornatus Nordmann, 1840

Androctonus cognatus L. Koch, 1878
Buthus afghanus Pocock, 1889
Buthus phillipsii Pocock, 1889
Buthus pachysoma Birula, 1900

Examined material and stations: 3♂♂, 2♀♀. Elbeyli District, Çangallı Village, ca. 36°43'N 37°31'E, 20.iv.2006, E.A. Yağmur.

Comments: *M. eupeus,* is known from Afghanistan, Armenia, Azerbaijan, China, Georgia, Iran, Iraq, Kazakhstan, Kyrghyzstan, Mongolia, Pakistan, Russia (Province of Astrakhan), Syria, Tajikistan, Turkey, Turkmenistan and Uzbekistan (Fet & Lowe, 2000). This species is spread over most of the eastern Anatolian region (Artvin, Kars, Erzurum, Ağrı, Kars, Van), all parts of the southeastern Anatolian region (Birula, 1917; Crucitti, 1993, 1999; Crucitti & Cicuzza 2000, 2001; Crucitti & Vignoli, 2002), Central Anatolia (Kayseri, Nevşehir and Niğde) (Karataş & Karataş, 2003) and The Aegean Region (Akhisar/Manisa) (Teruel, 2002). The limit of *M. eupeus* is Gaziantep in the southeastern Anatolian region (Fet & Braunwalder, 2000). The present study gives the first record of *M. eupeus*, found east of Kilis Province (Fig. 5). It was already recorded from central, eastern and northeastern parts of Gaziantep (Yağmur, 2005).

Ecological notes: *M. eupeus* is collected from steppe and stony area near an agricultural field. No other species was recorded from the same habitat with *M. eupeus*. Yağmur (2005) reported this species with *C. nordmanni*, *C. matthiesseni*, *L. quinquestriatus*, *M. nigrocinctus* and *S. maurus* in the same habitat and noted that surface lowest activity temperature was 8°C for it.

Mesobuthus nigrocinctus (Ehrenberg, 1828)

Androctonus (Prionurus) nigrocinctus Ehrenberg in Hemprich & Ehrenberg, 1828
Type Locality: Beirut, Lebanon.
Mesobuthus nigrocinctus Fet *et. al.*, 2000

Synonyms:
Buthus nigrocinctus Simon, 1872
Buthus gibbosus (part) Kraepelin, 1891
?*Mesobuthus sp.* Kinzelbach, 1984
?*Mesobuthus gibbosus ssp.* (?) Kinzelbach, 1985
?*Mesobuthus sp.* Kabakibi *et.al.*, 1999

Examined material and stations: 9♂♂, 9♀♀, 2 juveniles. 1♂, 2♀♀; Musabeyli District, Aşağı Kalecik Village, ca. 36°56'N 37°01'E, 22.iv.2006, E.A. Yağmur. 1♀; Musabeyli District, Çınar Village, ca. 37°00'N 36°59'E, 29.vii.2006, E.A. Yağmur. 5♂♂, 4♀♀, 1 juvenile; Central District, Çörten Village, ca. 36°46'N 37°16'E, 27.v.2006, E.A. Yağmur. 1♂, 1♀, 1 juvenile; Musabeyli District, Hüseyinoğlu Village, ca. 36°56'N 36°56'E, 22.iv.2006, E.A. Yağmur. 1♂; Central District, Konak Village fork in road, the road from Kilis to Gaziantep, 12th km, ca. 36°44'N 37°14'E, 22.iv.2006, E.A. Yağmur. 1♂; Musabeyli District Küçükahmethöyüğü (Körahmethöyüğü) Village, ca. 37°01'N 36°56'E, 28.v.2006, E.A. Yağmur. 1♀; Central District, Küplüce Village, 1 km east, ca. 36°43'N 37°13'E, 29.vi.2006, E.A. Yağmur.

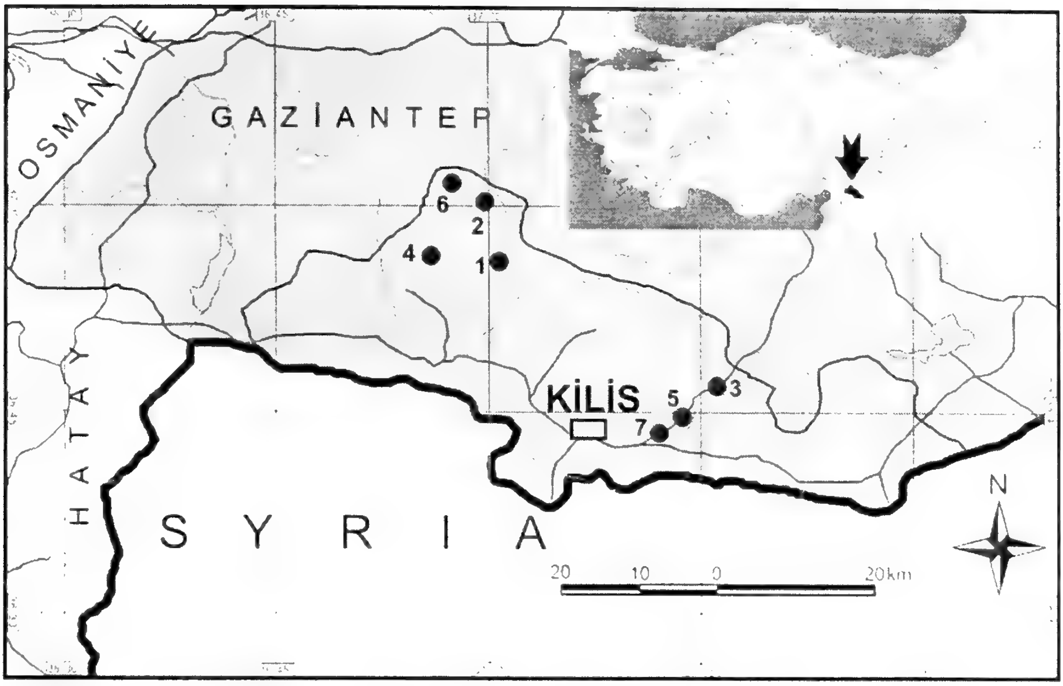

Fig. 6. Map showing *Mesobuthus nigrocinctus* specimens' localities in Kilis Province: 1. Aşağı Kalecik Village, 2. Çınar Village, 3. Çörten Village, 4. Hüseyinoğlu Village, 5. Konak Village fork in road (the road from Kilis to Gaziantep, 12th km), 6. Küçükahmethöyüğü (Körahmethöyüğü) Village and 7. Küplüce Village, 1 km east.

Comments: *M. nigrocinctus* was described for the first time from Lebanon by Ehrenberg (Hemprich & Ehrenberg, 1828). It was recently recorded from Israel (Fet *et al.*, 2000) and Turkey (Crucitti & Vignoli, 2002) from Adıyaman and Hatay Provinces. Afterwards, Yağmur (2005) recorded this species from Gaziantep, and more recent findings of it from middle, east, north and south-west of Gaziantep were reported. He suggested that *Mesobuthus gibbosus* is distributed west and north-west of Gaziantep. Our record is the first time from Kilis. In spite of the record of Crucitti & Vignoli (2002) of *M. gibbosus* from one locality of Gaziantep, southeast Anatolia, Yağmur (2005) stated that only *M. eupeus* and *M. nigrocinctus* occur at the same area, and that there is no other *Mesobuthus* species distributed in southeast Anatolia. Also, both *M. eupeus* and *M. nigrocinctus* were recently found from the same area (Yağmur, unpublished data). The zoogeographical distribution and present findings of *M. nigrocinctus* in Kilis Province support Yağmur's (2005) findings (Fig. 6).

Ecological notes: The specimens were collected by turning rocks, under stones in the scarce vegetation of oak forested area or in the mountainous area with scarce vegetation. Acording to Yağmur (2005) and present study, the distribution of *M. nigrocinctus* is allopatric with *M. gibbosus* and sympatric with *M. eupeus*. Fet *et al.* (2000) and Varol *et al.* (2006) noted that this species was sympatrically found with *S. maurus* and *Compsobuthus schmiedeknechti*. Similarly, *M. nigrocinctus* was syntopically found with *C. matthiesseni*, *L. quinquestriatus* and *S. maurus*. Yağmur (2005), in his studies in Gaziantep Province, emphasized that *C. nordmanni*, *L. quinquestriatus* and *S. maurus* were predominantly found with *M. nigrocinctus* in the same area. Fet *et al.* (2000) appended notes on vertical distribution of *M. nigrocinctus* between 1300-1700 m, and

Yağmur (2005) gave a detail that surface lowest activity temperature was 13°C for this species.

Family Iuridae Thorell, 1876

***Calchas nordmanni* Birula, 1899**

Calchas nordmanni Birula, 1899
Type Locality: Ardanuch, Artvin, Turkey.

Synonyms:
Chactas nordmanni Mello-Leitão, 1942
Paraiurus nordmanni Vachon & Kinzelbach, 1987

Examined material and stations: 4♀♀. 2♀♀; Elbeyli District, Çanak Village, Sekizler Village fork in road, 1 km west, ca. 36°40'N 37°22'E, 30.iv.2006, E.A. Yağmur. 2♀♀; Elbeyli District, Uzunali Village, 1.5 km northeast, ca. 36°41'N 37°26'E, 22.iv.2006, E.A. Yağmur.

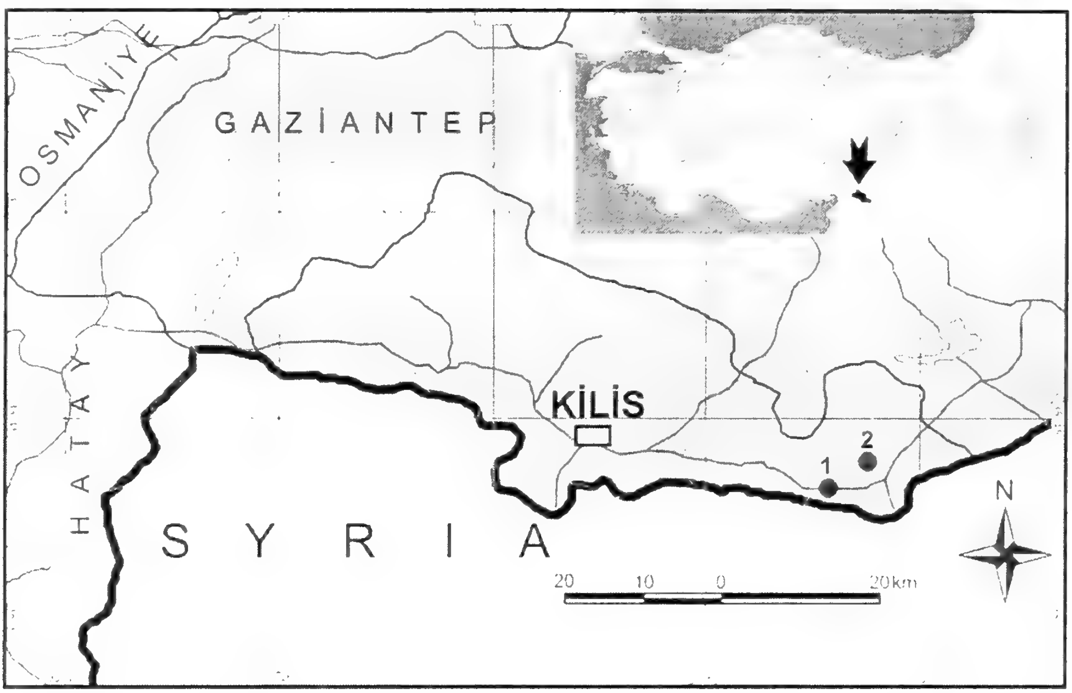

Fig. 7. Map showing *Calchas nordmanni* specimens' localities in Kilis Province: 1. Çanak Village (Sekizler fork in road) 1 km west and 2. Uzunali Village 1.5 km northeast.

Comments: *C. nordmanni* was originally described from Artvin (Çoruh Vadisi) (Birula, 1899). Then, this species was collected from Erzurum, Antalya, Siirt (Kinzelbach, 1980, 1982), Diyarbakır, Elazığ, Batman, Siirt, Şırnak, Hakkâri, Şanlıurfa (Vachon & Kinzelbach, 1987), Samos Isl. (Sissom, 1987), Megisti Isl., Malatya ve Hatay, Halfeti (Şanlıurfa), Nemrut Mountain (Adıyaman) (Fet & Braunwalder, 2000), Bilecik (Francke & Soleglad, 1981) and Gaziantep (Yağmur, 2005). This species is spread in central and eastern parts of Gaziantep (Yağmur, 2005; Yağmur, unpublished data). The distributional characteristics of this species is similar in Kilis and Gaziantep (Fig. 7).

Fig. 8. A picture of *Calchas nordmanni.*

Ecological notes: This species is endemic to some of Greek Islands (near western and southern coastal borders of Turkey) and Turkey. This represents a small population with limited distribution. *C. nordmanni* is usually found under stones in steppe vegetation, covered with basalt stones (Fig. 8). This scorpion's niche is overlapping with *C. matthiesseni*. Yağmur (2005) recorded the coexistence of *M. eupeus*, *M. nigrocinctus* and *S. maurus* in the same habitat and that vertical distribution of *C. nordmanni* was up to 1000 m.

Family Scorpionidae Latreille, 1802

Scorpio maurus Linnaeus, 1758

Scorpio maurus Linnaeus 1758
Type Locality: Africa.

Synonyms:
Buthus (*Heterometrus*) *palmatus* Ehrenberg in Hemprich & Ehrenberg, 1828
Buthus testaceus C.L. Koch, 1838
Heterometrus propinquus Simon, 1872
Heterometrus arabicus Pocock, 1900
Heterometrus townsendi Pocock, 1900
Heterometrus fuliginosus Pallary, 1928

Examined material and stations: 4 ♂♂, 1♀, 1 juvenile. 1 juvenile; Polateli District, Belenözü (Ravanda) Village, 2 km north, ca. 36°48'N 37°05'E, 07.iv.2006, E.A. Yağmur. 1♀; Central District, Çörten Village, ca. 36°46'N 37°16'E, 29.iv.2006, E.A. Yağmur. 1♂; Central District, Gözkaya Village, 1 km northwest, ca. 36°50'N 36°48'E, 27.v.2006, E.A. Yağmur. 2♂♂; Musabeyli District, Hasancalı Village, 1 km west, ca. 36°54'N 36°46'E, 27.v.2006, E.A. Yağmur. 1♂; Musabeyli District, Küçükahmethöyüğü (Körahmethöyüğü) Village, ca. 37°01'N 36°56'E, 28.v.2006, E.A. Yağmur.

Comments: *S. maurus* is spread in North Africa, Middle East and Arabian Peninsula. This species is known from Elazığ to Mersin and to the Amanos Mountains (Levy & Amitai, 1980). Kinzelbach (1985) indicated on the map that this species exhibited wide spread in Mersin, Adana, Hatay, Gaziantep, Kilis, Adıyaman, Şanlıurfa, Diyarbakır, Batman, Siirt, Bitlis, Van, Hakkâri, Şırnak and Mardin. But he did not record any locality from Kilis Province. According to Crucitti & Vignoli (2002), this species occurs in Mersin, Adana, Hatay in the eastern Mediterranean region; nevertheless it is under suspect in Kahramanmaraş; and well known in Adıyaman, Gaziantep, Şanlıurfa, Diyarbakır and Mardin in southeast Anatolia. We suggested that *S. maurus* is spread all over Kilis Province, and Yağmur (2005) also stated that this species is spread all over Gaziantep (Fig. 9).

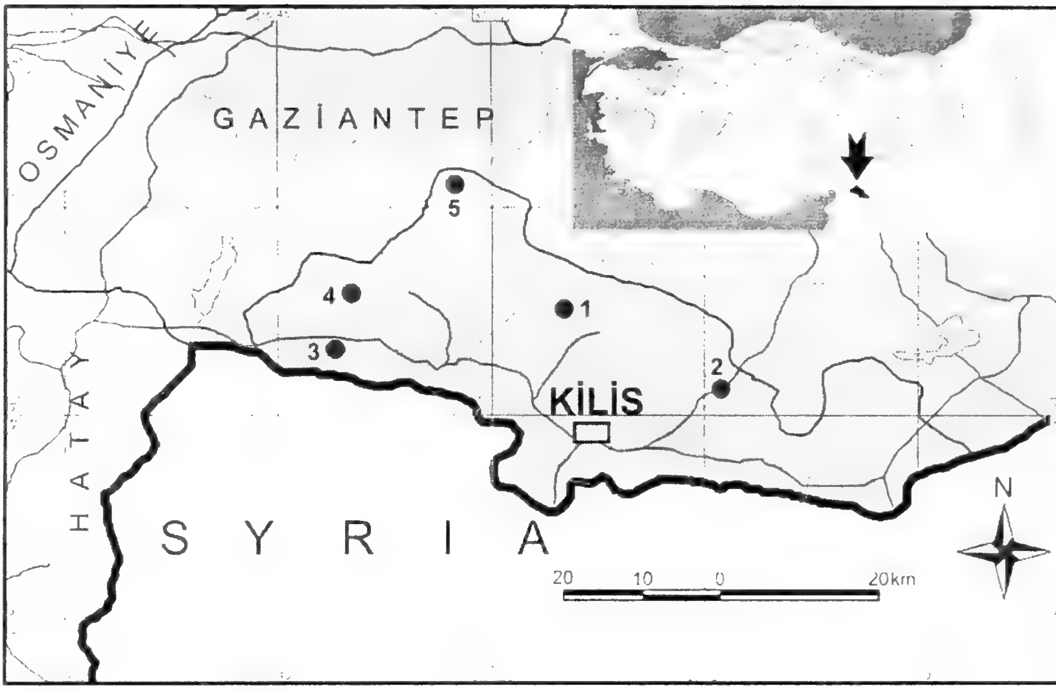

Fig. 9. Map showing *Scorpio maurus* specimens' localities in Kilis Province: 1. Belenözü (Ravanda) Village, 2 km north, 2. Çörten Village, 3. Gözkaya Village, 1 km northwest, 4. Hasancalı Village, 1 km west and 5. Küçükahmethöyüğü (Körahmethöyüğü) Village.

Ecological notes: This species is fossorial and constructs its burrow under stones. It was collected from under stones in steppe vegetation where sparse, dense or without oak forested area. Warburg (1997) stated that, this oakwook scorpionid, formerly the most abundant scorpion in the Mediterranean region, showed a marked decline in numbers. *S. maurus* is collected with *C. matthiesseni*, *L. quinquestriatus* and *M. nigrocinctus* in the same habitat. Yağmur (2005) reported that *C. nordmanni*, *L. quinquestriatus*, *M. eupeus*, *M. gibbosus* and *M. nigrocinctus* coexist with *S. maurus*. Vertical distribution of *S. maurus* was reported up to 1600 m (Karataş, 2001) and lowest surface activity temperature registered was 8°C (Yağmur, 2005).

Discussion

The Kilis material includes 60 specimens that belong to seven species: *A. crassicauda*, *C. nordmanni*, *C. matthiesseni*, *L. quinquestriatus*, *M. eupeus*, *M.*

nigrocinctus and *S. maurus*. Kilis Province has rich scorpion fauna that includes seven of 17 species [*Androctonus crassicauda, Calchas nordmanni, Compsobuthus matthiesseni, Euscorpius carpathicus, E. italicus, E. mingrelicus, E. tergestinus, Iurus dufoureius asiaticus, Leiurus quinquestriatus, Mesobuthus caucasicus, M. eupeus, M. gibbosus, Scorpio maurus fuscus* (Fet *et al.*, 2000), *Buthacus macrocentrus, Hottentotta saulcyi, Mesobuthus nigrocinctus* (Crucitti & Vignoli, 2002), *Compsobuthus schmiedeknechti* (Varol *et al.*, 2006)] of Turkish scorpions.

The most venomous scorpion, *L. quinquestriatus* (16 specimens) [with LD_{50} = 0.25 mg/kg (Simard & Watt, 1990)] and *M. nigrocinctus* (20 specimens) were very common in the province. We also found another venomous scorpion, *A. crassicauda* [with LD_{50} = 0.40 (Simard & Watt, 1990)], only 3 specimens in the study area. Observations indicated that *L. quinquestriatus* prefers to live far away from the human settlements. On the contrary, *A. crassicauda* enters the farmhouses and barns. Similarly, *M. nigrocinctus* and *M. eupeus* were found near or inside the human settlements too. Both *L. quinquestriatus* and *A. crassicauda* are dangerous for human life. It is interesting that *M. gibbosus* could not be found in Kilis Province despite a few researchers collected it in the neighbour province Gaziantep (Crucitti & Vignoli, 2002; Yağmur, 2005) and Hatay (Karataş, 2001).

Considering distributional affinities of the genera, genus *Mesobuthus* has Central Asian-Balkan range and genus *Calchas* has Aegean-Anatolian range while the genera *Androctonus*, *Compsobuthus*, *Leiurus* and *Scorpio* have Saharo-Sindian distribution. Since Kilis is situated in the southeastern Anatolian transitional region, the scorpiofauna of this area is a mixture of the species with different zoogeographical origin. Therefore, Kilis has rich scorpion fauna relatively more than other provinces of Turkey.

C. nordmanni, *C. matthiesseni*, *M. eupeus*, *M. nigrocinctus* and *S. maurus* are reported in this study as new geographical records for Kilis Province.

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A seven-legged pholcid spider from Egypt (Araneida: Pholcidae)

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Abstract

The second seven-legged spider is here recorded. It belongs to family Pholcidae. This male *Artema atlanta* Walckenaer, 1837 was collected from Burg El-Arab, in the Mediterranean region north of Egypt.

Keywords: Spiders, Araneida, Pholcidae, Seven-legged, Egypt.

Among a collection of arthropods from the western area of the Mediterranean coast of Egypt made by Drs. A.H. Ali and T. Tantawi of the Faculty of Science of Alexandria University, I found a seven-legged pholcid male spider. It was collected from the area of El-Mallahat near Burg El-Arab, about 50 km west of Alexandria (30°55'36"N, 29°31'50"E, elevation 20m), on 19 September 1998, by Drs. A.H. Ali and T. Tantawi. It is now deposited in the Arachnid Collection of Egypt (ACE 19980919-01).

This specimen is identified as *Artema atlanta* Walckenaer, 1837, a pantropical pholcid species (Platnick, 2007) which is widely distributed in Egypt (El-Hennawy, 2006). It has four right legs and only three left legs. There is only one leg instead of the 1^{st} and 2^{nd} left legs (Fig.1).

The first recorded seven-legged spider was a female *Larinioides suspicax* (O.P.-Cambridge, 1876) of Family Araneidae (El-Hennawy, 2002). It was also collected from the Mediterranean region of Egypt. It had only three legs at the left side too.

This is the second case of a seven-legged spider which I could find in Egypt. There is no other published records of this kind until now.

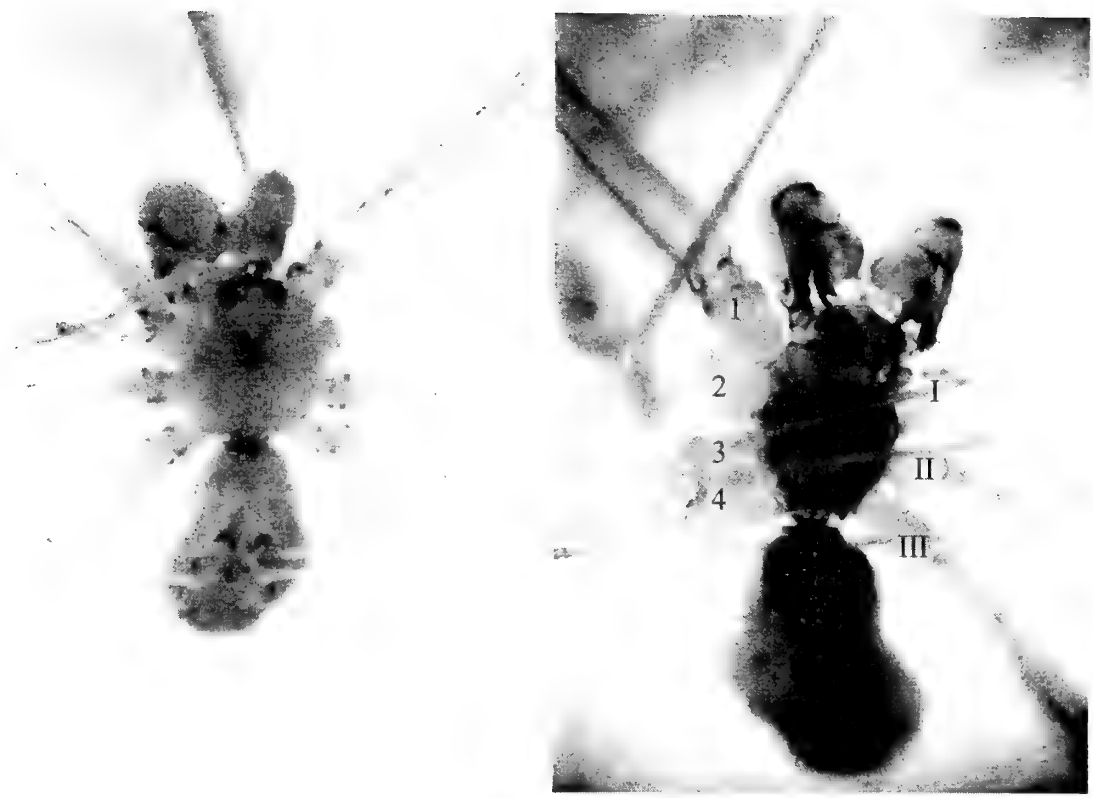

Fig. 1. Seven-legged *Artema atlanta* male, dorsal view (left) and ventral view (right).

Acknowledgments

I thank Drs. Abdel-Nasser H. Ali and Tarek Tantawi (Alexandria) who collected the examined pholcid specimen and made it available to me.

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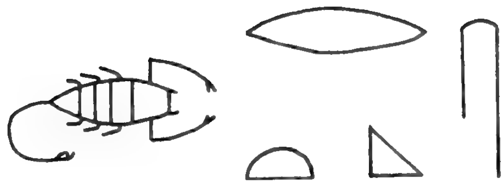

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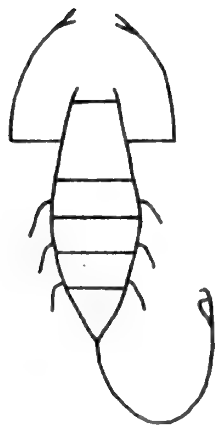

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A new locality for *Charinus ioanniticus* (Kritscher, 1959) (Amblypygi: Charinidae) in Turkey

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Abstract

Charinus ioanniticus (Kritscher, 1959) (Charinidae) is recorded from a new locality in Turkey. Seven specimens were collected from Aşağıarıcaklı village near Bahçe district from the south of Turkey. Identifying photographs and distribution map of this species in Turkey are given.

Keywords: Amblypygi, *Charinus ioanniticus*, Turkey.

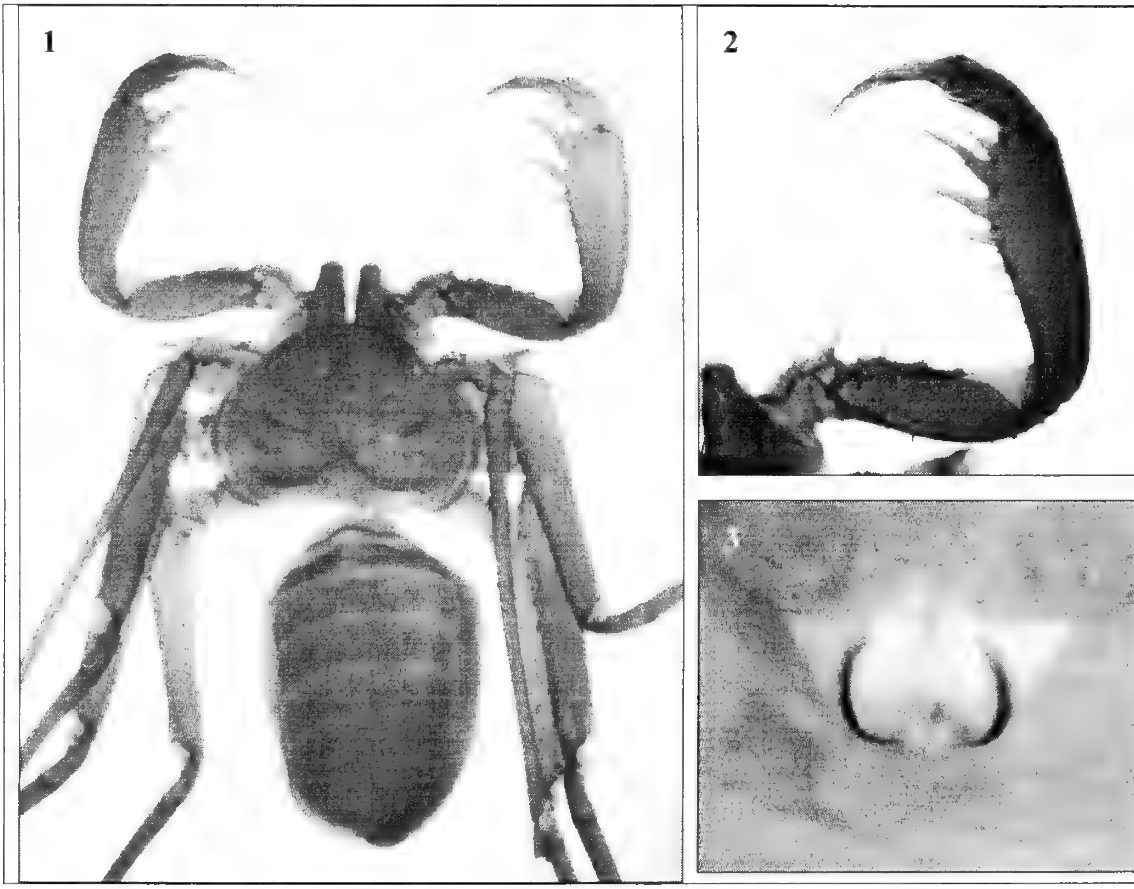
Introduction

Members of the Amblybygi are commonly known as whip spiders. Whip spiders are mainly found in tropical and sub-tropical terrestrial ecosystems but most genera have localized distribution, where they occur under rocks, in rock crevices, caves, cave-like places and under bark of trees. They have flattened bodies and spiny pedipalps that are lengthened in many species, particularly in adult males. The carapace is wider than long and the chelicerae are two-segmented. They lack the flagellum found in other Pedipalpi (Harvey, 2003).

The studies on amblypygid fauna of Turkey, despite its outstanding zoogeographical interest, is nearly unknown. Only one study was made by Kovařík & Vlasta (1996) on amblypygid fauna of Turkey. In their study, *Charinus ioanniticus* (Kritscher, 1959) had been recorded from Turkey for the first time. Other specimens of *C. ioanniticus* had been collected from different localities and their data were published by Weygoldt in 2005. In the present study, we add identifying photographs and new locality to the distribution of *C. ioanniticus* in Turkey.

Material and Methods

In this study, seven specimens were collected from south of Turkey. Examined specimens are deposited in the Arachnology Museum of Niğde University (NUAM). The specimens were preserved in 70% ethanol. The identification was made by means of a SZX61 Olympus stereomicroscope. In the identification of this species, the works of Kritscher (1959), Kovařík & Vlasta (1996), El-Hennawy (2002) and Weygoldt (2005) were consulted.



Figs. 1-3: *Charinus ioanniticus* (Kritscher, 1959) male. 1. General habitus. 2. Right pedipalp, dorsal view. 3. Genitalia.

Results

Charinus ioanniticus (Kritscher, 1959)
Figs. 1-4

Lindosiella ioannitica Kritscher, 1959: 454–457, figs 1-4; Kraus, 1961: 491.
Charinus ioanniticus (Kritscher): Weygoldt, 1972: 123, 129, fig. 22c; Delle Cave, 1986: 150-151, fig. II ; Kovařík & Vlasta, 1996: 57–58; Weygoldt, 2000: 74, 126; El-Hennawy, 2002: 452-453, figs 1-2; Harvey, 2003: 6; Weygoldt, 2005: 44-47.

Material. 1 male and 4 juveniles, Aşağıarıcaklı village, Bahçe district, Osmaniye Province, south of Turkey (37°11.418N-36°36.525E), 02 May 2007, 375m; 2 juveniles, 22 May 2007, same locality (Figs. 1-3).

Remarks. During our trips, we found one male and 6 juvenile amblypygid samples. All specimens were collected from under-surface flat and broad boulders from desiccated brook-bed out of Aşağıarıcaklı village. The stony building where we found all specimens, was covered by *Platanus* trees and their debris. Although most of Turkish specimens were from small and humid caves which were only a few meters long, where they appeared at night close to floor (Weygoldt, 2005), we collected this species from a stony building area at daytime. The former records of *C. ioanniticus* and this new one show that this species is distributed around the south of Turkey (Fig. 4). It is expected that careful searching will reveal further localities in this area.

World distribution. Egypt, Greece, Israel and Turkey (Weygoldt, 2005).

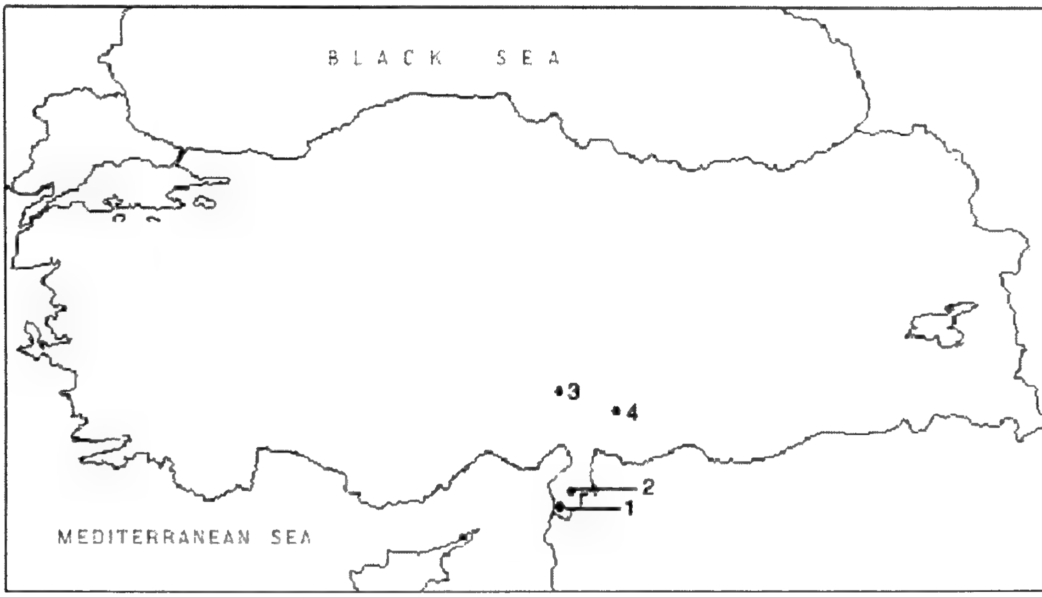


Fig. 4. Distribution map of *Charinus ioanniticus* in Turkey. 1. Hatay, Samandağ (Çevlik village); 2. Antakya (7 km east of Yesilkent); 3. Adana (12 km north of Kozan); 4. Osmaniye, Bahçe (Aşağıarıcaklı village) (New Locality).

Acknowledgments

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The comb-footed spiders fauna of the central Anatolia region and new records for the Turkish fauna (Araneae: Theridiidae)

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Abstract

Twenty nine species of Theridiidae were collected from Central Anatolia. Five species, *Neottiura bimaculata* (Linnaeus, 1767), *Simitidion simile* (C.L. Koch, 1836), *Theridion betteni* Wiehle, 1960, *Theridion blackwalli* O.P.-Cambridge, 1871, and *Theridion nigrovariegatum* Simon, 1873 are recorded for the first time from Turkey. A few identification morphological hints of those five species, in addition to figures of their male palp and females epigynes, are included. The characteristic features of these species are not different from those of European specimens.

Keywords: Spiders, Araneae, Theridiidae, Fauna, Central Anatolia Region, Turkey.

Introduction

Members of the family Theridiidae exhibit great variety in shape and colouration; the majority have an abdominal pattern, but some are uniformly greyish or black and resemble those small members of the Linyphiidae, known as 'Money spiders'. However, tarsus IV is characteristic, with a comb of serrated bristles on the under surface (Roberts, 1995). The comb-footed spiders (Theridiidae) constitute one of the largest spider families, with 2281 species in 96 worldwide distributed genera (Platnick, 2007). They are among successful spider families. So far, 10 genera and 46 species were recorded from Turkey (Bayram, 2002, 2007; Topçu *et al.*, 2005; Türkeş & Mergen, 2005a, 2005b).

Material and Methods

The material was collected during the years 2003-2005. The specimens were preserved in 70% ethanol. The identifications and drawings were done by means of a Nikon SMZ-U stereomicroscope with a camera lucida. The keys of Heimer & Nentwig (1991), Roberts (1995) and Locket & Millidge (1953) were consulted for identification. The studied specimens were deposited in the Arachnology Museum of Niğde University (NUAM). All measurements are in millimetres. [IMH = identification morphological hints]

Results and Discussion

Achaearanea lunata (Clerck, 1757)
Material examined: 1♀, Ankara province, Kızılcahamam district, 10.VII.2003.
World distribution: Palearctic (Platnick, 2007).

Crustulina sticta (O.P.-Cambridge, 1861)
Material examined: 1♂, 4♀♀, Karaman province, Ermenek district, 28.V.2005; 3♀♀, Konya province, Hadım district, 27.V.2005; 2♀♀, Konya province, Ortaköy district, 13.V.2005; 1♂, Karaman province, Kazımkarabekir district, 27.V.2005; 1♀, Ankara province, Çubuk district, 16.V.2003; 1♀, Ankara province, Evren district, 28.V.2003.
World distribution: Holarctic (Platnick, 2007).

Dipoena braccata (C.L. Koch, 1841)
Material examined: 1♀, Çankırı province, Ilgaz district, 22.VII.2004.
World distribution: Europe, Mediterranean (Platnick, 2007).

Dipoena erythropus (Simon, 1881)
Material examined: 2♂♂, Ankara province, Nallıhan district, 23.VI.2003.
World distribution: Europe (Platnick, 2007).

Enoplognatha mordax (Thorell, 1875)
Material examined: 1♂, Kayseri province, Pınarbaşı district, 23.VI.2005; 1♀, Çankırı province, Şabanözü district, 29.VII.2005; 1♀, Ankara province, Bala district, 21.VI.2003.
World distribution: Palearctic (Platnick, 2007).

Enoplognatha ovata (Clerck, 1757)
Material examined: 2♂♂, Ankara province, Polatlı district, 18.VI.2003; 1♂, 2♀♀, Ankara province, Elmadağ district, 15.V.2003; 4♀♀, Ankara province, Çubuk district, 16.VII.2003; 3♀♀, Ankara province, Kalecik district, 23.VII.2003; 3♀♀, Ankara province, Beypazarı district, 07.VI.2003; 1♂, Ankara province, Ayaş district, 20.VI.2003; 2♀♀, Ankara province, Akyurt district, 23.VII.2003; 2♀♀, 2♂♂, Ankara province, Kızılcahamam district, 10.VII.2003; 1♂, Ankara province, Çubuk district, 25.VI.2003; 5♀♀, Ankara province, Nallıhan district, 17.VII.2003; 4♀♀, 1♂, Yozgat province, Akdağmadeni district, 18.VII.2003; 2♀♀, Aksaray province, Ortaköy district, 29.VI.2004; 1♀, Kayseri province, Pınarbaşı district, 20.VII.2003; 2♀♀, Kırşehir province, Mucur district, 26.VI.2004; 1♀, Sivas province, Zara district, 19.VII.2003; 1♂, 7♀♀, Çankırı province, Kurşunlu district, 27.VII.2005; 7♀♀, Çankırı province, İkizören district, 22.VII.2004; 1♂, 7♀♀, Çankırı province, Çerkeş district, 27.VII.2005; 5♀♀, Çankırı province, Korgun district, 28.VII.2005; 6♀♀, Çankırı province, Ilgaz district, 28.VII.2005; 1♂, 1♀, Nevşehir province, Ürgüp district, 22.VI.2005; 1♂, 5♀♀, Sivas province, Hafik district, 21.VII.2005; 2♀♀, Sivas province, Doğanşar district, 21.VII.2005; 5♀♀, Yozgat province, Akdağmadeni district, 20.VII.2005; 3♀♀, Sivas province, Yıldızeli district, 22.VII.2005; 3♂♂, Kayseri province, Yeşilhisar district, 22.VI.2005; 1♂, 1♀, Sivas province, Suşehri district, 21.VII.2005.
World distribution: Holarctic (Platnick, 2007).

Enoplognatha thoracica (Hahn, 1833)
Material examined: 2♀♀, Aksaray province, Yenikent district, 29.VI.2004; 1♂, 2♀♀, Ankara province, Ayaş district, 14.V.2003; 5♀♀, Kırşehir province, Akpınar district,

21.VI.2005; 1♀, Kırşehir province, Kaman district, 21.VI.2005; 1♀, Sivas province, Koyulhisar district, 21.VII.2005; 3♀♀, Ankara province, Çubuk district, 25.VI.2003; 4♀♀, Nevşehir province, Ürgüp district, 22.VI.2005; 1♀, Ankara province, Güdül district, 24.V.2004; 1♀, Niğde province, Ulukışla district, 17.VI.2005; 1♀, Ankara province, Şereflikoçhisar district, 09.VII.2003; 1♀, Ankara province, Kazan district, 16.VI.2003; 1♀, Niğde province, Çiftlik district, 27.VI.2004; 5♀♀, Kırşehir province, Akpınar district, 21.VI.2005; 1♀, Kırşehir province, Kaman district, 21.VI.2005; 1♀, Sivas province, Koyulhisar district, 21.VII.2005; 1♀, Çankırı province, Ilgaz district, 28.VII.2005; 4♀♀, Nevşehir province, Ürgüp district, 22.VI.2005.
World distribution: Holarctic (Platnick, 2007).

Episinus angulatus (Blackwall, 1836)
Material examined: 1♀, Ankara province, Polatlı district, 18.VI.2003; 1♀, Ankara province, Çubuk district, 29.V.2003; 1♂, Ankara province, Ayaş district, 20.VI.2003; 1♂, Yozgat province, Center district, 18.VII.2003.
World distribution: Europe to Russia (Platnick, 2007).

Episinus truncatus Latreille, 1809
Material examined: 1♂, 1♀, Nevşehir province, Göreme district, 26.VI.2004; 1♂, Ankara province, Kazan district, 16.VI.2003; 1♂, Kırşehir province, Mucur district, 26.VI.2004; 1♂, Çankırı province, Ilgaz district, 22.VII.2004; 1♂, 2♀♀, Kırşehir province, Çiçekdağ district, 19.VII.2005.
World distribution: Palearctic (Platnick, 2007).

Euryopis quinqueguttata Thorell, 1875
Material examined: 2♀♀, Niğde province, Ulukışla district, 17.VI.2005; 2♀♀, Niğde province, Eskigümüşler district, 29.V.2005.
World distribution: Europe to Turkmenistan (Platnick, 2007).

Kochiura aulica (C.L. Koch, 1838)
Material examined: 1♀, Ankara province, Gölbaşı district, 24.VI.2003; 1♂, Ankara province, Bala district, 09.V.2003; 1♀, Ankara province, Beypazarı district, 07.VI.2003; 1♀, Ankara province, Kalecik district, 30.V.2003; 13♀♀, Eskişehir province, Seyitgazi district, 14.VII.2004; 1♂, Ankara province, Evren district, 28.V.2003; 1♂, 1♀, Aksaray province, Yenikent district, 29.VI.2004; 3♀♀, Kırıkkale province, Keskin district, 25.VI.2004; 3♂♂, 6♀♀, Kırşehir province, Mucur district, 26.VI.2004; 5♀♀, Nevşehir province, Kozaklı district, 24.VI.2005; 10♀♀, Kırşehir province, Mucur district, 21.VI.2005; 1♀, Sivas province, Hafik district, 21.VII.2005; 13♀♀, Niğde province, Altunhisar district, 18.VI.2005; 1♂, 12♀♀, Aksaray province, Güzelyurt district, 16.VI.2005; 1♂, Konya province, Cihanbeyli district, 13.V.2005; 1♀, Kayseri province, Pınarbaşı district, 23.VI.2005; 8♀♀, Kayseri province, Tomarza district, 23.VI.2005; 1♀, Kırşehir province, Akpınar district, 21.VI.2005; 1♀, Nevşehir province, Ürgüp district, 22.VI.2005.
World distribution: Canary Islands, Cape Verde Is., south and middle Europe to Azerbaijan ((Heimer & Nentwig, 1991; Roberts, 1995; Platnick, 2007).

Lasaeola tristis (Hahn, 1833)
Material examined: 2♂♂, Niğde province, Ulukışla district, 17.VI.2005; 2♀♀, Ankara province, Nallıhan district, 23.VI.2003.
World distribution: Europe to Tajikistan (Platnick, 2007).

Neottiura bimaculata (Linnaeus, 1767)
IMH: Body length: female 2-2.5 mm. Prosoma light brown with dark brown median band. Chelicerae and sternum brown. Legs light yellow, long and cylindrical. Opisthosoma dark brown with ovoid shape. Epigyne (Fig. 1).
Material examined: 2♀♀, Çankırı province, Çerkeş district, 27.VII.2005; 1♀, Çankırı province, Ilgaz district, 28.VII.2005.
World distribution: Holarctic (Platnick, 2007).

Robertus arundineti (O.P.-Cambridge, 1871)
Material examined: 2♀♀, Ankara province, Güdül district, 24.V.2003; 1♀, Ankara province, Kızılcahamam district, 21.V.2003.
World distribution: Palearctic (Platnick, 2007).

Simitidion simile (C.L. Koch, 1836)
IMH: Body length: female 2-2.5 mm. Prosoma yellowish-brown. Chelicerae light brown. Sternum yellowish-brown, laterally dark brown. Legs yellowish-brown with dark brown marks. Opisthosoma dark brown. Folium grey, sinuate. Epigyne (Fig. 2).
Material examined: 1♀, Ankara province, Kalecik district, 23.VII.2003; 1♀, Ankara province, Kazan district, 16.VI.2003; 8♀♀, Ankara province, Kızılcahamam district, 17.VI.2003; 1♀, Karaman province, Kazımkarabekir district, 27.V.2005; 4♀♀, Niğde province, Ulukışla district, 17.VI.2005.
World distribution: Holarctic (Platnick, 2007).

Steatoda albomaculata (De Geer, 1778)
Material examined: 1♂, 1♀, Ankara province, Kızılcahamam district, 09.VI.2003; 1♀, Ankara province, Çamalan district, 17.VII.2003; 2♀♀, Kayseri province, Yeşilhisar district, 23.VI.2004; 1♀, Niğde province, Uluağaç district, 16.06.2001; 1♂, Ankara province, Kızılcahamam district, 30.VII.2003; 1♀, Ankara province, Nallıhan district, 17.VII.2003; 1♀, Sivas province, Suşehri district, 21.VII.2005; 5♀♀, Kayseri province, Develi district, 23.VI.2005; 1♀, Karaman province, Ermenek district, 28.V.2005.
World distribution: Cosmopolitan (Platnick, 2007).

Steatoda bipunctata (Linnaeus, 1758)
Material examined: 4♂♂, 14♀♀, Ankara province, Çubuk district, 16.VII.2003; 2♀♀, Eskişehir province, Mihalıççık district, 13.VII.2004; 1♀, Ankara province, Nallıhan district, 23.VI.2003; 3♀♀, Ankara province, Kızılcahamam district, 17.VI.2003; 2♀♀, Çankırı province, Ilgaz district, 22.VII.2004; 4♀♀, Ankara province, Pazar district, 17.VI.2003; 1♂, Aksaray province, Ortaköy district, 16.VI.2005; 1♀, Çankırı province, Çerkeş district, 27.VII.2005; 1♀, Sivas province, Hafik district, 21.VII.2005; 2♀♀, Konya province, Seydişehir district, 15.V.2005; 5♀♀, Konya province, Doğanhisar district, 13.V.2005; 5♀♀, Konya province, Akşehir district, 14.V.2005.
World distribution: Holarctic (Platnick, 2007).

Steatoda castanea (Clerck, 1757)
Material examined: 1♂, 4♀♀ Ankara province, Kızılcahamam district, 10.VII.2003; 1♂, 9♀♀, Ankara province, Beytepe district, 02.VII.2003; 1♀, Eskişehir province, Beyyazı district, 14.VII.2004; 1♂, 2♀♀ Niğde province, Bor district, 08.VIII.2005; 1♀, Ankara province, Bala district, 21.VI.2003; 1♂, 3♀♀, Ankara province, Nallıhan district, 23.VI.2003; 5♀♀, Kayseri province, Sarıoğlan district, 23.VI.2005; 1♀, Nevşehir

province, Ürgüp district, 22.VI.2005; 1♀, Aksaray province, Ağaçören district, 16.VI.2005; 1♀, Yozgat province, Yenifakılı district, 24.VI.2005.
World distribution: Palearctic, Canada (Platnick, 2007).

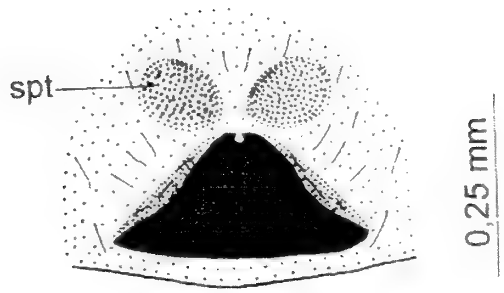
Steatoda nobilis (Thorell, 1875)
Material examined: 1♀♀, Sivas province, Suşehri district, 21.07.2005.
World distribution: Madeira, Canary Islands, England, Ireland, Portugal, Spain, Corsica, (Heimer & Nentwig, 1991; Platnick, 2007).

Steatoda paykulliana (Walckenaer, 1805)
Material examined: 2♀♀, Ankara province, Elmadağ district, 15.V.2003; 3♀♀, Ankara province (Şereflikoçhisar district), 09.V.2003; 1♀, Niğde province, Çiftlik district, 27.VI.2004; 2♀♀, Ankara province, Ayaş district, 14.V.2003; 1♀, Ankara province, Evren district, 28.V.2003; 2♀♀, Ankara province, Gölbaşı district, 05.VI.2005; 1♀, Ankara province, Polatlı district, 11.V.2003; 1♀, Kayseri province, Yahyalı district, 21.VII.2003; 1♀, Ankara province, Haymana district, 25.V.2003; 1♀, Kırşehir province, Mucur district, 26.VI.2004; 1♀, Ankara province, Kazan district, 16.VI.2003; 2♀♀, Ankara province, Beypazarı district, 14.V.2003; 4♀♀, Konya province, Bozkır district, 15.V.2005; 1♀, Konya province, Ereğli district, 16.V.2005; 1♀, Konya province, Hüyük district, 14.05.2005; 1♀, Karaman province, Kazımkarabekir district, 27.V.2005; 2♀♀, 1♂, Ankara province, Beytepe district, 09.IV.2005.
World distribution: Europe, Mediterranean to Central Asia (Platnick, 2007).

Steatoda phalerata (Panzer, 1801)
Material examined: 4♀♀, Ankara province, Nallıhan district, 23.VI.2003; 1♀, Ankara province, Polatlı district, 18.VI.2003; 1♀, Ankara province, Beypazarı district, 07.VI.2003; 2♀♀, Niğde province, Altunhisar district, 27.VI.2004; 2♀♀, Çankırı province, Eldivan district, 22.VII.2004; 1♀, Ankara province, Kazan district, 16.VI.2003; 1♀, Niğde province, Çamardı district, 27.VI.2004; 1♀, Konya province, Seydişehir district, 15.V.2005; 1♀, Karaman province, Kazımkarabekir district, 27.V.2005.
World distribution: Palearctic (Platnick, 2007).

Steatoda triangulosa (Walckenaer, 1802)
Material examined: 4♀♀, Ankara province, Beytepe district, 03.VI.2003; 2♀♀, Ankara province, Gölbaşı district, 29.V.2004; 1♀, Ankara province, Çubuk district, 04.IX.2003; 1♀, Ankara province, Bala district, 21.VI.2003; 1♂, Niğde province, Center district, 18.VII.2004; 1♂, Kırşehir province, Çiçekdağ district, 19.VII.2005.
World distribution: Cosmopolitan (Platnick, 2007).

Theridion betteni Wiehle, 1960
IMH: Body length: female 2.5-3.5 mm. Prosoma yellowish-brown with dark brown ocular area and dorsal longitudinal band. Chelicerae yellowish-brown. Sternum dark brown with yellowish-brown patches. Legs yellow with dark brown spots. Opisthosoma dark brown. Folium grey with brown design. Epigyne (Fig. 3).
Material examined: 2♀♀, Ankara province, Kızılcahamam district, 17.VI.2003; 1♀, Ankara province, Nallıhan district, 17.VII.2003; 1♀, Çankırı province, Çerkeş district, 17.VI.2003; 1♀, Kırşehir province, Kaman district, 21.VI.2005; 1♀, Kayseri province, Develi district, 23.VI.2005.
World distribution: Palearctic (Platnick, 2007).



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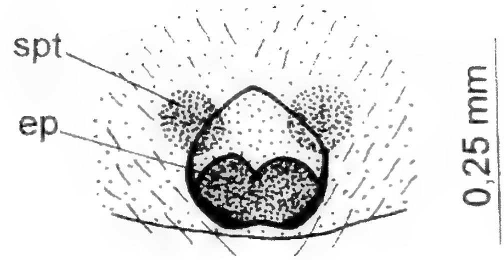

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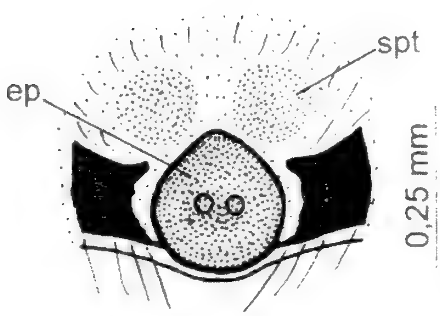

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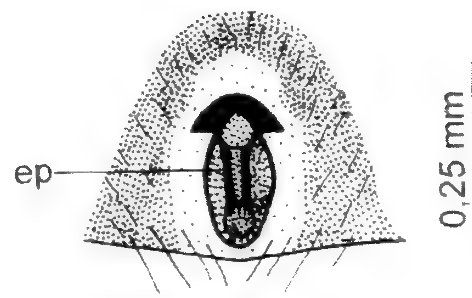

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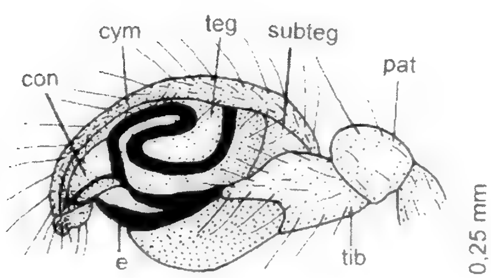
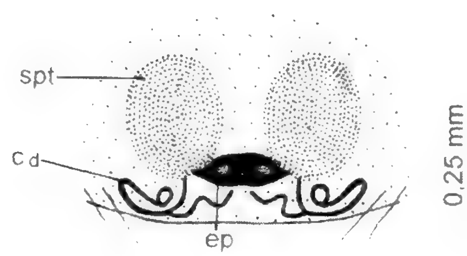


5a



5b

Figs. 1-5. 1. *Neottiura bimaculata* (Linnaeus, 1767), 2. *Simitidion simile* (C.L. Koch, 1836), 3. *Theridion betteni* Wiehle, 1960, 4. *Theridion blackwalli* O.P.-Cambridge 1871, 5. *Theridion nigrovariegatum* Simon, 1873.
Figs. 1-4, 5b. Epigyne, ventral view. **cd:** coiled duct; **ep:** epigynal pit; **spt:** spermatheca. Fig. 5a. Male palp, retrolateral view. **con:** conductor; **cym:** cymbium; **e:** embolus; **subteg:** subtegulum; **teg:** tegulum; **tib**: tibia; **pat:** patella.

Theridion blackwalli O.P.-Cambridge, 1871

IMH: Body length: female 2.5-3.0 mm. Prosoma dark brown, almost black. Chelicerae yellow. Sternum black. Legs light yellow with dark brown marks. Opisthosoma yellowish-grey with black design. Epigyne (Fig. 4).
Material examined: 2♀♀, Ankara province, Akyurt district, 23.VII.2003; 1♀, Ankara province, Çubuk district, 25.VI.2003.
World distribution: Europe, Russia, Ukraine, North Africa (Platnick, 2007).

Theridion impressum L. Koch, 1881

Material examined: 1♂, 1♀, Ankara province, Gölbaşı district, 24.VI.2003; 3♀♀, Çankırı province, Ilgaz district, 22.VII.2004; 2♂♂, Ankara province, Beypazarı district,

07.VI.2003; 1♂, 4♀♀, Çankırı province, Çerkeş district, 21.VII.2004; 2♂♂, 1♀, Ankara province, Bala district, 21.VI.2003; 2♂♂, 3♀♀, Sivas province, Zara district, 19.VII.2003; 2♀♀, Yozgat province, Saraykent district, 18.VII.2003; 1♀, Eskişehir province, Sarıyar district, 13.VII.2004; 1♂, 1♀, Nevşehir province, Göreme district, 26.VI.2004; 1♀, Aksaray province, Taşpınar district, 28.VI.2004; 1♀, Kayseri province, Pınarbaşı district, 20.VII.2003; 1♀, Sivas province, Boğazören district, 19.VII.2003; 2♂♂, 2♀♀, Ankara province, Çubuk district, 25.VI.2003; 2♀♀, Ankara province, Nallıhan district, 23.VI.2003; 1♀, Niğde province, Çamardı district, 27.VI.2004; 1♀, Eskişehir province, Seyitgazi district, 14.VII.2004; 1♀, Kayseri province, Yahyalı district, 22.VI.2005; 1♂, 1♀, Sivas province, Suşehri district, 21.VII.2005; 1♀, Çankırı province, Kurşunlu district, 27.VII.2005; 4♀♀, Çankırı province, Çerkeş district, 27.VII.2005; 3♀♀, Çankırı province, Ilgaz district, 28.VII.2005; 2♀♀, Sivas province, Hafik district, 21.VII.2005; 4♀♀, Çankırı province, Bayramören district, 27.VII.2005; 3♂♂, 6♀♀, Niğde province, Altunhisar district, 18.VI.2005; 1♂, Aksaray province, Güzelyurt district, 16.VI.2005; 2♀♀, Çankırı province, Korgun district, 28.VII.2005.
World distribution: Holarctic (Platnick, 2007).

Theridion melanurum Hahn, 1831
Material examined: 1♀, Ankara province, Şereflikoçhisar district, 28.V.2003; 1♀, Ankara province, Nallıhan district, 23.VI.2003; 2♀♀, Ankara province, Çubuk district, 25.VI.2003; 7♀♀, Ankara province, Kazan district, 16.VI.2003; 1♂, 6♀♀, Ankara province, Ayaş district, 30.V.2004; 8♀♀, Ankara province, Elmadağ district, 23.VII.2003; 2♀♀, Ankara province, Akyurt district, 23.VII.2003; 6♀♀, Ankara province, Kızılcahamam district, 10.VII.2003; 2♀♀, Kırşehir province, Mucur district, 26.VI.2004; 2♀♀, Kırıkkale province, keskin district, 25.VI.2004; 1♀, Aksaray province, Ortaköy district, 29.VI.2004; 2♀♀, Eskişehir province, Beyyazı district, 14.VII.2004; 1♀, Eskişehir province, Çifteler district, 14.VII.2004; 1♀, Çankırı province, Şabanözü district, 22.VII.2004; 2♀♀, Konya province, Kulu district, 13.V.2005; 1♀, Sivas province, Koyulhisar district, 21.VII.2005; 2♀♀, Aksaray province, Ağaçören district, 16.VI.2005; 2♂♂, Konya province, Cihanbeyli district, 13.V.2005; 1♀, 2♂♂, Konya province, Yunak district, 13.V.2005; 4♀♀, Kırşehir province, Mucur district, 21.VI.2005; 1♀, Konya province, Hadım district, 27.V.2005.
World distribution: Holarctic, Azores (Platnick, 2007).

Theridion mystaceum L. Koch, 1870
Material examined: 1♂, 1♀, Niğde province, Ulukışla district, 25.V.2001; 3♀♀, Ankara province, Nallıhan district, 23.VI.2003; 3♀♀, Ankara province, Kızılcahamam district, 10.VII.2003; 1♀, Ankara province, Çubuk district, 25.VI.2003; 2♀♀, Aksaray province, Ihlara district, 28.VI.2004; 1♀, Çankırı province, Ilgaz district, 22.VII.2004; 2♂♂, Konya province, Akşehir district, 14.V.2005; 2♀♀, Niğde province, Çamardı district, 17.VI.2005; 2♀♀, Kayseri province, Yahyalı district, 22.VI.2005; 3♀♀, Kayseri province, Himmetdede district, 24.VI.2005; 1♀, Çankırı province, Çerkeş district, 27.VII.2005; 2♀♀, Çankırı province, Korgun district, 28.VII.2005; 1♀, Sivas province, Yıldızeli district, 22.VII.2005; 1♀, Kayseri province, Pınarbaşı district, 23.VI.2005; 2♀♀, Aksaray province, Gülağaç district, 18.VI.2005; 1♀, Yozgat province, Yenifakılı district, 24.VI.2005; 3♀♀, Karaman province, Ermenek district, 28.V.2005.
World distribution: Palearctic (Platnick, 2007).

Theridion nigrovariegatum Simon, 1873

IMH: Body length: male 2.5-3.0 mm, female 3.0-3.5 mm. Prosoma yellow with yellowish-brown median band. Chelicerae and sternum yellow. Legs yellowish-white. Opisthosoma grey-white with black spots, median band black, ventrally grey-brown with two black marks. Male palp (Fig. 5a). Epigyne (Fig. 5b).

Material examined: 1♂, Ankara province, Bala district, 21.VI.2003; 1♀, Ankara province, Beypazarı district, 07.VI.2003; 1♂, 1♀, Ankara province, Çubuk district, 25.VI.2003; 1♂, 1♀, Kırşehir province, Mucur district, 26.06.2004; 1♂, Kırşehir province, Kaman district, 21.06.2005; 2♀♀, Ankara province, Nallıhan district, 23.VI.2003; 2♀♀, Ankara province, Kızılcahamam district, 17.VI.2003; 1♀, Ankara province, Ayaş district, 20.VI.2003; 1♀, Çankırı province, İkizören district, 22.VII.2004; 1♀, Çankırı province, Ilgaz district, 28.VII.2005; 1♂, Niğde province, Ulukışla district, 17.VI.2005; 1♀, Nevşehir province, Ürgüp district, 22.VI.2005; 2♀♀, Yozgat province, Akdağmadeni district, 20.VII.2005; 1♀, Çankırı province, Ilgaz district, 28.VII.2005.

World distribution: Palearctic (Platnick, 2007).

Theridion varians Hahn, 1833

Material examined: 1♀♀, Ankara province, Kızılcahamam district, 21.05.2003; 1♀, Aksaray province, Ihlara district, 28.VI.2004; 1♀, Çankırı province, Kurşunlu district, 21.VII.2004; 4♂♂, 3♀♀, Ankara province, Ayaş district, 20.VI.2003; 1♀, Ankara province, Polatlı district, 18.06.2003; 3♀♀, Aksaray province, Ortaköy district, 29.VI.2004; 1♂, Ankara province, Güdül district, 21.V.2003; 1♂, Kayseri province, Pınarbaşı district, 23.VI.2005; 4♀♀, Nevşehir province, Ürgüp district, 22.06.2005.

World distribution: Holarctic (Platnick, 2007).

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A review of the genus *Synema* Simon, 1864 (Araneae: Thomisidae) in Turkey with a new record, *Synema utotchkini* Marusik & Logunov, 1995

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Abstract

The distributional status of the recorded Turkish species of genus *Synema* Simon, 1864 is determined. *Synema utotchkini* Marusik & Logunov, 1995 is recorded for the first time from Turkey. Zoogeographical remarks and chorotype information are here presented for the three Turkish *Synema* species.

Keywords: Spiders, Araneae, Thomisidae, *Synema*, new record, Turkey.

Introduction

Genus *Synema* Simon, 1864, is represented by 7 species and 4 subspecies in Palearctic region (Platnick, 2007). They are brightly coloured and their abdomens usually have a distinct colourful pattern. *Synema* spiders live in vegetation and occasionally inside flower corollas. Their movement is quick and their preys are caught by ambush (Levy, 1975). Both Turkish and foreign researches made important contributions to the Turkish thomisid fauna. They recorded 71 species and 1 subspecies. Only two species of them belong to genus *Synema*: *Synema globosum* (Fabricius, 1775) and *Synema plorator* (O.P.-Cambridge, 1872) (Topçu *et al.*, 2005; Marusik *et al.*, 2005, Logunov & Demir, 2006; Logunov, 2006, Demir *et al.*, 2006, 2007; Bayram *et al.*, 2007). However, the previous works were densely made in central Anatolian region, Black Sea region, and Mediterranean region (Central parts) of Turkey respectively. Nevertheless, it is impossible to say that the fauna of Turkey has been completely investigated. Since Turkey appears of continental properties, variable within very short distances in terms of climatic features and field structures. Besides, the number of studies are not enough to cover the whole fauna. In this study, a third species of *Synema* is recorded for the first time from Turkey. With this record, the number of thomisid spiders in Turkey has increased to 72 species and 1 subspecies belonging to 14 genera.

Material and Methods

Studied specimens were collected from different regions of Turkey by sweeping net over plants. They were preserved in 70% ethanol and deposited in the collection of the Arachnology Museum of Niğde University (NUAM). Identification references consulted are: Levy (1975), Roberts (1995), and Marusik & Logunov (1995). Male palp of *Synema utotchkini* Marusik & Logunov, 1995 was mounted using a double sided tape on the SEM stubs, coated with gold in a Polaron SC 502 Sputter Coater, and examined with a JOEL JSM 5600 Scanning Electron microscope at 15kw. Distribution of species in Turkey is summarized in remarks according to Topçu *et. al.* (2005) [MR = Marmara, AR = Aegean, CAR = Central Anatolia, EAR = East Anatolia, and MER = Mediterranean Regions]. One Chorotype, or zoogeographical characterization of the species, designation is identified for each taxon according to Vigna Taglianti *et. al.* (2000).

Results

Synema globosum (Fabricius, 1775)

Material examined: 3♂♂, Hatay province, Erzin district, Isos harabeleri, (36°58'N, 36°07'E), 47m, 04.05.2007; 1♂, Kilis province, Polateli district, Çakaldere village, (36°47'N, 37°05'E), 652m, 03.05.2007; 2♂♂, Adana province, Yumurtalık district, Narlıören village, (36°52'N, 35°49'E), 49m, 04.05.2007; **Osmaniye province:** 4♀♀, Bahçe district, Aşağı Arıcaklı village, (37°11'N, 36°36' E), 375m, 02.05.2007; 4♂♂, 8♀♀, Düziçi district, Yarbaşı village, (37°10'N, 36°25'E), 380m, 22.05.2007; 2♀♀, Toprakkale castle, (37°03'N, 36°08'E), 70m, 01.05.2007; 2♂♂, 1♀, Kadirli district, Karatepe, Çakıcılar village, (37°16'N, 36°13'E), 100m, 24.05.2007; 9♂♂, 5♀♀, Bahçe district, Aşağı Arıcaklı village, (37°11'N, 36°36'E), 375m, 22.05.2007; 1♂, Zorkun plateau, Karınca yaylası, (36°58'N, 36°19'E), 1520m, 23.05.2007; 2♂♂, 2♀♀, Bahçe district, Yaylalı village, (37°17'N, 36°37'E), 1086m, 22.05.2007; 2♂♂, Kesmeburun village, (37°09'N, 36°10'E), 70m, 23.05.2007; 3♀♀, Yarpuz village, (37°03'N, 36°25'E), 903m, 23.05.2007.

World Distribution. Palearctic (Platnick, 2007). **Remarks.** It is distributed in MR, AR, CAR, MER in Turkey. It may be distributed in all regions of Turkey.

Chorotype. This species has the Palearctic chorotype.

Synema plorator (O.P.-Cambridge, 1872)

Material examined: 3♂♂, 8♀♀, Osmaniye province, Düziçi district, Yarbaşı village, (37°10'N, 36°25'E), 380m, 02.05.2007; 3♀♀, Kahramanmaraş province, Türkoğlu district, Kızılleniş village, (37°20'N, 36°46'E), 655m, 22.05.2007.

World Distribution. Slovakia to Israel, Central Asia (Platnick, 2007).

Remarks. Until now, this species was only known from Marmara Region in Turkey (MR). It is secondly recorded from Turkey by our record (MER, EAR).

Chorotype. This species has the Palearctic chorotype.

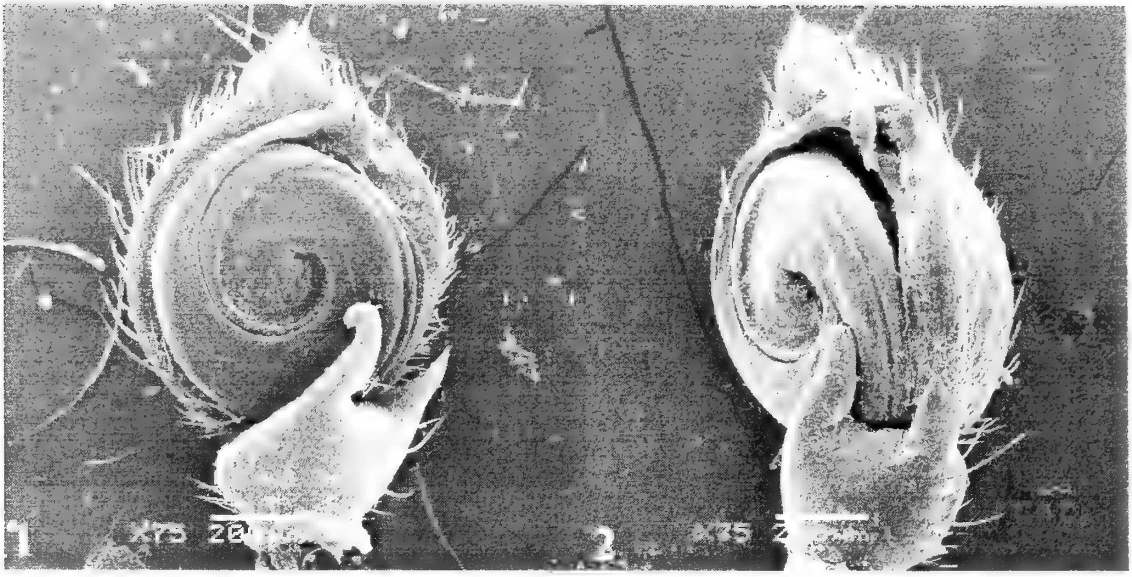
Synema utotchkini Marusik & Logunov, 1995 (Figs. 1-2)

Material examined: 3♂♂, Kahramanmaraş province, Göksun district, Kocakonak village, (38°12'N, 36°25'E), 1604m, 20.05.2007.

World Distribution. Kazakhstan, Kyrgyzstan (Platnick, 2007); Turkey (**New Record**).

Remarks. New to Turkey. It is found in East Anatolia Region (EAR) and It may be distributed in south Turkey. As seen above, the species is mainly distributed in Central Asia. The record from Turkey widens its distribution southwards.

Chorotype. This species has the Turanian chorotype.



Figs. 1-2. *Synema utotchkini* Marusik & Logunov, 1995, left male palp, 1. ventral view, 2. retrolateral view.

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Three new ground spider records for the Turkish spider fauna (Araneae: Gnaphosidae)

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Abstract

Three species of Gnaphosidae are recorded from Turkey for the first time. They are *Berinda amabilis* Roewer, 1928, *Nomisia palaestina* (O.P.-Cambridge, 1872) and *Pterotricha lesserti* Dalmas, 1921. Their localities (with GPS coordinates), descriptions and geographical distributions are given.

Keywords: Spiders, Araneae, Gnaphosidae, New Record, Turkey.

Introduction

Gnaphosid spiders are generally characterized by having barrel-shaped anterior spinnerets that are one spinneret diameter apart. In Gnaphosidae, 1990 species belonging to 114 genera have been described all over the world (Platnick, 2007). This family is the most abundant and one of the most diverse of all spider families on Turkey. Until now, 90 gnaphosid species belonging to 21 genera were recorded from Turkey (Ovtsharenko *et al.*, 1992, Topçu *et al.*, 2005, 2006, Özdemir *et al.*, 2006, Seyyar *et al.*, 2006a, 2006b, Varol *et al.*, 2006). Three gnaphosid species are here recorded for the first time from Turkey.

Material and Methods

In this study, most of specimens were obtained from pitfall traps or found under stones in central parts of Turkey. Examined specimens were preserved in 70% ethanol and deposited in the Arachnology Museum of Niğde University (NUAM). The works of Chatzaki *et al.* (2002a, 2002b) and Levy (1995) were consulted for identifying the species by means of a SZX9 Olympus stereomicroscope.

Results

Berinda amabilis Roewer, 1928 was recorded from Niğde (37°57'N, 34°33'E) in Central Anatolia, Turkey. Two males (NUAM GNA 51/001-2) were found under stones on 19.VI.2001. Description ♂: Body length 6.9-7.6 mm. Prosoma oval, yellow to red-brown, narrow at cephalic part and widening at thoracic part. Scutum orange, covered with strong bristles. Sternum oval. Maxillae as in *Zelotes*. Labium longer than wide. Anterior row of eyes slightly recurved, posterior row slightly procurved or straight. Opisthosoma yellow grey. Anterior spinnerets long and cylindrical. Male palp resembles the description of Chatzaki (2002a). World distribution: Crete, Russia, Central Asia (Platnick, 2007).

Nomisia palaestina (O.P.-Cambridge, 1872) was recorded from Bor district in Niğde Province (37°57'N, 34°33'E) and Gülek town in Mersin Province (37°12'N, 34°45'E). Three females (NUAM GNA 51/046-47, NUAM GNA 33/005) were found under stones during July 2002. Description ♀: Body length 10.2-8.50 mm. Prosoma reddish-brown. Sternum oval, reddish-brown. Opisthosoma grey-brown, with darker chevron-shaped spots. Legs yellowish brown, leg IV the longest. Epigynum resembles the description of Chatzaki (2002b). World distribution: Greece, Syria, Israel (Platnick, 2007).

Pterotricha lesserti Dalmas, 1921, was recorded from Niğde (37°58'N, 34°40'E). Only one female (NUAM GNA 51/059) were collected by hand in July 2004. Description ♀: Body length 8.7 mm. Prosoma yellow with a distinct fovea, narrow at the front. Posterior median eyes elliptic. Sternum oval, reddish-yellow. Opisthosoma light yellow, with brown and light brown spots. Epigynum resembles the description of Levy (1995). World distribution: Egypt, Israel, Saudi Arabia (Platnick, 2007).

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Oecobius maculatus Simon, 1870 (Araneae: Oecobiidae) a new record for the Turkish spider fauna

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Abstract

The characteristic features and drawings of both male and female genitalia of *Oecobius maculatus* Simon, 1870, which is recorded for the first time from Turkey, are presented in this study.

Keywords: Spiders, Araneae, Oecobiidae, *Oecobius maculatus*, New Record, Turkey.

Introduction

The distinctive morphological character of Oecobiidae is the anal tubercle which is rendered highly conspicuous by a fringe of long curved hairs, together with the conformation of the spinnerets (Murphy & Murphy, 2000). The family is represented by 6 genera and 103 species worldwide. There are 79 species and 1 subspecies of genus *Oecobius* Lucas, 1846 recorded all over the world (Platnick, 2007). This genus was well studied in Africa (Shear & Benoit, 1974), North America, Mexico and the West Indies (Shear, 1970), India (Tikader, 1962), South America (Santos & Gonzaga, 2003), and the Mediterranean region (Wunderlich, 1994). Genus *Oecobius* and the oecobiid spiders of Turkey are still inadequately known (Karol, 1967; Bayram, 2002; Topçu *et al.*, 2005). Only one species, *Oecobius cellariorum* (Dugès, 1836), was recorded from Turkey (Kaya *et al.*, 2006). The second *Oecobius* species, *Oecobius maculatus* Simon, 1870, is here recorded for the first time from Turkey.

Material and Methods

Studied specimens were collected by the authors from two localities (Fig. 1):

1. Antalya (Manavgat): near the Oymapınar Dam (Manavgat - Antalya) [36°53′52"N, 31°31′53"E, Alt. 65m]: 10 females on 30 April 2006; 1 female on 1 May 2006; 8 subadult males and 24 juveniles on 28 October 2006, and 6 males on 17 March 2007. All of them were found under stones. (Note: *Oecobius maculatus* is very common and dominant in this locality where *O. cellariorum* is also present and collected.)

2. Bursa (Uludağ Mountain): One male specimen was found under a stone in the region of Kaplıkaya Valley (Uludağ Mountain – Bursa) [40°10′11"N, 29°07′04"E, Alt. 400m], on 18 May 2007.

The identification was made using the keys of Nentwig *et al.* (2003) and Wunderlich (1994; figs. 29, 30a-b). The drawings were made by means of a camera lucida attached to a Zeiss Stemi SR microscope and the measurements were made by Olympus SZ 51.

Abbreviations used: ALE = anterior lateral eye; AME = anterior median eye; L = length; PLE = posterior lateral eye; PME = posterior median eye; TL = total length; W = width. All measurements are in millimetres.

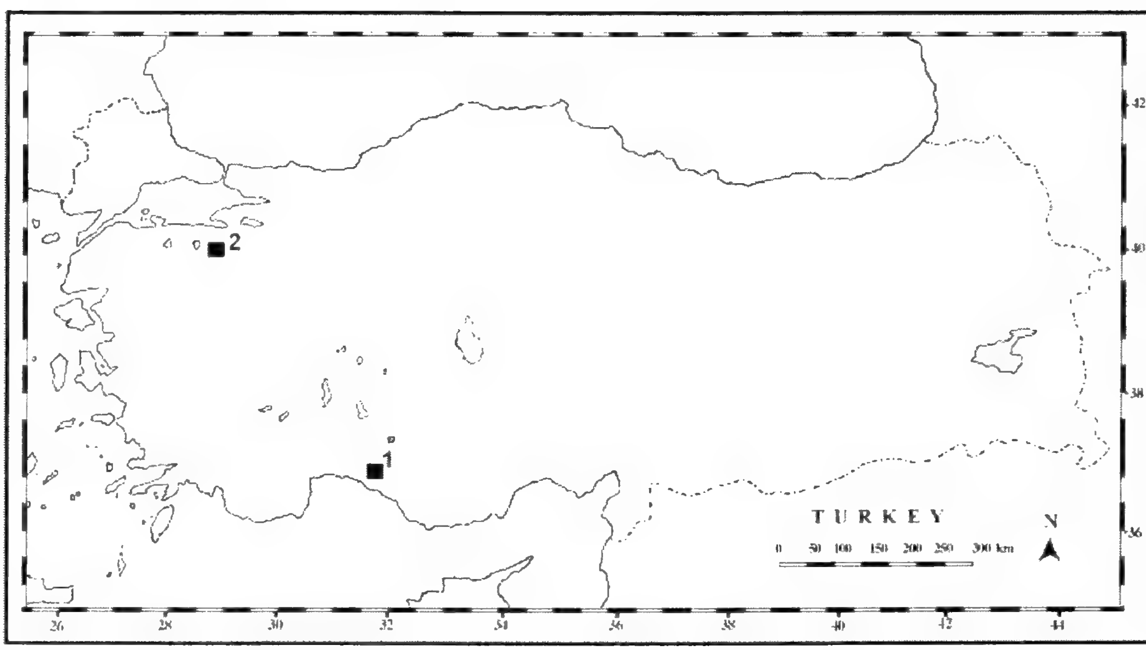


Fig. 1. Localities of the collecting sites from which the specimens were collected:
1. Oymapınar Dam - Manavgat (Antalya),
2. Kaplıkaya Valley – Uludağ Mountain (Bursa).

Results

Family: Oecobiidae Blackwall, 1862

Genus: ***Oecobius*** Lucas, 1846

Species: ***Oecobius maculatus*** Simon, 1870

Synonyms:

Oecobius annulipes maculatus Hassan, 1953

Oecobius kahmanni Kritscher, 1966; Hansen, 1988; Thaler & Noflatscher, 1990

Thalamia kahmanni Lehtinen, 1967

Description (Based on living specimens, rather than preserved ones.)

Female: TL 2.17- 2.62. Cephalothorax L 0.80-0.85, W 0.90-0.97; circular shaped with its front slightly pointed and wider than long, yellowish-brown, marginal line black; with brownish area surrounding eyes and extending backwards to posterior margin of carapace, this area is anteriorly constricted between AME, extending down to tip of clypeus; with three pairs of marginal dark spots on the carapace, and hairs on margins and beside ocular area. Clypeus is prolonged and yellowish. Chelicerae are pale, with dark spots. Ocular area is the highest point of carapace. Eyes in two rows, anterior row of eyes slightly procurved, posterior row procurved, ALE and PME light, AME and PLE dark and have dark ridges, PLE largest, ALE smallest, PME irregular in shape. Labium nearly triangular, wider at the base. Sternum is heart-shaped, bordered by a thin black line and densely covered by hairs. Legs (Table 1) yellowish, densely covered by hairs, some spines arranged irregularly. Legs are annulated as follows: Femur with two rings, ventrally entire; patella with one ring; tibia with two rings, one incomplete dorsally, the other is dorsally entire; metatarsus with two rings; tarsi without rings but slightly darker distally. Sternum, labium and endites pale yellowish. Palpi dusky towards distal end. Abdomen L 1.60-1.85, W 1.32-1.47; rounded at the front and narrowed near the posterior point; densely covered with hairs; dorsum appears yellowish-brown, mottled white, with darker un-mottled cardiac mark; its anterior margin with dark band extending laterally about one-half length of abdomen; cardiac region is dark, and 2-3 pairs of dark patches are located on the abdomen.

Table 1: ♀, Legs measurements (mm).

Leg	Femur	Patella	Tibia	Metatarsus	Tarsus
I	0.75-0.92	0.22-0.32	0.65-0.67	0.55-0.70	0.45-0.52
II	0.82-0.92	0.25-0.35	0.70-0.77	0.60-0.80	0.50-0.55
III	0.82-0.92	0.25-0.32	0.60-0.72	0.55-0.67	0.47-0.50
IV	0.85-0.97	0.27-0.32	0.65-0.80	0.67-0.85	0.50-0.52

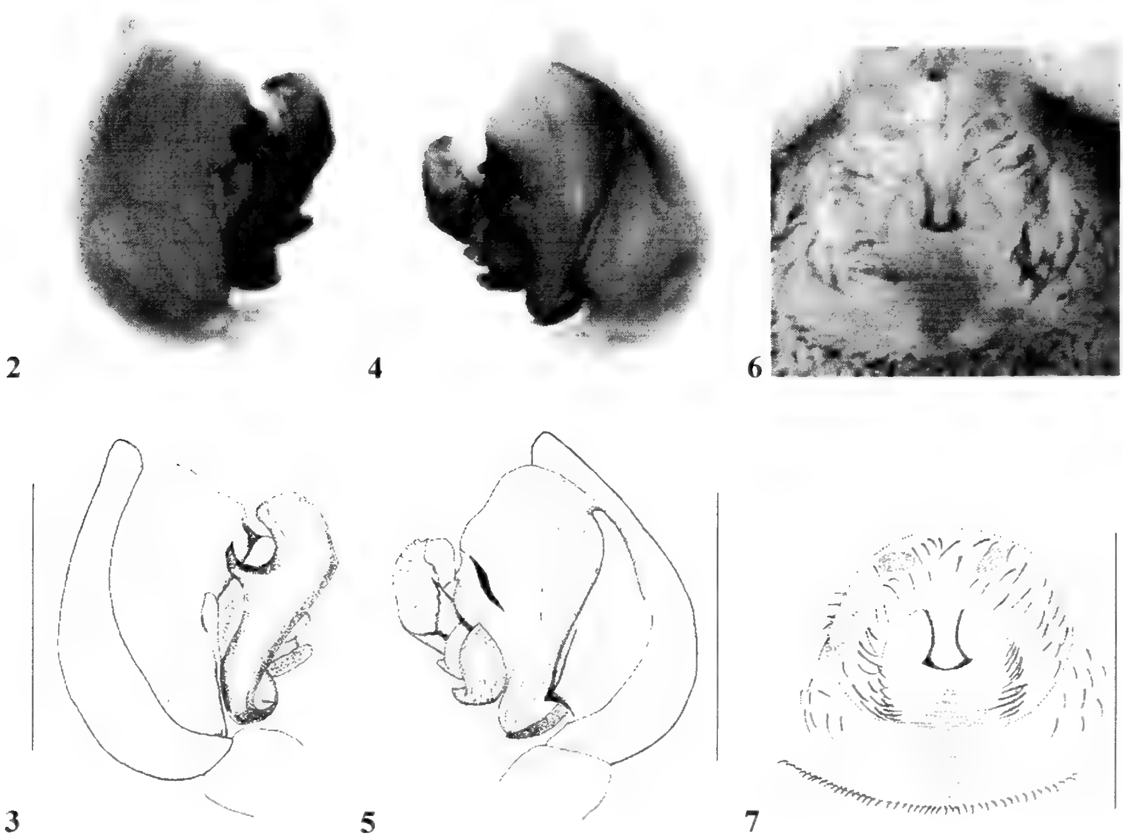
Male: As female, except for the following: ocular area slightly higher, abdomen slimmer, and legs thinner than in female. TL 1.50-1.85; Cephalothorax L 0.60-0.80, W 0.87-0.92; Abdomen L 1.12-1.30, W 0.70-0.90. Legs (Table 2).

Table 2: ♂, Legs measurements (mm).

Leg	Femur	Patella	Tibia	Metatarsus	Tarsus
I	0.62-0.90	0.22-0.25	0.55-0.60	0.57-0.70	0.45- 0.50
II	0.70-0.95	0.25-0.27	0.62-0.70	0.60-0.80	0.50-0.55
III	0.50-0.80	0.22-0.25	0.57-0.67	0.55-0.57	0.47-0.52
IV	0.67-0.87	0.25-0.32	0.65-0.72	0.65-0.72	0.47-0.50

Diagnosis

Oecobius maculatus can be distinguished from the other known *Oecobius* species by its genital characters: the large blade-shaped radix apophysis and its position of the male palpal organs (Figs. 2-5), and the epigynum of the female that is distinguished by the position of the short scape which is far from the epigastric furrow (Figs. 6-7).



Figs. 2-7: *Oecobius maculatus* Simon, 1870.
2-3. Male palpus, prolateral view. 4-5. Male palpus, retrolateral view.
6-7. Female epigynum, ventral view. Scale bars: (3, 5) 0.5 mm, (7) 0.4 mm.

Habitat and distribution

All specimens were found under stones. Especially female specimens were collected from their star shaped nests. They run very quickly when disturbed.

Oecobius maculatus is not a common species. It had been collected from Italy, Greece and France (Wunderlich, 1994). This species occurs in Mediterranean region to Azerbaijan (Platnick, 2007).

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Sun-spiders of Turkey (Arachnida: Solpugida), list of species and key to genera

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Abstract

This work includes a list of 33 species and 1 subspecies of 12 genera of 5 families of order Solpugida recorded from Turkey. Twenty species are endemic. The distribution of every species is included. A key to the recorded families and genera is prepared.

Keywords: Sun-spiders, Solpugida, Arachnida, Turkey.

Introduction

It is necessary to know the solpugid species recorded from a country before starting the study of this arachnid order in this country. Therefore, the following list is prepared as a first step to assist the arachnologist who likes to study Order Solpugida in Turkey. This preliminary list is extracted from the works of Roewer (1934, 1941) and Harvey (2003). The other references are listed within them. A key to the previously recorded genera from Turkey is prepared depending on the keys of Roewer (1934) and El-Hennawy (1990).

The idea of preparing this work came after reading the work of Bayram *et al.* (2005) in their study of the arachnid fauna of Kırıkkale Province and my visit to Turkey due to the kind invitation of my friend Kadir Kunt and the Turkish Arachnological Society this year where I met my friend Mohammad İsmail Varol who was eager to know more and more about the Turkish solpugid species.

In this study, 33 solpugid species and 1 subspecies are recorded, classified within 12 genera and 5 families. Twenty species are endemic, only recorded from Turkey. The distribution of every species is included in the list after species name and the page number in Harvey's catalogue (2003).

List of Turkish species of Order Solpugida

Barrussus pentheri (Werner, 1905) * p.283: Turkey [Lifos, Erciyeş Dağı, *Kayseri*, and Ereğli-Bor].

Biton (Biton) tauricus Roewer, 1941 * p.225: Turkey [Toros Dağları (Taurus)].

Biton (Biton) zederbaueri (Werner, 1905) p.226: Turkey [Illany Dağı]; Israel.

Blossia anatolica (Roewer, 1941) * p.213: Turkey [Toros Dağları (Taurus)].

Eusimonia nigrescens Kraepelin, 1899 p.284: Turkey; Greece, Syria.

Galeodes anatoliae Turk, 1960 * p.256: Turkey [Tuz Gölü].

Galeodes arabs arabs C.L. Koch, 1842 pp.256-257: Turkey; Algeria, Djibouti, Egypt, Ethiopia, Iran, Iraq, Israel, Kenya, Libya, Morocco, Niger, Oman, Saudi Arabia, Somalia, Sudan, Syria, Tunisia, Yemen.

Galeodes araneoides (Pallas, 1772) pp.257-258: Turkey [İzmir and south of İzmir (Smyrna), *İzmir*, Bodrum (Halicarnassus), *Muğla*]; Afghanistan, Armenia, Azerbaijan, Egypt, Iran, Iraq, Israel, Kazakhstan, Russia, Syria, Turkmenistan, Ukraine.

Galeodes armeniacus Birula, 1929 p.258: Turkey? [near Ararat mountain]; Armenia, Azerbaijan.

Galeodes darendensis Harvey, 2002 * p.262: Turkey [9 km east of Darende, *Malatya*].

Galeodes forcipatus Roewer, 1934 * p.263: Turkey [Eskişehir, *Eskişehir*].

Galeodes graecus C.L. Koch, 1842 pp.263-264: Turkey; Armenia, Bulgaria, Cyprus, Egypt, Greece, Syria.

Galeodes gromovi Harvey, 2002 p.264: Turkey [Berdük, *Van*]; Azerbaijan, Iraq.

Galeodes lapidosus Roewer, 1934 * pp.265-266: Turkey [Makri, *Muğla*].

Galeodes lycaonis Turk, 1960 * p.266: Turkey [Aci Gölü].

Galeodes marginatus Roewer, 1961 * p.266: Turkey [Yumurtalık, *Adana*].

Galeodes ruptor Roewer, 1934 p.269: Turkey [northern Diyarbakır, *Diyarbakır*]; Greece.

Galeodes schach Birula, 1905 p.269: Turkey?; Iran.

Galeodes separandus Roewer 1934 * p.270: Turkey [near Erzurum, *Erzurum*].

Galeodes subsimilis Roewer, 1934 * p.271: Turkey [near Erzurum, *Erzurum*].

Galeodes taurus (Roewer, 1934) * p.271: Turkey [northern Diyarbakır, *Diyarbakır*].

Galeodes toelgi Werner, 1922 * p.271: Turkey [Gavur Dağları (Amanos Dağları), *Hatay*].

Galeodes viridipilosus Roewer, 1941 * p.273: Turkey [Toros Dağları (Taurus)].

Gluviopsida taurica Roewer, 1933 * p.229: Turkey [northern Diyarbakır, Toros Dağları (Taurus), *Diyarbakır*].

Gluviopsilla discolor (Kraepelin, 1899) p.229: Turkey [İzmir (Smyrna), *İzmir*]; Algeria, Greece (Rhodes), Somalia, Syria.

Gluviopsis paphlagoniae Turk, 1960 * p.230: Turkey [Ereğli, *Konya*].

Gnosippus anatolicus Roewer, 1961 * p.231: Turkey [32 km west of Kayseri, *Kayseri*].

Gylippus (Gylippus) quaestiunculus Karsch, 1880 * p.278: Turkey [Kubek].

Gylippus (Gylippus) syriacus (Simon, 1872) p.278: Turkey; Cyprus, Iraq, Israel, Syria.

Gylippus (Paragylippus) caucasicus Birula, 1907 p.279: Turkey; Armenia, Azerbaijan, Georgia.

Gylippus (Paragylippus) caucasicus koenigi Birula, 1913 * p.279: Turkey [ca. 10 km east of Oltu, Abusar Dağları, *Erzurum*].

Gylippus (Paragylippus) monoceros Werner, 1905 * p.279: Turkey [Lifos, Erciyeş Dağı, *Kayseri*].
Karschia (Karschia) mastigofera Birula, 1890 p.286: Turkey [Kars, *Kars*]; Armenia, Georgia.
Rhagodia obscurior (Penther, 1913) p.297: Turkey; Iran.

[* = endemic species]

Key to Solpugid Families of Turkey

1. Anus : ventrally located **Family RHAGODIDAE**
Tarsal segmentation : 1-1-1-1
Heavy-bodied; short-legged; small to large (10-60 mm)
Leg 1 : tarsi : with a pretarsus + 2 claws
metatarsi : with a dense ventral clothing of short spinelike setae
Male cheliceral flagellum : paraxially immovable; composed of 2 flattened, curled, setae that form a nearly complete, slightly curved, truncate, hornlike tube on the mesial surface
Distribution : northeastern Africa, southwestern Asia, and Near East.
[27 genera, 98 species]
-. Anus : terminally located **...2**

2. Tarsal claws of legs 2 to 4 : setaceous **Family GALEODIDAE**
Tarsal segmentation : 1-2-2-3
Long-legged; small to large (12-70 mm)
Leg 1 : tarsi : without claws or with 1 or 2 claws
Male cheliceral flagellum : paraxially movable; a single, capitate (terminally enlarged) seta located on the mesial surface
Distribution : northern Africa, and Asia.
[8 genera, 199 species]
-. Tarsal claws of legs 2 to 4 : smooth **...3**

3. Leg 1 : tarsi : without claws **Family DAESIIDAE**
Tarsal segmentation : 1-1-1-1 to 1-2-2-4
Long-legged; tiny to moderate-sized (6-23 mm)
Male cheliceral flagellum : paraxially movable, ovate to irregular membranous structure attached to the mesial surface by a disk
Female genital opercula : not differentiated from other abdominal sternites and not specifically variable
Propeltidium : exterior lobes : fused.
Distribution : Africa, southern Europe, Near East, and South America.
[7 subfamilies, 28 genera, 189 species]
-. Leg 1 : tarsi : with 1 or 2 claws
Tarsal segmentation : 1-1-1-1
Small to moderate-sized (8-26 mm); long-legged
Female genital opercula : differentiated from other abdominal sternites and specifically variable **...4**

4. Chelicerae : multidentate **Family KARSCHIIDAE**

Propeltidium : exterior lobes : posteriorly fused

Male cheliceral flagellum : paraxially immovable; fanlike to coiled, whiplike seta located on the mesial surface, with associated modified setae and a dorsal cheliceral horn

Tiny to moderate-sized (8-20 mm).

Distribution : Asia and Near East to southeastern Europe and northwestern Africa.

[4 genera, 40 species]

-. Chelicerae : not multidentate **Family GYLIPPIDAE**

Propeltidium : exterior lobes : free

Male cheliceral flagellum : paraxially immovable; dorsal, more or less membranous process associated with one or more strongly modified setae

Small to moderate-sized (11-26 mm).

Distribution : central Asia to Near East.

[5 genera, 26 species]

****

I. Family DAESIIDAE **Key to Sub-Families and Genera**

a. Tarsal segmentation: 1-1-1-1 .... Subfamily Gnosippinae
Ventral spination of tarsus 2-3: 1.2.2.2.2, and tarsus 4: 2.2.2.2.2.2 ...... *Gnosippus* [1 sp.]

b. Tarsal segmentation: 1-1-1-2 .... Subfamily Blossiinae
Ventral spination of tarsus 2-3: 2.2.2.2, and tarsus 4: 2.2.2/2.2 .... *Blossia* [1 sp.]

c. Tarsal segmentation: 1-1-1-3 .... Subfamily Gluviopsinae
Ventral spination of tarsus 2-3: 1.2.2.2.2, and tarsus 4: 2.2/2/2.2.2 ... *Gluviopsis* [1 sp.]
2.2/2/1.2.2 ... *Gluviopsilla* [1 sp.]
2.2.2/2/0 .... *Gluviopsida* [1 sp.]

d. Tarsal segmentation: 1-2-2-4 .... Subfamily Daesiinae
Ventral spination of tarsus 2-3: 1.1/0, and tarsus 4: 2.2/0/2/0 .... *Biton* [2 spp.]

II. Family GALEODIDAE *Galeodes* [18 species]

III. Family GYLIPPIDAE *Gylippus* [2 subgenera]

1. Male chelicerae with 2 principal setae; female genital sternites evenly rounded posteriorly .... *Gylippus (Gylippus)* [2 spp.]

-. Male chelicerae with only 1 principal seta; female genital sternites clearly clefted .... *Gylippus (Paragylippus)* [2 spp, 1 ssp..]

IV. Family KARSCHIIDAE **Key to Genera**

1. Ocular area anteriorly with a blunt top, carrying 2 little bristles. Male flagellum like that of *Eusimonia* .... ***Barrussus*** [1 sp.]

-. Ocular area normal, only with bristles or occupied with tubular hairs in male 2

2. Male flagellum with a strongly differentiated bristles tuft. Female cheliceral movable finger with 2 or more small intermediate-teeth between front and main teeth .... ***Karschia*** [1 sp.]

-. Male flagellum, prolaterally, with a curved, more or less, blunt horn; Ocular area and also the front edge of male's propeltidium only with normal bristles and hairs .... ***Eusimonia*** [1 sp.]

V. Family RHAGODIDAE *Rhagodia* [1 species]

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New Species, New Names

Araneida

Cheiracanthium siwi El-Hennawy, 2001 from Egypt (*Serket*, 7(4): 114-155).
(A new name of *C. tenue* Denis, 1947, a primary junior homonym of *C. tenue* L. Koch, 1873).

Eresus algericus El-Hennawy, 2004 from Algeria (*Serket*, 9(1): 1-4).

Eresus jerbae El-Hennawy, 2005 from Tunisia & Algeria (*Serket*, 9(3): 87-90).

Scorpionida

Pandinus (*Pandinops*) *pococki* Kovařík, 2000 from Somalia (*Serket*, 7(1): 1-7).

Chaerilus petrzelkai Kovařík, 2000 from Vietnam (*Serket*, 7(2): 38-77).
Chaerilus tichyi Kovařík, 2000 from Malaysia
Chaerilus tryznai Kovařík, 2000 from China (Tibet),

Compsobuthus becvari Kovařík, 2003 from Pakistan (*Serket*, 8(3): 87-112).
Compsobuthus jakesi Kovařík, 2003 from Iraq
Compsobuthus kabateki Kovařík, 2003 from Egypt
Compsobuthus kafkai Kovařík, 2003 from Iran
Compsobuthus kaftani Kovařík, 2003 from Iran
Compsobuthus plutenkoi Kovařík, 2003 from Iran
Compsobuthus seicherti Kovařík, 2003 from Sudan
Compsobuthus sobotniki Kovařík, 2003 from Iran

Butheoloides cimrmani Kovařík, 2003 from Ghana (*Serket*, 8(3): 125-127).

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