

New data on the harvestman fauna of Israel (Arachnida: Opiliones)

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Summary

New faunistic data on the Opiliones of Israel are provided. A total of five species of the families Nemastomatidae and Phalangidae are (re)described. Two species, *Phalangium venustum* sp. n. (♂♀) and *Opilio setipenis* sp. n. (♂♀), are described as new.

Introduction

The opilionid fauna of Israel is poorly known, with relevant data virtually limited to the works by Simon (1884, 1892), Roewer (1912, 1923, 1953, 1956) and Starega (1966, 1973, 1984). A total of 13 species have been recorded from the territory of Israel: *Trogulus gypseus* Simon, 1879; *Dicranolasma hoberlandti* Šilhavý, 1955; *Mediostoma haasi* (Roewer, 1953); *Haasus judaues* Roewer, 1949; *Phalangium savignyi* Audouin, 1825; *P. punctipes* (L. Koch, 1878); *P. warhmani* Roewer, 1955; *Metaphalangium cirtanum* (C. L. Koch, 1839); *M. orientale* Starega, 1973; *Opilio coxipunctus* (Sørensen, 1912); *Zachaeus crista* (Brullé, 1832); *Z. hebraicus* (Simon, 1884), and *Z. leucomelas* (Simon, 1884).

This study adds new data to the knowledge of five opilionid species of Israel, of which two are described as new: *Phalangium venustum* sp. n. and *Opilio setipenis* sp. n.

Material and methods

Type and voucher specimens are shared among the following institutions: ZIN=Zoological Institute of Russian Academy of Science, St. Petersburg, Russia (V. A. Krivokhatski); ZMUM=Zoological Museum of Moscow State University, Moscow, Russia (K. G. Mikhailov); ISEA=Siberian Zoological Museum, Institute for Systematics and Ecology of Animals, Novosibirsk, Russia (G. N. Azarkina); IZB=Zoological Institute of National Academy of Sciences of Azerbaijan, Baku (N. Y. Snegovaya); BIDR=Mitrani Department of Desert Ecology, Baustein Institute for Desert Research, Ben Gurion University, Israel (Y. Lubin).

Abbreviations used in the text and tables: Fm=femur, Pt=patella, Tb=tibia, Mt=metatarsus, Ta=tarsus. All measurements are in mm.

The present study is based on the Opiliones material collected in five different localities during the springtime of 2004–2006. The site characteristics are given in Table 1, and their locations are shown on Fig. 1. All the studied material was collected by Prof. Yael Lubin (YL) by pitfall trapping. The traps were plastic cups 10 cm in diameter and 10 cm deep, placed into the ground so that their tops were level with the surface. No preservative was used. The traps were used for a week each year and checked daily. Some traps were placed under shrubs or



Fig. 1: Map of the locations of the field stations for pitfall traps.

trees, others in open patches (bare soil, grassy areas or areas with annual vegetation). There were three traps in each habitat patch.

Survey of species

Mediostoma haasi (Roewer, 1953) (Figs. 2–13)

Mediostoma haasi Roewer, 1953: 209–210, figs. 6a–c.

“*Nemastoma*” *haasi*: Starega, 1973: 132–133, figs. 7–9.

Material: ISRAEL: Mt. Carmel, Ramat Ha-Nadiv: 2♂, 2♀ (BIDR, 90b), May 2004, YL; 6♂, 5♀ (IZB, 90b), same locality and date, YL; 6♂, 6♀ (IZB, 98b), same locality, April 2004, YL. Mt. Meron, 25 May 2006: 6♂, 5♀ (IZB), 2♂, 2♀ (ZIN), 2♂, 2♀ (ISEA), 2♂, 2♀ (ZMUM), YL.

Distribution: Israel, Lebanon (Roewer, 1953; Starega, 1973).

Habitat: This species was collected from under trees and from open patches with annual grasses.

Description: **Male:** Measurements: Body length 1.45, width 1.25. Chelicera: basal segment 0.43, distal segment 0.46, appendage 0.1. Penis: length 1.0, length of glans 0.11. Lengths of palp and leg segments:

	Fm	Pt	Tb	Mt	Ta	Total
Palp	0.51	0.43	0.36	—	0.21	1.51
I	0.53	0.28	0.4	0.75	0.8	2.76
II	1.4	0.35	0.9	2.15	1.4	6.2
III	0.75	0.18	0.4	0.85	0.75	2.93
IV	1.15	0.38	0.63	1.2	0.88	4.24

Station: location (coordinates, elevation a.s.l.)	Annual rainfall (mm)	Substrate & habitats	Grazing	References
Avdat: Agricultural Research Farm (30°47'N, 34°46'E, 600–700 m)	≤100	Loess; sandy wadis; rocky slopes; ancient agricultural terraces; scattered dwarf shrubs	Goats, sheep, camels	Yair & Danin, 1980; Evenari <i>et al.</i> , 1982; Danin, 1983; Aronson & Shmida, 1992
Lehavim: Agricultural Research Organization Experimental & Demonstration Farm; an ILTER site (31°20'N, 34°45'E, 350–500 m)	~300	Limestone & chalk; rocky slopes, alluvial soil wadis; scattered dwarf shrubs and patches of herbaceous vegetation	Sheep, goats (camels)	Danin & Orshan, 1990; Osem <i>et al.</i> , 2002; Dan <i>et al.</i> , 1975; Aronson & Shmida, 1992
Adulam: NPA Nature Reserve & Research Site (31°40'N, 34°50'E, 200 m)	~400	Limestone & chalk; evergreen Mediterranean woodland; sclerophyllous woody vegetation (of all sizes), patches of herbaceous vegetation	Goats	Dan <i>et al.</i> , 1975; Aronson & Shmida, 1992
Mt. Carmel: Ramat Ha-Nadiv, managed by Yad Hanadiv as private park and nature reserve, ILTER site (32°30'N, 34°55'E, 120 m)	~600	Dolomite & limestone; evergreen Mediterranean garigue; sclerophyllous trees and shrubs; diverse herbaceous patches	Cattle	Dan <i>et al.</i> , 1975; Aronson & Shmida, 1992
Mt. Meron: Nature Reserve and cattle rangeland (32°00'N, 35°20'E, 900 m)	~800	Dolomite; Mediterranean forest: 50% of trees deciduous; dense trees and shrub patches	Cattle	Carmel & Kadmon, 1999; Dan <i>et al.</i> , 1975; Aronson & Shmida, 1992

Table 1: Characteristics of the five stations (ILTER=Israel long-term ecological research station).

Body oblong-rounded, somewhat quadrangular; integument papillose (Fig. 2). Body dark brown, with two large lateral light spots. Legs, palps, chelicerae light brown, with dark brown patches. Dorsum with numerous small blunt tubercles. Tergites I–VII with a pair of relatively long and narrow cylindrical tubules, expanded distally. Ocularium low and spherical, with numerous small blunt tubercles. Legs not very long, II and IV thinner and longer than I and III. Femora, patellae and tibiae covered with tiny tubercles and aciculae. All legs covered with setae and hairs. Femora I–IV with pseudo-segments as follows: I-0, II-3, III-1, IV-3. Chelicerae small (Figs. 4–5). Basal segment dorsally and mesally with small tubercles, dorsally with wide appendage having a small spoon-like depression, covered with different long setae. Distal segment of typical structure, also covered with setae. Basal segment retrolaterally with line of finger-shaped plates (Fig. 4, inset). Palps covered with setae and club-shaped bristles (Fig. 6). Tarsus relatively short. Penis (Figs. 7–8): two wings at base of glans; glans with small setae.

Female: Measurements: Body length 1.8, width 1.4. Chelicera: basal segment 0.5, distal segment 0.5. Ovipositor length 0.57 (Figs. 12–13). Lengths of palp and leg segments:

	Fm	Pt	Tb	Mt	Ta	Total
Palp	0.68	0.5	0.4	—	0.13	1.71
I	0.63	0.3	0.5	0.8	0.75	2.98
II	1.2	0.35	0.88	1.9	1.35	5.68
III	0.65	0.3	0.4	0.75	0.8	2.9
IV	1.05	0.3	0.63	1.15	0.9	4.03

Female similar to male, but body slightly bigger and wider (Figs. 3, 9–13). Also no appendage on basal segment of chelicera.

***Phalangium savignyi* Audouin, 1826** (Figs. 14–29)

Phalangium savignyi Audouin, 1826: 182, pl. 9, fig. 3; Roewer, 1923: 752–753, fig. 928; Staręga, 1973: 133–134, figs. 10–12.

Material: ISRAEL: Lehavim: 2♂, 2♀ (BIDR, 99b), March 2004, YL; 23♂, 28♀ (IZB, 99b), 2♂, 2♀ (ZIN), 2♂, 2♀ (ISEA), 2♂, 2♀ (ZMUM), same locality and date. Adulam, 31♂, 30♀, 13 juv. (IZB, 95b), March 2004. Mt. Carmel, Ramat Ha-Nadiv, 7♂, 18♀ (IZB, 98b), April 2004, YL.

Distribution: Israel, Egypt, Jordan, Lebanon (Staręga, 1973).

Habitat: This species was collected from under shrubs and trees and from open patches with annual grasses.

Description: *Male*: Measurements: Body length 5.0, width 4.2. Chelicera: basal segment 2.0, distal segment 2.6, horn 6.4. Penis: length 3.3, length of glans 0.5, length of stylus 0.2. Lengths of palp and leg segments:

	Fm	Pt	Tb	Mt	Ta	Total
Palp	6.0	1.7	2.9	—	6.5	17.1
I	6.0	2.0	4.5	5.7	8.2	26.4
II	8.3	1.6	6.8	7.9	16.0	40.6
III	5.5	1.6	4.1	6.8	10.5	28.5
IV	8.0	1.5	5.3	9.1	13.6	37.5

Body quadrangular (Fig. 14), light brown. Constriction between cephalothorax and abdomen well marked. Saddle-shaped figure dark brown, well marked. Anterior-lateral angles extended and bear groups of denticles; 2–3 denticles on each side of apertures of odoriferous glands. Tergite edges with small denticles. Groups of 5–6 denticles on each side of V-shaped stripe in front of ocularium; group of 9–10 denticles on each side of ocularium. Supracheliceral lamellae with single

hair-tipped denticle. Ocularium bears hair-tipped denticles (8–9) on each side. Legs long, Fe I and III slightly thickened, covered with small denticles and setae. Chelicera (Figs. 16–17). Chelicerae and palps light brown, with dark brown spots. Basal cheliceral segment dorsally with denticles and setae, prolaterally with group of setae; distal segment with appendage of varied length, can be even absent in young individuals, covered dorsally with black-tipped small denticles, microdenticles and setae; only setae laterally and on tip of appendage. Palps long (Figs. 18–19), Fe, Pa prolaterally with poorly visible apophyses, densely covered with setae. All segments with setae of different sizes. Tarsus ventrally with microdenticles. Legs light brown, with dark brown patches. Penis (Figs. 20–23): glans with 2 pairs of setae; stylus bent as a hook.

Female: Measurements: Body length 6.5, width 4.0. Chelicera: basal segment 1.3, distal segment 2.3. Ovipositor length 4.6 (Figs. 28–29). Lengths of palp and leg segments:

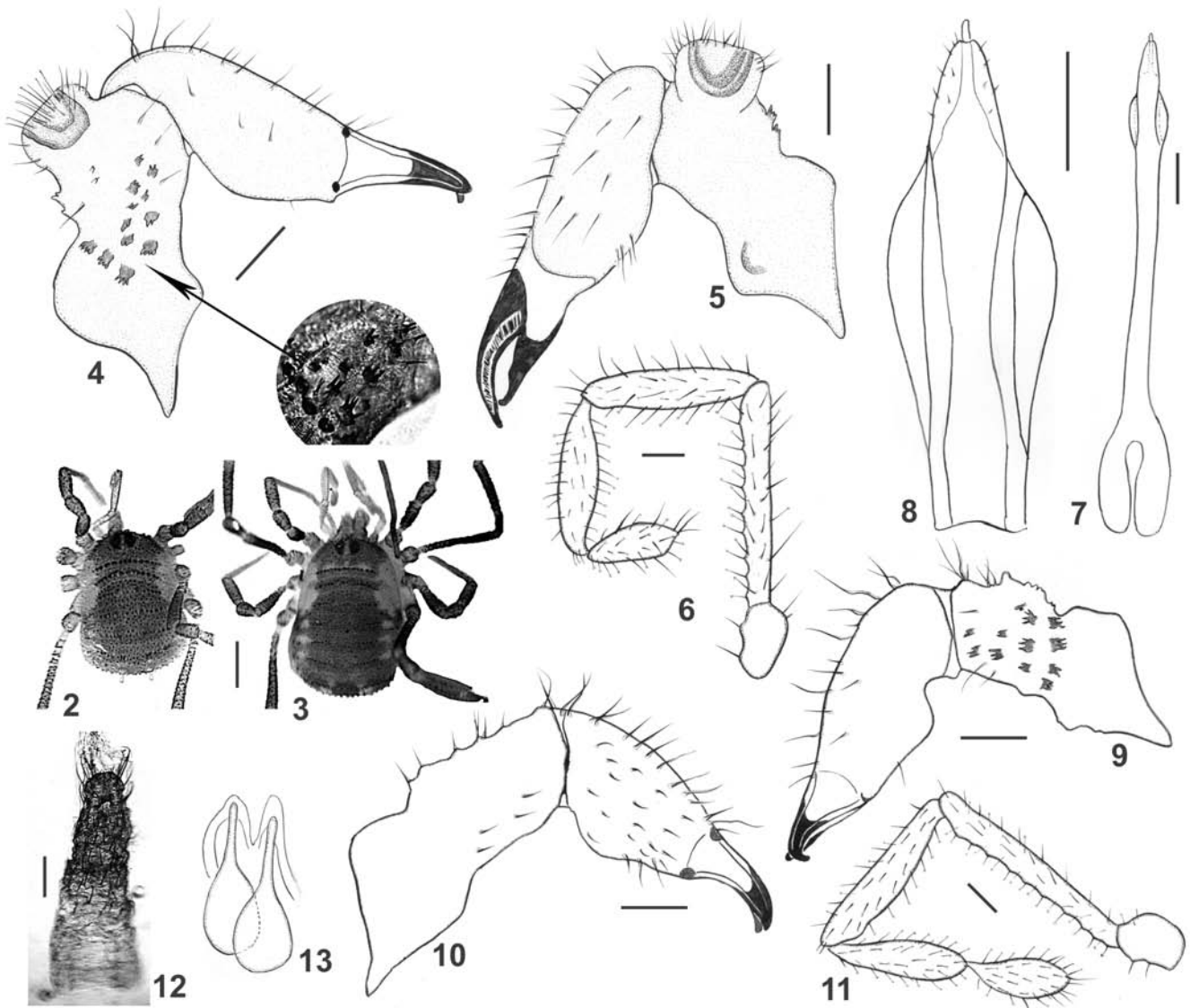
	Fm	Pt	Tb	Mt	Ta	Total
Palp	4.5	2.0	2.5	—	5.7	14.7
I	3.8	1.3	3.25	4.25	6.1	18.7
II	6.5	1.6	5.8	5.6	15.2	34.7
III	4.5	1.7	3.7	5.3	8.8	24.0
IV	6.3	1.7	4.8	8.6	12.2	33.6

Female similar to male, but slightly larger and with more rounded body shape (Figs. 15, 24–29). Legs shorter than in male. Palps also shorter, with more clearly marked apophyses and more downy (Figs. 26–27).

Phalangium venustum sp. n. (Figs. 30–46)

Type: Holotype ♂ (ZIN) from Israel, Avdat, 24–28 March 2004, YL. Paratypes: 1♀ (ZIN), same locality and date; 1♂ (IZB, 47c), 2♂, 2♀ (BIDR, 97b); 2♂, 9♀ (IZB, 97b), 1♂, 2♀ (ISEA), 1♂, 2♀ (ZMUM), same locality, March 2005.

Etymology: The species is named after its graceful body shape.



Figs. 2–13: *Medioloma haasi* (Roewer, 1953). 2 Male body, dorsal view; 3 Female body, dorsal view; 4 Male chelicera, retrolateral view (inset: finger-shaped plates); 5 Ditto, prolateral view; 6 Male palp, retrolateral view; 7 Penis, dorsal view; 8 Glans of penis, dorsal view; 9 Female chelicera, prolateral view; 10 Ditto, retrolateral view; 11 Female palp, retrolateral view; 12 Ovipositor, dorsal view; 13 Seminal receptacles. Scale lines=0.5 mm (2–3, 8), 0.1 mm (4–7, 9–12).

Diagnosis: The new species is closest to *Phalangium punctipes* C. L. Koch, 1878, but differs from it by the characters given in Table 2.

Distribution: Israel.

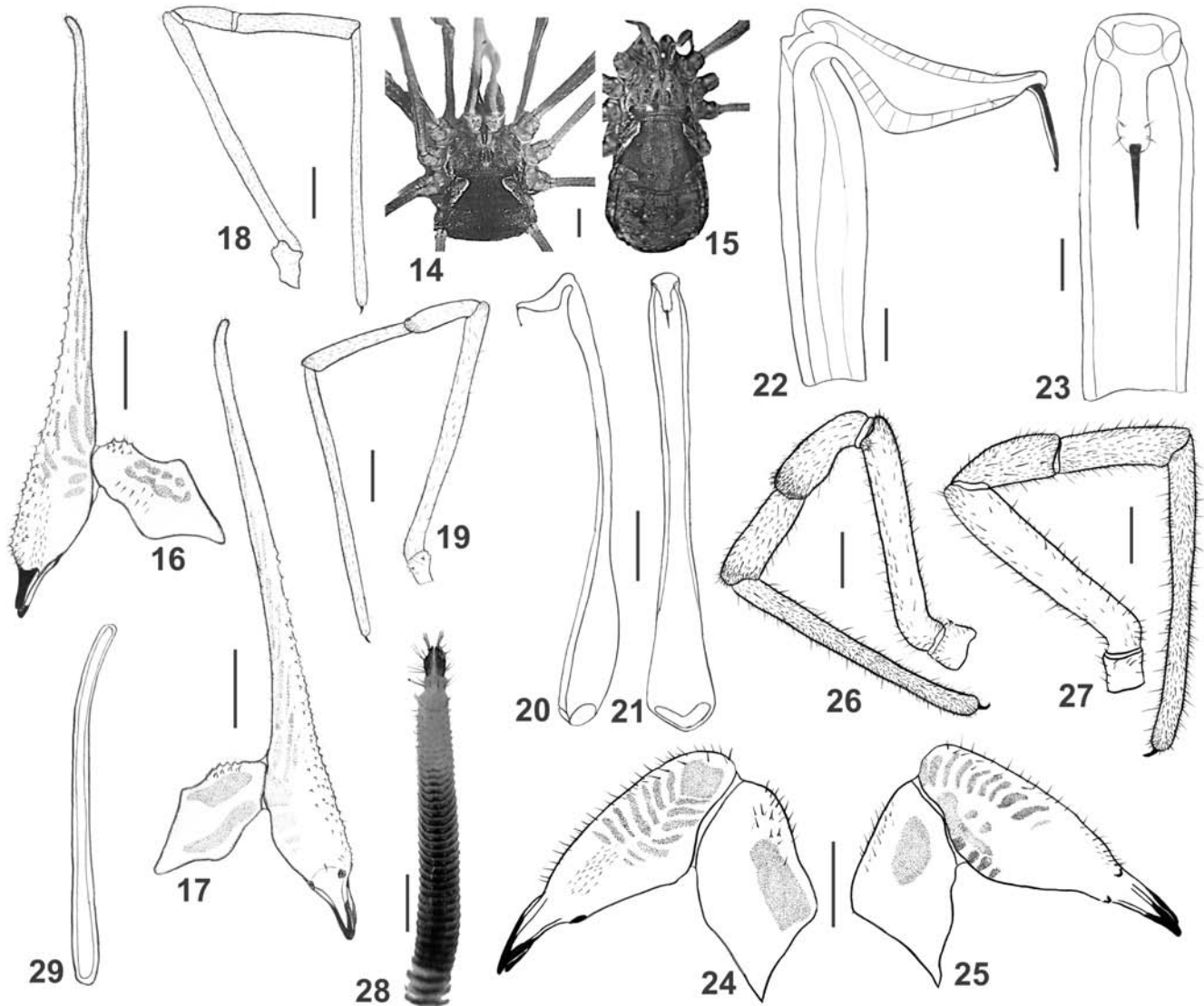
Habitat: This species was collected from under shrubs.

Description: Male: Measurements: Body length 4.2, width 2.6. Chelicera: basal segment 1.5, distal segment 1.6. Penis: length 2.5, length of glans 0.4, length of stylus 0.15. Lengths of palp and leg segments:

	Fm	Pt	Tb	Mt	Ta	Total
Palp	1.3	0.6	0.8	—	1.8	4.5
I	5.2	1.0	4.2	4.2	13.5	28.1
II	10.2	1.7	9.1	3.6	27.6	52.2
III	5.2	1.2	4.3	4.5	15.2	30.4
IV	7.0	1.2	5.2	5.2	19.6	38.2

Body rectangular, yellowish grey, with clearly visible saddle-shape pattern and with well-marked constriction

(Figs. 30, 32). Dorsal side of body covered with rows of small denticles on tergite borders. Operculum almost as long as wide. Ocular tubercle with 7–8 hair-tipped denticles along its median line. In front of ocularium, a dark, V-shaped figure with light longitudinal stripe in middle. Group of 6 hair-tipped denticles on each side of V-shaped figure. Two denticles on each side of ocularium. Venter covered with irregularly scattered small setae; coxae of legs and genital operculum covered with setae. Chelicerae grey-brown, with numerous dark spots (Figs. 33–34). Basal segment dorsally with small denticles and setae; distal segment covered with setae and frontally with microdenticles. Palps short (Figs. 35–36). Fe ventrally covered with denticles and setae; Pa and Ti covered only with setae; Ta covered with setae and ventrally covered with granulations. Legs short and slender. Fe covered with small denticles, other parts covered with small denticles and setae. Palps and legs



Figs. 14–29: *Phalangium savignyi* Audouin, 1826. **14** Male body, dorsal view; **15** Female body, dorsal view; **16** Male chelicera, prolateral view; **17** Ditto, retrolateral view; **18** Male palp, retrolateral view; **19** Ditto, prolateral view; **20** Penis, lateral view; **21** Ditto, dorsal view; **22** Glans of penis, lateral view; **23** Ditto, dorsal view; **24** Female chelicera, prolateral view; **25** Ditto, retrolateral view; **26** Female palp, prolateral view; **27** Ditto, retrolateral view; **28** Ovipositor, dorsal view; **29** Seminal receptacle. Scale lines=1 mm (14–19, 26–27), 0.5 mm (20–21, 24–25, 28), 0.1 mm (22–23).

Phalangium venustum

Body	Not very long, c. 4.2 mm (Figs. 30, 32)
Legs	Long, Fe equally thick along their length
Chelicera	Not large, dorsal side of basal segment with some denticles, other parts covered with setae only (Figs. 33–34)
Palp	Short (Figs. 35–36)
Penis	Shorter, stylus with 3 pairs of setae (Figs. 37–40)

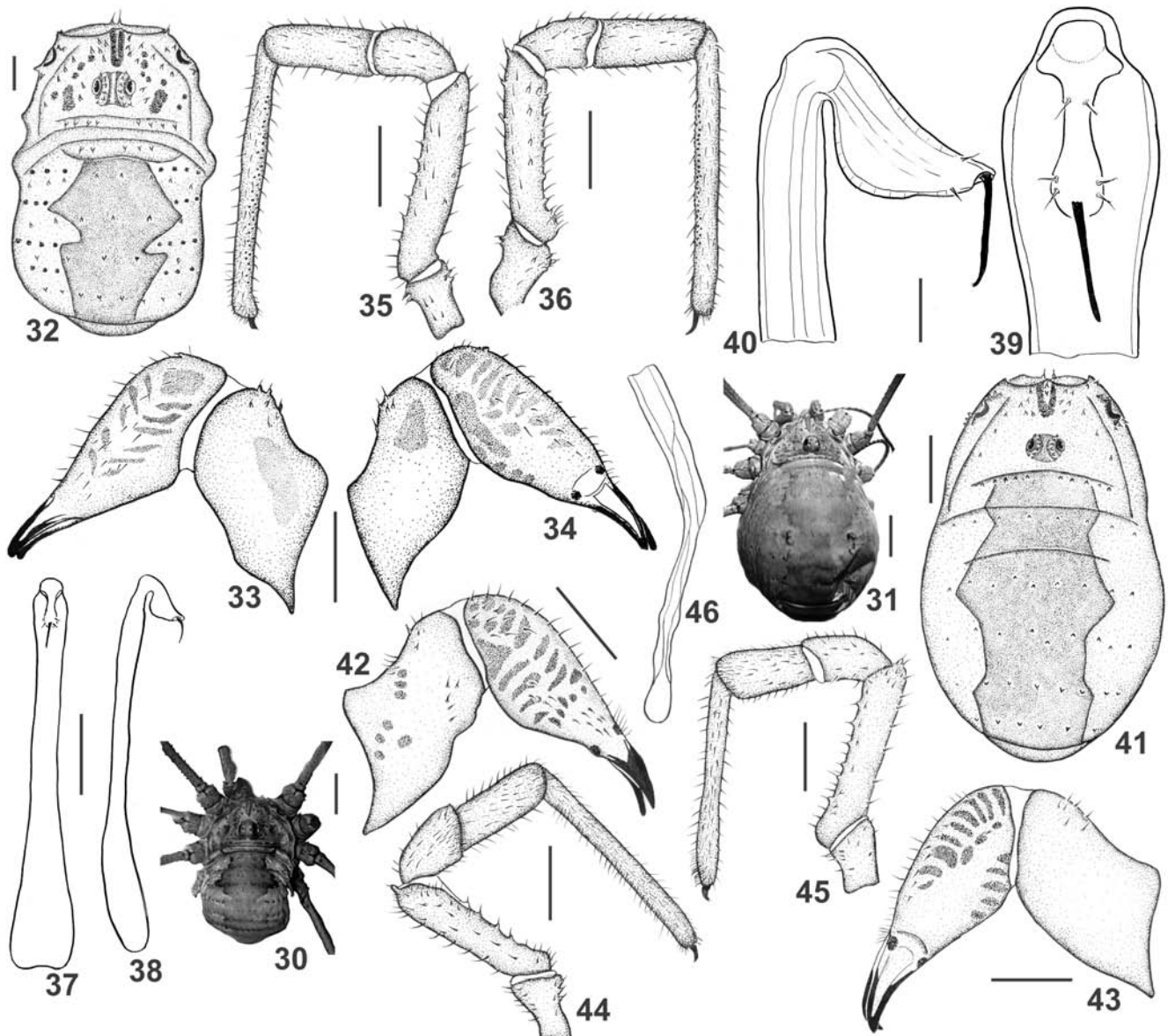
Phalangium punctipes

Body	Body relatively long, 8.2 mm (Chemersis & Kovblyuk, 2005: figs. 9–11)
Legs	Short, Fe I significantly thickened
Chelicera	Rather thickened, dorsal side of basal and distal segments covered with denticles, granulations and setae (Chemersis & Kovblyuk, 2005: figs. 13–14)
Palp	Relatively long (Chemersis & Kovblyuk, 2005: fig. 16)
Penis	Longer, with 2 pairs of setae; wings of penis widened (Chemersis & Kovblyuk, 2005: figs. 15, 17–18)

Table 2: Diagnostic characters of *Phalangium venustum* sp. n. and *P. punctipes* C. L. Koch, 1878.

light brown, with dark spots. Penis light yellow, wide at base (Figs. 37–40), narrowed in middle and widened again distally. Glans of penis with 3 setae on each side: two pairs close to stylus and one pair toward base.

Female: Measurements: Body length 5.5, width 3.5. Chelicera: basal segment 1.5, distal segment 1.4. Ovipositor length 4.1 (Fig. 46). Lengths of palp and leg segments:



Figs. 30–46: *Phalangium venustum* sp. n. **30, 32** Male body, dorsal view; **31, 41** Female body, dorsal view; **33** Male chelicera, prolateral view; **34** Ditto, retrolateral view; **35** Male palp, prolateral view; **36** Ditto, retrolateral view; **37** Penis, dorsal view; **38** Ditto, lateral view; **39** Glans of penis, dorsal view; **40** Ditto, lateral view; **42** Female chelicera, prolateral view; **43** Ditto, retrolateral view; **44** Female palp, retrolateral view; **45** Ditto, prolateral view; **46** Seminal receptacle. Scale lines=1 mm (30–32, 41), 0.5 mm (33–38, 42–45), 0.1 mm (39–40).

	Fm	Pt	Tb	Mt	Ta	Total
Palp	1.2	0.5	0.7	—	1.6	4.0
I	3.5	1.0	3.3	2.7	7.1	17.6
II	7.1	1.5	6.7	3.0	14.7	33.0
III	3.3	1.3	2.8	3.0	7.5	17.9
IV	5.0	1.3	3.8	3.3	10.2	23.6

Female differs from male only in larger body size (Figs. 31, 41–46), in shorter legs and in more numerous denticles in front of ocularium ($n=14-16$).

***Opilio coxipunctus* (Sørensen, 1912)** (Figs. 47–63)

Material: ISRAEL: Mt. Carmel, Ramat Ha-Nadiv: 2♂, 2♀ (BIDR, 99b), 49♂, 30♀, 3 juv. (IZB 71c, 90b, 99b), 2♂, 2♀ (ZIN), 2♂, 2♀ (ISEA), 2♂, 2♀ (ZMUM), May 2004, YL; 55 juv. (IZB 98b), same locality, April 2004, YL. Mt. Meron, Bertins, 4♂, 3♀ (IZB), May 2006, YL.

Distribution: Israel, Lebanon, Libya, Syria, Iraq (Starega, 1973).

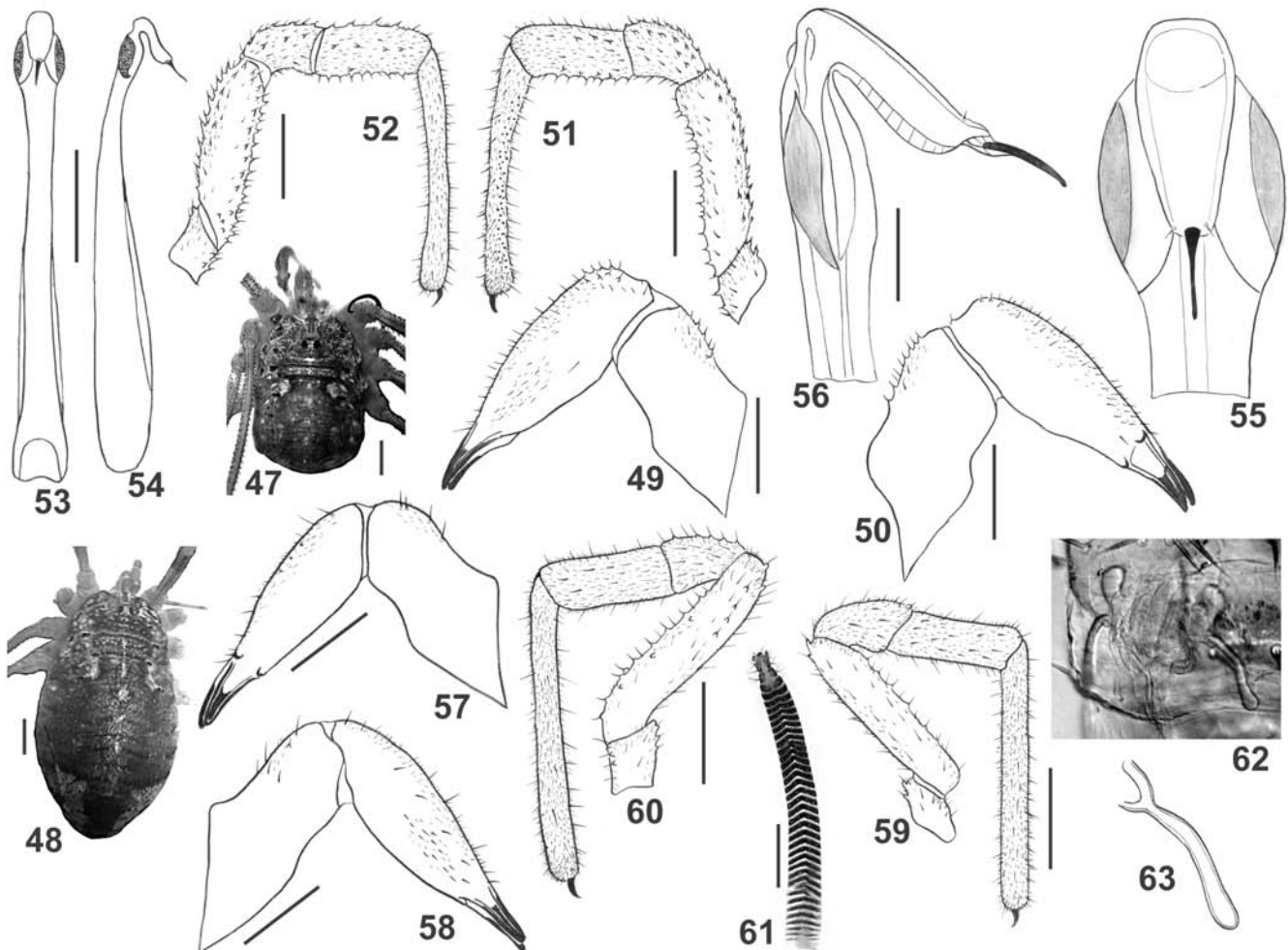
Habitat: This species was collected from under shrubs and from an open area with annual grasses.

Description: Male: Measurements: Body length 4.3, width 2.5. Chelicera: basal segment 1.25, distal segment

1.45. Penis: length 2.2, length of glans 0.26, length of stylus 0.1. Lengths of palp and leg segments:

	Fm	Pt	Tb	Mt	Ta	Total
Palp	0.9	0.5	0.65	—	1.5	3.55
I	4.0	1.3	3.2	2.5	7.5	18.5
II	8.2	1.5	6.8	4.3	15.6	36.4
III	4.0	1.2	3.1	4.25	6.9	19.45
IV	5.8	1.2	4.5	6.3	8.8	26.6

Body quadrangular, grey yellow, with dark patches of various shapes and with well-marked constriction (Fig. 47). Borders of tergites with a single or double lines of small denticles. Groups of denticles in front of ocularium and 5–6 on each side. Ocularium low. Apertures of odoriferous glands bear 2–3 denticles on each side. Legs relatively long, light brown, with dark spots. Fe I and II slightly thicker than others and densely covered with transverse rows of denticles and setae. Chelicerae small (Figs. 49–50), light brown, with dark spots of various sizes. Basal segment with some denticles and setae; distal segment dorsally with denticles and setae. Palps short (Figs. 51–52), light brown, with brown spots. Fe dorsally and ventrally with denticles and setae, laterally with setae only; Pa and Ti dorsally and laterally



Figs. 47–63: *Opilio coxipunctus* (Sørensen, 1912). 47 Male body, dorsal view; 48 Female body, dorsal view; 49 Male chelicera, prolateral view; 50 Ditto, retrolateral view; 51 Male palp, prolateral view; 52 Ditto, retrolateral view; 53 Penis, lateral view; 54 Ditto, dorsal view; 55 Glans of penis, dorsal view; 56 Ditto, lateral view; 57 Female chelicera, retrolateral view; 58 Ditto, prolateral view; 59 Female palp, retrolateral view; 60 Ditto, prolateral view; 61 Ovipositor, dorsal view; 62–63 Seminal receptacles. Scale lines=1 mm (47–48, 61), 0.5 mm (49–54, 57–60), 0.1 mm (55–56).

with denticles and setae; Ta with setae, ventrally with microdenticles. Penis (Figs. 53–56), with wide wings; glans with one pair of setae.

Female: Measurements: Body length 5.5, width 3.3. Chelicera: basal segment 1.25, distal segment 1.55. Ovipositor length 3.5 (Figs. 61–63). Lengths of palp and leg segments:

	Fm	Pt	Tb	Mt	Ta	Total
Palp	1.05	0.55	0.65	—	1.5	3.75
I	3.8	1.1	3.5	3.8	6.5	18.7
II	7.5	1.6	7.0	4.3	15.6	36.0
III	4.1	1.0	3.4	4.3	6.8	19.6
IV	6.0	1.2	4.7	6.1	9.6	27.6

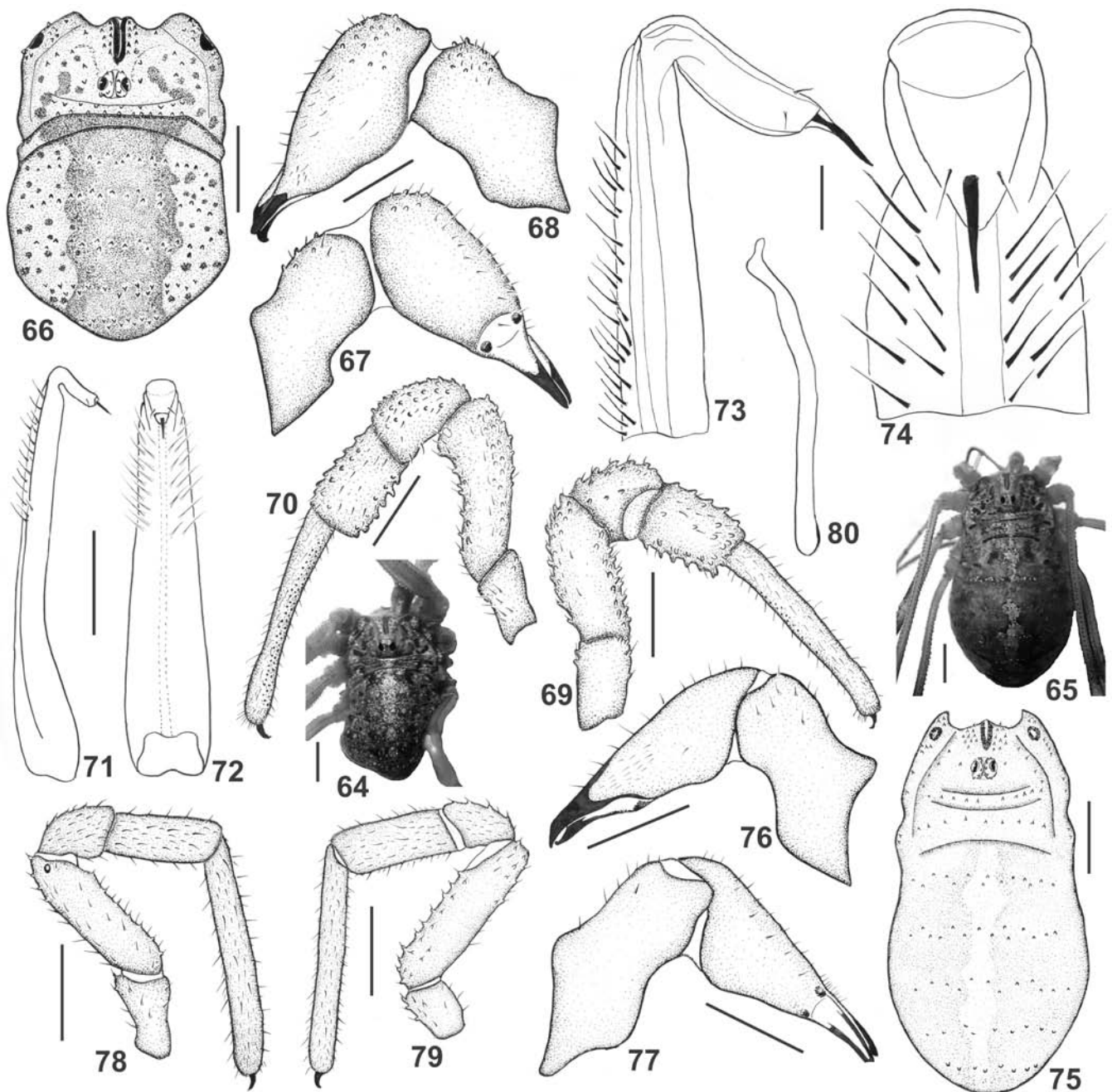
Female differs from male in larger and more rounded body (Figs. 48, 57–63) and in less armed palps.

Opilio setipenis sp. n. (Figs. 64–80)

Type: Holotype ♂ (ZIN) from Israel, Lehavim, March 2004, YL. Paratypes: 1♀ (ZIN), 1♂, 1♀ (BIDR, 99b), 2♂, 2 juv. (IZB 99b), same locality and date.

Etymology: The species is named after the morphological structure of its penis.

Diagnosis: The new species is closest to *Opilio saxatilis* C. L. Koch, 1839, but differs from it by the characters given in Table 3.



Figs. 64–80: *Opilio setipenis* sp. n. **64, 66** Male body, dorsal view; **65, 75** Female body, dorsal view; **67** Male chelicera, retrolateral view; **68** Ditto, prolateral view; **69** Male palp, prolateral view; **70** Ditto, retrolateral view; **71** Penis, lateral view; **72** Ditto, dorsal view; **73** Glans of penis, lateral view; **74** Ditto, dorsal view; **76** Female chelicera, prolateral view; **77** Ditto, retrolateral view; **78** Female palp, prolateral view; **79** Ditto, retrolateral view; **80** Seminal receptacle. Scale lines=1 mm (64–66, 75), 0.5 mm (67–72; 76–79), 0.1 mm (73–74).

*Opilio setipenis**Opilio saxatilis*

Legs	Fe I considerably thickened; legs pentagonal in cross section, but segments' sides poorly marked, each with 2–3 longitudinal rows of denticles and setae	Fe I slightly thickened, clearly pentagonal in cross section and with single row of denticles and setae on each side
Penis	Penis without lateral wings; shaft widened at base and narrowed to its apical part; distal third covered with long setae; glans armed with two setae on each side (Figs. 71–74)	Penis with lateral wings; shaft slightly widened and narrowed in middle, then again widened apically; apical part of shaft with long setae on each side (Martens, 1978: 243–247, figs. 429–430)

Table 3: Diagnostic characters of *Opilio setipenis* sp. n. and *O. saxatilis* C. L. Koch, 1839.

Distribution: Israel.

Habitat: This species was collected from under shrubs.

Description: Male: Measurements: Body length 3.8, width 2.8. Chelicera: basal segment 1.5, distal segment 1.9. Penis: length 1.9, length of glans 0.3, length of stylus 0.09. Lengths of palp and leg segments:

	Fm	Pt	Tb	Mt	Ta	Total
Palp	1.1	0.6	0.75	—	1.4	3.85
I	2.6	1.0	2.25	2.5	3.6	11.95
II	5.5	1.0	4.9	3.3	9.6	24.3
III	2.75	1.0	2.4	2.75	4.2	13.1
IV	3.8	1.0	3.0	4.3	5.1	17.2

Body quadrangular, with clearly marked constriction (Figs. 64, 66). Group of 8 denticles on each side in front of ocularium, and a few denticles on each side of eye tubercle. Transverse double rows of black-tipped denticles on dorsal side along tergite borders. Group of 9–10 denticles on each side of each odoriferous gland. Eye tubercle low with 4–5 small setae on each side. Ventral parts of body, coxae and genital operculum covered with setae. Venter silver-coloured, coxae and genital operculum light brown, coxae with dark brown patches. Body light brown with numerous black-brown patches of different sizes. Legs short, Fe I and II significantly widened. Legs pentagonal in cross section, but sides poorly marked. Fe and Pa covered with longitudinal rows of denticles and setae; Ti dorsally with denticles, other parts with setae. Legs light brown, with dark brown patches. Palps (Figs. 69–70). Fe, Pa, Ti covered with black-tipped denticles and setae; Ta ventrally with 2–3 rows of microdenticles and with setae. Chelicerae (Figs. 67–68): Basal segment dorsally with small denticles and setae; distal segment dorsally with microdenticles and setae, laterally also with setae basally. Penis (Figs. 71–74): wide basally, narrowing to glans; distal third ventrally covered with long setae. Glans triangular in dorsal view, with two setae on each side.

Female: Measurements: Body length 5.3, width 3.2. Chelicera: basal segment 1.13, distal segment 1.4. Lengths of palp and leg segments:

	Fm	Pt	Tb	Mt	Ta	Total
Palp	0.93	0.45	0.63	—	1.25	3.26
I	—	—	—	—	—	—
II	5.5	1.3	4.8	3.3	9.8	24.7
III	2.3	1.0	2.0	2.8	3.8	11.9
IV	3.8	1.0	3.1	3.9	6.2	18.0

Female larger than male and with oval body; legs thinner and slender (Figs. 65, 75–80); chelicerae and palps with fewer denticles.

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An ontogenetic shift in habitat use by the Neotropical tarantula *Ephebopus murinus* (Araneae, Theraphosidae, Aviculariinae)

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Summary

We studied the structure and placement of retreats of the tarantula *Ephebopus murinus* (Walckenaer, 1837) in the field in French Guiana. We found that early-instar spiderlings construct above-ground silken tubular retreats among low vegetation, and shifted to a fossorial lifestyle when subadult. Discriminant analysis of microhabitat variables associated with each class of retreat demonstrated that each was predicted by different habitat features. The location of above-ground retreats was predicted by the presence of the terrestrial bromeliad *Bromelia* spp., whereas leaf-litter predicted the placement of the burrows. This is one of the few examples of an ontogenetic habitat shift (OHS) in a spider. OHS has been suggested to fulfill an ecological function by reducing cannibalism and intraspecific competition. *Ephebopus* is a fossorial tarantula genus in an otherwise arboreal subfamily. Because of this we suggest that the fossorial lifestyle of subadult/adult *E. murinus* has evolved secondarily, with the arboreal habit of the early instars reflecting the ancestral habit. This would be a case where phylogeny, and not ecology, explains OHS.

Introduction

Spiders have proven to be a very useful research taxon with which to study habitat selection and its consequences (e.g. Wise, 1993). One of the main reasons is that many spider species are sedentary, making habitat choice unambiguous. Web-building spiders have been the focus of habitat selection studies because the web itself is a foraging mechanism, making site choice a significant investment (Riechert, 1974, 1976; Hodge, 1987a, b).

Despite the extensive literature documenting the ecology of habitat selection and its consequences for araneo-

morph spiders, the body of literature on mygalomorph ecology is small (e.g. Stradling, 1994). Coyle (1986) provides an excellent review of the literature on prey capture by liphistiomorphs and mygalomorphs. He notes that mygalomorph spiders are sedentary, and foraging behaviour generally consists of sitting by the entrance of the retreat at night, waiting for prey to come within striking range. Despite the availability of Coyle's (1986) synthesis, Foelix (1996: 165) reiterates the common misconception that mygalomorphs are vagrant: "... which merely move about until they come across potential prey". Far from being vagrant, the vast majority of mygalomorphs are sedentary to the point of being functionally sessile.

Diverse animal taxa have been observed to exhibit an ontogenetic habitat shift, in which different age/size classes selectively utilise different microhabitats (reviewed in Werner & Gilliam, 1984). Ontogenetic habitat shifts (hereafter referred to as OHS) have been suggested to reduce size-dependent predation, cannibalism and intraspecific competition and are particularly well documented in fish (Werner & Gilliam, 1984, Werner & Hall, 1988). Previous research into habitat use in spiders has found evidence of spatial and temporal OHS, e.g. the OHS exhibited by the wolf spiders *Rabidosa (Lycosa) santrita* (Chamberlin & Ivie, 1942) (Kronk & Riechert, 1979) and *Pardosa (Lycosa) lugubris* (Walckenaer, 1802) (Edgar, 1971) as well as the web-placement shift in colonies of the orb-weaver *Metepeira incrassata* F. O. P.-Cambridge, 1903 (Rayor & Uetz, 1993).

This study describes an apparent case of OHS in the Neotropical tarantula *Ephebopus murinus* (Walckenaer, 1837). The tarantula genus *Ephebopus* Simon, 1892 is a fossorial member of the otherwise arboreal subfamily Aviculariinae (Lucas *et al.*, 1991, 1992). Members of this genus bear urticating hairs on the apical prolateral surface of the palpal femora as opposed to the dorsal surface of the abdomen as in all other urticating hair-bearing theraphosid spiders (Marshall & Uetz, 1990). In the field in French Guiana we discovered that early-instar spiderlings build tubular, silken retreats off the ground among vegetation in contrast to the distinctive burrows that older juveniles and adult females build in the soil. The aim of this study was to quantify retreat-site variables for a population of *E. murinus*.