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First record of the genus *Megachernes* (Pseudoscorpiones: Chernetidae) from an Iranian cave

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Abstract. The pseudoscorpion genus *Megachernes* is recorded for the first time in Iran. Adults and protonymphs of *Megachernes pavlovskyi* Redikorzev, 1949 were found in a porcupine nest and under stones in the Deh Sheikh (Pataveh) cave, Kohgiluyeh and Boyer-Ahmad Province, Southwest Iran. A short description of the species is provided, based on the main morphological and morphometric characters of the adults.

Keywords: cave, Iran, new record, porcupine nest, pseudoscorpion, Southern Asia, taxonomy

Pseudoscorpions in the family Chernetidae Menge, 1855 are found all over the world, occurring under tree bark, in nests, leaf litter and caves, as well as in a variety of other habitats. Three subfamilies are recognized – Chernetinae Menge, 1855, Goniochernetinae Beier, 1932 and Lamprochernetinae Beier, 1932 – but their status and interrelationships are still very poorly understood (Harvey 2011). Lamprochernetinae can be recognized by the structure of the female spermathecae, which are basically T-shaped. Thirty-nine pseudoscorpion species were recorded from Iran, eight of them are representatives of the family Chernetidae (Harvey 2011).

The genus *Megachernes* Beier, 1932, currently encompassing twenty-three species, occurs in Asia, Australia and the European part of Russia (Harvey 2011, Harvey et al. 2012). *Megachernes* species are usually associated with small mammals, their nests or pelage, but they have also been found in nests of birds and bumblebees, and some are troglophiles found in caves, frequently on bat guano (Beier 1948, Schawaller & Dashdamirov 1988, Harvey et al. 2012). Most species of this genus are only known from a single country (Harvey 2011), but this is probably due to under-collecting and it is likely that the distribution of many species is much broader. An exception is *M. pavlovskyi* Redikorzev, 1949, which is known to have a particularly wide distribution: Afghanistan, Azerbaijan, Kyrgyzstan, Pakistan, Russia, Tajikistan and Turkmenistan (Harvey 2011). This species is mostly found on bat guano in caves (Beier 1959, Krumpál 1986, Schawaller 1986, Schawaller & Dashdamirov 1988, Dashdamirov & Schawaller 1995). *Megachernes pavlovskyi* is here recorded in Iran for the first time, having been discovered in the nest of a porcupine, *Hystrix indica* (Keep, 1792).

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Material and methods

Specimens were preserved in 70% ethanol; some were studied as permanent slide mounts in Swan's fluid and the others as temporary slide mounts in lactic acid (det. Christophoryová, the identification confirmed by S. Dashdamirov). Microphotographs were made using the EOS Utility software and a digital camera (Canon EOS 1100D) connected to a Zeiss Stemi 2000-C stereomicroscope. The female genitalia were dissected in ethanol and macerated using a NaOH solution, then mounted on a permanent slide in Swan's fluid. Microslides of the spermathecae were photographed using a Leica ICC50 camera connected to a Leica DM1000 microscope, using Leica LAS EZ 1.8.0 software. Digital images were combined using the CombineZP image stacking software. All measurements were obtained using AxioVision 4.8.2. Part of the material is deposited in the collection of the first author at the Comenius University, Bratislava, and the rest in the collection of Department of Biology at Shiraz University, Iran (CBSU-Ar-Ps.1). Morphological terminology follows Beier (1963), Harvey (1992) and Judson (2007).

Results

Megachernes pavlovskyi Redikorzev, 1949

The species has been described under two names: *Megachernes pavlovskyi* Redikorzev, 1949: 651-652 (Redikorzev 1949), 274 (Beier 1959), 31 (Lindberg 1961), 3 (Schawaller 1986), 43 (Schawaller & Da-

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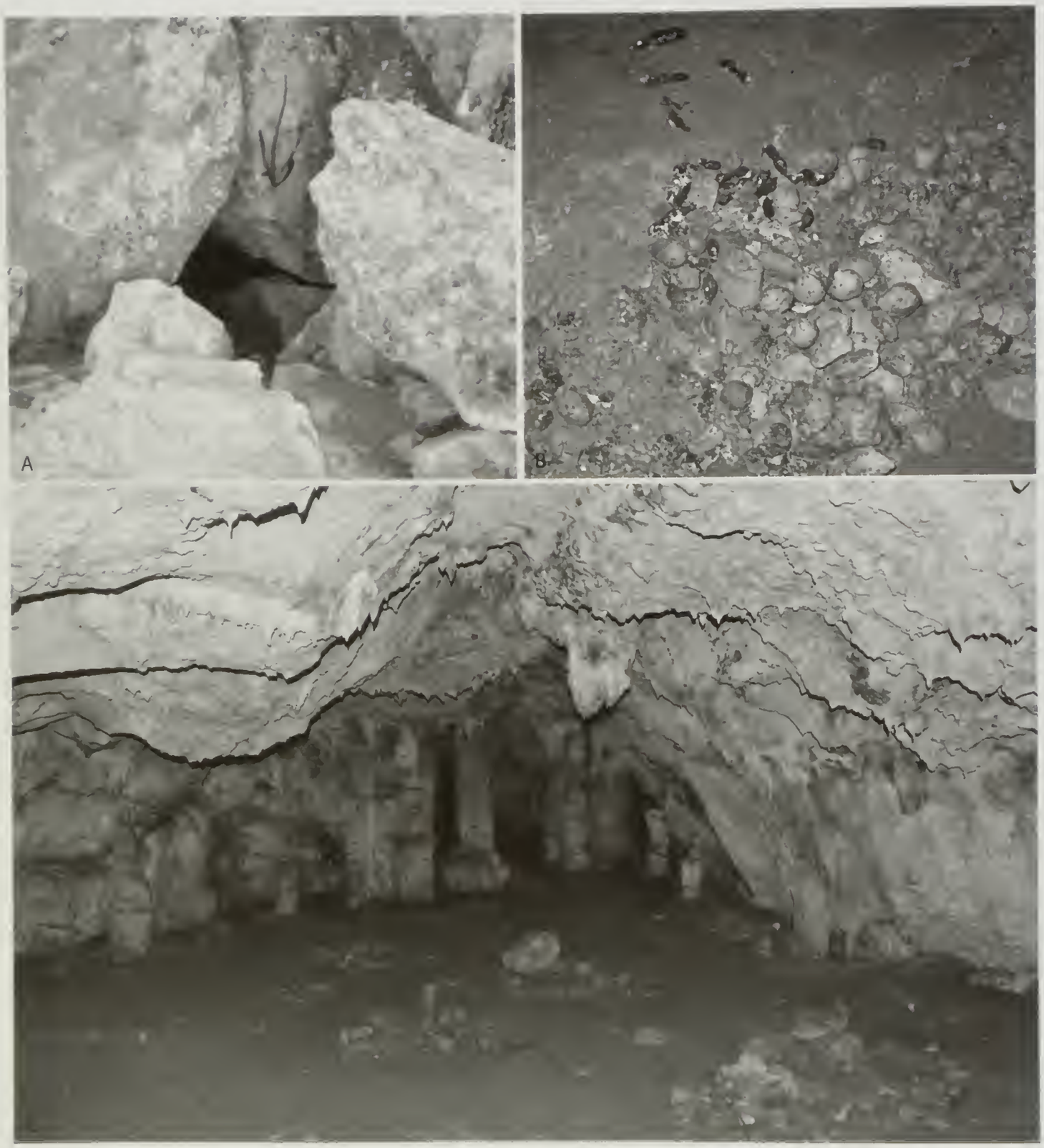

Fig. 1: Deh Sheikh cave, in which *Megachernes pavlovskyi* was found. A. Cave entrance. B. Detail of porcupine den. C. Cave interior. – Photos: Mohammad Javad Malek Hosseini.

shdamirov 1988), 600-601 (Harvey 1991), 56 (Dashdamirov & Schawaller 1992), 8 (Dashdamirov & Schawaller 1995), 258-259 (Dashdamirov 2004), 2530 (Harvey et al. 2012).

Megachernes caucasicus Krumpál, 1986: 170-171 (Krumpál 1986); synonymised by Schawaller & Dashdamirov (1988).

Material examined

The pseudoscorpions were collected individually under stones and in a porcupine nest in the aphotic (dark) zone (about 70–80 m from the main entrance) of the Deh Sheikh (Pataveh) cave, by Malek Hosseini & Sadeghi. Several specimens were taken there, 11 of which (27.9.2011: 3 females, 1 male, 2 protonymphs; 13.7.2012:

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Fig. 2: *Megachernes pavlovskyi* from Deh Sheikh cave. A. Female. B. Male. Scale: 1 mm. – Photos: Jana Christophoryová.

1 female, 4 males) were examined in detail. The cave is situated in the mountains around the village of Dehsheikh, north-west of the city of Yasuj, in Kohgiluyeh and Boyer-Ahmad Province (30°57′22″N; 51°14′17″E; 1735 m a.s.l.; Fig. 1). The temperature inside the cave is constant, about 15.5–16.5 °C. The relative humidity was measured only on the visiting days; its values were between 72 and 84 %. Unfortunately, due to human activities, some parts of the Deh Sheikh cave have been destroyed and animal life here is endangered.

Short description of adults (Fig. 2)

The genus *Megachernes*, subfamily Lamprochernetinae, is characterized by the following characters (Fig. 3): posterior corners of coxae IV enlarged and rounded, lobe-shaped, better developed in females; cheliceral rallum of three blades; tarsus IV with a long tactile seta situated in middle of segment; and female spermathecae T-shaped and with very long ends uniform in diameter and slightly expanded terminally (Harvey et al. 2012).

Adults of both sexes were measured; the measurements and ratios are summarised in Tables 1 and 2.

Females (4 specimens)

Carapace and pedipalps reddish-brown, tergites and sternites brown (Fig. 2A). Carapace: about as long as broad, broadest posteriorly, anterior margin straight; eyes or eyespots completely absent; with two distinct transverse furrows; chaetotaxy of carapace: about 68–75 short setae, finely dentate apically, about 8–9 of which noticeably longer than others on anterior margin, about 40–48 in front of median transverse furrow and about 11–13 behind subbasal transverse furrow; many slit-like lyrifissures present over entire carapace. Chelicerae with 4 retrorse teeth on fixed finger; 7 setae on hand, basal 5 finely dentate apically, movable finger with one acuminate seta; galea well-developed, with approximately 9–10 short terminal and subterminal branches; rallum with three blades. Pedipalps (Fig. 2A): robust, well-sclerotized, with well-developed granulation; chelal finger longer than hand width; chelal fingers with normal number of trichobothria – 8 on fixed finger, 4 on movable finger; trichobothrial pattern identical to that described by previous authors (Krumpál 1986, Dashdamirov & Schawaller 1995, Dashdamirov 2004); venom appa-

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Tab. 1: Morphometric data for *Megachernes pavlovskyi* females (in mm).

Characteristics	min	max	x	M	SD	n
Body, length	3.54	4.55	3.99	3.88	0.51	3
Carapace, length	1.07	1.24	1.16	1.16	0.08	4
Carapace, posterior width	1.08	1.23	1.15	1.15	0.07	4
Carapace, length/posterior width ratio	0.99	1.18	1.09	1.10	0.08	4
Chelicera, length	0.32	0.33	0.32	0.32	0.01	3
Chelicera, width	0.15	0.16	0.16	0.16	0.01	3
Chelicera, length/width ratio	2.06	2.13	2.08	2.06	0.04	3
Cheliceral movable finger, length	0.25	0.29	0.27	0.26	0.02	3
Palpal trochanter, length	0.54	0.57	0.55	0.55	0.01	4
Palpal trochanter, width	0.34	0.38	0.36	0.35	0.02	4
Palpal trochanter, length/width ratio	1.50	1.62	1.55	1.54	0.05	4
Palpal femur, length	0.99	1.20	1.13	1.16	0.09	4
Palpal femur, width	0.32	0.39	0.36	0.37	0.03	4
Palpal femur, length/width ratio	3.03	3.22	3.10	3.09	0.08	4
Palpal patella, length	0.94	1.07	1.02	1.04	0.06	4
Palpal patella, width	0.38	0.45	0.42	0.42	0.03	4
Palpal patella, length/width ratio	2.29	2.68	2.46	2.45	0.16	4
Palpal hand with pedicel, length	0.93	1.11	1.02	1.01	0.08	4
Palpal hand without pedicel, length	0.80	0.97	0.89	0.89	0.07	4
Palpal hand, width	0.53	0.66	0.61	0.62	0.05	4
Palpal hand with pedicel, length/width ratio	1.61	1.75	1.68	1.68	0.06	4
Palpal finger, length	0.87	1.00	0.96	0.99	0.06	4
Palpal chela, length	1.67	1.93	1.85	1.90	0.12	4
Palpal chela, length/palpal hand width	2.86	3.15	3.06	3.11	0.13	4
Leg I trochanter, length	0.23	0.26	0.25	0.26	0.01	4
Leg I trochanter, width	0.15	0.18	0.17	0.17	0.01	4
Leg I trochanter, length/width ratio	1.44	1.53	1.49	1.50	0.04	4
Leg I femur I, length	0.26	0.29	0.28	0.29	0.01	4
Leg I femur I, width	0.16	0.20	0.18	0.19	0.02	4
Leg I femur I, length/width ratio	1.45	1.63	1.54	1.54	0.07	4
Leg I femur II, length	0.50	0.57	0.54	0.55	0.03	4
Leg I femur II, width	0.15	0.19	0.17	0.17	0.02	4
Leg I femur II, length/width ratio	2.89	3.67	3.26	3.24	0.33	4
Leg I tibia, length	0.53	0.62	0.59	0.61	0.04	4
Leg I tibia, width	0.11	0.12	0.12	0.12	0.01	4
Leg I tibia, length/width ratio	4.82	5.45	5.13	5.13	0.26	4
Leg I tarsus, length	0.43	0.52	0.49	0.50	0.04	4
Leg I tarsus, width	0.08	0.09	0.09	0.09	0.01	4
Leg I tarsus, length/width ratio	5.00	5.78	5.43	5.47	0.33	4
Leg IV trochanter, length	0.29	0.39	0.35	0.37	0.05	3
Leg IV trochanter, width	0.17	0.21	0.19	0.18	0.02	3
Leg IV trochanter, length/width ratio	1.71	2.06	1.88	1.86	0.18	3
Leg IV femur, length	0.95	1.09	1.05	1.07	0.06	4
Leg IV femur, width	0.18	0.24	0.21	0.21	0.03	4
Leg IV femur, length/width ratio	4.54	5.63	5.03	4.97	0.52	4
Leg IV tibia, length	0.82	0.97	0.91	0.93	0.07	4
Leg IV tibia, width	0.14	0.15	0.14	0.14	0.00	4
Leg IV tibia, length/width ratio	5.86	6.93	6.39	6.38	0.44	4
Leg IV tarsus, length	0.54	0.63	0.60	0.62	0.04	4
Leg IV tarsus, width	0.11	0.12	0.11	0.11	0.01	4
Leg IV tarsus, length/width ratio	4.50	5.73	5.38	5.64	0.59	4

Abbreviations: min – minimum, max – maximum, x – arithmetic mean, M – median, SD – standard deviation, n – number of individuals measured.

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Tab. 2: Morphometric data for *Megachernes pavlovskyi* males (in mm).

Characteristics	min	max	x	M	SD	n
Body, length	3.19	3.76	3.46	3.54	0.24	5
Carapace, length	1.08	1.16	1.12	1.13	0.03	5
Carapace, posterior width	1.03	1.12	1.06	1.05	0.04	5
Carapace, length/posterior width ratio	0.98	1.12	1.09	1.11	0.06	5
Chelicera, length	0.31	0.33	0.32	0.31	0.01	5
Chelicera, width	0.15	0.16	0.16	0.16	0.01	5
Chelicera, length/width ratio	1.94	2.07	2.03	2.06	0.06	5
Cheliceral movable finger, length	0.26	0.28	0.27	0.28	0.01	5
Palpal trochanter, length	0.54	0.62	0.59	0.59	0.03	5
Palpal trochanter, width	0.32	0.39	0.37	0.38	0.03	5
Palpal trochanter, length/width ratio	1.49	1.69	1.59	1.62	0.08	5
Palpal femur, length	1.02	1.09	1.06	1.05	0.03	5
Palpal femur, width	0.35	0.38	0.36	0.36	0.01	5
Palpal femur, length/width ratio	2.84	3.03	2.92	2.91	0.08	5
Palpal patella, length	0.92	1.10	1.01	1.02	0.07	5
Palpal patella, width	0.40	0.45	0.42	0.41	0.02	5
Palpal patella, length/width ratio	2.24	2.49	2.41	2.44	0.10	5
Palpal hand with pedicel, length	0.91	1.03	0.98	1.02	0.06	5
Palpal hand without pedicel, length	0.77	0.90	0.84	0.85	0.05	5
Palpal hand, width	0.56	0.63	0.59	0.57	0.03	5
Palpal hand with pedicel, length/width ratio	1.63	1.79	1.68	1.66	0.07	5
Palpal finger, length	0.87	0.96	0.91	0.91	0.03	5
Palpal chela, length	1.73	1.82	1.78	1.80	0.04	5
Palpal chela, length/palpal hand width	2.87	3.16	3.04	3.09	0.11	5
Leg I trochanter, length	0.22	0.25	0.24	0.24	0.02	5
Leg I trochanter, width	0.16	0.18	0.17	0.17	0.01	5
Leg I trochanter, length/width ratio	1.33	1.47	1.39	1.38	0.05	5
Leg I femur I, length	0.26	0.31	0.29	0.30	0.02	4
Leg I femur I, width	0.17	0.19	0.18	0.18	0.01	5
Leg I femur I, length/width ratio	1.53	1.63	1.60	1.62	0.05	4
Leg I femur II, length	0.47	0.56	0.52	0.53	0.04	4
Leg I femur II, width	0.16	0.17	0.17	0.17	0.01	5
Leg I femur II, length/width ratio	2.76	3.29	3.10	3.18	0.24	4
Leg I tibia, length	0.56	0.62	0.58	0.58	0.02	5
Leg I tibia, width	0.10	0.12	0.11	0.11	0.01	5
Leg I tibia, length/width ratio	4.67	5.64	5.22	5.27	0.42	5
Leg I tarsus, length	0.41	0.50	0.47	0.50	0.04	5
Leg I tarsus, width	0.08	0.10	0.09	0.09	0.01	5
Leg I tarsus, length/width ratio	5.00	5.56	5.25	5.13	0.29	5
Leg IV trochanter, length	0.31	0.41	0.35	0.33	0.04	5
Leg IV trochanter, width	0.17	0.22	0.19	0.18	0.02	5
Leg IV trochanter, length/width ratio	1.63	2.11	1.89	1.88	0.17	5
Leg IV femur, length	0.95	1.06	1.01	1.04	0.05	5
Leg IV femur, width	0.19	0.22	0.20	0.20	0.01	5
Leg IV femur, length/width ratio	4.73	5.25	4.98	5.05	0.23	5
Leg IV tibia, length	0.85	0.92	0.90	0.92	0.03	5
Leg IV tibia, width	0.13	0.15	0.14	0.14	0.01	5
Leg IV tibia, length/width ratio	6.13	6.69	6.50	6.57	0.21	5
Leg IV tarsus, length	0.56	0.63	0.59	0.60	0.03	5
Leg IV tarsus, width	0.11	0.12	0.11	0.11	0.00	5
Leg IV tarsus, length/width ratio	5.08	5.73	5.31	5.18	0.28	5

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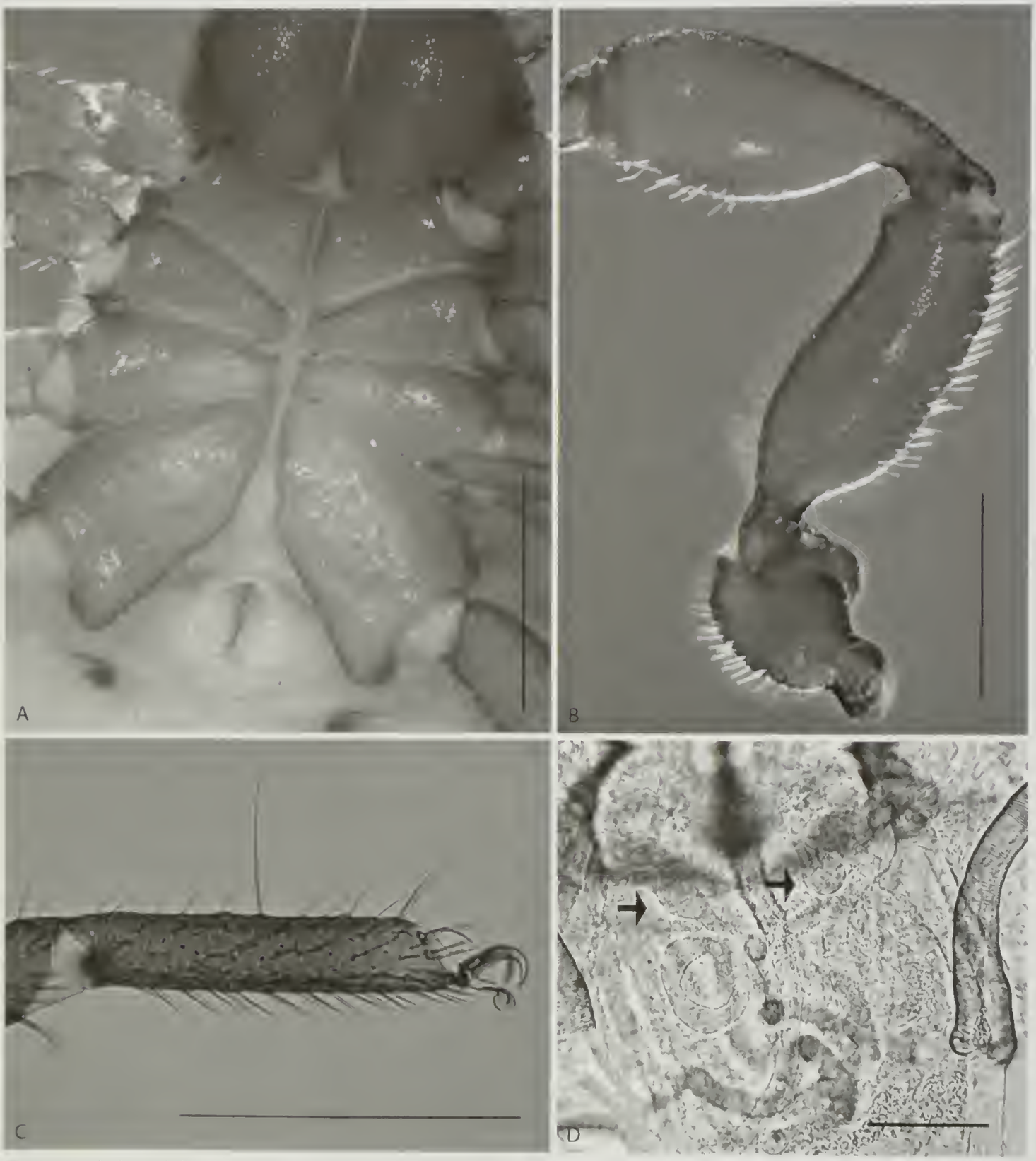

Fig. 3: Morphological characters of *Megachernes pavlovskyi*. A. Coxae, posterior corners of coxae IV (female, ventral view). B. Palpal trochanter, femur and patella (male, dorsal view). C. Tarsus IV with tactile seta (female, lateral view). D. Spermatheca (female, dorsal view). Arrows point to terminally expanded spermathecae ends. Scales: 0.2 mm (D), 0.5 mm (A, B, C). – Photos: Jana Christophoryová.

ratus developed only in movable finger, with nodus ramosus terminating between terminal trichobothrium (*t*) and subterminal trichobothrium (*st*); fixed finger with 50, movable finger with 51–54 marginal teeth; movable finger medially with 9–11 accessory teeth, fixed finger medially with 6–8 accessory teeth; movable finger laterally with 5 accessory teeth, fixed finger laterally with 9–12 accessory teeth; setae on trochanter and femur small and inconspicuous. Posterior corners of coxae IV lobe-shaped, enlarged and rounded (Fig. 3A); pedal tarsus IV with a long tactile seta situated in middle of segment (Fig. 3C). Sper-

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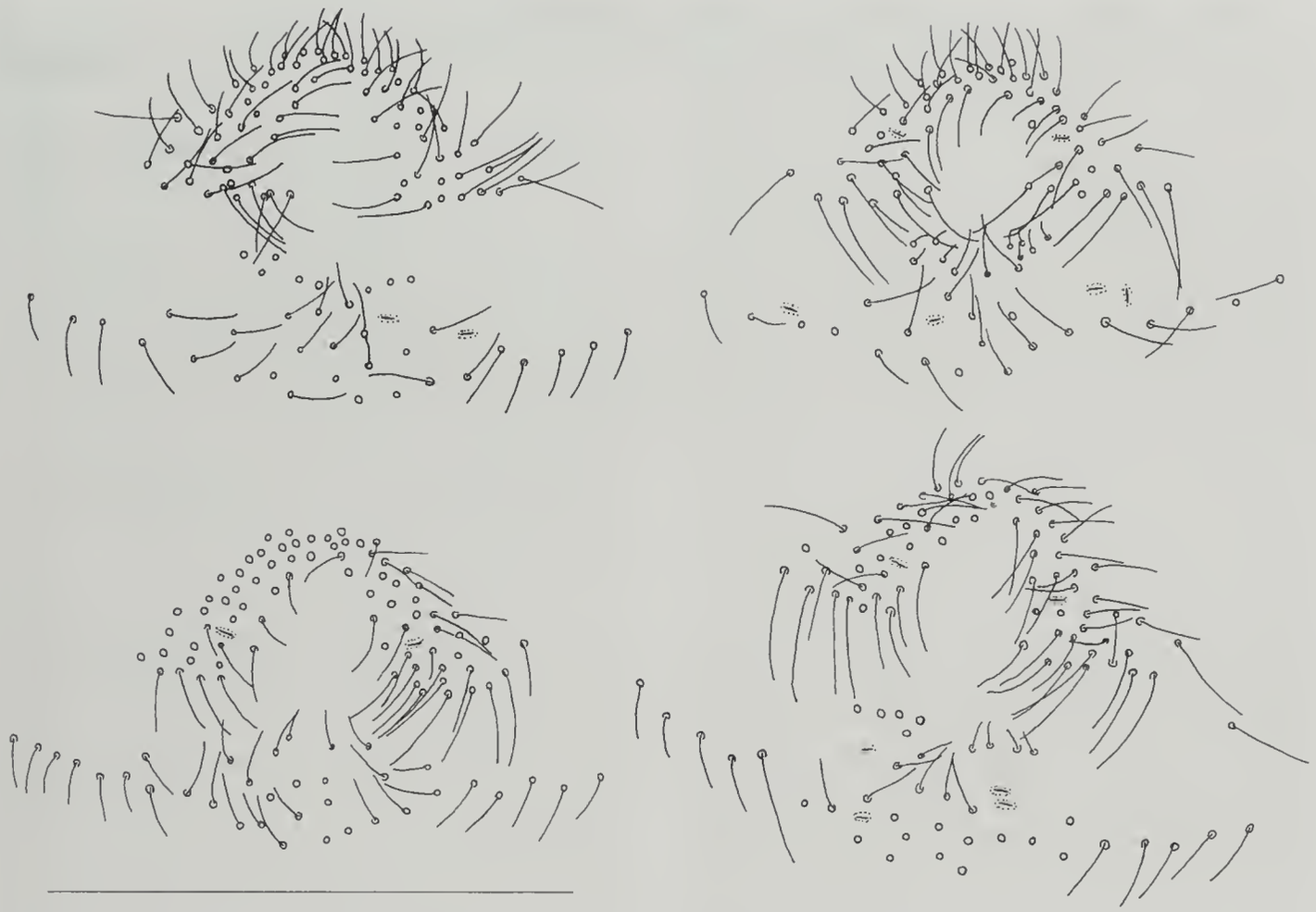

Fig. 4: Variation in the setation in the genital area of four *Megachernes pavlovskyi* males. Scale: 0.5 mm.

matheca T-shaped, with extremely elongated ends, both expanded terminally (Fig. 3D); anterior genital operculum with 35–44 acuminate and curved setae and with 2 lyrifissures, posterior genital operculum with 9–11 setae and 2 lyrifissures. Abdominal tergites: I–X distinctly divided, tergite XI undivided; chaetotaxy of tergites I–X (left+right half-tergite): 5–6+4–6: 5–6+5–6: 5–6+4–6: 5–7+5–6: 5–7+6–8: 5–8+5–8: 6–8+6–8: 5–8+5–7: 5–6+5–8: 4–5+4–6, tergite XI with 8–9 setae, including a pair of long tactile setae.

Males (five specimens)

Males differ from females by the following characters: Carapace with about 69–76 setae, of which 8–10 noticeably longer than others on anterior margin, about 40–42 in front of median transverse furrow and about 13–16 behind subbasal transverse furrow. Chelicerae with 4–5 retrorse teeth on fixed finger; galea with approximately 2–3 short branches. Pedipalps: fixed finger with 47–52, movable finger with 50–56 marginal teeth; movable finger medially with 8–11 accessory teeth, fixed finger medially with 6–7 accessory teeth; movable finger laterally with 4–5 accessory teeth, fixed finger laterally with 8–11 accessory teeth. Palp with long setae medially on trochanter and femur (Fig. 3B). Number of setae in genital region highly variable (Fig. 4). Abdominal tergites I–X distinctly divided, tergite XI undivided; chaetotaxy of tergites I–X (left+right half-tergite): 5–6+5–7: 4–6+5–6: 4–6+5–6: 5–6+6: 6–7+6–7: 6–7+6–7: 6–7+6–7: 6–7+6–7: 5–8+5–7: 5–6+4–6, tergite XI with 8–9 setae, including a pair of long tactile setae.

Discussion

Megachernes pavlovskyi was originally described by Redikorzev (1949) from cracks in a livestock barn in Turkmenistan and from Tajikistan. His description contains basic morphological and morphometric characters, as well as figures of an entire specimen, the chelicera and coxa IV. Beier (1959) recorded several adults and nymphs taken from guano in a cave in Afghanistan, considering the species to be a troglophile. Only the setation of the male palpal femur

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and the measurements of the palpal femur of one male and one female were given (Beier 1959). Schawaller (1986) recorded the species from Kyrgyzstan, based on about 40 specimens collected in bat and pigeon guano. Krumpál (1986) described the species *Megachernes caucasicus*, found in bat guano in a cave in Azerbaijan (Azykh Cave, Karabakh). Schawaller & Dashdamirov (1988) recorded more than 200 *Megachernes* specimens from bat guano at the type locality of *M. caucasicus* and, in addition, two specimens from a *Taxus-Buxus-Fagus* forest, western Caucasus, Russia (Krasnodar prov., Sochi/Khosta), having compared them with type material of *M. caucasicus*. As a result, *M. caucasicus* was found to be a junior synonym of *M. pavlovskyi*. Rich material from the Azykh Cave was later restudied and accompanied by new illustrations of the male palp and female coxa IV (Dashdamirov & Schawaller 1992). Profound variation in many characters was revealed, particularly the dimensions of the pedipalps and the number of accessory teeth on the chelal fingers. Moreover, the Caucasian specimens were very similar to material from Central Asia and Afghanistan (Beier 1959, Schawaller 1986, Dashdamirov & Schawaller 1995). More recently, Dashdamirov (2004) studied a small collection from northern Pakistan that fell within this range of variation and was therefore identified as *M. pavlovskyi*. It is concluded, that *M. pavlovskyi* is a highly widespread and vagile species, probably as a result of its periodic associations with bats and rodents (phoresis), and, perhaps, humans.

The main taxonomic characters of the Iranian females examined correspond to those given by Dashdamirov (2004). The material described here represents the first discovery of this genus in Iran. Because the country is vast and ecologically diverse, further material of this genus can be expected. Moreover, this is the first record of *M. pavlovskyi* from the nest of a porcupine.

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