

The pseudoscorpions of the Caucasian *Sphagnum* bogs: part II.
Description of *Ehippichthonius juliae* sp.n. from Georgia, with
remarks on the taxonomic status of some Caucasian species of the
genus *Ehippichthonius* Beier, 1930 (Arachnida: Pseudoscorpiones:
Chthoniidae)

Ложноскорпионы сфагновых болот Кавказа: часть II. Описание
Ehippichthonius juliae sp.n. из Грузии, с замечаниями о
таксономическом статусе некоторых кавказских видов рода
Ehippichthonius Beier, 1930 (Arachnida: Pseudoscorpiones:
Chthoniidae)

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KEY WORDS: biodiversity, bryobiont, ecology, mire, morphology, new species, peat bog, taxonomy, Transcaucasia, tytrphophile.

КЛЮЧЕВЫЕ СЛОВА: биоразнообразие, бриобионт, экология, болото, морфология, новый вид, торфяник, таксономия, Закавказье, тирфофил.

ABSTRACT. A new species of pseudoscorpions, *Ehippichthonius juliae* sp.n., is described from *Sphagnum* bogs situated in the Kolcheti Lowland, near the town of Kobuleti in the Republic of Adjara, Georgia, western Transcaucasia. Diagnostic and ecological features of this species are presented, discussed and compared with those of related species of this genus. A map of all known records of species of the genus *Ehippichthonius* Beier, 1930 in the Caucasus is given. We demonstrated that two European species, *E. tetrachelatus* (Preyssler, 1790) and *E. fuscimanus* (Simon, 1900), mentioned from the Caucasus in publications, actually represent a complex of undescribed species that require a detailed study and further descriptions.

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РЕЗЮМЕ. Описывается новый вид ложноскорпионов, *Ehippichthonius juliae* sp.n., из сфагновых болот, расположенных в Колхидской низменности близ города Кобулет в Республике Аджария, Грузия, Западное Закавказье. Приводятся и обсуждаются диагностические и экологические особенности этого вида, и также новый вид сравнивается с близкими видами этого рода. Представлена карта всех известных указаний видов рода *Ehippichthonius* Beier, 1930 для Кавказа. В статье показана

но, что европейские виды *E. tetrachelatus* (Preyssl, 1790) и *E. fuscimanus* (Simon, 1900), указанные для Кавказа в литературе, в действительности представляют собой комплекс неописанных видов, который требует детального изучения и дальнейшего описания.

Introduction

This article is a continuation of the study of pseudoscorpions from the Caucasian *Sphagnum* bogs (see Kolesnikov *et al.* [2022]). Here, we describe a new species of the genus *Ephippiochthonius* Beier, 1930 from the bogs located near the town of Kobuleti in the Republic of Adjara, Georgia, western Transcaucasia.

Recently Zaragoza [2017] erected *Ephippiochthonius* as a valid genus. The genus currently contains 121 recent species distributed across the Mediterranean and Macaronesian region, reaching Iran to the east, and Scandinavia to the north. There are records of *Ephippiochthonius* from other parts of the World (North and South America, Hawaii, Cuba, Seychelles, and south-western Australia) [WPC, 2022].

Recently three species of *Ephippiochthonius* were described from the Russian Caucasus, *E. caucasicus* Nassirkhani, Snegovaya et Chumachenko, 2019 (Krasnodar Territory: Sochi) [Nassirkhani *et al.*, 2019], *E. oryzis* Kolesnikov, Turbanov et Gongalsky, 2019 (Krasnodar Territory: near Kalininskaya) and *E. sarmaticus* Kolesnikov, Turbanov et Gongalsky, 2019 (Krasnodar Territory: near Risoopytniy and Mogukorovskiy) [Kolesnikov *et al.*, 2019]. It is worth noting, however, that widely distributed European species *E. tetrachelatus* (Preyssl, 1790) and *E. fuscimanus* (Simon, 1900) were recorded many times from different parts of the Caucasus including Georgia [Rafalski, 1949; Kobakhidze, 1960, 1961, 1964; Schawaller, 1983; Schawaller, Dashdamirov, 1988; Dashdamirov, 1993, 1999]. We reconsider the taxonomic status of these species and therefore regard them as “aff.” (*affinis*, i.e. similar to these species but not conspecific with them), prior to detailed study and description (see Discussion for more details).

Study bogs

The *Sphagnum* bogs Ispani 1 and Ispani 2 (Fig. 1) are situated in the Kolcheti Lowland, near the town of Kobuleti in the Republic of Adjara, Georgia, western Transcaucasia, ca. 1 km of the Black Sea coast. These bogs are ombrotrophic (only rain-fed), acidic and oligotrophic, with *Sphagnum papillosum* Lindb., *S. austini* Sull., and *S. palustre* L. predominating in the vegetation cover.

The natural conditions, vegetation and environmental history of Ispani 1 and Ispani 2 are relatively well documented [Kaffke, 2008; de Klerk *et al.*, 2009; Krebs *et al.*, 2009, 2017; see also Kolesnikov *et al.*, 2022].

Material and methods

Five specimens of a new species (3 ♂♂ and 2 ♀♀) were collected from the bogs Ispani 1 and Ispani 2 briefly de-

scribed above. All specimens were taken from quantitative samples of substrate consisting mostly of *Sphagnum*, taken up to a depth of 20–30 cm from the surface. Samples were washed in sieves (the smallest mesh size 0.25 × 0.25 mm), and then macroinvertebrates were extracted by flotation in a strong solution of NaCl combined with hand-sorting of the coarse fraction (see e.g., Khalin *et al.* [2022]) for further details of flotation). All specimens were kept in 85% ethyl alcohol. Habitat parameters were measured in the water squeezed from *Sphagnum* at the sample point: pH value by a Hanna pHep+ pH-meter and mineralisation (ppt) by a Hanna DIST2 conductometer.

For morphological examination using light microscopy, *Ephippiochthonius juliae* sp.n. was cleaned in pure lactic acid and was temporarily mounted on microscopic slides in glycerol. Animals were examined and dissected using a Biomed MC-2 binocular stereo microscope and measured using an ocular micrometer installed on Biomed 6 (variant 3) microscope. Some specimens were dissected for a more detailed study of the chelicerae, pedipalps and legs IV. Morphological drawings were performed by means a computer monitor using Adobe Photoshop CS6 (ver. 13.0.1.3) based on images of these structures obtained using a Euromex Color HD-Ultra (5MPs) digital microscope camera connected to a Bioptic C-400 microscope. The photographs of habitus were taken with a Leica MC170 HD (12MPs) digital microscope camera using the extended focus technology (Helicon Focus 7.7.4). After the study, each specimen including the dissected body parts was returned to the vial containing 96% ethanol. The distribution map was created using Google Earth Pro (ver. 7.3.4.8248) and Adobe Photoshop CS6.

The type material of *Ephippiochthonius juliae* sp.n. is deposited at the Zoological Institute of the Russian Academy of Sciences, Saint Petersburg (ZISP) and Zoological Museum of the Moscow University (ZMMU).

The measurements were taken with an ocular micrometer using the reference points proposed by Chamberlin [1931] and expressed in millimeters, followed by standard ratios in parentheses. The ratios provided were: length to width for carapace, chelicerae and pedipalps, except in the case of the chela and its hand, for which the depth was used instead of width [Mahnert, 2011]. We applied terminology used by Chamberlin [1931], with amendments proposed by Harvey [1992], and Judson [2007]. The chaetotactic formulae of the carapace and chelicera are given according to Gabbutt & Vachon [1963]. Terminology of setae on carapace, pedipalpal coxa and chelal hand, lyrifissures for pedipalpal chela and chelicera follows Zaragoza [2017]. The terms “sublateral ocular seta” (*osl*), “lateral ocular seta” (*ol*), “posterior dorsal row”, “lateral row”, “median row” and “anterior dorsal row” were used in accordance with the interpretation of Gabbutt & Vachon’s [1963] for the ocular row and femoral chaetotaxy. Following Gardini [2013, 2014], measurements of the pedipalpal trochanter were excluded because they added too little meaningful information.

Abbreviations used in text and figures: *al* — anterolateral seta of carapace; *ame* — anteromedial seta of carapace; *as* — antiaxial sensory setae; *cs* — cheliceral spinneret; *di* — isolated subapical tooth of movable cheliceral finger; *dps* — distal marginal seta of pedipalpal coxa; *fa* — antiaxial lyrifissure of fixed chelal finger; *fb* — basal lyrifissures of fixed chelal finger; *fd₁*, *fd₂*, *fd₃* — dorsal lyrifissures of the fixed chelal finger; *hd* — distal lyrifissure of chelal hand; *hp* — proximal lyrifissure of chelal hand; *ip* — intercondylar pro-

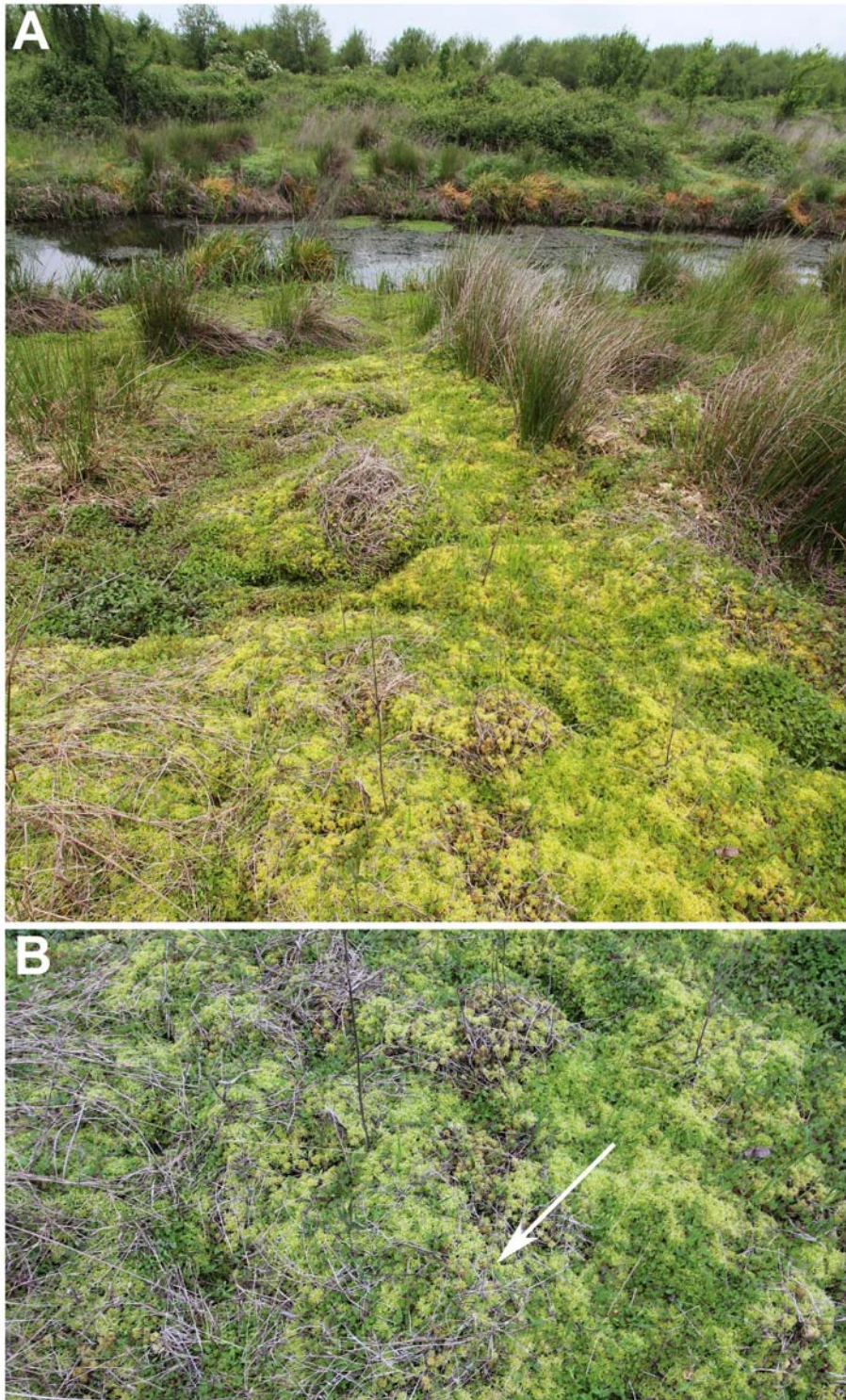


Fig. 1. The habitat of *Ehippichthonius juliae* sp.n., Ispani 2 bog near the town of Kobuleti (Republic of Adjara, Georgia): A — general view of site 2, bank of Shavi Ghele River W of main bog (9 May 2019); B — *Sphagnum palustre* carpet, with exact location where the holotype was collected (sample I-7) indicated by an arrow (9 May 2019). Photographs by Andrey Przhiboro.

Рис. 1. Биотоп *Ehippichthonius juliae* sp.n. — болото Испани 2 близ города Кобулет (Республика Аджария, Грузия): А — общий вид участка 2, берег реки Шави Геле западнее основного болота (9 мая 2019 г.); В — ковер *Sphagnum palustre*, точное место сбора голотипа (проба I-7) указано стрелкой (9 мая 2019 г.). Фотографии Андрея Пржиборо.



Fig. 2. Habitus of *Ehippichthonius juliae* sp.n., ♀ holotype (ZISP 1439), dorsal view.

Рис. 2. Общий вид *Ehippichthonius juliae* sp.n., ♀ голотип (ZISP 1439), сверху.

tubercle; *ldb*, *ldst*, *ldt*, *lvb*, *lvt* — lyrifissures associated with cheliceral setae *db*, *dst*, *dt*, *vb* and *vt*, respectively; *m* — microseta; *ma*₁, *ma*₂ — antiaxial lyrifissures of movable chelal finger; *ol* — lateral ocular seta of carapace; *om* — medial ocular seta of carapace; *osl* — sublateral ocular seta of carapace; *pc* — coupled sensilla of movable chelal finger; *pl* — posterolateral seta of carapace; *pm* — posteromedial seta of carapace; *sp* — subdistal protuberance; T — tactile seta; *td* — accessory tooth of movable chelal finger.

Results

Class Arachnida Lamarck, 1801
Order Pseudoscorpiones de Geer, 1778
Family Chthoniidae Daday, 1889

Genus *Ehippichthonius* Beier, 1930

Ehippichthonius juliae sp.n.
Figs 2–4.

HOLOTYPE ♀ (ZISP 1439), Georgia, Adjara, near Kobuleti, Ispani 2 bog, 41.86560°N, 41.78986°E, Site 2 (near Shavi Ghele River W of main bog): wet carpet of *Sphagnum palustre*, sample I-7, 9.V.2019, A. Przhiboro leg.

PARATYPES: 1 ♀ (ZMMU TI-99) same collection data as for holotype; 1 ♀, 1 ♂ (ZISP 1440), 1 ♂ (ZMMU TI-100), Georgia, Adjara, near Kobuleti, Ispani 1 bog, 41.85805°N, 41.78750°E, Site 1 (150 m E of NE bog edge): dry *Sphagnum* hummocks, sample I-18, 11.V.2019, A. Przhiboro leg.

ETYMOLOGY. The new species is named in honour of Yulia Dunaeva (Saint Petersburg, Russia), who provided much help during the fieldwork in Ispani bogs.

DIAGNOSIS. An eyed epigeal *Ehippichthonius* that differs from other species of the *E. tetrachelatus*-group in the following combination of characters: movable finger with a well-developed isolated subapical tooth (*di*); spin-

neret (*cs*) prominent and apically rounded in both sexes; carapace without epistome; lateral ocular setae 1.28–1.33 times as long as sublateral ocular setae and approximately equal in length to anterolateral setae; posterolateral seta (*pl*) absent; fixed and movable chelal fingers with 14–15 and 5–6 triangular teeth, respectively; fixed chelal finger at level of *est-it* with 4 teeth occupying 0.1 mm (distance between successive apices 0.030–0.040 mm); proximal half of dental lamina with one low vestigial tooth without dental canals and 5–7 proximal vestigial teeth, with rounded tips, gradually reduced a little proximad of *sb*; length of chela 0.76–0.80 (♂), 0.70–0.72 (♀), length of movable chelal finger 0.42–0.44 (♂), 0.39–0.41 (♀); chela 4.22–4.60 (♂) 5.14–5.38 (♀) times as long as deep; ratio of pedipalpal femur/carapace 1.34–1.38 (♂) 1.40–1.44 (♀).

DESCRIPTION. Adults (♂, ♀).

Medium-sized epigeal species (Fig. 2). Integument pigmented; marked hispid granulation on lateral surfaces of carapace, on cheliceral hand and on base of chelal fingers.

Carapace equal to or slightly shorter than broad, weakly constricted posteriorly; anterior margin (Fig. 3A–C) strongly dentate between median macrosetae, without epistome; ocular area as in Fig. 3A; anterior eyes with convex lens (diameter 0.040–0.043 mm), posterior eyes reduced to a smooth cuticular area (diameter 0.050–0.054 mm); all eyes with tapetum; distance from anterior eyes to anterior margin of carapace 0.034–0.037 mm; distance between anterior and posterior eyes 0.03 mm. Chaetotaxy: 18 macrosetae and 2 preocular microsetae (*m*) on each side, posterior area with 2 medial macrosetae (*pm*), posterolateral seta (*pl*) absent, macrosetae thick; setal formula: mm4mm:5–6:4:2:2, anteromedial setae 0.09–0.10 mm long, anterolateral setae 0.07–0.09 mm long, medial ocular setae 0.09–0.10 mm long, sublateral ocular setae 0.067–0.075 mm long, lateral ocular setae 0.086–0.10 mm long, posteromedial setae 0.10–0.12 mm long; 4 lyrifissures anteriorly and 2 posteriorly.

Chaetotaxy of tergites ♀ and ♂: 4:4:4:4:6:6:6:6:1T2T1:4:1T2T1:0.

Chaetotaxy of sternites ♀: 10:(3)8–9(3):(2)7(2):m6m:m4–5m:m4m:6:6:2T1T2:0:2, ♂: 10–11:(3)10(3):(2)7(2):m6–7m:m4–5m:m4–5m:6:6:2T1T2:0:2, lateral setae on sternites III–VII microsetal in size, sternite X with 2 submedial tactile setae, genital notch of ♂ (Fig. 3D) flanked by 7–8 setae on each side and 4+4 internal glandular tubes.

Genitalia. ♂ genitalia as in Fig. 3D, ♀ genitalia as in Fig. 3E.

Chelicera (Fig. 3G, F): hand with 6 setae and 2 lateral microsetae; seta *vb* 0.039–0.046 mm long, seta *it* 0.051–0.060 mm long, seta *db* 0.058–0.060 mm long, seta *dst* 0.097–0.12 mm long, seta *dt* 0.13–0.14 mm long, microsetae 0.026–0.030 mm long; all macrosetae about same as thick; hand with 5 dorsal and 1 ventral lyrifissures, lyrifissure *ldb* present. Fixed finger with 5–6 teeth proximally reduced in size, 3–4 distal teeth larger than others; movable finger with a well-developed isolated subapical tooth (*di*), with 6–7 teeth decreasing in size proximally, 3–4 distal teeth larger than others (two distal teeth paired); seta *gl* 0.065–0.070 mm long, ratio seta *gl* 0.66; spinneret (*cs*) prominent and apically rounded; rallum with 11 blades; serrulae interior and exterior with 10 and 12 blades, respectively.

Coxal setae: pedipalpal coxa with 5 setae (including 2 on manducatory process), distal marginal seta of disc 0.09–0.11 mm long; coxa I 3 + 3 marginal microsetae and 3 + 3 macrosetae, distal marginal seta 0.07–0.08 mm long; II 4 + 4 macrosetae and 9 + 9–10 bipinnate coxal spines, III 5 + 5–6

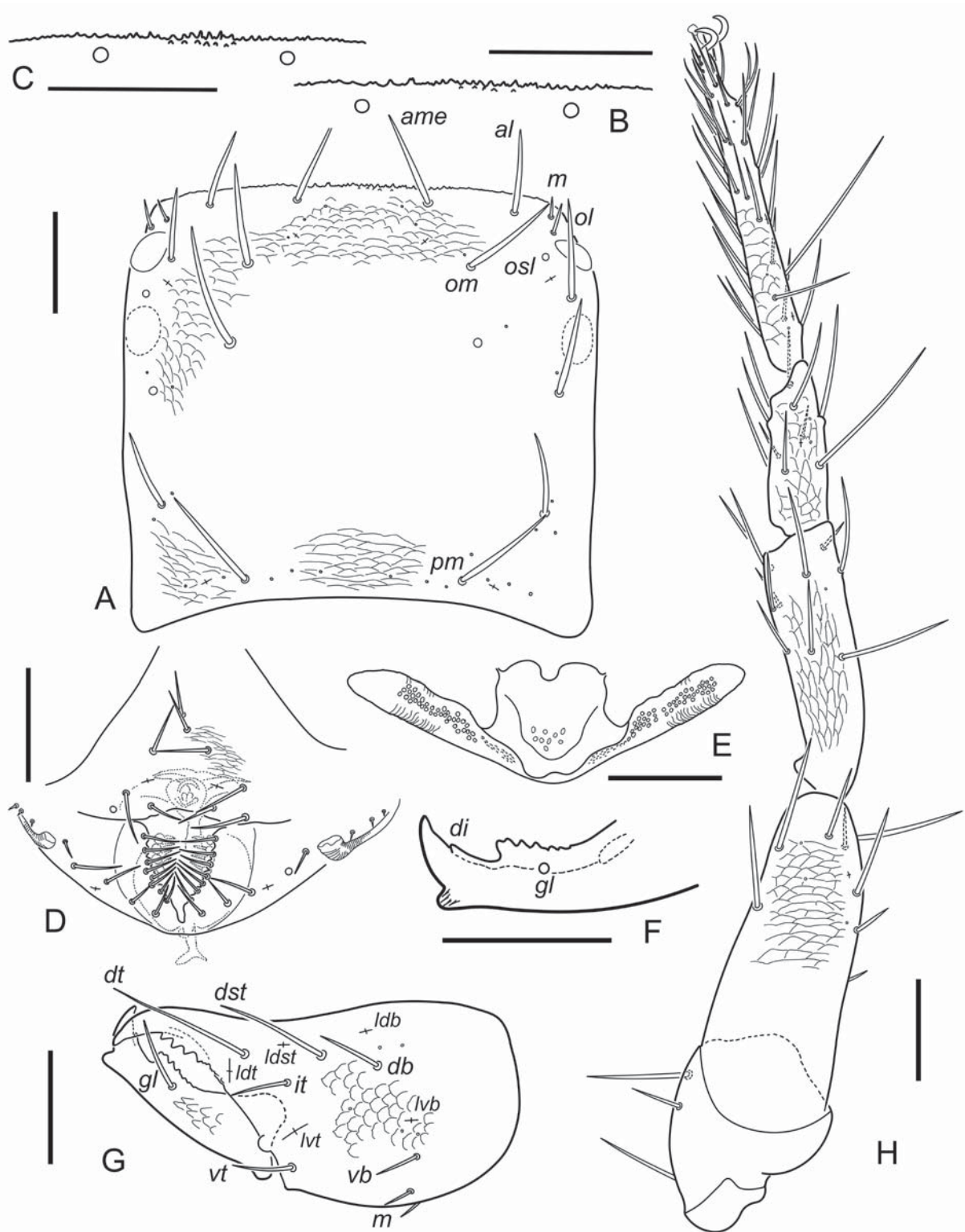


Fig. 3. *Ehippichthonius juliae* sp.n., holotype ♀ (A, B, E, F, G, H), paratypes ♂ (C, D): A — carapace, dorsal view; B, C — anterior margin of carapace, dorsal view; D — male genital area, ventral view; E — female genitalia, ventral view; F — movable finger of right chelicera, partial dorsal view; G — left chelicera, dorsal view; H — right leg IV (without trochanter), dorsal view. Scale bars: 0.1 mm.

Рис. 3. *Ehippichthonius juliae* sp.n., голотип ♀ (A, B, E, F, G, H), паратип ♂ (C, D): A — карапакс, вид сверху; B, C — передний край карапакса, вид сверху; D — генитальная область самца, вид снизу; E — гениталии самки, вид снизу; F — подвижный палец правой хелицеры, частичный вид сверху; G — левая хелицера, вид сверху; H — правая нога IV (без вертлуга), вид сзади. Масштаб: 0,1 мм.

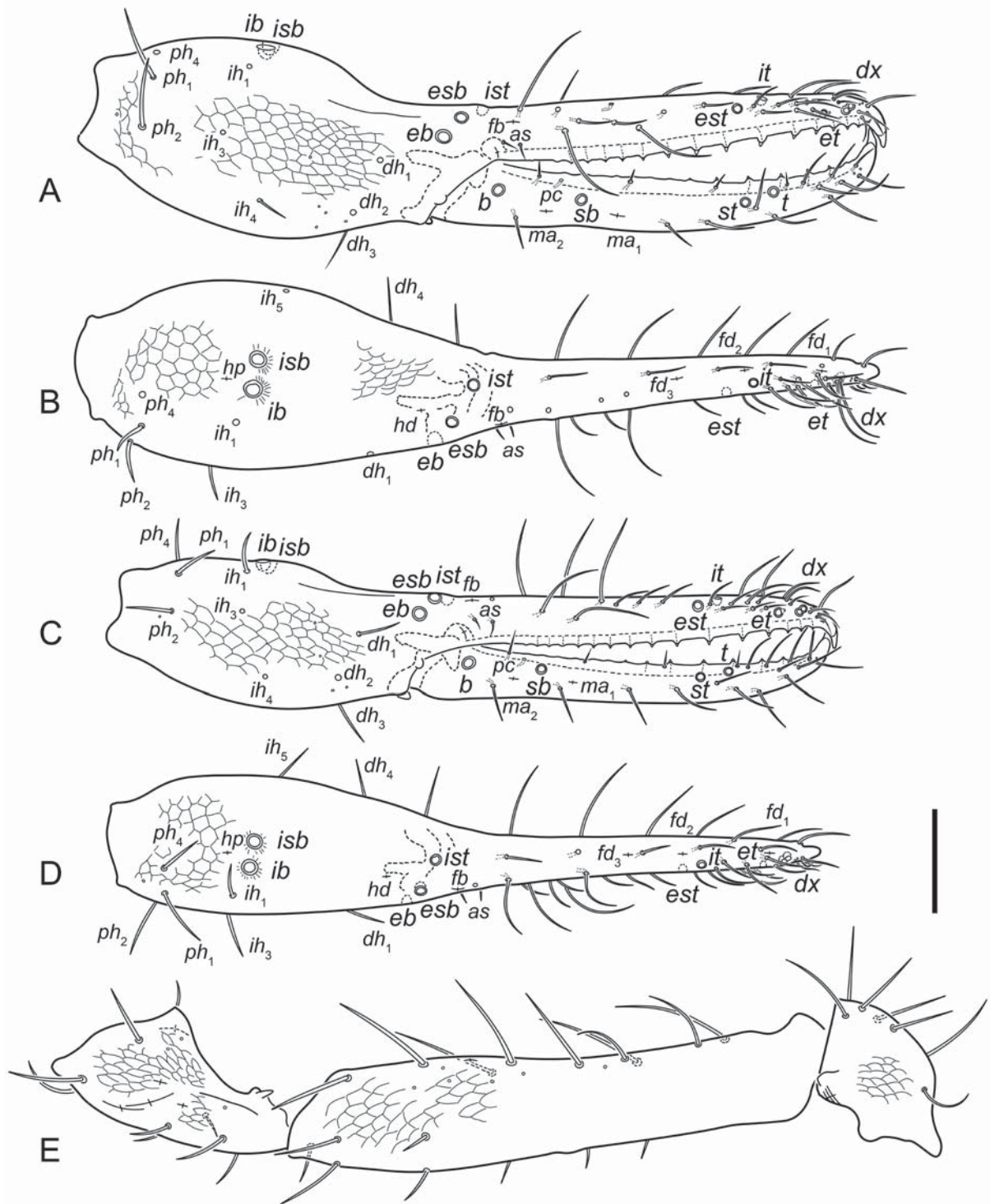


Fig. 4. *Ehippochthonius juliae* sp.n., holotype ♀ (A, B, E), paratypes ♂ (C, D): A, C — left chela, lateral view; B, D — left chela, dorsal view; E — left pedipalp (without chela), dorsal view. Scale bars: 0.1 mm.

Рис. 4. *Ehippochthonius juliae* sp.n., голотип ♀ (A, B, E), паратип ♂ (C, D): A, C — левая хела, вид сбоку; B, D — левая хела, вид сверху; E — левая педипальпа (без хелы), вид сверху. Масштаб: 0,1 мм.

and 4–5 + 4–5 bipinnate coxal spines and IV 6; intercoxal tubercle bisetose.

Pedipalp: femoral chaetotaxy 3:6:2:5:1 (Fig. 4E). Chela (Fig. 4A–D) with hand weakly depressed at level of *ib/isb* and abrupt slope between trichobothria *ib/isb* and *eb*; intercondylar protuberance (*ip*) present; chaetotaxy 4:5:3; seta *ph₃* lacking, setae *ih₁*, *ih₃* and *ih₄* approximately level with trichobothria *ib/isb*, *ih₄* more distal than *ih₃*. Fixed finger with 14–15 teeth, mostly pointed and with dental canals, decreasing in size proximally, first distal tooth distinctly smaller than second, dental row almost reaching distal half of *b–sb*; base of fixed finger with 1–2 microtubercles; tip of fixed finger with a modified accessory tooth (*td*) on antiaxial face; one pair of short antiaxial sensory setae (*as*) at finger base, distance between these setae shorter than finger depth at base; fixed chelal finger at level of *est-it* with 4 teeth occupying 0.1 mm (distance between successive apices 0.030–0.040 mm). Tip of fixed chelal finger of male with a deep hollow on paraxial face and subapical protuberance (*sp*). Distal half of movable chelal finger with 5–6 pointed teeth with dental canals, subdistal tooth very small, proximal half of dental lamina with one low vestigial teeth without dental canals and 5–7 proximal vestigial teeth, with rounded tips, gradually reduced slightly proximad of *sb*; basal apodemes long and apically indented; coupled sensilla *pc* proximad of *sb* in both sexes. Trichobothria as in Figs 4A–D, trichobothrium *ist* slightly distal of *esb* and well proximal of lyrifissures *fb*; distance between *st* and *sb* twice as long as that between *sb* and *b*. Chelal lyrifissure patterns *hp*, *hd*, *fb*, *fa*, *fd₁*, *fd₂*, *fd₃*, *ma₁*, *ma₂* present.

Legs (Fig. 3H) with small hispid granulation; claws simple and narrow; arolia simple, thin, shorter than claws. Metatarsus IV with one tactile seta (0.15–0.17 mm long) situated proximal to middle (TS=0.31–0.35), tarsus IV with one tactile seta (0.16–0.18 mm long) situated sub-basally (TS=0.27–0.30).

Measurements and ratios. ♀ holotype (paratype in square brackets): Body 1.6 [1.4–1.5]. Carapace 0.40/0.45 (0.88) [0.40–0.41/0.42–0.44 (0.93–0.95)]. Chelicera 0.35/0.18 (1.94) [0.34–0.36/0.17–0.18 (2.0)], movable finger 0.18 [0.18]. Pedipalp: femur 0.55/0.10 (5.5) [0.54–0.55/0.09–0.10 (5.5–6.0)], patella 0.24/0.13 (1.84) [0.22–0.23/0.13 (1.69–1.77)], chela 0.76/0.18 (4.22) [0.78–0.80/0.17–0.18 (4.44–4.60)], hand length and depth 0.34/0.18 (1.88) [0.33–0.35/0.18–0.19 (1.83–1.84)], movable finger 0.42 [0.43–0.44]; ratio movable finger/hand 1.23 [1.25–1.30], femur/movable finger 1.30 [1.25], femur/carapace 1.38 [1.34–1.35], chela/carapace 1.90 [1.95], chela/femur 1.38 [1.44–1.45]. Leg I: femur 0.30/0.07 (4.28) [0.30/7 (4.28)], patella 0.13/0.05 (2.60) [0.14–0.16/0.05–0.06 (2.66–2.80)], tibia 0.15/0.04 (3.75) [0.16–0.18/0.05 (3.20–3.60)], tarsus 0.30/0.04 (7.50) [0.30–0.32/0.04 (7.50–8.0)]. Leg IV: femur + patella 0.45/0.15 (3.0) [0.45–0.50/0.15 (3.0–3.33)], tibia 0.30/0.08 (3.75) [0.26–0.31/0.08 (3.25–3.88)], metatarsus 0.18/0.05 (3.60) [0.17–0.20/0.05 (3.40–4.0)], tarsus 0.30/0.04 (7.50) [0.33–0.36/0.03–0.04 (9.0–11.0)].

Paratype ♂: Body 1.4–1.5. Carapace 0.34–0.37/0.38–0.40 (0.90–0.92). Chelicera 0.32–0.33/0.15 (2.13–2.20), movable finger 0.16. Pedipalp: femur 0.49–0.52/0.08–0.09 (5.77–6.12), patella 0.17–0.20/0.10–0.11 (1.70–1.81), chela 0.70–0.72/0.13–0.14 (5.14–5.38), hand length and depth 0.30/0.14–0.16 (1.90–2.14), movable finger 0.39–0.41; ratio movable finger/hand 1.30–1.36, femur/movable finger 1.25–1.27, femur/carapace 1.40–1.44, chela/carapace 1.94–2.05, chela/femur 1.39–1.43. Leg I: femur 0.27–0.28/0.06–

0.07 (4.0–4.50), patella 0.12–0.14/0.04–0.05 (2.80–3.0), tibia 0.14–0.16/0.04–0.05 (3.20–3.50), tarsus 0.28–0.30/0.03–0.04 (7.50–9.30). Leg IV: femur + patella 0.41–0.44/0.16 (2.56–2.75), tibia 0.25–0.27/0.06–0.07 (3.86–4.16), metatarsus 0.16–0.17/0.05 (3.20–3.40), tarsus 0.32–0.33/0.03–0.04 (8.25–10.66).

DISTRIBUTION. Known only from two adjacent *Sphagnum* bogs, Ispani 1 and Ispani 2, situated near the town of Kobuleti in the Republic of Adjara (Georgia).

HABITATS. In Ispani 1 bog, *E. juliae* sp.n. was collected in its northwestern part (site 1), with large relatively dry hummocks (20–40 cm high, 1–2 m wide) and moist flat spaces between them. The new species was collected only from hummocks. This habitat (same sample) was described in detail and illustrated by Kolesnikov *et al.* [2022: 167, 169, 179].

In Ispani 2 bog, *E. juliae* sp.n. was collected from a sloping site 20–40 m wide located at the bank of Shavi Ghele River (site 2; Fig. 1A) and separated from the main area of the bog by a belt of shrubs (mainly alder). Most of the site is covered by a loose carpet of *Sphagnum palustre*, with common *Juncus effusus* L., *Molinia caerulea arundinacea* (Schrank) K. Richt., *Rhynchospora alba* (L.) Vahl, *Microstegium japonicum* (Miq.) Tzvelev and *Persicaria thunbergii* (Siebold et Zucc.) H. Gross. Sample I-7 (Fig. 1B), where the new species was collected, was taken ca. 6 m from the river; the sample contained moist *Sphagnum* carpet 10–15 cm high, with a pH of 3.2 and mineralization of 0.08 ppt.

The new species seems to be rare, considering that only 2–3 specimens were collected from 5 quantitative samples taken at each site (sample size of 0.05 m²). As distinct from some other pseudoscorpion species, all specimens of *E. juliae* sp.n. were collected only from quantitative samples and no specimens were collected by other techniques (sifting, pit-fall trapping, and/or rearing from substrata in the lab). All specimens of the new species were collected from the sample series taken in May, and no specimens, from the sample series taken from the same habitats and sites in October.

TAXONOMIC REMARKS. The new species is assigned to the genus *Ephippiochthonius* based on the following features: chela lagyniform (ephippochthonian), seta *hp₃* in the proximal portion of chelal hand absent, medial protuberance (*ip*) present between chelal condyles, tip of fixed chelal finger of male with a deep hollow on paraxial face and subapical protuberance (*sp*).

The new species belongs to the *E. tetrachelatus*-group as defined by Gardini [2013] and Zaragoza [2017] by having the chelal teeth of the fixed finger present nearly to the base of the finger, movable chelal finger with low, rounded, sometimes vestigial teeth, without a marginal lamina, intermediate paraxial setae *hi₁*, *hi₃* and *hi₄* of chelal hand level with trichobothria *ib/isb*, and chelal lyrifissure *ma₂* present.

Within the *E. tetrachelatus*-group, the new species is morphologically close to the epigeal *E. lucanus* Callaini, 1984 from central and southern Italy [Callaini, 1984; Gardini, 2013] in the presence of an isolated subapical tooth (*di*) on the movable cheliceral finger. It differs from *E. lucanus* in the absence of posterolateral seta (*pl*), the number of triangular teeth on chelal movable finger (14–15 vs. 11–14 in *E. lucanus*) and the length of the anteromedian macrosetae of the carapace (0.09–0.10 mm vs. 0.080–0.090 mm in *E. lucanus*).

The new species is close to the following two Caucasian species of the *E. tetrachelatus*-group. It can be clearly separated from the epigeal *E. caucasicus* (described from Sochi,



Fig. 5. Distribution of pseudoscorpions of the genus *Ehippichthonius* Beier, 1930 in the Caucasus: *E. juliae* sp.n. (red circle); *E. sarmaticus* (blue circle); *E. oryzis* (green circle); *E. caucasicus* (purple circle); *E. sp. aff. fuscimanus* (brown circle); *E. sp. aff. tetrachelatus* (yellow circle). See Supplementary Table 1 for locality numbering.

Рис. 5. Распространение ложноскорпионов рода *Ehippichthonius* Beier, 1930 на Кавказе: *E. juliae* sp.n. (красный круг); *E. sarmaticus* (синий круг); *E. oryzis* (зелёный круг); *E. caucasicus* (фиолетовый круг); *E. sp. aff. fuscimanus* (коричневый круг); *E. sp. aff. tetrachelatus* (жёлтый круг). Нумерацию локалитетов см. в Supplementary Table 1.

Krasnodar Territory, Russia) [Nassirkhani *et al.*, 2019] by the dorsum of chelal hand concave or slightly concave at level of *ib-isb* (distinctly curved distally and clearly depressed in *E. caucasicus*) and the proximal half of dental lamina of movable chelal finger undulating, with clearly visible rounded blunt teeth without dental canals (smooth without teeth in *E. caucasicus*). The new species can be clearly separated from the epigeal *E. oryzis* (described from Kalininskaya, Krasnodar Territory, Russia) [Kolesnikov *et al.*, 2019] by the movable finger with a well-developed isolated subapical tooth (*di*) of chelicera (weakly expressed as a rounded tubercle in *E. oryzis*), posterolateral seta (*pl*) of carapace absent (presence in *E. oryzis*) and the epistome absent (well-defined epistome in *E. oryzis*).

Discussion

After Gardini [2009] designated the neotype and redescribed *E. tetrachelatus* from the type locality of this species (Czech Republic, Prague, Karlovo náměstí)

[Preyssler, 1790], it has been repeatedly shown that this supposedly most widely distributed and frequently recorded species among the pseudoscorpions (see e.g. Harvey [1991]; WPC [2022]) is actually a complex of species, the *E. tetrachelatus*-group (see Gardini [2013]), with many new species described recently [Gardini, 2013; Zaragoza, 2017; Nassirkhani, Shoushtari, 2015; Nassirkhani *et al.*, 2019; Kolesnikov *et al.*, 2019; Turbanov, Kolesnikov, 2021; this study]. In turn, Gardini [2013] redescribed *E. fuscimanus* based on the type (Italy, Trentino, Lavarone) [Simon, 1900] and other material from Italy. In particular, he demonstrated that it is a complex of species, *E. fuscimanus*-group. Many species were recently described in this species complex as well [Gardini, 2013; Zaragoza, 2017; Kolesnikov *et al.*, 2019].

As mentioned above, *E. tetrachelatus* and *E. fuscimanus* have been repeatedly reported for the Caucasus [Rafalski, 1949; Kobakhidze, 1960, 1961, 1964; Scha-

waller, 1983; Schawaller, Dashdamirov, 1988; Dashdamirov, 1993, 1999] (see Fig. 5, Supplementary Table 1). However, Dashdamirov & Schawaller [1992] pointed out that *E. tetrachelatus*, ubiquitous in the Caucasus, may represent a species complex. Following the above principles in the taxonomy of the genus *Ephippiochthonius*, three species of the *E. tetrachelatus*-group have been described to date from the territory of the Caucasus, *E. caucasicus*, *E. oryzis* and *E. juliae* sp.n. [Nassirkhani *et al.*, 2019; Kolesnikov *et al.*, 2019; this study], and one species from the *E. fuscimanus*-group, *E. sarmaticus* [Kolesnikov *et al.*, 2019]. At the same time, based on morphological studies of our own extensive collections and the materials stored in museum collections, including those used in the earlier studies, we conclude that *E. tetrachelatus* and *E. fuscimanus* are absent from the Caucasus. The Caucasian materials actually represent two complexes of undescribed species that require detailed study and further description. Thus, all the earlier records of these two species from the Caucasus should be regarded as *Ephippiochthonius* sp. aff. *tetrachelatus* and *E. sp. aff. fuscimanus* for the time being, and their descriptions will be carried out in the foreseeable future in a series of works on this genus.

We summarised the published records of species in the genus *Ephippiochthonius* for the Caucasus (see Fig. 5, Supplementary Table 1). We consider the Caucasus within the following boundaries: the Kumo-Manych Depression separating it from the Russian Plain in the north; the Black Sea and the Sea of Azov in the west and the Caspian Sea in the east; the state borders of Georgia, Azerbaijan and Armenia with Iran and Turkey in the south, with the Araks River running along most of them [Coene, 2009].

The description of *E. juliae* sp.n. and the remarks of the taxonomic status of some Caucasian species of the genus *Ephippiochthonius* significantly complement the available data on pseudoscorpions of the Caucasus as a region of the Eastern Mediterranean, with biodiversity hotspots and a high variety of landscapes and habitats [Myers *et al.*, 2000].

Supplementary data. The following Table is available online at <http://kmkjournals.com/journals/AS>.

Supplementary Table 1. Distribution of pseudoscorpions of the genus *Ephippiochthonius* Beier, 1930 in the Caucasus.

Compliance with ethical standards

CONFLICT OF INTEREST: The authors declare that they have no conflict of interest.

Ethical approval: No ethical issues were raised during our research.

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References

- Callaini G. 1984. Osservazioni su alcune specie di *Chthonius* del sottogenere *Ephippiochthonius* Beier (Arachnida, Pseudoscorpionida, Chthoniidae). *Notulae Chernetologicae XVII // Annali del Museo Civico di Storia Naturale "Giacomo Doria"*. Vol.85. P.125–159.
- Chamberlin J.C. 1931. The arachnid order Chelonethida // *Stanford University Publications, University Series (Biological Sciences)*. Vol.7. No.1. P.1–284.
- Coene F. 2009. *The Caucasus: An introduction*. London and New York: Routledge. 256 pp.
- Dashdamirov S.D. 1992. [A fauna and zoogeography of Pseudoscorpiones of the Azerbaijan (Arachnida, Pseudoscorpiones)] // *Ovtsharenko V.I. (ed.) Fauna i ekologiya paukov, skorpionov i lozhnoskorpionov SSSR. Trudy Zoologicheskogo Instituta AN SSSR. Vol.226 (for 1990). Leningrad. P.105–110 [in Russian, with English summary]*.
- Dashdamirov S. 1999. New records of false scorpions in the Caucasus (Arachnida: Pseudoscorpiones) // *Arthropoda Selecta*. Vol.8. No.2. P.79–87.
- Dashdamirov S., Schawaller W. 1993. [Pseudoscorpions of the Caucasian fauna (Arachnida Pseudoscorpionida)] // *Arthropoda Selecta*. Vol.1 (for 1992). No.4. P.31–72 [in Russian, with English summary].
- de Klerk P., Haberl A., Kaffke A., Krebs M., Matchutadze I., Minke M., Schulz J., Joosten H. 2009. Vegetation history and environmental development since ca 6000 cal yr BP in and around Ispani 2 (Kolkheti lowlands, Georgia) // *Quaternary Science Reviews*. Vol.28. Nos.9–10. P.890–910. <https://doi.org/10.1016/j.quascirev.2008.12.005>
- Gabbutt P.D., Vachon M. 1963. The external morphology and life history of the pseudoscorpion *Chthonius ischnocheles* (Hermann) // *Proceedings of the Zoological Society of London*. Vol.140. P.75–98. <https://doi.org/10.1111/j.1469-7998.1963.tb01855.x>
- Gardini G. 2009. Neotype fixation and redescription of *Chthonius tetrachelatus* (Preyssl, 1790), type species of the subgenus *Ephippiochthonius* Beier, 1930 (Pseudoscorpiones: Chthoniidae) // *Klapalekiana*. Vol.45. P.23–31.
- Gardini G. 2013. A revision of the species of the pseudoscorpion subgenus *Chthonius* (*Ephippiochthonius*) (Arachnida, Pseu-

- doscorpiones, Chthoniidae) from Italy and neighbouring areas // *Zootaxa*. Vol.3655. No.1. P.1–151. <http://dx.doi.org/10.11646/Zootaxa.3655.1.1>
- Gardini G. 2014. The species of the *Chthonius heterodactylus* group (Arachnida, Pseudoscorpiones, Chthoniidae) from the eastern Alps and the Carpathians // *Zootaxa*. Vol.3887. No.2. P.101–137. <https://doi.org/10.11646/zootaxa.3887.2.1>
- Harvey M.S. 1991. Catalogue of the Pseudoscorpionida. Manchester and New York: Manchester University Press. 726 pp.
- Harvey M.S. 1992. The phylogeny and classification of the Pseudoscorpionida (Chelicerata: Arachnida) // *Invertebrate Taxonomy*. Vol.6. P.1373–1435. <https://doi.org/10.1071/IT9921373>
- Judson M.L.I. 2007. A new and endangered species of the pseudoscorpion genus *Lagynochthonius* from a cave in Vietnam, with notes on chelal morphology and the composition of the Tyranochthoniini (Arachnida, Chelonethi, Chthoniidae) // *Zootaxa*. Vol.1627. No.1. P.53–68. <http://dx.doi.org/10.11646/zootaxa.1627.1.4>
- Kaffke A. 2008. Vegetation and site conditions of a Sphagnum percolation bog in the Kolkheti Lowlands (Georgia, Transcaucasia) // *Phytocoenologia*. Vol.38. No.3. P.161–176. <https://doi.org/10.1127/0340-269X/2008/0038-0161>
- Khalin A.V., Aibulatov S.V., Przhiboro A.A. 2022. Sampling techniques for bloodsucking dipterans (Diptera: Culicidae, Simuliidae, Ceratopogonidae, Tabanidae) // *Entomological Review*. Vol.101. No.9. P.1219–1243. <https://doi.org/10.1134/S0013873821090013>
- Kobakhidze D. 1960. Materialien zur Höhenstufenverbreitung der Pseudoscorpionidea in der Georgischen SSR // *Zeitschrift der Arbeitsgemeinschaft Österreichischer Entomologen*. Jg.12. Nr.2. S.103–106.
- Kobakhidze D. 1961. Die Standorte des *Chthonius tetrachelatus* (Preissler) in den verschiedenen Landschaftstypen der Georgischen SSR // *Zoologischer Anzeiger*. Bd.167. H.4/5. S.166–169.
- Kobakhidze D. 1964. [Pseudoscorpions (Pseudoscorpiones)] // *Zhivotnyi mir Gruzii*. Vol. 2. Chlenistonogie. Tbilisi, Metsniereba. P.30–47 [in Georgian].
- Kolesnikov V.B., Turbanov I.S., Gongalsky K.B. 2019. Two new species false scorpion genus *Ephippiochthonius* Beier, 1930 (Arachnida: Pseudoscorpiones: Chthoniidae) from the Western Ciscaucasia, Russia // *Arthropoda Selecta*. Vol.28. No.1. P.73–82. <https://doi.org/10.15298/arthscl.28.1.06>
- Kolesnikov V.B., Christophoryová J., Przhiboro A.A., Turbanov I.S. 2022. The pseudoscorpions of the Caucasian *Sphagnum* bogs: part I. Description of *Neobisium (Neobisium) adjaricum* sp. nov. and redescription of the holotype of *N. (N.) vilcekii* Krumpál, 1983 (Arachnida, Pseudoscorpiones, Neobisiidae) // *ZooKeys*. Vol.110. P.165–190. <https://doi.org/10.3897/zookeys.1100.81910>
- Krebs M., Kaffke A., de Klerk P., Matchutadze I., Joosten H. 2009. A future for Ispani 2 (Kolkheti, Georgia) and adjacent lands // *International Mire Conservation Group Newsletter* 2009. Vol.2. P.3–14.
- Krebs M., Matchutadze I., Bakuradze T., Kaiser R. 2017. Georgia // Joosten H., Tanneberger F., Moen A. (eds.). *Mires and peatlands of Europe: status, distribution and conservation*. Schweizerbart Science Publishers, Stuttgart. P.403–412.
- Mahnert V. 2011. A nature's treasury: pseudoscorpion diversity of the Canary Islands, with the description of nine new species (Pseudoscorpiones, Chthoniidae, Cheiridiidae) and new records // *Revista Ibérica de Aracnología*. Vol.19. P.27–45.
- Myers N., Mittermeier R.A., Mittermeier C.G., da Fonseca G.A.B., Kent J. 2000. Biodiversity hotspots for conservation priorities // *Nature*. Vol.403 (6772). P.853–858. <https://doi.org/10.1038/35002501>
- Nassirkhani M., Shoushtari R.V. 2015. Description of the new species *Chthonius (Ephippiochthonius) negarinae* sp. nov. (Pseudoscorpiones: Chthoniidae) from Iran // *Turkish Journal of Zoology*. Vol.39. P.762–767. <https://doi.org/10.3906/zoo-1408-8>
- Nassirkhani M., Snegovaya N., Chumachenko Y. 2019. Description of a new epigeal species of the pseudoscorpion genus *Ephippiochthonius* (Pseudoscorpiones: Chthoniidae) from Russia // *Acta Arachnologica*. Vol.68. No.1. P.1–5. <https://doi.org/10.2476/asjaa.68.1>
- Preyssl J.D. 1790. Verzeichniss böhmischer Insekten. Erstes Hundert mit zwei Kupfertafeln. Prague: Schönfeld-Meissnerischen. 108 S.
- Rafalski J. 1949. Pseudoscorpionidea z Kaukazu w zbiorach Państwowego Muzeum Zoologicznego // *Annales Musei Zoologici Polonici*. Vol.14. P.75–120.
- Schawaller W. 1983. Pseudoskorpione aus dem Kaukasus (Arachnida) // *Stuttgarter Beiträge zur Naturkunde. Serie A (Biologie)*. Nr.362. S.1–24.
- Schawaller W., Dashdamirov S. 1988. Pseudoskorpione aus dem Kaukasus, Teil 2 (Arachnida) // *Stuttgarter Beiträge zur Naturkunde. Serie A (Biologie)*. Nr.415. S.1–51.
- Simon E. 1900. Studio sui Chernetes Italiani conservati nel Museo Civico di Genova. II // *Annali del Museo Civico di Storia Naturale di Genova. Sér.2*. Vol.20. P.593–595.
- Turbanov I.S., Kolesnikov V.B. 2021. Three new hypogean species of the false scorpions genus *Ephippiochthonius* Beier, 1930 (Arachnida: Pseudoscorpiones: Chthoniidae) from the Crimean Peninsula // *Arthropoda Selecta*. Vol.30. No.2. P.193–204. <https://doi.org/10.15298/arthscl.30.2.06>
- WPC. 2022. World Pseudoscorpiones Catalog. Natural History Museum Bern. <http://wac.nmbe.ch> [accessed on 04 February, 2022]
- Zaragoza J.A. 2017. Revision of *Ephippiochthonius* complex in the Iberian Peninsula, Balearic Islands and Macaronesia, with proposed changes to the status of *Chthonius* subgenera (Pseudoscorpiones, Chthoniidae) // *Zootaxa*. Vol.4246. No.1. P.1–221. <https://doi.org/10.11646/zootaxa.4246.1.1>

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