Description of the new species *Chthonius* (*Ephippiochthonius*) *negarinae* sp. nov. (Pseudoscorpiones: Chthoniidae) from Iran

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Abstract: A new species, *Chthonius* (*Ephippiochthonius*) *negarinae* sp. nov., is described from Iran. In addition, illustrations and measurements are given.

Key words: Arachnida, faunistic, *tetrachelatus*-group, Middle East

1. Introduction

The genus *Chthonius* C. Koch is characterized by the presence of bisetose intercoxal tubercles and the presence of spines on coxae II and III, and also by the presence of simple teeth on the inner margins of the chelal fingers (Chamberlin, 1929; Beier, 1932). It is distributed all over the world, mainly in the western Palearctic region, with a few species described from North America, and is generally found in soil and leaf litter and under stones. The subgenus *Ephippiochthonius*, which was established by Beier (1930), differs from the subgenus *Chthonius* by the presence in the former of a dorsal depression between the trichobothrial groups, *ib*-isb and eb-esb-ist; Gardini (2013) revised the Italian species of this subgenus.

The Chthoniidae family is represented in Iran by 5 species: *Chthonius* (*Chthonius*) shelkovnikovi Redikorzev, 1930 in Guilan Province; *Chthonius* (*Ephippiochthonius*) *anatolicus* Beier, 1969 in Mazandaran, Guilan, and Kerman provinces; *Chthonius* (*Ephippiochthonius*) *iranicus* Beier, 1971 in the Elbors Mountains–Mazandaran Province; *Chthonius* (*Ephippiochthonius*) *romanicus* Beier, 1935 in Mazandaran and Guilan provinces; and *Chthonius* (*Ephippiochthonius*) *tetrachelatus* (Preyssler, 1790) in Guilan Province (Beier, 1971; Mahnert, 1974; Nassirkhani and Takallozadeh, 2012). The new species *Chthonius* (*Ephippiochthonius*) *negarinae* sp. nov. is described and illustrated herein.

2. Materials and methods

The specimens that are described and illustrated here are deposited in the Acarology Laboratory, Islamic Azad University of Arak (IAUA), Iran. The materials that were examined for this study were extracted from soil and litter consisting of decayed leaf pieces by using Berlese funnels. All materials were preserved in 70% ethanol, cleared with 60% lactic acid, and studied as permanent slides mounted in Swan’s fluid. Circular coverslips were placed on dish slides consisting of decayed leaf pieces. The specimens were examined with an Olympus BH-2 compound microscope and illustrated with the aid of a drawing tube attachment. The basic morphological characters were measured by using an ocular graticule. The following abbreviations are used throughout this study: *eb* = external basal; *esb* = external subbasal; *ib* = internal basal; *isb* = internal subbasal; *ist* = internal subterminal; *est* = external subterminal; *it* = internal terminal; *et* = external terminal; *xs* = double subapical trichobothria; *t* = terminal; *st* = subterminal; *sb* = subbasal; *b* = basal; *mm* = millimeter; *L* = length; *W* = width; *D* = depth. Morphological terminology and mensuration mostly follow Chamberlin (1931), Harvey (1992), Harvey et al. (2012), and Judson (2007).

3. Results and discussion

IRAN: Golestan Province: holotype ♂, allotype ♀, Jahan Nama Protected Area, soil and litter, June 2011, M. Nassirkhani (IAUA). Paratypes 4 ♂, 1 ♀, collected with holotype (IAUA).
3.1. Diagnosis

*Chthonius (Ephippiochthonius) negarinae* differs from all other species of the *C. tetrachelatus* group sensu Gardini, 2013, which is characterized by the presence of triangular teeth on the basal half of the fixed chelal finger that are gradually reduced as far as the base of the finger, and the presence of rounded teeth on the basal half of the movable chelal fingers, by the following combination of characters: the presence of 4 eyes (posterior eyes are eyespots); the presence of 4 preocular microsetae (2 microsetae on each side); the presence of an isolated subapical tooth on the movable cheliceral finger; the presence of 2 microsetae on the cheliceral hand; the trichobothriotaxy, especially the position of trichobothrium *ist* in the fixed chelal finger; the morphometric characters, e.g., chelal L/W is 0.60–0.62/12–13 mm for males and 0.68/0.16–0.17 mm for females, chelal hand L is 0.25–0.26 mm for males and 0.30 mm for females, and movable chelal finger L is 0.35–0.37 mm for males and 0.38 mm for females; movable chelal finger with 7–11 and fixed chelal finger with 15–18 (6–7 teeth at level of trichobothria *est–it*, 2–3 teeth occupying 0.1 mm in distance) teeth.

3.2. Description

**Adults** (Figures 1–11)

Body length: 1.07–1.25 mm for males and 1.22–1.25 mm for females.

**Carapace:** Uniformly brown, smooth; lateral margins with a few small modified teeth; L/W 0.92–1.30; with 2 pairs of eyes; anterior eyes corneate and situated close to anterior margin; posterior eyes distinctly reduced (eyespots) and located less than 1 ocular diameter from the anterior eyes (Figure 1); anterior margin finely denticulate (Figures 1 and 2); anterior margin with 4 setae, medial setae longer than lateromedial setae; preocular setae smallest, 2 microsetae situated on each side; 1 seta situated between eyes (Figure 1); carapace with setae arranged: mm4/mm: 6: 4: 2: m2m; transverse furrows absent; with 6 lyrifissures (only 1 specimen with 4(!) lyrifissures), first pair situated between the anteromedial setae and the median ocular setae, second pair located between eyes, closer to anterior eyes than posterior eyes, and third pair situated on posterior margin between short and long setae.

**Tergites:** Brown, anterior tergites lighter and posterior tergites darker in color than carapace; not granulate; lightly sclerotized; without median suture line; tergites VI–IX with long and stout setae situated laterally; tergite XI with 2 tactile setae situated submedially; tergite setae arranged 4: 4: 4: 6: 6: 6: 6: 4: 2; setae long, acute, and stout.

**Sternites:** Yellowish brown, paler than tergites, posterior sternites similar to tergites in color; not granulate; poorly sclerotized; without median suture line; sternite X with 2 long tactile, 2 slightly long, and 3 normal setae; males with genital atrium relatively short, with 4 pairs glandular setae (Figure 11); females with widely cribriform plate (Figure 10); sternite III of males with V-shaped opening aperture, 6–8 pairs surrounding genital aperture and 10 setae situated irregularly; most setae acute, simple, and same as tergal setae; sternal setae arranged 9–10: (3)10(3): (1–2)8(1–2): 6: 6: 6: 6: 7: 0: 2 for males; anterior spiracle more swollen than posterior one; anterior tracheal trunk larger than posterior one.

**Pleural membrane:** Plicate and granulated with small granules.

**Chelicera:** Brown, distinctly darker than body; with 6 (rarely 7) [+2(ms)] setae on palm and 1 medial seta on movable finger; setae simple and acute; rallum with 9–11 denticulate blades (Figure 3); spinneret bulb-shaped and situated subdistally (Figure 3); serrula exterior with 13–14 blades; lamina exterior with 9–10 blades; fixed finger with 8 distinct teeth, basal teeth smaller than apical teeth; movable finger with 8 teeth, subapical tooth largest and situated separately from others, basal teeth blunt and very small, teeth become larger gradually from base to apical margin of finger (Figure 3).

**Pedipalps:** Brown; lighter in color than carapace, chela darker in color than femur; entirely smooth; coxa with 5 setae, 2 setae situated on manducatory process; trochanter L/W 1.55–1.77; femur elongate, without pedicel, with irregularly shaped ornamentations, prolateral margin with longer setae than retralateral margin (Figure 4), femoral setae arranged 3: 6: 2: 5, L/W 5.50–6.28; patella with very short and stout pedicel, L/W 1.77–2.00; chela without pedicel; chela L/W 4.70–5.16; dorsum of hand slightly curved distally and weakly depressed at level of *ib*- *isb*, L/W 2.00–2.15; movable finger distinctly longer than hand, movable finger 1.38–1.48 longer than hand; chelal hand setae arranged 2 (basal): 3 (medial): 3 (apical); fixed finger and dorsum of hand with 8+2(xs) and movable finger with 4 trichobothria (Figure 5); fixed finger with trichobothrium *et* closer to xs than to *ist*, it situated closer to *est* than to *t*, *est* situated slightly proximal to *it*, *ist* situated at base of finger, *ib* and *isb* situated on dorsum of hand; movable finger with trichobothrium *st* distinctly closer to *t* than to *sb*, *t* and *st* situated in distal third, and *b* and *sb* located in basal third of finger; both fingers apically curved; fixed finger with 15–18 and movable finger with 7–11 separated teeth; teeth of fixed finger triangular and acute, 3–5 basal teeth small; fixed finger at level of *est*–*it* with 2–3 teeth occupying 0.1 mm (distance between successive apices 0.012–0.020 mm); males with a modified accessory tooth and a hollow near tip of fixed finger (Figure 6); basal internal apodeme of movable finger sclerotized, club-like, with 1 submedian point branch and truncated apically (Figure 5); teeth of movable finger triangular-shaped and acute, 1–2 basal teeth blunt.
Figures 1–6. Chthonius (E.) negarinae sp. nov. 1- Male holotype, carapace (showing anterior margin and chaetotaxy), dorsal view; 2- Male paratype, anterior margin of carapace; 3a- Male holotype, chelicera; 3b- Male holotype, rallum; 4- Male holotype, pedipalp; 5- Male holotype, right chela, lateral view; 6- Male paratype, tip of fixed finger, dorsal view.
Figures 7–11. Chthonius (E.) negarinae sp. nov. 7- Female allotype, left coxae (showing chaetotaxy, coxal spines and bisetose intercoxal setae); 8- Female allotype, leg I; 9- Female allotype, leg IV; 10- Female allotype, cribriform plate; 11- Male holotype, genitalia.
Legs: Yellowish brown, slightly lighter in color than sternites; coxal setae (Figure 7) arranged I 3+3(3s), II 4, III 4–5, and IV 6; coxa I with apical projection, microsetae situated on this projection; most coxal setae acute and long; coxal spines situated on coxae II and III, each coxa II with 7–9 and each coxa III with 4 coxal spines; 2 bisetose intercoxal setae present and situated between coxae III and IV; claws simple and narrow; arolia simple, thin and shorter than claws (Figures 8 and 9). Leg I: Tibia L/D 3.00–3.75 and tarsus L/D 8.66–9.66. Leg IV: Tibia L/D 3.83–4.16, metatarsus L/D 2.80–3.25, tarsus L/D 8.33–9.30; metatarsus with 1 tactile seta situated medially; tarsus with 1 tactile seta situated submedially (Figure 9).

Dimensions (in mm) of males: Carapace: 0.33–0.42/0.32–0.40. Pedipalp: Trochanter 0.13–0.14/0.08–0.09; femur 0.41–0.44/0.07–0.08; patella 0.16–0.18/0.08–0.09; chela 0.60–0.62/0.12–0.13; hand L 0.25–0.26; movable finger L 0.35–0.37. Leg I: Tibia 0.12–0.14/0.04; tarsus 0.25–0.27/0.03. Leg IV: Tibia 0.23–0.25/0.06; metatarsus 0.13–0.15/0.04–0.05; tarsus 0.25–0.27/0.03 of females. Carapace: 0.40–0.43/0.35–0.45. Pedipalp: Trochanter 0.16/0.09; femur 0.48–0.49/0.09; patella 0.17/0.10–0.11; chela 0.68/0.16–0.17; hand L 0.38; movable finger L 0.30. Leg I: Tibia 0.15/0.04; tarsus 0.28–0.29/0.03. Leg IV: Tibia 0.27–0.28/0.07; metatarsus 0.15/0.05–0.06; tarsus 0.28–0.29/0.03.

3.3. Remarks
The subgenus Chthonius (Epilipiochthonius) is not very well represented in the Asian regions, with only a handful of species recorded: C. (E.) tetrachelatus, C. (E.) fuscimanus Simon, 1990, C. (E.) iranicus, C. (E.) sacer Beier, 1963, and C. (E.) romanicus (summarized in Harvey, 2013). Schawaller and Dashdamirov (1988) found wide morphological variation in populations that were attributed to C. (E.) tetrachelatus, but were unable to find consistent morphological differences that could be used to identify distinct species. Many of the previously described Asian species are difficult to identify, mainly due to the short published descriptions and lack of comprehensive illustrations.

Chthonius (E.) negarinae belongs to the tetrachelatus group that was recently defined by Gardini (2013) as having the chelal teeth of the fixed finger present nearly to the base of the finger and the movable chelar finger lacking a marginal lamina. Within the tetrachelatus group, the new species belongs to a group that is characterized by the presence of an isolated distal tooth on the movable chelical finger. Gardini (2013) included C. (E.) gibbus Beier, 1953, C. (E.) lucanus Callaini, 1984, and C. (E.) messapicus Gardini, 2013 in this group, but it is unknown how many other species also possess this suite of characters; thus, most published descriptions lack sufficient details or illustrations.

Chthonius (E.) negarinae differs from C. (E.) gibbus by the presence of 2 pairs of preocular setae [which are lacking in C. (E.) gibbus; see Gardini (2013)] and from C. (E.) lucanus and C. (E.) messapicus by the dentition of both chelal fingers, which extends further basally than in C. (E.) negarinae, and the shape of the chelal hand.

Callaini (1984) reported Chthonius (E.) lucanus from Marmmano, Monte Pollino, Calabria, Italy; it is distributed in central and southern Italy. The pedipalpal femur L/W of C. (E.) lucanus from Italy is 0.47–0.55/0.08–0.10 mm, the chelal L/W is 0.65–0.77/0.12–0.15 mm, and the movable finger length is 0.37–0.44 mm; all of these measurements are relatively larger than those of the Iranian specimens. The other observable difference that may be significant is the number of teeth on the movable chelal finger, which are 11–14 for C. (E.) lucanus and 7–11 for C. (E.) negarinae. The position of trichobothrium ist on the fixed chelal finger of C. (E.) negarinae is completely different from the trichobothriotaxy of C. (E.) lucanus. In the species C. (E.) negarinae, the trichobothrium ist is located distinctly distal to trichobothria eb-esb, whereas in C. (E.) lucanus, the trichobothria eb-esb-ist are placed mostly in a straight line or trichobothrium ist is placed slightly distal of eb-esb (Gardini, 2013).
The length of the movable chelal finger of *C. (E.) iranicus* is distinctly greater (0.50 mm) than that of *C. (E.) negarinae*. Additionally, the chelal hand ratio is 2.28× (0.32/0.14 mm) for *C. (E.) iranicus*, and there are 3 basal setae on its chelal hand (Beier, 1971). These characters can be used for distinguishing the species *C. (E.) iranicus* from the new species from Iran.

*Chthonius* (E.) *sacer* is distributed only in Israel. This species can be recognized from the newly collected specimens from Iran by the presence of 4 well-developed corneate eyes and the morphometric characters, which show that the species *C. (E.) sacer* is clearly larger than *C. (E.) negarinae*, e.g., the pedipalpal femur L/W is 6.30× (L = 0.83 mm), chelal L/W is 5.30×, chelal hand L/W is 3.84× (0.46/0.12 mm), and movable chelal finger L is 0.64 mm (Beier, 1963a).

### 3.4. Etymology

This species is named for Negarin, the daughter of one of the authors.

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### References


