Neobisium (Neobisium) moreoticum (Pseudoscorpiones: Neobisiidae) from Georgia

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Neobisium (*Neobisium*) *moreoticum* (Pseudoscorpiones: Neobisiidae) from Georgia

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Abstract. A redescription of males of *Neobisium* (*N.*) *moreoticum* from Georgia is provided. Notes on its morphological variability and geographical distribution in Georgia are given.

Keywords: Arachnida, Caucasus, pseudoscorpion, taxonomy, variability

Zusammenfassung. *Neobisium* (*Neobisium*) *moreoticum* (Pseudoscorpiones: Neobisiidae) aus Georgien. Eine Wiederbeschreibung des Männchens von *Neobisium* (*N.*) *moreoticum* aus Georgien wird präsentiert. Die morphologische Variabilität und die Verbreitung in Georgien werden dargestellter Kopulationsorgane beider Geschlechter der Art präsentiert. Ergänzt wird dies durch Fotos nahe verwandter anatolischer Arten.

The subgenus *Neobisium* (*Neobisium*) Chamberlin, 1930 currently contains 15 known species occurring in Georgia (Harvey 2013): *N.* (*N.*) *anatolicum* Beier, 1949, *N.* (*N.*) *brevidigitalum* (Beier, 1928), *N.* (*N.*) *carcinoides* (Hermann, 1804), *N.* (*N.*) *cephalonicum* (Daday, 1888), *N.* (*N.*) *crassifemoratum* (Beier, 1929), *N.* (*N.*) *doderoi* (Simon, 1896), *N.* (*N.*) *erythrodactylum* (L. Koch, 1873), *N.* (*N.*) *fuscimanum* (C. L. Koch, 1843), *N.* (*N.*) *kobakhidzei* Beier, 1962, *N.* (*N.*) *granulatum* Beier, 1937, *N.* (*N.*) *labinskyi* Beier, 1937, *N.* (*N.*) *moreoticum* Beier, 1931, *N.* (*N.*) *simile* (L. Koch, 1873), *N.* (*N.*) *sylvaticum* (C. L. Koch, 1835) and *N.* (*N.*) *validum* (L. Koch, 1873).

Neobisium (*N.*) *moreoticum* was originally described from Kumani (southern Greece) by Beier (1931), subsequently briefly redescribed by Beier (1963), reported from Gori (central Georgia) by Rafalski (1949) and from various localities in Bulgaria by Petrov & Šťáhlavský (2007). In addition, Schmalfuss & Schawaller (1984) recorded *N.* aff. *moreoticum* from Santorini (south-eastern Greece). With respect to the lack of modern description of the species, here we redescribe the males of *N.* (*N.*) *moreoticum* based on the newly collected material from several localities of Georgia. Additionally, a revised range of size, a distribution map for Georgia and some morphological variations of this species are presented.

Material and methods

Pseudoscorpions were collected from different localities in Georgia during the years 2013 to 2017. Specimens were cleared with a 60 % solution of lactic acid, dissected using black enamelled pins, and prepared as temporary and permanent slides. The temporary slide mounts were carried out in glycerin, and returned to small microtubes filled by 75 % ethanol after study. A number of specimens were permanently mounted on microscope slides in Hoyer's medium. Microscopical examination was carried out with an Olympus CH–2 compound microscope, which was also used to illustrate the specimens with an attached drawing tube, and to take measurements of the specimens with an ocular graticule. The specimens were deposited in the Collection of the Acarology Laboratory, Ilia State University, Tbilisi, Georgia (ISUTG). The morphological terminology and measurements follow Chamberlin (1931), Harvey (1992), Harvey et al. (2012), Judson (2007) and Zaragoza (2008).

It is important to note that the types of *N.* (*N.*) *moreoticum* should, according to Beier (1931), be lodged in the Natural History Museum of Vienna, but unfortunately they are currently unavailable because they may have not been placed back correctly or may be lost (C. Hörweg pers comm. in Dec. 2018).

Abbreviations: L = length, W = width, D = depth. Chaetotaxy: *Em* = external microseta, *Im* = internal microseta, *Mm* = medial microseta, *T* = tactile seta on tergites and sternites X-XI, *TS* = tactile seta, ISUPS = Ilia State University, Pseudoscorpion collection.

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Results

Neobisiidae Chamberlin, 1930

Neobisium Chamberlin, 1930

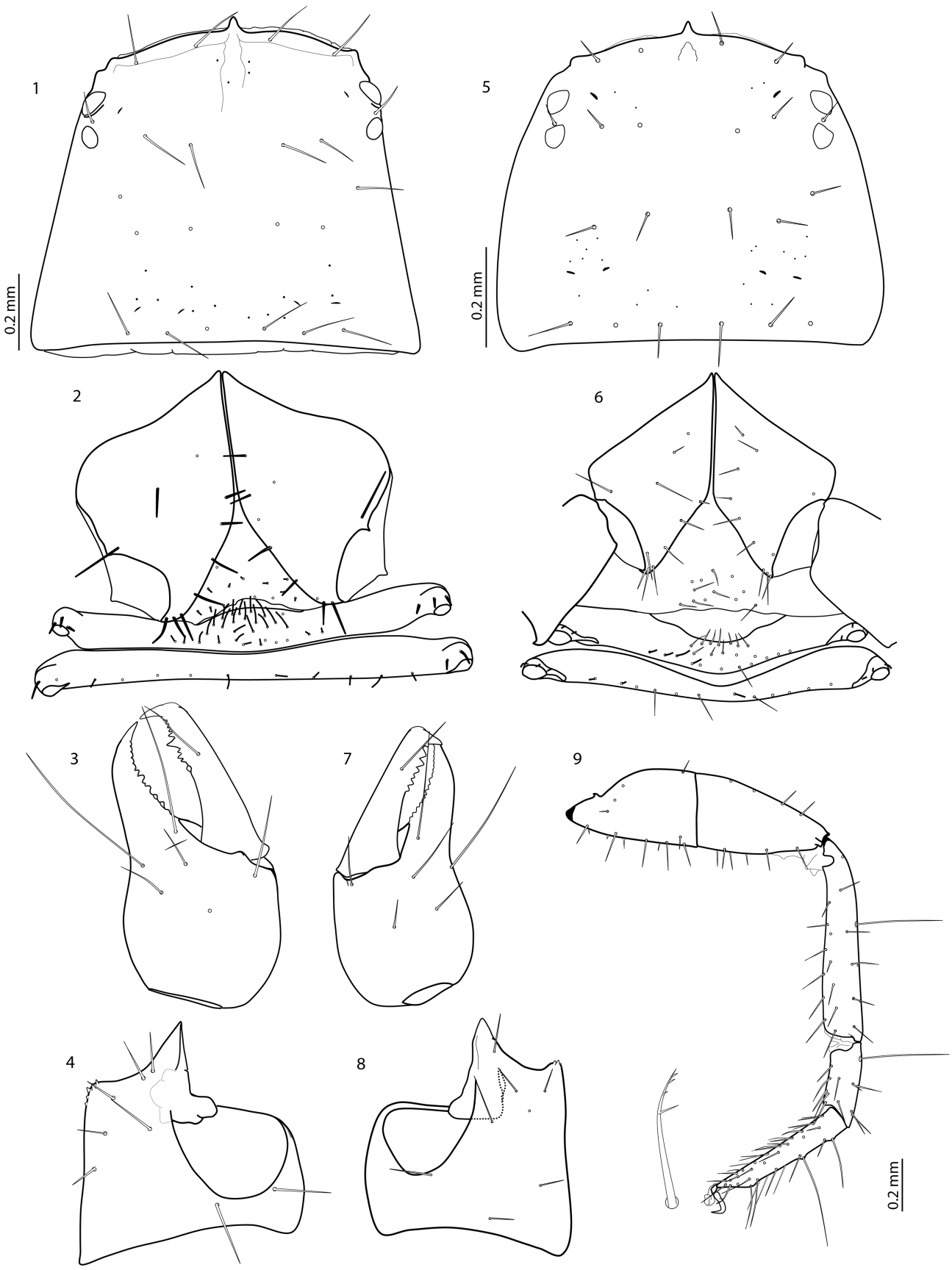
***Neobisium* (*Neobisium*) *moreoticun* Beier, 1931** (Figs 1–13)

Neobisium (*Neobisium*) *moreoticum* Beier, 1931: 22–23; Beier 1932: 99–100, fig. 109.

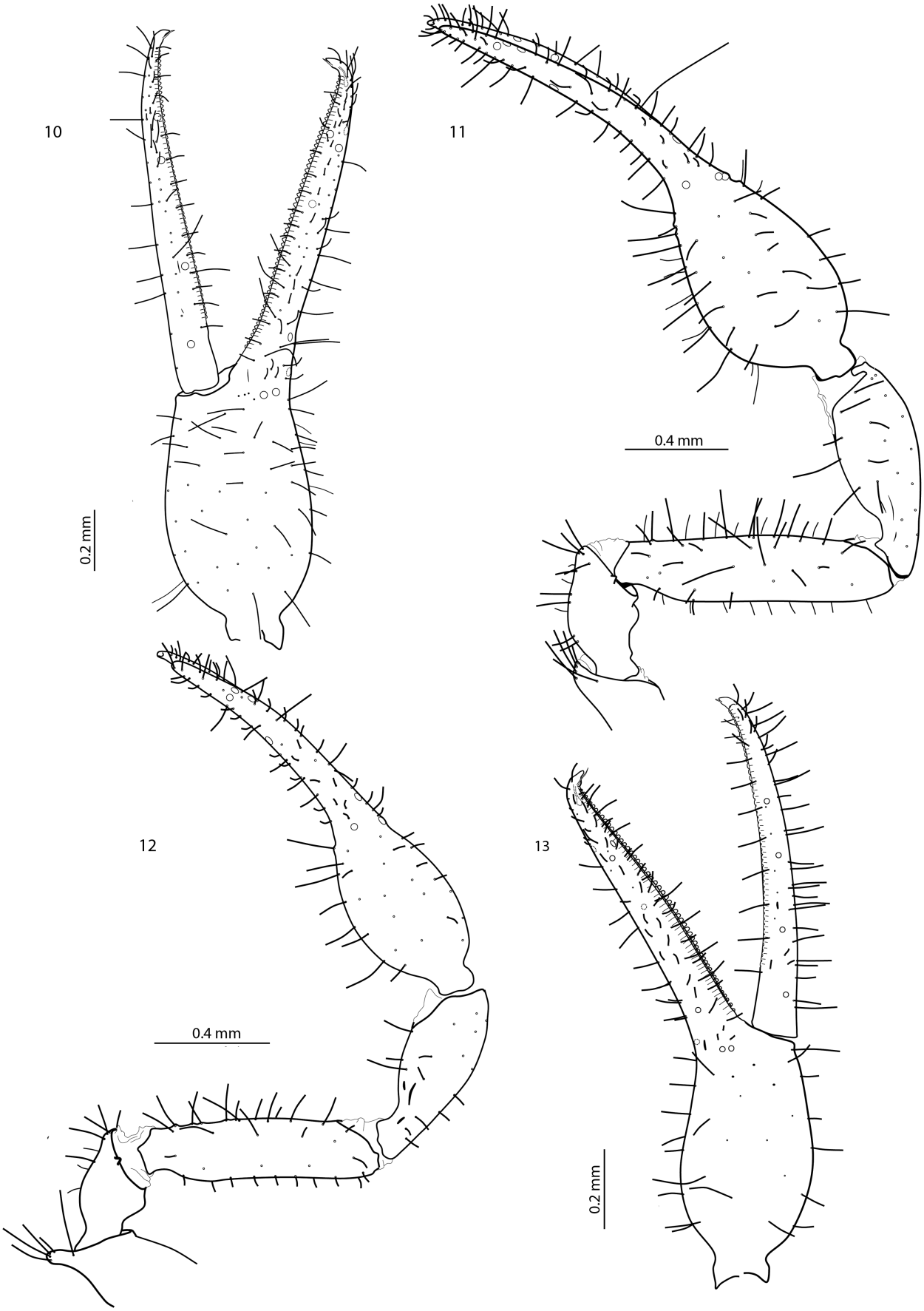
Material examined. GEORGIA: 2 ♂♂, Lagodekhi National Park, mixed broadleaf forest, (41.85363°N, 46.30317°E, 710 m a.s.l.), VI.2013 (ISUPS25); 2 ♂♂, Lagodekhi National Park, mixed broadleaf forest, (41.85257°N, 46.31721°E, 1010 m a.s.l.), VI.2013 (ISUPS35); 5 ♂♂, village Lashe, mixed secondary forest (42.052206°N, 43.162798°E, 670 m a.s.l.), IX.2014 (ISUPS8); 2 ♂♂, Village Bakhmaro, coniferous (*Abies nordmaniana* (Steven) Spach, 1841) forest, (41.94630°N, 43.50936°E, 2070 m a.s.l.), VIII.2017 (ISUPS5); 2 ♂♂, North of village Jvari, mixed broadleaf forest, (42.77657°N, 42.05402°E, 790 m a.s.l.), VIII.2010 (ISUPS11); 1 ♂, West of village Chkhakoura, mixed broadleaf forest, (41.89922°N, 42.37073°E, 1230 m), IX.2017 (ISUPS14).

Redescription (variations within species in square brackets)

Carapace. reddish–brown to dark brown, posterior border pale and not sclerotized; entirely smooth; sub-quadrate, 0.71–0.85× wider than length (in flattened specimens); with 2 pairs of corneate eyes, anterior eyes larger than posterior ones, anterior eyes located a little more than/as long as one diameter from anterior margin (distance from anterior margin 0.075–0.087 mm, diameter of anterior eyes 0.070–0.080 mm, separation between eyes 0.025–0.035 mm); with 21–22



Figs 1–9: *Neobisium* (*N.*) *moreoticum* Beier, 1931, ♂: 1–4 from the village of Lashe (ISUPS8): **1.** carapace, dorsal view; **2.** coxae IV and sternites II–IV (showing chaetotaxy of coxae IV and genital area), ventral view; **3.** right chelicera, dorsal view; **4.** coxa I, ventral view. 5–9 from Lagodekhi National Park (ISUPS25): **5.** carapace, dorsal view; **6.** coxae IV and sternites II–IV (showing chaetotaxy of coxae IV and genital area), ventral view; **7.** left chelicera, dorsal view; **8.** coxa I, ventral view; **9.** leg IV (trochanter omitted, sub-terminal seta magnified)



Figs 10–13: *Neobisium* (*N.*) *moreoticum* Beier, 1931, ♂: 10–11 from the village of Lashe (ISUPS8): **10.** left chela, lateral view; **11.** right pedipalp, dorsal view, 12–13 from Lagodekhi National Park (ISUPS25): **12.** right pedipalp, dorsal view; **13.** right chela, lateral view

setae, anterior margin with 4 setae, preocular setae absent, 1 seta situated each side between eyes, posterior margin with 6 setae, chaetotaxy (Figs 1, 5): 4:6:5–6:6; epistome prominent, large and apically rounded (length 0.025–0.037 mm, width 0.027–0.040 mm) (Figs 1, 5); anterolateral corners without protuberances (in one specimen, each anterolateral corner with a very small protuberance at lower level of the carapace surface); with 6 microlyrifissures, one pair situated in ocular zone and 2 pairs located near posterior margin (two specimens with 8 microlyrifissures, one on each side close to eyes, one on each side in median zone, and 2 on each side at posterior margin).

Tergites. brown, clearly lighter in colour than carapace; smooth; all setae simple; X–XI with 2 slightly long setae (shorter than tactile setae) situated sub-laterally; X–XI with 2 long tactile setae located medially/sub-medially (in one specimen, XI with 4 lateral and lateromedian tactile setae, T1T1T1T); chaetotaxy: 5–7:6–8:8–10:9–10:8–10:9–10:9:9–10:9–10:3T1T3–4TT4:3TT3–3T(1–2)T3:2.

Sternites. brown, lighter in colour than tergites; entirely smooth; genital area with 10–14 setae on anterior operculum, 23–30 setae on posterior operculum, of which 12–16 setae located along posterior margin of genital aperture (Figs 2, 6); genital organ with long lateral and relatively short median genital sacs (in two specimens, lateral genital sacs shorter than those of the others), 5–6 internal setae located each side (5+5/5+6) (in two specimens, 3 of internal setae located each side (3+3)), anterior spiracles with 3–4 and posterior spiracles with 2–3 short suprastigmal setae; all setae simple; IV–XI uniseriate; X with 2 slightly long setae (shorter than tactile setae) situated lateromedially; X with 2 median (in one specimen, sub-median), and XI with 2 sub-median tactile setae; chaetotaxy: 10–14:(3–4)23–30(3–4):(2–3)10–13(2–3):13–16:11–16:10–14:11–14:13–15:11–14:4T(0–1)T4–(5–6)T1T(5–6):T(2–4)T:2.

Pleural membrane. distinctly granulated.

Chelicerae. brown; hand with 6 acuminate setae; galea short, knob-like, with an indistinct rounded hyaline convexity; galeal seta situated sub-medially, proximal to median large tooth on movable finger (Fig. 3) (in two specimens, located in the midway of dental line (Fig. 7); in one specimen, located at same level as most proximal tooth); fixed finger with 12–14 teeth not reaching to base, distal teeth small, rounded and close-set, 2 median teeth larger and acute, proximal teeth medium in size, acute, and separated (Fig. 3) (two specimens with 16–17 contiguous teeth reaching to base, of which two sub-median teeth larger than others (Fig. 7)); movable finger with 10–11 teeth reaching proximal to galeal seta, with 1 sub-median large tooth (Fig. 3) (two specimens with 2 sub-apical large teeth, other teeth medium in size (Fig. 7)); serrula interior with 17–20 and exterior with 20–28 blades; rallum with 8 blades, 6 posterior blades simple, smooth and acuminate, 2 anterior blades long and denticulate, 2–3 proximalmost blades smallest, basal blade isolated.

Pedipalps. reddish brown to brown, slightly darker in colour than carapace; entirely smooth (Figs 11–12); coxa including manducatory process with 10–12 setae, manducatory process with 4–5 acuminate setae; trochanter with prominent dorsal tubercle, L/W 2.00–2.92; femur with short pedicel, without tubercle/s on retrolateral/prolateral margins, most setae on prolateral margin longer than those on retrolateral margin, many of long setae without enlarged alveoli situated basally and sub–medially (Figs 11–12), L/W 3.82–4.43; patella with stout pedicel (L 0.18–0.27 mm); patella distinctly shorter and wider than femur, notch on the median side reaching to at least distal third of the club length (sometimes slightly more extended from distal third but not reaching to middle of the club length), with 3 lyrifissures situated basally, L/W 2.54–2.89; chela (with pedicel) L/W 3.91–4.15; chela (without pedicel) L/W 3.63–3.88; movable finger 1.29–1.40× longer than chelal hand (with pedicel); chelal hand (with pedicel) L/W 1.77–2.09; fixed finger with 8 and movable finger with 4 trichobothria (Figs 10, 13); fixed finger with trichobothria *et*, *it* and *est* aggregated in distal third of the finger, trichobothrium *it* located slightly proximal to *et* (in one specimen, located at same level of *et*), *ist* located approximately in the middle of the finger, *isb* on retrolateral face, *ib* proximal to *isb*, *eb* and *esb* located sub–basally; movable finger with trichobothrium *st* situated distinctly closer to *t* than to *sb*, distance *b–sb* longer than *t–st*; 3–6 short sensory setae situated distal

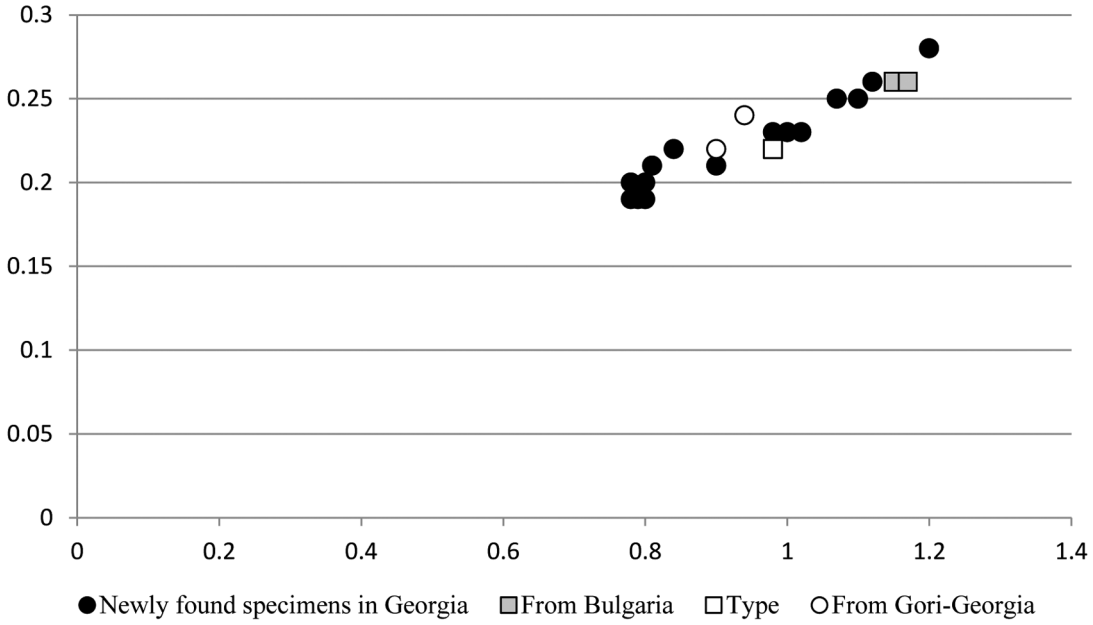


Fig. 14: *Neobisium* (*N.*) *moreoticum* Beier, 1931: graph depicting pedipalpal femur ratios of the type, the males from Bulgaria, the males from Gori–Georgia and the newly collected males from Georgia.

Fig. 15: Records of *Neobisium* (*N.*) *moreoticum* Beier, 1931 in Georgia: north of the village of Jvari (ISUPS11); west of the village of Chkhakoura (ISUPS14); village of Bakhmaro (ISUPS5); village of Lashe (ISUPS8); Lagodekhi National Park (ISUPS25); Lagodekhi National Park (ISUPS35); Gori (Rafalski 1949)

to trichobothria *eb* and *esb*, proximal to trichobothrium *ib* in lateral view; basal third of fixed finger with 4–7 sensory setae in dorsal view, chaetotaxy: *Em* = 1–3, *Mm* = 2–5, *Im* = 0; base of fixed finger with 4 glandular pores on prolateral and 3 ones on retrolateral surface in lateral view; basal half of movable chelal finger with 8–10 sensory setae ending proximal to trichobothrium *st* in lateral view; prolateral face of chelal hand with a few long setae at base of fixed finger and median area of chelal hand in lateral view; fixed finger with 55–65 even, retroconical and contiguous teeth, reaching to level of trichobothrium *ib*, 1–3 distal and 1–4 basal teeth smaller than others, all teeth with dental canal; movable finger with 50–57 contiguous teeth, distal teeth large and retroconical, reaching to trichobothrium *t*, the others rounded, blunt, and small, not reaching to level of trichobothrium *b*, all teeth with dental canal; nodus ramosus of venom duct in fixed chelal finger situated distal to *et* (Figs 10, 13).

Legs. pale brown; smooth; coxa I with long, triangular, sclerotized and apically thin and pointed anterolateral process, mediolateral face denticulate (Fig. 4), in two specimens, anterolateral process more or less apically stout (Fig. 8); coxal chaetotaxy: 6–9:5–8:6–7:9–12; sub–terminal setae bifid (Fig. 9), longer ramus with denticulations; claws simple; arolia simple and shorter than claws. Leg I: femur L/D 4.20–4.78; patella L/D 2.80–3.50; femur 1.48–1.72× longer than patella; tibia L/D 3.75–4.67; metatarsus L/D 3.12–3.57; tarsus L/D 4.33–7.25. Leg IV (Fig. 9): femur L/D 1.44–1.63; patella L/D 1.60–1.93; femur + patella L/D 3.00–3.55; tibia with a tactile seta situated slightly proximal to middle (TS = 0.41–0.48), L/D 4.69–6.15; metatarsus with one tactile setae situated basally (TS = 0.15–0.19), L/D 2.66–3.64; tarsus with a relatively long seta located basally (TS = 0.12–0.14), a tactile setae situated proximal to middle (TS = 0.31–0.44), and 2 distal tactile setae, L/D 4.37–6.37.

Dimensions (in mm)**.** Body length: 2.78–2.90. Carapace: 0.70–0.89/0.85–1.12. Pedipalp: trochanter 0.41–0.79/0.20–0.30; femur 0.78–1.20/0.19–0.28; patella 0.60–0.85/0.23–0.32; chela (with pedicel) 1.37–2.07/0.33–0.52; chela (without pedicel) 1.27–1.92; hand (with pedicel) L.0.61–0.99; movable finger L. 0.83–1.27. Leg I: femur 0.43–0.66/0.09–0.14; patella 0.28–0.42/0.10–0.12; tibia 0.31–0.45/0.08–0.10; metatarsus 0.20–0.28/0.06–0.08; tarsus 0.26–0.41/0.04–0.07. Leg IV: femur 0.36–0.50/0.23–0.31; patella 0.40–0.60/0.23–0.31; femur + patella 0.75–1.10; tibia 0.61–0.90/0.13–0.15; metatarsus 0.25–0.40/0.08–0.12; tarsus 0.35–0.55/0.08–0.10.

Remarks

The newly collected specimens from Georgia are attributed to *Neobisium* (*Neobisium*) *moreoticum* on the basis of the presence of a distinct epistome, loss of preocular microsetae on the anterior margin of the carapace and the presence of 6–7 setae on the posterior margin of the carapace, smooth pedipalp, the absence of tubercle/s on prolateral/retrolateral margin of the pedipalpal femur, the position of the notch on the median side of the patella which is not extended to the middle of the patellal club length, the elliptical shape of the chelal hand in dorsal view (see Beier 1963: fig. 99, Schmalfuss & Schawaller 1984: fig. 2, Petrov & Šťáhlavský 2007: Fig. 13, this study: Figs 11–12), the similar size and shape of the chelal teeth in the distal half of the fixed chelal finger, the pedipalpal proportions especially the femur which is 4.50× longer than broad for the type, 4.45–4.52× for the males from Bulgaria, and 3.90–4.20× for the males from the Caucasus (Beier 1963, Petrov & Šťáhlavský 2007, Rafalski 1949), the length of the movable chelal finger which is distinctly longer than the chelal hand (with pedicel), the pedipalpal femur length (slightly longer than the chelal finger in the type, and slightly shorter or as long as the movable chelal finger in the males from Bulgaria and central Georgia), and the condition of trichobothrium *ist* located slightly distal to the middle of the fixed chelal finger, and *st* situated closer to *t* than to *sb* (see Beier 1963: fig. 99, Schmalfuss & Schawaller 1984: fig. 3).

The recently examined specimens from Georgia show some morphometric and morphological differences in comparison to the published descriptions of the species in the literature. In the present contribution, morphometric differences (Fig. 14. Tab. 1) are considered to be within the intraspecific variation of this species. Modification of the shape of the epistome has been previously illustrated for the species. It can be observed as a large protuberance with a blunt apex, e.g. in the specimen from Greece (see Schmalfuss & Schawaller 1984: fig. 1) or as a triangular lump gradually becoming thinner at the end, e.g. in the specimens from Bulgaria (see Petrov & Šťáhlavský 2007: fig. 12). The newly collected specimens from Georgia have both mentioned forms of the epistome (see Figs 1, 5). In addition, there are a few minor modifications

Tab. 1: Dimensions of pedipalpal femur and chelal hand (with pedicel) of *Neobisium* (*N.*) *moreoticum* Beier, 1931 (♂)

Neobisium (*N.*) *moreoticum*	Pedipalpal femur length/breadth (mm)	Chelal hand length (mm)	Reference
Type	0.98/0.22	0.78	Beier (1931, 1963)
Males from Gori-Georgia	0.90-0.94/0.22-0.24	0.72-0.75	Rafalski (1949)
Males from Bulgaria	1.15-1.17/0.26	0.86-0.88	Petrov & Šťáhlavský (2007)
Males from Georgia	0.78-1.20/0.19-0.28	0.61-0.99	Present study

between the newly collected specimens from Georgia, e.g. the cheliceral fingers' dentition (see Figs 3, 7).

The specimens belonging to *N.* (*N.*) *moreoticum* reported from Bulgaria were found in litters of *Fagus orientalis*, *Rhododendron ponticum*, *Quercus cerris*, and *Quercus* spp. and also on the soil surface (Petrov & Šťáhlavský 2007). During recent collection attempts across Georgia, this species has been collected from similar habitats (leaf litter of mixed broadleaf forest dominated by *Fagus orientalis* with or without evergreen understory). Moreover, the species was also collected in litter of a coniferous forest at the elevation of 2070 m a.s.l. (ISUPS5). Until now, *N.* (*N.*) *moreoticum* was only known from single locality in central Georgia (surroundings of Gori town), however new locality records include south and western parts of South Great Caucasus and Lesser Caucasus mountains from an elevation of 500 m up to 2100 m a.s.l. (Fig. 15).

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