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NOTES ON *RONCUS MICROPHTHALMUS* (DADAY, 1889) (PSEUDOSCORPIONES: NEOBISIIDAE), A POLYMORPHIC SPECIES, WITH A KEY TO THE *RONCUS* SPECIES FROM THE MIDDLE EAST AND THE CAUCASUS REGION

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Abstract: The epigean species, *Roncus microphthalmus* (Daday, 1889) is briefly redescribed based on males from Georgia. Also, the taxonomic figures, and a wide range of intraspecific variations within this species are discussed. In addition, an identification key is proposed for the adults of the *Roncus* species occurring in the Middle East and the Caucasus region.
Key words: Pseudoscorpiones, Neobisiidae, *Roncus microphthalmus,* faunistics, taxonomy, Middle East, Caucasus region.

Notas sobre *Roncus microphthalmus* (Daday, 1889) (Pseudoscorpiones: Neobisiidae), especie polimorfa, y clave de las especies de *Roncus* de Oriente Medio y el Cáucaso
Resumen: Se redescribe brevemente la especie epígea *Roncus microphthalmus* (Daday, 1889), a partir de machos de Georgia. También se discuten las figuras taxonómicas y una amplia gama de varaciones intraespecíficas de esta especie. Por otra parte, se propone una clave de identificación de las especies de *Roncus* adultos presentes en Oriente Medio y la región del Cáucaso.
Palabras clave: Pseudoscorpiones, Neobisiidae, *Roncus microphthalmus,* faunística, taxonomía, Oriente Medio, región del Cáucaso.

Introduction

The genus *Roncus* L. Koch, 1873 belonging to the family Neobisiidae Chamberlin, 1930, subfamily Neobisiinae Chamberlin, 1930, currently contains 9 species distributing around the Middle East and Caucasia (Rafalski, 1949; Kvavadze *et al*., 2008; Harvey, 2013). The species *Roncus microphthalmus* (Daday, 1889) was originally described from Azerbaijan and currently is widely distributed in that mentioned area, being also found in Georgia, Iran, Russia and Turkey (Harvey, 2013). *Roncus microphthalmus* has been previously reported from different localities within Georgia (Fig. 1), e.g. from Batumi-south westernmost part of Georgia, Meskheti range-southern Georgia, Mestia county-northern Georgia, Kutaisi county-central Georgia, the Batsara Strict Nature Reserve and the Babaneuri Strict Nature Reserve-eastern Georgia (Schawaller, 1983; Kvavadze *et al*., 2008). Specimens of this species were collected from soil and litter including leaves and wood pieces of the beech during a faunistic expedition at 2013 and represent the first report for the Lagodekhi National Park, easternmost part of Georgia.

So far, Rafalski (1949) and Beier (1963) briefly redescribed *R. microphthalmus*, and later, Schawaller (1983), Schawaller & Dashdamirov (1988), Dashdamirov (1991), and Dashdamirov & Schawaller (1992) provided a number of illustrations of its pedipalp in dorsal view. Noticeably, *Roncus brignolii* Beier, 1973 from Turkey was synonymized with *R. microphthalmus* by Schawaller (1983). In this contribution, a short redescription of *R. microphthalmus* based on the specimens recently found in Georgia, illustrations of the diagnostic figures and some notes on the intraspecific variations within the species are given.

Unfortunately many of known species from the Middle East and Caucasia were inadequately described, redescribed or illustrated in the published papers. Nonetheless, an identification key to the *Roncus* species from the area is provided here. Basically, the chaetotaxy of the carapace, the trichobothriotaxy, the morphometric characteristics and the morphological figures are used for separating the species in the present key.

Material and methods

The specimens used for this morphological study were cleared with 60% solution of lactic acid, and prepared as permanent slides mounted on microscope slides in Hoyer's medium. Microscopical examination and drawings were carried out with an Olympus CH–2 compound microscope. Measurements were made with an ocular graticule. The specimens were deposited in the collection of Acarology Laboratory, Ilia State University, Tbilisi, Georgia (ISUTG). The morphological terminology and mensuration follow Chamberlin (1931), Harvey (1992), Harvey *et al.* (2012), and Judson (2007), chelal lyrifissures terminology follows Zaragoza (2017).

Abbreviations: Trichobothriotaxy, as in Chamberlin (1931); D: depth; L: length; mm: millimeter; T: tactile seta; W: width. Institutions: DEUA: Departamento de Ecología, Universidad de Alicante, Spain; IAUA: Islamic Azad University of Arak, Iran; ISUTG: Ilia State University, Tbilisi, Georgia. ISUPS: Ilia State University, Pseudoscorpions.

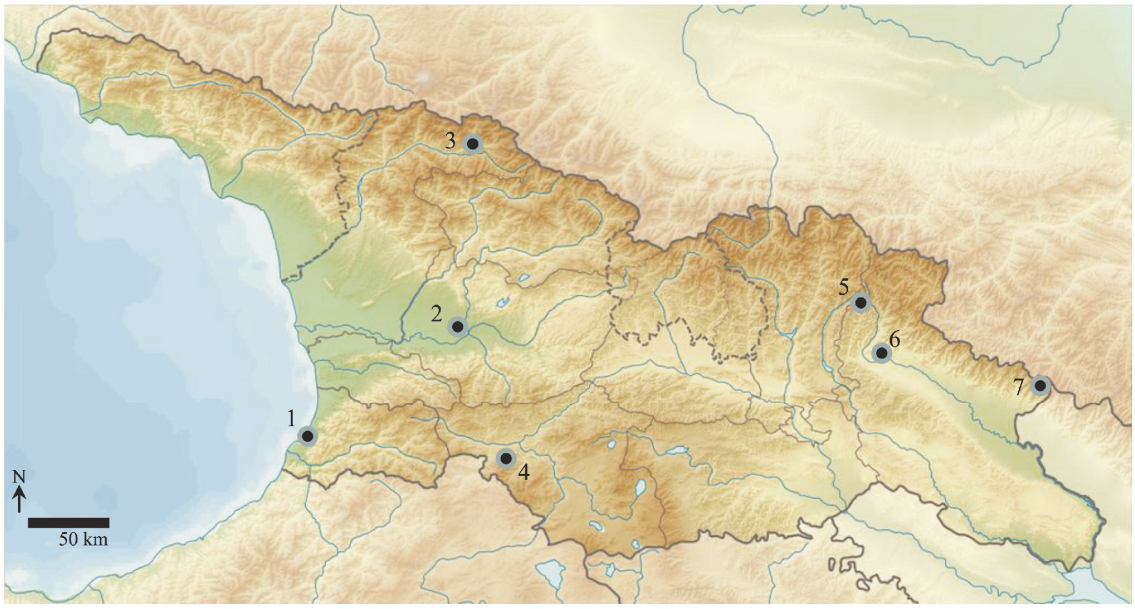


Fig. 1. Records of *Roncus microphthalmus* (Daday, 1889) in Georgia: 1. Batumi; 2. Kutaisi; 3. Mestia; 4. Meshketi; 5. Batsara Strict Nature Reserve; 6. Babaneuri Strict Nature Reserve; 7. Lagodekhi Protected Area.

Key to the *Roncus* species (♀♂) from the Middle East and Caucasia

1. Pedipalpal femur 2.6–2.7x longer than broad (ratio < 3.0x) 2
– Pedipalpal femur 3.1–4.5x longer than broad (ratio > 3.0x) 3
2. Prolateral margin of pedipalpal femur with two tubercles; movable chelal finger slightly longer than chelal hand (with pedicel) and slightly shorter than pedipalpal femur ..... *R. caucasicus* (Beier, 1962) [Georgia]
– Prolateral margin of pedipalpal femur without tubercle/s; movable chelal finger slightly shorter than chelal hand (with pedicel) and pedipalpal femur ..... *R. crassipalpus* Rafalski, 1949 [Georgia]
3. Chela (with pedicel) stout, 2.5–2.7x longer than broad (ratio < 3.00x) ..... *R. corimanus* Beier, 1951 [Georgia, Iran]
– Chela (with pedicel) more slender than above, 3.0–4.2x longer than broad (ratio ≥ 3.00x) 4
4. Movable chelal finger 1.6x longer than chelal hand (with pedicel); movable chelal finger distinctly longer than pedipalpal femur; trichobothrium *ist* located distinctly distad to middle of fixed chelal finger ..... *R. viti* Mahnert, 1974 [Iran]
– Movable chelal finger extremely 1.5x longer than chelal hand (with pedicel); utmost movable chelal finger slightly longer than pedipalpal femur; trichobothrium *ist* located approximately in the middle of fixed chelal finger 5
5. Posterior margin of carapace with 8 setae; prolateral margin of pedipalpal femur with 3 tubercles ..... *R. birsteini* Krumpál, 1986 [Georgia]
– Posterior margin of carapace with 5–6 (rarely 7–8) setae; prolateral margin of pedipalpal femur without or with 1–2 tubercle/s 6
6. Epistome distinctly enlarged; chela (with pedicel) 4.1–4.2x longer than broad ..... *R. araxellus* Schawaller & Dashdamirov, 1988 [Armenia, Azerbaijan]
– Epistome small or medium in size; chela (with pedicel) 3.0–4.0x longer than broad 7
7. Length of pedipalpal femur 1.34 mm, chelal hand (with pedicel) 1.16 mm, and chelal finger 1.27 mm; trichobothrium *et* located distinctly distad to *t* ..... *R. troglophilus* Beier, 1931 [Italy, Turkey]
– Length of pedipalpal femur 0.46–1.25 mm, chelal hand (with pedicel) 0.48–1.06, and chelal finger 0.59–1.12 mm; trichobothrium *et* located at same level as or slightly distad to *t* 8
8. Claws of tarsus IV with an external tooth; pedipalpal femur length 0.90–1.25 mm, chelal hand (with pedicel) length 0.82–1.06 mm, and chelal finger 1.03–1.12 mm.. ..... *R. parablothroides* Hadži, 1938 [Azerbaijan, Bulgaria, Greece, Macedonia, Serbia, Turkey]
– Claws of tarsus IV without an external tooth; pedipalpal femur length 0.46–0.89 mm, chelal hand (with pedicel) length 0.48–1.05 mm, and chelal finger 0.59–0.83 mm.. 9
9. Microsetae proximad to *eb–esb* absent ..... *R. microphthalmus* (Daday, 1889) [Azerbaijan, Georgia, Iran, Russia, Turkey]
– A group of 1–4 microsetae proximad to *eb–esb* present. ..... *R. lubricus* L. Koch, 1873 [Albania, Algeria, Austria, Belgium, Bosnia-Herzegovina, Bulgaria, Croatia, Czech Republic, France, Georgia, Germany, Greece, Hungary, Ireland, Italy, Malta, Morocco, Netherlands, Portugal, Romania, Saint Helena, Serbia, Slovakia, Slovenia, Spain, Switzerland, Ukraine, United Kingdom, United States of America]

***Roncus microphthalmus* (Daday, 1889)**. Fig. 2-9.

MATERIAL EXAMINED. 3♂, GEORGIA: Kakheti region, subalpine meadows in Lagodekhi National Park (41°52′N 46°22′E, 23120 m a.s.l); 15 June 2013; L. Mumladze leg. (ISUPS16).

SHORT REDESCRIPTION. *Carapace* (Fig. 2): sub-quadrate, 0.96–0.98x longer than broad; one pair of small eyespots

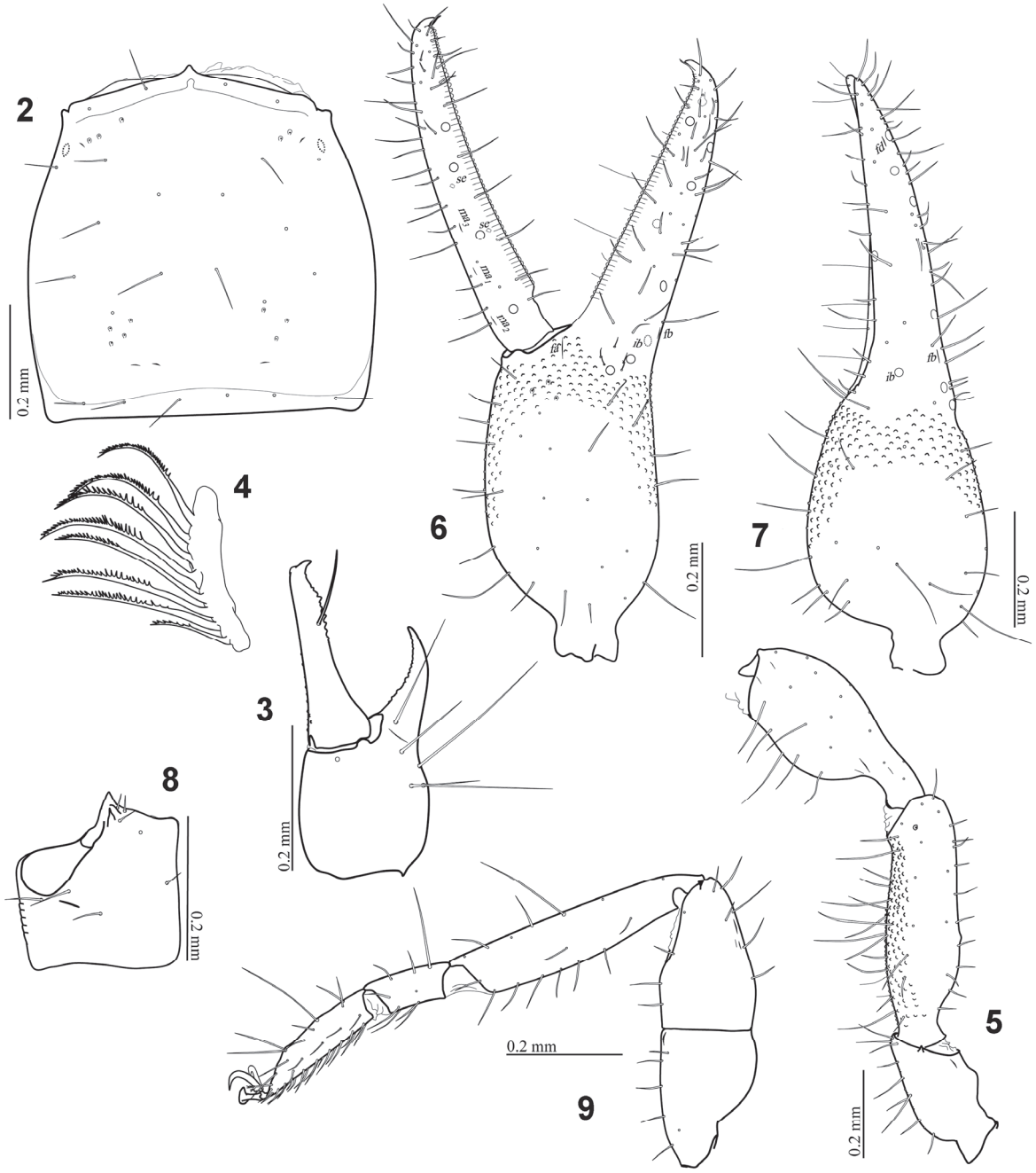


Fig. 2–9: *Roncus microphthalmus* (Daday, 1889), from Lagodekhi National Park, ♂: **2**. carapace, dorsal view; **3**. left chelicera, dorsal view; **4**. rallum; **5**. right pedipalp (without chela), dorsal view; **6**. left chela, retrolateral view; **7**. right chela, dorsal view; **8**. right coxa I, ventral view; **9**. left leg IV, retrolateral view (trochanter omitted). *Abbreviations*: *fa*: retrolateral lyrifissure of fixed chelal finger; *fb*: dorso-retrolateral lyrifissure of fixed chelal finger; *fd*: dorso-distal lyrifissure of fixed chelal finger; ma_1, ma_2, ma_3: retrolateral lyrifissures of movable chelal finger; *se*: sensillum.

(distance from anterior margin 0.062 mm); 24–26 setae, chaetotaxy: 4:8:6:6 (one specimen with 8 setae on posterior margin); epistome prominent, small, and apically rounded (length 0.015 mm, width 0.022 mm); glandular pores present, 3 on each side in ocular zone; 5–6 microlyrifissures, one pair situated in ocular zone, close to each eyes, and 3–4 located on posterior margin. *Tergal chaetotaxy*: 6–7:7–11:11–12:11–12:11:11–12:10–12:10–12:10–12:1T1T1T1T1:T1T1T1T:2. *Sternites*: anterior genital operculum with 14 setae, 6–7 setae located on anterior border of genital aperture, and posterior operculum with 14–16 setae, 4–6 setae located on posterior border of genital aperture; lateral genital sacs as long as median genital sac, genital opening with 3+3 internal setae; chaetotaxy: 14:(2)14–16(2):(2–3)9–10(2–3):15:13–14:12–14: 14:14:3T1T3:T1T:2. *Pleural membrane*: granulate. *Chelicera* (Fig. 3–4): hand with 6 acuminate setae; galea knob–like, with a very small hyaline convexity; dorsal face of basal half of movable finger somewhat finely granulated; rallum with 7 denticulate blades. *Pedipalps*: trochanter and patella entirely smooth, prolateral half of femur and distal half of chelal hand granulated (Fig. 5–7); coxa including manducatory process with 9–10 setae, manducatory process with 4 acuminate setae, seta located at base of manducatory process longest; trochanter with a small dorsal ridge, L/W 2.1; femur with one tuber-

cle located sub-medially on retrolateral margin, L/W 3.2–3.4; patella with short and stout pedicel (L=0.16 mm), with 3 lyrifissures situated basally and 2 lyrifissures located distally, L/W 2.1–2.2; chela (with pedicel) L/W 3.5–3.6; chela (without pedicel) L/W 3.2–3.3; chelal setae simple; movable finger 1.1–1.2x longer than hand (with pedicel) and 1.40–1.44x longer than hand (without pedicel); hand (with pedicel) L/W 1.7–1.8; hand (without pedicel) L/W 1.4–1.5; fixed finger with 8 and movable finger with 4 trichobothria (Fig. 6); 4 microsetae lying between trichobothria *eb–esb* (Fig. 6, 7); microsetae proximad to trichobothria *eb–esb* absent; fixed finger with 3 lyrifissures: one (*fb*) located slightly distad to trichobothrium *ib*, one (*fa*) close to base of fixed finger in lateral view and one (*fd*) at same level as trichobothrium *et* in dorsal view; movable finger with 3 lyrifissures in lateral view: one (ma_2) located at same level as trichobothrium *b*, one (ma_1) between trichobothria *b* and *sb*, and one (ma_3) slightly distad to trichobothrium *sb*; two sensilla present (Fig. 6), one located very close to dental canals at same level as trichobothrium *sb*, and other located proximad to trichobothrium *st*; fixed finger with 52–56 contiguous teeth reaching distad of trichobothrium *ib*, 4–5 distal teeth distinctly smaller than others, all teeth with dental canal; movable finger with 54–56 contiguous not reaching to the level of trichobothrium *b*, teeth in distal third of finger slightly larger than others, all teeth with dental canal; nodus ramosus of venom duct in fixed chelal finger situated distinctly distad to trichobothrium *et*. *Legs*: coxa I with short, triangular, sclerotized and pointed anterolateral process, mediolateral face with rounded, slightly prominent, membranous layer (Fig. 8); coxal chaetotaxy: 7–8:5–6:4–5:7–9. Leg I: femur L/D 2.5–2.7.; patella L/D 2.2–2.3; femur 1.4–1.5x longer than patella; tibia L/D 3.6–4.1; metatarsus L/D 2.3–2.8; tarsus L/D 4.4; tarsus 1.6x longer than metatarsus. Leg IV (Fig. 9): femur L/D 1.4–1.6; patella L/D 1.7–1.8; femur + patella L/D 3.0–3.1; tibia L/D 5.4–5.8 and with a long tactile seta situated more or less medially (T=0.49–0.53); metatarsus L/D 2.2–2.4 and with a long tactile seta situated basally (T=0.17–0.25); tarsus with a tactile seta situated proximad to middle (T=0.37–0.39), L/D 3.50–3.85.

DIMENSIONS (in mm.): *Body length*: 2.15–2.25.*Carapace*: 0.62–0.63/0.63–0.64. *Pedipalp*: trochanter 0.36/0.17; femur 0.58–0.59/0.17–0.18; patella 0.50/0.22–0.23; chela (with pedicel) 1.02–1.06/0.29–0.30; chela (without pedicel) 0.93–0.95; hand (with pedicel) L.0.50–0.53; hand (without pedicel) 0.40–0.42; movable finger L. 0.59–0.62. *Leg I*: femur 0.30–0.31/0.11–0.12; patella 0.20–0.21/0.09; tibia 0.25–0.29/0.07; metatarsus 0.14/0.05–0.06; tarsus 0.22/0.05. *Leg IV*: femur 0.24–0.25/0.16–0.17; patella 0.28/0.15–0.16; femur + patella 0.51–0.52; tibia 0.47–0.49/0.08–0.09; metatarsus 0.16–0.17/0.07; tarsus 0.27–0.28/0.06–0.07.

Results and Discussion

Polymorphism in zoology is the occurrence of two or more clearly different forms of a single species. According to the available published literature, *Roncus microphthalmus*, originally described from Azerbaijan, is a polymorphic pseudoscorpion species with a wide range of variety in morphology and morphometric characters.

The presence/absence of eyes, the presence/absence of a dorsal tubercle in the pedipalpal trochanter, the granulation pattern of the pedipalp, and the presence/absence of tubercles on the pedipalpal femur are the most important morphological differences within this species.

On the basis of Beier (1963), the femur, the patella, and the chelal hand are medially granulated. In the specimen from Turkey, prolateral half of the pedipalpal femur and the distal half of the chelal hand are roughly granulated whereas the pedipalpal patella is entirely smooth (Beier, 1973). In the specimens from Alexeevka and Kerrar-Azerbaijan, the pedipalpal femur and the chelal hand are almost entirely granulated, and the pedipalpal patella somewhat granulated (Schawaller & Dashdamirov 1988: fig. 40–41; Dashdamirov & Schawaller 1992: fig. 3B). In the specimen from Shemakha-Azerbaijan, prolateral half of the pedipalpal femur, the patella and almost distal half of the chelal hand are distinctly granulated (Dashdamirov 1991: fig. 8). In the specimens from Batumi-Georgia, Dagomys-Russia, and Lenkoran and Zakatali Reservat-Azerbaijan, the pedipalpal patella is entirely smooth and the pedipalpal femur and the chelal hand are rather granulated (Schawaller 1983: fig. 47–51).

Based on Beier (1963), the pedipalpal trochanter lacks a dorsal tubercle, whereas it has been clearly illustrated by some authors (Rafalski, 1949: fig. 14; Beier, 1973: fig. 5; Schawaller & Dashdamirov, 1988: fig. 40–41; Dashdamirov, 1991: fig. 8 and Dashdamirov & Schawaller, 1992: fig. 3B).

The absence of eyes on the carapace of the specimens from Turkey (Beier, 1973) and loss of tubercles on prolateral margin of the pedipalpal femur of the specimen from Zakatali Reservat-Azerbaijan (Schawaller 1983: fig. 50) are the other morphological variations within this species.

Moreover, *R. microphthalmus* has a wide range of morphometric variation, e. g. the pedipalpal femur size is 0.60–0.89/0.19–0.24 mm (3.30–3.70x), the patella is 0.52–0.76/0.22–0.32 mm (2.10–2.40x), and the chelal hand (with pedicel) is 0.43–0.77/0.32–0.45 mm (1.30–1.70x) (Beier, 1963, 1973).

According to possibility of the mentioned variations and due attention to the shape of the epistome, and the trichobothiotaxy, in spite of that under *R. microphthalmus* previously recorded from different localities could most probably be hidden different taxa, at the present level of knowledge the newly collected specimens from Georgia are attributed to *R. microphthalmus*. These newly found specimens in Georgia are similar to the specimens from Dagomys-Russia and Lenkoran-Azerbaijan based on the shape and granulation pattern of the pedipalp, and the presence of only one tubercle on retrolateral margin of the pedipalpal femur (Schawaller 1983: fig. 49, 51).

Due attention to the sub-quadrate form of the carapace, the presence of two poorly developed eyes, the shape of epistome (small, triangular/tubercular and apically rounded (Gardini & Rizzerio, 1985: fig. 62; Ćurčić *et al*., 1992: fig. 34), the chaetotaxy of the carapace and tergite I (carapace with 24 setae, posterior margin and tergite I with 6 setae), the granulation pattern of the pedipalp (see Ćurčić *et al*., 1992: fig. 39, 40; Gardini & Rizzerio, 1985: fig. 61, 65–67), the presence of one tubercle located sub-medially on retrolateral margin of the pedipalpal femur, the absence of microsetae located proximad to trichobothria *eb–esb*, the median position of trichobothrium *ist* (Beier, 1948: fig. 2; Gardini & Rizzerio, 1985: fig. 61, 67; Ćurčić *et al*., 1992: fig. 41), and the morphometric characters, e.g. pedipalpal femur ratio is less than 4.0x (♀♂2.9–3.5x), *Roncus microphthalmus* is very similar to

Roncus abditus (Chamberlin, 1930) from France and Italy, and *Roncus tenuis* Hadži, 1933 from Croatia.

Roncus microphthalmus can be separated from *R. abditus* by the tricobothrial pattern, being the trichobothrium *sb* located slightly closer to *b* than to *st* in the movable chelal finger, and the trichobothrium *ib* situated at the same level as *esb* in the fixed chelal finger of the types of *R. abditus* (Chamberlin, 1931: fig. 35E; Beier, 1948: fig. 2; Gardini & Rizzerio, 1985: fig. 61, 66), whereas in *R. microphthalmus* the trichobothrium *sb* is located at the midway between *st* and *b* in the movable chelal finger, and the trichobothrium *ib* situated sometimes slightly and usually distinctly distad to *esb* (Schawaller & Dashdamirov, 1988: fig. 40, 41; Dashdamirov, 1991: fig. 8; Dashdamirov & Schawaller, 1992: fig. 3B; present study: Fig. 6, 7).

Roncus tenuis differs from *R. microphthalmus* by the length of the movable chelal finger which is somewhat shorter than the pedipalpal femur, and as long as or slightly longer than the chelal hand (with pedicel) (Beier, 1963; Ćurčić *et al*., 1992); on the contrary, in *R. microphthalmus*, the length of the movable chelal finger is somewhat longer than the pedipalpal femur, and more or less distinctly longer than the chelal hand (with pedicel) (e.g. Beier, 1963, 1973; present study).

The species, *R. microphthalmus* can be usually collected from forest litter, and rarely found under stone and in rodent burrow (Schawaller, 1983; Dashdamirov, 1991 and Dashdamirov & Schawaller, 1992). The newly collected specimens from Georgia have been found in soil and litter composing of broadleaves and wood pieces of *Fagus orientalis* Lipsky.

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