New records of millipedes (Diplopoda) from the Caucasus region

Новые находки двупарноногих многоножек (Diplopoda) из кавказского региона

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ABSTRACT. New faunistic records are provided for 38 millipede species, representing nine families and six orders from the Caucasus, including the Krasnodar and Stavropol provinces, Adygea, Karachaevo-Cherkessia, Abkhazia, Georgia, Armenia, and Ciscaucasia (Rostov-on-Don Region). A new iconography is presented for 14 species. Records of several recently described species are of particular interest, because they considerably extend our knowledge of their actual distribution areas.

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KEY WORDS: taxonomy, iconography, Russia, Abkhazia, Armenia, fauna, distribution.

КЛЮЧЕВЫЕ СЛОВА: таксономия, иконография, Россия, Абхазия, Армения, фауна, распространение.

REЗОМЕ. Представлены новые фаунистические находки для 38 видов двупарноногих многоножек из 9 семей и 6 отрядов из Кавказа, включая Краснодарский и Ставропольский край, Адыгею, Карачаево-Черкесию, Абхазию, Грузию и Армению, и Предкавказье (Ростовская область). Дана новая иконография для 14 видов. Особенно интересны находки недавно описанных видов, расширяющие представления об их ареалах.

Introduction

Studies on the diplopod fauna of the Caucasus have recently experienced significant progress. Many millipede groups have been revised based on abundant material, both old and new [Vagalinski, Golovatch, 2021;...
Evstyukov et al., 2020, 2021; Short et al., 2020, etc. However, the distributions of numerous species remain far from thoroughly revealed. In addition to papers devoted to the diplodop faunas of separate regions or countries in the Caucasus [Evstyukov, Golovatch, 2013; Zuev, 2014, 2021; Kokhia, Golovatch, 2020; Korobushkin et al., 2013], there are contributions to individual taxa [Golovatch, Chumachenko, 2013; Golovatch et al., 2021; Golovatch, 2021]. The present paper puts on record another considerable number of millipedes in Ciscaucasia and the Caucasus.

Material and methods

The material has been shared between the collections of the Zoological Museum of the Moscow University (ZMUM), the Zoological Institute of the Russian Academy of Sciences, Saint-Petersburg (ZIN), the Don State Technical University, Rostov-on-Don (DSTU), the National Museum of Natural History, Sofia, Bulgaria (NMNHS), the Senckenberg Museum für Naturkunde Görlitz (SMNG), and the private collection of I. Turbanov (IT), as indicated below. The samples are stored in 95% ethanol. SEM micrographs were taken using a Zeiss CrossBeam 340 (DSTU) scanning electron microscope. After examination, SEM material was reprocessed using Adobe Photoshop 2020 software.

Taxonomic part

ORDER POLYXENIDA
Family Lophoproctidae

Lophoproctus coecus Pocock, 1894
MATERIAL. 1 ex. (DSTU), Russia, Rostov-on-Don Region, near Stoyanov, valley of Tuzlov River, under stones, 47.4727ºN, 42.2454ºE, 13.VII.2019, A.P. Evsyukov leg.

REMARKS. Because the single lophoproctid species presently known to occur in the entire Caucasian region and the Near East, to the entire Caucasus region, including much of the limestone area around Kutaisi, and is probably a troglobiont [Golovatch, 1976, 1990a].

ORDER GLOMERIDA
Family Glomeridae

Hypleoglomeris awchasica (Brandt, 1840)
MATERIAL. 1 ♂, 1 ♀ (DSTU), Abkhazia, Tkvarchel Dist., near Akarmara, mixed forest, litter, 42.8605ºN, 41.7662ºE, 23.III.2021, leg. I.S. Turbanov; 4 ♀♀ (DSTU), Russia, Adygea, Caucasian Nature Reserve, Lagonaki Plateau, mixed Betula & Picea forest, 44º03.92ºN, 40º01.03.0ºE, 5.V.2021, A.P. Evsyukov leg.

REMARK. A widespread western Caucasian species recorded from Georgia, Abkhazia and Russia within Adygea, and the Krasnodar and Stavropol provinces [Golovatch, 1989, 2021; Golovatch et al., 2006; Korobushkin et al., 2013].

Hypleoglomeris specialis Golovatch, 1990
MATERIAL. 1 juv. (ZMUM), Dagestan Republic, Buynaksk Dist., Erpeli, 42.7958ºN, 47.014616ºE, broadleaved forest, litter, Berlese extraction, 17.X.2021; 36 juv. (ZMUM), Russia, Chechen Republic, Kurchaloy Dist., near Niki-Khita, 43.104215ºN, 46.07969ºE, broadleaved forest, litter, hand-sorting, 18.X.2021, all K.B. Gongalsky leg.

REMARKS. A widespread Caucasian endemic species ranging from Chechnya, Russia in the north to central and eastern Georgia in the south [Golovatch, 1989]. One of the above records is new to the fauna of Dagestan.

Trachysphaera solida Golovatch, 1976
MATERIAL. 1 ♂ (SMNG), Georgia, Imereti, Kutaisi, Tkaltubo, Kumistavi, Tkaltubo Cave, on dead wood and droppings, 42.3773ºN, 42.6005ºE, 11.VI.2019, H. Reip leg.

REMARK. This species is endemic to the western Caucasian region, previously recorded as T. rotundata (Lignau, 1911), a junior synonym of T. costata (see Golovatch [2008]), from Armenia, Georgia, Abkhazia and Russia (Adygea, Krasnodar and Stavropol Provinces, Kabardino-Balkaria, Chechnya and Ingushetia) [Golovatch, 1990a, 2010, 2021; Korobushkin et al., 2013; Zuev, 2014, 2021; Golovatch et al., 2021]. One of the above records is new to the fauna of Dagestan.

Trachysphaera costata (Waga, 1857)
MATERIAL. 1 ♂, 6 ♀♀ (DSTU), Russia, Adygea, Caucasian Nature Reserve, Lagonaki Plateau, mixed Betula & Picea forest, 44º03.92ºN, 40º01.03.0ºE, 5.V.2021, A.P. Evsyukov leg.; 1 ♂, 1 ♀ (ZMUM), Dagestan Republic, Buynaksk Dist., Erpeli, 42.7958ºN, 47.014616ºE, broadleaved forest, litter, Berlese extraction, 17.X.2021, K.B. Gongalsky leg.

REMARKS. A widespread Eastern European to Eastern Mediterranean species ranging from Central Europe and the Balkan Peninsula in the west, through Ukraine, Crimea, and the Near East, to the entire Caucasian region, including much of Hyrcania in Iran in the east [Golovatch, 1990a, b; 2008; Antici et al., 2021]. In the Caucasus, previously recorded as T. rotundata (Lignau, 1911), a junior synonym of T. costata (see Golovatch [2008]), from Armenia, Georgia, Abkhazia and Russia (Adygea, Krasnodar and Stavropol Provinces, Kabardino-Balkaria, Chechnya and Ingushetia) [Golovatch, 1990a, 2010, 2021; Korobushkin et al., 2013; Zuev, 2014, 2021; Golovatch et al., 2021]. One of the above records is new to the fauna of Dagestan.

Trachysphaera fragilis Golovatch, 1976
MATERIAL. 2 ♂♂, 2 ♀♀, 1 juv. (SMNG), Georgia, Imereti, Kutaisi, Tkaltubo, Kumistavi, Tkaltubo Cave, on dead wood and droppings, 42.3773ºN, 42.6005ºE, 11.VI.2019, H. Reip leg.; many ♂♂, ♀♀ and juv. (SMNG), same region, Kutaisi, Sataplia reserve, Sataplia Cave, near the entrance, on dead wood, 42.312ºN, 42.6754ºE, 6.VI.2019, H. Reip leg.

REMARK. This species is apparently a narrow endemic to the limestone area around Kutaisi, and is probably a troglobiont [Golovatch, 1976, 1990a].
New records of millipedes from the Caucasus region

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Figs 1–6. Habitus (a) and gonopods (b) of some millipedes from the Caucasus region: 1 — Amblyiulus hirtus Evsyukov, Golovatch et Antić, 2021; 2 — Cylindroiulus placidus (Lignau, 1903); 3 — Cylindroiulus pterophylacum Read, 1992; 4 — Cylindroiulus ruber (Lignau, 1903); 5 — Julus colchicus Lohmander, 1936; 6 — Julus lignaui Verhoeff, 1910. Scale bars: 1 mm (a); 0.1 mm (b).

Remarks. In the Caucasus, this widespread Eastern European to Eastern Mediterranean species is known to occur in Abkhazia and Ajaria, Georgia [Enghoff, 1984; Kime, Enghoff, 2017]. At least partly, probably anthropochoric [Talikadze, 1982].

Nopoiulus kochii (Gervais, 1847)

Material. Numerous ♂♂, ♀♀ and juv. (ZMUM), Russia, Krasnodar Prov., Greater Sochi, Khosta, Cave Partizanskaya, pit-fall traps, 30.IV–24.VIII.1992, A.G. Koval leg.

Remarks. This subcosmopolitan species is widespread across the entire Caucasus region, being encountered in various habitats, both man-made and natural [Golovatch, Enghoff, 1990]. It has already been recorded from two other caves near Sochi, Caucasus [Turbanov et al., 2016].

Family Julidae

Amblyiulus hirtus Evsyukov, Golovatch et Antić, 2021

Fig. 1.

Material. 3 ♀♂ (ZMUM), Russia, Dagestan, near Primorsky, Samur Forest, 41.86°N, 48.58°E, 3–8.IV.2021, leg. O. Makarova; 1 ♂ (ZMUM), Dagestan, Buinaksk Distr., Chirkeiskoe Reservoir, under stones, 400 m a.s.l., 7.VI.2021, R.V. Zuev & E.M. Bondarenko leg.

Remark. Eastern Caucasian endemic. Known only from northern Azerbaijan and Dagestan, Russia [Evsyukov et al., 2021].
**Cylindroiulus bicolor** Lohmander, 1936

**Cylindroiulus quadrus** (Smirnov, 1953) (ZMUM) 1 juv. (SMNG), Georgia, Samegrelo-Zemo Svaneti, near Ambrolauri, at Shareula River, forest, litter, 42.5175°N, 42.9165°E, H. Reip leg., 14.VI.2019, H. Reip leg.

**Cylindroiulus kacheticus** Lohmander, 1936

**Cylindroiulus placidus** (Lignau, 1903)

**Cylindroiulus pterophylacum** Read, 1992

**Cylindroiulus quadrus** (Smirnov, 1953) (ZMUM) 1 juv. (SMNG), Georgia, Samegrelo-Zemo Svaneti, near Ambrolauri, at Shareula River, forest, litter, 42.5175°N, 42.9165°E, H. Reip leg., 14.VI.2019, H. Reip leg.

**Cylindroiulus kacheticus** Lohmander, 1936

**Cylindroiulus quadrus** (Smirnov, 1953) (ZMUM) 1 juv. (SMNG), Georgia, Samegrelo-Zemo Svaneti, near Ambrolauri, at Shareula River, forest, litter, 42.5175°N, 42.9165°E, H. Reip leg., 14.VI.2019, H. Reip leg.

**Cylindroiulus cuferichus** [sensu Read (1992)]

**Cylindroiulus ruber** (Lignau, 1903) Fig. 4.

**Cylindroiulus schistoperovi** Lohmander, 1932

**Cylindroiulus placentus** (Lignau, 1903) Fig. 2.

**Cylindroiulus quadrus** (Smirnov, 1953) (ZMUM) 1 juv. (SMNG), Georgia, Samegrelo-Zemo Svaneti, near Ambrolauri, at Shareula River, forest, litter, 42.5175°N, 42.9165°E, H. Reip leg., 14.VI.2019, H. Reip leg.

**Cylindroiulus placentus** (Lignau, 1903) Fig. 2.

**Cylindroiulus placidus** (Lignau, 1903)

**Cylindroiulus placentus** (Lignau, 1903) Fig. 2.

**Cylindroiulus pterophylacum** Read, 1992

**Julus colchicus** Lohmander, 1936

**Julus lignai** Verhoeoff, 1910

**Julus lignai** Verhoeoff, 1910

**Kubaniulus gracilis** Lohmander, 1936

**Kubaniulus gracilis** Lohmander, 1936

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**Kubaniulus gracilis** Lohmander, 1936

**Kubaniulus gracilis** Lohmander, 1936

**Kubaniulus gracilis** Lohmander, 1936
Figs 7–11. Habitus (a) and gonopods (b) of some millipedes from the Caucasus region: 7 — *Kubaniulus gracilis* Lohmander, 1936; 8 — *K. lativelatus* Evsyukov, Golovatch, Reip et VandenSpiegel, 2020; 9 — *Leptoiulus hastatus* Lohmander, 1932; 10 — *Omobrachyiulus fasciatus* Vagalinski, 2021; 11 — *Syrioiulus armeniacus* Evsyukov, Golovatch et Antić, 2021. Scale bars: 1 mm (a); 0.1 mm (b).

REMARK. This pan-Caucasian species has previously been recorded from northwestern Iran, Armenia, Azerbaijan and Georgia [Lohmander, 1932; Evsyukov et al., 2020].

*Leptoiulus hastatus* Lohmander, 1932

Fig. 9.

MATERIAL. 3 ♀ (ZMUM), Armenia, Lake Sevan, near Sevan Town, forest stripe, under stones, 15.VIII.1985, leg. ?: 1 ♀ (ZMUM), Azerbaijan, Turanchay Nature Reserve, xerophytic *Quercus & Pistacia* forest, litter, 2–4.X.1994, S. Dashdamirov leg.; 2 ♀♂, 2 ♀ (SMNG), Armenia, Syunik, Gorayk towards Tsghuk, old cemetery above Spandarian Reservoir, 2080 m a.s.l., 39.6737ºN, 45.8061ºE, 20.VIII.2018, F. Walther leg.; 1 ♀, 3 ♀ (SMNG), Armenia, Tavush, Semyonovka, 1 km towards Dilijan, 2080 m a.s.l., 40.6666ºN, 44.8868ºE, 16.VIII.2018, F. Walther leg.

REMARK. This species is likewise very common and widespread, yet being confined to the eastern half of the Caucasus region: northwestern Iran, Armenia, Azerbaijan, Russia (Dagestan), and both central and eastern Georgia [Lohmander, 1932; Evsyukov et al., 2020].
REMARKS. Endemic to the Caucasus Minor within Armenia [Evsyukov et al., 2021]. The above record is apparently the species’ westernmost locality.

ORDER POLYDESMIDA

Family Polydesmidae

Brachydesmus furcatus Lohmander, 1936

MATERIAL. 1 Ʌ, 1 ɇ (IT), Russia, Krasnodar Prov., Goryachiy Klyuch, near Fanagoriyskoe, Fanagoriyskaya Cave, 1.12.2018, P.V. Somchenko leg.

REMARKS. Endemic to the western Caucasus: Russia and Abkhazia [Golovatch et al., 2016], also encountered as a troglobite in several caves: Piketnaya, Akhunskaya, Fanagoriyskaya, Medvezhya and Baribana, all within the Krasnodar Prov., Russia [Strasser, 1970; Golovatch et al., 2016, 2018, 2021].

Brachydesmus kalichewskyi Lignai, 1915

REMARKS. Endemic to the northern and northwestern parts of the Caucasus Major [Vagalinski, Golovatch, 2021].

Polydesmus stuxbergi

Family Polydesmidae

Polydesmus stuxbergi

MATERIAL. 4 Ʌ, 13 ɇ (DSTU), Russia, Krasnodar Prov., Caucasian Nature Reserve, valley of Khodzhibi River, Abies & Betula forest, 2050 m alt., 43°49.388′N, 40°27.503′E, 30.IX.2021, Y.A. Chamachenko leg.

REMARKS. Described from Adivi and the Krasnodar Province, both Russia. Endemic to the northwestern parts of the Caucasus Major [Vagalinski, Golovatch, 2021].

Omobrachyiulus fasciatus Vagalinski, 2021

Fig. 10.

MATERIAL. 2 Ʌ (ZMUM), Dagestan Prov., slope of Aishkha Mountain Ridge, Mzymta River valley, Fagus forest, 1250 m alt., 43°37.055′N, 40°27.503′E, 16.IX.2021, Y.A. Chamachenko leg.; 1 ɇ (ZMUM), Dagestan Republic, Agul Distr., Chirag, 41.817649′N, 47.472732′E, Chiragchay River bank, Alnus forest, 15.X.2021; 1 ɇ, 1 Ʌ (ZMUM), Chechen Republic, Shali Distr., Anishty, 43.104215′N, 46.079969′E, broadleaved forest, litter, hand-sorting, 18.X.2021; all D.I. Korobushkin & K.B. Gongalsky leg.

REMARKS. Endemic to the western Caucasus, Russia and Abkhazia [Golovatch et al., 2021]. It has been recorded from the Ushchelnaya (= Kholodtsova) Cave near Sochi, and a nameless grotto near Novorossiysk, Krasnodar Prov., Russia [Golovatch, 1984/85], as well as Abkhazian caves: Samshitovaya, Upatapachy (= Kolodets nad Golovoy Otpa) and Marshalnya [Golovatch et al., 2021].

Pachyiulus krivolatškij Golovatch, 1977

MATERIAL. 1 ɇ, 2 juv. (IT), Russia, Krasnodar Prov., Great-er Sochi, Mount Boltshoy Akhun, Akhunskaya Cave, 22.V.2016, I.S. Turbanov leg.

REMARKS. Endemic to the western, Colchidian part of the Caucasus within Russia, Abkhazia and Georgia [Evsyukov, 2016]. It has been recorded from the Ushchelnaya (= Pionerskaya) Cave near Sochi, and a nameless grotto near Novorossiysk, Krasnodar Prov., Russia [Golovatch, 1984/85], as well as Abkhazian caves: Samshitovaya, Upatapachy (= Kolodets nad Golovoy Otpa) and Marshalnya [Golovatch et al., 2021].

Rossiitius kessleri (Lohmander, 1927)

MATERIAL. 6 Ʌ (DSTU), Russia, Rostov-on-Don Region, Neklinovka Dist., Pnyatkhatki, bank of pond, Phragmites thicket, under stones, 47°41′24.9″N, 39°12′38.6″E, 23.V.2021, A.P. Evsyukov leg.

REMARKS. Subendemic to the East European, or Russian Plain [Lokšina, 1969; Chornyi, Golovatch, 1993; Golovatch, 1984], in the south up to the subalpine meadows of North Ossetia – Alania, northern macro slope of the central Caucasus Major [Golovatch, Antipova, 2022]. Very common in the Rostov-on-Don Region [Evsyukov, Golovatch, 2013].

Syrioitius armeniacus Evsyukov, Golovatch et Antić, 2021

Fig. 11.

MATERIAL. 1 ɇ, 4 ɇ (ZIN), Armenia, Erzven, Nok, dry slopes, 16.III.1936, A. Richter leg.

REMARKS. Endemic to the Caucasian Minor within Armenia [Evsyukov et al., 2021]. The above record is apparently the species’ westernmost locality.

Polydesmus abchasius Atems, 1898

MATERIAL. 3 Ʌ, 7 ɇ (SMNG), Georgia, Samegrelo-Zemo Svaneti, Martvili municipality, near Balda village, Balda Canyon, 42.48822′N, 42.40799′E, 13.VI.2019, H. Reip leg.; 1 ɇ (DSTU), Abkhazia, Tkvarchel Dist., near Akamara, broadleaved forest, litter, 42.8605°N, 41.7662ºE, 23.III.2021, leg. I.S. Turbanov; 1 ɇ, 1 ɇ (DSTU), Russia, Adygea, Caucasian Nature Reserve, Lagonaki Plateau, mixed Betula & Picea forest, 44°03′39.2″N, 40°01′03.0″E, 5.V.2021, A.P. Evsyukov leg.

REMARKS. Endemic to the northern and northwestern Caucasus. Previously recorded from the Krasnodar Province, Adygea, Abkhazia and Georgia [Golovatch et al., 2016; Kokhia et al., 2020; Golovatch, 2021].

Polydesmus stuxbergi Atttems, 1907

Fig. 13.

MATERIAL. 2 Ʌ, 7 ɇ (DSTU), Russia, Rostov-on-Don Region, near Stoyanov, valley of Yuzlov River, under stones, 47°47′27.9″N, 39°47′06.5″E, 5.XI.2021, A.P. Evsyukov leg.

REMARKS. This species has been recorded so far from Crimea, the Kharkov Region of Ukraine [Golovatch, 1909b], as well as the Rostov-on-Don Region and Stavropol Province of Russia [Evsyukov, Golovatch, 2013; Zuev, 2021]. Mostly occurring in anthropogenic habitats.

Family Paradoxosomatidae

Strongylosoma kordayamythrum Atems, 1898

MATERIAL. 1 ɇ (SMNG), Georgia, Samegrelo-Zemo Svaneti, Nikortsminda, at Sakinule Cave, deciduous forest, in litter,
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ORDER CHORDEUMATIDA
Family Anthroleucosomatidae
Caucaseuma variabile Antić et Makarov, 2016

Figs 12–14. Habitus (a) and gonopods (b) of some millipedes from the Caucasus region: 12 — Brachydesmus kalischewskyi Lignau, 1915; 13 — Brachydesmus stuxbergi Attems, 1907; 14 — Caucaseuma variabile Antić et Makarov, 2016. Scale bars: 1 mm (a); 0.1 mm (b).

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ORDER CHORDEUMATIDA
Family Anthroleucosomatidae
Caucaseuma variabile Antić et Makarov, 2016

Fig. 14.

MATERIAL. 2 ♂♂, 2 ♀♀ (DSTU), Russia, Krasnodar Prov., Caucasian Nature Reserve, valley of Khodzhibi River, Abies & Betula forest, 2050 m a.s.l., 43°49.388′N, 40°31.138′E, 30.IX.2021, Y.A. Chumachenko leg.

REMARKS. Endemic of the Caucasus Major. Described from North Ossetia – Alania, as well as the Krasnodar and Stavropol provinces of Russia, and the Mtskheta-Mtianeti region of Georgia [Antić, Makarov, 2016, 2022; Golovatch, Antipova, 2022].
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