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# New records of millipedes (Diplopoda) from the Karachay-Cherkess Republic, northern Caucasus, Russia

# Новые находки двупарноногих многоножек (Diplopoda) из Карачаево-Черкесской республики (Северный Кавказ, Россия)

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KEY WORDS: diversity, fauna, distribution, iconography.
КЛЮЧЕВЫЕ СЛОВА: разнообразие, фауна, распространение, иконография.

ABSTRACT. New, often illustrated records are provided for 19 species of millipedes from the Karachay-Cherkess Republic, Russia's Caucasus. A checklist of all diplopod species presently known to occur in the republic is given: 31 species, 17 genera, nine families and five orders. Eight species are recorded from the republic for the first time: *Polydesmus complanatus* (Linnaeus, 1761) (also new to the entire Caucasian fauna), *Nopoiulus kochii* (Gervais, 1847), *Nemasoma caucasicum* (Lohmander, 1932), *Cylindroiulus arborum* Verhoeff, 1928, *Omobrachyiulus caucasicus* (Karsch, 1881), *O. curvocaudatus* (Lignau, 1903), *O. implicitus* (Lohmander, 1936) and *O. zuevi* Vagalinski, 2021. The fauna of the republic is dominated by endemics and subendemics of the Caucasus.

РЕЗЮМЕ. Представлены новые, в основном проиллюстрированные находки 19 видов двупарноногих многоножек с территории Карачаево-Черкессии (российский Кавказ). Приведён список всех известных пока в республике видов диплопод: 31 вид из 17 родов, девяти семейств и пяти отрядов. Из них восемь видов впервые отмечены для этой республики: *Polydesmus complanatus* (Linnaeus, 1761) (одновременно новый для фауны Кавказа), *Nopoiulus kochii* (Gervais, 1847), *Nemasoma caucasicum* (Lohmander, 1932), *Cylindroiulus arborum* Verhoeff, 1928, *Omobrachyiulus caucasicus* (Karsch, 1881), *O. curvocaudatus* (Lignau, 1903), *O. implicitus* (Lohmander, 1936) и *O. zuevi* Vagalinski, 2021. В фауне диплопод республики доминируют эндемики и субэндемики Кавказа.

## Introduction

The millipede fauna of the Caucasus has lately been studied especially actively. Numerous groups of Diplopoda have recently been revised. Mainly based on abundant fresh material [Golovatch *et al*., 2015, 2016; Antić, Makarov, 2016, 2022; Evsyukov *et al*., 2016, 2020; Vagalinski, Golovatch, 2021, etc.]. Records of diplopods, often illustrated, from various regions of the Caucasus have also appeared [Zuev, 2014, 2021; Korobushkin *et. al.*, 2016; Kokhia, Golovatch, 2018; Evsyukov *et al.*, 2022; Golovatch, Antipova, 2022. etc.]. However, the distribution of many species still remains too poorly or patchily studied, information concerning the diplopod faunas of many parts of the Caucasus, northern one included, being yet fragmentary. The Karachay-Cherkess Republic as part of Russia's Caucasus is one such region. Most of the territory of the republic is mountainous and cut by rivers flowing from south to north. The complex landscapes and the remarkable variety of natural conditions which range from lowland to high-montane, up to purely anthropogenic, must have clearly affected the diversity of the region's diplopods. Only 23 species of millipedes have hitherto been recorded from Karachay-Cherkessia. The present paper summarizes and updates the fauna of Diplopoda of the Karachay-Cherkess Republic, bringing it to a total of 31 species, 17 genera, nine families and five orders. New, often illustrated records are also provided, all culminating in a checklist.

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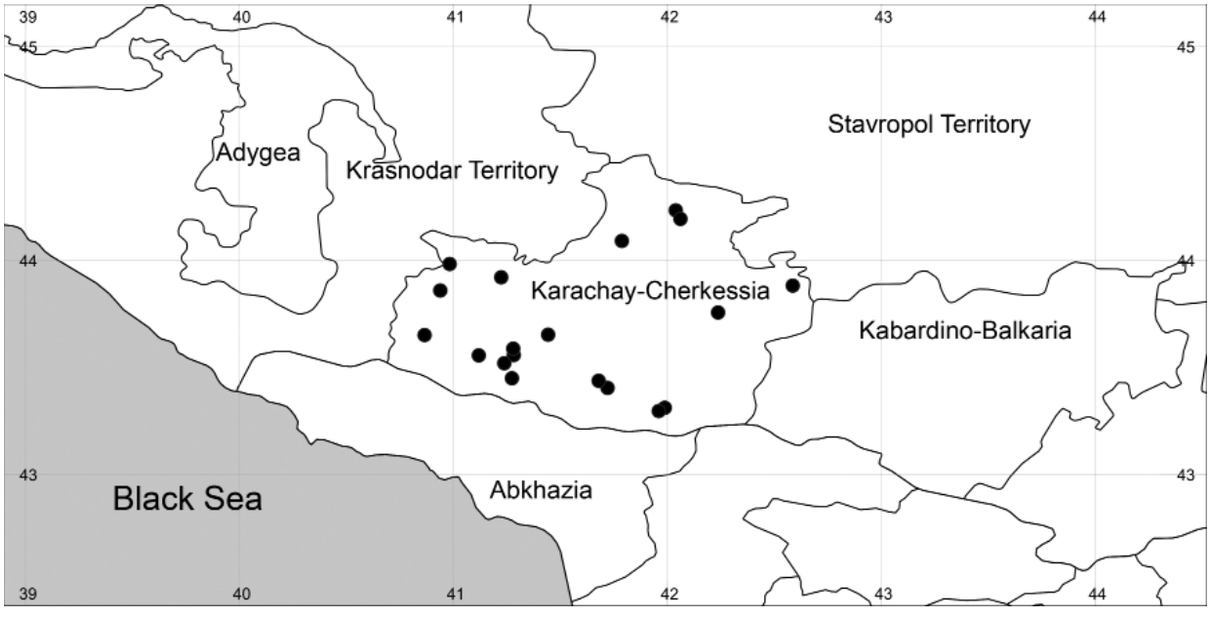



Map. New records of Diplopoda from the Karachay-Cherkess Republic.
Карта. Новые находки Diplopoda в Карачаево-Черкессии.

## Material and methods

Material underlying this paper was collected in different places and habitats in Karachay-Cherkess Republic (Map). Specimens were taken either with hand or soil and leaf litter sampling. All material is deposited in the collections of the Zoological Museum of the North Caucasian Federal University, Stavropol (ZMS) and the Don State Technical University, Rostov-on Don (DSTU), both Russia. Photographs were taken with a Levenhuk D800T, Zeiss StereoDiscovery V.20 and Canon PowerShot SX620 HS digital camera. Images were processed using Adobe Photoshop CS5 software.

## Taxonomic part

CLASS DIPLOPODA
ORDER POLYZONIIDA
Family HIRUDISOMATIDAE

*Hirudisoma roseum* (Victor, 1839)

MATERIAL. 2 ♂♂, 6 ♀♀ (ZMS), Karachay-Cherkess Republic, Urupsky Distr., between Damkhurts and Zagedan, *Abies* & *Acer* forest, 1200 m a.s.l., 16.IX.2017; 2 ♂♂, 15 ♀♀, 2 juv. (ZMS), between Aziatsky and Rozhkao, *Abies*, *Fagus* & *Acer* forest, 1000 m a.s.l., 25.IX.2016, all R.V. Zuev leg.

REMARKS. A widespread Caucasian species, also known from Turkey [Golovatch *et al.*, 2015; Golovatch, Antipova, 2022; Evsyukov *et al.*, 2022]. In Karachay-Cherkessia, it has only been recorded from the valley of Laba River [Golovatch *et al.*, 2015].

ORDER GLOMERIDA
Family GLOMERIDAE

*Trachysphaera costata* (Waga, 1857)

MATERIAL. 1 ♀ (ZMS), Karachay-Cherkess Republic, Urupsky Distr., between Damkhurts and Zagedan, *Abies* & *Acer* forest, 1200 m a.s.l., 16.IX.2017, leg. R.V. Zuev.

REMARKS. An Eastern Euro-Mediterranean species widely distributed across the Caucasus [Golovatch, 1990, 2008; Golovatch, Antipova, 2022; Zuev, 2014, 2021; Evsyukov *et al.*, 2022]. In the territory of the republic, it has hitherto been recorded only from the very same Urupsky District [Golovatch, 1990].

ORDER POLYDESMIDA
Family POLYDESMIDAE

*Polydesmus abchasius* Attems, 1898

MATERIAL. 1 ♂, 1 ♀ (ZMS), Karachay-Cherkess Republic, Urup Distr., between Aziatsky and Rozhkao, *Abies*, *Fagus* & *Acer* forest, 1000 m a.s.l., 25.IX.2016; 1 ♀ (ZMS), same place, 15.IX.2017; 1 juv. (ZMS), near Pregradnaya, broadleaved forest, 800 m a.s.l., 25.IX.2016; 4 ♀♀ (ZMS), between Damkhurts and Zagedan, *Abies* & *Acer* forest, 1200 m a.s.l., 16.IX.2017; 2 ♂♂ (ZMS), near Psemen, broadleaved forest, 900 m a.s.l., 25.IX.2016, all R.V. Zuev leg.

REMARKS. This species is widespread in the western Caucasus: Krasnodar Territory, Adygea, Abkhazia and Georgia [Golovatch et al., 2016, Kokhia et al. 2020; Evsyukov *et al.*, 2022]. In the Karachay-Cherkess Republic, it has hitherto been recorded only from near Arkhyz [Golovatch *et al.*, 2016].

*Polydesmus complanatus* (Linnaeus, 1761)
Figs 1–5.

MATERIAL. 2 ♀♀ (ZMS), Karachay-Cherkess Republic, Cherkessk, «Zelenyi ostrov» Park, Kuban River floodplain, *Salix* & *Populus* forest, 500 m a.s.l., 17.VII.2022; 2 ♂♂ (ZMS), Cherkessk, forest strip along Abazinka River, *Fraxinus* & *Robinia*, 500 m a.s.l., 44°11′45″N, 42°3′38″E, 16.VII.2022; 1 ♂, 1 ♀ (ZMS), same place, 19.VIII.2022, all R.V. Zuev & E.D. Proskura leg.

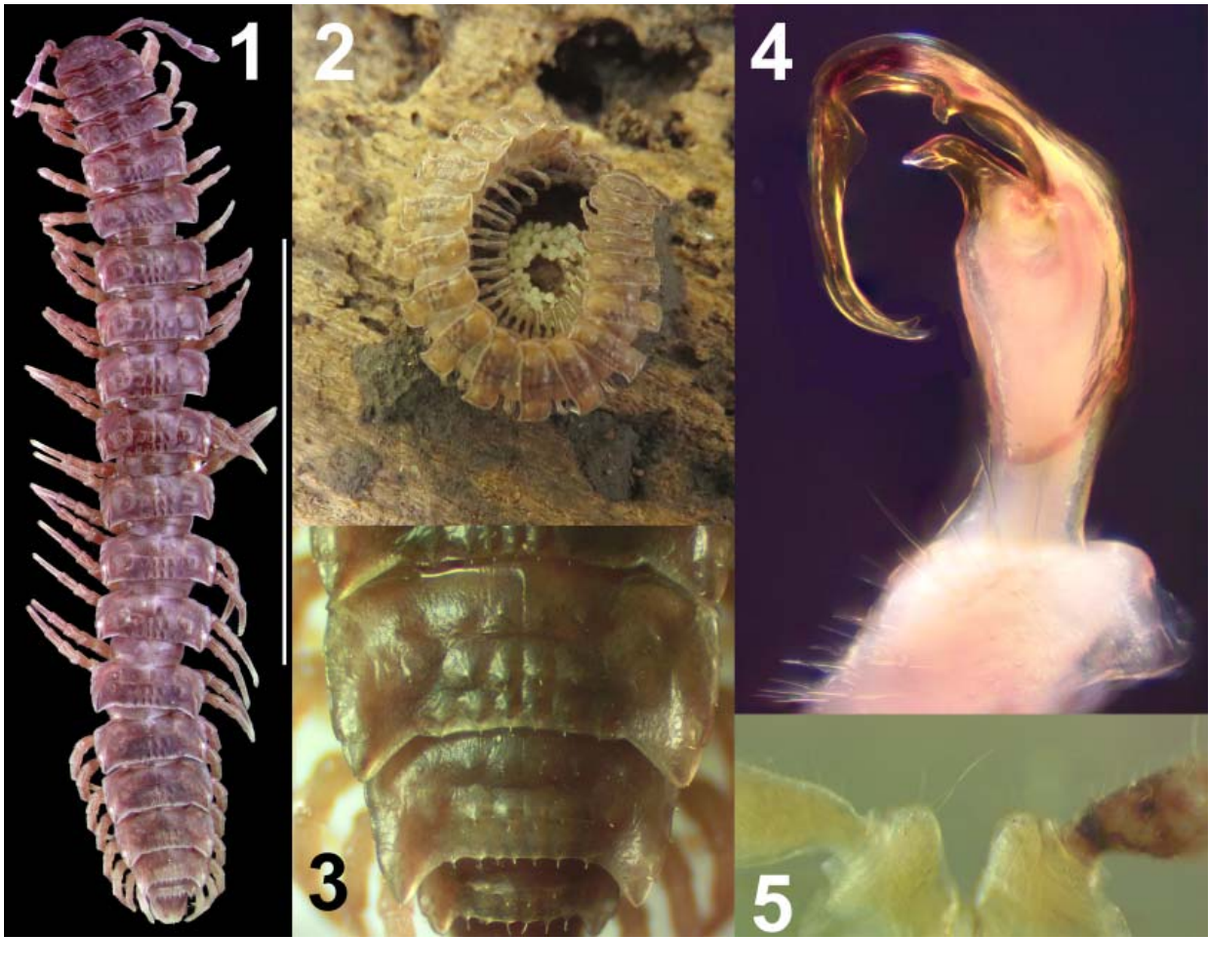
REMARKS. A widespread eurytopic species known from Turkey, Eastern and Northern Europe, including the central European part of Russia [Kime, Enghoff, 2011]. Previously recorded by Muralewicz [1907, 1911, 1927] from Abkhazia and North Ossetia, but this information is actually considered erroneous [Golovatch *et al.*, 2016]. This species is thus new to the entire Caucasian fauna, having been found only in purely anthropogenic habitats and apparently reflecting a recent introduction.

A female laying eggs and building an earthy capsule around the clutch was found in August 2022 (Fig. 1). Building such "nests" is typical of other polydesmidans species [Minelli, Michalik, 2015].

*Brachydesmus kalischewskyi* Lignau, 1915

MATERIAL. 1 ♂ (DSTU), Karachay-Cherkess Republic, Teberda Biosphere Nature Reserve, Teberda River valley, 24.VII.2012, D.D. Khisametdinova & Y.V. Kochetov leg.; 1 ♂ (ZMS), Urupsky Distr., between Aziatsky and Rozhkao, *Abies*, *Fagus* & *Acer* forest, 1000 m a.s.l., 15.IX.2017; 2 ♀♀ (ZMS), same place, 25.IX.2016, all leg. R.V. Zuev.

REMARKS. A highly polymorphous species, subendemic to the Caucasus. Widespread in the Russian part of the Caucasus: Krasnodar and Stavropol territories, Adygea, Karachay-Cherkessia, North Ossetia, Dagestan and Chechnya. It has also been recorded from Abkhazia, Azerbaijan, Georgia, Armenia, Iran and Turkey [Golovatch *et al.*, 2016; Kokhia, Golovatch, 2018; Evsyukov *et al.*, 2022].




Figs 1–5. *Polydesmus complanatus* (Linnaeus, 1761) from Cherkessk: 1 — habitus; 2 — a female building a brooding egg capsule in a natural habitat; 3 — tergites 17–19; 4 — right gonopod; 5 — coxa of ♀ leg pair 2, posterior view. Scale bar: 10 mm (1), without scale (2–5).

Рис. 1–5. *Polydesmus complanatus* (Linnaeus, 1761) из Черкесска: 1 — габитус; 2 — самка, строящая «гнездо» для яиц в естественной среде обитания; 3 — тергиты 17–19; 4 — правый гонопод; 5 — тазик пары ног 2 самки, вид сзади. Масштаб 10 мм (1), без масштаба (2–5).

Family PARADOXOSOMATIDAE

*Strongylosoma kordylamythrum* Attems, 1898

MATERIAL. 1 ♂, 1 ♀ (DSTU), Karachay-Cherkess Republic, near Arkhyz, *Alnus* forest, 1400 m a.s.l., under bark, 5.VIII.2015, A.P. Evsyukov leg.; 1 ♀ (ZMS), Urupsky Distr., between Damkhurts and Zagedan, *Abies* & *Acer* forest, 1200 m a.s.l., 16.IX.2017, leg. R.V. Zuev; 1 ♂, 2 ♀♀ (ZMS), Zelenchuk Distr., Arkhyz, «Narat» hostel, *Abies* & *Betula* forest, 1400 m a.s.l., 43º33′34″N, 41º16′53″E, 5.VII.2022; 1 ♂ (ZMS), same place, 10.VII.2022; 1 ♂ (ZMS), near Arkhyz, *Fagus*, *Pinus* & *Betula* forest, 1500 m a.s.l., 9.VII.2022; 1 ♂, 1 ♀ (ZMS), Arkhyz, near Baritovyi Waterfall, subalpine meadow, 2100 m a.s.l., 43°35'21"N 41°16'44"E, 12.VII.2022; 1 ♀ (ZMS), 5 km SW of Arkhyz, Taulu meadow, *Pinus* & *Picea* forest, 1590 m a.s.l., 43º31′16″N, 41º14′13″E, 3.VIII.2022; 1 ♂, 1 juv. (ZMS), near Nizhny Arkhyz, near Special Astrophysical Observatory of the Russian Academy of Sciences, *Betula* forest, 1950–2050 m a.s.l., 8.VII.2022; 1 ♂ (ZMS), near camp in Sofyiskaya meadow, *Pinus* & *Picea* forest, 2180 m a.s.l., 43º27′03″N, 41º16′22″E, 4.VIII.2022; 1 ♂, 1 ♀ (ZMS), Abazinsk Distr., near Elburgan, Yew grove, *Carpinus* & *Taxus* forest, 700 m a.s.l., 44º5′34″N, 41º47′12″E, 12.VII.2022; 1 ♂ (ZMS), Cherkessk, forest strip along Abazinka River, *Fraxinus* & *Robinia*, 500 m a.s.l., 44º11′45″N, 42º3′38″E, 16.VII.2022; 2 juv. (ZMS), same place, 19.VIII.2022, all R.V. Zuev & E.D. Proskura leg.

REMARK. A very common species widespread in the Caucasus and Ciscaucasia, including the Karachay-Cherkess Republic [Evsyukov *et al*., 2016].

ORDER JULIDA
Family BLANIULIDAE

*Nopoiulus kochii* (Gervais, 1847)

MATERIAL. 1 ♀ (ZMS), Karachay-Cherkess Republic, Cherkessk, «Zelenyi ostrov» Park, floodplain of Kuban River, *Salix* & *Populus* forest, 500 m a.s.l., 17.VII.2022, R.V. Zuev & E.D. Proskura leg.

REMARKS. This subcosmopolitan species is extremely widespread in the Caucasus [Enghoff, 1984; Golovatch, Enghoff, 1990; Evsyukov *et al*., 2022], yet being formally new to the fauna of Karachay-Cherkess Republic.

Family NEMASOMATIDAE

*Nemasoma caucasicum* (Lohmander, 1932)

MATERIAL. 1 ♂, 1♀ (DSTU), Karachay-Cherkess Republic, Teberda Biosphere Nature Reserve, Teberda River valley, 24.VII.2012, D.D. Khisametdinova & Y.V. Kochetov leg.; 5 ♂♂, 1 ♀ (ZMS), Cherkessk, forest strip along Abazinka River, *Fraxinus* & *Robinia*, 500 m a.s.l., 44º11′45″N, 42º3′38″E, 16.VII.2022; 2 ♂♂, 1 ♀ (ZMS), «Zelenyi ostrov» Park, floodplain of Kuban River, *Salix* & *Populus* forest, 500 m a.s.l., 17.VII.2022, all R.V. Zuev & E.D. Proskura leg.

REMARKS. A species subendemic to the Caucasus, having been recorded from Georgia, Azerbaijan, Armenia and Turkey [Enghoff, 1985, 2006]. In the North Caucasus, it has hitherto been found in the Stavropol and Krasnodar territories, North Ossetia and Dagestan [Lohmander, 1932; Enghoff, 1985, Korobushkin et al, 2016; Zuev, 2021; Golovatch, Antipova, 2022]. Usually, it occurs under the bark of trees. This is formally a species new to the fauna of Karachay-Cherkess Republic.

Family JULIDAE

*Byzantorhopalum rossicum* (Timotheew, 1897)

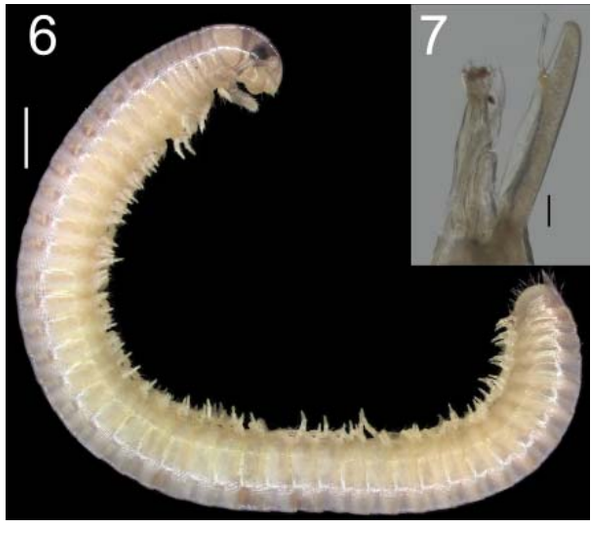
MATERIAL. 4 ♂♂, 1 ♀, 1 juv. (ZMS), Karachay-Cherkess Republic, Urupsky Distr., between Aziatsky and Rozhkao, *Abies*, *Fagus* & *Acer* forest, 1000 m a.s.l., 25.IX.2016; 2 ♀♀, 1 juv. (ZMS), Karachayevsk Distr., 2.5 km S of Gumbashi Pass, near «Mara» hostel, subalpine meadow, 2500 m a.s.l., 25.VIII.2017; 2 ♀♀ (ZMS), Malokarachayevsk Distr., 1.5 km S of Kommunstroy, «Medovye» Waterfalls, meadow, 1000 m a.s.l., 43°53′01″N, 42°35′11″E, 24.VIII.2017, all R.V. Zuev leg.; 1 ♀ (ZMS), Cherkessk, «Zelenyi ostrov» Park, floodplain of Kuban River, *Salix* & *Populus* forest, 500 m a.s.l., 17.VII.2022; 1 juv. (ZMS), Cherkessk, forest strip along Abazinka River, *Fraxinus* & *Robinia*, 500 m a.s.l., 44º11′45″N, 42º3′38″E, 19.VIII.2022, all R.V. Zuev & E.D. Proskura leg.

REMARKS. An Eastern Euro-Mediterranean species widely distributed in the Caucasus [Vagalinski, Golovatch, 2021; Golovatch, Antipova, 2022]. It has hitherto been recorded from the Urupsky and Zelenchuk districts of Karachay-Cherkess Republic [Lohmander, 1936].

*Colchiobrachyiulus montanus* Vagalinski, 2021
Figs 6, 7.

MATERIAL. 4 ♂♂, 7♀♀, 1 juv. (DSTU), Karachay-Cherkess Republic, Teberda Biosphere Nature Reserve, *Fagus* & *Carpinus* forest, litter and under barks, 26.VII.2012, D.D. Khisametdinova & Y.V. Kochetov leg.

REMARKS. Endemic to the northwestern parts of the Caucasus Major. Previously recorded only from the very same Teberda Biosphere Nature Reserve [Vagalinski, Golovatch, 2021].




Figs 6–7. *Colchiobrachyiulus montanus* Vagalinski, 2021 from the Teberda Biosphere Nature Reserve: 6 — habitus; 7 — gonopod. Scale bar: 10 mm (6), 1 mm (7).

Рис. 6–7. *Colchiobrachyiulus montanus* Vagalinski, 2021 из Тебердинского заповедника: 6 — хабитус; 7 — гонопод. Масштаб 10 мм (6), 1 мм (7).

*Cylindroiulus arborum* Verhoeff, 1928
Figs 8–10.

MATERIAL. 1 ♂, 5 ♀♀ (ZMS), Karachay-Cherkess Republic, Cherkessk, «Zelenyi ostrov» Park, floodplain of Kuban River, *Salix* & *Populus* forest, 500 m a.s.l., 17.VII.2022, R.V. Zuev & E.D. Proskura leg.


Figs 8–10. *Cylindroiulus arborum* Verhoeff, 1928 from Cherkessk: 8 — habitus; 9 — telson; 10 — gonopod. Not to scale.

Рис. 8–10. *Cylindroiulus arborum* Verhoeff, 1928 из Черкесска: 8 — габитус; 9 — тельсон; 10 — гонопод. Без масштаба.

REMARKS. In the Caucasus, this Central and Eastern European species [Korsós, Enghoff, 1990; Kime, Enghoff, 2017] has hitherto been recorded only from North Ossetia and the Stavropol Territory [Zuev, 2014, 2021], thus being formally new to the fauna of Karachay-Cherkessia.

*Cylindroiulus pterophylacum* Read, 1992
Figs 11–13.

MATERIAL. 3 ♂♂, 1 ♀ (ZMS), Karachay-Cherkess Republic, Urupsky Distr., between Aziatsky and Rozhkao, *Abies*, *Fagus* & *Acer* forest, 1000 m a.s.l., 25.IX.2016; 2 ♀♀ (ZMS), near Pregradnaya, broadleaved forest, 800 m a.s.l., 25.IX.2016; 2 ♀♀ (ZMS), near Psemen, broadleaved forest, 900 m a.s.l., 25.IX.2016, all R.V. Zuev leg.; 1 ♂, 2 ♀♀ (ZMS), Abazinsk Distr., near Elburgan, Yew grove, *Carpinus* & *Taxus* forest, 700 m a.s.l., 44°5′34″N, 41°47′12″E, 12.VII.2022, R.V. Zuev & E.D. Proskura leg.

REMARKS. Endemic to the western Caucasus, found in the Krasnodar and Stavropol territories, Adygea and Georgia [Read, 1992; Evsyukov et al., 2022; Zuev, 2014, 2021]. It has hitherto been recorded only from the Urupsky District of Karachay-Cherkess Republic [Read, 1992]. The new illustrations reflect variations in the shape of the telson (Figs 9–11).

*Cylindroiulus ruber* (Lignau, 1903)
Figs 14, 15.

MATERIAL. 4 ♂♂, 3 ♀♀, 1 juv. (ZMS), Karachay-Cherkess Republic, Urupsky Distr., between Damkhurts and Zagedan, *Abies* & *Acer* forest, 1200 m a.s.l., 16.IX.2017; 1 ♀ (ZMS), near Pregradnaya, broadleaved forest, 800 m a.s.l., 25.IX.2016, all R.V. Zuev leg.; 1 ♀ (ZMS), Zelenchuk Distr., near Nizhny Arkhyz, near Special Astrophysical Observatory of the Russian Academy of Sciences, *Betula* forest, 1950–2050 m a.s.l., 8.VII.2022; 2 ♂♂, 1 ♀ (ZMS), 4.5 km WNW of Romantik, *Pinus*, *Picea* & *Betula* forest, 1900 m a.s.l., in leaf litter, 43°33'28"N 41°07'04"E, 12.VII.2022, all R.V. Zuev & E.D. Proskura leg.

REMARKS. Endemic to the western Caucasus [Lignau, 1903; Read, 1992; Kokhia, Golovatch, 2018; Evsyukov et al., 2022], in Karachay-Cherkessia it has hitheto been recorded only from near Damkhurts [Read, 1992].


Figs 11–13. Variations in telson shapes of *Cylindroiulus pterophylacum* Read, 1992: 11 — from Elburgan; 12, 13 — from Psemen. Not to scale.

Рис. 11–13. Вариации формы тельсона у *Cylindroiulus pterophylacum* Read, 1992: 11 — из Эльбургана; 12, 13 — из Псемёна. Без масштаба.


Figs 14–15. *Cylindroiulus ruber* (Lignau, 1903) in natural habitats: 14 — juvenile from near Damkhurts; 15 — adult from Arkhyz. Not to scale.

Рис. 14–15. *Cylindroiulus ruber* (Lignau, 1903) в естественной среде обитания: 12 — ювенильная особь из окрестностей Дамхурца; 13 — взрослая особь из Архыза. Без масштаба.

### *Julus kubanus* Verhoeff, 1921

MATERIAL. 2 ♂♂, 1 ♀, 1 juv. (ZMS), Karachay-Cherkess Republic, Urupsky Distr., between Damkhurts and Zagedan, *Abies* & *Acer* forest, 1200 m a.s.l., 16.IX.2017, R.V. Zuev leg.; 3 ♂♂, 1 ♀, 1 juv. (ZMS), Zelenchuk Distr., Arkhyz, near Baritovyi Waterfall, subalpine meadow, 2100 m a.s.l., 43°35'21"N 41°16'44"E, 12.VII.2022, R.V. Zuev & E.D. Proskura leg.

REMARKS. Endemic to the Caucasus Major, there being one of the most common species of the genus *Julus*. Found in Adygea, North Ossetia, Chechnya, as well as Georgia and Abkhazia. It has hitherto been recorded from the Teberda Biosphere Nature Reserve in the valley of Aksaut River and in some other places of the Karachay-Cherkess Republic [Lohmander, 1936; Evsyukov *et al.*, 2020a].

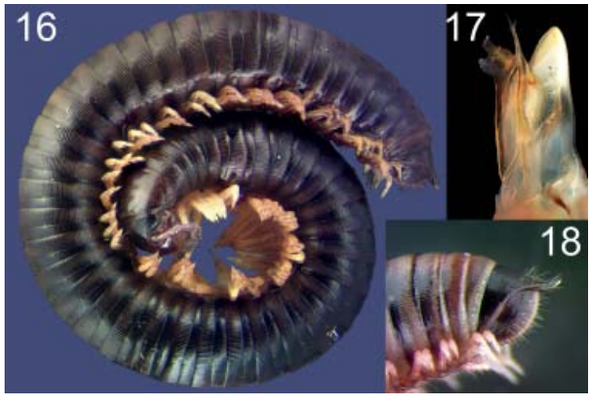
### *Omobrachyiulus caucasicus* (Karsch, 1881)

MATERIAL. 1 ♀ (DSTU), Karachay-Cherkess Republic, Teberda Biosphere Nature Reserve, Teberda River valley, 24.VII.2012, D.D. Khisametdinova & Y.V. Kochetov leg.; 1 ♂ (DSTU), same locality, slope of Mount Malaya Khatipara, 25.VII.2012, all D.D. Khisametdinova & Y.V. Kochetov leg.

REMARKS. This species is subendemic to the Caucasus, being very common in North Ossetia, Dagestan, Georgia, Armenia and Azerbaijan. Beyond the Caucasus, it is highly widespread in Ciscaucasia (Stavropol Territory and Kalmykia), Iran and Turkey [Vagalinski, Golovatch, 2021; Golovatch, Antipova, 2022]. It is formally new to the fauna of Karachay-Cherkessia.

### *Omobrachyiulus curvocaudatus* (Lignau, 1903)
Figs 16–18.

MATERIAL. 1 ♀ (ZMS), Karachay-Cherkess Republic, Karachayevsk Distr., Makharskoe Gorge, *Abies*, *Picea* & *Betula* forest, 1650–1800 m a.s.l., 43°18′46″N 41°59′14″E, 21.VIII.2022; 3 ♂♂, 2 ♀♀, 4 juv. (ZMS), same place, steppe meadow, 1950 m a.s.l., 43°17′52″N 41°57′33″E, 23.VIII.2022, all R.V. Zuev & E.D. Proskura leg.




Figs 16–18. *Omobrachyiulus curvocaudatus* (Lignau, 1903) from Makharskoe Gorge: 16 — habitus; 17 — gonopod; 18 — telson. Not to scale.

Рис. 16–18. *Omobrachyiulus curvocaudatus* (Lignau, 1903) из Махарского ущелья: 16 — хабитус; 17 — гонопод; 18 — тельсон. Без масштаба.

REMARKS. This species has hitherto been recorded from the Krasnodar Territory, Adygea and Georgia [Lohmander, 1936; Vagalinski, Golovatch, 2021], thus being formally new to the fauna of Karachay-Cherkess Republic. New illustrations are provided to document the identity (Figs 14–16).

### *Omobrachyiulus implicitus* (Lohmander, 1936)
Figs 19–20.

MATERIAL. 1 ♂ (ZMS), Karachay-Cherkess Republic, Urupsky Distr., near Pregradnaya, broadleaved forest, 800 m


Figs 19–20. *Omobrachyiulus implicitus* (Lohmander, 1936) from Psemen: 19 — habitus; 20 –gonopod. Not to scale.

Рис. 19–20. *Omobrachyiulus implicitus* (Lohmander, 1936) из Псемёна: 19 — габитус; 20– гонопод. Без масштаба.

a.s.l., 25.IX.2016; 1 ♂ (ZMS), near Psemen, broadleaved forest, 900 m a.s.l., 25.IX.2016, all R.V. Zuev leg.

REMARKS. Endemic to the Caucasus, in Russia having been recorded from Adygea and the Krasnodar Territory [Vagalinski. Golovatch, 2021]. The above record is new to the fauna of Karachay-Cherkess Republic.

*Omobrachyiulus zuevi* Vagalinski, 2021
Figs 21, 22.

MATERIAL. 1 ♂, 3 juv. (ZMS), Karachay-Cherkess Republic, Urupsky Distr., between Aziatsky and Rozhkao, *Abies*, *Fagus* & *Acer* forest, 1000 m a.s.l., 25.IX.2016, R.V. Zuev leg.; 1 ♂ (ZMS), Zelenchuk Distr., near Nizhny Arkhyz, near Special Astrophysical Observatory of the Russian Academy of Sciences, *Betula* forest, 1950–2050 m a.s.l., 8.VII.2022; 1 ♀ (ZMS), Arkhyz, near Baritovyi Waterfall, subalpine meadow, 2100 m a.s.l., 43°35'21"N 41°16'44"E, 12.VII.2022; 4 ♀♀, 1 juv. (ZMS), Cherkessk, «Zelenyi ostrov» Park, floodplain of Kuban River, *Salix* & *Populus* forest, 500 m a.s.l., 17.VII.2022; 1 ♂, 16 ♀♀, 6 juv. (ZMS), forest strip along Abazinka River, *Fraxinus* & *Robinia*, 500 m a.s.l., 44º11′45″N, 42º3′38″E, 16.VII.2022; 2 ♂♂, 3 ♀♀, 1 juv. (ZMS), same place, 19.VIII.2022, all R.V. Zuev & E.D. Proskura leg.


Figs 21–22. *Omobrachyiulus zuevi* Vagalinski, 2021 from Arkhyz: 21 — habitus; 22 — gonopod. Not to scale.

Рис. 21–22. *Omobrachyiulus zuevi* Vagalinski, 2021 из Архыза: 21 — габитус; 22 — гонопод. Без масштаба.

REMARKS. This species has hitherto been found only from near Stavropol [Vagalinski, Golovatch, 2021; Zuev, 2021]. The above records significantly expand the known distribution of the species, formally being new to the fauna of the republic.

*Pachyiulus krivolutskyi* Golovatch, 1977

MATERIAL. 1 ♂, 1 ♀, 1 juv. (ZMS), Karachay-Cherkess Republic, Urupsky Distr., between Aziatsky and Rozhkao, *Abies*, *Fagus* & *Acer* forest, 1000 m a.s.l., 25.IX.2016, R.V. Zuev leg..

REMARK. Endemic to the western part of the Caucasus, previously found in Karachay-Cherkessia only in the valley of Laba River [Evsyukov, 2016].

*Rossiulus kessleri* (Lohmander, 1927)

MATERIAL. 2 ♂♂, 1 juv. (ZMS), Karachay-Cherkess Republic, Abazinsk Distr., near Elburgan, Yew grove, *Carpinus* & *Taxus* forest, 700 m a.s.l., 44º5′34″N, 41º47′12″E, 12.VII.2022; 1 juv. (ZMS), Cherkessk, «Zelenyi ostrov» Park, floodplain of Kuban River, *Salix* & *Populus* forest, 500 m a.s.l., 17.VII.2022; 1 ♀, 4 juv. (ZMS), forest strip along Abazinka River, *Fraxinus* & *Robinia*, 500 m a.s.l., 44º11′45″N, 42º3′38″E, 16.VII.2022; 3 juv. (ZMS), same place, 19.VIII.2022, all R.V. Zuev & E.D. Proskura leg.

REMARKS. This species is subendemic to the Eastern European Plain [Golovatch, 1984], being widely distributed in the North Caucasus as well [Lohmander, 1936; Zuev, 2014; Golovatch, Antipova, 2022; Evsyukov *et al*., 2022]. In the Karachay-Cherkess Republic, it has hitherto been recorded only from the Aksaut Gorge [Lohmander, 1936].

## Discussion and conclusions

The diplopod fauna of the Karachay-Cherkess Republic is presently known to contain 31 species from 17 genera, nine families and five orders (Table). Among them, eight species appear to be formally new to the fauna of the republic: *Polydesmus complanatus*, *Nopoiulus kochii*, *Nemasoma caucasicum*, *Cylindroiulus arborum*, *Omobrachyiulus caucasicus*, *O. curvocaudatus*, *O. implicitus*, and *O. zuevi*. This alone shows the fauna as being far from completely surveyed. Most researchers have focused their attention on the mountainous regions of the republic as more promising for interesting records. However, they are floodplain forests and steppes of the lowland and foothill parts of Karachay-Cherkessia that remain virtually unexplored. In addition, anthropogenic habitats can also yield more new millipede records, in particular anthropochorous species such as *P. complanatus*. Thus, four of the eight species records that are new to the fauna of the republic come from the town of Cherkessk. In addition, there are still no records of the order Polyxenida from Karachay-Cherkessia, a group very common and widespread in the Caucasus and already reported from North Ossetia, northern Caucasus [Golovatch, Antipova, 2022].

Endemism of the diplopods of Karachay-Cherkessia at the species level is profound. Of the 31 presently known species, 25 (80.6%) are endemic or subendemic to the Caucasus. This roughly corresponds to the endemism of millipedes in North Ossetia (90%) [Golovatch, Antipova, 2022] and is significantly higher than in the Stavropol Territory (51%) [Zuev, 2021]. Only three species seem to be strictly endemic to the

Table. Fauna and chorology of Diplopoda of the Karachay-Cherkess Republic.
Таблица. Фауна и хорология Diplopoda Республики Карачаево-Черкессия.

| Species | Chorotypes | Main relevant references |
|---|---|---|
| *Hirudisoma roseum* (Victor, 1839) | CSe | Golovatch *et al.*, 2015 |
| *Hyleoglomeris awchasica* (Brandt, 1840) | CE | Golovatch 1976, 1989; Kokhia, Golovatch, 2018 |
| *Trachyspaera costata* (Waga, 1857) | EM | Golovatch, 1990, 2008 |
| *Polydesmus abchasius* Attems, 1898 | CE | Golovatch *et al*., 2016 |
| *P. complanatus* Lohmander, 1936* | CEE | Kime, Enghoff, 2011 |
| *P. lignaui* Lohmander, 1936 | CE | Golovatch *et al*. 2016 |
| *Brachydesmus kalischewskyi* Lignau, 1915 | CE | Golovatch *et al*. 2016 |
| *Strongylosoma kordylamythrum* Attems, 1898 | Pc | Evsyukov *et al*., 2016; Golovatch, Antipova, 2022 |
| *Caucaseuma elephantum* Antić et Makarov, 2016 | T | Antić, Makarov, 2016, 2022 |
| *C. glabroscutum* Antić et Makarov, 2016 | KChE | Antić, Makarov, 2016, 2022 |
| *Nopoiulus kochii* (Gervais, 1847)* | A | Enghoff, 1984; Golovatch, Enghoff, 1990 |
| *Nemasoma caucasicum* (Lohmander, 1932)* | CSe | Enghoff, 1985 |
| *Byzantorhopalum rossicum* (Timotheew, 1897) | EM | Vagalinski, Golovatch, 2021 |
| *Colchiobrachyiulus dioscoriadis* (Lignau, 1915) | CE | Vagalinski, Golovatch, 2021 |
| *C. montanus* Vagalinski, 2021 | KChE | Vagalinski, Golovatch, 2021 |
| *Cylindroiulus arborum* Verhoeff, 1928* | CEE | Korsós, Enghoff, 1990; Kime, Enghoff, 2017 |
| *C. pterophylacum* Read, 1992 | CE | Read, 1992 |
| *C. ruber* (Lignau, 1903) | CE | Read, 1992 |
| *Julus colchicus* Lohmander, 1936 | CE | Evsyukov *et al.*, 2020a |
| *J. kubanus* Verhoeff, 1921 | CE | Evsyukov *et al*., 2020a |
| *J. lignaui* Verhoeff, 1910 | CE | Evsyukov *et al*., 2020a |
| *J. lindholmi* Lohmander, 1936 | CE | Evsyukov *et al*., 2020a |
| *Kubaniulus lativelatus* Evsyukov, Golovatch, Reip et VandenSpiegel, 2020 | CE | Evsyukov *et al*., 2020b |
| *Omobrachyiulus caucasicus* (Karsch, 1881)* | CSe | Vagalinski, Golovatch, 2021; Golovatch, Antipova, 2022 |
| *Omobrachyiulus curvocaudatus* (Lignau, 1903)* | CE | Vagalinski, Golovatch, 2021 |
| *O. geniculatus* (Lohmander, 1928) | CE | Vagalinski, Golovatch, 2021 |
| *O. implicitus* (Lohmander, 1936)* | CE | Vagalinski, Golovatch, 2021 |
| *O. macrourus* (Lohmander, 1928) | CE | Vagalinski, Golovatch, 2021 |
| *O. zuevi* Vagalinski, 2021* | CE | Vagalinski, Golovatch, 2021 |
| *Pachyiulus krivolutskyi* Golovatch, 1977 | CE | Evsyukov, 2016 |
| *Rossiulus kessleri* (Lohmander, 1927) | EE | Lohmander, 1936; Golovatch, 1984 |

Chorotypes, from wider to increasingly narrower distributions: A — subcosmopolitan anthropochore; CEE — Central and Eastern European; EE — Eastern European; EM — Euro-Mediterranean; Pc — pan-Caucasian; CSe — subendemic to the Caucasus; CE — endemic to the Caucasus; KChE — endemic or subendemic to Karachay-Cherkessia; T — troglobiont.

* Species new to the fauna of Karachay-Cherkessia.

Karachay-Cherkess Republic: *Caucaseuma elephantum* Antić et Makarov, 2016, *C. glabroscutum* Antić et Makarov, 2016 and *Colchiobrachyiulus montanus*. Such a high level of endemism is associated with both the complex physiography of the Caucasus and the diplopods generally being poorly vagile and mesophilic soil/litter-dwellers, often with strongly restricted distributions, especially so in montane countries [Enghoff *et al*., 2015].

There can be little doubt that further faunistic studies in the Karachay-Cherkess Republic, let alone in the Caucasus as a whole, will reveal numerous new remarkable records.

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