Two remarkable new records of millipedes (Diplopoda) from far inland European Russia

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ABSTRACT. For the first time, the subcosmopolitan bristly millipede, *Polyxenus lagurus* (Linnaeus, 1758) is recorded from the Zhiguli State Nature Biosphere Reserve, middle-course region of the Volga River, east-central Russia. This concerns a parthenogenetic population and represents the easternmost record not only from European Russia, but also from entire Europe. The same habitat also supports the julid, *Rossiulus kessleri* (Lohmander, 1927), a species subendemic to the Russian Plain and the Northern Caucasus, similarly representing one of the easternmost records of the species.
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KEY WORDS: faunistics, distribution, middle-course Volga Region, Russian Plain, Samara Region, Zhiguli Hills.

Две примечательные новые находки многоножек-диплопод (Diplopoda) в глубине европейской России

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РЕЗЮМЕ. Впервые субкосмополитный кистехвост *Polyxenus lagurus* (Linnaeus, 1758) отмечен в Жигулевском биосферном заповеднике в Среднем Поволжье (Восточно-Центральная Россия). Находка касается партеногенетической популяции и представляет собой самую восточную не только для европейской России, но и всей Европы. В том же заповеднике отмечен и кивсяк *Rossiulus kessleri* (Lohmander, 1927), субэндемик Русской равнины и Северного Кавказа, сходным образом представляющий одну из самых восточных находок этого вида.
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КЛЮЧЕВЫЕ СЛОВА: фаунистика, распространение, Среднее Поволжье, Русская равнина, Самарская область, Жигулевские горы.

Introduction

In Russia, bristly millipedes (the order Polyxenida) are known to be represented by only a handful of species, in three genera and two families, Polyxenidae and Lophoproctidae. The eyed Polyxenidae contains the subcosmopolitan, chiefly Holarctic *Polyxenus lagurus* (Linnaeus, 1758), a species known from bisexual and/or, in harsher environments, parthenogenetic populations, and ranging across Europe to Russia's northwestern parts in the north (Karelia and the Leningrad Region) (Lokshina, 1969; Kime, Enghoff, 2011) to Donbass, Crimea, the Rostov-on-Don Region and, surprisingly only a few records, the Western Caucasus in the south (Prisnyi, 2001; Short *et al.*, 2020; Evsyukov *et al.*, 2022; Golovatch, 2023); *Polyxenus lankaranensis* Short, Vahtera, Wesener et Golovatch, 2020, from Azerbaijan and Dagestan, NE Caucasus (Short *et al.*, 2020); *Polyxenus* sp., a closer unidentified species recorded from the Maritime Province, Russia's Far East (Mikhaljova, 2004, 2017); and *Propolyxenus argentifer* (Verhoeff, 1921), from Crimea, the Krasnodar and Stavropol provinces, and nearly throughout the remaining Caucasus, including the Hyrcanian parts of Azerbaijan and Iran (Short *et al.*, 2020; Zuev, 2021). The blind Lophoproctidae comprises in the Russian fauna only a single species: *Lophoproctus coecus* Pocock, 1894, from Crimea, the Rostov-on-Don Region and across the entire Caucasus region, including the Hyrcanian part of Iran, and Kyrgyzstan, Central Asia (Short, 2015; Evsyukov *et al.*, 2022).

The family Julidae, as well as the entire order Julida, both clearly dominate the millipede fauna of European Russia (Golovatch, 1984). *Rossiulus kessleri* (Lohmander, 1927) is certainly among the most widespread and common species subendemic to the Russian Plain and the northern Caucasus. The new records of *Polyxenus lagurus* and *Rossiulus kessleri*, both given below, seem to be of sufficient biogeographic interest to warrant the present publication.

Material and Methods

Millipedes were collected by sifting both litter and topsoil. All specimens were fixed in 97% ethanol. All material is deposited in the collection of Zoological Institute of the Russian Academy of Sciences, St. Petersburg (ZISP). Live specimens of *Polyxenus lagurus* were photographed using a Canon EOS 80D DSLR camera with a Canon EF-S 35mm F/2.8 Macro IS STM lens and a set of Kenko Automatic Extension Tube Set DG to provide higher magnification as well as Yongnuo YN14 EX II Macro flash. Images were edited and finalized using Adobe Photoshop 25.3.1 (2024) software.

Faunistic records

Polyxenus lagurus (Linnaeus, 1758)

MATERIAL. Numerous ♀♀ and various juvenile instars, Russia, Samara Region, Stavropolskiy District, right bank of Volga River, Zhiguli State Nature Biosphere Reserve, 736 m E of Bakhilova Polyana Village, 53°26′09.3″N, 49°40′34.9″E, at summit (190 m a.s.l.), edge of a pine-broadleaf forest at a pine grove with petrophytic steppe vegetation, sifting both litter and topsoil under *Euonymus verrucosus* Scop. and a little under *Caragana frutex* (L.) K.Koch, 6.IX.2023, A.S. Kurochkin leg. (Figs 1–7).

REMARKS. This highly eurybiontic, often colonial species is found across Europe on cliffs on the sea shore and strand forest, even on exposed dunes or salinas, to an altitude 1700 m in the Alps and 2600 m in the Rila Mountains in Bulgaria, also common in bird, rodent, ant or squirrel nests (Kime, Enghoff, 2011). The above unexpectedly inland report from the Zhiguli Hills (limestone) that support pine and broadleaved woodlands in the middle course of the Volga River concerns a parthenogenetic population and represents the easternmost record not only from European Russia, but also from entire Europe. The previous easternmost record of *P. lagurus* belonged to the Voronezh Region, central-southern Russia (Prisnyi, 2001; Kime, Enghoff, 2011).

Rossiulus kessleri (Lohmander, 1927)

MATERIAL. 2 early juvenile instars, Russia, Samara Region, Stavropolskiy District, right bank of Volga River, Zhiguli State Nature Biosphere Reserve, 736 m E of Bakhilova Polyana Village, 53°26′09.3″N, 49°40′34.9″E, at summit (190 m a.s.l.), edge of a pine-broadleaf forest at a pine grove with petrophytic steppe vegetation, sifting both litter and topsoil under *Euonymus verrucosus* Scop. and a little under *Caragana frutex* (L.) K.Koch, 6.IX.2023, A.S. Kurochkin leg. (Figs 1–3).

REMARKS. This very common, calciphilous and widespread species is subendemic to the Russian Plain, largely characteristic of the region's forested steppe belt (Golovatch, 1984). Its distribution ranges from near Arkhangelsk, Vologda and Vyatka in the north

Figs 1–7. Habitat of *Polyxenus lagurus* and *Rossiulus kessleri* (6.IX.2023); individuals of *P. lagurus*: 1 — general view; 2, 3 — microhabitat under shrubs of *Euonymus verrucosus*; 4, 6, 7 — females in litter; 5 — female und a juvenile instar in litter.
Рис. 1–7. Биотоп *Polyxenus lagurus* и *Rossiulus kessleri* (6.IX.2023); особи *P. lagurus*: 1 — общий вид; 2, 3 — микростация под кустарниками *Euonymus verrucosus*; 4, 6, 7 — самки в подстилке; 5 — самка и незрелая личинка в подстилке.

to North Ossetia – Alania, Kalmykia and Dagestan, Northern Caucasus in the south, and from near Minsk, central Belarus in the west to Bashkortostan, the Orenburg and Saratov regions in the east (Lokshina, 1969; Kime, Enghoff, 2017; Golovatch, 2023). The above new record is thus among the easternmost. Prisnyi (2001) showed and depicted considerable variations in the structure, both peripheral and gonopodal, of *R. kessleri* in the Middle-Russian Upland within the Voronezh and Belgorod regions (mainly supporting arid dry steppes), generally referring to a valley-nemoral distribution pattern of this species.

Notes on bionomy

Both identified species of millipedes were recorded near the summit at the edge of a pine-broadleaved forest near a pine grove with petrophytic steppe vegetation (Fig. 1). The habitat is southern in exposure, sufficiently well shaded by shrubs (to keep the soil moist enough) and well warmed. Millipedes inhabit the litter and topsoil (dark-humus carbo-lithozems, see Abakumov *et al.*, 2008) under shrubby vegetation (Figs 2, 3),

where the number of *Polyxenus lagurus* reaches dozens of individuals per square meter, while *Rossiulus kessleri* were observed to be much less numerous (only several individuals per square meter). Apparently, this is under the shrubs and at a short distance off that a special microclimate is formed, one favorable as a habitat of these species of millipedes. None of which were recorded in the petrophytic steppe of the mountain pine forest adjacent to their habitat (or their density there is rather low due to drying heat on open grounds and a poorly developed humus layer).

Compliance with ethical standards

CONFLICTS OF INTEREST: The authors declare that they have no conflicts of interest.

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