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Beetles (Coleoptera) from the burrows of the great gerbil *Rhombomys opimus* (Lichtenstein, 1823) (Mammalia: Muridae) in the southern Turkmenistan

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Abstract. The study is the first attempt to generalize the data on the burrow biocenoses of the great gerbil (*Rhombomys opimus* (Lichtenstein, 1823)) in the region of persistent plague epizootics in the lowland part of the Karakum Desert (Southern Turkmenistan). The material was collected in May, November, and December of 1987–1988 using trapping cylinders in residential and non-residential colonies of the great gerbil. Coleoptera made up about 40% of the species composition of invertebrates; their share of the total abundance was 19%. The beetle fauna of the studied burrows was represented by fifteen species belonging to seven families (another four taxa from the Staphylinidae family were identified down to the genus level). *Atheta flagellicornis* G. Benick, 1967 was the most abundant species, common species were *Sepedophilus rufulus* (Hochhuth, 1849), *Aleochara jacobsoni* Kirshenblat, 1935 (Staphylinidae), and large zoophagous *Eremosphodrus dvorshaki* Casale et Vereschagina, 1986 (Carabidae). The photographs of *Atheta flagellicornis* (Staphylinidae) and *Bradyus pygmaeus* (Fischer von Waldheim, 1821) (Tenebrionidae) are provided for the first time.

Keywords: nidicolous beetles, Karakum Desert, beetles, mammals, rodents

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Научная статья

Жесткокрылые (Coleoptera) из нор большой песчанки *Rhombomys opimus* (Lichtenstein, 1823) (Mammalia: Muridae) на юге Туркмении

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Аннотация. Представлена первая попытка обобщить данные по жукам микробиоценозов нор большой песчанки (*Rhombomys opimus* (Lichtenstein, 1823)) в районе стойких эпизоотий чумы в низменной части Каракумов (Южная Туркмения). Материал был собран в мае, ноябре и декабре 1987–88 гг. при помощи ловчих цилиндров в жилых и нежилых колониях большой песчанки. Жесткокрылые составили около 40% видового состава беспозвоночных; их доля от общего числа особей насчитывает 19%. Фауна жесткокрылых исследованных нор представлена 15 видами из 7 семейств (еще 4 таксона из семейства Staphylinidae были определены до рода). Самым массовым в сборах был вид *Atheta flagellicornis* G. Benick, 1967, обычными – *Sepedophilus rufulus* (Hochhuth, 1849) и *Aleochara jacobsoni* Kirshenblat, 1935 (Staphylinidae), а также крупный зоофаг *Eremosphodrus dvorshaki* Casale et Vereschagina, 1986 (Carabidae). В статье впервые приводятся фотографии *Atheta flagellicornis* (Staphylinidae) и *Bradyus pygmaeus* (Fischer von Waldheim, 1821) (Tenebrionidae).

Ключевые слова: нидиколы, пустыня Каракумы, жуки, млекопитающие, грызуны

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Introduction

The natural focality of some especially dangerous diseases (plague, rickettsiosis, and viral infections) is closely related to the nest/burrow biocenoses of small mammals. A burrow is considered as an elementary focus of such infections. The pathogenic agents circulate in different ways and along different biocenotic chains, in which many systematic groups of living organisms participate. For this reason, the study of the fauna of burrows of common rodent species, considered the carriers of natural focal infections, is of particular interest. Taking into account the regional nature of a number of natural focal infections, arid territories occupy a special place in epizootic studies.

The study of the inhabitants of burrows and nests in various post-Soviet regions has been carried out

by employees of anti-plague stations and parasitologists since the beginning of the XX century. The most detailed studies of Coleoptera have been performed by Ya.D. Kirshenblat (1935, 1936a, b, 1937a, b), who considered the fundamental issues of the emergence of nidicolous beetles and the general provisions of biocenology in addition to faunistics and taxonomy. Subsequent works on the structure of burrow biocenoses were devoted to the regions adjacent to Turkmenistan, on the example of gerbil burrows (Kashcheev and Iskakov, 1981; Kashcheev, 1982b; Klimova et al., 1970; Klimova and Nelzina, 1971; Nelzina et al., 1978, etc.).

Ya.P. Vlasov (1937) with colleagues (Vlasov and Ioff, 1937; Vlasov and Kirichenko, 1937, etc.) were among the pioneer researchers of rodent nests (mainly different gerbil species) in Turkmenistan, followed by a number of authors (Bakhaeva, 1962; Dudnikova, 1960; Zagniborodova, 1960) studying certain groups of arthropods in the biocenoses of rodent burrows in Turkmenistan. Most publications were devoted to parasite fauna and did not consider other groups of invertebrates, including Coleoptera. The most complete information about the insects of burrowing consortia of gerbils in Turkmenistan (eastern Karakum) was presented by V.A. Krivokhatsky (1982, 1983, 1985) together with V.A. Kashcheev (Krivokhatsky and Kashcheev, 1986).

The study aims to characterize the species composition of beetles (Insecta: Coleoptera) in burrow biocenoses of the great gerbil *Rhombomys opimus* (Lichtenstein, 1823), which is the most common rodent species of the lowland part of the Central Karakum (Turkmenistan). This report is the first attempt to summarize the data on biocenoses of the great gerbil burrows in this part of its range, i.e., in the area of persistent plague epizootics. Given the present difficulties in studying the fauna and flora of Turkmenistan for foreign scientists, the collected material is largely unique.

Materials and methods

The material was collected by N.M. Ermakov in May, November, and December of 1987–1988 in the natural foci of the plague in the lowland part of the Karakum in the colonies of the great gerbil:

Turkmenistan, Akhal Velayat, Gökdepe Etrap, lowland part of the central Karakum Desert, environs of the city of Gökdepe (before 1993, Geok-Tepe), ridge-cellular sands.

The method of trapping cylinders was used to collect the material (Fasulati, 1971). Sampling was carried out both in residential and non-residential colonies of the great gerbil. Glass jars (0.4–0.5-L volume) were used as the trapping cylinders. A 1% formadehyde solution was used as a fixative; in cold (frosty) weather, glycerol was added. Cylinders were placed in the burrows at a 25–30-cm distance from the entrance. The upper cut of the cylinder was placed on a par with the soil surface in the burrow or 2–3 mm lower. Two cylinders (internal and external) were installed into each burrow. The total number of cylinders ranged from 5 to 10, depending on the size of the colony. A strip of metal foil (or glass) was inserted into the gap between the cylinders across the course of the burrow, rising 3–5 cm above the surface of the burrow and closely adhering to its walls (Fig. 1). It largely served as a barrier to animals moving along the burrow, which made it possible to estimate the direction of movement of invertebrates in the burrow (from the depth of the burrow or from the surface).

After removal of the cylinders, invertebrates were picked up manually or concentrated onto a fine sieve, then fixed in a 70% alcohol solution. During the field work, 77 samples containing beetles were obtained; in total, about 230 imago beetle specimens were collected. The material was stored in alcohol and mounted dry. Most of material is now stored in the collection of invertebrates of the Papanin Institute for Biology of Inland Waters, Russian Academy of Sciences (Borok, Russia). Some specimens were granted to the collection of the Zoological Institute of the Russian Academy of Sciences (St. Petersburg, Russia). Species nomenclature and general distribution data are taken according to the latest editions of the Catalogue of Coleoptera of the Palearctic (Alonso-Zarazaga et al., 2022; Catalogue..., 2007, 2015, 2017, 2020).

The illustrations were made by the first author using a Leica M165C stereo microscope on a Leica MC170 HD (12 MP) digital camera. Photos were processed and stacked in Sketchbook and Helicon Focus 7.7.4.

The Coleoptera were defined by A.S. Sazhnev with the help of colleagues studying particular taxonomic groups: K.V. Makarov (Carabidae), S. Anlaş and A.V. Kovalev (Staphylinidae), V.O. Kozminykh (Histeridae), L.V. Egorov (Tenebrionidae), and I.A. Zabaluev (Curculionidae).

Results and discussion

Great gerbil is a rodent species common for the lowland part of the central Karakum Desert, it is distributed everywhere in the region, so wider than other gerbils. As a rule, the great gerbils settle in colonies, their burrows are both temporary and permanent, simple and complex. The number of exits/entrances in burrows ranges from 7 to 900. The depth of the nesting chamber in the colonies may reach 2.7 m below the ground surface (Kamnev et al., 1968).

The characteristic features of the microclimate (lack of direct influence of sunlight, moderate thermal

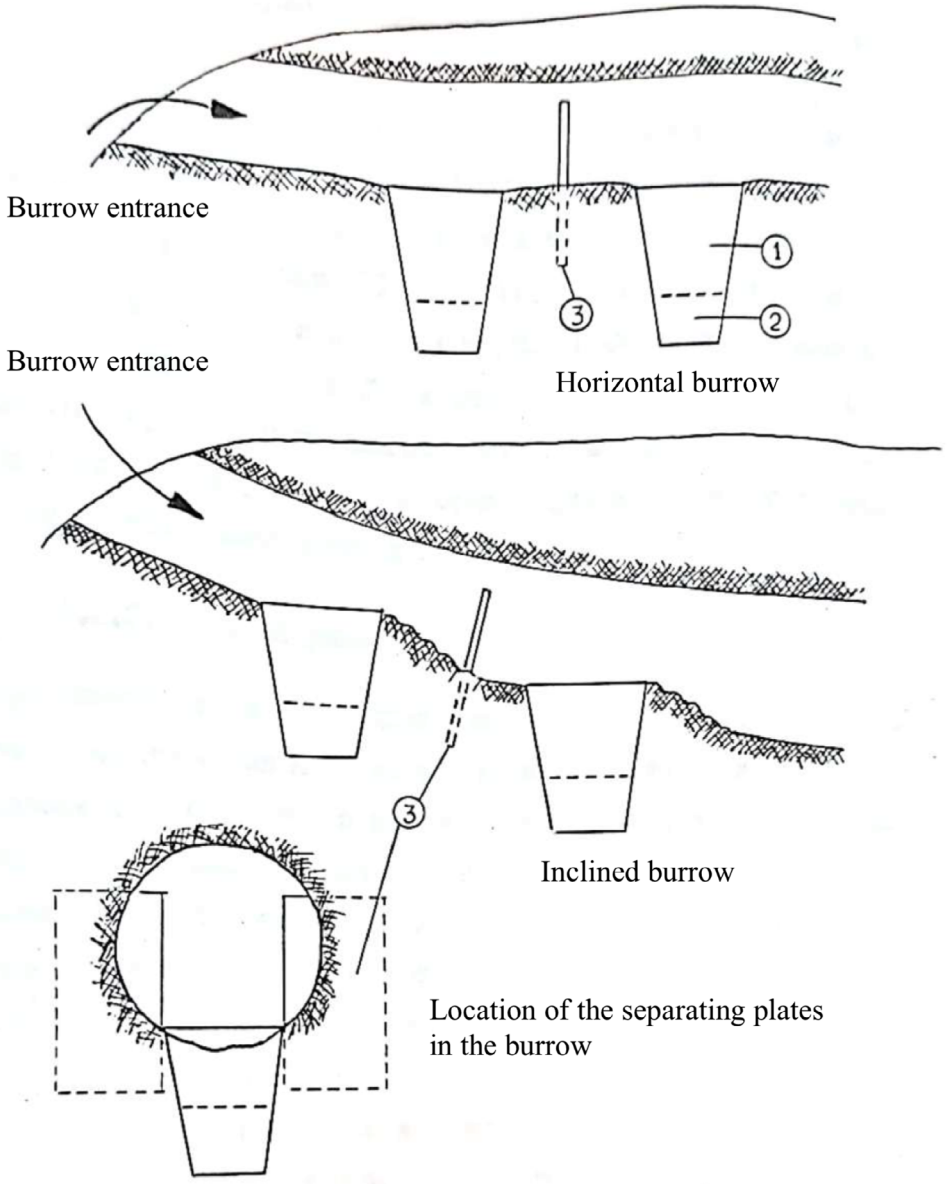

Fig. 1. Scheme of placement of trapping cylinders in rodent burrows. 1 – conical cylinder, 2 – level of the fixative liquid, 3 – separating plates.

conditions, and high relative humidity) make the burrow a special kind of microbiotope (Beklemishev, 1959; Vlasov, 1937). It serves as a habitat both for the host (consortium founder) and for many invertebrates and microorganisms (consorts). In the lowland part of the central Karakum Desert, beetles make up 40% of the species composition of invertebrates in the burrows of the great gerbil, their share in the total abundance of the main taxonomic groups is relatively permanent (19%).

Some beetles belonging to the Staphylinidae family (genera *Falagria, Haploglossa, Oxypoda* and *Heterothops*) were not identified down to the species level due to poor preservation and lack of serial material. An annotated list of the species found in the samples is given below.

Annotated list of Coleoptera species from the burrows of the great gerbil in the southern Turkmenistan

Carabidae

Eremosphodrus (*Rugisphodrus*) *dvorshaki* Casale et Vereschagina, 1986

Fairly common in our samples (31 ind. in 6 samples). Asian species, distributed in Kazakhstan, Turkmenistan, Uzbekistan, and Tajikistan. Zoophagous. Like many representatives of the Sphodrini tribe, it is a facultative nidicolous beetle.

Staphylinidae

Dropephylla caucasica (Kolenati, 1846)

Found singly, but quite constantly (7 ind. in 7 samples). The species was recorded in the central European part of Russia (probably, mistakenly);

noted for the Caucasus, Azerbaijan, Afghanistan, Iran, the Asian part of Turkey, Turkmenistan, and Kyrgyzstan. Probably, a saprophage. The bionomics of the species of the genus Dropephylla is poorly studied, indications for nests of mammals are known (Jászay and Hlavac, 2006).

Sepedophilus rufulus (Hochhuth, 1849)

Common in samples (38 ind. at 30 samples). The species is distributed in the south of the European part of Russia, in Azerbaijan, Armenia, Georgia, Afghanistan, Iran, Iraq, Asian Turkey, Turkmenistan, Uzbekistan, in the south of Western Siberia, in Pakistan, and India (Kashmir). Probably, a saprophage. Common in gerbil burrows (Krivokhatsky and Kashcheev, 1986), where it appears as a facultative nidicolous beetle.

Tachyporus (*Palporus*) *nitidulus* (Fabricius, 1781)

In the burrows of gerbils, it is represented by a single find (2 ind. in 1 sample). The species has a cosmopolitan distribution; it has been introduced to the New World, Africa, and Australian zoogeographic region. Ubiquist; probably, the finds in the burrows are accidental.

Aleochara (*Xenochara*) *jacobsoni* Kirshenblat, 1935

Common in samples (13 ind. in 16 samples). Described from the Mirzachol Steppe (clay-saline desert in Central Asia, located in south Kazakhstan, Turkmenistan, and Uzbekistan) from the burrows of the long-clawed ground squirrel *Spermophilopsis leptodactylus* (Lichtenstein, 1823) and the great gerbil (Kirschenblat, 1935). In the Palearctic Catalogue (Catalogue..., 2015), the species is listed for Kazakhstan and Turkmenistan, it is also indicated as the most common species in the burrows of the great gerbil in these regions (Krivokhatsky and Kashcheev, 1986). Recorded in burrows of little ground squirrel (*Spermophilus pygmaeus* (Pallas, 1778)) (Kirschenblat, 1937a). Obligate facultative nidicolous beetle.

Atheta (*Traumoecia*) *flagellicornis* G. Benick, 1967 (Fig. 2)

The most common species in samples (131 ind. in 36 samples). The species is known from the Asian part of Turkey, Syria, and Turkmenistan (Assing, 2006; Catalogue..., 2015), from where it has been described from the vicinity of Ashgabat (Benick, 1967). In Turkey and Syria, the species is found in the litter, on *Tamarix* sp., on the river bank (Assing, 2006); in Turkmenistan, it is an obligate nidicolous beetle. Perhaps, the taxon includes a complex of species.

Sunius nidicola (Kashcheev, 1982)

Relatively rare in samples (3 ind. in 3 samples). The species was described from the nesting chamber of the great gerbil from Kazakhstan (type locality "280 km east of Nukus (Uzbekistan)" (Kashcheev, 1982a) was specified in the revision of the genus (Assing, 2010), where the original holotype label "Karakalpakia, Chaban-Kazgan" is given (now Kazakhstan, city of Shobankazgan on the border with Uzbekistan)), also known from Turkmenistan. Obligate nidicolous beetle.

Heterothops cf. *praevius* Erichson, 1839

Relatively common in samples (6 ind. in 6 samples). The species is widely distributed in the Palearctic, known in Central Asia from Uzbekistan and Southeast Kazakhstan (Catalogue..., 2015; Kashcheev, 2002). Like other representatives of the genus, it may be nidicolous beetle optionally.

Philonthus (*Philonthus*) cf. *variabilis* Eppelsheim, 1892

Only 1 ind. (female) has been found, so undoubtful identification is problematic. The species is known only from Turkmenistan and Uzbekistan. Possibly may be nidicolous beetle optionally.

Histeridae

Erebidus vlasovi (Reichardt, 1941)

Rare in samples (3 ind. in 2 samples). A comparison with a sibling species E. reichardti Tishechkin & Lackner, 2012, revealed clear differences (reported by V.O. Kozminykh). Endemic to the arid Turan Province, known from single finds from Kazakhstan, Turkmenistan and Uzbekistan. Nidicolous species, associated with sands and loess soils (Kryzhanovsky and Reichard, 1976). Recorded in burrows of gerbils, long-clawed ground squirrel, etc. (Krivokhatsky and Kashcheev, 1986; Kryzhanovsky and Reichard, 1976).

Pholioxenus phoenix (Reichardt, 1929)

Rare in our samples (2 ind. in 2 samples), common in the burrows of the great gerbil (Krivokhatsky and Kashcheev, 1986). Turanian species, noted for Central Asia (Kazakhstan, Turkmenistan, and Uzbekistan). Nidicolous beetles, associated with gerbil burrows on loess and clayey soils, less often on fixed sands (Kryzhanovsky and Reichard, 1976).

Coccinellidae

Coccinella (*Coccinella*) *septempunctata* L., 1758

Widely distributed in the Palaearctic. Zoophagous, polyphagous; it mainly consumes aphids that live on both woody and herbaceous vegetation. It is not associated with mammalian burrows; one specimen found is a random case.

Cryptophagidae

Cryptophagus quadrimaculatus Reitter, 1877

Known in samples from 1 sample (4 ind.). Widely distributed in the Palearctic; known from Kazakhstan, Kyrgyzstan, Turkmenistan, Tajikistan, and Uzbekistan in Central Asia. Probably, may be nidicolous beetle optionally.

Tenebrionidae

Bradyus pygmaeus (Fischer von Waldheim, 1821) (Fig. 3)

Relatively rare in samples (3 ind. in 2 samples). Central Asian species: Afghanistan, Kazakhstan, Turkmenistan, and Uzbekistan. Widespread in the

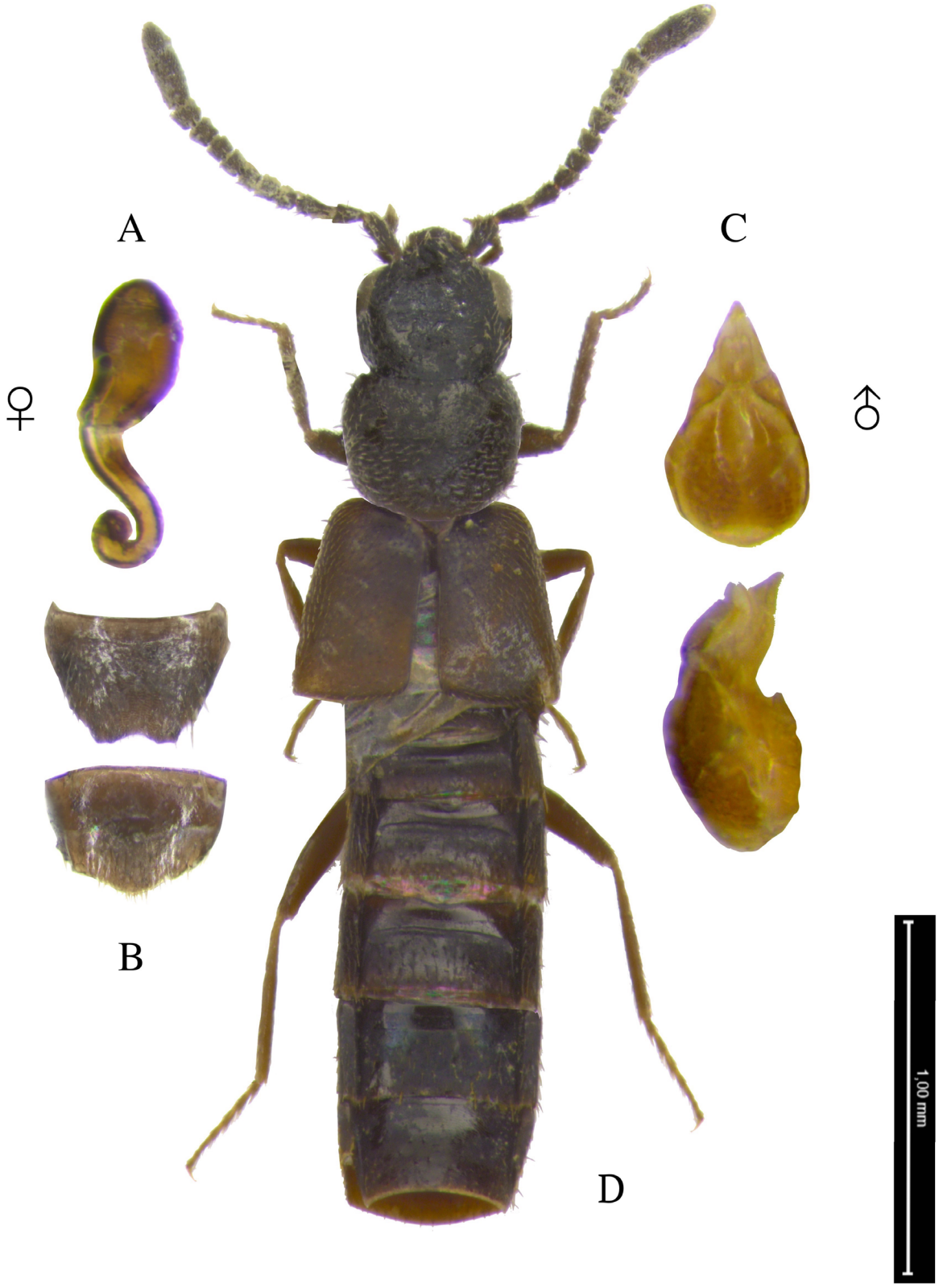

Fig. 2. *Atheta* (*Traumoecia*) *flagellicornis* G. Benick, 1967: **A** – spermatheca (lateral view), **B** – tergite VIII and sternite of female, **C** – aedeagus (dorsal and lateral view), **D** – general view (male).

Fig. 3. Male of *Bradyus pygmaeus* (Fischer von Waldheim, 1821).

Karakum and Kyzylkum deserts (Medvedev and Nepesova, 1985), may be nidicolous beetle optionally.

Curculionidae

Sitona macularius (Marsham, 1802)

In training camps random (1 ind.). The West Palearctic species is associated in development with various types of legumes. First reported for Turkmenistan (Alonso-Zarazaga et al., 2022).

Conclusions

In Turkmenistan, beetles make up about 40% of the species composition of invertebrates and 19% of the total abundance in the burrows of the great gerbil. In the lowland part of the Central Karakum, the beetle fauna of the studied burrows is represented by 15 species from 7 families (another 4 taxa from the Staphylinidae family are identified down to the genus level). Obligate and facultative nidicolous beetles are found, as well as randomly sampled species that are not the representatives of the burrow fauna. The beetles of the Staphylinidae family (12 taxa) are the most represented in the samples, both quantitatively and qualitatively. The most abundant is *Atheta flagellicornis,* followed by two other species of rove beetles, *Sepedophilus rufulus* and *Aleochara jacobsoni.* The large zoophagous *Eremosphodrus dvorshaki* (Carabidae) is also quite common in the samples.

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