

*To the cherished memory of Jacob Avadievich Birstein (1911–1970)*

# The State of the Art of Biospeleology in Russia and Other Countries of the Former Soviet Union: a Review of the Cave (Endogean) Invertebrate Fauna. 1. Introduction—Crustacea<sup>1</sup>

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**Abstract**—At least 308 species or subspecies of stygo- or troglobionts and at least 735 species or subspecies of mostly presumed stygo- or troglaphiles representing 17 phyla, 38 classes, 90 orders, and 278 families of invertebrates are currently known to populate the caves and subterranean waters of Russia and other countries of the former Soviet Union. The main evolutionary burst in the endogean habitats including the MSS (milieu souterrain superficiel, or mesovoid shallow stratum) is observed in arthropods, primarily crustaceans, collembolans, and beetles. The major centers of taxonomic diversity among stygo- and troglobionts within the study region are the Caucasus (181 species, or almost 59%) and Crimea (44 species, or over 14%), which are montane karstified “glacial” refugia of the nemoral biota. The contribution of the other major regions including karstified areas is considerably smaller and gradually decreases from Central Asia (35 species; over 11%), the Far East (33; nearly 11%), the Ukrainian Carpathians with Podolia (12; almost 4%), the Russian Plain (7; over 2%), the Urals and Ural region (7; over 2%) to Siberia (5 species; 1.6%). Inventorying remains a topical problem in assessing the stygo- and troglfaunas of the territories in question. The most complete bibliography possible is included.

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Biospeleology is the study of organisms that live in caves. Most of them are animals, since green plants are practically never to be found in the permanent darkness of the underground cavities and waters. They inhabit not only large structures that are commonly referred to as caves or grottoes but also much smaller cavities, reservoirs, and streams: fissures, micro-caverns, deeper horizons of loose soils and rocks, and in places also specific habitats within the soil or bed-rock layers termed MSS (an acronym of “mesovoid shallow stratum” or the French “milieu souterrain superficiel”) (see, e.g., Vandel, 1960; Juberthie, 1983; Deharveng and Bedos, 2012). The boundaries between the edaphic, interstitial, and cavernicolous faunas are quite vague (see, e.g., Ljovuschkin, 1972b).

The organisms occurring in caves are commonly subdivided into the following categories: **trogloxenes**, which occasionally enter the endogean environment but cannot reproduce there, **troglophiles**, which can colonize endogean cavities, reproduce, and establish more or less permanent populations in them, and, finally, **troglobionts**, which are sufficiently specialized forms adapted to subterranean life. It is representatives of the latter group that most frequently possess specific adaptive traits differentiating them from their epigeal relatives, such as pronounced reduction of the eyes or complete blindness, loss of pigmentation, elongation of appendages, including antennae, and other outgrowths of the body, and sometimes the so-called “cave gigantism.” The inhabitants of subterranean waters are subdivided in a similar way into stygoxenes, stygophiles, and stygobionts. The great

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majority of them are invertebrates, mostly arthropods: crustaceans, chelicerates, myriapods, and insects (see Birstein and Ljovuschkin, 1967a). Troglo- and stygobionts are generally characterized by very high diversity and degree of endemism, both in regions with sufficiently warm temperate climate and in tropical ones. They mainly occur in regions with karst landscapes, i.e., land forms resulting from erosion and dissolution of quite ancient, mostly calcareous rocks (Deharveng and Bedos, 2012). Caves, subterranean cavities, and streams can also be formed in halite strata, glaciers, marine intertidal zones, and even in place of eroded lava tubes or large bubbles in the lava. Still, the main faunistic diversity in caves and subterranean waters is associated with calcareous karst areas.

It is the true cave inhabitants, i.e., troglo- and stygobionts that demonstrate pronounced traits of troglomorphism, or distinct morphological adaptations to subterranean life, which are sometimes present in very odd forms and combinations. The cave-dwelling organisms displaying such characters are usually placed in this ecological category, even though their biology and distribution may be insufficiently known.

The founder of biospeleology in the USSR was Jacob Avadievich Birstein (1911–1970), who worked since 1936 to the end of his life at the Department of Zoology and Comparative Anatomy of Invertebrates of the Faculty of Biology and Soil Sciences, Lomonosov Moscow State University. Among his outstanding contributions to the Soviet science and economy was the project of introduction of the polychaete *Nereis diversicolor* from the Sea of Azov to the Caspian Sea, in which he participated in 1939–1940 together with the head of the department, Academician L.A. Zenkevitch. Since 1948, the introduced polychaete has been the principal trophic resource for fish, including sturgeons. The many years of studying brackish- and freshwater invertebrates led J.A. Birstein to an important general conclusion about the role of continental reservoirs as refugia for faunistic relicts. During his thorough research of the deep-sea benthos, in particular the taxonomic studies of marine crustaceans, he described over 100 new species and genera. Besides, his interest in the relict groups stimulated his work on collecting and summarizing data on the endogean fauna of the USSR. J.A. Birstein was an outstanding teacher and speaker. His lectures were clear and intelligible, full of impromptu pieces, and he delivered

them with his invariable unlit pipe in the corner of his mouth, using neither notes nor the microphone. His lecture hall was always overcrowded, not only by the first year students whom J.A. Birstein taught the obligatory course of invertebrate zoology, but also by senior students, teachers, and researchers from other departments.

A number of his colleagues and friends, in particular V.I. Zhadin, E.V. Borutzky, V.V. Redikortsev, I.I. Malevich, and some other distinguished zoologists, worked actively together with J.A. Birstein since the early 1930s, i.e., since the very beginning of his regular studies of the endogean fauna of the USSR. Some of his pupils who actively worked in the field of biospeleology in the USSR from the 1940s to the 1970s were S.I. Ljovuschkin, Ya.I. Starobogatov, N.T. Zaleskaya, and others. They were among the first contributors to the *Biospeologica Sovietica* series, founded by J.A. Birstein in 1940, which comprised over 50 publications. This series made a natural contribution to the worldwide biospeleological research. Biospeleology as a discipline originated as early as at the beginning of the XX century, when the *Biospeologica* series was published, which united the numerous papers and monographs by the outstanding scientists and organizers of research of the world endogean fauna: the Romanian carcinologist Emil Racoviță and the French entomologist and biogeographer René Jeannel.

Russia and other countries of the former USSR occupy a vast territory that lies entirely in the areas of cold and temperate climates. The main karst areas and, correspondingly, the great majority of troglo- and stygobionts are to be found in its relatively warm southern parts, first of all in the Caucasus, Crimea, and Central Asia. Although some fairly incomplete reports on the regional endogean faunas of the Caucasus and Crimea (Lebedinsky, 1900, 1904, 1914; Lebedev, 1912, 1914; Pliginsky, 1912, 1914, 1927; Shugurov, 1913; Mokrzhetzsky, 1914) and particularly of Georgia (Zaitsev, 1948), existed before the works of J.A. Birstein, it was he who initiated systematic research of the cave faunas of these and other regions, taking the most active part in expeditions and collection of invertebrates. He was also the co-author of the first major publication summarizing the results of biospeleology development in the USSR (Birstein and Ljovuschkin, 1967a), according to which the known endogean fauna of the country comprised over

470 species, including at least 185 troglobionts. As could be expected, the highest diversity of cave faunas was recorded in the Caucasus and Crimea, since these regions are the largest “glacial” refugia of the nemoral biota that has been preserved in some mountain areas at the southern periphery of the Holarctic (De Lattin, 1967). Among the recent publications, the monograph of Kniss (2001) is to be noted despite some inaccuracies and fairly incomplete data; it comprises about 640 animal species for the caves and subterranean waters of the former USSR territory, and includes separate lists of localities for the main speleological regions. Besides, there are still more recent reviews of the endogean faunas of Ukraine (Zagorodnyuk, 2004) and Georgia (Barjadze et al., 2015a).

Our review of the endogean fauna of Russia and the adjacent territories of the former USSR contains as complete a list of troglo- and stygobionts as possible, together with data on their ecological status and distribution. It is these forms which determine the aspect and specificity of the cave faunas. Among all the endogean forms, invertebrates are characterized by a much higher diversity and a much lower level of knowledge despite the great number of publications. Correspondingly, this paper is focused on invertebrates, of which the troglo- and stygophiles are less extensively covered while the occasional “cave guests,” i.e., troglo- and stygoxenes, are given almost no attention. The group of bats (Chiroptera), typical of caves, and many parasitic and phoretic organisms associated with these mammals are not included since all of them are trogliphiles or troglloxenes. As a result, of all the vertebrates present in the study region, only one endogean fish, *Paracobitis starostini* (Parin, 1983) from Turkmenistan, which is undoubtedly a stygobiont species, is listed in this review. Data on this species as well as on the troglophilous and troglloxenous vertebrates were considered in sufficient detail by Kniss (2001) and do not need to be repeated here. Besides, since our paper is dedicated to the memory of J.A. Birstein, we confine ourselves to the review of invertebrates and largely follow the outline of his first large summarizing work (Birstein and Ljovuschkin, 1967a).

It should be noted that many caves, especially the long-known ones, often have more than one name. Some synonyms are given in parentheses in this review, but more complete lists can be found in a number of special publications (see, e.g., Kniss, 2001; Isaev et al., 2005; Isaev, 2014; Barjadze et al., 2015a).

The following biospeleological regions corresponding to the main karst areas are presently distinguished in the former USSR territory (e.g., Gvozdetski et al., 1994; Kniss, 2001): Central Russia, the Urals, Siberia, Crimea, the Caucasus, Central Asia, south of the Russian Far East, and also Transcarpathia and Transnistria. Regional reviews of the endogean biota, including the faunas of some individual caves, have been published: Central Russia (Korchagin, 1889; Behning, 1940; Birstein and Ljovuschkin, 1966; Kniss, 1980a; Chertoprud et al., 2011; Kapralov and Chernorudsky, 2009; Kapralov, 2015); the Urals (Kniss, 1984b, 1987b, 1987d, 1989, 1994, 1996, 1997, 1999; Smirnov and Kniss, 1986; Kniss and Smirnov, 1990; Pankov and Krainev, 2003, 2004; Chertoprud et al., 2006; Pankov et al., 2006, 2009; Abdullin and Kniss, 2008; Pankov, 2008; Abdullin et al., 2012); Siberia (Malkov and Marinin, 1989; Kniss, 1991); Crimea (Lebedev, 1900, 1904, 1914; Novikov, 1912; Lebedev, 1912, 1914, 1927; Shugurov, 1913; Mokrzhetzsky, 1914; Pliginsky, 1914, 1927; Birstein, 1963a, 1963b; Koval, 2001; Amelichev, 2005; Kovtun, 2010; Kovtun and Pronin, 2011; Vorobieva et al., 2012; Turbanov and Prokopov, 2015); the Caucasus (Shugurov, 1913; Borutzky, 1930d, 1947; Zaitsev, 1940, 1948; Birstein, 1950; Birstein and Ljovuschkin, 1960, 1965c; Dzhanashvili and Okrozhanashvili, 1963; Ljovuschkin, 1963a, 1966a, 1971a; Kobakhidze, 1963; Dzhanashvili, 1965, 1971c, 1980; Koval, 2004a, 2004b; Sendra and Reboleira, 2012; Sidorov et al., 2014; Sokolova and Palatov, 2015; Barjadze et al., 2015a, 2015b); Central Asia (Vlasov, 1937; Yankovskaya, 1972a); the Far East (Ljovuschkin, 1965; Sidorov and Semenchenko, 2009); Transcarpathia and Transnistria (Ljovuschkin, 1962; Koval, 2002; Vargovich and Monich, 2004; Zagorodnyuk, 2004). In addition, there are more general publications devoted to the endogean fauna of Russia and other territories of the former USSR (Birstein, 1940a, 1940b, 1946, 1952a, 1970, 1985; Birstein and Lopashov, 1940; Borutzky, 1947a; Bey-Bienko and Birstein, 1966; Ljovuschkin, 1966b, 1969; Birstein and Ljovuschkin, 1967a; Kniss and Smirnov, 1987, 1992; Kniss, 2001, 2004).

According to the data of Kniss (2001), the faunistic diversity of troglo- and stygobionts is the highest in the southern, mostly mountain peripheral regions of the former USSR: in the Caucasus, Crimea, Central Asia, and the south of the Russian Far East (40, 34, 34, and 31%, respectively); there are very few such forms in the much colder regions of Siberia, Central Russia,

and the Urals (1, 2, and 3%, respectively). A similar but shorter analysis is included in this communication as well. The zoogeographic relations of different cave faunas were recently considered by Kniss (2004), and his data remain up to date. The first analysis of these relations was also performed by J.A. Birstein.

**KINGDOM CHROMISTA**  
CAVALIER-SMITH, 1981

Phylum **Ochrophyta** Cavalier-Smith, 1995

Class **Bacillariophyceae** Haeckel, 1878

Order **Rhopalodiales** D.G. Mann, 1990

Family Rhopalodiaceae (Karsten)

Topachevs'kyj et Oksiyuk, 1960

*Pyxidicula patens* Claparède et Lachman, 1858. Possibly a stygophile. Found in the Mamed-Yar brackish well in the Karakum Desert (Turkmenistan) (Brodsky, 1929).

*Pyxidicula minutissima* Brodsky, 1929. Possibly a stygophile. Described from the Mamed-Yar brackish well in the Karakum Desert (Turkmenistan) (Brodsky, 1929).

Class **Chrysophyceae** Pascher, 1914

Order **Ochromonadales** Pascher, 1910

Family Paraphysomonadaceae

Preisig et Hibberd, 1983

*Paraphysomonas bandaiensis* (Hibberd, 1979). Possibly a stygophile. Recorded in Vorontsovskaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Mylnikov et al., 2006).

Family Chromulinaceae Engler, 1897

*Spumella* sp. Possibly a stygophile. Recorded in Vorontsovskaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Mylnikov et al., 2006).

Class **Raphidophyceae** Chadeffaud et Silva, 1980

Order **Thaumatomonadida** Shirkina, 1987

Family Thaumatomastigidae Patterson et Zolffel, 1991

*Thaumatomonas seravini* Mylnikov et Karpov, 1993. Possibly a stygophile. Recorded in Vorontsovskaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Mylnikov et al., 2006).

**KINGDOM RHIZARIA**  
CAVALIER-SMITH, 2002

Phylum **Cercozoa** Cavalier-Smith, 1998

Class **Imbricatea** Cavalier-Smith, 2003

Order **Euglyphida** Copeland, 1956

Family Euglyphidae Wallich, 1864

*Assulina seminulum* (Ehrenberg, 1848). Possibly a stygophile. Found in adits in Zhiguli Mts. (Stavropol Distr., Samara Prov.) (Mazei et al., 2012).

*Euglypha alveolata oblonga* Brodsky, 1928. Possibly a stygophile. Described from the Mamed-Yar brackish well in the Karakum Desert (Brodsky, 1929).

*Euglypha denticulata* Brown, 1912. Possibly a stygophile. Found in the Mamed-Yar, Gildybai, and Ierbent brackish wells in the Karakum Desert (Turkmenistan) (Brodsky, 1929).

*Euglypha rotunda* Wailes, 1915. Possibly a stygophile. Found in the Mamed-Yar brackish well in the Karakum Desert (Brodsky, 1929), and also in adits in Zhiguli Mts. (Stavropol Distr., Samara Prov.) (Mazei et al., 2012).

*Corythion dubium* Taranek, 1871. Possibly a stygophile. Found in the Mamed-Yar brackish well in the Karakum Desert (Turkmenistan) (Brodsky, 1929).

*Sphenoderia lenta* Schlumberger, 1845. Possibly a stygophile. Found in the Mamed-Yar brackish well in the Karakum Desert (Turkmenistan) (Brodsky, 1929).

Family Trinematidae Hoogenraad et de Groot, 1940

*Trinema complanatum* Penard, 1890. Possibly a stygophile. Found in adits in Zhiguli Mts. (Stavropol Distr., Samara Prov.) (Mazei et al., 2012).

*Trinema enchelys* (Ehrenberg, 1838). Possibly a stygophile. Found in the Ierbent and Mamed-Yar brackish wells in the Karakum Desert (Turkmenistan) (Brodsky, 1929) and in adits in Zhiguli Mts. (Stavropol Distr., Samara Prov.) (Mazei et al., 2012).

*Trinema enchelys galeata* (Penard, 1890). Possibly a stygophile. Found in the Mamed-Yar brackish well in the Karakum Desert (Turkmenistan) (Brodsky, 1929).

*Trinema lineare* Penard, 1890. Possibly a stygophile. Found in the Mamed-Yar brackish well in the Karakum Desert (Turkmenistan) (Brodsky, 1929).

Class **Sarcomonadea** Cavalier-Smith, 1993

Order **Glissomonadida** Howe, Bass,  
Vickerman, Chao et Cavalier-Smith, 2009

Family Allapsidae Howe, Bass,  
Vickerman, Chao et Cavalier-Smith, 2009

*Allantion tachyploon* Sandon, 1924. Possibly a stygophile. Recorded in Vorontsovskaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Mylnikov et al., 2006).

Order **Cercomonadida** Poche, 1913

Family Heteromitidae Kent, 1880

*Heteromita globosa* (Stein, 1878). Possibly a stygophile. Recorded in Vorontsovskaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Mylnikov et al., 2006).

*Heteromita* sp. Possibly a stygophile. Recorded in Vorontsovskaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Mylnikov et al., 2006).

Phylum **Foraminifera** d'Orbigny, 1826

Class **Globothalamea** Pawlowski,  
Holzmann et Tyszk, 2013

Order **Rotaliida** Delage et Herouard, 1896

Family Bolivinitidae Cushman, 1927

*Bolivina brodskyi* Mikhalevich, 1976. Probably a stygophile. Described from subterranean waters in Turkmenistan: the wells Bokurdak (Ahal Region; depth 20 m), Mairamiloi (80 m), Bugdali (7 m) (Balkan Region), and Mauli (16 m) (Ahal Region) (Mikhalevich, 1976).

Family Discorbidae Ehrenberg, 1838

*Discorbina* sp. Probably a stygophile. Recorded in the Midzhair brackish well in the Karakum Desert (Turkmenistan) (Brodsky, 1929).

*Discorbis subterranea* Mikhalevich, 1976. Probably a stygophile. Described from subterranean waters in Turkmenistan: the wells Bokurdak (Ahal Region; depth 20 m), Mairamiloi (80 m), and Kafigshem (5 m) (Balkan Region) (Mikhalevich, 1976).

Family Cibicididae Cushman, 1927

*Cibicides strelkovi* Mikhalevich, 1976. Described from subterranean waters in Central Asia; found in the wells Bessyk-Ty (depth 7 m), Tyu-Sup-Berdy (30 m)

(Mangystau Prov., Kazakhstan), Mairamiloi (80 m), Bugdali (7 m) (Balkan Region, Turkmenistan), Mauli (16 m), Bachardok (20 m), and Ierbent (30 m) (Ahal Region, Turkmenistan) (Mikhalevich, 1976).

Family Elphidiidae Galloway, 1933

*Elphidiella* sp. Possibly a stygophile. Found in subterranean waters on southern shores of Lake Issyk Kul (Kyrgyzstan) (Yankovskaya, 1972a), and also in wells in Turkmenistan: Mairamiloi (depth 80 m), Bugdali (7 m) (Balkan Region), and Mauli (16 m) (Ahal Region) (Mikhalevich, 1976).

*Elphidium* sp. Probably a stygophile. Reported from subterranean waters of the Bokurdak well (Ahal Region, Turkmenistan; depth 20 m) (Mikhalevich, 1976).

Family Globigerinidae Carpenter et al., 1862

*Globigerina turkomanica* Brodsky, 1929. Possibly a stygophile. Described from the Khalka brackish well in the Karakum Desert (Turkmenistan) (Brodsky, 1929).

Family Turrilinidae Cushman, 1927

*Turrilina turkomanica* Mikhalevich, 1976. Probably a stygophile. Described from subterranean waters of the Bokurdak well (Ahal Region, Turkmenistan; depth 20 m) (Mikhalevich, 1976).

Order **Lituolida** Lankester, 1885

Family Haplophragmoididae Maync, 1952

*Haplophragmoides brodskyi* Mikhalevich, 1976. Probably a stygophile. Described from subterranean waters of the Bokurdak well (Ahal Region, Turkmenistan; depth 20 m) (Mikhalevich, 1976).

*Haplophragmoides* sp. Possibly a stygophile. Reported from subterranean waters of Turkmenistan (Golemansky and Bonnet, 1994).

*Trochamminita* sp. A stygophile. Reported from a brackish lake in Kaptar-Khana Cave (Lebap Region, Turkmenistan) (Birstein and Ljovuschkin, 1965c, 1967b).

Family Trochamminidae Schwager, 1877

*Jadammina zernovi* Schmalhausen, 1950 (= ?*Jadammina polystoma* Bartenstein et Brand, 1938). A stygophile. Reported from a brackish lake in Kaptar-Khana Cave (Lebap Region, Turkmenistan) (Birstein and Ljovuschkin, 1965c, 1967b). Described from Lake

Balpash-Sor (Kokshetau Prov., Kazakhstan) (Schmalhausen, 1950).

*Jadammina polystoma caspica* Maier, 1972. Probably a stygobiont. Described from subterranean waters of Central Asia (Maier, 1979, cited after Kniss, 2001).

Order **Textulariida** Delage et Hérouard, 1896

Family Textulariidae Ehrenberg, 1838

*Textularia* sp. Possibly a stygophile. Reported from the Midzhagir brackish well in the Karakum Desert (Turkmenistan) (Brodsky, 1928, 1929).

Class **Monothalamea** Haeckel, 1862,  
emend. Pawlowski et al., 2013

Order **Allogromiida** Loeblich et Tappan, 1961

Family Lagynidae Schultze, 1854

*Diplophrys archeri* Barker, 1868. Possibly a stygophile. Reported from Geograf (= Iograf) Cave in Crimea (Lebedinsky, 1904).

Class **Tubothalamea** Pawlowski,  
Holzmann et Tyszk, 2013

Order **Miliolida** Delage et Hérouard, 1896

Family Fischerinidae Millett, 1898

*Fischerina* sp. Possibly a stygophile. Found in the brackish wells Kara-Adzhi, Oyukly, Kyzyl-Sakal, Bakht, Geldy-Bai, Kaushok-Kyzyl-Takyr, Okly, Ierbent, Kosha-Takyr, Geldy-Dar, and Tanderli in the Karakum Desert (Turkmenistan) (Nikolyuk, 1948).

Family Hauerinidae Schwager, 1876

*Biloculina turkomanica* Brodsky, 1928. Possibly a stygophile. Described from the Ierbent brackish well in the Karakum Desert (Turkmenistan) (Brodsky, 1928); later also recorded in the Midzhair well in the same desert (Brodsky, 1929).

*Triloculina turkomanica* Brodsky, 1929. Possibly a stygophile. Described from the Ierbent brackish well in the Karakum Desert (Turkmenistan) (Brodsky, 1929).

Family Miliamminidae Saidova, 1981

*Miliammina oblonga arenacea* Chapman, 1916 (= *Biloculina elongata turkomanica* Brodsky, 1928). Possibly a stygophile. Reported from the Ierbent brackish well in the Karakum Desert (Turkmenistan)

(Brodsky, 1928); later also found in the wells Chaashkyn, Midzhair, Oyukly, Bakht, Geldy-Bai, Kaushok-Kyzyl-Takyr, Gely-Dar, and Tanderli in the same desert (Brodsky, 1929; Nikolyuk, 1948).

*Miliammina* sp. A stygophile. Reported from a brackish lake in Kaptar-Khana Cave (Lebap Region, Turkmenistan) (Birstein and Ljovuschkin, 1965c, 1967b).

Family Spiroloculinidae Wiesner, 1920

*Spiroloculina turkomanica* Brodsky, 1928. Possibly a stygophile. Described from brackish wells in the Karakum Desert (Turkmenistan), where it is the most common foraminiferan. Known from many wells in this desert (Brodsky, 1928, 1929; Nikolyuk, 1948).

**Foraminifera incertae sedis**

Order Lagenida Delage et Hérouard, 1896

Family Lagenidae Reuss, 1862

*Lagena* sp. Tentatively reported from Kizil-Koba (= Krasnaya) Cave in Crimea (Russia) (Lebedinsky, 1900).

*Lagena subterranea* Brodsky, 1929. Possibly a stygophile. Described from the Ierbent brackish well in the Karakum Desert (Turkmenistan) (Brodsky, 1929).

*Lagena turkomanica* Brodsky, 1929. Possibly a stygophile. Described from the Mamed-Yar brackish well in the Karakum Desert (Turkmenistan) (Brodsky, 1928, 1929).

Family Nodosariidae Ehrenberg, 1838

*Nodosauria turkomanica* Brodsky, 1929. Possibly a stygophile. Described from the Geldybai brackish well in the Karakum Desert (Turkmenistan); also recorded in the Koushak-Kyzyl-Takyr well in the same desert (Brodsky, 1928, 1929).

**SUPERPHYLUM ALVEOLATA**  
CAVALIER-SMITH, 1991

Phylum **Ciliophora** Doflein, 1901

Class **Phyllopharyngea** de Puytorac et al., 1974

Subclass **Suctorina** Claparède et Lachmann, 1858

*Suctorina* gen. sp. Epibiont forms, found on hypogean amphipods in caves of the Western Transcaucasia: Dzhokhara (Gagra Distr., Abkhazia), Beloskal-

skaya, and Ushchel'naya (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Birstein, 1950).

Order **Endogenida** Collin, 1912

Family Acinetidae Stein, 1859

*Tokophrya niphargi* (Strouhal, 1939). A stygobiont parasitizing amphipods. Recorded in springs in Mezhgorsky Distr., Zakarpattia Prov. of Ukraine on *Iphigenella shablensis* Carausu, 1943 (Dovgal, 2003a, 2003b), and in springs near Rodnikovoe (Crimea) on *Gammarus balcanicus* Schaferna, 1922 (Dovgal and Vargovitsh, 2010; Dovgal, 2016).

Order **Evaginogenida** Jankowski, 1978

Family Dendrocometidae Haeckel, 1866

*Dendrocometes paradoxus* Stein, 1852. A parasitic ciliate found on the gills of the stygobiont amphipod *Synurella* sp. in springs in the Holosiivskiyi Nature Park in Kiev, Ukraine (Boshko, 2010).

Order **Exogenida** Collin, 1912

Family Spelaeophryidae Jankowski in Batische, 1975

*Spelaeophrya troglocaridis* Stammer, 1935. A stygobiont, a parasite of stygobiont shrimps of the genus *Troglocaris*. Found in Nizhnyaya Shakuranskaya Cave (Gulripshi Distr., Abkhazia) on *Troglocaris osterloffii* Jusbaschjan, 1940 (Dovgal and Vargovitsh, 2010).

Class **Prostomatea** Schewiakoff, 1896

Order **Prorodontida** Corliss, 1974

Family Holophryidae Perty, 1852

*Holophrya simplex* Schewiakoff, 1893. Possibly a stygophile. Found in the Shiikh brackish well in the Karakum Desert (Turkmenistan) (Brodsky, 1929).

Class **Oligohymenophorea** de Puytorac et al., 1974

Order **Sessilida** Stein, 1933

Family Epistylididae Kahl, 1933

*Rhabdostyla ovum* Kent, 1881. Possibly a stygophile. Found in the Mamed-Yar brackish well in the Karakum Desert (Turkmenistan) (Brodsky, 1929).

Order **Apostomatida** Chatton et Lwoff, 1928

Family Foettingeriidae Chatton, 1911

*Gymnodinioides* sp. A stygobiont, an endoparasite of various shrimps. Found in Nizhnyaya Shakuranskaya Cave (Gulripshi Distr., Abkhazia) on *Troglo-*

*caris osterloffii* Jusbaschjan, 1940 (Dovgal and Vargovitsh, 2010; Dovgal, 2016).

Class **Spirotrichea** Bütschli, 1889

Order **Euplotida** Small et Lynn, 1985

Family Euplotidae Ehrenberg, 1838

*Euplotes harpa* Stein, 1859. Possibly a stygophile. Found in the Mamed-Yar brackish well in the Karakum Desert (Turkmenistan) (Brodsky, 1929).

Phylum **Myzozoa** Cavalier-Smith et Chao, 2004

Class **Dinophyceae** Fritsch, 1927

Order **Desmomastigales** Bourrelly, 1970

Family Protaspidaceae Skuja, 1939

*Protaspis simplex* Vørs, 1992. Possibly a stygophile. Recorded in Vorontsovskaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Mylnikov et al., 2006).

Class **Colponemea** Cavalier-Smith, 1993

Order **Colponemida** Cavalier-Smith, 1993

Family Colponemidae Cavalier-Smith et Chao, 2004

*Colponema edaphicum* Mylnikov et Tikhonenkov, 2007. Possibly a stygophile. Described from Vorontsovskaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Mylnikov et Tikhonenkov, 2007).

KINGDOM **PROTOZOA** R. OWEN, 1858

SUBKINGDOM **SARCOMASTIGOTA**

CAVALIER-SMITH, 1983

Group **Excavata** (Cavalier-Smith), 2002

Phylum **Euglenozoa** Cavalier-Smith, 1981

Class **Euglenophyceae** Schoenichen, 1925

Order **Peranemida** Bütschli, 1884

Family Peranemaceae Ching, 1940

*Heteronema acus* F. Stein, 1878. Possibly a stygophile. Reported from Suuk-Hoba (= Kholodnaya) and Geograf (= Iograf) Caves, Crimea (Lebedinsky, 1900).

Class **Kinetoplastea** Honigberg, 1963

Order **Eubodonida** Vickerman, in Moreira et al., 2004

Family Bodonaceae Bütschli, 1884

*Bodo designis* Skuja, 1948. Possibly a stygophile. Recorded in Vorontsovskaya Cave (Khosta Distr.,

Sochi Urban Area, Krasnodar Terr.) (Mylnikov et al., 2006).

*Bodo saliens* Larsen et Paterson, 1990. Possibly a stygophile. Recorded in Vorontsovskaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Mylnikov et al., 2006).

*Bodo saltans* Ehrenberg, 1838. Possibly a stygophile. Recorded in Vorontsovskaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Mylnikov et al., 2006).

*Cercomonas granulifera* (Hollande, 1942). Possibly a stygophile. Recorded in Vorontsovskaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Mylnikov et al., 2006).

*Cercomonas laciniaegerens* (Krassilstschick, 1886). Possibly a stygophile. Recorded in Vorontsovskaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Mylnikov et al., 2006).

*Cercomonas* sp. Possibly a stygophile. Recorded in Vorontsovskaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Mylnikov et al., 2006).

*Dimastigella mimosa* Frolov, Mylnikov et Malyshva, 1997. Possibly a stygophile. Recorded in Vorontsovskaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Mylnikov et al., 2006).

*Rhynchomonas nasuta* (Stokes) Klebs, 1892. Possibly a stygophile. Recorded in Vorontsovskaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Mylnikov et al., 2006).

Phylum **Metamonada** Cavalier-Smith, 1987

Class **Trepomonadea** Wenyon, 1926

Order **Distomatida** Wenyon, 1926

Family Hexamitidae Kent, 1880

*Trepomonas* sp. Possibly a stygophile. Reported from the Suuk-Khoba (= Kholodnaya) Cave in Crimea (Lebedinsky, 1900).

Phylum **Amoebozoa** Lühe, 1913

Class **Tubulinea** Smirnov et al., 2005

Order **Arcellinida** Kent, 1880

Family Arcellidae Ehrenberg, 1843

*Arcella arenaria compressa* Chardez, 1974. Possibly a stygophile. Found in adits in Zhiguli Mts. (Stavropol Distr., Samara Prov.) (Mazei et al., 2012).

*Arcella discoides* Ehrenberg, 1843. A stygophile. Found in Golova Otapa Cave (Ochamchira Distr., Abkhazia) (Chibisova, 1967).

Family Centropyxidae Jung, 1942

*Centropyxis aculeata* (Ehrenberg, 1838). Probably a stygophile. Recorded in the Khodzha-Kainar karst spring in the south of Turkmenistan (Labap Region) (Chibisova, 1967) and in the Mamed-Yar brackish well in the Karakum Desert (Turkmenistan) (Brodsky, 1929).

*Centropyxis aculeata intermedia* Van Oye, 1913. Probably a stygophile. Recorded in the Khodzha-Kainar karst spring in the south of Turkmenistan (Labap Region) (Chibisova, 1967).

*Centropyxis aculeata oblonga* Deflandre, 1929. A stygophile. Found in Golova Otapa Cave (Ochamchira Distr., Abkhazia) (Chibisova, 1967).

*Centropyxis aerophila* Deflandre, 1929. Possibly a stygophile. Found in adits in Zhiguli Mts. (Stavropol Distr., Samara Prov.) and in a cave in the Pechora River bank in the Pechora-Ilych Nature Reserve (Troitsko-Pechorsky Distr., Komi Republic) (Mazei et al., 2012).

*Centropyxis aerophila sphagnicola* Deflandre, 1929. Possibly a stygophile. Found in adits in Zhiguli Mts. (Stavropol Distr., Samara Prov.) (Mazei et al., 2012).

*Centropyxis cassis grandis* Tschibisova, 1967. Probably a stygophile. Described from the Khodzha-Kainar karst spring in the south of Turkmenistan (Labap Region) (Chibisova, 1967).

*Centropyxis constricta* (Ehrenberg, 1841). A stygophile. Reported from Suuk-Khoba (= Kholodnaya) and Geograf (= Iograf) Caves in Crimea (Lebedinsky, 1900, 1904), Labirintovaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.), and the Khodzha-Kainar spring in the south of Turkmenistan (Labap Region) (Chibisova, 1967).

*Centropyxis deflandrei* Decloitre, 1955. Probably a stygophile. Recorded in the Khodzha-Kainar karst spring in the south of Turkmenistan (Labap Region) (Chibisova, 1967).

*Centropyxis ecornis* (Ehrenberg, 1841). Probably a stygophile. Reported from sulphurous springs in the Agura karst canyon (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) and from the Khodzha-Kainar karst



spring in the south of Turkmenistan (Labap Region) (Chibisova, 1967).

*Centropyxis ecornis angularis* Tschibisova, 1967. Probably a stygophile. Described from the Khodzha-Kainar karst spring in the south of Turkmenistan (Labap Region) (Chibisova, 1967).

*Centropyxis ecornis megastoma* Tschibisova, 1967. Probably a stygophile. Described from the Khodzha-Kainar karst spring in the south of Turkmenistan (Labap Region) (Chibisova, 1967).

*Centropyxis ecornis turcestanica* Tschibisova, 1967. Probably a stygophile. Described from the Khodzha-Kainar karst spring in the south of Turkmenistan (Labap Region) (Chibisova, 1967).

*Centropyxis gibba* Deflandre, 1929. Probably a stygophile. Recorded in the Khodzha-Kainar karst spring in the south of Turkmenistan (Labap Region) (Chibisova, 1967).

*Centropyxis latissima* Tschibisova, 1967. Probably a stygophile. Described from the Khodzha-Kainar karst spring in the south of Turkmenistan (Labap Region) (Chibisova, 1967).

*Centropyxis laevigata* Penard, 1890. Probably a stygophile. Recorded in the Ierbent brackish well in the Karakum Desert (Turkmenistan) (Brodsky, 1929).

*Centropyxis marsupiformis* (Wallich, 1864). Probably a stygophile. Recorded in the Khodzha-Kainar karst spring in the south of Turkmenistan (Labap Region) (Chibisova, 1967).

*Centropyxis orbicularis* Deflandre, 1929. A stygophile. Reported from Labirintovaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Chibisova, 1967).

*Centropyxis plagiostoma* Bonnet et Thomas, 1955. A stygophile. Reported from Labirintovaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Chibisova, 1967; Ljovuschkin, 1972b).

*Centropyxis platystoma* (Penard, 1890). A stygophile. Reported from Labirintovaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Chibisova, 1967).

*Centropyxis spinifera* Tschibisova, 1967. Probably a stygophile. Described from the Khodzha-Kainar karst spring in the south of Turkmenistan (Labap Region) (Chibisova, 1967).

*Centropyxis spinosa* Cash, 1905. A stygophile. Reported from Labirintovaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Chibisova, 1967).

*Centropyxis subsphaerica* Tschibisova, 1967. Probably a stygophile. Described from the Khodzha-Kainar karst spring in the south of Turkmenistan (Labap Region) (Chibisova, 1967).

*Cyclopyxis arcelloides* (Penard, 1902). A stygophile. Recorded in a cave near Anukhva (Gudauta Distr., Abkhazia) (Chibisova, 1967).

*Cyclopyxis bathystoma* Tschibisova, 1967. A stygophile. Described from a cave near Anukhva (Gudauta Distr., Abkhazia) (Chibisova, 1967).

*Cyclopyxis kahli* (Deflandre, 1929). A stygophile. Recorded in a cave near Anukhva (Gudauta Distr., Abkhazia) (Chibisova, 1967).

*Cyclopyxis penardi minor* Tschibisova, 1967. A stygophile. Described from a cave near Anukhva (Gudauta Distr., Abkhazia) (Chibisova, 1967).

#### Family Diffugiidae Wallich, 1864

*Diffugia avellana* Penard, 1890. A stygophile. Reported from Labirintovaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Chibisova, 1967).

*Diffugia avellana gigas* Gauthier-Lievre et Thomas, 1958. A stygophile. Reported from Ushchelnaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Chibisova, 1967).

*Diffugia globulosa* (Dujardin, 1837). A stygophile. Reported from Suuk-Khoba (= Kholodnaya) Cave in Crimea (Lebedinsky, 1900), Nizhne-Peishulinskaya Cave (Shkotovsky Distr., Primorskii Terr.), and the Khodzha-Kainar karst spring in the south of Turkmenistan (Labap Region) (Chibisova, 1967).

*Diffugia globulus* (Ehrenberg, 1848). Possibly a stygophile. Recorded in the Ierbent brackish well in the Karakum Desert (Turkmenistan) (Brodsky, 1929).

*Diffugia elongata* Penard, 1905. A stygophile. Reported from Nizhne-Peishulinskaya Cave (Shkotovsky Distr., Primorskii Terr.) (Chibisova, 1967).

*Diffugia lebes* Penard, 1899. A stygophile. Reported from Nizhne-Peishulinskaya Cave (Shkotovsky Distr., Primorskii Terr.) (Chibisova, 1967).

*Diffugia lucida* Penard, 1890. Possibly a stygophile. Recorded in the brackish wells Ierbent and

Mamed-Yar in the Karakum Desert (Turkmenistan) (Brodsky, 1929).

*Diffflugia penardi* Hopkinson, 1909. A stygophile. Reported from Labirintovaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Chibisova, 1967).

*Diffflugia pyriformis* Perty, 1849. A stygophile. Reported from Suuk-Khoba (= Kholodnaya), Kizil-Koba (= Krasnaya), Binbash-Koba (= Tsyachegolovaya), and Geograf (= Iograf) Caves in Crimea (Lebedinsky, 1900, 1904).

*Diffflugia oblonga* Ehrenberg, 1838. A stygophile. Reported from Labirintovaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) and Golova Otapa Cave (Ochamchira Distr., Abkhazia) (Chibisova, 1967).

*Pontigulasia incisa* Rhumbler, 1896. A stygophile. Reported from caves near Anukhva (Gudauta Distr., Abkhazia) and from Labirintovaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Chibisova, 1967).

#### Family Heleoperidae Jung, 1942

*Heleopera sphagni* Leidy, 1874 (= *Heleopera picta* Leidy, 1879). Possibly a stygophile. Reported from Labirintovaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Chibisova, 1967). A common inhabitant of sphagnum mosses (Mazei and Tsyganov, 2006).

#### Family Plagiopyxidae Bonnet et Thomas, 1960

*Plagiopyxis callida* Penard, 1910. A stygophile. Reported from a cave near Anukhva (Gudauta Distr., Abkhazia) (Chibisova, 1967; Ljovuschkin, 1972b).

#### Family Hyalospheniidae Schultze, 1877

*Hyalosphenia papilio* Leidy, 1879. Possibly a stygophile. Found in adits in Zhiguli Mts. (Stavropol Distr., Samara Prov.) (Mazei et al., 2012).

#### Family Phryganellidae Jung, 1942

*Phryganella acropodia* (Hertwig et Lesser, 1874). Possibly a stygophile. Found in adits in Zhiguli Mts. (Stavropol Distr., Samara Prov.) (Mazei et al., 2012).

*Phryganella hemisphaerica* Penard, 1902. Possibly a stygophile. Found in adits in Zhiguli Mts. (Stavropol Distr., Samara Prov.) and in a cave in the Pechora

River bank in the Pechora-Ilych Nature Reserve (Troitsko-Pechorsky Distr., Komi Republic) (Mazei et al., 2012).

#### Family Nebelidae Taranek, 1882

*Nebela parvula* Cash, 1909. Possibly a stygophile. Found in adits in Zhiguli Mts. (Stavropol Distr., Samara Prov.) (Mazei et al., 2012).

*Nebela tinctoria* Leidy, 1879. Possibly a stygophile. Found in adits in Zhiguli Mts. (Stavropol Distr., Samara Prov.) (Mazei et al., 2012).

#### Subphylum **Conosa** Cavalier-Smith, 1998

##### Infraphylum **Mycetozoa** de Bary, 1859

##### Class **Myxogastria** Macbride, 1899

##### Order **Physarida** Macbride, 1922

##### Family Physaridae Rostafinski, 1873

*Physarum flagellatum* (Alexeieff, 1923) (= *Hyperamoeba flagellata* Alexeieff, 1923). Possibly a stygophile. Recorded in Vorontsovskaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Mylnikov et al., 2006).

#### KINGDOM ANIMALIA LINNAEUS, 1758

##### Phylum "**Porifera**" Grant, 1836

##### Class **Demospongiae** Sollas, 1885

##### Order **Poecilosclerida** Topsent, 1928

##### Family Microcionidae Carter, 1875

*Clathra cleistochela* (Topsent, 1925). A stygophile. Recorded in marine caves of Cape Tarkhankut (Western Crimea) (Ereskovsky and Kovtun, 2013).

##### Phylum **Cnidaria** Hatschek, 1888

##### Class **Anthozoa** Ehrenberg, 1831

##### Order **Actiniaria** Hertwig, 1882

##### Family Sagartiidae Gosse, 1858

*Sagartia elegans* (Dalyell, 1848). A stygophile. Recorded in marine caves of Western Crimea (Kovtun, 2008; Grebelny and Kovtun, 2013).

We do not include herein the species listed by Korchagin (1888) in his paper on the fauna of Moscow wells, since the reliability of his identifications raises certain doubts while his list contains a number of names that are now considered invalid and their synonymy would be difficult to determine.

Phylum **Platyhelminthes** Claus, 1887Class **Turbellaria** Ehrenberg, 1831Order **Tricladida** Lang, 1884

Turbellarians remain one of the least studied groups of stygobionts in Russia and the adjacent states: 99 specifically stygobiont species are known in Europe (Beauchamp, 1932; Gourbault, 1972, cited after Shumeev, 2008), and only several endemic forms are known in the former USSR territory, even though turbellarians are quite frequently found in cave waters.

Unidentified unpigmented tricladids were recorded in Bolshaya Vorontsovskaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Birstein, 1950), Tskhal-Tsiteli Cave (Imereti, Georgia) (Birstein and Lopashov, 1940), other caves of the Western and Eastern Transcaucasia, and also in caves of Primorye (Birstein and Ljovuschkin, 1967a) and Crimea (Lebedinsky, 1900).

Family **DugesIIDae** Ball, 1974

*Dugesia taurocaucasica* (Livanov, 1951). A stygophile. Recorded in a small river emerging from a cave near Gagra (Gagra Distr., Abkhazia) (Porfirieva and Dyganova, 1987), in a cave in Armovka Mt. within the Tryu-Yatyrgvarta Range (Mostovskoi Distr., Krasnodar Terr.), and also in Fanagoriiskaya Cave near Goryachy Klyuch (Krasnodar Terr.) (Shumeev, 2008). The species is widespread in the epigeal biotopes of the Caucasus and Crimea (Porfirieva and Dyganova, 1987). Populations from different caves somewhat differ in coloration and morphology of the penis (Shumeev, 2008).

*Dugesia* (sensu lato) spp. Probably stygophiles, not identified to species. Recorded in Golova Otapa, Uatapakhy (= Tunnel above Golova Otapa), Nizhnyaya Shakuranskaya, and Srednyaya Shakuranskaya Caves (Abkhazia) (Chertoprud et al., 2016).

Family **Dendrocoelidae** Hallez, 1892

*Dendrocoelides* sp. Probably a stygobiont. Recorded in a stream in Anglo-Russkaya Cave at Pshekha-Su Mt. (Maikop Distr., Adygeya Republic) (Shumeev, 2008).

*Dendrocoelides cavatica* (Fries, 1874) (= *Planaria cavatica* Fries, 1874). A stygobiont. Recorded in Tysyachegolovaya and Geograf (= Iograf) Caves in Crimea (Lebedinsky, 1904). This identification is doubtful.

*Dendrocoelum mamkaevi* Shumeev, 2008. A stygophile. Described from streams of the Tryu-Yatyrgvarta Range, including a stream in a cave in Armovka Mt. (Mostovskoi Distr., Krasnodar Terr.) (Shumeev, 2008).

*Dendrocoelum sureni* Shumeev, 2008. A stygobiont. Described from streams of Bolshaya Fanagoriiskaya Cave (Goryacheklyuchevskoi Distr., Krasnodar Terr.) (Shumeev, 2008).

*Dendrocoelum* (sensu lato) spp. Probably stygobionts, not identified to species. Recorded in Novofonskaya and Tsebelinskaya Caves in Abkhazia (Chertoprud et al., 2016).

Phylum **Nematoda** Diesing, 1861

This vast group remains poorly studied in the subterranean biotopes of Russia and adjacent states. Many findings were reported without sufficient detail. In particular, Birstein and Ljovuschkin (1967a) reported the findings of 48 species of nematodes in the caves in different parts of the USSR, most of which were soil-dwelling forms not specific to caves.

Many identifications, especially those made by early authors, need to be verified.

Class **Enoplea** Inglis, 1983Order **Monhysterida** Filipjev, 1929Family **Alaimidae** Micoletzky, 1922

*Alaimus* sp. A troglophile. Recorded in Mlinki (Chortkivski Distr., Ternopol Prov., Ukraine), Greben, and Romaniya Caves (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

Family **Dorylaimidae** De Man, 1876

*Dorylaimus* sp. Probably a troglophile. Reported by Kniss (2001) from the caves of Georgia with reference to Birstein (1950). However, the species is not mentioned in the cited work of J.A. Birstein.

*Eudorylaimus carteri* (Bastian, 1865) (= *Dorylaimus carteri* Bastian, 1865). A stygophile. Well no. 38 in Saratov (Behning, 1928).

*Eudorylaimus carteri rotundatus* (Micoletzky, 1922) (= *Dorylaimus carteri rotundatus* Micoletzky, 1922). A stygophile. Wells nos. 30, 32, 34 in Saratov (Behning, 1928).

*Eudorylaimus monohystera* (De Man, 1880) (= *Dorylaimus monohystera* (De Man, 1880). A stygophile. Well no. 34 in Saratov (Behning, 1928).

*Eudorylaimus obtusicaudatus* (Bastian, 1865) (= *Dorylaimus obtusicaudatus* Bastian, 1865; = *Dorylaimus obtusicaudatus* f. *butschlii* Micoletzky, 1922). A stygophile. Wells nos. 5, 13, 14, 26, 30, 36, 42, 43, 44 in Saratov (Behning, 1928).

*Eudorylaimus* spp. Troglaphiles. Recorded in Mlinki (Chortkivski Distr., Ternopol Prov., Ukraine), Greben, and Romaniya Caves (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

*Laimydorus pseudostagnalis* (Micoletzky, 1927) (= *Dorylaimus pseudostagnalis* Micoletzky, 1927). A stygophile. Well no. 41 in Saratov (Behning, 1928).

*Mesodorylaimus* spp. Troglaphiles. Recorded in Mlinki Cave (Chortkivski Distr., Ternopol Prov., Ukraine) and in Greben Cave (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

#### Family Monhysteridae De Man, 1876

*Monhystera* sp. 1. A troglaphile. Recorded in Chamkhona Cave (Gagra Distr., Abkhazia) (Eliava, 1966).

*Monhystera* sp. 2. Probably a troglaphile. Reported by Kniss (2001) from the caves of Georgia with reference to Birstein (1950). However, the species is not mentioned in the cited work of J.A. Birstein.

*Monhystera paludicola* De Man, 1881. A stygophile. Well no. 34 in Saratov (Behning, 1928).

*Monhystrella* sp. A troglaphile. Recorded in Romaniya Cave (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

#### Order **Mononchida** Jairajpuri, 1969

##### Family Anatonchidae Jairajpuri, 1969

*Miconchus* sp. A troglaphile. Recorded in Romaniya Cave (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

##### Family Mononchidae Chitwood et Chitwood, 1937

*Mononchus macrostoma* Bastian, 1865. A stygophile. Wells nos. 5, 12, 26, 40 in Saratov (Behning, 1928).

*Mononchus papillatus* Bastian, 1865. A stygophile. Well no. 32 in Saratov (Behning, 1928).

*Mononchus* sp. A troglaphile. Recorded in Mlinki Cave (Chortkivski Distr., Ternopol Prov., Ukraine) and in Romaniya Cave (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

*Prionchulus* sp. A troglaphile. Recorded in Romaniya Cave (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

#### Order **Triplonchida** Cobb, 1920

##### Family Tobrilidae Filipjev, 1918

*Tobrilus* sp. A troglaphile. Recorded in Greben and Romaniya Caves (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

*Tobrilus* sp. (= *Trilobus* sp.). Probably a troglaphile. Reported by Kniss (2001) from the caves of Georgia with reference to Birstein (1950). However, the species is not mentioned in the cited work of J.A. Birstein.

*Tobrilus allophysoides* (Micoletzky, 1925) (= *Trilobus allophysoides* Micoletzky, 1925). A stygophile. Well no. 34 in Saratov (Behning, 1928).

##### Family Tripylidae (De Man, 1876)

*Tripyla* spp. Troglaphiles. Recorded in Greben and Romaniya Caves (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

##### Family Prismatolaimidae Micoletzky, 1922

*Prismatolaimus dolichurus* De Man, 1880. A troglaphile. Recorded in Zheopse Cave (Gagra Distr., Abkhazia) (Eliava, 1966).

*Prismatolaimus* sp. A troglaphile. Recorded in Zheopse Cave (Gagra Distr., Abkhazia) (Eliava, 1966).

#### Order **Dorylaimida** Pearse, 1942

##### Family Aporcelaimidae Heyns, 1965

*Aporcelaimellus* sp. A troglaphile. Recorded in Mlinki Cave (Chortkivski Distr., Ternopol Prov., Ukraine) and in Greben Cave (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

*Aporcelaimus* sp. A troglaphile. Recorded in Romaniya Cave (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

*Takamangai* sp. A troglaphile. Recorded in Mlinki Cave (Chortkivski Distr., Ternopol Prov., Ukraine) and in Romaniya Cave (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

## Family Mydonomidae Thorne, 1964

*Dorylaimoides* sp. A troglophile. Recorded in Romaniya Cave (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

Class **Chromadorea** Inglis, 1932Order **Plectida** Malakhov, 1982

## Family Plectidae Örley, 1880

*Anaplectus granulosus* (Bastian, 1865). A troglophile. Recorded in Greben Cave (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

*Plectus rhyzophilus* De Man, 1880. A troglophile. Recorded in Chamkhona Cave (Gagra Distr., Abkhazia) (Eliava, 1966).

*Plectus armatus* Buetschli, 1873. A troglophile. Recorded in Mlinki Cave (Chortkivski Distr., Ternopol Prov., Ukraine) (Golovachov, 2004).

*Plectus aquatilis* Andrásy, 1985. A troglophile. Recorded in Greben Cave (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

*Plectus exinocaudatus* Truskova, 1976. A troglophile. Recorded in Mlinki Cave (Chortkivski Distr., Ternopol Prov., Ukraine) (Golovachov, 2004).

*Plectus geophilus* De Man, 1880. A troglophile. Recorded in Mlinki Cave (Chortkivski Distr., Ternopol Prov., Ukraine) and in Greben and Romaniya Caves (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

*Plectus elongatus* Maggenti, 1961. A troglophile. Recorded in Greben and Romaniya Caves (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

*Plectus refus* Tahseen et al., 1994. A troglophile. Recorded in Greben Cave (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

*Ereptonema arcticum* Loof, 1971. A troglophile. Recorded in Mlinki Cave (Chortkivski Distr., Ternopol Prov., Ukraine) (Golovachov, 2004).

Order **Rhabditida** Chitwood, 1933

## Family Myolaimidae Goodey, 1963

*Myolaimus heterurus* Cobb, 1920. A troglophile. Recorded in Romaniya Cave (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

## Family Rhabditidae Örley, 1880

*Ablechroiulus ciliatus* (Fuchs, 1931). A troglophile. Recorded in Romaniya Cave (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

*Rhabditis* sp. Probably a troglophile. Recorded in Geograf (= Iograf) Cave in Crimea (Lebedinsky, 1904).

*Rhabditis curvicaudata* (Schneider, 1866). A stygophile. Well no. 35 in Saratov (Behning, 1928).

*Rhabditis oxycerca* (De Man, 1895) (= *Cuticularia oxycerca* De Man, 1895). A troglophile. Recorded in Mlinki Cave (Chortkivski Distr., Ternopol Prov., Ukraine) (Golovachov, 2004).

*Rhabditis* spp. Troglophiles. Recorded in Mlinki Cave (Chortkivski Distr., Ternopol Prov., Ukraine) and in Greben and Romaniya Caves (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

*Phasmarhabditis papillosa* (Schneider, 1966). A troglophile. Recorded in Mlinki Cave (Chortkivski Distr., Ternopol Prov., Ukraine) and in Romaniya Cave (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

Class **Secernentea** Lorenzen, 1981Order **Aphelenchida** Siddiqi, 1980

## Family Aphelenchoididae Skarbilovich, 1947

*Aphanolaimus aquaticus* Daday, 1894. Possibly a stygophile. Recorded in the Tenderli brackish well in the Karakum Desert (Turkmenistan) (Brodsky, 1929).

*Aphelenchoides* sp. A troglophile. Recorded in Romaniya Cave (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

Order **Tylenchida** Thorne, 1949

## Family Anguinidae Nicoll, 1935

*Ditylenchus* cf. *exilis* Brzeski, 1984. A troglophile. Recorded in Mlinki Cave (Chortkivski Distr., Ternopol Prov., Ukraine) and in Romaniya Cave (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

## Family Tylenchidae Örley, 1880

*Aglenchus agricola* (De Man, 1884) (= *Tylenchus agricola* De Man, 1884). A troglophile. Recorded in

Chamkhona Cave (Gagra Distr., Abkhazia) (Eliava, 1966).

*Filenchus cf. vulgaris* (Brzeski, 1963). A troglophile. Recorded in Greben Cave (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

Family Cephalobidae Filipjev, 1934

*Acrobelloides* sp. A troglophile. Recorded in Mlinki Cave (Chortkivski Distr., Ternopol Prov., Ukraine) (Golovachov, 2004).

*Cephalobus elongatus* De Man, 1880. A troglophile. Recorded in Romaniya Cave (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

*Cephalobus rigidus* Schneider, 1866. A stygophile. Well no. 38 in Saratov (Behning, 1928).

*Eucephalobus striatus* (Bastian, 1865). A troglophile. Recorded in Mlinki Cave (Chortkivski Distr., Ternopol Prov., Ukraine) (Golovachov, 2004).

*Eucephalobus hooperi* Marinari-Palmisano, 1967. A troglophile. Recorded in Greben Cave (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

*Pseudacrobeles pseudolatus* (Hernandez, 1990). A troglophile. Recorded in Romaniya Cave (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

Family Neotylenchidae Thorne, 1941

*Deladenus* sp. A troglophile. Recorded in Romaniya Cave (Tyachivski Distr., Zakarpattia Prov., Ukraine) (Golovachov, 2004).

Phylum **Rotifera** Cuvier, 1817

Class **Eurotatoria** De Ridder, 1957

Order **Ploima** Hudson et Gosse, 1886

Family Asplanchnidae Eckstein, 1883

*Asplanchna priodonta* Gosse, 1850. Possibly a stygophile. Recorded in the Mamed-Yar and Bakht brackish wells in the Karakum Desert (Turkmenistan) (Brodsky, 1929).

Family Brachionidae Ehrenberg, 1838

*Anuraeopsis fissa* Gosse, 1851 (= *Anuraeopsis hypelasma* Gosse, 1886). Possibly a stygophile. Recorded in the Bakht brackish well in the Karakum Desert (Turkmenistan) (Brodsky, 1929).

*Brachionus urceolaris* Müller, 1773. Possibly a stygophile. Recorded in the Kara-Adzhi brackish well in the Karakum Desert (Turkmenistan) (Brodsky, 1929).

Family Gastropodidae Haring, 1913

*Ascomorpha ecaudis* Perty, 1850. Possibly a stygophile. Recorded in the Koushaknyn-Kyzyl-Takyr brackish well in the Karakum Desert (Turkmenistan) (Brodsky, 1929).

Family Dicranophoridae Haring, 1913

*Dicranophorus forcipatus* (O.F. Müller, 1786). Possibly a stygophile. Recorded in water from boreholes and wells in the South Kyzylkum Desert (Jizzakh Prov., Uzbekistan) (Yankovskaya, 1972).

Family Notommatidae Hudson et Gosse, 1886

*Cephalodella gibba* (Ehrenberg, 1830). Possibly a stygophile. Recorded in well no. 2 in the South Kyzylkum Desert (Jizzakh Prov., Uzbekistan) (Yankovskaya, 1972).

Order **Bdelloidea** Hudson, 1884

Family Adinetidae Hudson et Gosse, 1889

*Adineta* ? sp. (in the original: *Callidina* sp). Possibly a stygophile. Recorded in the Tenderli brackish well in the Karakum Desert (Turkmenistan) (Brodsky, 1929).

Phylum **Annelida** Lamarck, 1809

Class **Oligochaeta** Grube, 1850

Order **Haplotaxida** Brinkhurst, 1971

Family Haplotaxidae Michaelsen, 1900

*Haplotaxis gordioides* (Hartmann, 1821). A troglophile. Recorded in Troika Cave in the Arabika karst system (Gagra Distr., Abkhazia) (Sidorov, 2014), and also in the hyporheic zone of the Narva River (Khasan Distr., Primorskii Terr.) (Semernoi and Sidorov, 2013). The species inhabits epigeal streams over the whole Transcaucasia, generally preferring karst areas (Palatov et al., 2016).

Order **Crassiclitellata** Jamieson, 1988

Family Lumbricidae Claus, 1876

*Allolobophora cavatica* Michaelsen, 1910. A troglophile. Described from a cave near the Khodz River within the territory of Adygeya Republic or Krasnodar

Terr.; also recorded in epigeal habitats in Transcaucasia (Lenkoran, Azerbaijan) (Michaelsen, 1910).

*Archaeodrilus cavaticus* Czerniavsky, 1880. Probably a troglobiont. Described from Protsenki Cave (Sukhumi Distr., Abkhazia) (Chernyavsky, 1880). The true identity of the species cannot be determined now since its description was based on immature specimens and its type material was not preserved (Malevich, 1947).

*Dendrobaena hortensis* (Michaelsen, 1890) (= *Eisenia birsteini* Malevics, 1947). A troglophile. Reported from Chlakhe Cave (Gudauta Distr., Abkhazia) (Malevich, 1947).

*Dendrobaena octaedra* (Savigny, 1826). A troglophile. Recorded in Shulgan-Tash Cave (Burzyansky Distr., Bashkortostan) (Kniss, 1984a, 2001).

*Dendrobaena veneta crassa* (Malevics, 1947). A troglophile. Described from Vorontsovskaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) as a special form (Malevich, 1947).

*Dendrobaena veneta minuta* (Malevics, 1947). A troglophile. Described from Ayusta Cave (Gudauta Distr., Abkhazia) as a special form (Malevich, 1947). Also recorded in Kortskheli Cave (Zugdidi Municipality, Samegrelo-Zemo Svaneti, Georgia) and Samertkhlekldi I Cave (Chiatura Municipality, Imereti, Georgia) (Barjadze et al., 2015a).

*Dendrodrilus rubidus* (Savigny, 1826). A troglophile. Recorded in caves of Bashkortostan (Kniss, 2001).

*Eisenia fetida* (Savigny, 1826). A troglophile. Recorded in a cave in the right bank of the Volga near the Kama outfall and Mordovskii Karatai village (Kamsko-Ustinsky Distr., Tatarstan Republic) (Michaelsen, 1926), and also in many caves of the Western Transcaucasia: Sataplia, Sakire (Imereti, Georgia), Khostinskaya (Khosta Distr., Sochi Urban Area, Krasnodar Terr.), Mzymta (Adler Distr., Sochi Urban Area, Krasnodar Terr.), near Venetsiansky Bridge (Sukhumi Distr., Abkhazia), and Chlakhe (Gudauta Distr., Abkhazia) (Malevich, 1947; Barjadze et al., 2015).

*Eisenia* sp. Probably a troglophile. Recorded in Golova Otapa Cave (Abkhazia) (Chertoprud et al., 2016).

*Eophila hypogea* Malevics, 1947. Probably a troglobiont. Described from Tskhal-Tsiteli Cave (Imereti, Georgia) (Malevich, 1947).

*Eiseniella tetraedra* (Savigny, 1826). Probably a troglophile. Recorded in well no. 5 in Saratov (Behning, 1928) and in Shulgan-Tash Cave (Burzyansky Distr., Bashkortostan) (Kniss, 1984a, 2001).

#### Order **Enchytraeida** Vejdovský, 1879

##### Family Enchytraeidae Vejdovský, 1879

Representatives of this family are regularly found in caves in the territory of Russia and adjacent states, but their identification is difficult and their species lists are seldom published. Potworms are known from the caves of Crimea (Lebedinsky, 1900, 1904), the Caucasus and Transcaucasia (Birstein and Lopashov, 1940; Malevich, 1947), the Urals and Siberia (Kniss, 2001), and Central Asia (Chekanovskaya, 1972; Yankovskaya, 1972a).

*Henlea ventriculosa* (d'Udekem, 1854). Probably a troglophile. Recorded in well no. 11 in Saratov (Behning, 1928).

*Enchytraeus albidus* Henle, 1837. Probably a troglophile. Recorded in wells nos. 7, 9, and 40 in Saratov (Behning, 1928).

*Fridericia bulbosa* (Rosa, 1887). Probably a stygophile. Recorded in wells nos. 6, 11, 39, and 42 in Saratov (Behning, 1928).

*Fridericia* sp. Probably a stygophile. Recorded in the hyporheic zone of the Tigrovaya River (Partizansk urban district, Primorskii Terr.) (Semernoi and Sidorov, 2013).

*Mesenchytraeus* sp. (? *Mesenchytraeus vshivkovae* Timm, 1994). Probably a stygophile. Recorded in the hyporheic zone of the Pasechnaya River (Lazo Distr., Primorskii Terr.) (Semernoi and Sidorov, 2013).

*Lumbricillus* sp. Probably a stygophile. Recorded in the hyporheic zone of the Arsenevka River (Anuchino Distr., Primorskii Terr.) (Semernoi and Sidorov, 2013).

#### Order **Tubificida** Brinkhurst, 1982

##### Family Naididae Ehrenberg, 1828

*Dero* sp. Possibly a stygophile. Recorded in boreholes and wells on the shores of Lake Issyk Kul (Issyk Kul Prov., Kyrgyzstan) (Chekanovskaya, 1972; Yankovskaya, 1972a).

*Dero obtusa* Udekem, 1855. Possibly a troglophile. Found in a groundwater reservoir near the Desert sta-

tion of the Uzbek SSR Academy of Sciences (Karakalpakstan Republic, Uzbekistan) (Chekanovskaya, 1972).

*Nais bretscheri* Michaelsen, 1899. Probably a stygophile. Recorded in the hyporheic zone of the Arsenevka (Anuchino Distr., Primorskii Terr.) and Partizanskaya (Partizansk Distr., Primorskii Terr.) Rivers (Semernoi and Sidorov, 2013).

*Nais communis* Piguet, 1906. A stygophile. Recorded in well no. 37 in Saratov, and also in other wells in European Russia (Behning, 1928) and in boreholes in the South Kyzylkum Desert (Jizzakh Prov., Uzbekistan) (Chekanovskaya, 1972; Yankovskaya, 1972a).

*Nais elinguis* Müller, 1774. Possibly a stygophile. Recorded in boreholes and wells on the shores of Lake Issyk Kul (Issyk Kul Prov., Kyrgyzstan) (Chekanovskaya, 1972; Yankovskaya, 1972a).

*Nais pardalis* Piguet, 1906. Possibly a stygophile. Recorded in boreholes and wells in the South Kyzylkum Desert (Jizzakh Prov., Uzbekistan) (Chekanovskaya, 1972; Yankovskaya, 1972a).

*Nais pseudobtusa* Piguet, 1906. Possibly a stygophile. Recorded in well no. 37 in Saratov (Behning, 1928).

*Specaria josinae* (Vejdovský, 1883). Probably a stygophile. Recorded in the hyporheic zone of the Kievka River (Lazo Distr., Primorskii Terr.) (Semernoi and Sidorov, 2013).

*Uncinais uncinata* (Ørsted, 1842). Probably a stygophile. Recorded in the hyporheic zone of the Steklyanukha (Shkotovsky Distr., Primorskii Terr.) and Kievka (Lazo Distr., Primorskii Terr.) Rivers (Semernoi and Sidorov, 2013).

#### Family Pristinidae Lastočkin, 1924

*Pristina aequisetata* Bourne, 1891. Probably a stygophile. Recorded in the hyporheic zone of the Razdolnaya (Ussuriisk Urban Area, Primorskii Terr.) and Partizanskaya (Partizansk Distr., Primorskii Terr.) Rivers (Semernoi and Sidorov, 2013).

*Pristina jenkinae* (Stephenson, 1932). A troglophile. Recorded in a number of wells in the South Kyzylkum Desert (Jizzakh Prov., Uzbekistan) (Chekanovskaya, 1972; Yankovskaya, 1972a).

*Pristina rosea* (Piguet, 1906). Probably a stygophile. Recorded in the hyporheic zone of the Pasech-

naya River (Lazo Distr., Primorskii Terr.) Rivers (Semernoi and Sidorov, 2013).

#### Family Tubificidae Vejdovský, 1884

This family includes many local endemic species, mostly of the subfamily Rhyacodrilinae Hrabec, 1963, in the cave streams of Western Europe (Timm, 2009). A similar situation is to be expected for the Transcaucasian caves, in which the fauna of aquatic oligochaetes is still very poorly studied.

*Embolocephalus velutinus* (Grube, 1879). A stygophile. Recorded in streams in Tsebeldinskaya and Srednyaya Shakuranskaya Caves (Gulripshi Distr., Abkhazia) (Birstein and Lopashov, 1940; Malevich, 1947; Chertoprud et al., 2016). In Transcaucasia the species also inhabits various spring-fed reservoirs (Palatov et al., 2016).

*Limnodrilus hoffmeisteri* Claparède, 1862. Probably a stygophile. Recorded in the hyporheic zone of the Arsenevka (Anuchino Distr., Primorskii Terr.) and Partizanskaya (Partizansk Distr., Primorskii Terr.) Rivers (Semernoi and Sidorov, 2013).

*Limnodrilus profundicola* (Verrill, 1871). Probably a stygophile. Recorded in the hyporheic zone of the Razdolnaya (Ussuriisk Urban Area, Primorskii Terr.) and Partizanskaya (Partizansk Distr., Primorskii Terr.) Rivers (Semernoi and Sidorov, 2013).

*Potamothrix hammoniensis* (Michaelsen, 1901). Possibly a stygobiont. Recorded in a number of wells (nos. 23, 24, 25, 26, 30, 46) in Saratov (Behning, 1928).

*Potamothrix moldaviensis* Vejdovský et Mrázek, 1903 (= *Euliyodrilus bavaricus* Oschmann, 1913). Possibly a stygobiont. Recorded in a number of wells in the South Kyzylkum Desert (Jizzakh Prov., Uzbekistan) (Chekanovskaya, 1972; Yankovskaya, 1972a).

*Psammoryctides* sp. 1. Probably a stygobiont. Reported from Geograf (= Iograf) Cave in Crimea (Lebedinsky, 1904).

*Psammoryctides* sp. 2. Probably a stygobiont. Inhabits springs in Tskhal-Tsiteli Cave (Imereti, Georgia) (Palatov et al., 2016).

*Rhyacodrilus coccineus* (Vejdovský, 1875). Probably a stygophile. Recorded in the hyporheic zone of the Razdolnaya River (Ussuriisk Urban Area, Primorskii Terr.) (Semernoi and Sidorov, 2013).



*Rhyacodrilus* (sensu lato) spp. Stygophiles or stygobionts. Probably several new species, commonly occurring on soft beds of springs in caves in the Western Transcaucasia (Palatov et al., 2016), in particular, reported from Abrskila, Nizhnyaya Shakuranskaya, and Srednyaya Shakuranskaya Caves in Abkhazia (Chertoprud et al., 2016).

*Rhyacodrilus* sp. Possibly a stygophile. Recorded in boreholes and wells on the shores of Lake Issyk Kul (Issyk Kul Prov., Kyrgyzstan) (Chekanovskaya, 1972; Yankovskaya, 1972a).

Tubificidae gen. sp. Immature worms found in the hyporheic zone of several rivers in Primorskii Territory: Narva (Khasan Distr.), Razdolnaya (Ussuriisk Urban Area), Steklyanukha, Sukhodol (Shkotovsky Distr.), Kievka (Lazo Distr.), Arsenevka (Anuchino Distr.), and Partizanskaya (Partizansk Distr.). Some of them most probably belong to the genus *Haber* (Semernoi and Sidorov, 2013).

#### Family Propappidae Coates, 1986

*Propappus arhynchotus* Sokolskaja, 1972. Possibly a stygophile. Found in the hyporheic zone of several rivers in Primorskii Territory: Narva (Khasan Distr.), Razdolnaya (Ussuriisk Urban Area), Steklyanukha (Shkotovsky Distr.), and Arsenevka (Anuchino Distr.) (Semernoi and Sidorov, 2013).

*Propappus volki* Michaelsen, 1915. Possibly a stygophile. Found in the hyporheic zone of the Lazovka (Lazo Distr., Primorskii Terr.) and Razdolnaya (Ussuriisk Urban Area, Primorskii Terr.) Rivers (Semernoi and Sidorov, 2013).

#### Order Lumbriculida Brinkhurst, 1971

##### Family Lumbriculidae Vejdovský, 1884

Many local endemic species of this family, mostly of the genera *Stylodrilus* and *Trichodrilus*, occur in the cave streams of Western Europe (Timm, 2009). A similar situation is to be expected in the Transcaucasian caves, where the fauna of aquatic oligochaetes is still very poorly studied.

*Stylodrilus* spp. Stygophiles or stygobionts. Apparently several species, differing at least in the structure of the setae, are common on soft beds of springs in caves in the Western Transcaucasia (Palatov et al., 2016).

Lumbriculidae gen. sp. Unidentified worms with simple or bifid setae found in the hyporheic zone of

several rivers in Primorskii Territory: Narva, Filipovka (Khasan Distr.), Steklyanukha (Shkotovsky Distr.), Kievka, Pasechnaya, Lazovka (Lazo Distr.), Arsenevka (Anuchino Distr.), and Tigrovaya (Partizansk Distr.) (Semernoi and Sidorov, 2013).

#### Class Hirudinea Lamarck, 1818

##### Order Arhynchobdellida Blanchard, 1894

Unidentified leeches were recorded in Kvilishori (= Tsikhe) Cave (Tsqaltubo Municipality, Imereti, Georgia) (Djanashvili, 1980).

##### Family Erpobdellidae Blanchard, 1894

*Dina absoloni ratschaensis* Kobakhidze, 1958. A troglobiont. Described from Sakishore and Tsvitskala Caves (Ambrolauri Municipality, Racha-Lechkhumi, Georgia) (Kobakhidze, 1958). The subspecies is characterized by the absence of eyes and pigmentation. Some authors consider it as a separate species (Barjadze et al., 2015a).

*Dina* spp. Probably stygobionts; apparently a complex of undescribed species. Known from the caves Verkhne-Andreevskaya near Sukhumi (Birstein, 1950), Sarma (Sidorov et al., 2014) and Krubera (= Krubera-Voronya) (Turbanov, 2015i) in the karst of Arabika Mt., and also from Abrskila Cave near Otap (Abkhazia) (Chertoprud et al., 2016).

*Erpobdella octoculata* (Linnaeus, 1758). A troglophile. Reported from streams of Fanagoriiskaya Cave (Goryacheklyuchsky Distr., Krasnodar Terr.); the specimen was distinguished by reduction of the eyes (Birstein and Ljovuschkin, 1967a).

#### Phylum Mollusca Linnaeus, 1758

##### Class Gastropoda Cuvier, 1797

##### Order Littorinimorpha

##### Golikov et Starobogatov, 1975

##### Family Cochliopidae Tryon, 1866

##### Subfamily Littoridininae Thiele, 1928

*Pseudocaspia ljovuschkini* Starobogatov, 1972. A stygobiont. Known from brackish waters in Kaptar-Khana Cave (Turkmenistan) (Birstein and Ljovuschkin, 1965a; Starobogatov, 1972).

##### Family Amnicolidae Tryon, 1863

*Akiyoshia* sp. A stygobiont. Known from ground waters in Primorskii Terr. (Sidorov and Semenchenko, 2009).

*Bythinella* sp. A stygo- and crenobiont. Sataplia-I Cave (West Georgia) (Barjadze et al., 2015a).

Family Bithyniinae Gray, 1857

*Codiella* sp. Probably a stygoxene. This identification is doubtful since representatives of the genus are known only in Europe but not in the Caucasus (Kantor et al., 2010). Found in Prometeya Cave (West Georgia) (Barjadze et al., 2015a).

Family Hydrobiidae Stimpson, 1865

Subfamily Belgrandiinae Stefani, 1877

*Belgrandiella abchasica* Starobogatov, 1962. A stygo- and crenobiont. Described from a spring in Nizhnyaya Shakuranskaya Cave (Abkhazia) (Starobogatov, 1962); also occurs in the nearby caves (Srednyaya Shakuranskaya, Tsebdinskaya) and spring-fed reservoirs (Palatov and Vinarski, 2015; Chertoprud et al., 2016).

*Belgrandiella* cf. *abchasica* Starobogatov, 1962. A stygo- and crenobiont. Empty shells found in Lake Anatoliya in Novoafonskaya Cave (Starobogatov, 1962). Numerous living snails occur near Novy Afon (Abkhazia) (Vinarski et al., 2014; Palatov and Vinarski, 2015).

*Belgrandiella caucasica* Starobogatov, 1962. A stygo- and crenobiont. Described from a spring in Krasnoaleksandrovskaya Cave (= Peshchera Vedm) in Lazarevsky District of Sochi Urban Area (Starobogatov, 1962). Inhabits cave (e.g., in Dolgaya Cave) and spring-fed reservoirs of the Black Sea coast from Tuapse to Psou (Palatov and Vinarski, 2015). The species is listed in the Red Book of Krasnodar Territory (Kiyashko, 2007a).

*Belgrandiella* sp. A peculiar, still undescribed species inhabiting the spring near the entry to Abrskila Cave (Abkhazia) (Palatov and Vinarski, 2015; Chertoprud et al., 2016).

“*Geyeria*” *horatieformis* Starobogatov, 1962. A stygobiont. Known from its type locality, a spring in Nizhnyaya Shakuranskaya Cave (Abkhazia) (Starobogatov, 1962). Possibly also occurs in a stream in Tsebdinskaya Cave, where an empty shell resembling a deformed “*G.*” *horatieformis* was found (Palatov and Vinarski, 2015; Chertoprud et al., 2016).

“*Geyeria*” *valvataeformis* Starobogatov, 1962. A stygobiont. Known only from its type locality,

a spring in Krasnoaleksandrovskaya Cave (Krasnodar Terr.) (Starobogatov, 1962). The species is listed in the Red Book of Krasnodar Territory (Kiyashko, 2007b).

“*Geyeria*” spp. Species close to “*G.*” *horatieformis* but differing in the shell proportions and the protoconch sculpture were found in streams in Golova Otapa, Abrskila, and Kolodets 85 m Caves in Abkhazia (Palatov and Vinarski, 2015; Chertoprud et al., 2016).

The taxonomic position of the Transcaucasian species of *Geyeria* should probably be reconsidered; some authors placed them in the genus *Plagygeyeria* (Birstein and Ljovuschkin, 1967a; Kniss, 2011) but gave no arguments in support of this decision. This appears to be a composite group (Palatov and Vinarski, 2015).

“*Horatia*” sp. 1. Juvenile shells found in a spring in Dolgaya Cave (Khosta Distr., Krasnodar Terr.) were described under this name (Starobogatov, 1962). In the course of subsequent studies of this cave, no *Horatia*-like snails were found but individuals of *Belgrandiella caucasica* were collected, which had not been recorded there previously. Since juvenile shells of *Belgrandiella* and *Horatia* are conchologically similar, the original material may have been misidentified (Palatov and Vinarski, 2015).

“*Horatia*” sp. 2. Found in Agumava Cave (Gudauta Distr., Abkhazia) (Birstein, 1950). The specimens were never described; they may belong to a separate species of *Pontohoratia*.

“*Lartetia*” sp. Recorded in Verkhne-Mzymtinskaya Cave (Adler Distr., Sochi Urban Area) (Birstein, 1950). This record probably refers to some Transcaucasian species of *Paladilhiopsis*.

*Motsametia borutzkyi* (Shadin, 1932). A stygobiont. Known from its type locality, a spring in Tskhal-Tsiteli Cave near Kutaisi (Imereti, Georgia) (Zhadin, 1952; Vinarski et al., 2014).

*Paladilhiopsis aculeus* Starobogatov, 1962. A stygobiont. Found only in its type locality, a spring in Nizhnyaya Shakuranskaya Cave (Gulripshi Distr., Abkhazia) (Starobogatov, 1962).

*Paladilhiopsis carpathica* L. Soos, 1940. A stygo- and crenobiont. Found in caves of Goverla (Ivano-Frankivsk Prov., Ukraine) (Anistratenko, 1998) and springs of Transcarpathia (Birstein and Ljovuschkin, 1967a).

*Paladilhiopsis orientalis* Starobogatov, 1962. A stygobiont. Found only in its type locality, a spring in Krasnoaleksandrovskaya Cave near Kalezh (Lazarevsky Distr., Sochi Urban Area, Krasnodar Terr.) (Starobogatov, 1962). The species is listed in the Red Book of Krasnodar Territory (Kiyashko, 2007c).

*Paladilhiopsis pulcherrima* Starobogatov, 1962. A stygo- and crenobiont. Described from a spring in Krasnoaleksandrovskaya Cave (Lazarevsky Distr., Sochi Urban Area, Krasnodar Terr.) (Starobogatov, 1962); also occurs in helocrenes and rheocrenes on the Black Sea coast from Tuapse to Psou (Palatov and Vinarski, 2015).

*Paladilhiopsis schakuranica* Starobogatov, 1962. A stygobiont. Described from a spring in Nizhnyaya Shakuranskaya Cave (Starobogatov, 1962), and also reported from Tsebeldinskaya Cave (Gulripshi Distr., Abkhazia) (Chertoprud et al., 2016). Conchologically similar forms were found in Abrskila and Golova Otapa Caves (Ochamchira Distr., Abkhazia); their exact status remains to be determined (Palatov and Vinarski, 2015).

*Paladilhiopsis shadini* Starobogatov, 1962. A stygobiont. Described from a spring in Tsebeldinskaya Cave (Gulripshi Distr., Abkhazia) (Starobogatov, 1962); empty shells were also found in Lake Anatoliya in Novoafonskaya Cave (Palatov and Vinarski, 2015; Chertoprud et al., 2016).

*Paladilhiopsis subovata* Starobogatov, 1962. A stygobiont. Found only in its type locality, a spring in Krasnoaleksandrovskaya Cave near Kalezh (Lazarevsky Distr., Sochi Urban Area, Krasnodar Terr.) (Starobogatov, 1962).

*Paladilhiopsis* sp. 1. An undescribed species found in Ayanskaya Cave in Crimea (Birstein and Ljovuschkin, 1967a).

*Paladilhiopsis* sp. 2. An undescribed species found in a spring in Srednyaya Shakuranskaya Cave (Gulripshi Distr., Abkhazia) (Palatov and Vinarski, 2015).

One more record of *Paladilhiopsis* sp. that has existed in the literature for a long time was based on an empty shell found in the dry bed of the Bukhchasai River in Samarkand Prov. of Uzbekistan (Starobogatov, 1972; Birstein and Ljovuschkin, 1967a; Kniss, 2011). According to the recent opinion, this shell may have been accidentally brought into this habitat from Transcaucasia with a contaminated plankton net (Izzatullaev, 2011; Izzatullaev et al., 2013).

*Pontohoratia birsteini* (Starobogatov, 1962). A stygobiont inhabiting streams in Nizhnyaya Shakuranskaya and Tsebeldinskaya Cave (Gulripshi Distr., Abkhazia) (Starobogatov, 1962; Vinarski et al., 2014; Chertoprud et al., 2016).

*Pontohoratia smyri* Vinarski, Palatov et Glöer, 2014. A stygo- and crenobiont inhabiting the waters of Novoafonskaya Cave and also springs near Novy Afon (Vinarski et al., 2014; Chertoprud et al., 2016).

*Pontohoratia* sp. A stygo- and crenobiont. Found in karst springs in the Bzyb and Gega valleys (Gudauta Distr., Abkhazia) (Palatov and Vinarski, 2015).

### Order “Pulmonata”

#### Non-taxonomic group “Basommatophora”

Keferstein, 1865

Stygoxenous species of the families Physidae Fitzinger, 1833 and Planorbinae Rafinesque, 1815 were found in the cave streams of West Georgia (Barjadze et al., 2015a).

#### Family Succineidae Beck, 1837

*Succinella oblonga* (Draparnaud, 1801). A troglophile. Found in Karani-Khoba Cave in Crimea (Wolf, 1938).

#### Order Geophila Ferrusac, 1821

Besides the species listed below, some troglodoxenous representatives of the families Agriolimacidae H. Wagner, 1935, Clausiliidae Gray, 1855, Cochlicopidae Hesse, 1922, Daudebardiidae Kobelt, 1906, Hygromiidae Tryon, 1866, Vitrinidae Fitzinger, 1833, and Zonitidae Mörch, 1864 were found in the caves of the Western Transcaucasia, Crimea, and Perm Territory (Birstein, 1950, Koval, 2001; Pankov et al., 2009; Barjadze et al., 2015a).

#### Family Orculidae Steenberg, 1925

*Euxinolauria vitrea* (Schileyko, 1989). Probably a trogllobiont. Described from Verkhnyaya Mzymtinskaya (=Verkhnyaya Kazachebrodskaya) Cave on the Mzymta River (Shileiko, 1988a); also known from Nizhnyaya Mzymtinskaya (= Akhshtyrskaya, Nizhnyaya Kazachebrodskaya) Cave (Adler Distr., Sochi Urban Area) (Egorov and Greke, 2005). The species is listed in the Red Book of Krasnodar Territory (Kiyashko, 2007d).

*Lauria* sp. Possibly a troglophile. Reported from Chlakhe Cave (Gudauta Distr., Abkhazia) (Birstein, 1950).

Family Clausiliidae Gray, 1855

*Acrotoma baryshnikovi* Likharev et Schileyko, 2007. Probably a troglophile. Known only from Taling-Leget Cave (Dzhavskii Distr., South Ossetia) (Likharev and Schileyko, 2007).

*Scrobifera taurica* (L. Pfeiffer, 1848). A troglophile. Reported from Shirokopokoskaya Cave (Khosta Distr., Krasnodar Terr.) as *Clausilia foveicollis* Parr. (Birstein, 1950).

Family Zonitidae Morch, 1864

*Conulopolita cavatica* (Riedel, 1966). A troglobiont. Described from Shirokopokoskaya Cave (Khosta Distr., Krasnodar Terr.); occurs in caves of the Western Transcaucasia as far as Sukhumi; reliably known from the caves Mikhailovskaya (Sukhumi Distr., Abkhazia), Bacha and Chlakhe (Gudauta Distr., Abkhazia), Zheopse (Gagra Distr., Abkhazia), Verkhn-Mzymtinskaya, Nizhn-Mzymtinskaya, and Chertova Nora (Sochi Urban Area) (Birstein, 1950; Ljovuschkin, 1966a; Riedel, 1966; Koval, 2004b). The name is a senior synonym of *Oxychilus cochlospeleus* Tzvetkov, in Birstein, 1950 (Kantor et al., 2010).

*Conulopolita raddei* (O. Boettger, 1879). A troglobiont, described from Mikhailovskaya (= Stalaktitovaya, Sukhumsкая, Shromskaya) Cave (O. Boettger, 1879). Reliably known from the caves Gumo-Sabashvili, near Venetsiansky Bridge (Sukhumi Distr., Abkhazia), Bacha, Chlakhe, Anysh (Gudauta Distr., Abkhazia), and from the environs of Tsebelda (Birstein, 1950; Kantor et al., 2010).

*Oxychilus subeffusus* (O. Boettger, 1879). A troglophile inhabiting the forest zone of the Great Caucasus, central and southern Georgia, Armenia, and the Talysh Mountains (Kantor et al., 2010). Recorded in Tsebeldinskaya Cave (Gulripshi Distr., Abkhazia) (Birstein and Lopashov, 1940; Tsvetkov, 1940).

*Oxychilus (Longiphallus)* sp. Probably a troglophile. Reported from Chertova Nora Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Koval, 2004b).

“*Oxychilus*” *birsteini* Tzvetkov, 1940. Probably a troglobiont. Known only from Nizhne-Andreevskaya

Cave near Apra (Sukhumi Distr., Abkhazia) (Birstein and Lopashov, 1940; Tsvetkov, 1940; Birstein, 1950).

“*Oxychilus (Retinella)*” sp. Probably a troglophile or a troglobiont. Known only from Gumo-Sabashvili Cave (Sukhumi Distr., Abkhazia) (Birstein, 1950).

Family Daubebardiidae Kobelt, 1906

*Daubebardia nivea* Schileyko, 1988. A troglobiont. Presently known only from its type locality, Oficho Cave near Kumistavi (Tskaltubo Distr., Imereti, Georgia) (Shileiko, 1988b).

*Daubebardia* sp. Probably a troglophile. Known from the cave near Venetsiansky Bridge in the environs of Sukhumi (Boldyrev, 1914, cited after Zaitsev, 1948); also found outside the cave.

Family Trigonochlamydidae Hesse, 1882.

*Lesticulus nocturnes* Schileyko, 1988. A troglobiont. Presently known only from its type locality, Oficho Cave near Kumistavi (Tskaltubo Distr., Imereti, Georgia) (Shileiko, 1988b).

*Selenochlamys* sp. Probably a troglophilous, endogean species. Juveniles were found in Nassonova (= Anlyusha) Cave in Ai-Petri Mt. in Crimea. They could not be identified to species since their genitalia were incompletely developed (Turbanov and Balashov, 2015). The form found in endogean habitats on the slopes of Babugan Plateau and listed for Crimea as the troglophilous species *Selenochlamys cf. ysbryda* Rowson et Symondson, 2008 (Balashov, 2012), is now cited as *Selenochlamys* sp. (Balashov, 2016).

*Troglolestes sokolovi* Ljovuschkin et Matiokin, 1965. A troglobiont. Known only from its type locality, Vorontsovskaya Cave in the upper course of the Kudepsta (Khosta Distr., Sochi Urban Area) (Ljovuschkin and Matiokin, 1965). The species is listed in the Red Book of Krasnodar Territory (Kiyashko, 2007e).

Family Limacidae Rafinesque, 1815

*Eumilax brandti* Martens, 1880. Probably a troglophile. Recorded in Mikhailovskaya Cave (Sukhumi Distr., Abkhazia) (Zaitsev, 1940; Birstein, 1950) as *Paralimax albocarinatus* H.R. Simroth, 1901.

*Eumilax cf. brandti* (Martens, 1880). Probably a troglophile. Recorded in Sakishore Cave (Imereti, Georgia) (Barjadze et al., 2015a, 2015b).

## Family Valloniidae Morse, 1864

*Vallonia pulchella* (Müller, 1774). A troglophile. Recorded in Karani-Khoba Cave in Crimea (Wolf, 1938).

Class **Bivalvia** Linnaeus, 1758Order **Veneroida** Adams et Adams, 1856

## Family Euglesidae Pirogov et Starobogatov, 1974

*Euglesa (Casertiana) crimeana* Stadnichenko, 1980. A stygophile. Known from waters of Karani-Khoba Cave in Crimea, and also from rivers and floodland reservoirs of the Carpathian Mountains (Starobogatov et al., 2004).

*Euglesa* (s. str.) *cavatica* (Shadin, 1952). A stygobiont. Described from a stream in Ushchelnaya Cave in the upper course of the Bolshaya Khosta (Khosta Distr., Sochi Urban Area); also reported from Tsebedinskaya, Nizhnyaya Shakuranskaya, and Srednyaya Shakuranskaya Caves (Starobogatov, 1962; Chertoprud et al., 2016), with some minor differences from the type form. The species is listed in the Red Book of Krasnodar Territory (Kiyashko, 2007f).

*Euglesa* (s. str.) *ljovuschkini* (Starobogatov, 1962). A stygobiont. Described from a spring in Tsebedinskaya Cave (Gulripshi Distr., Abkhazia) (Starobogatov, 1962); also recorded in Nizhnyaya Shakuranskaya and Srednyaya Shakuranskaya Caves (Chertoprud et al., 2016).

*Euglesa* (s. str.) *personata* (Malm, 1855). Probably a stygophile. Occurs in Europe, the Caucasus, and Asia Minor (Kantor et al., 2010); recorded in wells and springs near Adler (Adler Distr., Sochi Urban Area, Krasnodar Terr.) (Starobogatov, 1962).

*Euglesa* spp. Probably stygobionts. A single empty shell with specific morphology found in a stream in Nizhnyaya Shakuranskaya Cave (Starobogatov, 1962); apparently a different undescribed species recorded in Abrskila Cave (Abkhazia) (Chertoprud et al., 2016).

*Euglesa* sp. Probably a stygophile. Recorded in a lake in Shulgan-Tash Cave (Abdullin et al., 2012).

*Euglesa* (s. str.) *subterranea* (Shadin, 1932). A stygobiont. Known only from its type locality, a stream in Rioni Cave near Kutaisi (Imereti, Georgia); also reported from the Pleistocene deposits of Uits locality (Syunik Prov., Armenia) (Arutyunova, 2011).

“*Pisidium zoctanum* (Poli).” In all appearance, this name was produced by misinterpretation of the

binomen “*Pisidium casertanum* (Poli, 1791).” It has occurred in the literature since the work of Wolf (1938), where the name was used for pea clams found in Karani-Khoba Cave in Crimea without specific reference to the cited data. The original work of Poli (1791) contains no description of this species. Since in the XIX century “*casertanum*” was frequently spelled with “z,” i.e., “*cazertanum*,” the name in question may have resulted from erroneous rearrangement of letters. The material from Karani-Khoba Cave kept in the collections of the Zoological Institute of RAS was collected by V.A. Lindholm early in the 1930s but it was processed and identified much later. The pseudo-taxon was possibly created as the result of erroneous citation of names pertaining to this material, which included *Euglesa casertana* (Poli, 1791) among other species.

Phylum **Arthropoda** Siebold, 1848Subphylum **Crustacea** Brünnich, 1772Class **Copepoda** Milne-Edwards, 1840Order **Calanoida** G.O. Sars, 1903

## Family Diaptomidae Baird, 1850

*Speodiaptomus birsteini* Borutzky, 1962. A stygobiont. Described from Skelskaya Cave (Baidar Valley, Crimea, Russia) (Borutzky, 1962b; Borutzky et al., 1991); listed in the Red Book of Ukraine (Samchishina, 2009).

Order **Cyclopoida** Burmeister, 1834

## Family Cyclopidae Rafinesque, 1815

*Acanthocyclops biarticulatus* Monchenko, 1972. A stygo- and interstitiobiont. Described from the interstitial of the dry bed of the Bukhchasai River in the Nuratau Range foothills near Samarkand (Uzbekistan) (Monchenko, 1972).

*Acanthocyclops bicuspidatus* (Claus, 1857). A stygophile. Found in Bornukovskaya Cave (Nizhny Novgorod Prov., Russia) (Birstein and Ljovuschkin, 1966).

*Acanthocyclops kieferi* (Chappuis, 1925). A stygo- and interstitiobiont. Reported from the interstitial of a small river near Malaya Ugolka and also for the caves Druzhba, Molochnyi Kamen (Zakarpattia Prov., Ukraine), and Golubykh Ozer (Ternopol Prov., Ukraine) (Monchenko, 1984, 1993).

*Acanthocyclops vernalis* (Fischer, 1853). A stygophile. Reported from Nizhne-Peishulinskaya Cave in Primorskii Terr. (Borutzky, 1966a) and Bornukovskaya Cave (Nizhny Novgorod Prov., Russia) (Birstein and Ljovuschkin, 1966).

*Acanthocyclops vernalis orientalis* Borutzky, 1966. A stygophile. Described from Nikolaevskaya and Kuznetsovskaya Caves (Primorskii Terr., Russia) (Borutzky, 1966a).

*Acanthocyclops venustus stammeri* (Kiefer, 1930). A stygo- and interstitiobiont. Found in the interstitial of the Psezuapse River near Lazarevskoe and the Dzhubga River near Dzhubga (Krasnodar Terr., Russia) (Monchenko, 1984).

*Bryocyclops jankowskajae* Monchenko, 1972. A stygo- and interstitiobiont. Described from wells near Sultan-Bibi in the southwest of Kyzylkum Desert (Uzbekistan) (Monchenko, 1972).

*Diacyclops bicuspidatus* (Claus, 1857). A stygophile. Reported from Riongesovskaya Cave near Kutaisi (Georgia) (Birstein, 1950); from Novoafonskaya Cave and a karst Vauculian spring above Lake Goluboe (Abkhazia) (Derevenskaya and Mingazova, 2015); also from ground waters of Kyzylkum Desert (Uzbekistan) (Monchenko, 1972).

*Diacyclops bisetosus* (Rehberg, 1880). A stygophile. Reported from a well in Sarykyariz near Samarkand (Uzbekistan) (Monchenko, 1972).

*Diacyclops clandestinus* (Yeatman, 1964). A stygophile. Found in caves of Ugolsky region in the Carpathian Mountains (Ukraine) (Monchenko, 1993).

*Paracyclops fimbriatus* (Fischer, 1853). A stygophile. Reported from Tarkiladze (= Tarkil) Cave near Gudauta (Abkhazia) (Borutzky, 1948a); found in wells, springs, and interstitial habitats of Kyzylkum Desert (Uzbekistan) (Monchenko, 1972).

*Paracyclops fimbriatus imminutus* Kiefer, 1929. A stygophile. Reported from Vorontsovskaya Cave near Khosta (Krasnodar Terr., Russia) (Borutzky, 1950a).

*Speocyclops atropatena* Monchenko, 2010. A stygophile and interstitiobiont. Described from the interstitial of mountain streams in the east of the Lesser Caucasus: Gosmalyan near Lerik (Azerbaijan) and near Stepanakert (Nagorno-Karabakh) (Monchenko, 2010).

*Speocyclops colchidanus* (Borutsky, 1930). A stygobiont. Described from a cave near Kutaisi (Borutzky, 1930b).

*Speocyclops demetiensis* (Scourfield, 1932). A stygo- and interstitiobiont. Reported from the interstitial of the Kintrishi and Lukhunukhali Rivers, and also a spring near Bakhmaro (Georgia), the Psezuapse, Khosta, Mzymta, and Psou Rivers (Krasnodar Terr., Russia), the Uchan-Su River near Yalta (Crimea, Russia) (Monchenko, 1986).

*Speocyclops lussianus* Borutzky, 1950. A stygobiont. Described from Vorontsovskaya Cave near Khosta (Krasnodar Terr., Russia) (Borutzky, 1950a).

*Speocyclops psezuapsensis* Borutzky, 1965. A stygobiont. Described from Kirovskaya Cave on the Psezuapse river near Lazarevskoe (Krasnodar Terr., Russia) (Borutzky, 1965).

*Speocyclops tauricus* Borutzky, 1965. A stygobiont. Described from Krubera Cave on Karabi Plateau (Crimea, Russia) (Borutzky, 1965).

*Tropocyclops prasinus* (Fischer, 1860). A stygophile. Found in an inundated gallery near Glubokoe (Transcarpathia, Ukraine) (Vargovich, 1993; 2004a).

#### Order **Harpacticoida** G.O. Sars, 1903

##### Family Ameiridae Boeck, 1865

*Nitokra lacustris* (Schmankewitsch, 1875). A stygophile. Found in ground waters near Cholpon-Ata on the north shore of Lake Issyk Kul (Kyrgyzstan) (Borutzky, 1972b).

*Nitocrella aktereki* Borutzky, 1978. A stygo- and interstitiobiont. Described from ground waters (Chappuis pit sample) at the mouths of the Akterek and Ton Rivers on the south shore of Lake Issyk Kul (Kyrgyzstan) (Borutzky, 1978).

*Nitocrella asiatica* (Štěrba, 1967). A stygo- and interstitiobiont. Described from ground waters of the Varzob River near Dushanbe (Gissar Range, Tajikistan) (Štěrba, 1967, 1968; Borutzky, 1969a, 1978).

*Nitocrella colchica* Borutzky et Michailova, 1970. A stygobiont. Described from a cave on the left bank of the Kumi River near Kvilishori (Tskaltubo, Georgia) (Borutzky and Mikhailova-Neikova, 1970).

*Nitocrella djirgalanica* Borutzky, 1978. A stygo- and interstitiobiont. Described from ground waters (Chappuis pit sample) of the Aksu River (a tributary of

the Dzhirgalan) on the east shore of Lake Issyk Kul (Kyrgyzstan) (Borutzky, 1978).

*Nitocrella hirta caucasica* Borutzky, 1967. A stygobiont. Described from Podparapetnaya Cave on the Khosta River near Sochi (Krasnodar Terr., Russia) (Borutzky, 1966a, 1972a).

*Nitocrella jankowskajae* Borutzky, 1972. A stygo- and interstitiobiont. Described from ground waters near Cholpon-Ata on the north shore of Lake Issyk Kul (Kyrgyzstan) (Borutzky, 1972b, 1978).

*Nitocrella kirgizica* Borutzky, 1972. A stygo- and interstitiobiont. Described from ground waters of the Cholpon-Ata River in the Kungei Alatau Range (Kyrgyzstan) (Borutzky, 1972b, 1978).

*Nitocrella kyzylkumica* Borutzky, 1972. A stygo- and interstitiobiont. Described from ground waters (Chappuis pit sample) of the dry bed of the Bukhchasai River near Nuraty (South Kyzylkum, Uzbekistan) (Borutzky, 1972b, 1978).

*Nitocrella ljevuschkini* Borutzky, 1967. A stygobiont. Described from Dolgaya and Ushchelnaya Caves near Sochi and from Krasnoaleksandrovskaya Cave near Tuapse (Krasnodar Terr., Russia) (Borutzky, 1967a, 1972a).

*Nitocrella monchenkoi* Borutzky, 1972. A stygo- and interstitiobiont. Described from wells near Sultan-Babi and Tashkuduk in the South Kyzylkum Desert (Uzbekistan) (Borutzky, 1972b, 1978).

*Nitocrella sterbai* Borutzky, 1969. A stygo- and interstitiobiont. Described as *Spelaeocamptus reductus* Štěrba, 1967 from ground waters of the Varzob River near Dushanbe (Gissar Range, Tajikistan) (Štěrba, 1967; Borutzky, 1969a, 1978).

*Nitocrella tianshanica* Borutzky, 1972. A stygo- and interstitiobiont. Described from ground waters and a well near Cholpan-Ata on the north shore of Lake Issyk Kul (Kyrgyzstan) (Borutzky, 1972b, 1978).

*Nitocrella tschatcalica* Borutzky, 1978. A stygo- and interstitiobiont. Described from ground waters (Chappuis pit sample) on the north shore of Lake Sary-Chalek (Chatkal Range, Kyrgyzstan) (Borutzky, 1978).

*Nitocrella* sp. Several unidentified species reported from a cave in the left bank of the Kumi River near Kvilishori (Tskaltubo, Georgia) (Borutzky and Mikhailova-Neikova, 1970) and from a salt lake in Kaptar-Khana Cave near Khojambas (Turkmenistan) (Birstein and Ljevuschkin, 1965a).

#### Family Canthocamptidae Brady, 1880

*Attheyella crassa* (G.O. Sars, 1863). A stygophile. Found in the caves: Suuk-Koba (= Kholodnaya) on Tshatyr-Dagh Plateau in Crimea (Borutzky, 1940); Fanagoriiskaya near Goryachii Klyuch, Krasnoaleksandrovskaya near Tuapse, Ushchelnaya, Labirintovaya, and Dolgaya near Sochi (Krasnodar Terr., Russia) (Borutzky, 1948c, 1972a); Anukhvinskaya (= Past Tigra), Nizhnyaya Shakuranskaya, Tsebel'dinskaya, and Abrskila in Abkhazia (Borutzky, 1972a); a cave on the left bank of the Kumi River near Kvilishori and Gliana Cave in Kumistavi near Tskaltubo (Georgia) (Borutzky and Mikhailova-Neikova, 1970); a cave in Gulbista near Dushanbe (Tajikistan) (Borutzky and Mikhailova-Neikova, 1970); also in ground waters near Nuraty in Kyzylkum Desert (Uzbekistan) (Borutzky, 1972a).

*Attheyella gladkovi sibirica* Borutzky, 1969. A stygophile. Described from Karaulinskaya Cave and a shaft cave on the Yenisei River near Krasnoyarsk (Russia) (Borutzky, 1969b).

*Attheyella orientalis mesasiatica* Borutzky, 1969. A stygophile. Described from a well in Cholpon-Ata on the north shore of Lake Issyk Kul (Kyrgyzstan) (Borutzky, 1969b, 1972b, 1978).

*Attheyella wulmeroides* Borutzky, 1930. A stygophile. Described from Riongesovskaya Cave near Kutaisi (Georgia) (Borutzky, 1930b, 1972a).

*Bryocamptus aquaedectus* Borutzky, 1934. A stygobiont. Described from the water supply system in Teberda (Karachay-Cherkessia, North Caucasus, Russia) (Borutzky, 1934).

*Bryocamptus birsteini* Borutzky, 1940. A stygobiont. Described from Gogoleti Cave near Ambrolauri (Georgia) (Borutzky, 1940).

*Bryocamptus bispinosus* Borutzky, 1940. A stygobiont. Described from Suuk-Koba (= Kholodnaya) Cave on Tshatyr-Dagh Plateau in Crimea (Russia) (Borutzky, 1940).

*Bryocamptus innominatus* Borutzky, 1940. A stygobiont. Described from Gogoleti Cave near Ambrolauri (Georgia) and Golova Otapa Cave (Abkhazia) (Borutzky, 1940); reported from a cave near Chuneshe (Tskaltubo, Georgia) and from Ushchelnaya near Khosta (Krasnodar Terr., Russia) (Borutzky, 1972a; Borutzky and Mikhailova-Neikova, 1970).

*Bryocamptus minutus* (Claus, 1863). A stygophile. Found in wells in the South Kyzylkum Desert (Uzbekistan) (Borutzky, 1969a, 1972b, 1978).

*Bryocamptus pygmaeus* (G.O. Sars, 1863). A stygophile. Found in Dolgaya and Labirintovaya Caves near Khosta (Krasnodar Terr., Russia) (Borutzky, 1972a).

*Bryocamptus reductus* Borutzky, 1940. A stygobiont. Described from Mikhailovskaya Cave near Sukhumi (Abkhazia) (Borutzky, 1948c, 1972a).

*Bryocamptus spinulosus* Borutzky, 1934. A creobiont and stygophile. Found in springs of the West and East Tien Shan (Kyrgyzstan), and also in ground waters of the Varzob River near Dushanbe (Gissar Range, Tajikistan) (Borutzky, 1978).

*Bryocamptus tarnogradskiyi* Borutzky, 1934. A stygophile. Reported from Fanagoriiskaya Cave near Khosta (Krasnodar Terr., Russia) (Borutzky, 1948c).

*Bryocamptus tauricus* Borutzky, 1930. A stygobiont. Described from Karani-Koba Cave on Karabi Plateau (Crimea, Russia) (Borutzky, 1930a).

*Bryocamptus zschokkei caucasicus* Borutzky, 1930. A stygophile. Described from Riongesovskaya Cave near Kutaisi (Georgia) (Borutzky, 1930a); reported from the caves: Kvilishori and Gliana near Tskaltubo (Georgia) (Borutzky and Mikhailova-Neikova, 1970); Verkhnyaya Mzymtinskaya, Ushchelnaya, Labirintovaya, Dolgaya near Sochi, Krasnoaleksandrovskaya near Tuapse, and Fanagoriiskaya near Goryachii Klyuch (Krasnodar Terr., Russia) (Borutzky, 1948c, 1972a); Anukhvinskaya (= Past Tigra) and Abrskila (Abkhazia) (Borutzky, 1972a); Makrushinskaya and Nikolaevskaya (Primorskii Terr., Russia) (Borutzky, 1966a); from ground waters of Lake Issyk Kul (Kyrgyzstan) and the Varzob River near Dushanbe (Gissar Range, Tajikistan) (Borutzky, 1978).

*Bryocamptus* sp. Naupliar stages reported from Tarkiladze (= Tarkil) Cave near Gudauta (Abkhazia) (Borutzky, 1948c); first copepodite stages reported from Vorontsovskaya Cave near Khosta (Krasnodar Terr., Russia) (Borutzky, 1950a); from Shulgan-Tash (= Kapovaya) Cave (Bashkortostan, Russia) (Chertoprud et al., 2006; Abdullin et al., 2012).

*Canthocamptus staphylinus* (Jurine, 1820). A stygophile. Reported from wells near Saratov (Russia) (Behning, 1928) and from the interstitial (Chappuis pit sample) downstream of the Kumi spring near Tskaltubo (Georgia) (Borutzky and Mikhailova-Neikova, 1970).

*Ceuthonectes serbicus colchidanus* (Chappuis, 1924). A stygobiont. Described as *Morariodes colchidana* Borutzky, 1930 from Riongesovskaya Cave near Kutaisi (Georgia) (Borutzky, 1930a, 1952); reported from a cave in the left bank of the Kumi River near Kvilishori and a cave near Chuneshe (Tskaltubo, Georgia) (Borutzky and Mikhailova-Neikova, 1970).

*Echinocamptus georgevitchi* (Chappuis, 1924). A stygobiont. Reported from the caves: Gliana in Kumistavi near Tskaltubo (Georgia); Krasnoaleksandrovskaya near Tuapse, Dolgaya, Labirintovaya, and Nikity near Sochi (Krasnodar Terr., Russia); Tsebildinskaya, Anukhvinskaya (= Past Tigra), Nizhnyaya Shakuranskaya, and Abrskila in Abkhazia (Borutzky and Mikhailova-Neikova, 1970; Borutzky, 1972a).

*Elaphoidella bidens coronata* (G.O. Sars, 1904). A stygophile. Found in the interstitial (Chappuis pit sample) of the Mzymta River near Adler (Krasnodar Terr., Russia) (Borutzky, 1972a).

*Elaphoidella birsteini* Borutzky, 1948. A stygobiont. Described from Mikhailovskaya Cave near Sukhumi (Abkhazia) (Borutzky, 1948c, 1972a).

*Elaphoidella czerkessica* Borutzky, 1972. A stygobiont. Described from Ushchelnaya Cave near Khosta (Krasnodar Terr., Russia) (Borutzky, 1972a).

*Epactophanes angulatus* Kessler, 1914. A stygophile. Reported from Ettykyz Cave (Kashkadarya Prov., Uzbekistan) (Borutzky and Mikhailova-Neikova, 1970).

*Epactophanes richardi* Mrázek, 1893. A stygophile. Reported from Aman-Kutak Cave (Samarkand Prov., Uzbekistan) (Borutzky and Mikhailova-Neikova, 1970) and ground waters near Cholpon-Ata on the north shore of Lake Issyk Kul (Kyrgyzstan) (Borutzky, 1972b, 1978).

*Epactophanoides udegeicus* Borutzky, 1966. A stygobiont. Described from Makrushinskaya Cave (Primorskii Terr., Russia) (Borutzky, 1966a).

*Limocamptus hostensis* Borutzky, 1972. Possibly a stygobiont. Described from Labirintovaya Cave near Khosta (Krasnodar Terr., Russia) (Borutzky, 1972a).

*Maraenobiotus brucei caucasicus* Borutzky, 1934. A stygophile. Reported from Azokhskaya Cave (Garut Distr., Nagorno-Karabakh) and Kilitskaya Cave near Ordubad (Nakhchivan Autonomous Republic, Azerbaijan) (Borutzky and Mikhailova-Neikova, 1970).



*Maraenobiotus insignipes kyzylkumicus* Borutzky, 1972. A stygophile. Described from the Sarykyariz well in the South Kyzylkum Desert (Uzbekistan) (Borutzky, 1972b, 1978).

*Moraria colchica* Borutzky et Michailova, 1970. A stygobiont. Described from a cave on the left bank of the Kumi River near Kvilishori (Tskaltubo, Georgia) (Borutzky and Mikhailova-Neikova, 1970).

*Moraria cornuta* Borutzky, 1948. A stygobiont. Described from Mikhailovskaya Cave near Sukhumi (Abkhazia) (Borutzky, 1948c, 1972a).

*Moraria operculata* Borutzky, 1948. A stygobiont. Described from Verkhnyaya Mzymtinskaya and Dolgaya Caves near Sochi, and also from the interstitial (Chappuis pit sample) of the Mzymta River bank (Krasnodar Terr., Russia) (Borutzky, 1948c, 1972a).

*Moraria hostensis* Borutzky, 1972. A stygobiont. Described from Podparapetnaya Cave near Khosta (Krasnodar Terr., Russia) (Borutzky, 1972a).

*Moraria poppei* (Mrázek, 1893). A stygobiont. Found in Dolgaya Cave near Khosta (Krasnodar Terr., Russia) (Borutzky, 1972a).

*Moraria subterranea* (Carl, 1904). A stygobiont. Described from Kizil-Koba (= Krasnaya) Cave on Dolgorukovskaya Plateau (Crimea, Russia) (Carl, 1904).

*Moraria varica* (Graeter, 1910). A stygobiont. Reported from Fanagoriiskaya Cave near Goryachii Klyuch and Labirintovaya Cave near Khosta (Krasnodar Terr., Russia) (Borutzky, 1972a).

*Moraria* sp. Naupliar stages reported from Tarkiladze (= Tarkil) Cave near Gudauta (Abkhazia) (Borutzky, 1948a) and Dolgaya Cave near Khosta (Krasnodar Terr., Russia) (Borutzky, 1972a).

#### Family Ectinosomatidae G.O. Sars, 1903

*Halectinosoma abrau* (Krichagin, 1877). A stygophile. Found in a salt lake in Kaptar-Khana Cave near Khojambas (western spurs of the Kugitangtau Range, Turkmenistan); also in ground waters on the bank of the Cholpon-Ata River, on the north shore of Lake Issyk Kul (Kyrgyzstan) (Borutzky, 1969a, 1972b, 1978; Birstein and Ljovuschkin, 1965c).

*Halectinosoma limnophilum* (Štěrba, 1968). A stygo- and interstitiobiont. Described from ground waters of the Varzob River near Dushanbe (Gissar

Range, Tajikistan) (Štěrba, 1967; Borutzky, 1969a, 1978).

*Halectinosoma uniarticulatum* Borutzky, 1972. A stygobiont. Described from the Uchkuduk-2 well in Kulzhuktau (South Kyzylkum, Uzbekistan) (Borutzky, 1972b, 1978).

#### Family Parastenocarididae Chappuis, 1940

*Parastenocaris fonticola* Borutzky, 1926. A stygobiont. Described from a well near Kosino in the env. of Moscow (Russia) (Borutzky, 1926).

*Parastenocaris tenuis* Borutzky, 1948. A stygobiont. Described from Fanagoriiskaya Cave near Goryachii Klyuch (Krasnodar Terr., Russia) (Borutzky, 1948c, 1972a).

#### Family Miraciidae Dana, 1846

*Schizopera paradoxa* (Daday, 1934). A stygophile. Found in a salt lake in Kaptar-Khana Cave near Khojambas (western spurs of the Kugitangtau Range, Turkmenistan) (Birstein and Ljovuschkin, 1965a); also in a well near Cholpon-Ata on the north shore of Lake Issyk Kul (Kyrgyzstan) (Borutzky, 1972b).

*Schizopera pseudojugurtha* Borutzky, 1972. A stygophile. Described from ground waters (Chappuis pit samples) on the north shore of Lake Issyk Kul (Kyrgyzstan) (Borutzky, 1972a, 1978).

Findings of stygoxenous, and possibly also some stygophilous copepod species in various hypogean biotopes (caves, ground waters, interstitial, springs, wells, etc.) in different parts of the former USSR were reported by many authors (Behning, 1928; Borutzky, 1952; Birstein and Ljovuschkin, 1966; Monchenko, 1972, 1974, 1993, 2003; Yankovskaya, 1972; Kniss, 1984a; Polishchuk and Garasevich, 1986; Vargovich, 1993, 2004a; Chertoprud et al., 2006, 2011; Abdullin and Kniss, 2008; Derevenskaya and Mingazova, 2015).

#### Class Ostracoda Latreille, 1802

##### Order Podocopida G.O. Sars, 1866

##### Family Candonidae Kaufmann, 1900

*Trapezicandona taurica* (Schornikov, 1969). A stygobiont. Described from a reservoir in Skelskaya Cave (Baidar Valley); also reported from submarine springs at Cape Aiya near Balaklava (Crimea, Russia) (Shornikov, 1969).

*Trapezicandona ljevuschkini* (Rudjakov, 1963). A stygobiont. Described from Krasnoaleksandrovskaya Cave on the Ashe River near Tuapse (Krasnodar Terr., Russia) (Rudyakov, 1963).

*Trapezicandona riongessa* (Bronstein, 1947). A stygobiont. Described from Riongesovskaya Cave near Kutaisi (Georgia) (Bronstein, 1947).

*Trapezicandona* sp. Probably a stygobiont. An empty shell resembling *T. ljevuschkini* was found in a stream in Zheltaya Cave in the northwest spurs of Ai-Petri Mt. (Crimea, Russia) (Rudyakov, 1963).

*Candona neglecta* G.O. Sars, 1887. A stygophile. Reported from springs and wells of the Ukrainian Carpathians (Polishchuk and Garasevich, 1986).

*Candona* sp. Unidentified ostracods were reported from Krasnoaleksandrovskaya and Labirintovaya Caves (Krasnodar Terr., Russia) (Rudyakov, 1963).

#### Family Cyprididae Baird, 1845

*Cavernocypris subterranea* (Wolf, 1920). A stygomorphic form reported from springs and wells of the Ukrainian Carpathians (Polishchuk and Garasevich, 1986) and wells near Lake Issyk Kul (Kyrgyzstan) (Akatova, 1972; Yankovskaya, 1972a).

*Cypria reptans* Bronstein, 1928. A crenobiont. Found in Dolgaya Cave (Krasnodar Terr., Russia) (Rudyakov, 1963).

*Potamocypris wolfi* Brech, 1920. A crenobiont. Found in subterranean springs under Tertiary sandstone slabs near Voronezh (Russia) (Bronstein, 1947).

Some representatives of the family Cyprididae not identified to species were reported from the Crimean caves Suuk-Koba (= Kholodnaya) on Tshatyr-Dagh Plateau (Lebedinsky, 1900) and Kizil-Koba (= Krasnaya) on Dolgorukovskaya Plateau (Lebedinsky, 1904).

#### Family Limnocytheridae Klie, 1938

*Kovalevskiella (Cordocythere) rudjakovi* (Danielopol, 1969). A stygobiont. Described and so far known only from Krasnoaleksandrovskaya Cave near Tuapse (Krasnodar Terr., Russia) (Danielopol, 1969); earlier identified as *Metacypris* sp. (Rudyakov, 1963).

Some rheocrenous and stygoxenous ostracod species were found in subterranean biotopes (wells, springs, ground waters) in the south part of the

Kyzylkum Desert and North Tien Shan in Kyrgyzstan (Akatova, 1972; Yankovskaya, 1972a), and also in wells in the central part of the Karakum Desert in Turkmenistan (Bronstein, 1947).

A number of ostracod species, apparently stygoxenous or stygophiles, were reported from the Kungurskaya Ledianaya Cave (Perm Terr., Russia) (Pankov, 2008a; Pankov and Krainev, 2004; Pankov et al., 2009) and Shulgan-Tash (= Kapovaya) Cave (Bashkortostan, Russia) (Chertoprud et al., 2006; Abdullin et al., 2012).

#### Class **Malacostraca** Latreille, 1817

#### Order **Bathynellacea** Chappuis, 1915

#### Family Bathynellidae Grobbon, 1904

*Baicalobathynella magna* (Bazikalova, 1954). Described from the environs of Listvinichny in the South Baikal area (Bazikalova, 1949, 1954; Birstein and Ljevuschkin, 1967b).

*Bathynella baicalensis* Bazikalova, 1954. Described from Lake Baikal (Bazikalova, 1949, 1954; Birstein and Ljevuschkin, 1967a, 1967b).

*Bathynella stammeri issykkulensis* Jankovskaja, 1964. An interstitial stygobiont. Described from a well on the north shore of Lake Issyk Kul (Kyrgyzstan) (Yankovskaya, 1964; Birstein and Ljevuschkin, 1967b; Serban, 1994).

*Bathynella stammeri ciscaucasica* Birstein et Ljevuschkin, 1964. An interstitial stygobiont. Described from a stream in Fanagoriiskaya Cave near Goryachii Klyuch (Krasnodar Terr., Russia) (Birstein and Ljevuschkin, 1964a, 1967b).

*Bathynella natans stammeri* Jakobi, 1954. An interstitial stygobiont. Found in wells in Melitopol Distr. of Zaporizhia Prov. (Ukraine) (Monchenko, 1968).

*Bathynella natans ukrainica* Monchenko, 1968. An interstitial stygobiont. Described from the Chumsh spring near Vladimirovka (Odessa Prov., Ukraine) (Monchenko, 1968).

*Bathynella natans natans* Vejdovsky, 1882. An interstitial stygobiont. Found in a reservoir in Ushchel'naya Cave in the upper course of the Vostochnaya Khosta River (Big Sochi area, Krasnodar Terr., Russia) (Birstein and Ljevuschkin, 1967b). Also recorded in subterranean waters of the Prut basin (Ukraine) (Polishchuk and Garasevich, 1986).

*Bathynella chappuisi* Delachaux, 1919. An interstitial stygobiont. Found in a well 65 km W of Kalachna-Donu (Volgograd Prov., Russia) (Schäfer, 1951). The species identity of this finding needs to be clarified (Birstein and Ljovuschkin, 1967b).

*Bathynella gregaria* Birstein et Ljovuschkin, 1967. An interstitial stygobiont. Described from reservoirs in Makrushinskaya Cave (Primorskii Terr., Russia) (Birstein and Ljovuschkin, 1967b).

*Bathynella glacialis* Birstein et Ljovuschkin, 1967. An interstitial stygobiont. Described from the subterranean lake in Ledyanaya Cave (Khabarovsk Terr., Russia) (Birstein and Ljovuschkin, 1967b).

*Bathynella arsenjevi* Birstein et Ljovuschkin, 1967. An interstitial stygobiont. Described from a small lake in Primorskii Velikan Cave (Primorskii Terr., Russia) (Birstein and Ljovuschkin, 1967b).

*Tianschanobathynella jankowskajae* Serban, 1993. An interstitial stygobiont. Described from the nearshore area of Lake Issyk Kul (Kyrgyzstan) (Serban, 1993).

*Tianschanobathynella paraisykhulensis* Serban, 1993. An interstitial stygobiont. Described from the nearshore area of Lake Issyk Kul (Kyrgyzstan) (Serban, 1993).

#### Family Parabathynellidae Noodt, 1964

*Parabathynella stygia* Chappuis, 1926. An interstitial stygobiont. Found, in particular, in a reservoir in the cave on the left bank of the Kumi River near Tskaltubo (Georgia) (Birstein and Ljovuschkin, 1968b; Camacho, 2006).

*Eobathynella mesasiatica* (Birstein et Ljovuschkin, 1964). An interstitial stygobiont. Described from a subterranean lake in a karst cavity in the southeast of Kyrgyzstan (Birstein and Ljovuschkin, 1964b, 1968b).

*Eobathynella minima* Jankowskaja, 1972. An interstitial stygobiont. Described from interstitial waters in Kyzylkum Desert (Uzbekistan) (Yankovskaya, 1972a; Birstein and Ljovuschkin, 1968b).

*Issykkulibathynella tianschanica* (Jankowskaja, 1964). An interstitial stygobiont. Described from a well on the north shore of Lake Issyk Kul (Kyrgyzstan) (Yankovskaya, 1964; Birstein and Ljovuschkin, 1968b; Serban, 1994).

There is an indication of a new representative of the order occurring on Kamchatka (Sidorov, 2008).

#### Order **Isopoda** Latreille, 1817

##### Suborder **Asellota** Latreille, 1803

##### Family Asellidae Latreille 1803, sensu Rafinesque-Schmaltz, 1815

*Asellus (Asellus) aquaticus* (Linnaeus, 1758). A stygophile. The population found in a well at the mouth of the Bolshoi Kastel ravine near Cape Tarkhankut (Crimea), is characterized by the presence of eyes and distinct pigmentation (Prokopov and Turbanov, 2015; Prokopov et al., 2015).

*Asellus (Asellus) aquaticus* forma *cavernicola* Racovitza, 1925. A stygobiont form. Unpigmented specimens with reduced eyes were reported from wells on the south coast of Crimea (Birstein, 1951).

*Asellus primoryensis* Henry et Magniez, 1993. A stygobiont. Described based on a series of syntypes from subterranean waters of Primorskii Territory: the Lazo Reserve (the Imbishi and Perekatnaya rivers, the Sukhoi, Blizkii, and Bolotnyi springs) and the Bikin and Taukhe Rivers (Henry and Magniez, 1993).

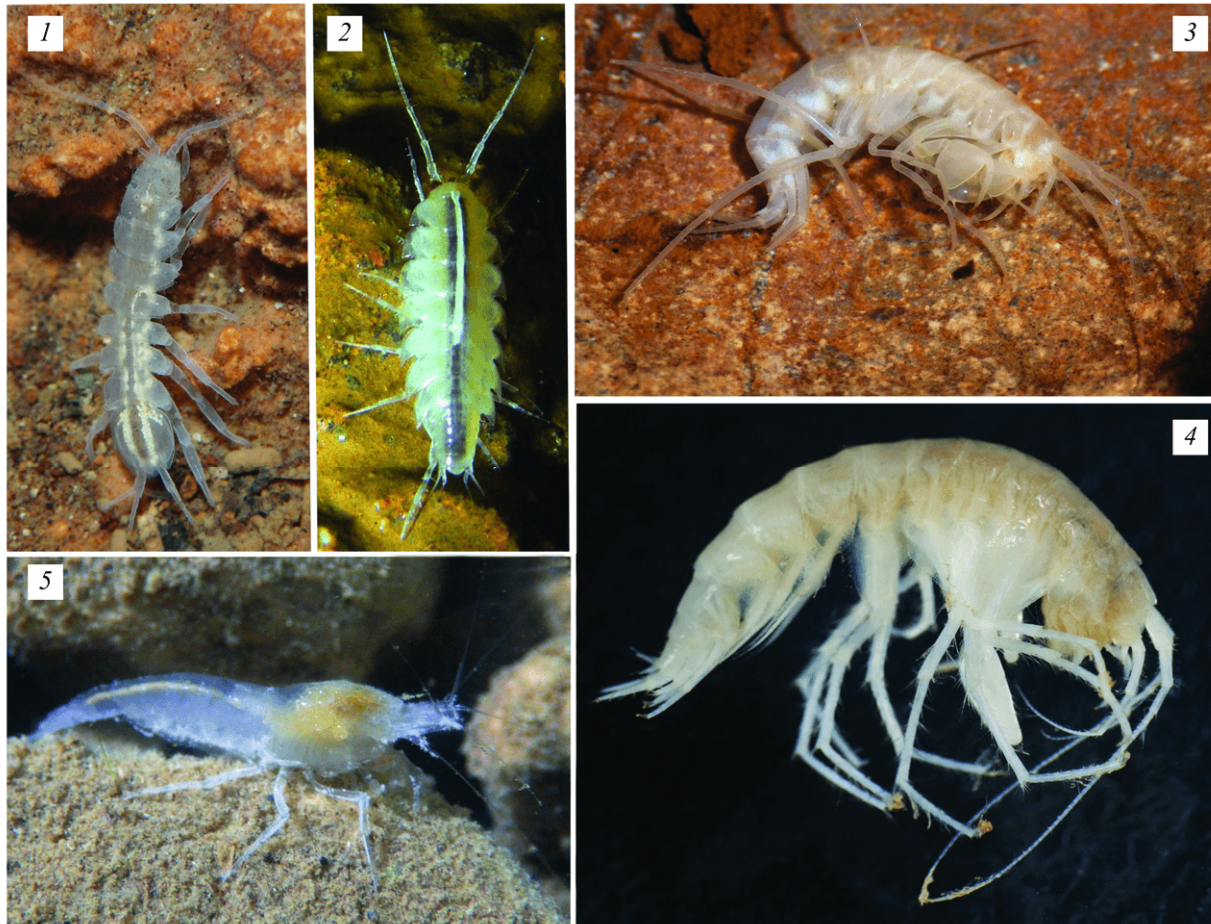
*Sibirasellus dentifer* (Birstein et Levanidov, 1952). A stygomorphic species. Described from subterranean water outlets along the branches Potopilis and Pavlenovskie Klyuchi, 35–40 km from the mouth of the Khor River (a tributary of the Ussuri, Khabarovsk Terr., Russia) (Birstein and Levanidov, 1952).

*Sibirasellus purpureae* Henry et Magniez, 1993. A stygobiont. Described from subterranean waters of the Edinka River (Primorskii Terr., Russia) (Henry and Magniez, 1993); also reported from subterranean waters of the Samarga River (Sidorov, 2005).

*Proasellus infirmus* (Birstein, 1936). A stygophile. Described from a karst spring in the Gumista River basin near Sukhumi (Abkhazia) (W Caucasus) (Birstein, 1936).

*Proasellus linearis* (Birstein, 1967). A stygobiont. Described from a spring in Evstafevskaya Shchel near Gelendzhik (Krasnodar Terr., Russia) (Birstein, 1967). *Proasellus* cf. *linearis* were found in the environs of Tuapse (Russia, NW Caucasus): in springs and water outcrops in the Agoi and Nebug river valleys, and also in streams of Kadosh Park where the isopods were washed out of the subterranean waters by rain floods (Sokolova and Palatov, 2015).

*Proasellus ljovuschkini* (Birstein, 1967). A stygobiont. Described from a karst Vauculian spring in the lower course of the Khosta (Russia) (Birstein, 1967).



**Fig. 1.** Some stygo- and troglobionts in the nature: (1) *Proasellus* sp., a stygobiont water louse from Avgust Cave (Sochi Urban Area, Krasnodar Terr.); (2) *Taurologidium stygium* Borutzky, 1950, a troglobiont wood louse from Skelskaya Cave (Crimea); (3) *Niphargus vadimi* Birstein, 1961, a stygobiont scud from Skelskaya Cave (Crimea); (4) *Zenkevitchia* cf. *admirabilis* Birstein, 1940, a stygobiont scud from Novoafonskaya Cave (Abkhazia); (5) *Trogllocaris jusbaschjani* Birstein, 1948, a stygobiont shrimp from sulphurous springs on the Agura River (Sochi Urban Area, Krasnodar Terr.). Photos by I.S. Turbanov (1, 2, 5), G.A. Prokopov (3), and D.M. Palatov (4).

*Proasellus similis* (Birstein, 1967). A stygobiont. Described from a reservoir in Nikity Cave in the basin of the Psakho River, a tributary of the Kudepsta (Russia) (Birstein, 1967).

*Proasellus* spp. Probably stygobionts (Fig. 1, 1). Possibly new, undescribed species reported from Avgust Cave near Adler (Russia) (this communication; see Fig. 1, 1) and from Novoafonskaya Cave (Abkhazia) (Chertoprud et al., 2016).

#### Family Stenasellidae Dudich, 1924

*Stenasellus asiaticus* Birstein et Starostin, 1949. A stygobiont. Described from the Khodzha-Kainar spring in the Kugitang-Tau Range (western spurs of the Gissar Range, Turkmenistan) (Birstein and Starostin, 1949).

#### Family Janiridae G.O. Sars, 1897

*Mackinia continentalis* Birstein et Ljovuschkin, 1965. A stygobiont. Described from a small lake in Kuznetsovskaya Cave on the right bank of the Partizanskaya River (Primorskii Terr., Russia) (Birstein and Ljovuschkin, 1965b).

#### Family Microparasellidae Karaman, 1933

*Microcharon tantalus* Birstein et Ljovuschkin, 1965. A stygobiont. Described from the interstitial of the Mzymta River (Russia, W Caucasus) (Birstein and Ljovuschkin, 1965b).

*Microcharon halophilus* Birstein et Ljovuschkin, 1965. A stygobiont. Described from a lake with slow-running brackish water in Kaptarkhana Cave (Turkmenistan) (Birstein and Ljovuschkin, 1965b).

*Microcharon kirghisicus* Jankovskaja, 1964. A stygobiont. Described from a well on the north shore of Lake Issyk Kul (Kyrgyzstan) (Yankovskaya, 1964).

*Microcharon* sp. A stygobiont. Reported from interstitial waters of the Kyzylkum Desert in Uzbekistan (Yankovskaya, 1972b); remained undescribed since A.I. Yankovskaya had only one damaged specimen.

#### Suborder **Oniscidea** Latreille, 1802

Findings of the troglobiont woodlouse *Titanethes albus* (C.L. Koch, 1841), which inhabits the caves of Slovenia and Northwestern Italy (Schmalfuss, 2003), were erroneously reported several times from Skelskaya and Krasnaya Caves in Crimea (Lebedinsky, 1900, 1904; Lebedev, 1912, 1914; Novikov, 1912). The error was pointed out by Pliginsky (1914) and Borutzky (1949) who stated that the Crimean caves were in fact inhabited by distinct endemic species of troglobiont woodlice.

#### Family Ligiidae Brandt, 1883

*Ligidium zaitzevi* Borutzky, 1950. A troglophile. Described based on a series of syntypes from Vorontsovskaya Cave (Sochi Urban Area, Russia), and also Mikhailovskaya Cave and the cave at the Venetiansky Bridge near Sukhumi (Abkhazia) (Borutzky, 1950b).

*Ligidium birsteini* Borutzky, 1950. A troglophile. Described from a karst spring close to Olginskoe, near Gagra (Abkhazia, W Caucasus) (Borutzky, 1950b).

*Ligidium fragile* Budde-Lund, 1885. A troglophile. Reported from Chlakhe, Lykhny, and Bacha Caves near Gudauta (Abkhazia, W Caucasus) as *L. euxinum* (Borutzky, 1950b).

*Ligidium nodulosum* Verhoeff, 1918. A troglophile. Reported from Mikhailovskaya Cave near Sukhumi and from Svyatogo Ipatiya Grotto near Gagra (Abkhazia, W Caucasus) (Borutzky, 1950b).

*Ligidium hypnorum* (Cuvier, 1792). A troglophile. Reported from Shirokopokoskaya Cave (Sochi Urban Area, Russia, W Caucasus) (Borutzky, 1950b).

*Ligidium cavaticum* Borutzky, 1950. A troglobiont. Described based on a series of syntypes from several caves: Pervomaiskaya, Podzemnaya Khosta, Shirokopokoskaya, and Vorontsovskaya (Sochi Urban Area, Russia, W Caucasus) (Borutzky, 1950b).

*Ligidium shadini troglophilum* Borutzky, 1948. A troglomorphic species. Described based on a series

of syntypes from springs of the Gissar Range in Tajikistan (Borutzky, 1948b).

*Caucasoligidium cavernicola* Borutzky, 1950. A troglophile. Five subspecies described, typical of particular cave or karst system (Borutzky, 1950b, 1966b): *C. c. cavernicola* Borutzky, 1950 from Adzaba and Mikhailovskaya Caves near Sukhumi (Abkhazia); *C. c. gumistae* Borutzky, 1950 from Verkhnyaya Andreevskaya and Nizhnyaya Andreevskaya Caves near Sukhumi; *C. c. ajustae* Borutzky, 1950 from Ayusta Cave near Gudauta (Abkhazia); *C. c. amtkelicum* Borutzky, 1950 from Nizhnyaya Shakuranskaya Cave near Tsebelda (Abkhazia); *C. c. gogoleticum* Borutzky, 1950 from Gogoleti Cave in Western Georgia.

*Typhloligidium coecum* (Carl, 1904). A troglobiont. Described from Krasnaya Cave on Dolgorukovskaya Plateau (Crimea, Russia) (Carl, 1904); later repeatedly reported from this cave (Borutzky, 1950b, 1962a; Vargovich, 2004; Zagorodnyuk and Vargovich, 2004). There are experimental data on the heat shock and death of woodlice at increased temperatures (Kleimenov, 1987). The species is listed in the Red Book of Crimea (Turbanov, 2015e).

*Typhloligidium karabijajlae* Borutzky, 1962. A troglobiont. Described from a shaft cave 42 m deep on Karabi Plateau (Crimea, Russia) (Borutzky, 1962a); also reported from other caves on Karabi: Soldatskaya and Profsoyuznaya (Vargovich, 2004; Zagorodnyuk and Vargovich, 2004). *T. karabijajlae* is listed in the Red Book of Crimea (Turbanov, 2015f).

*Typhloligidium lithophagum* Turbanov et Gongalsky, 2016. A troglobiont. Described from Bytshya and Alushtinskaya Caves on Tshatyr-Dagh Plateau (Crimea, Russia) (Turbanov and Gongalsky, 2016). Reports of *T. coecum* from Ayanskaya Cave in the north of Tshatyr-Dagh Plateau (Lebedev, 1927) actually refer to *T. lithophagum* (Turbanov and Gongalsky, 2015, 2016).

*Typhloligidium kovali* Gongalsky et Taiti, 2014. A troglobiont. Described from Omega-15 Cave on the Nalchik River (Kabardino-Balkaria, Russia) (Gongalsky and Taiti, 2014).

*Taurologidium stygium* Borutzky, 1950. A troglobiont (Fig. 1, 2). Described from Skelskaya Cave in the western spurs of Ai-Petri Plateau in Crimea (Borutzky, 1950b); also reported from a shaft cave 43 m deep in Besh-Tekne Depression (Borutzky, 1962a) and from

Skelskaya, Geofizicheskaya, and Kaskadnaya Caves (Vargovich, 2004; Zagorodnyuk and Vargovich, 2004). Reports of *T. coecum* from several caves of Ai-Petri Plateau, namely Skelskaya, Uzundzha, Talakanskaya, Boryu-Teshik (= Partizanskaya), and Villyaburunskaya (= Kokozskaya-2) (Lebedev, 1914; Pliginsky, 1914), actually refer to *T. cf. stygium* (Turbanov et al., 2015).

#### Family Buddelundiellidae Verhoeff, 1930

*Buddelundiella cataractae* Verhoeff, 1930. A troglophile. Reported from Sataplia Cave near Tskaltubo (Western Georgia) (Borutzky, 1973).

*Pseudobuddelundiella hostensis* Borutzky, 1967. A troglobiont. Described from Labirintovaya and Ushchelnaya Caves near Khosta (Sochi Urban Area, Russia, W Caucasus) (Borutzky, 1967b).

*Pseudobuddelundiella ljovuschkini* Borutzky, 1967. A troglobiont. Described from Kirovskaya Cave on the Psezuapse River (Lazarevskoe Distr., Sochi Urban Area, Russia, W Caucasus) (Borutzky, 1967b).

*Borutzkyella revasi* (Borutzky, 1973). A troglobiont. Described from Akuya (= Abhazskikh Speleologov) Cave near Novy Afon (Abkhazia, W Caucasus) (Borutzky, 1973).

#### Family Trichoniscidae Sars, 1899

*Tauronethes lebedinskyi* Borutzky, 1949. A troglobiont. Described from Skelskaya Cave in the western spurs of Ai-Petri Plateau (Crimea, Russia) (Borutzky, 1949), and subsequently repeatedly reported from this cave (Borutzky, 1962a; Vargovich, 2004; Zagorodnyuk and Vargovich, 2004).

*Caucasonethes borutzkyi* Verhoeff, 1932. A troglobiont. Described from Riongesovskaya and Tskhal-Tsiteli Caves (Western Georgia) (Verhoeff, 1932).

*Colchidoniscus kutaissianus* Borutzky, 1974. A troglobiont. Two subspecies described from caves in Western Georgia (Borutzky, 1974): *C. k. kutaissianus* Borutzky, 1974 from Belaya, Sakadzhia, Solkota, and Orpiri-II Caves near Tskaltubo; *C. k. motenae* Borutzky, 1974 from Motena Cave near Martvili.

*Mingrelloniscus inchhuricus* Borutzky, 1974. A troglobiont. Described from a cave on the left bank of the Abash River near Martvili (Western Georgia) (Borutzky, 1974).

*Caucasocyphonethes cavaticus* Borutzky, 1948. A troglobiont. Represented by four subspecies from

caves on the Mzymta, Khosta, and Kudepsta Rivers (Sochi Urban Area, Russia, W Caucasus) (Borutzky, 1948a): *C. c. cavaticus* Borutzky, 1948 from Nizhnyaya Kazachebrodsckaya Cave; *C. c. chostensis* Borutzky, 1948 from Podzemnaya Khosta Cave; *C. c. msymticus* Borutzky, 1948 from Verkhnyaya Kazachebrodsckaya Cave; *C. c. adlerensis* Borutzky, 1948 from Shirokopokosskaya Cave.

*Psachonethes czerkessicus* Borutzky, 1969. A troglomorphic species. Described from a cave on the Psakho River, a tributary of the Kudepsta (Sochi Urban Area, Russia, W Caucasus) (Borutzky, 1969c).

*Trichoniscus aphoniscus* Borutzky, 1977. A troglobiont. Three subspecies described from different caves in Abkhazia (Borutzky, 1977): *T. a. aphoniscus* Borutzky, 1977 from caves near Novy Afon; *T. a. abchasicus* Borutzky, 1977 from caves near Sukhumi: Andreevskaya, Mikhailovskaya, Adzaba, cave near Venetsiansky Bridge, and others; *T. a. codoricus* Borutzky, 1977 from Abrskila and Golova Otapa Caves in the Mokva River basin.

*Trichoniscus gudauticus* Borutzky, 1977. A troglobiont. Two subspecies described from caves in Abkhazia (Borutzky, 1977): *T. g. gudauticus* Borutzky, 1977 from Lykhny and Bacha near Gagra; *T. g. anamalus* Borutzky, 1977 from an unknown cave in Gudauta District.

*Trichoniscus pygmaeus tuapsensis* Borutzky, 1972. A troglobiont. Described from a cave on the Psebe River near Tuapse (Krasnodar Terr., Russia) (Borutzky, 1972c).

*Trichoniscus* sp. Troglomorphic woodlice were reported from Shirokopokosskaya Cave (Sochi Urban Area, Krasnodar Terr., Russia) (Borutzky, 1972c).

#### Family Cylisticidae Verhoeff, 1949

*Cylisticus birsteini* Borutzky, 1961. A troglophile. Described from a cave on the Psakho River, a tributary of the Kudepsta (Sochi Urban Area, Russia, Caucasus) (Borutzky, 1961).

#### Order Amphipoda Latreille, 1816

##### Family Bogidiellidae Hertzog, 1936

*Bogidiella ruffoi* Birstein et Ljovuschkin, 1968. A stygo- and crenobiont. Described from the Khodzha-Kainar karst spring (Koytendag Distr., Lebap Prov., Turkmenistan) (Birstein and Ljovuschkin, 1968a).

## Family Crangonyctidae Bousfield, 1973

*Amurocrangonyx arsenjevi* (Derzhavin, 1927) (= *Eucrangonyx arsenjevi* Derzhavin, 1927). A stygophile. Described from springs in the Khor River floodlands in Khabarovsk Territory (Derzhavin, 1927); redescribed in a new genus based on material from the Orekhovyi stream and water outcrops on the bank of Privalovskaya branch in the Khor River floodlands, 4 km E of Georgievka (Pereyaslavsk Distr., Khabarovsk Terr.) (Sidorov and Holsinger, 2007).

*Crangonyx chlebnikovi* Borutzky, 1928 (= *Crangonyx chlebnikovi maximovitshi* Pankov and Pankova, 2004). A stygobiont. Described from Bolshaya Mechinskaya Cave (Borutzky, 1928; Sidorov et al., 2012); also recorded in Kungurskaya Ledyanaya and Babynogorskaya Caves (Kungur Distr., Perm Terr.), Orda Cave (Ordinsky Distr., Perm Terr.), and springs near Shakharovo and Verkh-Suksun (Suksun Distr., Perm Terr.) (Pankov, 2008b; Sidorov et al., 2012).

*Crangonyx ermannii* (Milne-Edwards, 1840). A stygomorphic crenobiont. Reported from thermal springs of Kamchatka (Derzhavin, 1930) but subsequently not recorded in the region; probably a misidentification.

*Lyurella hyrcana* Derzhavin, 1939. A stygo- and crenobiont. Described from springs near Arkevan and Khaftali (Masally Distr., Azerbaijan) (Derzhavin, 1939); also known from other springs of Masally District (Sidorov, 2015).

*Lyurella shepsiensis* Sidorov, 2015. A stygo- and crenobiont. Described from springs in the Shepsi River basin (Tuapse Distr., Krasnodar Terr.) (Sidorov, 2015); also recorded in springs in the Ashe River valley near Kalezh and in Krasnoaleksandrovsкая Cave (Lazarevskoe Distr., Sochi Urban Area, Krasnodar Terr.) (Sokolova and Palatov, 2015).

*Stygobromus kazakhstanica* Kulkina, 1992. Apparently a stygobiont. Described from a small spring near Chernorechenskaya (=Agolotasskaya) Cave (Kordai Distr., Kazakhstan) (Kulkina, 1992).

*Stygobromus mikhaili* Sidorov, Holsinger et Takhteev, 2010. A crenobiont. Described from springs in the Chuya River valley near the Kyzyltash River mouth (Kosh-Agach Distr., Altai Republic) (Sidorov et al., 2010). The species is close to *S. pusillus* (Martynov, 1930), occurring in Lake Teletskoe and the upper course of the Biya (Altai Republic) (Sidorov et al., 2010).

*Stygobromus anastasiae* Sidorov, Holsinger et Takhteev, 2010. A crenobiont. Described from the Universitetsky spring within Irkutsk city area and from the Olkhinsky spring (Shelekhovskiy Distr., Irkutsk Prov.) (Sidorov et al., 2010).

*Synurella apsheronia* Derzhavin, 1945. A stygobiont. Described based on juveniles from a spring-fed well near Gyuzdek (Apsheron Distr., Azerbaijan). Found only once; probably inhabits subterranean freshwater cavities under the Apsheron Peninsula and Gobustan (Derzhavin, 1945b).

*Synurella ambulans* (F. Müller, 1847) (= *Synurella meschtscherica* Borutzky, 1929). A stygophile, widely distributed in European Russia. Recorded in springs of Ryazan (Borutzky, 1927), Moscow (Chertoprud, 2006), Vladimir, Kaluga, Pskov, and Bryansk Provinces of Russia (Sidorov and Palatov, 2012); common in Belarus (Giginyak and Moroz, 2009; Moroz et al., 2014), Western Ukraine (mountain and plain Transcarpathia) (Vargovich, 2004), and Moldova (Dedyu, 1961). Populations from wells and springs are characterized by partial reduction of the eyes (Borutzky, 1929).

*Synurella ambulans* forma *taurica* Martynov, 1931. Described as a special form from a stream near Livadia (Crimea, Russia) (Martynov, 1931). Later, based on material from a karst spring on the Ai-Petri slope, Birstein (1961) showed the creation of this form to be unjustified.

*Synurella* cf. *ambulans* (F. Müller, 1847). Recorded in springs of the Black Sea coast of the Caucasus near Tuapse (Tuapse Distr., Krasnodar Terr.) (Sokolova and Palatov, 2015); the taxonomic status of this form remains to be determined.

*Synurella behningi* (Birstein, 1948). A stygophile, with well-developed eyes. Described from Bacha Cave in Otkhara (Gudauta Distr., Abkhazia) (Birstein, 1948a).

*Synurella dershavini* Behning, 1928. A stygophile, with unpigmented eyes and body. Described from wells in Saratov (Behning, 1928).

*Synurella donensis* (Martynov, 1919). A stygophile. Described from springs in the Kiziterinka River valley (now Rostov-on-Don city area) (Martynov, 1919).

*Synurella jakutana elegans* Martynov, 1931. A crenobiont, with well-developed eyes and expressed pigmentation. Described from a stream near Zhigansk (Zhigansk Distr., Sakha Republic) (Martynov, 1931).

*Synurella jakutana* Martynov, 1931. Described from lakes near Tiksi (Bulun Distr., Sakha Republic). The species has well-developed eyes and expressed pigmentation (Martynov, 1931).

*Synurella levanidovae* G.S. Karaman, 1991. Described from the Pucheveem River (Chaun Distr., Chukotka Autonomous Okrug); not recorded in the hypogean waters proper. The species has well-developed eyes and expressed pigmentation (Karaman, 1991).

*Synurella odessana* Sidorov et Kovtun, 2015. A stygobiont. Described from flooded tunnels in Sloboka neighbourhood of Odessa (Ukraine) (Kovtun and Sidorov, 2014; Sidorov and Kovtun, 2015).

*Synurella philareti* Birstein, 1948. Described from Verevchataya Ravine (lower Dnieper basin) near Kherson (Ukraine); not recorded in hypogean waters. The species has well-developed eyes and expressed pigmentation (Birstein, 1948a).

*Synurella* sp. 1. A stygophile. Recorded in springs of the Hosiivskiyi nature park (Kiev, Ukraine) (Boshko, 2010).

*Synurella* sp. 2. A stygophile with typical troglomorphic features. Recorded in a spring on Khortytsia Island (Zaporizhia Prov., Ukraine) (Vargovich, 2004).

*Synurella* sp. 3. Probably a stygobiont. A new, still undescribed species, reported from Novoafonskaya Cave (Abkhazia) (Chertoprud et al., 2016).

*Synurella stadukhini* Derzhavin, 1930. A crenobiont. Described from reservoirs of the Inya basin on the north coast of the Sea of Okhotsk (Okhotsk Distr., Magadan Prov.) (Derzhavin, 1930); redescribed based on material from the Ozernyi stream (Magadan Prov.) (Karaman, 1990).

*Synurella wachushtii* (Behning, 1940) (= *Di-  
asynurella wachushtii* Behning, 1940). A stygophile, with unpigmented eyes and body. Described from a spring on the Tskhra-Tskharo Pass near the Bakuriani–Tabitskuri road (Samtskhe-Javakheti, Georgia) (Behning, 1940).

*Tadzhocrangonyx setiferus* (Birstein et Ljovuschkin, 1972). A stygophile. Described from springs of the At-Bashi River valley in Tien Shan (At-Bashi Distr., Kyrgyzstan) (Birstein and Ljovuschkin, 1972a).

*Tadzocrangonyx schizurus* (Birstein, 1948). A stygophile. Described from springs near the Gissar Fortress (Gissar Distr., Tajikistan) (Birstein, 1948b).

#### Family Eusiridae Stebbing, 1888

*Paramoera (Ganigamoera) myslenkovi* Sidorov, 2010. A stygobiont, with reduced eyes and no pigmentation. Described from subterranean waters of the Kievka River; also recorded in the underflow of the Peschanaya River (Lazo Distr., Primorskii Terr.) (Sidorov, 2010).

*Paramoera (Ganigamoera) tiunovi* Sidorov, 2010. A stygo- and crenophile, with quite well-developed eyes. Described from a spring on the bank of the Solontsovskaya River (Olginsky Distr., Primorskii Terr.) (Sidorov, 2010).

#### Family Gammaridae Latreille, 1802

*Anopogammarus birsteini* Derzhavin, 1945. A stygo- and crenobiont. Inhabits karst springs on the shores of Lake Goluboe (Derzhavin, 1945b; Birstein and Ljovuschkin, 1970), and also springs of the Bzyb River valley (Gagra Distr., Abkhazia) (Sidorov et al., 2015).

*Gammarus balcanicus* Schäferna, 1922. A stygophile. The first report of gammarids in the subterranean waters of Crimea referred to the finding of *G. pulex* (Linnaeus, 1758) in Krasnaya Cave (Lebedinsky, 1900); later, Martynov (1931) described a new species *G. spelaeus* Martynov, 1931 from the same cave. However, it was eventually shown (Schellenberg, 1937; Birstein, 1961) that *G. spelaeus*, as well as *G. nudus* and *G. tauricus* also described by A.V. Martynov, undoubtedly belonged to the widespread and polymorphic species *G. balcanicus*. The latter occurs almost ubiquitously in the various biotopes of Mountain Crimea: inside caves, in springs, streams, mountain rivers, etc.

*Gammarus komareki imeretinus* Birstein, 1933. A stygophile characterized by normally developed eyes and partial loss of pigmentation. Described from Tskhal-Tsiteli Cave near Kutaisi (Imereti, Georgia) (Birstein, 1933).

*Gammarus pulex* (Linnaeus, 1758). A stygophile. Recorded in caves of the Western Transcaucasia (Birstein, 1950) and in Chistaya and Sumgan-Kutuk Caves (Meleuz Distr., Bashkortostan) (Kniss, 1984a, 2001).

Gammaridae gen. sp. A troglomorphic representative of the family was reported from Soldatskaya Cave on Karabi Plateau (Crimea, Russia) (Vargovich, 2004; Vargovich and Zagorodnyuk, 2004).



## Family Niphargidae Bousfield, 1977

*Niphargus abchasicus* Martynov, 1932. A stygophile. Described from springs of the Khosta and Kudepsta interfluve (Khosta Distr., Sochi Urban Area, Krasnodar Terr.), where it was also recorded later (Ljovuschkin, 1963a); also reported from springs within and near the city of Sochi (Derzhavin, 1945b).

*Niphargus ablaskiri* Birstein, 1940. A stygobiont. Described from Achkhshe-Tyz-Gua (= Abrskila) Cave (Ochamchira Distr., Abkhazia); also reported from Novoafonskaya, Golova Otapa, Abrskila Caves and the shaft cave Kolodets 85 m (Abkhazia) (Skalski, 1980; Chertoprud et al., 2016).

*Niphargus abricossovi* Birstein, 1932. A stygophile. Described from springs on the Zanga (= Razdan) River (Kotayk Prov., Armenia) (Birstein, 1932), from which it was also repeatedly recorded later (Derzhavin, 1945b; Behning and Popova, 1947). Distributed in the eastern part of the Armenian Highlands, in springs and underflows in the basins of Lake Sevan and the rivers Hrazdan, Nakhichevanchaya, Bazarchai, Akery, and Tertera (Ararat, Vayots Dzor, Gegharkunik, Kotayk, and Syunik Provinces of Armenia; Nakhchivan Autonomous Republic of Azerbaijan, Nagorno-Karabakh) (Derzhavin, 1938, 1945b).

*Niphargus abricossovi inornatus* Derzhavin, 1945. A stygophile. Described from springs in the Okhrichai River basin near Shamsuza and Arajatura (Nagorno-Karabakh) (Derzhavin, 1945b).

*Niphargus aggtelekiensis* Dudich, 1932. A stygophile. Reported from springs in the upper Dnieper basin and from Transcarpathia (Birstein, 1969, cited after Kniss, 2001).

*Niphargus alasonius* Derzhavin, 1945. A stygophile. Described from the Dumastori spring on the left bank of the Alazani, opposite Dzhokolo (Akhmet Municipality, Kakheti, Georgia) (Derzhavin, 1945b).

*Niphargus baloghi* Dudich, 1940 (= *Niphargus puteanus baloghi* Dudich, 1940). A stygophile. Described from a spring near Keretski (Ortschaft Kerecke); also found in springs near the Tisa mountain stream (Svaliava Distr., Zakarpattia Prov., Ukraine) (Dudich, 1940; Straškraba, 1957).

*Niphargus birsteini* Dedyu, 1963 (= *Niphargus stygius birsteini* Dedyu, 1963). A stygophile. Described from a spring in the basin of the Reut River, a tributary of the Dniester, near Pyatra (Orhei Distr., Moldova) (Dedyu, 1963b).

*Niphargus borutzkyi* Birstein, 1933. A stygobiont. Described based on females from a stream of Tskhal-Tsiteli Cave near Kutaisi (Imereti, Georgia) (Birstein, 1933); males described later from Sataplia Cave (Jusbashjan, 1942); also recorded in Sapichkhia (= Riongesovskaya) Cave in the same region (Birstein, 1950).

*Niphargus caelestis* G.S. Karaman, 1982 (= *Niphargus stygius longidactylus* Birstein, 1952). A stygobiont. Described from Ushchelnaya Cave near Vorontsovka (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Birstein, 1952a). The original name was changed following the requirements of ICZN, since the epithet "longidactylus" had been used before in the description of *Niphargus kochianus longidactylus* Ruffo, 1937 from the springs of Verona (Italy) (G.S. Karaman, 1982).

*Niphargus carpathorossicus* Straškraba, 1957 (= *Niphargus puteanus carpathorossicus* Straškraba, 1957). A stygophile. Described from springs under Bliznetsy and Apshinets Mts. (Rakhiv Distr., Zakarpattia Prov., Ukraine) (Straškraba, 1957).

*Niphargus corinae* Dedyu, 1963 (= *Niphargus stygius corinae* Dedyu, 1963). A stygophile. Described from mountain springs (2000 m above sea level) on Goverla Mt. (Rakhiv Distr., Zakarpattia Prov., Ukraine) (Dedyu, 1963a).

*Niphargus cubanicus* Birstein, 1954. Possibly a stygophile. Described from a well-heated pond in the fish hatchery of Goryachii Klyuch (Krasnodar Terr.) (Birstein, 1954).

*Niphargus derzhavini* Birstein, 1952 (= *Niphargus puteanus derzhavini* Birstein, 1952). A stygophile. Described from springs near Olginskoe (Gagra Distr., Abkhazia) (Birstein, 1952a).

*Niphargus dimorphus* Birstein, 1961. A stygobiont. Described from wells in Sorokino (now Perevalnoe, Simferopol Distr., Crimea, Russia) (Birstein, 1961; Dedyu, 1980); listed in the Red Book of Crimea (Turbanov, 2015b).

*Niphargus eugeniae* Derzhavin, 1945. A stygobiont. Described from the subterranean source of the Chernaya (= Mchishta) River at its emergence from the cave (Gudauta Distr., Abkhazia) (Derzhavin, 1945b).

*Niphargus galenae* Derzhavin, 1939. A stygophile. Described from a spring in the Vilyash-Chaya valley near Khalfalyar (Masally Distr., Azerbaijan) (Derzhavin, 1939).

*Niphargus glontii* Borutzky, 1940. A stygophile. Described from a spring on the Tskhra-Tskharo Pass near the Bakuriani–Tabitskuri road (Samtskhe-Javakheti, Georgia) (Behning, 1940).

*Niphargus gurjanovae* Birstein, 1941. A stygophile. Described from a spring on Sataple Mt. near Kutaisi (Imereti, Georgia) (Birstein, 1941).

*Niphargus hoverlicus* Dedyu, 1963 (= *Niphargus stygius hoverlicus* Dedyu, 1963). A stygophile. Described from mountain springs (2000 m above sea level) on Goverla Mt. (Rakhiv Distr., Zakarpattia Prov., Ukraine) (Dedyu, 1963a).

*Niphargus inermis* Birstein, 1940 (= *Niphargus ablaskiri inermis* Birstein, 1940). A stygobiont. Described from a stream in Nizhnyaya Shakuranskaya Cave (Gulripshi Distr., Abkhazia) (Birstein, 1940); also reported from Kelasuri and Shroma (= Mikhailovskaya) Caves (Birstein, 1950), Troika Cave in the Arabika karst system (Sidorov, 2014), and also from Srednyaya Shakuranskaya, Tsebdinskaya, Golova Otapa, and Abrskila Caves (Abkhazia) (Chertoprud et al., 2016).

*Niphargus iniochus* Birstein, 1941 (= *Niphargus puteanus iniochus* Birstein, 1941). A stygobiont. Described from Apra Cave (Sukhumi Distr., Abkhazia); also recorded in Tsebdela and Nizhnyaya Shakuranskaya Caves (Sidorov, 2014).

*Niphargus jaroschenkoi* Dedyu, 1963 (= *Niphargus stygius jaroschenkoi* Dedyu, 1963). A stygophile. Described from a spring on the left bank of the Prut River near Novye Badrazhi (Edineț Distr., Moldova) (Dedyu, 1963b).

*Niphargus komareki* S. Karaman, 1932 (= *Niphargus puteanus komareki* S. Karaman, 1932). A stygophile. Described from springs in Kuzii region (Rakhiv Distr., Zakarpattia Prov., Ukraine) (Karaman, 1932).

*Niphargus krasnodarus* Karaman, 2012. A stygobiont. Described from Fanagoriiskaya Cave (Goryacheklyuchskii Distr., Krasnodar Terr.) (Karaman, 2012).

*Niphargus kurdus* Derzhavin, 1945. A stygophile. Described from a spring in the Akery River basin near Pirajan (Azerbaijan, Nagorno-Karabakh) (Derzhavin, 1945b).

*Niphargus latimanus* Birstein, 1952 (= *Niphargus stygius latimanus* Birstein, 1952). A stygobiont. Described from a stream in Vorontsovskaya Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.)

(Birshtein, 1952a). Morphologically close forms were recorded in springs near Tuapse (Sokolova and Palatov, 2015).

*Niphargus leopoliensis* Jaworowski, 1893. A stygophile. Described from a well within the urban territory of Lviv (Ukraine) (Jaworowski, 1893).

*Niphargus lori* Derzhavin, 1945. A stygophile. Described from springs in the Dzoraget River valley near Stepanavan (Lori Prov., Armenia) (Derzhavin, 1945b).

*Niphargus magnus* Birstein, 1940 (= *Niphargus longicaudatus magnus* Birstein, 1940). A stygobiont. Described from Golova Otapa Cave (Ochamchira Distr., Abkhazia); also found in Srednyaya Shakuranskaya and Tsebdela Caves (Birstein, 1940). A morphologically similar but probably new species was found in springs near Tuapse (Sokolova and Palatov, 2015).

*Niphargus otharicus* Birstein, 1952. A stygobiont. Described from Bacha Cave (Gagra Distr., Abkhazia) (Birstein, 1952a). The species is very close to *N. eugeniae* Derzhavin, 1945, described from the same region, and may be its junior synonym (Birstein, 1952a).

*Niphargus pliginskii* Martynov, 1931. A stygobiont. Described from Ful-Koba (= Tuakskaya) Cave on Karabi Plateau (Crimea, Russia) (Martynov, 1931); listed in the Red Book of Crimea (Turbanov, 2015c).

*Niphargus polonicus* Schellenberg, 1936 (= *Niphargus kochianus polonicus* Schellenberg, 1936). A stygophile. Described from a “reservoir” (probably a well) in Ivano-Frankivsk (Ukraine) (Schellenberg, 1936).

*Niphargus poloniticus* Straškraba, 1957 (= *Niphargus stygius poloniticus* Straškraba, 1957). A stygophile. Described from the Klausura Kvasna springs and from springs near Goverla Mt., (Rakhiv Distr., Zakarpattia Prov., Ukraine) (Straškraba, 1957).

*Niphargus potamophilus* Birstein, 1954. Probably a stygophile. Described from ponds of the experimental fish farm in the Don delta, a floodland pool near Rostov-on-Don (Rostov Prov.), and Atkhyrskie fish farms in the Kuban delta (Abinsky Distr., Krasnodar Terr.) (Birstein, 1954).

*Niphargus pseudocaspius* G. Karaman, 1982 (= *Niphargus caspius* Derzhavin, 1945). Probably a stygobiont. Described from depths of 32–36 m in Kendirli Bay of the Caspian Sea (Karakiyani Distr., Mangystau Prov., Kazakhstan) (Derzhavin, 1945a). Most probably

inhabits cavities with fresh water under the sea bottom. The original name was changed following the requirements of ICZN, since the epithet "caspius" had been used before in the description of *Niphargus caspius* Grimm, 1880 (= *Niphargoides caspius* Sars, 1894) from the Caspian Sea near Baku (G.S. Karaman, 1982).

*Niphargus pseudolatimanus* Birstein, 1952 (= *Niphargus stygius pseudolatimanus* Birstein, 1952). A stygobiont. Described from a stream in Novaya (= Dolgaya) Cave (Khosta Distr., Sochi Urban Area, Krasnodar Terr.) (Birstein, 1952).

*Niphargus puteanus* (C.L. Koch, 1836). A stygobiont. Reported from Syundyurlyu Cave near Ai-Dimitrii area on the northwest spurs of Ai-Petri Plateau (Crimea, Russia) (Lebedev, 1914); however, this identification needs to be confirmed with additional material (Turbanov et al., 2015).

*Niphargus smirnovi* Birstein, 1952. A stygophile. Described from Verkhnemzymtinskaya Cave in the Mzymta River valley (Adler Distr., Krasnodar Terr.); later recorded in springs of the Khosta and Kudepsta valleys (Khosta Distr., Sochi Urban Area), the Psou valley (Adler Distr., Sochi Urban Area and border with Abkhazia), and also in Vorontsovskaya, Labirintovaya, Dolgaya, Ushchelnaya, and Podzemnaya Khosta Caves (Khosta Distr., Krasnodar Terr.). The species is highly variable, with unique morphotypes present in each river basin or cave system; there may actually be a group of close species (Ljovuschkin, 1963a).

*Niphargus* spp. Four undescribed species reported from caves of Karabi, Ai-Petri, and Dolgorukovskaya Plateaux in Crimea (Vargovich, 2004; Vargovich and Zagorodnyuk, 2004); some representatives of the genus not identified to species reported from Novoa-fonskaya and Simona Kanonita Caves (Abkhazia) (Chertoprud et al., 2016).

*Niphargus submersus* (Derzhavin, 1945) (= *Martynovia submersa* Derzhavin, 1945). A stygophile. Described from the Sochinka River under the bridge within Sochi city area (Krasnodar Terr.); later recorded in springs of the Vostochnaya Khosta (= Bolshaya Khosta) River (Ljovuschkin, 1963a).

*Niphargus talikadzei* Ljovuschkin in Giljarov et al., 1974. A stygophile. Described from bogged soil in an alder forest near Shavi-Gele (Kobuleti Distr., Georgia) (Gilyarov et al., 1974a).

*Niphargus tauricus* Birstein, 1964. A stygobiont. Described from a capped spring near the old Yalta-Sevastopol road close to the Shaitan-Merdven Pass, in the southwest spurs of Ai-Petri Plateau (Crimea, Russia) (Birstein, 1964). The species is listed in the Red Book of Crimea (Turbanov, 2015d).

*Niphargus vadimi* Birstein, 1961. A stygobiont (Fig. 1, 3). Described from Skelskaya Cave in Baidar valley, the western spurs of Ai-Petri Plateau (Crimea, Russia) (Birstein, 1961; Dedyu, 1980).

*Niphargus valachicus* Dobreanu et Manolache, 1933 (= *Niphargus tatrensis valachicus* Dobreanu et Manolache, 1933). A stygophile. Recorded in springs in the Dniester basin in Moldova (Dedyu, 1961, 1963b). Described from Romania.

The phylogenetic relations of the Crimean representatives of the genus *Niphargus*: *N. tauricus* is close to the Romanian species *N. dobrogicus* Dancau, 1964, while *N. vadimi* and *N. dimorphus* are close to the Romanian species *Pontoniphargus racovitzai* Dancau, 1970 and the Iranian species *N. daniali* Esmaeil-Rineh et Sari, 2013 (Angyal et al., 2015; Esmaeil-Rineh et al., 2015).

Besides the species of *Niphargus* listed above, several undescribed species are mentioned in the literature. In particular, *Niphargus chostensis* was reported from streams of Vorontsovskaya Cave (Birstein, 1950) and possibly described later under a different name (Birstein, 1952a). Some peculiar juvenile forms of *Niphargus* sp. were found in Golova Otapa Cave, but they were not described since no mature specimens were collected (Birstein, 1941).

#### Family Pallaseidae Tachteew, 2000

*Pallasea* sp. Possibly a stygobiont. Reported from Golubinskii Proval and Kitezha Caves (Pinega Distr., Arkhangelsk Prov.). This form resembles the North European species *Pallasea quadrispinosa* Sars, 1867, differing in the absence of lateral cephalic protrusions and dorsal metasomal spines (the latter being replaced by inconspicuous tubercles) (Sidorov et al., 2011).

#### Family Pseudocrangonyctidae Holsinger, 1989

*Procrangonyx primoryensis* Stock et Jo, 1990 (= *Procrangonyx stygoedincus* Sidorov et Holsinger, 2007). A stygobiont. Occurs in ground waters in the Edinka and Samarga basins (Terney Distr., Primorskii

Terr.) (Stock and Jo, 1990; Sidorov and Holsinger, 2007; Sidorov and Barabanshchikov, 2010).

*Pseudocrangonyx birsteini* Labay, 1999. A stygobiont. Described from springs of the Susunai Range near Bolshevik Mt. and Yuzhno-Sakhalinsk (Sakhalin Island, Sakhalin Prov.) (Labay, 1999).

*Pseudocrangonyx bohaensis* (Derzhavin, 1927) (= *Niphargonyx bohaensis* Derzhavin, 1927). A stygo- and crenobiont. Described from springs within the urban territory of Ussuriisk, "in Mishenny yard" (Primorskii Terr.) and on Fedorovskaya Mt. near the mouth of the Razdolnaya River (Nadezhdinsky Distr., Primorskii Terr.) (Derzhavin, 1927).

*Pseudocrangonyx camtschaticus* Birstein, 1955. A stygo- and crenobiont. Described from the Korymaisk spring in the lower course of the Bystraya River (Ust-Bolsheretsky Distr., Kamchatka Terr.) (Birstein, 1955).

*Pseudocrangonyx elenae* Sidorov, 2011. A stygo- and crenobiont. Described from the source spring of the Solontsovy stream (Terney Distr., Primorskii Terr.) (Sidorov, 2011).

*Pseudocrangonyx febras* Sidorov, 2009. A stygobiont. Described from ground waters of the Arsenevka River (Anuchinsky Distr., Primorskii Terr.) (Sidorov, 2009).

*Pseudocrangonyx holsingeri* Sidorov et Gontcharov, 2013. A stygobiont. Described from the underflow of the Steklyanukha River (Shkotovsky Distr., Primorskii Terr.) (Sidorov and Gontcharov, 2013).

*Pseudocrangonyx korkishkoorum* Sidorov, 2006. A stygobiont. Described from the underflow of the Kedrovaya, Barabashevka, and Narva Rivers (Khasan Distr., Primorskii Terr.) (Sidorov, 2006).

*Pseudocrangonyx kseniae* Sidorov, 2012. A stygobiont. Described from subterranean waters of the Kievka River (Lazo Distr., Primorskii Terr.) (Sidorov, 2012).

*Pseudocrangonyx levanidovi* Birstein, 1955. A stygobiont. Described from the Bezymyanny spring in the Potopilis branch in the Hor River valley; also known from springs of the Privalovskaya branch in the same valley (Lazo Distr., Khabarovsk Terr.) (Birstein, 1955; Sidorov, 2009).

*Pseudocrangonyx relictata* Labay, 1999. A stygobiont. Described from a spring on the NW slope of the

Vaida Range, 16 km SE of Pervomaiskoe (Sakhalin Island, Sakhalin Prov.) (Labay, 1999).

*Pseudocrangonyx susanaensis* Labay, 1999. A stygobiont. Described from springs of the Susunai Range near Yuzhno-Sakhalinsk (Sakhalin Island, Sakhalin Prov.) (Labay, 1999).

*Pseudocrangonyx sympatricus* Sidorov et Gontcharov, 2013. A stygobiont. Described from subterranean waters in the Kievka River basin (Lazo Distr., Primorskii Terr.) (Sidorov and Gontcharov, 2013).

*Pseudocrangonyx tiunovi* Sidorov et Gontcharov, 2013. A stygo- and crenobiont. Described from a spring near Tikhaya Inlet (Ussuri Bay) (Vladivostok, Primorskii Terr.) (Sidorov and Gontcharov, 2013).

#### Family Talitridae Rafinesque, 1815

*Orchestia solifuga* Iwasa, 1939. A stygophile. Recorded in subterranean waters in the Samarga River basin (Terney Distr., Primorskii Terr.) (Sidorov and Barabanshchikov, 2010).

#### Family Typhlogammaridae Bousfield, 1977

*Adaugammarus pilosus* Sidorov, Gontcharov et Sharina, 2015. A stygobiont. Described from Sarma Cave in the Arabika karst system at depths 1270–1700 m (Gagra Distr., Abkhazia) (Sidorov et al., 2015a).

*Zenkevitchia admirabilis* Birstein, 1940. A stygobiont. Described from Andreevskaya (= Akhalsheni) Cave near Sukhumi (Abkhazia) (Birstein, 1940b); later reported from various regions of Abkhazia: the source of the Chernaya River emerging from a cave near Gudauta (Derzhavin, 1945b), and from Tarkil (=Tarkiladze), Novoafonskaya (= Anokopiiskaya), Tsebelinskaya, Verkhnyaya Shakuranskaya, Srednyaya Shakuranskaya, and Nizhnyaya Shakuranskaya Caves (Birstein, 1940a; Birstein and Ljovuschkin, 1970).

*Zenkevitchia revasi* Birstein et Liovushkin, 1970. A stygobiont. Described from Motena Cave on Ashi Plateau (Samegrelo-Zemo Svaneti, Georgia) (Birstein and Ljovuschkin, 1970).

*Zenkevitchia sandroruffoi* Sidorov, Gontcharov et Sharina, 2015. A stygobiont. Described from Sarma, Troika, and Orlineo Gnezdo Caves in the Arabika karst system at depths 30–350 m (Gagra Distr., Abkhazia) (Sidorov et al., 2015a).

*Zenkevitchia yakovi* Sidorov, 2015. A stygobiont. Described from Tsebdinskaya (= Istochnik Tsebdela) Cave (Sidorov et al., 2015b); also recorded in Srednyaya Shakuranskaya, Nizhnyaya Shakuranskaya, Golova Otapa, Abrskila, and Uatapakhy Caves (Abkhazia) (Chertoprud et al., 2016).

*Zenkevitchia* spp. Several undescribed stygobiont species reported from "Dva Kapitana" vent (depth 2140 m) in Krubera (= Krubera-Voronya) Cave in the Arabika karst system (Abkhazia) (Sendra and Reboleira, 2012; Turbanov, 2015i). One more species of this genus (Fig. 1, 4) reported from Lake Anatoliya in Novoafonskaya Cave (Vinarski et al., 2014) and previously misidentified as *Anopogammarus* sp. A new, still undescribed species reported from Avgust Cave near Adler (Krasnodar Terr., Russia) (Turbanov and Marin, 2015) and from Novoafonskaya Cave (Abkhazia) (Chertoprud et al., 2016).

#### Order **Decapoda** Latreille, 1802

##### Infraorder **Caridea** Dana, 1852

##### Family Atyidae De Haan, 1849

*Troglocaris (Xiphocaridinella) ablaskiri* Birstein, 1939. A stygobiont. Described from Abrskila (= Achkhshe-Tyz-Gua) and Golova Otapa Caves near Otap (Abkhazia) (Birstein, 1939) and later repeatedly reported from these caves (Birstein and Lopashov, 1940; Zaitsev, 1948; Jusbaschjan, 1941a, 1942, 1951); also found in Uatapakhy Cave (= the well above Golova Otapa Cave) and the shaft cave 85 m (Chertoprud et al., 2016).

*Troglocaris (Xiphocaridinella) fagei* Birstein, 1939. A stygobiont. Described from Psyrtskha near Novy Afon (Abkhazia) (Birstein, 1939; Birstein and Lopashov, 1940; Zaitsev, 1948; Jusbaschjan, 1951); also reported from Novoafonskaya Cave (Abkhazia) (Marin and Sokolova, 2014; Chertoprud et al., 2016).

*Troglocaris (Xiphocaridinella) jusbaschjani* Birstein, 1948. A stygobiont. (Fig. 1, 5). Described from sulphurous springs on the Agura River in the Big Sochi area (Krasnodar Terr., Russia) (Birstein, 1948c; Zaitsev, 1948; Jusbaschjan, 1951; Marin and Sokolova, 2014).

*Troglocaris (Xiphocaridinella) kutaissiana* (Sadovskiy, 1930). A stygobiont. Described from Riongesovskaya Cave near Kutaisi (Georgia) (Sadovskiy,

1930) and later repeatedly reported from this cave (Birstein, 1933; Jusbaschjan, 1934, 1940a, 1940b, 1940c, 1940d, 1941b, 1942, 1947, 1950; Birstein and Vinogradov, 1934; Birstein, 1939; Zaitsev, 1948; Zharkova, 1978); also reported from Tskhaltsiteli Cave near Kutaisi (Georgia) (Marin and Sokolova, 2014).

*Troglocaris (Xiphocaridinella) osterloffii* Jusbaschjan, 1940. Described from Nizhnyaya Shakuranskaya Cave near Tsebdela (Abkhazia) (Jusbaschjan, 1940a) and later repeatedly reported from this cave (Birstein and Lopashov, 1940; Jusbaschjan, 1941a, 1941b, 1942, 1951; Zaitsev, 1948); also found in Srednyaya Shakuranskaya and Tsebdinskaya Caves (Chertoprud et al., 2016).

*Troglocaris (Xiphocaridinella) birsteini* Mugue, Zueva et Ershov, 2001. A stygobiont. Reported from Golova Otapa Cave in Abkhazia as a species sympatric with but genetically different from *T. ablaskiri* (Mugue et al., 2001). The species name "*T. birsteini*" should be considered a nomen nudum since no complete description was published and no holotype was designated (Marin and Sokolova, 2014; Marin and Turbanov, 2015).

*Troglocaris* sp. A stygobiont. Shrimps of the genus *Troglocaris* not identified to species were reported from several caves in Abkhazia and Georgia: the cave at the Venetsiansky Bridge on the Besletka River near Sukhumi (Birstein, 1939; Birstein and Lopashov, 1940); Kelasurskaya Cave near Sukhumi (Zaitsev, 1940, 1948); Krubera (= Krubera-Voronya) Cave in the Arabika karst system (Sendra and Reboleira, 2012); Motena Cave near Martvili (Ioffe, 1981; Ioffe and Djanashvili, 1981).

Phylogenetic relations between the stygobiont shrimps of the genus *Troglocaris* from the Balkan Peninsula and the Caucasus were discussed (Zaksek et al., 2007).

##### Family Hippolytidae Spence Bate, 1888

*Lysmata seticaudata* (Risso, 1816). A troglophile with expressed negative phototaxis. Found in a number of submarine caves and grottoes on the Tarkhankut Peninsula (Crimea, Russia) (Kovtun, 2006, 2010; Kovtun and Makarov, 2011; Kovtun and Pronin, 2011) and near Sevastopol (Statkevich and Turbanov, 2014; Karpova et al., 2015). The species is listed in the Red

Books of Ukraine (Kovtun, 2009b) and Crimea (Statkevich, 2015).

Family Palaemonidae Rafinesque, 1815

*Palaemon serratus* (Pennant, 1777). A troglophile with expressed negative phototaxis. Found in a number of submarine caves of the Tarkhankut Peninsula (Crimea, Russia) (Kovtun, 2009, 2010; Kovtun and Makarov, 2011).

Infraorder **Brachyura** Linnaeus, 1758

Family Potamidae Ortmann, 1896

*Potamon ibericum tauricum* (Czerniavsky, 1884). Possibly a troglophile. Found in Chertova Nora Cave on the Agura River (Big Sochi area, Krasnodar Terr., Russia) (Koval, 2004b).

Some decapod species more or less common to the Black Sea were reported from various submarine caves and grottoes of the Tarkhankut Peninsula (Vorobieva et al., 2012; Kovtun and Pronin, 2011).

Order **Mysida** Boas, 1883

Family Mysidae Haworth, 1825

*Hemimysis serrata* Bacescu, 1938. A troglophile with expressed negative phototaxis. Found in submarine caves and grottoes of the Azov and Black Sea coast of Crimea (Russia) (Kovtun, 2010; Kovtun and Petryashev, 2012; Petryashev and Kovtun, 2013; Komarova, 1991; Reznichenko, 1959). The species is listed in the Red Book of Ukraine (Dovgal, 2009).

*Siriella jaltensis* Czerniavsky, 1868. A troglophile with expressed negative phototaxis. Found in a number of submarine caves of the Tarkhankut Peninsula (Crimea, Russia) (Kovtun and Petryashev, 2012; Petryashev and Kovtun, 2013).

*Hemimysis lamornae pontica* Czerniavsky, 1882. A troglophile with expressed negative phototaxis. Found in a number of submarine caves of the Tarkhankut Peninsula (Crimea, Russia) (Kovtun and Petryashev, 2012; Petryashev and Kovtun, 2013).

*TO BE CONTINUED*