

The Invertebrate cave fauna of the Eastern Rhodopes (Bulgaria and Greece)

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Beron P., Petrov B., Stoev P. 2004. The Invertebrate Cave Fauna of the Eastern Rhodopes (Bulgaria and Greece). – In: Beron P. & Popov A. (eds). Biodiversity of Bulgaria. 2. Biodiversity of Eastern Rhodopes (Bulgaria and Greece). Pensoft & Nat. Mus. Natur. Hist., Sofia, 791-822.

Abstract. The current paper summarizes all the information concerning the distribution of the invertebrate cave fauna in the Eastern Rhodopes. So far, on their territory are registered 106 cave-dwelling invertebrates, nine of which, *Trichoniscus rhodopiense*, *Alpioniscus thracicus*, *Lithobius lakatnicensis*, *Maroniella beroni*, *Bureschiana drenskii*, *B. thracica*, *Duvallius* sp. n. Guéorguiev, *Trogloorhynchus beroni*, *T. angelovi*, are categorized as troglobites. Twelve cave inhabitants are local endemics. Thirty-six caves are studied biospeleologically on the territory of the Eastern Rhodopes, of which only three on the Greek side of the mountain. Apart of three caves in Bulgaria, all the rest are prospected in the course of present survey. The zoogeographic affinities of the cave fauna and some aspects of its conservation are discussed.

Key words: Cave fauna, Invertebrates, Eastern Rhodopes, Bulgaria, Greece

Introduction

The Eastern Rhodopes are moderately high mountains, stretching between Bulgaria and Greece and covering a territory of about 6000 sq. km (Fig. 1). In terms of biospeleology, the region remains among the least explored in the Eastern Balkans.

The first collecting trips in the Bulgarian territory were organised by one of us (P.B.) in the caves Karagug near Tarnovtsi, on 18.08.1960, and Tilki Ini near Ostrovitsa, on 08.09.1960. Two years later, the prominent Polish malacologist Prof. A. Riedel, intrigued by the existence of live specimens of “*Paraegopis frivasdskyanus*”, visited Tilki Ini (together with P.B.) on 15.12.1962, and Hasarskata Peshtera near Gorna Snezhinka on 16.12.1962. Another Polish zoologist, R. Bielawski, collected some invertebrates from Tilki Ini on 16.10.1963 (RIEDEL, 1988). These trips resulted in the erection of the genus *Balcanodiscus*, proposed to include *P. frivasdskyanus*, and also in the description of a new cave beetle, *Bureschiana drenskii* V. Guéorguiev, 1963. Two years later, the prominent French zoologist Prof. A. Vandel described *Trichoniscus rhodopiense* Vandel, 1965 from the cave Karagug.

Until 1994-1995, sparse information about the cave fauna of the Bulgarian Eastern Rhodopes had been published in the papers of ANDREEV (1972), ANGELOV (1985),

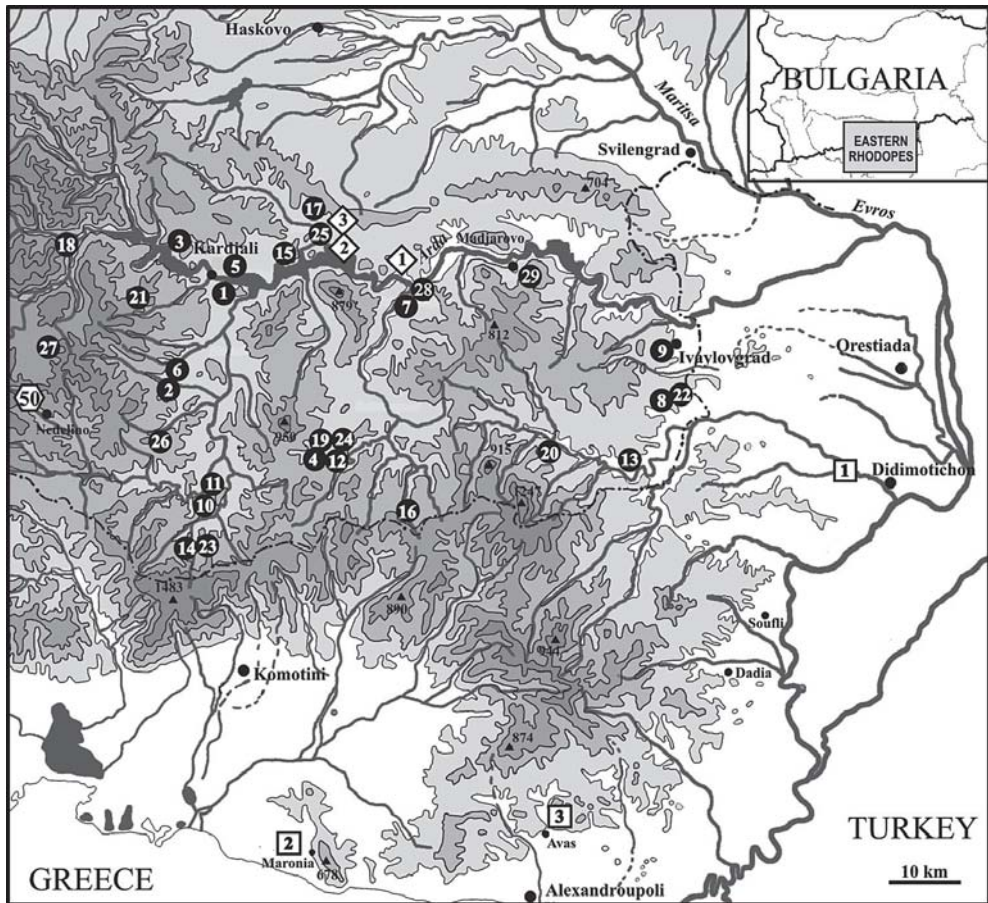


Fig. 1. BULGARIA: Hs 1. Zandana Cave. Hs 2. Kodja In Cave. Hs 3. Karadjainler Cave. Kr 1. Tilki Ini Cave. Kr 2. Karagug Cave. Kr 3. Hasarskata Peshtera Cave. Kr 4. Samara Cave. Kr 5. Karangil Cave. Kr 6. Inkaya Cave. Kr 7. Gouk In Cave. Kr 8. Zmiyamnika Cave. Kr 9. Dupkata Cave. Kr 10. Anifena Propast Cave. Kr 11. Varlidolskata Peshtera Cave. Kr 12. Aina Ini Cave. Kr 13. Prilepova Dupka Cave. Kr 14. Zlatnata Yama Cave. Kr 15. Yarasa Ini Cave. Kr 16. Rupata Cave. Kr 17. Maarata Cave. Kr 18. Hladilnata Peshtera Cave. Kr 19. Brashlyanovata Peshtera Cave. Kr 20. Mechkina Dupka Cave. Kr 21. Vodnata Peshtera Cave. Kr 22. Belopolyanskata Peshtera Cave. Kr 23. Naredenite Kamani Cave. Kr 24. Balaka Cave. Kr 25. Manaf Koyusyu Cave. Kr 26. Gyaurhambar Cave. Kr 27. Tamnata Peshtera Cave. Kr 28. Karangin Cave. Kr 29. Prilepnata Peshtera Cave. Sm 50. Vodnata Peshtera Cave. GREECE: TW 1. Koufovouno Cave. TW 2. Maronia Cave. TW 3. Avanos Cave. ◇ - Dist. Haskovo, ● - Dist. Kardjali, ○ - Dist. Smolyan, □ - Greece

BERON (1972, 1994), DELTSHEV (1970, 1974, 1982), GUÉORGUIEV (1963), NOVOSAD et al. (1987), SKURATOWICZ et al. (1982), STOEV & RIBAROV (1995), STRASSER (1966), RIEDEL (1985, 1988), RIEDEL & URBANSKI (1964), THIBAUD (1995) and VANDEL (1965). The four parts of the Catalogue of the Bulgarian cave fauna (the Essays) summarize in a concise form all the available data and indicate the slow progress of the research in the area. Only two caves, "Peshterata" (= Karagug) and Tilki Ini, were mentioned in the first essay (GUÉORGUIEV & BERON, 1962), with no invertebrates identified on a species level. The next two essays added to the list of the studied caves in the Eastern Rhodopes only one cave, Hasarskata Peshtera, as the number of the species reached

eleven (BERON & GUÉORGUIEV, 1967; BERON, 1972). Our knowledge on the issue was considerably increased with the fourth reviewing paper of BERON (1994). There are already 20 species from 11 caves listed, 16 of which for the first time in the Eastern Rhodopean caves. The progress is mainly due to the research trips of P. Beron in 1982, and to the incidental collecting activities of the local cavers B. Nuriev and B. Kolev.

In the last 13 years, Bulgarian biospeleologists of the younger generation, B. Petrov, P. Stoev, T. Ivanova, N. Simov, A. Georgieva, have been actively exploring the caves in SE Bulgaria, and especially the districts of Haskovo and Kardjali. As a result of these efforts, the invertebrate cave fauna of 33 caves (29 in the District of Kardjali, 3 in the District of Haskovo and 1 in the District of Smolyan) has become known.

The history of the biospeleological research in the Greek part of the mountain is even shorter. Invertebrates are now known only from the caves of Koufovouno, Maronia and Avas. Altogether, 25 species have hitherto been recorded from these caves, 17 of which identified on a species level. The chiropterologist K. Bauer was the first to collect invertebrates in the cave of Koufovouno on 10.06.1965. This important bat roost has attracted also some other zoologists like J. Niethammer (in 1971), P. Beron (22.05.1984), T. Ivanova (23.07.1997) and B. Petrov, P. Stoev and S. Beshkov (29.09.2000).

One of the most interesting caves in Western Thrace is the Maronia Cave, also known as the cave of the mythical Cyclops Polyphemus. It has long remained outside the attention of biospeleologists. Even prominent collectors like K. Lindberg, P. Strinati and H. Coiffait have missed it while working in Greece. The first visit of biospeleologists was that of P. Beron and V. Beshkov on 01.11.1983. It led to discovery of several new species, among which the troglobites *Alpioniscus thracicus* Andreev, 1986, *Maroniella beroni* Casale et Giachino, 1985, and the troglophilic snail *Balcanodiscus cerberus* Riedel, 1985. T. Ivanova and A. Georgieva visited the cave on 26.07.1997, and B. Petrov, P. Stoev and S. Beshkov on 26.09.2000, collecting additional material. In another trip (on 17.05.1987), P. Beron collected some isopods and millipedes (yet unidentified) in a pothole near the village of Avas (7 km N of Alexandroupoli). The last contribution to the fauna of the region is due to GIACHINO (1995), who considered the phyletic relationships among the genera of family Cholevidae in the Eastern Balkans.

Summarizing, 106 species of invertebrates have hitherto been registered in the caves and potholes of the Eastern Rhodopes. Eight of them, *Trichoniscus rhodopiense*, *Alpioniscus thracicus*, *Maroniella beroni*, *Bureschiana drenskii*, *B. thracica*, *Duvalius* sp.n. Guéorguiev, *Trogloorrhynchus beroni* and *T. angelovi*, are troglobites, restricted only to the region. Given the fact that only a small part of the collected material has been an object of scientific treatment, this number could hardly be considered as a final.

Geologic history, volcanism, karst and caves in the Eastern Rhodopes

About 3600 sq. km of the Eastern Rhodopes are covered with rocks of volcanic origin. Volcanic formations are common everywhere in the mountain, having been the largest area in the Balkans with prominent volcanic activity during the Paleocene-Oligocene (KOLEV, 1989). Continuous submarine eruptions took place at the bottom of shallow sea, which led to a mixture of several basic layers. After land emerging in the late Tertiary, formation of volcanic landforms initiated and caves of different origin and types were formed.

Bulgaria

The Eastern Rhodopean volcanic caves (e.g. Hs 3, Kr 15, Kr 29) are usually short (5-25 m), lacking tunnel-like galleries and their temperature, humidity, airflow, CO₂ rates, etc., are largely dependent on the outer environments. The longest volcanic cave in Bulgaria is Kodja In (Golyamata Peshtera, Hs 3) (KOLEV, 1989). It has a large entrance (14 m x 5 m) and two large halls (640 sq. m in total). The galleries are generally short (about 51 m), being parallel to the surface. Thus, the cave has neither a typical Eastern Rhodopean cave climate (inside 23.5°C, outside 32°C in August), nor stable humidity levels (GOSPODINOV, 2001). Another bigger volcanic cave is Yarasa Ini (Kr 15), which shelters a large breeding bat colony, with up to 10 000 individuals (IVANOVA & GEORGIEVA, 2004).

The lava-limestone caves (e.g. Hs 2, Hs 4, Kr 1) were formed in the contact zone between volcanic and sediment layers. These caves are relatively long and sometimes offer a real cave environment. The Tilki Ini Cave is such an example, harboring rich cave-dwelling fauna with several troglobites.

Almost all limestone caves in the Eastern Rhodopes were formed during the Early Pleistocene (i.e. 500-800 thousand years ago). Most of the recent karstic caves are relatively small and usually less than 100 m in length. The longest cave is Samara (327 m) (Kr 4). There are only three caves long between 150 m and 400 m (Kr 4, Kr 12, and Kr 17) and four caves between 100 m and 150 m (Hs 2, Kr 2, Kr 22, Kr 26). Most of the remaining *ca.* 76 karstic caves in the Bulgarian Eastern Rhodopes are less than 100 m (KOLEV, 1991). The deepest pothole in the region is Manaf Koyusyu (-36 m; 46 m total length; Kr 25). Regarding the location of the karstic caves, we follow here the national cave division system proposed by POPOV (1982), who recognized three main regions:

Ardino Cave Region (411). It comprises 44 caves located close to the following settlements: Ardino, Nedelino, Kirkovo, Benkovski, Mlechino, Djebel, Byal Izvor and Kardjali.

Haskovo Cave Region (412). There are several small caves located close to the villages Madrets, Kravevo and Dolno Cherkovishte.

Krumovgrad Cave Region (413). There are *ca.* 36 caves known in this region. Most of them are located close to the villages Ribino, Byal Kladenets, Oreshari and the town of Ivaylovgrad.

The temperature in the inner parts of the caves usually varies between 12°C and 14°C (rarely up to 15°C). Air humidity has its highest values during the winter vs. lowest values in the summer. As a rule, caves with smaller entrances keep higher humidity levels and have stable temperature favoring the presence of rich cave biota.

In conclusion, at present, about 82 karstic and *ca.* 70 volcanic caves are known in the Bulgarian part of the Eastern Rhodopes (KOLEV, 1989, 1991). The geological characteristics of the region are not favorable for the existence of larger caves in this part of the mountain.

Greece

The caves in the Greek Rhodopes are poorly explored and less known, compared to the Bulgarian part. There are several small caves of volcanic origin in many places throughout the mountain, with highest concentration around Dadia and Provatonas. All of them have the same geophysical characteristics as those described for the Bulgarian ones. The limestone deposits cover relatively small area. The longest karst cave is Maronia (TW 2).

It is a labyrinthine system with two main entrances, several large halls and temperature of 16°C. Its total underground surface is about 10 000 sq. m, as the length of the passages exceeds 2000 m (PETROCHILOU 1970, 1984). Another cave, deserving a mention, is Koufovouno (TW 1). Being an important bat nursery roost, it is rich in bat guano (IVANOVA & GEORGIEVA, 2004).

Material and methods

All the information concerning the invertebrate cave fauna of the investigated region, is reviewed. The cave numbers follow the way of numbering utilized in the fourth essay of the cave fauna of Bulgaria (BERON, 1994) and that of Greece (BERON, in prep.). In order to collect additional material, thirty caves in Bulgaria and three ones in Greece were visited in different seasons. The air temperature was measured at ca. 1 m above the ground. All troglobites are bolded.

Abbreviations: BG - Bulgaria; GR - Greece; Gastr. - Gastropoda; Amph. - Amphipoda; Is. - Isopoda; Ps. - Pseudoscorpiones; Opil. - Opiliones; Ar. - Araneae; Chil. - Chilopoda; Dipl. - Diplopoda; Coll. - Collembola; Orth. - Orthoptera; Col. Car. - Carabidae; Col. Cholev. - Cholevidae; Col. Hist. - Histeridae; Col. Staphyl. - Staphylinidae; Col. Curcul. - Curculionidae; Siph. - Siphonaptera; Trich. - Trichoptera; Lepid. - Lepidoptera.

A review of the invertebrates recorded in the Eastern Rhodopean caves

Annelida

Oligochaeta

Lumbricidae

***Eisenia lucens* (Waga, 1857)**

BG: Tilki Ini (Kr 1) - BERON & GUÉORGUIEV (1967: 152).

Trogloxene.

Mollusca

Gastropoda

Stylommatophora

Zonitidae

***Oxybilus depressus* (Sterki, 1880)**

BG: Belopolyanskata Peshtera (Kr 22) - IRIKOV & DEDOV (2004: 788).

Trogloxene.

***Oxybilus glaber striarius* (Westerlund, 1881)**

BG: Tilki Ini (Kr 1) - RIEDEL & URBANSKI (1964: 78); Aina Ini (Kr 12) - (new record, I. Dedov det.).

Troglophile.

***Oxybilus hydatinus* (Rossmassler, 1838)**

BG: Tilki Ini (Kr 1) – RIEDEL & URBANSKI (1964: 78).

Troglophile (?).

***Oxybilus urbanskii* Riedel, 1963**

BG: Aina Ini (Kr 12), Vodnata Peshtera (Kr 21), Vodnata Peshtera (Sm 50) – IRIKOV & DEDOV (2004: 788).

Trogloxene.

***Balcanodiscus cerberus* Riedel, 1985**

GR: Maronia Cave (TW 2) – RIEDEL (1985: 142).

Troglophile.

***Balcanodiscus frivaldskyanus* (Rossmassler, 1842)**

BG: Tilki Ini (Kr 1), Hasarskata Peshtera (Kr 3) – RIEDEL & URBANSKI (1964: 21); Inkaya (Kr 6) – RIEDEL (1985: 139); Zandana (Hs 1), Samara (Kr 4), Gouk In (Kr 7) Aina Ini (Kr 12), Zlatnata Yama (Kr 14), Rupata (Kr 16), Mechkina Dupka (Kr 20), Vodnata Peshtera (Kr 21), Balaka (Kr 24), Gyaurhambar (Kr 26), Tamnata Peshtera (Kr 27), Vodnata Peshtera (Sm 50) – DEDOV & PETROV (2003: 39).

GR: Koufovouno Cave (TW 1) – RIEDEL (1985: 139).

Troglophile. In the Eastern Rhodopes this species is found only in caves. In the western part of the mountain it occurs outside caves, in proper, more humid habitats (DEDOV & PETROV, 2003).

Amphipoda

Gammaridae

***Nipbargus* sp.**

BG: Samarskata Peshtera (Kr 4) – (new record).

Isopoda

Oniscidea

Ligidiidae

***Ligidium herzegovinense* Verhoeff, 1901**

GR: Maronia Cave (TW 2) – ANDREEV (1986: 154).

Trogloxene.

Trichoniscidae

***Trichoniscus rhodopiense* Vandel, 1965**

BG: Peshterata (Kr 2) – VANDEL (1965: 258); Samarskata Peshtera (Kr 4) – BERON (1994: 15); Hasarskata Peshtera (Kr 3), Aina Ini (Kr 12), Zlatnata Yama (Kr 14), Rupata (Kr 16), Tamnata Peshtera (Kr 27) – ANDREEV (2002: 64).

Troglobite. Distribution: Rhodopes Mts., Thassos Island.

Trichoniscus sp.

BG: Zandana (Hs 1), Prilepova Dupka (Kr 13), Mechkina Dupka (Kr 20), Narendenite Kamani (Kr 23), Vodnata Peshtera (Sm 50) - ANDREEV (2002: 66). GR: Koufovouno Cave (TW 1) - (new record).

Hyloniscus sp.

BG: Dupkata (Kr 9) - ANDREEV (2002: 59).

Alpioniscus thracicus Andreev, 1986

GR: Maronia Cave (TW 2) - ANDREEV (1986: 156).

Troglobite.

Monocyphoniscus bulgaricus Strouhal, 1939

BG: Tilki Ini (Kr 1) - VANDEL (1965: 264); Hasarskata Peshtera (Kr 3) - ANDREEV (1972: 181); Zandana (Hs 1) - ANDREEV (2002: 67).

Troglophile?

Philosciidae

Chaetophiloscia bastata Verhoeff, 1929

BG: Tilki Ini (Kr 1) - VANDEL (1965: 264); Belopolyanskata Peshtera (Kr 22) - ANDREEV (2002: 68).

Trogloxene.

Plathyarthridae

Plathyarthrus hoffmannseggi Brandt, 1833

BG: Maarata (Kr 17) - ANDREEV (2002: 68).

Myrmecophile.

Cylisticidae

Cylisticus convexus (De Geer, 1778)

BG: Samarskata Peshtera (Kr 4) - ANDREEV (2002: 68).

Trogloxene.

Arachnida**Pseudoscorpiones**

Chernetidae

Allochernes wideri (C.L. Koch, 1843)

BG: Prilepnata Peshtera (Kr 29) - PETROV (2004: 162).

Trogloxene.

Chthoniidae

Chthonius sp.

BG: Zandana (Hs 1), Tilki Ini (Kr 1), Karagug (Kr 2), Hasarskata Peshtera (Kr 3), Karangil (Kr 5), Aina Ini (Kr 12), Prilepova Dupka (Kr 13), Maarata (Kr 17), Mechkina Dupka (Kr 20), Gyaurhambar (Kr 26), Vodnata Peshtera (Sm 50) - (new records).

Neobisiidae

***Roncus* sp.**

BG: Zandana (Hs 1), Karadjainler (Hs 3), Karagug (Kr 2), Samarskata Peshtera (Kr 4), Gouk In (Kr 7), Aina Ini (Kr 12), Prilepova Dupka (Kr 13), Zlatnata Yama (Kr 14), Yarasa Ini (Kr 15), Rupata (Kr 16), Brashlyanovata Peshtera (Kr 19), Mechkina Dupka (Kr 20), Vodnata Peshtera (Kr 21), Belopolyanskata Peshtera (Kr 22), Naredenite Kamani (Kr 23), Gyaurhambar (Kr 26), Karangin (Kr 28), Vodnata Peshtera (Sm 50) – PETROV (2004: 159).

***Microbisium* sp.**

BG: Karagug (Kr 2) – PETROV (2004: 156).

***Acanthocreagris* sp.**

BG: Inkaya (Kr 6) – PETROV (2004: 154).

Opilionida

Palpatores

Phalangiidae

***Zacheus crista* (Brullé, 1832)**

BG: Gouk In (Kr 7), Zmiyarnika (Kr 8) – BERON (1994: 21).

Trogloxene.

Araneae

Linyphiidae

***Centromerus lakatnikensis* (Drensky, 1931)**

BG: Belopolyanskata Peshtera (Kr 22) – DELTSHEV et al. (2004: 186).

Trogloxene.

***Centromerus milleri* Deltshév, 1974**

BG: Karangil (Kr 5) – DELTSHEV (1974: 81); Hasarskata Peshtera (Kr 3), Aina Ini (Kr 12), Belopolyanskata Peshtera (Kr 22) – DELTSHEV et al. (2003: 15). Zandana (Hs 1), Karagug (Kr 2), Dupkata (Kr 9), Mechkina Dupka (Kr 20), Prilepnata Peshtera (Kr 29) – DELTSHEV et al. (2004: 186).

GR: Maronia Cave (TW 2) – DELTSHEV et al. (2004: 186).

Troglophile.

***Porrhomma convexum* (Westring, 1851)**

BG: Tilki Ini (Kr 1), Samarskata Peshtera (Kr 4), Brashlyanovata Peshtera (Kr 19), Mechkina Dupka (Kr 20), Vodnata Peshtera (Kr 21), Vodnata Peshtera (Sm 50) – DELTSHEV et al. (2003: 18). Gyaurhambar (Kr 26) – DELTSHEV et al. (2004: 186).

Troglophile.

***Palliduphantes istrianus* (Kulczynski, 1914)**

BG: Rupata (Kr 16) – DELTSHEV et al. (2004).

GR: Koufovouno Cave (TW 1) – DELTSHEV et al. (2004: 186).

Troglophile.

***Lepthyphantes leprosus* (Ohlert, 1865)**

BG: Tilki Ini (Kr 1), Hasarskata Peshtera (Kr 3), Hladilnata Peshtera (Kr 18) - DELTSHEV et al. (2003: 16); Karangin (Kr 28), Vodnata Peshtera (Sm 50) - DELTSHEV et al. (2004: 186).

Regular troglaxene.

Tetragnathidae

***Meta bourneti* Simon, 1922**

BG: Samarskata Peshtera (Kr 4), Belopolyanskata Peshtera (Kr 8), Aina Ini (Kr 12), Zlatnata Yama (Kr 14), Balaka (Kr 24) - DELTSHEV et al. (2003: 20); Karangil (Kr 5), Gouk In (Kr 7), Zmiyarnika (Kr 8) - (new records, D. Dimitrov det.).

Troglophile.

***Meta menardi* (Latreille, 1804)**

BG: Tilki Ini (Kr 1) - DELTSHEV (1970: 91); Mechkina Dupka (Kr 21) - DELTSHEV et al. (2003: 20); Gyaurhambar (Kr 26), Vodnata Peshtera (Sm 50) - DELTSHEV et al. (2004: 187); Hasarskata Peshtera (Kr 3), Gouk In (Kr 7), Zmiyarnika (Kr 8) - (new records, D. Dimitrov det.).

GR: Koufovouno Cave (TW 1), Maronia Cave (TW 2) - DELTSHEV et al. (2004: 187).
Troglophile.

***Metellina merianae* (Scopoli, 1763)**

BG: Karagug (Kr 2) - DELTSHEV et al. (2004).

GR: Koufovouno Cave (TW 1) - DELTSHEV et al. (2004: 187).

Troglophile.

Nesticidae

***Nesticus cellulanus* (Clerck, 1757)**

BG: Aina Ini (Kr 12), Zlatnata Yama (Kr 14), Rupata (Kr 16), Maarata (Kr 17), Mechkina Dupka (Kr 20), Vodnata Peshtera (Kr 21), Vodnata Peshtera (Sm 50) - DELTSHEV et al. (2003: 13-14); Gyaurhambar (Kr 26) - DELTSHEV et al. (2004: 185).

Troglophile.

Liocranidae

***Liocranum rupicola* (Walckenaer, 1830)**

BG: Prilepnata Peshtera (Kr 29), Vodnata Peshtera (Sm 50) - DELTSHEV et al. (2004: 189).

Troglaxene.

Agelenidae

***Tegenaria silvestris* L. Koch, 1873**

BG: Anifena Propast (Kr 10) - DELTSHEV (1982: 101).

Regular troglaxene.

Theridiidae

Steatoda triangulosa (Walckenaer, 1802)

BG: Aina Ini (Kr 12) – DELTSHEV et al. (2003: 14).

Trogloxene.

Acari

Ixodida

Ixodidae

Ixodes vespertilionis C.L. Koch, 1844

BG: Tilki Ini (Kr 1), Gouk In (Kr 7), Belopolyanskata Peshtera (Kr 22) (new records, P. Beron det.).

Parasite.

Myriapoda

Chilopoda

Scutigermorpha

Scutigeridae

Scutigera coleoptrata (Linnaeus, 1758)

BG: Gouk In (Kr 7) – STOEV (2004b: 208).

Trogloxene.

Lithobiomorpha

Lithobiidae

Eupolybothrus transsylvanicus (Latzel, 1882)

BG: Zandana (Hs 1), Yarasa Ini (Kr 15), Mechkina Dupka (Kr 20) – STOEV (2001: 49).

GR: Koufovouno Cave (TW 1) – STOEV (2004a: 83).

Troglophile or regular trogloxene.

Eupolybothrus sp.

BG: Rupata (Kr 16), Maarata (Kr 17) – STOEV (2001: 49).

Lithobius (s.str.) *lakatnicensis* Verhoeff, 1926

BG: Zlatnata Yama (Kr 14) – STOEV (2001: 34).

Troglobite.

Lithobius (s.str.) *viriatu*s Sselivanoff, 1878

GR: Maronia Cave (TW 2) – MATIC & STAVROPOULOS (1988: 42).

Trogloxene.

Lithobius (*Monotarsobius*) *crassipes* L. Koch, 1862

BG: Dupkata (Kr 9) – BERON (1994: 36); Kodja In (Hs 2) – STOEV (2001: 43).

Troglophile.

Lithobius (*Sigibius*) cf. *apfelbecki* Verhoeff, 1900

BG: Zandana (Hs 1) – STOEV (2001: 43).

***Lithobius (Sigibius) beroni* Negrea, 1965**

BG: Rupata (Kr 16), Karangin (Kr 28) – STOEV (2001: 44).

Trogloxene.

***Pleuroolithobius patriarchalis* (Berlese, 1894)**

BG: Zmiyarnika (Kr 8), Prilepova Dupka (Kr 13) – STOEV (2001: 47).

Trogloxene.

***Harpolithobius banaticus rhodopensis* Kaczmarek, 1975**

BG: Zandana (Hs 1), Aina Ini (Kr 12) – STOEV (2001: 46).

Trogloxene.

Scolopendromorpha

Scolopendridae

***Cryptops hortensis* (Donovan, 1810)**

BG: Tilki Ini (Kr 1), Zmiyarnika (Kr 8), Rupata (Kr 16) – STOEV (2001: 33).

Trogloxene.

***Cryptops parisi* Brolemann, 1920**

BG: Dupkata (Kr 9) – STOEV (2001: 33).

Trogloxene.

Geophilomorpha

Geophilidae

***Clinopodes flavidus* C.L. Koch, 1847**

BG: Mechkina Dupka (Kr 20) – STOEV (2001: 32).

Trogloxene.

Schendylidae

***Schendyla* sp.**

BG: Tilki Ini (Kr 1), Mechkina Dupka (Kr 20) – STOEV (2001: 33).

Diplopoda

Glomerida

Glomeridae

***Glomeris balcanica* Verhoeff, 1906**

BG: Maarata (Kr 17), Mechkina Dupka (Kr 20) – STOEV (2004b: 213).

Trogloxene.

Doderiidae

***Trachysphaera costata* (Waga, 1857)**

BG: Dupkata (Kr 9) – BERON (1994: 37).

Troglophile.

***Trachysphaera* sp.**

BG: Samarskata Peshtera (Kr 4), Zlatnata Yama (Kr 14), Rupata (Kr 16), Brashlyanovata Peshtera (Kr 19), Mechkina Dupka (Kr 20), Belopolyanskata Peshtera (Kr 22), Vodnata Peshtera (Sm 50) – (new records).

Polydesmida

Polydesmidae

***Polydesmus herzogowinensis* Verhoeff, 1897**

BG: Dupkata (Kr 9) – STOEV (2004b: 214).

Trogloxene.

Paradoxosomatidae

***Metonomastus pomak* Golovatch et Stoev, 2004**

BG: Belopolyanskata Peshtera (Kr 22) – GOLOVATCH & STOEV (2004: 200).

Troglophile.

***Metonomastus* sp.**

BG: Prilepova Dupka (Kr 13) – STOEV (2004b: 215).

Troglophile.

Callipodida

Schizopetalidae

***Balkanopetalum petrovi* Stoev et Enghoff, 2003**

BG: Samarskata Peshtera (Kr 4), Aina Ini (Kr 12), Zlatnata Yama (Kr 14) – STOEV & ENGHOFF (2003: 12).

Troglophile.

Julida

Julidae

***Apfelbeckiella trnowensis rhodopina* Strasser, 1966**

BG: Tilki Ini (Kr 1), Hasarskata Peshtera (Kr 3) – STRASSER (1966: 362).

Troglophile.

***Rhodopiella beroni* (Strasser, 1966)**

BG: Karangil (Kr 5), Gouk In (Kr 7), Zlatnata Yama (Kr 14), Maarata (Kr 17) – STOEV (2004b).

GR: Koufovouno Cave (TW 1) – BERON (in prep.).

Endogeic.

Insecta

Collembola

Hypogastruridae

***Hypogastrura purpurescens* (Lubbock, 1867)**

BG: Karagug (Kr 2) – THIBAUD (1995: 22).

Onychiuridae

Onychiurus variabilis Stach, 1954

BG: Karagug (Kr 2) - THIBAUD (1995: 22).

Orthoptera

Rhaphidophoridae

Troglobilus neglectus Krauss, 1879

BG: Karagug (Kr 2) - PETROV & STOEV (1997); Hasarskata Peshtera (Kr 3), Zlatnata Yama (Kr 14), Naredenite Kamani (Kr 23), Gyaurhambar (Kr 26), Vodnata Peshtera (Sm 50) - POPOV & CHOBANOV (2004: 267).

Troglophile.

Gryllidae

Gryllomorpha dalmatina (Ocskay, 1832)

BG: Zmiyarnika (Kr 8), Zlatnata Yama (Kr 14), Naredenite Kamani (Kr 23) - PETROV & STOEV (1997); Gouk In (Kr 7), Aina Ini (Kr 12), Rupata (Kr 16) - POPOV & CHOBANOV (2004: 268).

Trogloxene.

Discoptila buresi Mařan, 1958

BG: Tilki Ini (Kr 1) - PETROV & STOEV (1997).

Trogloxene.

Coleoptera

Carabidae

Trechus austriacus Dejean, 1831

BG: Dupkata (Kr 9) - GUÉORGUIEV (2004: 386).

GR: Koufovouno Cave (TW 1), Maronia Cave (TW 2) - GUÉORGUIEV (2004: 386).

Troglophile.

Trechus crucifer La Brûlerie, 1875

BG: Zandana (Hs 1) - GUÉORGUIEV (In press).

Trogloxene.

Trechus quadristriatus (Schrank, 1781)

BG: Karangil (Kr 5) - BERON (1994: 45).

Trogloxene - muscicole.

Duvalius (Paraduvalius) sp. n. Guéorguiev, in press

BG: Zandana (Hs 1) - GUÉORGUIEV (In press).

Troglobite.

Duvalius (Paraduvalius) cf. sp. n. Guéorguiev, in press

BG: Hasarskata Peshtera (Kr 3) - GUÉORGUIEV (In press).

Troglobite.

Laemostenus (Pristonychus) cimmerius s.l. (Fischer von Waldheim, 1832) (= *terricola punctatus* Dejean, 1828 auct.)

BG: Hasarskata Peshtera (Kr 3), Dupkata (Kr 9) – BERON (1994: 46); Kodja In (Hs 2), Mechkina Dupka (Kr 20), Vodnata Peshtera (Kr 21), Belopolyanskata Peshtera (Kr 22), Manaf Koyusyu (Kr 25) – GUEORGUIEV (2004: 395); Karangil (Kr 5) – (new record, B. Guéorguiev det.).

GR: Koufovouno Cave (TW 1) – GUÉORGUIEV (2004: 395).

Regular trogloxene. According to CASALE (1988: 809) *L. cimmerius* is “regolamento troglofilo e guanofilo”.

Laemostenus (Actenipus) plasoni plasoni (Reitter, 1885)

BG: Varlidolskata Peshtera (Kr 11) – BERON (1994: 47); Samarskata Peshtera (Kr 4), Aina Ini (Kr 12), Rupata (Kr 16), Vodnata Peshtera (Sm 50) – GUÉORGUIEV (2004: 395).
Troglophile.

Agonum angustatum Dejean, 1828

BG: Zlatnata Yama (Kr 14) – GUÉORGUIEV (2004: 393).

Trogloxene.

Pterostichus (Pseudomaseus) nigrita (Paykull, 1790)

BG: Zlatnata Yama (Kr 14) – GUÉORGUIEV (2004: 394).

Trogloxene.

Staphylinidae

Atheta macroptera Bernhauer, 1913

BG: Karangil (Kr 5) – BERON (1994: 49).

Troglophile – guanobite.

Pselaphidae

Bryaxis sp.

GR: Koufovouno Cave (TW 1) – BESUCHET (1993: 228).

Cholevidae

Nargus badius s.l. (Sturm, 1839)

BG: Varlidolskata Peshtera (Kr 11), Mechkina Dupka (Kr 20) – GUÉORGUIEV (2004: 399).

Subtroglophile.

Anemadus graecus (Kraatz, 1870)

BG: Samarskata Peshtera (Kr 4), Maarata (Kr 17), Hladilnata Peshtera (Kr 18) – GUÉORGUIEV (2004: 398).

GR: Koufovouno Cave (TW 1) – GUÉORGUIEV (2004: 398).

Troglophile.

***Catopsimorphus orientalis* (Aubé, 1850)**

BG: Samarskata Peshtera (Kr 4) - GUÉORGUIEV (2004: 399).

Trogloxene.

***Bureschiana drenskii* V. Guéorguiev, 1963**

BG: Tilki Ini (Kr 1) - GUÉORGUIEV (1963: 394); Hasarskata Peshtera (Kr 3) - BERON & GUÉORGUIEV (1967: 175).

Troglobite.

***Bureschiana cf. drenskii* V. Guéorguiev, 1963**

BG: Zandana (Hs 1) - GUÉORGUIEV (In press).

Troglobite.

***Bureschiana thracica* s.l. Giachino, 1989**

BG: Vodnata Peshtera (Sm 50) - GUÉORGUIEV (2004: 400).

Troglobite.

***Maroniella beroni* Casale et Giachino, 1985**

GR: Maronia Cave (TW 2) - CASALE & GIACHINO (1985: 228).

Troglobite.

Curculionidae

***Troglorrhynchus beroni* Angelov, 1985**

BG: Inkaya (Kr 6) - ANGELOV (1985: 74); Hasarskata Peshtera (Kr 3) - GUÉORGUIEV & PETROV (2004: 458).

Troglobite.

***Troglorrhynchus angelovi* Guéorguiev, 2004**

BG: Zandana (Hs 1); Pilepnata Peshtera (Kr 29) - GUÉORGUIEV & PETROV (2004: 455).

Troglobite.

Histeridae

***Gnathoncus nannetensis* Marsham, 1862**

BG: Karangin (Kr 28) - CHECHLAROV (2004: 416).

Troglophile?

***Margarinotus brunneus* (Fabricius, 1775)**

BG: Karangin (Kr 28) - CHECHLAROV (2004: 415).

Trogloxene.

Siphonaptera

Ischnopsyllidae

***Rhinolophopsylla unipectinata* (Taschenberg, 1800)**

BG: Dupkata (Kr 9) - SKURATOWICZ et al. (1982: 105).

Parasite.

Diptera

Phoridae

***Triphleba antricola* (Schmitz, 1918)**

BG: Gouk In (Kr 7), Rupata (Kr 16), Belopolyanskata Peshtera (Kr 22), Vodnata Peshtera (Sm 50) - LANGOUROV (2001: 34); Karagug (Kr 2), Karangil (Kr 5), Tamnata Peshtera (Kr 27) - LANGOUROV (2004: 761).

Troglophile.

Heleomyzidae

***Heleomyza captiosa* (Gorodkov, 1962)**

BG: Karagug (Kr 2) - BERON (1994: 53).

Subtroglophile.

Nycteribiidae

***Nycteribia (Nycteribia) schmidli* Schinner, 1853**

BG: Dupkata (Kr 9) - NOVOSAD et al. (1987: 678-680).

GR: Koufovouno Cave (TW 1) - HURKA (1972: 710); KOCK (1974: 93).

Parasite.

***Nycteribia (Nycteribia) latreillei* (Leach, 1817)**

GR: Koufovouno Cave (TW 1) - KOCK (1974: 91).

It is a parasite mainly on bats of the genus *Myotis*.

***Nycteribia (Nycteribia) pedicularia* Latreille, 1805**

GR: Koufovouno Cave (TW 1) - HURKA (1972: 710); KOCK (1974: 92).

Parasite.

***Nycteribia (Acrocholidia) vexata* Westwood, 1835**

BG: Dupkata (Kr 9) - NOVOSAD et al. (1987: 682).

GR: Koufovouno cave (TW 1) - HURKA (1972: 710); KOCK (1974: 94).

Parasite.

***Phthiridium biarticulatum* (Hermann, 1804)**

BG: Dupkata (Kr 9) - NOVOSAD et al. (1987: 683).

Parasite.

***Penicillidia (Penicillidia) dufouri* (Westwood, 1835)**

BG: Dupkata (Kr 9) - NOVOSAD et al. (1987: 686).

Parasite.

***Penicillidia (Neopenicillidia) conspicus* Speiser, 1904**

BG: Dupkata (Kr 9) - NOVOSAD et al. (1987: 684-685).

Parasite.

Streblidae

***Brachytarsina flavipennis* Macquart, 1851**

BG: Zandana (Hs 1), Samarskata Peshtera (Kr 4) – (new records).

It is a parasite on bats of the genus *Rhinolophus*. Second record for Bulgaria.

Trichoptera

Limnephilidae

***Micropterna malaspina* Schmid, 1955**

BG: Samarskata Peshtera (Kr 4) – KUMANSKI (2004: 521).

GR: Koufovouno Cave (TW 1) – KUMANSKI (2004: 521).

Regular troglaxene.

***Mesophylax impunctatus* Mc Lachlan, 1884**

BG: Zlatnata Yama (Kr 14) – (new record K. Kumanski det.).

Regular troglaxene.

Lepidoptera

Tineidae

***Monopis laevigella* ([Denis et Schiffermüller], 1775)**

BG: Tilki Ini (Kr 1) – BESHKOV & PETROV (1996: 434).

Subtroglophile.

***Monopis obviella* ([Denis & Schiffermüller], 1775)**

BG: Karangil (Kr 5) – BESHKOV & LANGOUROV (2004: 538).

Subtroglophile.

Acrolepiidae

***Digitivalva pulicariae* (Klimesch, 1956)**

BG: Karagug (Kr 2), Gyaurhambar (Kr 26) – BESHKOV & LANGOUROV (2004: 538).

Subtroglophile?

Alucitidae

***Alucita cymatodactyla* Zeller, 1852**

BG: Gouk In (Kr 7), Yarasa Ini (Kr 15), Maarata (Kr 17) – BESHKOV & PETROV (1996: 435-436); Tilki Ini (Kr 1) – BESHKOV & LANGOUROV (2004: 539).

Subtroglophile.

***Alucita buebneri* Wallengren, 1859**

GR: Koufovouno Cave (TW 1) – BESHKOV & WEGNER (2004: 679).

Troglophile.

Nymphalidae

***Inachis io* (Linnaeus, 1758)**

BG: Gyaurhambar (Kr 26), Zlatnata Yama (Kr 14) – BESHKOV & LANGOUROV (2004: 539).

Troxene.

Geometridae

***Xanthorhoe oxybiata* (Millière, 1872)**

BG: Samarskata Peshtera (Kr 4) - BESHKOV & LANGOUROV (2004: 539).

Regular troglaxene.

***Tripbosa dubitata* (Linnaeus, 1758)**

BG: Gouk In (Kr 7) - BESHKOV & LANGOUROV (2004: 539).

Troglaxene.

Noctuidae

***Scoliopteryx libatrix* (Linnaeus, 1758)**

BG: Samarskata Peshtera (Kr 4), Gouk In (Kr 7), Maarata (Kr 17) - BESHKOV & PETROV (1996: 442-443); Gyaurhambar (Kr 26) - BESHKOV & LANGOUROV (2004: 593).

Subtroglaphile.

***Hypena palpalis* (Hübner, 1796)**

BG: Samarskata Peshtera (Kr 4) - BESHKOV & LANGOUROV (2004: 540).

Troglaxene or Subtroglaphile.

***Hypena rostralis* (Linnaeus, 1758)**

BG: Yarasa Ini (Kr 15), Maarata (Kr 17) - BESHKOV & PETROV (1996: 440-441).

Regular troglaxene.

***Autophila limbata* Staudinger, 1871**

BG: Samarskata Peshtera (Kr 4), Gyaurhambar (Kr 26) - BESHKOV & LANGOUROV (2004: 539).

Subtroglaphile.

***Pyrois effusa* (Boisduval, [1828])**

BG: Karagug (Kr 2), Zlatnata Yama (Kr 14), Gyaurhambar (Kr 26) - BESHKOV & LANGOUROV (2004).

GR: Maronia Cave (TW 2) - BESHKOV & WEGNER (2004: 700).

Troglaxene.

List of the caves in the Eastern Rhodopes with known invertebrate fauna

BULGARIA

Haskovo - Hs

Hs 1. Zandana - cave 3 km W of Dolno Cherkovishte Village, 200 m from the bridge, on the left bank of Arda River, entrance - 1.0 × 0.40 m. Alt. ca. 300 m. Length ca. 76 m, on the principal axis 43 m. Denivelation: - 18 m. It's a winter hibernation roost of many bats. Visited on 21.04.1996 (B. Petrov, P. Stoev); 09.02.1998 (B. Petrov); 11.04.2002 (B. Petrov, T. Ivanova).

Gastr.: *Balcanodiscus frivaldskyanus*

Is.: *Monocyphoniscus bulgaricus*, *Trichoniscus* sp.

Ps.: *Chthonius* sp., *Roncus* sp.

Ar.: *Centromerus milleri*

Chil.: *Lithobius* cf. *apfelbecki*, *Eupolybothrus transylvanicus*, *Harpolithobius banaticus rhodopensis*

Col. Car.: *Duvalius* sp. n. **Guéorguiev, in press**, *Trechus crucifer*

Col. Cholev.: *Bureschiana* cf. *drenskii*

Col. Curcul.: *Troglorrhynchus angelovi*

Dipt. Streblidae: *Brachytarsina flavipennis* (host: *Rhinolophus blasii*)

Hs 2. Kodja In (Golyamata Peshtera) – the longest volcanic cave in the Eastern Rhodopes located near Byal Kladenets Village. Length *ca.* 51 m. Denivelation: +5 m. Visited on 12.06.1999 (B. Petrov, B. Barov).

Chil.: *Lithobius crassipes*

Col.: Car.: *Laemostenus cimmerius*

Hs 3. Karadjainler (Sarnenata) – cave near Byal Kladenets Village. Visited on 10.10.1995 (B. Petrov, P. Stoev).

Ps.: *Roncus* sp.

Kardjali – Kr

Kr 1. Tilki Ini - cave near Ostrovitsa Village. Alt. 220 (285) m. Length *ca.* 36 m. Temp. 13-14°C. Visited on 8.09.1960, 15.07.1962 (P. Beron), 17.11.1991 (B. Petrov, T. Ivanova); 01.04.1992 (B. Petrov, S. Beshkov); 13.10.1996 (B. Petrov, B. Barov); 03.08.1999 (B. Petrov, V. Beshkov).

Gastr.: *Balcanodiscus frivaldskyanus*, *Oxychilus glaber striarius*, *O hydatinus*

Olig.: *Eisenia lucens*

Is.: *Monocyphoniscus bulgaricus*, *Chaetophiloscia hastata*

Ps.: *Chthonius* sp.

Ar.: *Lepthyphantes leprosus*, *Porrhomma convexum*, *Meta menardi*

Acari: *Ixodes vespertilionis*

Dipl.: *Apfelbeckiella trnowensis rhodopina*

Chil.: *Schendyla* sp., *Cryptops hortensis*

Orth.: *Discoptila bureschi*

Col. Cholev.: *Bureschiana drenskii*

Lepid.: *Monopis laevigella*, *Alucita cymmatodactyla*

Kr 2. Karagug (syn. Peshterata) - cave near Tarnovtsi Village. Alt. 345 m. Length *ca.* 105 m. Denivelation: -10 m. Temp. 14°C. Underground stream. Visited on 10.08.1960 (P. Beron), 27.04.1996 (B. Petrov, P. Stoev); 22.10.2003 (B. Petrov, P. Beron).

Is.: *Trichoniscus rhodopiense*

Ps.: *Chthonius* sp., *Roncus* sp., *Microbisium* sp.

Ar.: *Centromerus milleri*, *Metellina merianae*

Coll.: *Hypogastrura purpurescens*, *Onychiurus variabilis*
 Orth.: *Troglophilus neglectus*
 Dipt. Phoridae: *Tripleba antricola*
 Dipt. Heleomyzidae: *Heleomyza captiosa*
 Lepid.: *Digitivalva pulicariae*, *Pyrois effusa*

Kr 3. Hasarskata Peshtera - cave near Gorna Snezhinka Village. Alt. 220 m. Length 97 m. Temp. 12°C. Wet clay; bat guano. Visited on 18.11.1991 (B. Petrov, T. Ivanova); 13.10.1996 (B. Petrov, B. Barov); 03.08.1999 (B. Petrov, V. Beshkov).

Gastr.: *Balcanodiscus frivaldskyanus*
 Is.: *Monocyphoniscus bulgaricus*, *Trichoniscus rhodopiense*
 Ar.: *Centromerus milleri*, *Lepthyphantes leprosus*, *Meta menardi*
 Ps.: *Chthonius* sp.
 Dipl.: *Apfelbeckiella trnovensis rhodopina*
 Orth.: *Troglophilus neglectus*
 Col. Car.: *Duvalius* cf. sp. n. **Guéorguiev, in press**, *Laemostenus cimmerius*
 Col. Curcul.: *Troglorrhynchus beroni*
 Col. Cholev.: *Bureschiana drenskii*

Kr 4. Samarskata Peshtera (Samara) - cave near Ribino Village. Alt. 410 m. Length 327 m. Temp. 7.5°C (the chamber with the bats). Visited on 21.04.1995 (B. Petrov); 11.10.1996 (B. Petrov, P. Stoev), 20.09.1996 (T. Ivanova), 03.01.1997 (T. Ivanova), 10.02.1998 (B. Petrov, G. Stoyanov).

Gastr.: *Balcanodiscus frivaldskyanus*
 Amph.: *Niphargus* sp.
 Is.: *Trichoniscus rhodopiense*, *Cylisticus convexus*
 Ps.: *Roncus* sp.
 Ar.: *Nesticus cellulanus*, *Porrhomma convexum*, *Meta bourneti*
 Dipl.: *Trachysphaera* sp., *Balkanopetalum petrovi*
 Col. Car.: *Laemostenus plasoni*
 Col. Cholev.: *Catopsimorphus orientalis*, *Anemadus graecus*
 Dipt. Streblidae: *Brachytarsina flavipennis* (host: *Rhinolophus blasii*)
 Trich.: *Micropterna malaspina*
 Lep.: *Scoliopteryx libatrix*, *Autophila limbata*, *Hypena palpalis*

Kr 5. Karangil - two-storey cave near Shiroko pole Village. Alt. 340 m. Length 250 m. Denivelation: +22 m. Visited on 01.04.1992 (B. Petrov, S. Beshkov); 10.08.1995 (B. Petrov), 13.06.1999 (B. Petrov, B. Barov); 21.10.2003 (B. Petrov, P. Beron).

Ar.: *Meta bourneti*, *Nesticus cellulanus*, *Centromerus milleri*, *Porrhomma* sp.
 Ps.: *Chthonius* sp.
 Dipl.: *Rhodopiella beroni*
 Col. Car.: *Trechus quadristriatus*, *Laemostenus cimmerius*
 Col. Staphyl.: *Atheta macroptera*
 Dipt. Phoridae: *Tripleba antricola*
 Lepid.: *Monopis obviella*

Kr 6. Inkaya - cave near Tsvyatovo Village (Kadakioy Area). Length 24 m. Visited on: 6.06.1982 (P. Beron).

Gastr.: *Balcanodiscus frivaldskyanus*

Ps.: *Acanthocreagris* sp.

Col. Curcul.: *Troglorrhynchus beroni*

Kr 7. Gouk In (Razklonenata Peshtera) - cave near Oreshari Village, Dishlik Dere Area. Alt. 380 m. Length 59 m. Denivelation: +5 m. Visited on 03.04.1992 (B. Petrov, S. Beshkov); 21.04.1996 (B. Petrov, P. Stoev); 12.06.1999 (B. Petrov, B. Barov); 27.04.2002 (B. Petrov).

Gastr.: *Balcanodiscus frivaldskyanus*

Ps.: *Roncus* sp.

Opil.: *Zacheus crista*

Ar.: *Meta menardi*, *M. bourneti*, *Nesticus cellulanus*

Acari: *Ixodes vespertilionis*

Chil.: *Scutigera coleoptrata*

Dipl.: *Rhodopiella beroni*

Orth.: *Grylломорpha dalmatina*

Dipt. Phoridae: *Tripleba antricola*

Lepid.: *Alucita cymatodactyla*, *Scoliopteryx libatrix*, *Autophila* sp., *Triphosa dubitata*

Kr 8. Zmiyarnika (syn. Peshterata pri Kodja Kad cf. BERON, 1994; BERON & MITOV, 1996) - cave near Belopolyane Village. Length 18 m. Dry; clay. Visited on 06.04.1992 (B. Petrov, S. Beshkov); 27.04.1995 (B. Petrov, B. Barov).

Opil.: *Zacheus crista*

Ar.: *Meta menardi*, *M. bourneti*

Chil.: *Pleuroolithobius patriarchalis*, *Cryptops hortensis*

Orth.: *Grylломорpha dalmatina*

Kr 9. Dupkata - cave in the city park of Ivaylovgrad. Alt. 270 m. Length 32 m. Denivelation: -8 m. Visited on 06.04.1992 (B. Petrov, S. Beshkov); 27.04.1995 (B. Petrov); 23.04.1996 (B. Petrov, P. Stoev); 23.04.1999 (B. Petrov).

Is.: *Hyloniscus* sp.

Ar.: *Centromerus milleri*

Chil.: *Lithobius crassipes*, *Cryptops parisi*

Dipl.: *Trachysphaera costata*, *Polydesmus herzogowinensis*

Col. Car.: *Laemostenus cimmerius*, *Trechus austriacus*

Dipt.: Nycterib.: *Nycteribia schmidli*, *N. vexata*, *Penicillidia conspicua*, *P. dufouri*

Siph.: *Rhinolophopsylla unipunctinata*

Kr 10. Anifena Propast - cave near Barziya Village.

Ar.: *Tegenaria silvestris*

Kr 11. Varlidolskata Peshtera - cave near Fotinovo Village, Varlidol Area. Visited on 07.06.1982 (P. Beron).

Col. Car.: *Laemostenus plasoni*

Col. Cholev.: *Nargus badius*

Kr 12. Aina Ini (Ogledalnata Peshtera) - cave near Ribino Village. Alt. 340 m. Length 157 m. Denivelation: -8 m. Temp. 11°C (on the bottom). Visited on 11.10.1995 (B. Petrov, P. Stoev); 10.02.1998 (B. Petrov).

Gastr.: *Balkanodiscus frivaldskyanus*, *Oxychilus glaber striarius*

Is.: *Trichoniscus rhodopiense*

Ps.: *Chthonius* sp., *Roncus* sp.

Ar.: *Centromerus milleri*, *Nesticus cellulanus*, *Steatoda triangulosa*, *Meta bourneti*

Dipl.: *Balkanopetalum petrovi*

Chil.: *Harpolithobius banaticus rhodopensis*

Orth.: *Gryllomorpha dalmatina*

Col. Car.: *Laemostenus plasoni*

Kr 13. Prilepova Dupka - cave near Dolno Lukovo Village. Length 15 m. Denivelation: -5 m. Visited on 23.04.1999 (B. Petrov); 05.11.1999 (B. Petrov, S. Beshkov).

Is.: *Trichoniscus* sp.

Ar.: *Centromerus* sp., *Meta* sp.

Dipl.: *Metonomastus* sp.

Ps.: *Chthonius* sp., *Roncus* sp.

Chil.: *Pleuroolithobius patriarchalis*

Kr 14. Zlatnata Yama (Kremenskata Peshtera) - cave near Kremen Village. Alt. 250 m. Length 50 m. Denivelation: -5 m. Visited on 27.04.996 (B. Petrov, P. Stoev); 20.07.1996 (T. Ivanova, T. Troanski); 07.11.1999 (B. Petrov, S. Beshkov); 23.10.2003 (B. Petrov, P. Beron).

Gastr.: *Balkanodiscus frivaldskyanus*

Is.: *Trichoniscus rhodopiense*

Ps.: *Roncus* sp.

Ar.: *Nesticus cellulanus*, *Meta bourneti*

Dipl.: *Balkanopetalum petrovi*, *Rhodopiella beroni*, *Trachysphaera* sp.

Chil.: *Lithobius lakatnicensis*

Orth.: *Gryllomorpha dalmatina*, *Troglophilus neglectus*

Col. Car.: *Agonum angustatum*, *Pterostichus nigritus*

Lepid.: *Inachis io*, *Pyrois effusa*

Trich.: *Mesophylax impunctatus*

Kr 15. Yarasa Ini (Prilepnata Peshtera) - volcanic cave near Sredna Arda Railway Station. Length ca. 15 m. Height - up to 4 m. Width ca. 8-9 m. Bat guano; wet clay. Visited on 16.11.1991 (B. Petrov, T. Ivanova); 31.03.1992 (B. Petrov, S. Beshkov); 10.08.1995 (B. Petrov); 12.10.1996 (B. Petrov).

Ps.: *Roncus* sp.

Chil.: *Eupolybothrus transsylvanicus*

Lepid.: *Alucita cymatodactyla*, *Hypena rostralis*

Kr 16. Rupata - cave near Egrek Village. Alt. 480 m. Length ca. 40 m. Denivelation: ca. -8 m. Temp. 14-15°C. Wet clay; bat guano; dripping water. Visited on 11.11.1992 (P. Beron); 07.11.1999 (B. Petrov, S. Beshkov); 12.12.2000 (B. Petrov, S. Beshkov).

Gastr.: *Balcanodiscus frivaldskyanus*

Is.: *Trichoniscus rhodopiense*

Ar.: *Nesticus cellulanus*, *Palliduphantes istrianus*

Ps.: *Roncus* sp.

Chil.: *Eupolybothrus* sp., *Lithobius beroni*, *Cryptops hortensis*

Dipl.: *Trachysphaera* sp.

Orth.: *Gryllomorpha dalmatina*

Col. Car.: *Laemostenus plasoni*

Dipt. Phoridae: *Tripleba antricola*

Kr 17. Maarata - cave near Madrets Village (1.5 km NW of Madrets), Kicherlika Area. Paleogene limestone. Alt. ca. 385 m. Length ca. 114.5 m, on the principle axis 68.8 m. Four entrances. Height of the chamber with the bats ca. 7 m. Many stalactites; humid; dripping water. Visited on 10.10.1995 (B. Petrov, P. Stoev); 12.10.1996 (B. Petrov, B. Barov).

Is.: *Platyarthrus hoffmannseggii*

Ar.: *Nesticus cellulanus*

Ps.: *Chthonius* sp.

Chil.: *Eupolybothrus* sp.

Dipl.: *Glomeris balcanica*, *Rhodopiella beroni*

Col. Car.: *Anemadus graecus*

Lepid.: *Alucita cymatodactyla*, *Hypena rostralis*, *Scoliopteryx libatrix*

Kr 18. Hladilnata Peshtera - cave near Lyubino Village. Alt. 500 m. Length 10 m. Denivelation: -1 m. Temp. 9-12°C. Visited on 02.08.1999 (B. Petrov, V. Beshkov).

Ar.: *Lepthyphantes leprosus*

Col. Cholev.: *Anemadus graecus*

Kr 19. Brashlyanovata Peshtera (Sarmashak Ini) - cave near Ribino Village. Alt. 350 m. Length 50 m. Denivelation: -16 m. Visited on 07.06.1995 (T. Ivanova).

Ar.: *Porrhomma convexum*, *Nesticus cellulanus*

Ps.: *Roncus* sp.

Dipl.: *Trachysphaera* sp.

Kr 20. Mechkina Dupka - 1 km E of Beli Dol Village, on the bank of Byala Reka River. Alt. ca. 155 m. Length 57 m. Denivelation: -12 m. Entrance - 0.70 × 0.90 m. Wet clay; bat guano; permanent lake (1.0 × 3.0 m) on the bottom. Visited on 24.04.1995 (B. Petrov, B. Barov); 22.04.1996 (B. Petrov, P. Stoev); 15.04.1998 (B. Petrov, B. Barov).

Gastr.: *Balcanodiscus frivaldskyanus*

Is.: *Trichoniscus* sp.

Ar.: *Centromerus milleri*, *Nesticus cellulanus*, *Meta menardi*, *Porrhomma convexum*

Ps.: *Chthonius* sp., *Roncus* sp.

Chil.: *Clinopodes flavidus*, *Schendyla* sp., *Eupolybothrus transsylvanicus*

Dipl.: *Glomeris balcanica*, *Trachysphaera* sp.

Col. Car.: *Laemostenus cimmerius*

Col. Cholev.: *Nargus badius*

Kr 21. Vodnata Peshtera - cave near Kobilyane Village, Chitashko Area. Alt. 580 m. Length 81 m. Denivelation: -24 m. Visited on 12.02.1998 (B. Petrov, T. Ivanova); 28.07.1999 (B. Petrov, V. Beshkov).

Gastr.: *Balcanodiscus frivaldskyanus*, *Oxychilus urbanskii*

Ps.: *Roncus* sp.

Ar.: *Nesticus cellulanus*, *Porrhomma convexum*

Col. Car.: *Laemostenus cimmerius*

Kr 22. Belopolyanskata Peshtera (syn. Kodja Kaya, Peshterata pri Kodja Kaya (not "Kad", cf. BERON, 1994)] - cave near Belopolyane Village, at Kodja Kaya Hill. Length 140 m. Denivelation: - 8 m. Wet clay; bat guano; fox droppings. Visited on 06.04.1992 (B. Petrov, S. Beshkov); 27.04.1995 (B. Petrov, B. Barov); 23.04.1996 (B. Petrov, P. Stoev); 11.06.1999 (B. Petrov, B. Barov).

Gastr.: *Oxychilus hydatinus*, *Oxychilus depressus*

Is.: *Chaetophiloscia hastata*

Ar.: *Centromerus milleri*, *Centromerus lakatnikensis*, *Meta bourneti*

Ps.: *Roncus* sp.

Acari: *Ixodes vespertilionis*

Dipl.: *Metonomastus pomak*, *Trachysphaera* sp.

Col. Car.: *Laemostenus cimmerius*, *Trechus* sp.

Dipt. Phoridae.: *Triphleba antricola*

Lepid.: *Scoliopteryx libatrix*

Kr 23. Naredenite Kamani - cave near Shumnatitsa Village. Length ca. 45 m. Denivelation: -3 m. Visited on 20.04.1995 (B. Petrov).

Is.: *Trichoniscus* sp.

Ps.: *Roncus* sp.

Orth.: *Troglophilus neglectus*, *Grylломорpha dalmatina*

Kr 24. Balaka - cave near Ribino Village, Kondjalar Area. Visited on 07.06.1995 (T. Ivanova).

Gastr.: *Balcanodiscus frivaldskyanus*

Ar.: *Meta bourneti*

Kr 25. Manaf Koyusyu - cave near Byala Polyana Village. The deepest pothole in the Eastern Rhodopes. Alt. 400 m. Length 46 m. Denivelation: -36 m. Wet clay; bat guano. Visited on 08.02.1998 (B. Petrov, T. Ivanova).

Col. Car.: *Laemostenus cimmerius*

Kr 26. Gyaurhambar - cave near Ridino village. Alt. ca 600 m. Length 112 m. Denivelation: -11 m. Temp. 10°C. Underground stream; dry clay; bat guano. Visited on 12.12.2000 (B. Petrov, S. Beshkov, M. Langourov).

Gastr.: *Balcanodiscus frivaldskyanus*

Ar.: *Nesticus cellulanus*, *Porrhomma convexum*, *Meta menardi*

Ps.: *Chthonius* sp., *Roncus* sp.

Orth.: *Troglophilus neglectus*

Lepid.: *Scoliopteryx libatrix*, *Autophila limbata*, *Pyrois effusa*, *Digitivalva pulicariae*, *Inachis io*

Kr 27. Tamnata Peshtera (syn. Nameless cave near Svetulka) - cave near Svetulka Village. Alt. 750 m. Length 30 m. Wet clay; rotten logs. Visited on 29.08.2001 (B. Petrov, V. Beshkov).

Gastr.: *Balcanodiscus frivaldskyanus*

Is.: *Trichoniscus rhodopiense*

Ar.: *Nesticus* sp.

Dipt. Phoridae: *Tripleba antricola*

Kr 28. Karangin - cave in the Oreshari Protected Site near Oreshari Village. Alt. 280 m. Length 24 m. Rich in bat guano. Visited on 20.07.1998 (N. Simov); 10.12.2000 (B. Petrov, S. Beshkov, M. Langourov).

Ps.: *Roncus* sp.

Ar.: *Lepthyphantes leprosus*

Chil.: *Lithobius beroni*

Col. Hist.: *Gnathoncus nannetensis*, *Margarinotus brunneus*

Kr 29. Prilepnata Peshtera - volcanic cave in Gyurgen Dere Valley near village Gaberovo. Length 9 m. Rich in bat guano. Visited on 17.06.1996 (P. Stoev, T. Ivanova); 09.02.1998 (B. Petrov); 10.05.1998 (B. Petrov); 09.12.2000 (B. Petrov).

Ps.: *Allochernes wideri*

Ar.: *Centromerus milleri*, *Liocranum rupicola*

Col. Curcul: *Troglorrhynchus angelovi*

Smolyan - Sm

Sm 50. Vodnata Peshtera - cave near Nedelino Village, Godumovi Kolibi Area. Alt. 700 m. Length 203 m. Denivelation: ca. - 4 m. Temp. 12°C. Underground stream; wet clay; bat guano. Visited on 31.07.1999 (B. Petrov, V. Beshkov); 12.12.2000 (B. Petrov, S. Beshkov, M. Langourov).

Gastr.: *Balcanodiscus frivaldskyanus*, *Oxychilus urbanskii*

Is.: *Trichoniscus* sp.

Ps.: *Chthonius* sp., *Roncus* sp.

Ar.: *Nesticus cellulanus*, *Porrhomma convexum*, *Lepthyphantes leprosus*, *Meta menardi*, *Liocranum rupicola*

Dipl.: *Trachysphaera* sp.

Orth.: *Troglophilus neglectus*

Col. Car.: *Laemostenus plasoni*

Col. Cholev.: *Bureschiana thracica*

Dipt. Phoridae: *Tripleba antricola*

GREECE

Western Thrace - TW

TW 1. Koufovouno Cave (syn. Cave of Coufovouno, “Kouvobono”, “Höhle bei Didymotichon”) - cave 3.5 km of Didimotihon and 1.5 km of Koufovouno Village. Alt. 150 m. Length *ca.* 100-150 m. Rich in bat guano; wet clay. Visited on 22.05.1984 (P. Beron); 23.07.1997 (T. Ivanova); 29.09.2000 (B. Petrov, P. Stoev, S. Beshkov).

Gast.: *Balcanodiscus frivaldskyanus*

Is.: **Haplophthalminae gen. sp.**; *Trichoniscus* sp.

Ar.: *Meta menardi*, *Metellina meriana*, *Nesticus cellulanus*, *Palliduphantes istrianus*.

Ps.: *Chthonius* sp., *Roncus* sp.

Chil.: *Eupolybothrus transsylvanicus*

Dipl.: *Rhodopiella beroni*

Col. Car.: *Trechus austriacus*, *Laemostenus cimmerius*

Col. Psel.: *Bryaxis* sp.

Col. Cholev.: *Anemadus graecus*

Trich.: *Micropterna malaspina*

Lepid.: *Alucita huebneri*

TW 2. Maronia Cave¹ (Cave of the Cyclops, Cave of Kyklops Polifimos) - cave 4 km of Maronia Village. Length over 2000 m. Very wet; stalagmites; several pools. Alt. 190 m. Visited on 1.10.1983 (P. Beron, V. Beshkov) 26.09.2000 (B. Petrov, P. Stoev, S. Beshkov).

Gast.: *Balcanodiscus cerberus*

Is.: *Alpioniscus thracicus*, *Ligidium germanicum*

Ar.: *Centromerus milleri*, *Tegenaria* sp., *Meta menardi*

Chil.: *Lithobius viriatus*

Col. Car.: *Trechus austriacus*

Col. Cholev.: *Maroniella beroni*

Lepid.: *Pyrois effusa*

TW 3. Avanos Cave² - pothole near the quarry of Avas Village, 7 km N of Alexandroupoli. Alt. 150 m. Deep 9-10 m. Two small horizontal galleries. Humid. Visited on 17.05.1987 (P. Beron).

Is.: Trichoniscidae indet. (?*Trichoniscus* sp.)

Dipl.: Julida indet.

Zoogeography

If we consider the subdivision of the Balkan Peninsula into biospeleological zones and provinces proposed by GUÉORGUIEV (1977), we shall conclude that the East Rhodopean Zone, outlined by him, is considerably larger than the territory, discussed here. In

¹ The description of the cave can be found in PETROCHILOU (1970, 1984).

² ILIOPOULU-GEORGUDAKI (1983) mentioned that the cave of “Avanhos” or “Avantos” has been destroyed by the local mine. This record, however, should perhaps be referred to another cave in the region.

his notable monograph, this zone includes, besides the Eastern Rhodopes *sensu stricto*, also a part of the Western Rhodopes (the karstic areas of Dobrostan, Yagodina, Orehovo and Mostovo), Sakar and Strandja (in Bulgaria and Turkey). At the same time, the West Rhodopean Zone of Guéorguiev stretches from Central Serbia to the Halkidiki Peninsula and from Vardar to Mesta, including East Macedonia and the valley of Struma.

It is not the aim of this paper to challenge Guéorguiev's subdivision, which is based on multiple paleogeographical and zoological data. We shall limit ourselves to comparing the cave faunas of the Eastern and the Western Rhodopes, as well to comparing the East Rhodopean cave invertebrates to those of neighbouring regions.

According to GUÉORGUIEV (1977), troglobite indicators for the East-Rhodopean Zone are: on generic level *Apfelbeckiella* (*Rhodopiella*), *Rhodopiola*, *Bureschiana* and on species level *Balkanoniscus* (now *Rhodopioniscus*) *beroni*, *Trichoniscus rhodopiense*, *T. valkanovi*, *Rhodopsoma meridionale*, *Rh. tridentifer*, *Apfelbeckiella* (*Rhodopiella*) *beroni*, *Lithobius tiasnatensis*, *Rhodopiola cavicola* and *Bureschiana drenskii*. It is worth mentioning that the underlined taxa are actually from the Western Rhodopes and from Strandja – Sakar and are unknown from the Eastern Rhodopes (*s. str.*). At the same time, when his monograph was finished (by the end of 1976), some of the troglobites of the Bulgarian and the Greek Eastern Rhodopes had not yet been described (*Maroniella beroni*, *Alpioniscus thracicus*, *Duvalius* sp.n. Guéorguiev, *Troglorrhynchus beroni*, *Troglorrhynchus angelovi*). Also, *Phodopiella beroni* is excluded from the list of troglobites being often found outside caves (cf. Stoev, 2004b).

GUÉORGUIEV (1979) concluded that the Rilo-Rhodopean region is the second richest in troglobites region in Bulgaria, surpassed only by that of the Stara Planina Mts. And finally, GUÉORGUIEV (1992), using the index of Czekanowski-Sørensen, proceeded further with a zoogeographical analysis of the Bulgarian cave fauna, although he did not consider the Rhodopean Zone.

Comparive analysis of the cave invertebrates of the Eastern Rhodopes with these of the neighbouring regions

Eastern and Western Rhodopes. The Western Rhodopes (geographically speaking, not the West Rhodopean Biospeleological Zone of GUÉORGUIEV, 1977) are much higher and wetter mountain, covered with coniferous forests and by far richer in caves. Furthermore, the dimensions of the caves are bigger. Twenty species of terrestrial troglobites have so far been recorded in the Western Rhodopes (also five stygobites vs. one in the Eastern Rhodopes). Below is the comparison between the terrestrial troglobites of the two regions:

Western Rhodopes

Cordioniscus schmallfussi
Trichoniscus petrovi
Trichoniscus raitsbevi
Trichoniscus rhodopiense
Rhodopioniscus beroni
Bulgaronethes haplophthalmoides

Troglobyphantes drenskii

Eastern Rhodopes

Trichoniscus rhodopiense

Alpioniscus thracicus

*Lithobius stygius**Lithobius lakatnicensis***Western Rhodopes***Lithobius rushovens**Troglodius meridionale**Troglodius tridentifer**Rhodoposoma rhodopinum**Stygiosoma beroni**Anamastigona lepenicae**Plusiocampa* cf. *beroni**Plusiocampa bulgarica**Pseudosinella duodecimocellata**Duvalius bureschi**Rhodopiola cavicola**Lithobius lakatnicensis***Eastern Rhodopes***Duvalius* sp. n. Guéorguiev*Maroniella beroni**Bureschiana drenskii**Bureschiana thracica**Troglorrhynchus beroni**Troglorrhynchus angelovi*

As we can see from the table, there are only two species, *Trichoniscus rhodopiense* and *Lithobius lakatnicensis*, occurring in the caves of the both parts of the mountain.

Eastern Rhodopes and Strandja – Sakar. The cave fauna between the river of Maritsa and the Black Sea is rather poor. So far, only four troglobite species – *Trichoniscus valkanovi* Andreev, *T. beroni* Andreev, *Lithobius tiasnatensis* Matic and *Porrhomma microps* (Roewer), are recorded from the area. None of them is known from the Rhodopes.

Bulgarian and Greek Eastern Rhodopes. The insufficient information existing for the cave fauna of the Greek part of the Eastern Rhodopes does not allow more comprehensive analysis. However, one could easily see the similarities between both regions, even on a species level. In the same time, the Greek fauna is characterized by some particular taxa such as *Alpioniscus thracicus* Andreev and *Maroniella beroni* Casale et Giachino. The genera *Balcanodiscus* and *Bureschiana* are represented by different species on the two sides of the Bulgarian-Greek border. No cave curculionids have so far been registered in the Greek Rhodopes, while two species are known in the Bulgarian part. It is very likely that species like *Balkanopetalum petrovi*, *Metonomastus pomak*, *Centromerus milleri* and *Duvalius* sp. n. occur in appropriate habitats on the Greek side of the mountain, too.

Endemics

So far, 12 endemic species are known from the caves of the Eastern Rhodopes:

Gastropoda – *Balcanodiscus cerberus* Riedel, *Balcanodiscus frivaldskyanus* (Rossmassler)

Isopoda – *Alpioniscus thracicus* Andreev

Araneae – *Centromerus milleri* Deltshv

Diplopoda – *Balkanopetalum petrovi* Stoev et Enghoff, *Metonomastus pomak* Golovatch et Stoev

Coleoptera Carabidae – *Duvalius* sp. n. Guéorguiev

Coleoptera Cholevidae – *Maroniella beroni* Casale et Giachino, *Bureschiana drensikii*
V. Guéorguiev, *Bureschiana thracica* Giachino

Coleoptera Curculionidae – *Troglorrhynchus beroni* Angelov, *Troglorrhynchus angelovi* Guéorguiev

Conservation

Land and forest use practices, urbanization, waste disposal, and environmental pollution threaten many caves and their fauna. Some of these threats are particularly valid for the caves in the Eastern Rhodopes. The Dupkata Cave (Kr 9), located in the City Park of Ivaylovgrad, is often visited by the local people. As a result, the bat colony is regularly disturbed, while the fires and waste disposal endanger seriously the invertebrate fauna. In the late 1980s, several hundred bats were burnt to death in Yarasa Ini (Kr 15). Disposal of herbicides has been discovered in the Zandana Cave (Hs 1). Illegal excavations, organized by treasure hunters, are widespread all over the region. Samarskata Peshtera (Kr 4) and Karangin (Kr 28) are frequently dug up for these purposes. Treasure hunting is amongst the most serious threats because of its high intensity and sophisticated equipment used. The digging seriously alters the cultural layers, which in some of the caves are exceptionally rich in archaeological and palaeontological materials. The cave of Koufovouno (TW 1) is located near to a large stone quarry and its future seems highly endangered from the ongoing intensive works. The same fate has already had the Avanos Cave (TW 3) destroyed by a local quarry (ILIOPOULU-GEORGUDAKI, 1983).

Some caves on Bulgarian territory are declared as “nature monuments” (e.g. Kr 9, 18, 22), other are located within the borders of larger protected sites (e.g. Kr. 4, 12, 15, 19, 28). The protection of these caves is guaranteed by their status, though the local authorities (Municipalities and the Regional Inspectorates of the Ministry of the Environment and Waters) rarely enforce sufficient field guarding. Since the laws in Bulgaria do not protect the cave invertebrates, declaring caves as “nature monuments” is possible only when there is breeding or hibernating colony of bats, or when the cave has a high aesthetic or cultural value.

Acknowledgements

We thank T. Ivanova, B. Barov, S. Beshkov, V. Beshkov, M. Langourov and many other colleagues who joined us on the field. Special thanks are due to S. Miteva, Hr. Hristov and E. Bojilova from the visitor center in Madjarovo who kindly supported our activities in the Eastern Rhodopes. The field trips in Bulgaria were partly funded by the Bulgarian-Swiss Biodiversity Conservation Program. The American Arachnological Society Research Fund supported the travel of Petrov, Stoev and Beshkov in Greece in September 2000.

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Безгръбначната пещерна фауна на Източните Родопи (България и Гърция)

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(Р е з ю м е)

Пещерната фауна на Източните Родопи е сравнително бедна и го 1960 г. е била свършено неизучена. Проследена е историята на проучванията в българската и в гръцката част на планината. Досега на българска територия са изследвани 33 пещери, а на гръцка само 3 – при Марония, Куфовуно и Авас. Общо в двете части са установени 106 вида, от които 1 стигобионт (*Niphargus* sp.) и 9 троплобионт. Дванадесет вида са ендемити за Източните Родопи, включително троплобионтите *Alpioniscus thracicus*, *Maroniella beroni*, *Bureschiana drenskii*, *B. thracica*, *Duvalius* sp.n. Guéorguiev, *Troglorrhynchus beroni* и *T. angelovi*. Направен е кратък зоогеографски анализ и преглед на заплахите върху пещерите и тяхната фауна.