

The subterranean waters of Bulgaria, still an insufficiently explored stygobiotic snail habitat: an updated and corrected checklist

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Abstract. This review provides an updated and corrected checklist of the stygobiotic freshwater snails (Gastropoda: Truncatelloidea) of Bulgaria. A total of 51 stygobiotic species are recorded, belonging to the families Bythinellidae (4 species) and Hydrobiidae (47 species), including several undescribed taxa and new species localities. Geographic coordinates and species distributions are revised and updated.

Key words: malacofauna, Balkans, subterranean, species, diversity.

Introduction

The waters of Bulgaria have attracted significant interest from researchers studying freshwater snails for over a century (Angelov, 2000). Recently, even new large species have been discovered and others re-described after being overlooked in modern species lists (Glöer & Georgiev, 2012, 2014; Glöer & Zettler, 2021). However, representatives of the superfamily Truncatelloidea that inhabit subterranean waters attract strong evolutionary and zoogeographical interest (Osikovski et al., 2015, 2017; Rysiewska et al., 2016). Information on the species composition and distribution of Bulgarian stygobiont gastropods has been periodically summarized and analyzed, but this has not been done in the last thirteen years, a period during which new data regarding their species composition, taxonomy, and distribution have been obtained (Angelov, 2000; Hubenov, 2005; Georgiev & Hubenov, 2013; Georgiev, 2013a, 2014a, 2023). The present paper aims to summarize the available data on Bulgarian stygobiont gastropods concerning their distribution and species richness, as well as to provide taxonomic cor-

rections, specifically regarding the generic affiliation of certain species.

Materials and methods

To avoid citing all available literature, the syntheses from previous checklists were utilized here (Angelov, 2000; Hubenov, 2005; Georgiev & Hubenov, 2013; Georgiev, 2013a; 2014a). However, the species composition and taxonomy have been updated based on all recent publications (Georgiev, 2013b, 2014b, 2022, 2023; Georgiev & Glöer, 2013, 2015a, b, c; Georgiev et al., 2017, 2022; Osikovski et al., 2015, 2017) and the author's current opinion, as noted in the text. Geographic coordinates and names of species localities have been provided and corrected where necessary; where this was not possible, the 10x10 km UTM grid code is indicated. Additionally, several new species localities are reported. Altitude is omitted because the actual habitats of many species are at unknown depths deep underground, rendering analysis of this parameter impossible. When the generic affiliation of a given species is questioned by the author, the generic name is placed in quotation marks.

Results and Discussion

Till now a total of 51 species of stygobiotic snails were registered in Bulgaria, some of them still undescribed:

Superfamily Truncatelloidea J. E. Gray, 1840

Family Bythinellidae Locard, 1893

Genus *Bythinella* Moquin-Tandon, 1856

1. *B. gloeeri* Georgiev, 2009: Lepenitsa Cave, near Velingrad town, West Rhodopes Mts, 41°57'14"N, 24°0'043.3"E;
2. *B. markovi* Glöer et Georgiev, 2009: Gargina Dupka Cave, near village of Mostovo, West Rhodopes Mts, 41°51'00.4"N, 24°55'57.1"E;
3. *B. stoychevae* Georgiev, 2011: Manuilova Dupka Cave, near village of Ribnovo, West Rhodopes Mts, 41°42'53"N, 23°46'58"E;
4. *Bythinella* sp.: Golobovitsa Cave, near village of Koshnitsa, West Rhodopes Mts, 41°30'55.3"N, 24°39'57.7"E;

Family Hydrobiidae W. Stimpson, 1865

Genus *Balkanica* Georgiev, 2011

5. *B. yankovi* Georgiev, 2011: Izvora (Padaloto, Yantra) Cave, near village of Sulari, Gabrovo town district, Stara Planina Mts, 42°57'23.08"N, 25°18'52.30"E;

Genus *Balkanospeum* Georgiev, 2012

6. *B. schniebsae* (Georgiev, 2011): Izvora (Padaloto, Yantra) Cave, near village of Sulari, Gabrovo town district, Stara Planina Mts, 42°57'23.08"N, 25°18'52.30"E; Machanov trap Cave, near village of Zdravkovets, Stara Planina Mts, 42°57'59.70"N, 25°13'30.23"E; Andaka Cave, Dryanovski Manastir area, Stara Planina Mts, 42°56'52.5"N 25°25'54.1"E;

Genus *Cavernisa* Radoman, 1978

7. *C. zaschevi* (Angelov, 1959): spring near Dushnika Cave, near village of Iskrets, Stara Planina Mts, 42°59'43.0"N, 23°14'14.0"E; Yamata Cave, near village of Tserovo, Stara Planina Mts, 43°00'06.6"N, 23°19'42.1"E; Vodnata Peshtera Cave, village of Tserovo, Stara Planina Mts, 43°00'39.6"N, 23°20'48.5"E;

Genus *Devetakia* Georgiev & Glöer, 2011

8. *D. apostoloui* Georgiev, Dedov & Taseva, 2022: exact locality not known, found as empty shells in sediments of Vacha River near Krichim

town, West Rhodopes Mts, 42°02'12.3"N 24°28'06.0"E;

9. *D. krushunica* Georgiev et Glöer, 2011: Vodopada Cave, near village of Krushuna, Devetashko Plateau, 43°14'33.2"N, 25°02'09.2"E; Urushka Maara Cave, near village of Krushuna, Devetashko Plateau, 43°14'41.7"N, 25°02'45.4"E;

10. *D. mandrica* Georgiev, 2012: Mandrata Cave, west of village of Chavdarts, Lovech town district, Devetashko Plateau, 43°14'31.3"N, 24°58'02.2"E;

11. *D. pandurskii* Georgiev et Glöer, 2011: Devetashka Cave, near village of Devetaki, Lovech town area, Devetashko Plateau, 43°14'06.9"N, 24°53'04.4"E;

12. *D. veselinae* Georgiev & Glöer, 2015: spring on the left bank of Yablanitsa River, southwest of village of Bankya, Tran town area, 42°50'53.3"N, 22°40'43.7"E;

Genus *Devetakiola* Georgiev, 2017

13. *D. devetakia* (Glöer & Georgiev, 2013): Urushka Maara Cave, near village of Krushuna, Devetashko Plateau, 43°14'41.7"N, 25°02'45.4"E; Brashlyanskata Cave, near village of Alexandrovo, North foothills of Stara Planina Mts, 43°14'14"N, 24°56'12"E; spring near Vreloto Cave, Prevala village, North foothills of Stara Planina Mts, 43°28'10"N, 22°51'40"E;

Subfamily Islamiinae Radoman, 1973

14. Unidentified "valvatiform hydrobiid" 1: Glava Panega Spring, Zlatna Panega Town, Pre-Balkan, North Bulgaria, 43°05'17.3"N 24°09'23.0"E;

15. Unidentified "valvatiform hydrobiid" 2: Rushovata (Gradeshniskata) Cave, near Glogovo Village, Teteven Town area, Stara Planina Mts., 42°58'59.8"N 24°15'41.3"E;

16. Unidentified "valvatiform hydrobiid" 3: Mandrata Cave, west of village of Chavdarts, Lovech town district, Devetashko Plateau, 43°14'31.3"N, 24°58'02.2"E;

Genus *Hauffenia* Pollonera, 1898

17. "*H.*" *lucidula* (Angelov, 1967): A deep well in south Dobrudza, near Taukliman Bay, Black Sea coast, 10x10 km UTM grid PJ20;

Genus *Iglica* Wagner, 1927

18. "*I.*" *acicularis* Angelov, 1959: spring near Dushnika Cave, near village of Iskrets, Stara Planina Mts, 42°59'43.0"N, 23°14'14.0"E;

Genus *Insignia* Angelov, 1972

19. *I. macrostoma* Angelov, 1972: Izvora Cave, Polaten District, Teteven town, Stara Planina Mts, 42°56'44.8"N 24°11'55.6"E; Toplya cave, Bulgaria, Stara Planina Mt., near village of Golyama Zhelyazna, 42°56'53.2"N, 24°29'15.1"E;

Genus *Kolevia* Georgiev & Glöer, 2015

20. *K. bulgarica* Georgiev & Glöer, 2015: Kalna Matnitsa spring, below Toshkova Dupka cave, Vrachanski Balkan Mts., Bulgaria, 43°15'54.3"N 23°20'50.9"E;

21. *K. toplensis* Georgiev, 2023: Toplya cave, Bulgaria, Stara Planina Mt., near village of Golyama Zhelyazna, 42°56'53.2"N, 24°29'15.1"E;

Genus *Microstygia* Georgiev & Glöer, 2015

22. *M. deltschevi* Georgiev & Glöer, 2015: Spring on the left bank of Yablanitsa River, southwest of village of Bankya, Tran town area, 42°50'53.3"N, 22°40'43.7"E;

23. *M. lakatnika* Georgiev, 2022: Temnata Dupka Cave, near Gara Lakatnik village, Iskar River Gorge, Stara Planina Mts, 43°05'20.0"N, 23°23'00.5"E;

Genus *Plagigeyeria* Tomlin, 1930

24. *P. procerula* (Angelov, 1965): Karst Spring at the village of Opitsvet, Sofia region, Stara Planina Mts, 10x10 km UTM grid FN64;

Genus *Polatenia* Georgiev, 2023

25. *P. sinuiapertura* Georgiev, 2023: Izvora Cave, Polaten District, Teteven town, Stara Planina Mts, 42°56'44.8"N 24°11'55.6"E;

Genus *Pontobelgrandiella* Radoman, 1978

26. "*P.*" *bulgarica* (Angelov, 1972): Izvora Cave, Polaten District, Teteven town, Stara Planina Mts, 42°56'44.8"N 24°11'55.6"E;

27. *P. bureschi* (Angelov, 1976): Karst Spring at the village of Bankya, Tran town district, 10x10 km UTM grid FN34; Spring on the left bank of Yablanitsa River, southwest of village of Bankya, Tran town area, 42°50'53.3"N, 22°40'43.7"E;

28. *P. delevae* (Georgiev & Glöer, 2015): Lednika Cave, Zlostena area, near Kotel town, East Stara Planina Mts, 42°56'01.0"N, 26°30'46.1"E;

29. "*P.*" *hessei* (A. Wagner, 1927): Temnata Dupka Cave, near Gara Lakatnik village, Iskar

River Gorge, Stara Planina Mts, 43°05'20.0"N, 23°23'00.5"E;

30. *P. hubenovi* (Georgiev, 2012): Water cave near village of Musina, North foothills of Stara Planina Mts, 43°13'14.9"N, 25°25'39.6"E;

31. *P. lomica* (Georgiev & Glöer, 2015): Deposits of a small stream flowing from village of Golyamo Gradishte at its inflow in Kalakoch River, near village of Krepcha, Danube River Plain, 43°27'55.5"N, 26°06'38.9"E;

32. *P. maarensis* (Georgiev, 2013): Urushka Maara Cave, near village of Krushuna, Deve-tashko Plateau, 43°14'41.7"N, 25°02'45.4"E;

33. *P. nitida* (Angelov, 1972): Izvora Cave, Polaten District, Teteven town, Stara Planina Mts, 42°56'44.8"N 24°11'55.6"E; Water cave at the village of Glozhene, Teteven town, Stara Planina Mts, 10x10 km UTM grid KH76; Toplya cave, Bulgaria, Stara Planina Mts, near village of Golyama Zhelyazna, 42°56'53.2"N, 24°29'15.1"E;

34. *P. petrovi* (Georgiev, 2014): Chuchura cave near Velchovtsi area of the village of Stantchov Han, Tryavna district, Stara Planina Mts, 42°47'58.0"N 25°34'23.7"E;

35. *P. pusilla* (Angelov, 1959): The source of Petrenska River, near Lakatnik town, Stara Planina Mts, 43°06'15.9"N, 23°22'25.3"E; Temnata Dupka Cave, near Lakatnik town, Stara Planina Mts, 43°05'20.0"N, 23°23'00.5"E;

36. *P. stanimirae* (Georgiev, 2011): Zmeyova Dupka Cave, near Tryavna town, Stara Planina Mts, 42°52'35.0"N, 25°28'35.1"E;

37. *P. tanevi* Georgiev, 2013: Parnitsite cave, near village of Bezhanovo, North foothills of Stara Planina Mts, 43°12'02.1"N, 25°25'58.4"E;

38. *Pontobelgrandiella* n. sp. (in prep.): A sinkhole with three holes at a dry water source, near the bus station at the area of Uzana area, West of Gabrovo town, Stara Planina Mts, 42°45'18.2"N, 25°14'18.4"E;

Genus *Saxurinator* Schütt, 1960

39. *S. bureschi* (A. Wagner, 1927): Temnata Dupka Cave, near Gara Lakatnik village, Iskar River Gorge, Stara Planina Mts, 43°05'20.0"N, 23°23'00.5"E;

40. *S. jazzii* (Georgiev & Glöer, 2013): Water cave near village of Musina, North foothills of Stara Planina Mts, 43°13'14.9"N, 25°25'39.6"E;

Genus *Stoyanovia* Georgiev, 2017

41. *S. bechevi* (Georgiev & Glöer, 2013): Rushovata Cave, Stara Planina Mts, near village of Glogovo, 42° 59' 00.30"N, 24° 15' 71.30"E;

42. *S. copiosa* (Angelov, 1972): The source of Petrenska River, near Lakatnik town, Stara Planina Mts, 43°06'15.9"N, 23°22'25.3"E;

43. "*S.*" *dourdeni* (Georgiev, 2012): Chuchura cave near Velchovtsi area of the village of Stan-tchov Han, Tryavna district, Stara Planina Mts, 42°47'58.0"N 25°34'23.7"E;

44. "*S.*" *iltchoi* (Georgiev & Glöer, 2015): Water source near Beli Lom River at village of Pisanets, Danube River Plain, Bulgaria, 43°40'01.7"N, 26°10'23.4"E;

45. "*S.*" *iltchokolevi* (Georgiev & Glöer, 2015): "Golyamo Selishte" spring, Katselovo village, Danube River Plain, 43°31'47.8"N, 26°05'28.3"E;

46. *S. juliae* (Georgiev & Glöer, 2015): Spring on the left bank of Yablanitsa River, southwest of village of Bankya, Tran town area, 42°50'53.3"N, 22°40'43.7"E;

47. *S. kolevi* (Georgiev, 2013): Golyamata Mikrenska Cave (Mandrata), Stara Planina Mts, 43°03'44.0"N, 24°31'29.9"E;

48. *S. pandurskii* (Georgiev, 2012): Vodna Pesht cave, near village of Lipnitsa, Botevgrad town district, Stara Planina Mts, 43°00'40.2"N, 23°44'46.5"E;

49. *S. simovi* (Georgiev, 2013): Zadanenska Cave, near village of Karlukovo, North foothills of Stara Planina Mts, 43°10'35.7"N, 24°04'14.1"E;

50. *S. stoyanovi* (Georgiev, 2013): Parnitsite Cave, near village of Bezhanovo, North foothills of Stara Planina Mts, 43°12'02.1"N, 25°25'58.4"E;

51. *Stoyanovia* n. sp. (in prep.): A sinkhole with three holes at a dry water source, near the bus station at the area of Uzana area, West of Gabrovo town, Stara Planina Mts, 42°45'18.2"N, 25°14'18.4"E.

Conclusions

The stygobiotic snail fauna of Bulgaria exhibits remarkably high species diversity considering the country's territorial extent. A total of 51 stygobiotic species are currently recorded, belonging to two main families of Truncatelloidea: Bythinellidae (4 species) and Hydrobiidae (47 species). The high proportion of endemic taxa underscores the subterranean aquatic habi-

tats of the region as major evolutionary sanctuaries and centers of speciation.

The spatial distribution of stygobiotic gastropods in Bulgaria is highly localized, with many species being micro-endemic to single cave systems or karst springs. Key regional hotspots of stygobiotic diversity include: The Stara Planina Mts. (including the Iskar River Gorge, Teteven area, and Tryavna/Gabrovo region), which harbor the highest number of endemic subterranean gastropod species; The Devetashko Plateau, characterized by rich subterranean drainage systems hosting distinct lineages such as *Devetakia* spp. and *Devetakiola devetakia*; and The Western Rhodopes with its stygobiotic *Bythinella* spp.

Thirteen years after the last comprehensive synthesis, the subterranean malacofauna of Bulgaria continues to reveal novel taxa and complex evolutionary relationships. Protecting these fragile subterranean ecosystems is critical, as groundwater pollution, karst quarrying, and altered hydrological regimes pose severe threats to these highly endemic and ecologically specialized organisms.

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