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Water beetles (Coleoptera: Adephaga, Hydrophiloidea, Byrrhoidea) in Bulgaria: new records

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Abstract: On the basis of original field surveys, carried out in Bulgaria in 2010, 2012 and 2015, 137 water beetle species from 12 families were recorded, 23 species new to this country. Compared with the 254 species from these families already known from Bulgaria, this figure is ca 9%, a significant result for a European country. Only within the Hydradephaga have the authors confirmed the satisfactory state of knowledge of the relevant fauna of Bulgaria, since the 2 new species as against 144 known ones makes up just 1.4%. In contrast, the percentages of species new to Bulgaria within the families Hydrochidae, Hydrophilidae and Helophoridae are 300% (sic!), 25% and 36.3% respectively, which indicates the poor state of knowledge of this group of beetles. The more interesting species among those listed are discussed.

Key words: Water beetles, Shore beetles, Bulgaria, new records, faunistics, Adephaga, Hydrophiloidea, Byrrhoidea.

INTRODUCTION

Although the study of water beetles in Bulgaria has a history stretching back to the 19th century, it only really started to bloom in the period 1960-1990, thanks in particular to the efforts of Vassil Borissov Guéorguiev. The aquatic beetle fauna of that country appeared then to be quite well known, especially the Hydradephaga ("*Hydrocanthares*"), for which the existing key that he published in the monographic series Fauna Bulgarica (Guéorguiev 1987) is still useful. It summarised the relevant faunistic data with reference to the mid-1980s. There is no such key for the suborder Polyphaga, however. Moreover, there has been something of a hiatus in faunistic studies of water beetles in Bulgaria during the last thirty years. In this time just a few papers providing new faunistic data have been published. Other publications have tended to be revisions, altering the status of individual taxa (Shaverdo 2004, Hájek 2006), although they, too, contain inferences and information of a faunistic nature.

The availability of a particularly useful tool, namely, the continually updated internet version of the Catalogue of Palearctic Dytiscidae (Nilsson & Hájek 2017) and Hydrophiloidea (Przewoźny 2017) means that now one can easily and precisely make reference to and compare results of faunistic research with the historical state of knowledge of this fauna in particular countries. In addition, the printed versions of the Catalogue of Palaearctic Coleoptera covering water beetles have recently been updated and revised (Löbl I. & Löbl D. 2015, 2016, 2017).

The objective of the present survey was to acquire new data on the water beetle fauna of Bulgaria and to attempt an assessment of the extent to which this knowledge is complete by comparing its results with what is already known on this subject using the updated Catalogue of Palaearctic Coleoptera.

Original data from Bulgaria for 137 species of water beetles, 23 of which have never before been recorded in this country are given below.

This survey covers not only water beetles "*sensu stricte*" (Jäch 1998), but also hydrophilic species associated with shorelines ("*shore beetles*") and species associated with decaying organic matter that were sometimes caught incidentally in an aquatic environment (some *Helophorus* and *Cercyon* species). To ensure the complete treatment of the family Hydrophilidae account is also taken of the coprophilic species from the genera *Cercyon* and *Sphaeridium*. Data relating to the family Hydraenidae will be the subject of a separate paper.

TERMINOLOGY AND SYSTEMATICS

The terminology and systematic layout of Dytiscidae are in accordance with that given in Nilsson & Hájek (2017); in addition, the latest classification of genera in the tribe Hygrotini is after Villastrigo *et al.* (2017), Noteridae are after Nilsson (2011), Haliplidae after van Vondel (2015), Hydrophiloidea after Przewoźny (2017), and the remaining families after Löbl I. & Löbl D. (2015, 2016). Following the inferences of Fossen *et al.* (2016), species of the genus *Hydrobius* have not been delimited, since the results of their study are applicable solely to specimens from northern Europe. Therefore all specimens of the genus *Hydrobius* Leach that were caught are identified as *Hydrobius fuscipes* (Linnaeus, 1758).

MATERIAL AND METHODS

The materials listed here were obtained during the period 2000-2015. Systematic fieldwork was carried out in 2010 and 2012 (first author) and in 2015 (both authors); the remaining few specimens come from a variety of sources. The beetles were caught using a number of techniques: standard hydrobiological sweep nets (GB-nets) in larger water bodies; plastic kitchen sieves of different diameters with a mesh size of around 1 mm in smaller and very tiny water bodies (puddles, seepages, high-mountain water bodies); UV lamps; bottle traps using organic bait; flotation (on the shores of water bodies, peatbogs); on sight. The voucher specimens are deposited in the collections of the authors and the Upper Silesian Museum, Bytom, Poland. A total of 3384 specimens was collected.

The list of localities in chronological order, i.e. from the earliest to the latest, includes the UTM codes and in some cases GPS coordinates; the altitudes of most of the mountain localities are given in metres above sea level; the names of the localities are in both the English transliteration and in the original Bulgarian spelling; in most cases information is provided on microhabitats and catching techniques.

1. Melnik (Мелник) [FL99], 41°31’N 23°24’E, 26-27.06.2000, leg. Roman Królik.
2. Kresna ad River Sejtendere (Кресна) [FM72], 10.07.2003, leg. Marek Bunalski.
3. Kiten (Китен) [NG67], 6-15.07.2007, leg. Walter Grosser.
4. Tsarevo (Царево) [NG77], 17.08.2010, leg. Czesław Greń.
5. Tsarevo (Царево) [NG67], on the beach, 17.08.2010, leg. Czesław Greń.
6. Tsarevo (Царево) [NG67], plant debris on the shore of the Black Sea, 17.08.2010, leg. Czesław Greń.
7. Tsarevo (Царево) [NG67], 18.08.2010, leg. Czesław Greń.
8. Tsarevo (Царево) [NG67], under plant debris on a Black Sea beach, 18.08.2010, leg. Czesław Greń.
9. Tsarevo (Царево) [NG67], periodic river, 18.08.2010, leg. Czesław Greń.
10. Tsarevo (Царево) [NG67], 19.08.2010, leg. Czesław Greń.
11. Tsarevo (Царево) [NG76], on the beach, 19.08.2010, leg. Czesław Greń.
12. Tsarevo (Царево) [NG77], horse excrement, 19.08.2010, leg. Czesław Greń.
13. Tsarevo (Царево) [NG66], pond, 19.08.2010, leg. Czesław Greń.
14. Tsarevo (Царево) [NG66], periodic river, 19.08.2010, leg. Czesław Greń.
15. Tsarevo (Царево) [NG67], periodic river, 19.08.2010, leg. Czesław Greń.
16. Tsarevo (Царево) [NG76], rock pool on the Black Sea shore, 19.08.2010, leg. Czesław Greń.
17. Tsarevo (Царево) [NG67], 22.08.2010, leg. Czesław Greń.
18. Tsarevo (Царево) [NG67], water film covering rocks on the shore of the Black Sea, 22.08.2010, leg. Czesław Greń.
19. Tsarevo (Царево) [NG67], under plant debris on the Black Sea beach, 22.08.2010, leg. Czesław Greń.
20. Tsarevo (Царево) [NG67], near the mouth of a stream, 22.08.2010, leg. Czesław Greń.
21. Tsarevo (Царево) [NG66], pond, 22.08.2010, leg. Czesław Greń.
22. Tsarevo (Царево) [NG66], periodic river, 22.08.2010, leg. Czesław Greń.
23. Tsarevo (Царево) [NG67], periodic river, 22.08.2010, leg. Czesław Greń.
24. Tsarevo (Царево) [NG67], near the mouth of a stream, 23.08.2010, leg. Czesław Greń.
25. Tsarevo (Царево) [NG67], 24.08.2010, leg. Czesław Greń.
26. Tsarevo (Царево) [NG67], near the mouth of a stream, 24.08.2010, leg. Czesław Greń.
27. Tsarevo (Царево) [NG66], periodic river, 24.08.2010, leg. Czesław Greń.
28. Tsarevo (Царево) [NG67], periodic river, 24.08.2010, leg. Czesław Greń.
29. Tsarevo (Царево) [NG67], 25.08.2010, leg. Czesław Greń.
30. Tsarevo (Царево) [NG67], under plant debris on the Black Sea beach, 25.08.2010, leg. Czesław Greń.
31. Tsarevo (Царево) [NG67], periodic river, 25.08.2010, leg. Czesław Greń.

32. Tsarevo (Царево) [NG67], source waters emerging from rocks on the Black Sea shore, 25.08.2010, leg. Czesław Greń.
33. Tsarevo (Царево) [NG77], source waters emerging from rocks on the Black Sea shore, 25.08.2010, leg. Czesław Greń.
34. Tsarevo (Царево) [NG66], periodic river, 25.08.2010, leg. Czesław Greń.
35. Tsarevo (Царево) [NG77], 25.08.2010, leg. Czesław Greń.
36. Tsarevo (Царево) [NG77], rock pool on the Black Sea shore, 26.08.2010, leg. Czesław Greń.
37. Tsarevo (Царево) [NG67], 27.08.2010, leg. Czesław Greń.
38. Tsarevo (Царево) [NG67], cow excrement, 27.08.2010, leg. Czesław Greń.
39. Tsarevo (Царево) [NG67], periodic river, 27.08.2010, leg. Czesław Greń.
40. Tsarevo (Царево) [NG77], a water-filled pit (foundations), 27.08.2010, leg. Czesław Greń.
41. Tsarevo (Царево) [NG77], rock pool on the Black Sea shore, 27.08.2010, leg. Czesław Greń.
42. Tsarevo (Царево) [NG77], a film of water trickling over coastal rocks from sources emerging from cracks in the rock, mat of algae, 27.08.2010, leg. Czesław Greń.
43. Fazanovo (Фаэаново), River Kaaragach (река Каарагач) [NG67], on a decaying, submerged tree branch, 29.05.2012, leg. Czesław Greń.
44. Pismenovo (Писменово) [NG57], 29.05.2012, leg. Czesław Greń.
45. Primorsko (Приморско), River Dyavolska (река Дяволска) [NG67], 29.05.2012, leg. Czesław Greń.
46. Varvara (Варвара), Black Sea coast [NG76], 29.05.2012, leg. Czesław Greń
47. Primorsko (Приморско), River Dyavolska (река Дяволска) [NG67], 30.05.2012, leg. Czesław Greń.
48. Varvara (Варвара), Black Sea coast [NG76], 30.05.2012, leg. Czesław Greń.
49. Varvara (Варвара), Black Sea coast [NG76], 31.05.2012, leg. Czesław Greń.
50. Sinemorets (Синеморец), River Veleka (река Велека) [NG85], 1.06.2012, leg. Czesław Greń.
51. Varvara (Варвара), Black Sea coast [NG76], 2.06.2012, leg. Czesław Greń.
52. Varvara (Варвара), Black Sea coast [NG76], 3.06.2012, leg. Czesław Greń.
53. Cherepovo (Черепово) [GM25], pond, 4.06.2012, leg. Czesław Greń.
54. Strandzha Mts. (Странджа) [NG57], ditch in a pasture, 4.06.2012, leg. Czesław Greń.
55. Grohotno (Грохотно), River Vacha (Въча) [KG81], 5.06.2012, leg. Czesław Greń.
56. Dabnitsa (Дъбница) [GM30], 5.06.2012, leg. Czesław Greń.
57. Dabnitsa (Дъбница) [GM30], cow excrement, 5.06.2012, leg. Czesław Greń.
58. Shiroka Laka (Широка Лъка) [KG91]. 5.06.2012, leg. Czesław Greń.
59. Ribnik (Рибник) [FL89], in a stream, 6.06.2012, leg. Czesław Greń.
60. Rupite (Рупите) [FL89], in a pool containing water from thermal sources, 6.06.2012, leg. Czesław Greń.

61. Rupite (Рупите) [FL89], in a pool containing water from thermal sources, 6.06.2012, leg. Czesław Greń.
62. Pirin Mts. (Пирин) [GM02], slopes of the Vihren, ca. 2100 m, snowmelt waters, 8.06.2012, leg. Czesław Greń.
63. Pirin Mts. (Пирин), Lake Zhabeshkoto (Жабешкото езеро) [GM02], 2322 m, 9.06.2012, leg. Czesław Greń.
64. Pirin Mts., Yulen Reserve (Пирин, Резерват Юлен) [GM02], above 2000 m, 9.06.2012, leg. Czesław Greń.
65. Simitli (Симитли), River Grabevska (Грабевска река) [FM74], 10.06.2012, leg. Czesław Greń.
66. Simitli (Симитли) [FM74], 10.06.2012, leg. Czesław Greń.
67. Rila Mts. (Рила), the Borovets (Боровец) – Maritsa (Марица) road [GM17], 11.06.2012, leg. Czesław Greń.
68. Rila Mts. (Рила), Central Rila Reserve (Централен рилски резерват) [GM17] 2200-2500 m, 13.06.2012, leg. Czesław Greń.
69. Rila Mts. (Рила), Musala (Мусала) [GM17], above 2200 m, 14.06.2012, leg. Czesław Greń.
70. Borovets (Боровец), Rila Mts. [GM18], 15.06.2012, leg. Czesław Greń.
71. ad Shabla (Шабла) [PJ22], 43°33’12”N 28°33’45”E, 6.06.2015, leg. Czesław Greń.
72. Durankulak (Дуранкулак), Black Sea coast [PJ 23], 43°41’47”N 28°33’53”E, pools around Lake Durankulak, emergent vegetation, 6.06.2015, leg. Czesław Greń and Krzysztof Lubecki.
73. ad Shabla (Шабла) [PJ22], 43°33’12”N 28°33’45”E, dry meadow, night, UV lamp, 6.06.2015, leg. Krzysztof Lubecki.
74. Pismenovo (Писменово), River Uzunchayrska [NG57], 42°13’44”N 27°42’22”E, 8.06.2015, leg. Czesław Greń and Krzysztof Lubecki.
75. Pismenovo (Писменово), River Uzunchayrska [NG57], 42°13’45”N 27°42’20”E, submerged wood, 8.06.2015, leg. Krzysztof Lubecki.
76. Pomorie (Поморие) [NH51], 42°36’48”N 27°37’26”E, coastal salt pans and the watercourses leading to them, 8.06.2015, leg. Czesław Greń and Krzysztof Lubecki.
77. Primorsko (Приморско) [NG68], 42°16’52”N 27°45’11”E, 8.06.2015, leg. Czesław Greń.
78. Primorsko (Приморско), Black Sea coast [NG68], 42°16’56”N 27°45’10”E, 8.06.2015, leg. Krzysztof Lubecki.
79. Primorsko (Приморско), Black Sea coast [NG68], 42°17’05”N 27°45’12”E, near the mouth of a stream, sand, algae, 8.06.2015, leg. Krzysztof Lubecki.
80. Primorsko (Приморско) [NG68], 42°17’40”N 27°45’10”E, 8.06.2015, leg. Czesław Greń.
81. Tsarevo (Царево), Black Sea coast [NG76], 42°10’43”N 27°51’06”E, freshwater seepages on a cliff, algae, 9.06.2015, leg. Krzysztof Lubecki.
82. Tsarevo (Царево) [NG76], 42°8’26”N 27°53’47”E, 9.06.2015, leg. Czesław Greń.

83. Varvara (Варвара), Black Sea coast [NG76], 42°08’10”N 27°53’52”E, 9.06.2015, leg. Krzysztof Lubecki.
84. ad Varvara (Варвара), Black Sea coast [NG76], 42°08’05”N 27°53’49”E, near the mouth of a stream, sand, algae, 10.06.2015, leg. Krzysztof Lubecki.
85. Tsarevo (Царево) [NG76], 42°8’26”N 27°53’47”E, 10.06.2015, leg. Czesław Greń.
86. Varvara (Варвара), Black Sea coast [NG76], 42°08’05”N 27°58’49”E, 10.06.2015, leg. Czesław Greń and Krzysztof Lubecki.
87. Sinemorets (Синеморец), River Veleka (река Велека) [NG85], 42°3’52”N 27°58’12”E, 11.06.2015, leg. Czesław Greń and Krzysztof Lubecki.
88. Rezovo (Резово), Black Sea coast [NG84], 41°58’58”N 28°02’00”E, freshwater seepages on a cliff, algae, 12.06.2015, leg. Czesław Greń and Krzysztof Lubecki.
89. Sinemorets (Синеморец), River Veleka (река Велека) [NG85], 42°03’51”N 27°58’11”E, emergent vegetation of bulrushes and irises, 12.06.2015, leg. Krzysztof Lubecki.
90. Sinemorets (Синеморец), River Veleka (река Велека) [NG85], 42°03’51”N 27°58’15”E, meadow among scrub, night, UV lamp, 12.06.2015, leg. Krzysztof Lubecki.
91. Sinemorets (Синеморец), River Veleka (река Велека) [NG85], 42°03’56”N 27°58’23”E, shallow, muddy oxbow lake, emergent vegetation, 12.06.2015, leg. Krzysztof Lubecki.
92. Varvara (Варвара), Black Sea coast [NG76], 42°08’05”N 27°58’49”E, 12.06.2015, leg. Krzysztof Lubecki.
93. Sinemorets (Синеморец), River Veleka (река Велека) [NG85], 42°03’50”N 27°58’10”E, emergent vegetation, bottle traps 12.06.2015, leg. Krzysztof Lubecki.
94. Sinemorets (Синеморец), oxbow lake on the River Veleka (река Велека) [NG85], 42°3’56”N 27°58’22”E, 13.06.2015, leg. Czesław Greń.
95. Sinemorets (Синеморец), River Veleka (река Велека) [NG85], 42°3’52”N 27°58’12”E, 13.06.2015, leg. Czesław Greń.
96. Ahtopol (Ахтопол), Black Sea coast [NG76], 42°06’10”N 27°55’27”E, sandy mouth of a stream where it enters the sea, 13.06.2015, leg. Krzysztof Lubecki.
97. Sinemorets (Синеморец), River Veleka (река Велека) [NG85], 42°3’52”N 27°58’12”E, 14.06.2015, leg. Czesław Greń.
98. Borovets (Боровец), Rila Mts. [GM18], 42°15’57”N 23°36’50”E, ~1370 m, puddles on a path, montane zone, 14.06.2015, leg. Czesław Greń and Krzysztof Lubecki.
99. Pirin Mts., Vihren (Пирин, Вихрен) [GM02], 41°45’40”N 23°24’42”E, ca. 2200-2300 m, on a mountain trail, 16.06.2015, leg. Krzysztof Lubecki.
100. Pirin Mts. (Пирин), by the River Glazniej [GM02], 41°45’07”N 23°24’50”E, 2060 m, seepages on a meadow, 17.06.2015, leg. Krzysztof Lubecki.
101. Pirin Mts., Yulen Reserve (Пирин, Резерват Юлен) [GM02], 41°45’03”N 23°24’47”E, 2060 m, seepages and small pools of water on a meadow by the River Glazniej, 17.06.2015, leg. Krzysztof Lubecki.
102. Pirin Mts., Yulen Reserve (Пирин, Резерват Юлен) [GM02], above 2000 m, 17.06.2015, leg. Czesław Greń.

103. Pirin Mts., Lake Zhabeshkoto (Пирин, Жабешкото езеро) [GM0], 41°44’18”N 23°25’20”E, 2320 m, by the shore, stones, 17.06.2015, leg. Krzysztof Lubecki.

The above list of localities shows that the authors’ fieldwork was concentrated on the Black Sea coast and in mountain areas. That is why it did not cover the whole spectrum of water bodies and watercourses, only a certain percentage of them. Because of their uniqueness, the outflows of freshwater from rock cracks on the Black Sea coast deserve fuller treatment. The quite small amounts of water, trickling out of these sources and forming a thin layer on the rocks, and at the same time the high level of insolation, create the perfect environment for the growth of bacteria and algae, which form a biofilm several mm thick (Fig. 1). Micro water bodies also form in rock depressions, several cm deep (Fig. 2). The following water beetle species were recorded among these mats of bacteria and algae: *Laccobius gracilis* together with numerous larvae, *Helophorus brevipalpis*, *Enochrus politus*, *Hydroglyphus geminus*, *Heterocerus fenestratus* as well as very large numbers of *Ochtebius* species from the family Hydraenidae. The small volumes of water in such environments (actually a water film and micro water bodies) is the reason for the considerable density of their coleopterofauna. The natural coastal saltmarshes, as well as the worked saltpans (Fig. 4), are the habitat of halophilic species and even halobionts, like *Hygrotus lernaeus*, *Nebrioporus ceresyi*, *Heterocerus flexuosus*, *Enochrus bicolor* or *Paracymus aeneus*. An extreme form of an ephemeral salt water body are the rock pools in the spray zone on the sea shore (Fig. 3), where *Eretes griseus* was recorded. Likewise highly interesting were the aquatic environments in the mountains, especially above the tree line. The numerous lakes in the alpine zone and the small pools, seepages and watercourses (Figs. 5 and 6), where temperatures are low throughout the year, the period without ice cover is short and the waters are oligotrophic, have a characteristic, often stenobiotic, water beetle species composition. The more interesting of these include A*gabus caraboides*, *Boreonectes riberae*, *Hydroporus hebaueri*, *H. nigellus*, *Oreodytes davisi*, *O. sanmarkii, Helophorus confrater* and *H. glacialis*.

Of necessity, the fieldwork largely ignored the plains in the centre of the country, and consequently the small water bodies in those areas, extremely species-rich microhabitats that are centres of biodiversity. All the more interesting, therefore, is the fact that so many water beetle species new to Bulgaria were recorded.

RESULTS

Table 1. List of species.

No.	Species	Localities
Noteridae Thomson C.G., 1860		
1.	*Noterus clavicornis* (De Geer, 1774)	15, 22, 45, 48, 50, 53, 72, 87, 89, 91, 94
Dytiscidae Leach, 1815		
2.	*Acilius sulcatus* (Linnaeus, 1758)	53
3.	*Agabus biguttatus* (Olivier, 1795)	59
4.	*Agabus bipustulatus* (Linnaeus, 1767)	28, 56, 62, 63, 68, 69, 90, 98, 101, 102
5.	*Agabus caraboides* Sharp, 1882	62
6.	*Agabus congener* (Thunberg, 1794)	62, 68, 69, 101, 102, 103

No.	Species	Localities
7.	*Agabus conspersus* (Marsham, 1802)	48, 54, 56, 74, 88, 101, 102
8.	*Agabus dilatatus* (Brullé, 1832)	44, 59, 86
9.	*Agabus guttatus* (Paykull, 1798)	62, 67, 68
10.	*Agabus melanarius* Aubé, 1837	70, 98
11.	*Agabus sturmii* (Gyllenhal, 1808)	44
12.	*Bidessus calabricus* Guignot 1957	25, 29, 40, 86
13.	*Bidessus unistriatus* (Goeze, 1777)	71, 72
14.	* * * *Boreonectes riberae* (Dutton & Angus, 2007)	103
15.	* * *Clemnius decoratus* (Gyllenhal, 1810)	45
16.	*Colymbetes fuscus* (Linnaeus, 1758)	53
17.	*Cybister lateralimarginalis* (De Geer, 1774)	53
18.	*Deronectes moestus inconspectus* Leprieur, 1876	59
19.	*Dytiscus dimidiatus* Bergsträsser, 1777	93, 95, 97
20.	*Dytiscus marginalis* Linnaeus, 1758	47
21.	*Eretes griseus* (Fabricius, 1781)	16
22.	*Hydaticus transversalis* (Pontoppidan, 1763)	15
23.	*Hydroglyphus geminus* (Fabricius, 1792)	4, 6, 14, 23, 28, 33, 34, 42, 48, 79, 81, 86, 90, 91
24.	*Hydroporus discretus* Fairmaire et Brisout, 1859	56, 62, 64, 67, 70, 102
25.	*Hydroporus erythrocephalus* (Linnaeus, 1758)	44
26.	*Hydroporus hebaueri* Hendrich, 1990	102
27.	*Hydroporus memnonius* Nicolai, 1822	54, 56
28.	*Hydroporus nigellus* Mannerheim, 1853	63, 64, 68, 69, 102, 103
29.	*Hydroporus nigrita* (Fabricius, 1792)	62, 63, 64, 68, 102, 103
30.	*Hydroporus palustris* (Linnaeus, 1761)	45, 50, 53, 70, 72, 81, 87, 89, 91, 94, 95, 97
31.	*Hydroporus planus* Fabricius, 1781	44, 56
32.	*Hydroporus pubescens* (Gyllenhal, 1808)	44
33.	**Hydroporus striola* (Gyllenhal, 1826)	71, 72
34.	*Hydroporus tessellatus* (Drapiez, 1819)	54, 59
35.	*Hydrovatus cuspidatus* (Kunze, 1818)	89, 97
36.	*Hygrotus impressopunctatus* (Schaller, 1783)	15, 91
37.	*Hygrotus inaequalis* (Fabricius, 1776)	15, 45, 72, 77, 79, 80
38.	*Hygrotus lernaeus* (Schaum, 1857)	91
39.	* * *Hygrotus musicus* Klug, 1834	48
40.	*Hyphydrus ovatus* (Linnaeus, 1761)	53
41.	*Ilybius chalconatus* (Panzer, 1797)	56
42.	*Ilybius fuliginosus* (Fabricius, 1792)	28, 62, 102, 103
43.	**Ilybius guttiger* (Gyllenhal, 1808)	44
44.	*Ilybius samokovi* (Fery & Nilsson, 1993)	70
45.	*Laccophilus hyalinus* (De Geer, 1774)	13, 21, 28, 74

No.	Species	Localities
46.	*Laccophilus minutus* (Linnaeus, 1758)	13, 14, 23, 24, 28, 53
47.	*Laccophilus poecilus* Klug, 1834	23, 24, 38, 86
48.	*Liopterus haemorrhoidalis* (Fabricius, 1787)	44
49.	*Melanodytes pustulatus* (Rossi, 1792)	93
50.	*Nebrioporus ceresyi* Aubé, 1838	76
51.	*Nebrioporus stearinus suavis* (Sharp, 1882)	28
52.	*Oreodytes davisi* (Curtis, 1831)	103
53.	*Oreodytes sanmarkii* (C. R. Sahlberg, 1826)	58
54.	*Platambus maculatus* (Linnaeus, 1758)	10, 17, 25, 50, 62, 74
55.	*Rhantus bistriatus* (Bergsträsser, 1778)	97
56.	*Rhantus suturalis* (MacLeay, 1825)	3, 5, 7, 11, 15, 16, 38, 93, 95, 97
57.	*Scarodytes halensis* (Fabricius, 1787)	15, 20, 22, 24, 26, 28, 31, 46, 48, 49, 51, 84, 86
	Gyrinidae Latreille, 1810	
58.	*Gyrinus caspius* Ménétries, 1832	20, 24, 47, 49, 50, 51, 72, 74, 77, 87
59.	*Gyrinus distinctus* Aubé, 1836	74, 87
60.	*Gyrinus substriatus* Stephens, 1829	20, 24, 49, 51, 56
61.	*Orectochilus villosus* (O. F. Müller, 1776)	56, 65
	Haliplidae Kirby W., 1837	
62.	*Haliplus flavicollis* Sturm, 1834	50, 97
63.	*Haliplus fluviatilis* Aubé, 1836	50, 94, 97
64.	*Haliplus ruficollis* (De Geer, 1774)	72
65.	*Peltodytes caesus* (Duftschmidt, 1805)	45, 53, 97
	Hygrobidae Régimbart, 1878	
66.	*Hygrobia hermanni* (Fabricius, 1775)	53
	Helophoridae Leach, 1815	
67.	**Helophorus aquaticus* (Linnaeus, 1758)	44, 54, 56, 64, 67, 68, 69, 98, 102
68.	*Helophorus brevipalpis* Bedel, 1881	14, 23, 34, 43, 44, 47, 49, 50, 51, 52, 53, 54, 56, 68, 74, 75, 77, 79, 80, 81, 82, 83, 86, 87, 88, 89, 90, 94, 96, 97
69.	*Helophorus confrater* Kuwert, 1886	62, 64, 68, 69, 101, 102, 103
70.	*Helophorus flavipes* Fabricius, 1792	15, 28, 44, 47, 53, 54, 56, 62, 63, 64, 67, 68, 69, 72, 75, 94, 101, 102
71.	*Helophorus glacialis* Villa, 1883	62, 63, 64, 68, 69, 102, 103
72.	**Helophorus grandis* Illiger, 1798	54
73.	*Helophorus griseus* Herbst, 1793	54, 56
74.	*Helophorus micans* Faldermann, 1835	87
75.	**Helophorus minutus* Fabricius, 1775	47, 50, 75, 79, 80, 86, 87, 89, 90, 91, 94, 97
76.	*Helophorus montenegrinus* Kuwert, 1885	44, 47, 48, 49, 52, 53, 54, 56, 68, 74, 75, 77, 79, 80, 85, 86, 87, 88, 89, 94
77.	**Helophorus obscurus* Mulsant, 1844	50, 87

No.	Species	Localities
	Hydrochidae Thomson C.G., 1859	
78.	**Hydrochus elongatus* (Schaller, 1783)	14
79.	**Hydrochus flavipennis* Küster, 1852	89, 94
80.	**Hydrochus ignicollis* Motschulsky, 1860	47
	Hydrophilidae Latreille, 1802	
81.	**Anacaena globulus* (Paykull, 1798)	28, 70
82.	*Anacaena limbata* (Fabricius, 1792)	14, 45, 53, 57, 89, 90, 94, 97
83.	**Anacaena lutescens* (Stephens, 1829)	57, 62, 67, 68, 69, 70, 101, 102, 103
84.	*Berosus affinis* Brullé, 1835	53
85.	*Berosus frontifoveatus* Kuwert, 1888	50, 90, 91, 94
86.	**Berosus fulvus* Kuwert, 1888	76
87.	*Berosus signaticollis* Charpentier, 1825	91
88.	**Cercyon depressus* Stephens, 1829	6, 8, 19, 30
89.	*Cercyon haemorrhoidalis* (Fabricius, 1775)	57, 70, 77
90.	**Cercyon lateralis* (Marsham, 1802)	65
91.	**Cercyon pygmaeus* (Illiger, 1801)	51
92.	*Cercyon quisquilius* (Linnaeus, 1760)	41, 57
93.	**Cercyon sternalis* Sharp, 1918	72
94.	**Chaetarthria seminulum* (Herbst, 1797)	28, 88
95.	*Coelostoma orbiculare* (Fabricius, 1775)	35, 72, 79
96.	*Cryptopleurum crenatum* (Kugelann, 1794)	12, 41
97.	*Cryptopleurum minutum* (Fabricius, 1775)	12, 54, 57
98.	*Cymbiodyta marginella* (Fabricius, 1792)	14, 45, 72
99.	**Enochrus ater* (Kuwert, 1888)	14, 45, 47, 49, 77, 82, 85, 86, 97
100.	*Enochrus bicolor* (Fabricius, 1792)	45, 48, 49, 72, 76, 77, 79, 91, 96, 97
101.	*Enochrus coarctatus* (Gredler, 1863)	72
102.	*Enochrus fuscipennis* (Thomson, 1884)	60, 74, 81, 90, 91
103.	**Enochrus halophilus* (Bedel, 1878)	97
104.	*Enochrus melanocephalus* (Olivier, 1792)	35, 60, 79
105.	*Enochrus ochropterus* (Marsham, 1802)	79
106.	**Enochrus politus* (Küster, 1849)	24, 32, 35, 40, 45, 48, 49, 52, 57
107.	*Enochrus quadripunctatus* (Herbst, 1797)	14, 54, 77, 82, 91, 96, 97
108.	*Enochrus testaceus* (Fabricius, 1801)	31, 77, 79
109.	*Helochares lividus* (Forster, 1771)	23, 24, 27, 28, 38, 53, 54, 79
110.	**Helochares obscurus* (O. F. Müller, 1776)	79, 80
111.	*Hydrobius fuscipes* (Linnaeus, 1758)	44, 45, 54, 56, 70, 72, 87, 89, 90, 91, 94, 98
112.	*Hydrochara caraboides* (Linnaeus, 1758)	44, 95
113.	*Hydrochara flavipes* (Steven, 1808)	72
114.	**Laccobius aegaeus* Gentili, 1974	6, 9, 14, 23, 28, 31, 40, 57, 75, 77, 81, 83, 88, 97

No.	Species	Localities
115.	*Laccobius bipunctatus* (Fabricius, 1775)	7, 14, 31, 65
116.	*Laccobius gracilis* Motschulsky, 1855	6, 7, 14, 18, 23, 31, 40, 49, 50, 55, 59, 61, 77, 78, 81, 82, 88
117.	*Laccobius minutus* (Linnaeus, 1758)	55
118.	*Laccobius scutellaris* Motschulsky, 1855	27, 28, 31, 96
119.	*Laccobius simulatrix* Orchymont, 1932	55, 59, 61, 77, 88
120.	*Laccobius striatulus* (Fabricius, 1801)	9, 14, 23, 28, 38, 44, 52, 55, 61, 75, 77, 81
121.	*Limnoxenus niger* (Gmelin, 1790)	45, 53, 72
122.	**Megasternum immaculatum* (Stephens, 1829)	67, 86
123.	*Paracymus aeneus* (Germar, 1824)	45, 50, 76
124.	*Sphaeridium bipustulatum* Thunberg, 1794	12
125.	*Sphaeridium marginatum* Fabricius, 1787	66
126.	*Sphaeridium scarabaeoides* (Linnaeus, 1758)	57, 66
Spercheidae Erichson, 1837		
127.	*Spercheus emarginatus* (Schaller, 1783)	24, 72
Dryopidae Billberg, 1820		
128.	*Dryops lutulentus* (Erichson, 1847)	2
129.	*Pomatinus substriatus* (Ph. Müller, 1806)	43
Elmidae Curtis, 1830		
130.	*Elmis obscura* (Ph. Müller, 1806)	65
131.	*Esolus parallelepipedus* (P.W.J. Müller, 1806)	100
132.	*Limnius volckmari* (Panzer, 1793)	1
Heteroceridae Macleay A., 1825		
133.	*Heterocerus fenestratus* (Thunberg, 1784)	33, 50, 83, 90, 92, 99
134.	*Heterocerus flexuosus* Stephens, 1829	71, 76
135.	*Heterocerus fossor* Kiesenwetter, 1843	73
136.	*Heterocerus fusculus* Kiesenwetter, 1843	79
137.	*Heterocerus obsoletus* Curtis, 1828	90

Explanation: * – species new to Bulgaria,

* * – the fact that the authors have taken the latest classification into account in the tribe Hygrotini after Villastrigo *et al.* (2017) means that *Herophydrus musicus* Klug, 1834 is listed within the genus *Hygrotus*, and *Hygrotus decoratus* (Gyllenhal, 1810) within *Clemnius*; this is emphasised in the light of the hitherto universally known and accepted classification,

* * * *Boreonectes riberae* (Dutton & Angus, 2007) – species newly described within the revision of the *Boreonectes* group of species (previously *Stictotarsus*) *griseostriatus* (De Geer, 1774) – see the discussion.

DISCUSSION

For a variety of reasons, the following species among those listed in Table 1 are deserving of special mention and comment.

Agabus caraboides Sharp, 1882.

This species occurs in a fairly small area delimited by Bulgaria, Georgia, Macedonia, Ukraine, Iran, Lebanon, Syria and Turkey (Nilsson & Hájek 2017). In Bulgaria it was recorded near Svishtov and in the high-mountain lakes in the Rila Mts. (Guéorguiev 1987).

Bidessus calabricus Guignot 1957.

A species inhabiting regions to the east of the Mediterranean and western Asia. Prior to the revision of the species from the *minutissimus* (Fery 1991) group, *B. calabricus* was treated as an aberration, form or subspecies of *B. minutissimus* (Germar, 1824). Hence, all information that had been published regarding the occurrence of this species in Bulgaria before that revision related to *B. minutissimus* (Hlisnikovský 1955, Guéorguiev 1962, 1965, 1987). Contemporary data on the occurrence of this species at several localities in Bulgaria, including Tsarevo, are given by Hájek (2006).

Boreonectes riberae (Dutton & Angus, 2007).

Boreonectes griseostriatus (De Geer, 1774) known from Bulgaria and recorded by Guéorguiev, who stated that it was found mostly in mountain areas (Rila, Pirin, Vitosha). Earlier, it had been placed in the genera *Potamonectes* (Zimmermann) and *Stictotarsus* (Zimmermann). Hitherto it has been described as a Holarctic species, widely distributed in the northern regions of both the Palearctic and Nearctic, and patchily in the south of those regions (a classic boreal-montane species). On the basis of karyogenetic studies (kariotypes), it was divided into a number of taxa by Dutton and Angus (2007), still as *Stictotarsus*. That publication contained a description of *Boreonectes riberae* (Dutton & Angus, 2007). In addition, a further four species placed in this genus were distinguished (*B. alpestris*, *B. inexpectatus*, *B. ibericus* and *B. creticus*). That is why the Bulgarian localities of *Boreonectes griseostriatus* were not included in the updated Catalogue of Palearctic Dytiscidae (Nilsson & Hájek 2017), because its authors were of the opinion that its earlier localities from Balkan countries require confirmation and in fact relate to *Boreonectes riberae*, a species that should be treated as having been recorded in Bulgaria. The above data given by Nilsson & Hájek (2017) should therefore be treated as confirmation of the occurrence of *Boreonectes riberae* in Bulgaria, which is why it is not listed here as a species new to that country. Further genetic studies, especially based on DNA, will surely lead to further changes in the systematics of the genus *Boreonectes*. From the practical point of view, it is important to bear in mind that identifications of these species based solely on their external morphological features at best will be highly unreliable, and that the morphological differences between the male genitalia are also minimal. The consequence of these minimal differences in the genitalia is that the prezygotic "mechanical" barrier to reproduction may not suffice to prevent interspecific fertilisation and the production of intermediate forms, especially as fertilisation among this group of species occurs by means of a spermatophore, as happens between *Nebrioporus depressus* and *N. elegans* (Dutton & Angus 2007). In the light of the above, the recent

record of *Boreonectes griseostriatus* from the Balkan Mountains (Stara Planina) (Teofilova & Pandakov 2016) seems doubtful, so it has not been included in the overall number of species recorded in Bulgaria.

Hydroporus hebaueri Hendrich, 1990

A species recorded in Albania, Bulgaria, Montenegro, Greece, Slovakia, Hungary and Turkey (Nilsson & Hájek 2017). In the revision of the species from the *memnonius* group, Fery (1999) states that the earlier Bulgarian records of *H. cantabricus* (Guéorguiev 1987) in fact refer to *H. hebaueri*; the range of *H. cantabricus* is restricted to Spain.

Ilybius samokovi (Fery & Nilsson, 1993)

A species described exclusively on the basis of the holotype, collected in 1911 (Fery & Nilsson 1993). It was not caught again until 2007 (Šťastný 2010, Fery & Hendrich 2011). The present locality of this species at Borovets in the Rila Mountains is thus its third record. One male was caught in a small, shallow, astatic water body, largely overgrown with herbaceous vegetation, at an altitude of ca 1400 m.

Melanodytes pustulatus (Rossi, 1792).

In Bulgaria this species is very rarely come across – to date only three localities are known: Alibotuš (Slavyanka Mts.) (Hlisnikovský 1955), Sozopol and Lozenets (Hájek 2006). Its overall distribution is limited to southern Europe around the Mediterranean Sea, from France to Turkey (Miller & Bergsten 2016).

Eretes griseus (Fabricius, 1781).

This beetle has the widest distribution of all the members of this genus. Because of the great morphological similarity with *E. sticticus* (Linnaeus, 1767), *E. griseus* and the former appellation were regarded as synonyms for over one hundred years. Miller (2002) restored *E. griseus* as a separate species, stating that its range of distribution extended northwards to southern Europe, and that data from the Balkan Peninsula should be ascribed to *griseus* rather than to *sticticus*. The latest publications have shown, however, that both species definitely occur in Bulgaria (Hájek 2006, Hájek *et al*. 2015). In this country, *E. griseus* has so far been found in the Slavyanka Mts. and at Tsarevo (Hájek 2006). The present material from Tsarevo confirms that it continues to occur in this area. The specimens were caught on the Black Sea shore in a highly saline rock pool in the spray zone, which is inundated by sea water during storms (Fig. 3). Apart from *E. griseus*, *Hydroglyphus geminus* was abundant in this habitat.

Hygrotus lernaeus (Schaum, 1857)

A halophilic species, in Bulgaria associated with saline water bodies on the Black Sea coast (Guéorguiev 1987).

Nebrioporus ceresyi (Aubé, 1838)

A typical halobiont, living in strongly saline water bodies (Guéorguiev 1987, Fery *et al.* 1996). Very numerous in the salt pans at Pomorie, in which *Heterocerus flexuosus*, *Berosus fulvus*, *Enochrus bicolor* and *Paracymus aeneus* also occurred.

Nebrioporus stearinus suavis (Sharp, 1882)

An eastern Mediterranean subspecies, known from Albania, Bosnia, Bulgaria, Croatia (Dalmatia), Greece and some of the Greek islands (except Crete), Macedonia, Montenegro, Serbia, and western and northern Turkey (Toledo 2009). At Tsarevo very abundant in pools on the bed of a periodic river.

Cercyon depressus Stephens, 1829

A typical halobiont, occurring mainly along the coasts of northern, central and western Europe, and also southern coasts of the Black Sea. Accidentally introduced to North America (Przewoźny 2017). During the present fieldwork, large numbers were found under plant debris on the Black Sea coast in the second half of August.

Enochrus politus (Küster, 1849)

A species with a wide distribution around the Mediterranean Sea, and known also from the Canary Is., Madeira and Afghanistan (Przewoźny 2017). In recent years very large numbers have been found in a few provinces of Turkey (Bektaş *et al.* 2014).

Enochrus ater (Kuwert, 1888)

A species formerly thought to occur only in the regions beyond the south-eastern end of the Mediterranean Sea; it is widespread in Egypt, Mesopotamia and Israel (Hebauer 1994). Further research has shown it to be widespread throughout the Mediterranean region (Spain, France, Italy, Bosnia and Hercegovina, Croatia, Montenegro, Greece, Turkey, Israel, Egypt and Algeria), and even central Europe (Romania, Austria). In the east, it has been recorded in Iran, Iraq, Turkmenistan, Tajikistan, Kazakhstan and Uzbekistan. It is also present on some Mediterranean islands, such as the Balearics and Cyprus (Ribera *et al.* 1997). In Bulgaria it is also frequent and numerous.

Megasternum immaculatum (Stephens, 1829)

A species that until recently was not distinguished from *M. concinnum*, the two names being regarded as synonyms (Hansen 2004). In the latest edition of *Handbooks for the Identification of British Insects* (Foster *et al.* 2014), it is treated as a separate species with a short identification key. Distinguishing the two species on the basis of the features given in this key is not particularly difficult, especially if the structures of the male genitalia are taken into consideration.

Table 2 lists the various beetle families in order to summarise and compare the state of knowledge of water beetles in Bulgaria:

• the number of species recorded by the authors;

• the number of species so far recorded in Bulgaria, prior to the authors' data – the state of knowledge according to the updated Catalogue of Palearctic Dytiscidae (internet version – Nilsson & Hájek 2017), Catalogue of Palearctic Hydrophiloidea (internet version – Przewoźny 2017), A World Catalogue of the Family Noteridae (internet version – Nilsson 2006), World checklist of freshwater Coleoptera: Haliplidae species (internet version – van Vondel 2015) and current literature data (Gueorguiev 1987, Chehlarov *et al.* 2016,

Teofilova & Pandakov 2016) in lines 1, 2, 3, 4, 5, 6, 7, 8, 9; lines 10, 11, 12 after Löbl I. & Löbl D. (Eds.) 2016;

- the number of species new to Bulgaria recorded by the authors;
- the total number of species reported from Bulgaria, including the authors' data.

No.	Family	Number of species recorded by the authors from Bulgaria	Number of species recorded from Bulgaria so far, prior to the authors' data	Number of species new to Bulgaria recorded by the authors	Total number of species recorded from Bulgaria, including the authors' data
1.	Noteridae	1	2	-	2
2.	Dytiscidae	56	115	2	117
3.	Gyrinidae	4	10	-	10
4.	Haliplidae	4	16	-	16
5.	Hygrobidae	1	1	-	1
6.	Helophoridae	11	11	4	15
7.	Hydrochidae	3	1	3	4
8.	Hydrophilidae	46	56	14	70
9.	Spercheidae	1	1	-	1
10.	Dryopidae	2	12	-	12
11.	Elmidae	3	19	-	19
12.	Heteroceridae	5	10	-	10
	Total:	**137**	**254**	**23**	**277**

The above list shows that a total of 277 beetle species from the relevant families have been found in Bulgaria (literature data and the authors' survey combined). Neither the Catalogue of Palaearctic Coleoptera (Löbl & Smetana 2003) nor the Catalogue of Palearctic Dytiscidae (Nilsson & Hájek 2017) mention the occurrence of *Hydaticus seminiger* in Bulgaria, even though Guéorguiev (1987) gives a few localities of this species. The same applies to *Brychius elevatus*, which is stated as having been recorded in Bulgaria by Guéorguiev (1987) and in the World checklist of freshwater Coleoptera: Haliplidae species (van Vondel 2015), but is not included in the Catalogue of Palaearctic Coleoptera (Löbl & Smetana 2003). We do not know the reason for this state of affairs.

The fact that 23 new species have been found in a medium-sized European country may seem surprising, since conventional wisdom has it that Europe, and therefore Bulgaria as well, has been relatively well researched faunistically. Such an interpretation appears to be endorsed by the present survey with respect to the families from the Hydradephaga group, among which there are only two new species, a diminishingly small percentage (of the order of 1.4%) in relation to the 144 already known. Their discovery in Bulgaria appears merely to have filled gaps in the knowledge of their overall ranges. In contrast, the considerable percentage of species new to Bulgaria within the families Hydrochidae, Hydrophilidae and Helophoridae (3 vs. 1 known, 14 vs. 56 known and 4 vs. 11 known respectively) requires quite a different interpretation. Such a large percentage of species found for the first time, of

the order of 300% (sic!), 25% and 36.3% respectively of the hitherto known coleopterofauna of these families, cannot be explained solely by the thirty-year hiatus in entomofaunistic research mentioned earlier. It testifies to the fact that these taxa were not properly researched in the more distant past. This appears to be sufficient justification for further research in this respect.

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Fig. 1. Biofilm of bacteria and algae on rocks where water is trickling out of cracks (photo C. Greń).

Fig. 2. Micro water body in a rock depression with a mat of bacteria and algae (photo C. Greń).

Fig. 3. Rock pool in the spray zone on the Black Sea shore at Tsarevo – the living environment of Eretes griseus and *Hydroglyphus geminus* (photo C. Greń).

Fig. 4. Salt pan at Pomorie – the living environment of halophilic species like *Nebrioporus ceresyi* and *Paracymus aeneus* (photo K. Lubecki).

Fig. 5. A high-mountain lake, oligotrophic in the extreme and devoid of plant life (Pirin Mts., Lake Zhabeshkoto – Пирин, Жабешкото езеро) – the living environment of species such as *Boreonectes riberae*, *Hydroporus hebaueri* and *H. nigellus* (photo K. Lubecki).

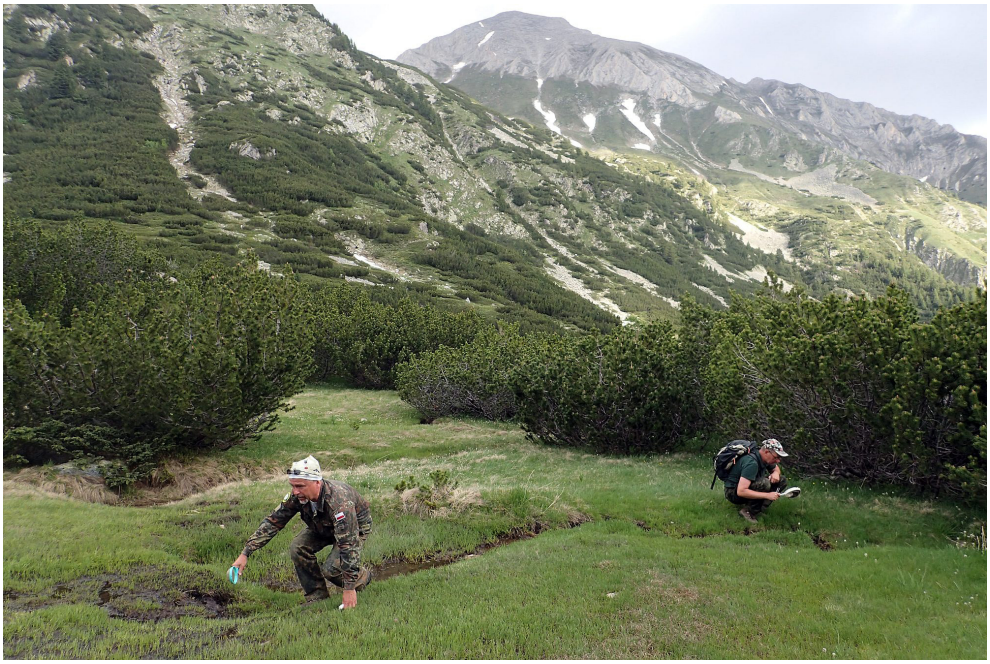

Fig. 6. Tiny pools of water and seepages in the dwarf pine zone (Pirin Mts. – Пирин). Kitchen sieves – the basic "tools" for catching beetles in the mountains are being used (photo A. Lubecka).