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Contribution to the knowledge of dragonflies (Odonata) of Montenegro, with the first record of *Ophiogomphus cecilia* (Fourcroy, 1785)

Przyczynek do wiedzy o ważkach (Odonata) Czarnogóry, z pierwszym stwierdzeniem *Ophiogomphus cecilia* (Fourcroy, 1785)

ABSTRACT

Authors discuss the collection of larvae and imagines of Odonata which was collected during hydrobiological and acarological studies conducted in Montenegro in 2010 and 2012. The material encompasses 28 dragonfly species of which *Ophiogomphus cecilia* has been recorded in this country for the first time. The updated checklist of the dragonflies of Montenegro was also provided.
Keywords: Odonata, dragonflies, Montenegro, records, *Ophiogomphus cecilia*

STRESZCZENIE

Autorzy omawiają zbiór larw i imagines Odonata, który zgromadzono podczas badań hydrobiologicznych i akarologicznych prowadzonych w Czarnogórze w latach 2010 i 2012. Obejmuje on 28 gatunków, z których *Ophiogomphus cecilia* stwierdzono pierwszy raz w tym kraju. Przedstawiono też uzupełniony wykaz ważek Czarnogóry.
Słowa kluczowe: Odonata, ważki, Czarnogóra, stwierdzenia, *Ophiogomphus cecilia*

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INTRODUCTION

Montenegro has belonged until recently to the part of the Balkans neglected with respect to odonatological studies (6). Although recent years have brought a greater amount of data, the knowledge on the fauna of this country is still incomplete. However, Montenegro is regarded as the area playing an important role in maintaining the species richness of dragonflies of Balkans as well as in protecting rare and endangered species. In addition, the borders of distribution areas of many dragonflies run through Montenegro and its vicinities, therefore data from this country is zoogeographically important (6, 8, 9).

In 2010 and 2012 we conducted the studies on zoobenthos of the river valleys and, to a lesser extent, the parasitism of water mites (Acari: Hydrachnidia) on dragonflies. Below, we discuss the collection of larvae and imagines which is quite rich in species and encompassing taxa that are interesting due to their geographic distribution, biology and threats.

STUDY AREA

Montenegro is a Western Balkan state on the south-eastern coast of the Adriatic Sea. Its area is 13,812 km^2. Most of the country is covered by the Dinaric Alps with the highest peaks exceeding 2,500 m a.s.l. Few areas lying below 500 m are centered around Lake Skadar and along the coast of the Adriatic Sea. The whole country is in warm Mediterranean climate zone (43). With respect to biogeography, Montenegro belongs to the Alpine and Mediterranean regions. The border between them, running approximately in parallel to the shore of the Adriatic Sea, divides the country into two almost equal halves (8, 12).

Numerous rivers flowing down from the mountains belong to the basins of the Adriatic Sea, a few ones – the Black Sea. In some regions lakes, especially alpine ones, are present. The largest lake in Montenegro is karst Skadar Lake with variable surface area of 360–550 km^2 which lies on the border of Montenegro with Albania (50).

The studies were conducted in areas of Montenegro (Fig. 1), belonging entirely to the Mediterranean region.

MATERIAL AND METHODS

Field studies were conducted in October 2010 and August 2012. Dragonfly larvae were collected with the use of hydrobiological kick sampler as well as picked up by hand from submerged objects. Imagines were caught sporadically with an entomological net. 228 larvae and 91 imagines (26 ♀♀, 65 ♂♂) were collected in total.

The studies covered 28 sites (Fig. 1):

1. Ribliak near Rosca, the River Zeta (42°39’ N, 19°00’ E, UTM: CN32). Width: ca. 10 m, depth: 1.5 m, bottom of stones, river banks steep, current fast. Surroundings: alluvial willow forests.
2. Between Rosca and Ribliak, an oxbow of the River Zeta (42°38’ N, 19°00’ E, CN32). Size: 10x80 m, under the trees, depth: 0.5 m, bottom of loam with organic debris. Surroundings: alluvial willow forests.
3. Dobropolje, the River Zeta near the bridge (42°37’ N, 19°01’ E, CN32). Width: ca. 25 m, depth: 1.5 m, bottom of stones with liverworts, current quite fast. Alluvial willow forests on the river banks.
4. Danilovgrad, the stretch of the River Zeta 50–150 m below the bridge (42°33’ N, 19°06’ E, CN41). Width: 15–20 m, depth: 1–3 m, sandy bottom with the patches of grass,

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Myriophyllum sp. and *Fontinalis antipyretica* L., current slow. River banks steep, closer to the bridge with cut trees, farther areas wooded.

5. Radanovići, the River Koložun near the airport (42°23' N, 18°43' E, CM19). Regulated (extracted bottom sediments on the bank), width: 2 m, depth: 0.7 m, bottom of tiny stones, sand and loam, current slow. Banks grown with *Phragmites australis* (Cav.) Trin. ex Steud.
6. Radanovići, a ponding water of the River Koložun in the centre of the village (42°22' N, 18°44' E, CM19). Width: 5 m, depth: 0.4 m, bottom of stones, current slow. River banks sheer, concreted to the height of 2 m.
7. Radanovići, the River Koložun above the center of the village (42°21' N, 18°45' E, CM19). Width: 5 m, depth: 0.2 m, bottom of stones, current fast, with ponding waters among stones. River banks steep, to the height of 2 m, with shrubs. Surroundings: fields and buildings.
8. Budva, the stream Grdevica near boulevard Žrtava Fašizma (42°17' N, 18°50' E, CM28). Width: 30 m, depth: 0.8 m, bottom of gravel and sand with lots of trash and organic debris, current still. River banks steep, insolated all day long. The mouth of a rivulet is situated within the site.
9. Budva, the canal of the stream Grdevica 200 m above the road E65/E80 (42°17' N, 18°50' E, CM28). Width: 10 m, depth: 0.2 m, bottom stones and gravel, current moderate. One river bank covered with concrete, the second one grown with herbaceous vegetation, steep. The site is located between houses, insolated all day long.
10. Boreti, the River Vestiča, near the bridge with the road E65/E80 (42°17' N, 18°50' E, CM28). A temporary running water, width of the bed: 6 m, with narrow stream sipping among stones, bottom of stones with gravel and silt. River banks mild, with ruderal vegetation, entirely insolated. The periphery of the village, with gardens on the sides.
11. Bečići, a stream near the point where it flows into the sea (42°17' N, 18°52' E, CM28), The width of a bed: 4.5 m, width of a stream: 1.5 m, bottom of stones, current moderate. Banks covered with concrete. The centre of town, near the road bridge, full insolation.
12. Sinjac, the spring Kaludjerovo Oko (42°22' N, 19°09' E, CM49). A limnocrene spring with the area of ca. 0.5 ha, deep, very hot water, insolated. Bottom of mud, with abundant *Myriophyllum* sp.
13. Karuč, backwater of Lake Skadar (42°21' N, 19°06' E, CM49). Vast, with the depth up to 0.5 m. From the lakeshore swamps of *Phragmites australis* and *Typha* spp., in backwater the patches of *Nuphar lutea* (L.) Sibth. & Sm. Bottom with large amounts of mud, sandy grasslands and meadows around.
14. Vranjina, flooded area in the valley of the River Morača near railway station Zeta (42°17' N, 19°09' E, CM48). A dry meadow sharing a border with a swamp of *Phragmites australis* and thickets of *Robinia pseudoacacia* L.
15. Vranjina, flooded area of Lake Skadar, a canal flowing into the River Morača (42°16' N, 19°08' E, CM48). Width: 5 m, depth: 0.7 m, standing water, bottom of mud. Patches of *Nuphar lutea*.
16. Vranjina, the River Morača near the point where it flows to Lake Skadar, near the site 17 (42°16' N, 19°08' E, CM48). Width: 100 m, depth: 1 m, bottom of sand and stones with large addition of silt, water almost standing, with *Trapa natans* L. and *Ceratophyllum* sp. River banks with a narrow belt of *Robinia pseudoacacia*. Surroundings: extensively used meadows.
17. Vranjina, a cove of Lake Skadar in the mouth of the River Morača (42°16' N, 19°08' E, CM48). Shallow, with flooded grasses.

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18. Vranjina, Lake Skadar near the southern end of the bridge with the road E65/E80 (42°16' N, 19°08' E, CM48). The depth of littoral up to 1 m, water green, bottom of stones (small pebbles) with *Potamogeton* sp.
19. Virpazar, the stream Orahovstica (42°14' N, 19°05' E, CM47). Width: 1 m, depth: 0.2 m, bottom of stones, grown with mosses, filamentous algae at some places, current fast.
20. Virpazar, Lake Skadar near the harbor for boats (42°14' N, 19°05' E, CM47). Water green (algal blooms), depth to 0.5 m, bottom of loam and sand with stones, dominating vegetation: *Elodea canadensis* Michx. and *Nuphar lutea*.
21. Sutomore, a rivulet by a small beach (42°08' N, 19°02' E, CM36). Banks steep, brushwood with *Ficus carica* L., bottom of stones, current very fast.
22. Bar, a stream below the bridge on the road E851 (42°06' N, 19°05' E, CM46). Width: 2 m, depth: 0.2 m, bottom of sand with stones and organic material, current slow. Surroundings: buildings, ruderal habitats (the centre of town).
23. Bar, the River Željeznica (42°06' N, 19°04' E, CM46). The river bed partially covered with concrete, width: 11 m, the width of water: 2.5 m, depth: 0.1–0.3 m, ponding waters at some places, bottom of sand grown with *Typha latifolia* L., current slow.
24. Bar, a canal in Burtaiši district along the road E851 (42°05' N, 19°06' E, CM46). Width: 2 m, depth: 0.1 m, bottom of stones, grown with mosses and *Polygonum* sp., current slow. The bed of canal concrete.
25. Bar, Čeluga district, the stream Ricavač near the bridge with the road E851 (42°04' N, 19°07' E, CM46). Width: 10 m, depth: 0.1–0.2 m, bottom of stones grown with mosses and algae, ponding waters with mosses and *Digitaria* sp. at some places. Banks steep, with brushwood.
26. Kolomza ad Kodre, the stream Mulina (41°55' N, 19°14' E, CM54). Regulated, width: 2 m, depth: 0.2 m, bottom of gravel, littered, current slow. Surroundings: fields and buildings.
27. Gornij Štoj, a meadow in a forest near the River Bojana (41°54' N, 19°19' E, CM64). Surrounded with alluvial willow forests.
28. Ada, the River Bojana near the point where it flows into the sea, about 150 m from the road bridge (41°52' N, 19°21' E, CM63). Width: 100 m, current very slow, bottom of sand. River banks with *Arundo donax* L., farther with ruderal vegetation.

RESULTS

The collected material encompasses 28 dragonfly species. Data on particular sites is given below, with the use of the following abbreviations and symbols: **1**–**28** – numbers of sites, L (LL) – larva (larvae), ♀ (♀♀) – female (females), ♂ (♂♂) – male (males).

− *Calopteryx splendens* (Harris, 1782)[1]: **2** (13-10-2010, 1 L); **4** (12-10-2010, 1 L); **10** (12-10-2010, 1 L).

− *Calopteryx virgo* (Linnaeus, 1758): **4** (12-10-2010, 14 LL); **10** (9-10-2010, 3 LL).

[1] There are two subspecies in Montenegro: the widespread nominative one and rare *C. s. balcanica* Fudakowski, 1930, known from eastern coasts of the Adriatic Sea – however, in larval stages they are not distinguishable (14, 22, 46).

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– *Lestes barbarus* (Fabricius, 1798): **27** (23-08-2012, 1 ♀).

– *Lestes virens* (Charpentier, 1825): **27** (23-08-2012, 2 ♀♀, 7 ♂♂).

– *Chalcolestes parvidens* Artobolevskii, 1829: **10** (9-10-2010, 1 ♂); **28** (23-08-2012, 3 ♀♀, 2 ♂♂).

– *Platycnemis pennipes* (Pallas, 1771): **4** (12-10-2010, 5 LL); **5** (8-10-2010, 1 L); **10** (9-10-2010, 3 LL); **18** (28-08-2012, 2 LL); **20** (22-08-2012, 1 ♀ – *P. p. pennipes*).

– *Ischnura elegans* (Vander Linden, 1820): **13** (28-08-2012, 1 ♀, 5 ♂♂); **14** (28-08-2012, 7 ♂♂); **15** (28-08-2012, 1 L); **16** (28-08-2012, 5 LL, 4 ♀♀); **17** (28-08-2012, 12 LL); **18** (22-08-2012, 11 LL, 2 ♀♀, 8 ♂♂); **23** (26-08-2012, 23 LL, 2 ♀♀, 4 ♂♂); **28** (23-08-2012, 3 LL).

– *Enallagma cyathigerum* (Charpentier, 1840): **20** (22-08-2012, 1 L).

– *Coenagrion puella* (Linnaeus, 1758): **2** (13-10-2010, 2 LL); **4** (12-10-2010, 1 L); **22** (26-08-2010, 1 L).

– *Coenagrion pulchellum* (Vander Linden, 1825): **15** (28-08-2012, 1 L).

– *Erythromma najas* (Hansemann, 1823): **16** (28-08-2012, 2 LL); **20** (22-08-2012, 2 LL).

– *Erythromma viridulum* (Charpentier, 1840): **20** (22-08-2012, 1 L).

– *Pyrrhosoma nymphula* (Sulzer, 1776): **12** (25-08-2012, 6 LL).

– *Aeshna affinis* Vander Linden, 1820: **1** (13-10-2010, 1 L); **7** (8-10-2010, 1 ♀); **15** (28-08-2012, 1 ♀).

– *Anax imperator* Leach, 1815: **12** (2508-2012, 2 LL).

– *Caliaeschna microstigma* (Schneider, 1845): **3** (12-10-2010, 4 LL); **6** (8-20-2010, 2 LL); **7** (8-20-2010, 1 L); **10** (9-10-2010, 1 L); **21** (31-08-2012, 3 LL).

– *Onychogomphus forcipatus forcipatus* (Linnaeus, 1758): **6** (8-10-2010, 1 L); **7** (8-10-2010, 3 LL); **10** (9-10-2010, 26 LL); **19** (30-08-2012, 3 LL); **25** (27-08-2012, 1 L).

– *Ophiogomphus cecilia* (Fourcroy, 1785): **11** (9-10-2010, 1 L).

– *Cordulegaster bidentata* Sélys, 1843: **2** (13-10-2010, 1 L); **21** (23-08-2012, 2 LL).

– *Somatochlora meridionalis* Nielsen, 1935: **5** (8-10-2010, 2 LL).

– *Libellula fulva* (O.F. Müller,1764): **5** (8-10-2010, 1 L).

– *Orthetrum albistylum* (Sélys, 1848): **8** (7-10-2010, 1 L); **9** (7-10-2010, 1 L).

– *Orthetrum brunneum* (Fonscolombe, 1837): **9** (7-10-2010, 6 LL); **10** (9-10-2010, 31 LL); **21** (24-08-2012, 4 LL); **22** (26-08-2012, 1 L); **23** (26-08-2012, 2 LL, 1 ♂); **24** (26-08-2012, 10 LL); **25** (27-08-2012, 3 LL).

– *Orthetrum coerulescens* (Fabricius, 1798): **23** (26-08-2012, 4 ♂♂); **25** (27-08-2012, 1 L).

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− *Crocothemis erythraea* (Brullé, 1832): **13** (28-08-2012, 1 ♀, 2 ♂♂); **14** (28-08-2012, 1 ♂); **16** (28-08-2012, 1 ♀, 1 ♂); **17** (28-08-2012, 1 L); **23** (26-08-2012, 7 LL).

− *Sympetrum meridionale* (Sélys, 1841): **10** (9-10-2012, 1 ♀, 2♂♂); **13** (28-08-2012, 1 ♂); **14** (28-08-2012, 1 ♂); **16** (28-08-2012, 4 ♂♂); **26** (27-08-2012, 1 ♀, 1 ♂); **27** (23-08-2012, 2 ♂); **28** (23-08-2012, 1 ♀, 3 ♂♂).

− *Sympetrum sanguineum* (O.F. Müller, 1764): **14** (28-08-2012, 1 ♂).

− *Sympetrum striolatum* (Charpentier, 1840): **7** (8-10-2010, 1 ♂); **10** (9-10-2010, 3 ♀♀, 1 ♂); **11** (9-10-2010, 1 ♀, 1 ♂).

22 species were collected as larval stages. Most numerous were: *Orthetrum brunneum* (24% of collected larvae), *Ischnura elegans* (23%), *Caliaeschna microstigma* (14%) and *Onychogomphus forcipatus* (12%). 11 species were collected as imagines. Most numerous were *Ischnura elegans* (39% of collected material), *Sympetrum meridionale* (20%) and *Lestes virens* (11%). Particular species were found at 1–8 sites. The most widely present were: *Ischnura elegans* (8 sites), *Orthetrum brunneum* and *Sympetrum meridionale* (7 sites each) and *Platycnemis pennipes*, *Caliaeschna microstigma*, *Onychogomphus forcipatus* and *Crocothemis erythraea* (5 sites each). The remaining species were found at the most at three sites.

DISCUSSION

The history of the studies on odonatofauna of Montenegro was discussed by Jović et al. (27). Worth mentioning is the fact that they omitted two papers: Kalkman and Lopau (35) provided the information about 5 specimens of *Pyrrhosoma nymphula* from Montenegro which were in the collections of Nationaal Natuurhistorisch Museum Naturalis in Leiden (Holland), Gligorović and Pešić (15) discussed the fauna of Lake Skadar. At least the second paper must have been in print when Jović et al. (27) were preparing their manuscript, therefore it was not available to them.

Jović et al. (27) have compiled 20 papers containing direct original data, beginning with the article of Stein from 1863 (48). Most of them included sparse data, often discussed on the margins of the analysis of larger areas or neighbouring countries. The richest in data is the work of Dumont (11). Taking into consideration the cited literature and their own data, Jović et al. (27) have compiled the list of 57 dragonfly species recorded in Montenegro, with 7 of them given for the first time in this country. But in the fact this number was 56 for *Calopteryx balcanica splendens* Fudakowski, 1930, given as a separate species, is actually not regarded as a separate taxon at present (46). Data of Kumerloeve (39) about *Chalcolestes viridis* (Vander Linden, 1825) was not taken into account. It was considered that

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"it is clear that the author didn't pay attention to the separation of *L. parvidens* and *L. viridis*, it can only be classified as '*Lestes viridis* complex' and is not included into present list" (27)[2].

In the years 2006–2013 there were as many as 16 papers about dragonflies of Montenegro (1, 2, 7, 8, 15–21, 25, 27, 35, 41, 52). They enriched the knowledge about the distribution and ecology as well as extended the list of the known species to 66. Faunistic data included in some papers is rich or even very rich (8, 15, 16, 21). Moreover, Gligorović et al. (16) gave *Chalcolestes viridis* again – it can be assumed that they had full access to the contemporary odonatological literature and this record is correct.

In this paper, *Ophiogomphus cecilia* has been given for the first time from Montenegro. Thus, in the area of Montenegro, 67 species of dragonflies have been recorded so far. Due to the scattered data in the literature, which is not always easily accessible, we present below the ordered checklist of dragonflies of Montenegro. It also takes into account some of the most distinctive subspecies.

Zygoptera
Calopterygidae
1. *Calopteryx splendens* (Harris, 1782)
− *C. s. balcanica* (Fudakowski, 1930)
− *C. s. splendens* (Harris, 1782)
2. *Calopteryx virgo* (Linnaeus, 1758)
− *C. v. festiva* (Brullé, 1832)
Lestidae
3. *Lestes barbarus* (Fabricius, 1798)
4. *Lestes dryas* Kirby, 1890
5. *Lestes macrostigma* (Eversmann, 1836)
6. *Lestes sponsa* (Hansemann, 1823)
7. *Lestes virens* (Charpentier, 1825)
− *L. v. vestalis* Rambur, 1842
8. *Chalcolestes parvidens* Artobolevskii, 1829
9. *Chalcolestes viridis* (Vander Linden, 1825)
10. *Sympecma fusca* (Vander Linden, 1820)
Platycnemididae
11. *Platycnemis pennipes* (Pallas, 1771)
− *P. p. nitidula* Brullé, 1832
− *P. p. pennipes* (Pallas, 1771)

[2] The view had dominated for a long time that *Chalcolestes* Leach, 1815 was a subgenus within the genus *Lestes* Leach, 1815 (24) – however, recently it has been again considered a separate genus, related to the genus *Sympecma* Burmeister, 1839 (10).

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Coenagrionidae
12. *Ischnura elegans* (Vander Linden, 1820)
13. *Ischnura pumilio* (Charpentier, 1825)
14. *Enallagma cyathigerum* (Charpentier, 1840)
15. *Coenagrion hastulatum* (Charpentier, 1825)
16. *Coenagrion ornatum* (Selys, 1950)
17. *Coenagrion puella* (Linnaeus, 1758)
18. *Coenagrion pulchellum* (Vander Linden, 1825)
19. *Coenagrion scitulum* (Rambur, 1842)
20. *Erythromma lindenii* (Selys, 1840)
21. *Erythromma najas* (Hansemann, 1823)
22. *Erythromma viridulum* (Charpentier, 1840)
23. *Pyrrhosoma nymphula* (Sulzer, 1776)
24. *Ceriagrion tenellum* Selys, 1876
Anisoptera
Aeshnidae
25. *Aeshna affinis* Vander Linden, 1820
26. *Aeshna cyanea* (O.F. Müller, 1764)
27. *Aeshna grandis* (Linnaeus, 1758)
28. *Aeshna isoceles* (O.F. Müller, 1767)
29. *Aeshna juncea* (Linnaeus, 1758)
30. *Aeshna mixta* Latreille, 1805
31. *Anax ephippiger* (Burmeister, 1839)
32. *Anax imperator* Leach, 1815
33. *Anax parthenope* (Selys, 1839)
34. *Brachytron pratense* (O.F. Müller, 1764)
35. *Caliaeschna microstigma* (Schneider, 1845)
Gomphidae
36. *Gomphus flavipes* (Charpentier, 1825)
37. *Gomphus pulchellus* Selys, 1840[3]
38. *Gomphus schneiderii* Selys, 1850
39. *Gomphus vulgatissimus* (Linnaeus, 1758)
40. *Ophiogomphus cecilia* (Fourcroy, 1785)
41. *Onychogomphus forcipatus* (Linnaeus, 1758)
− *O. f. forcipatus* (Linnaeus, 1758)
42. *Lindenia tetraphylla* (Vander Linden, 1825)

[3] Montenegro is situated far from the clumped distribution area of this species (6), however, in 2010 one larvae of *G. pulchellus* was found in the River Zeta in Danilovgrad (7).

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Cordulegastridae
43. *Cordulegaster bidentata* Selys, 1843
44. *Cordulegaster heros* Theischinger, 1979
45. *Cordulegaster picta* (Selys, 1854)[4]
Corduliidae
46. *Cordulia aenea* (Linnaeus, 1758)
47. *Somatochlora flavomaculata* (Vander Linden, 1825)
48. *Somatochlora meridionalis* Nielsen, 1935
49. *Somatochlora metallica* (Vander Linden, 1825)
50. *Epitheca bimaculata* (Charpentier, 1825)
Libellulidae
51. *Libellula depressa* Linnaeus, 1758
52. *Libellula fulva* O.F. Müller, 1764
53. *Libellula quadrimaculata* Linnaeus, 1758
54. *Orthetrum albistylum* (Selys, 1848)
55. *Orthetrum brunneum* (Fonscolombe, 1837)
56. *Orthetrum cancellatum* (Linnaeus, 1758)
57. *Orthetrum coerulescens* (Fabricius, 1798)
− *O. c. coerulescens* (Fabricius, 1798)
58. *Leucorrhinia dubia* (Vander Linden, 1825)
59. *Sympetrum flaveolum* (Linnaeus, 1758)
60. *Sympetrum fonscolombii* (Selys, 1840)
61. *Sympetrum meridionale* (Selys, 1841)
62. *Sympetrum sanguineum* (O.F. Müller, 1764)
63. *Sympetrum striolatum* (Charpentier, 1840)
64. *Crocothemis erythraea* (Brullé, 1832)
65. *Trithemis annulata* (Palisot de Beavois, 1807)
66. *Selysiothemis nigra* (Vander Linden, 1825)
67. *Pantala flavescens* (Fabricius, 1798)

In the light of the presented data, a small Montenegro is characterized by richer fauna than more biogeographically diversified and in the similar degree studied neighbouring countries, which underlines the importance of this country for the protection of dragonflies. For example, in Bosnia and Herzegovina, 63 dragonfly species have been recorded so far (38), in Serbia – 64 (29, 28, 31–33, 37, 45, 53). Moreover, taking into account how dynamically it has been extended

[4] The species is known only from spring areas in Gornji Crnci-Piperi near Podgorica where larvae and imagines were caught (19). Nevertheless, De Knijf et al. (8) suggest the untypically coloured individuals of *Cordulegaster heros* – and even if *C. picta* was actually found this population became extinct due to temporary drying out of its habitats in the years 2009 and 2011.

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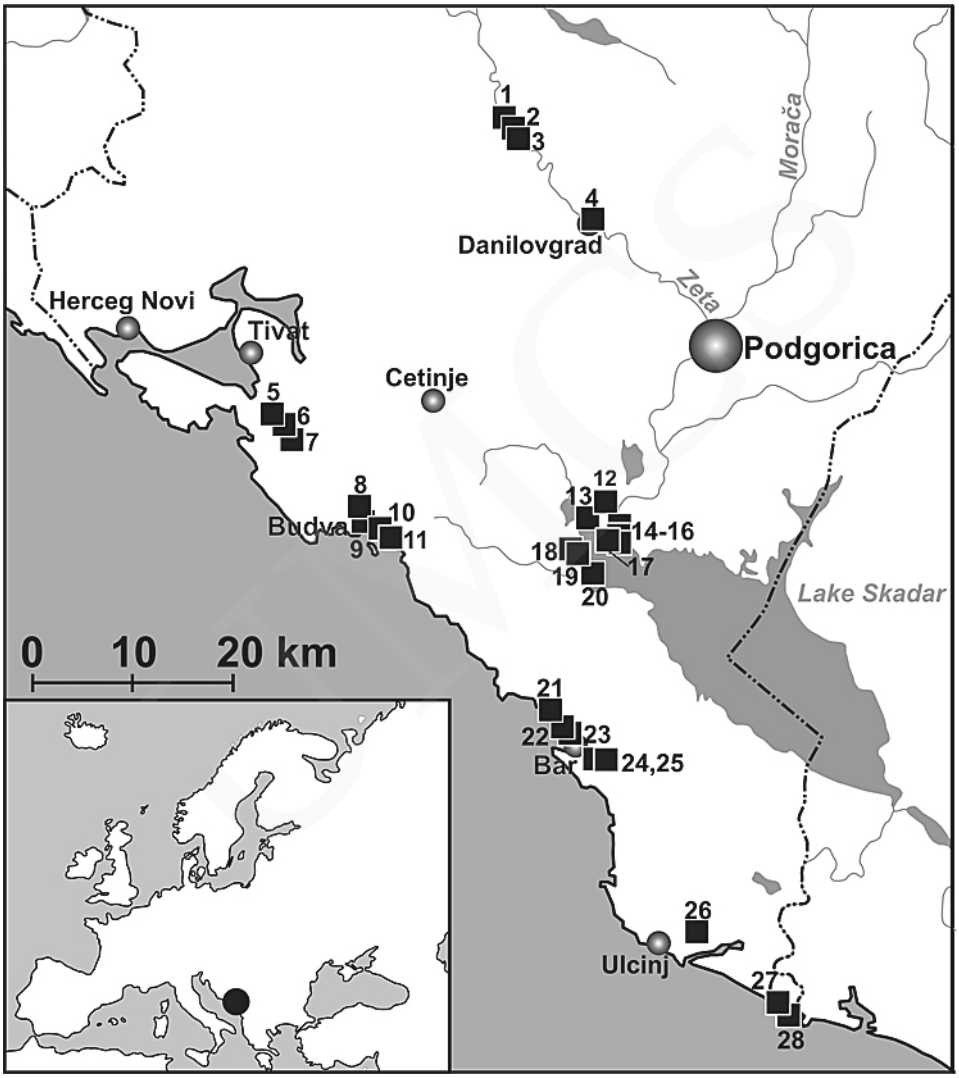

Fig. 1. Study area and study sites (numeration of the sites like in the text)

in recent years (6, 8, 15, 16, 19, 27, 30, 41, data in this paper), the list is still far from complete. It can be assumed that it has more than 70 species, like in Croatia (13).

In the material discussed in this paper, particularly important for the knowledge on dragonflies of Montenegro is not only recorded for the first time *Ophiogomphus cecilia*. For example: *Lestes virens*, *Coenagrion pulchellum* and *Erythromma najas* were rarely recorded in the country (6, 8, 19, 27).

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The boundary of the distribution area of *Ophiogomphus cecilia*, belonging to west-Siberian element of the fauna of Europe (4), runs through the southern and western Balkans (6, 9). This species is very rare in Croatia (9 sites) and even rarer in Serbia (one site in north-eastern country) as well as unknown in Bosnia and Herzegovina, Albania and almost all of Greece (except for its north-eastern edge) (6, 13, 38). Our record is just the second one from the coast of the Adriatic (13) (Fig. 2). The site of *O. cecilia* in Montenegro is in the typical spectrum of its habitats in Europe, encompassing lowland courses of different size from small streams to large rivers. However, higher numbers of this species are found in larger courses – either at the European level (9) or the Balkans as well (3, 26, 36, 47). Systematic studies of such habitats may bring new records of this species.

Near the southern or south-eastern border of their distribution area, although not on the edge, lie given by us the sites of *Enallagma cyathigerum*, *Erythromma najas*, *Coenagrion pulchellum* and *Pyrrhosoma nymphula* (6).

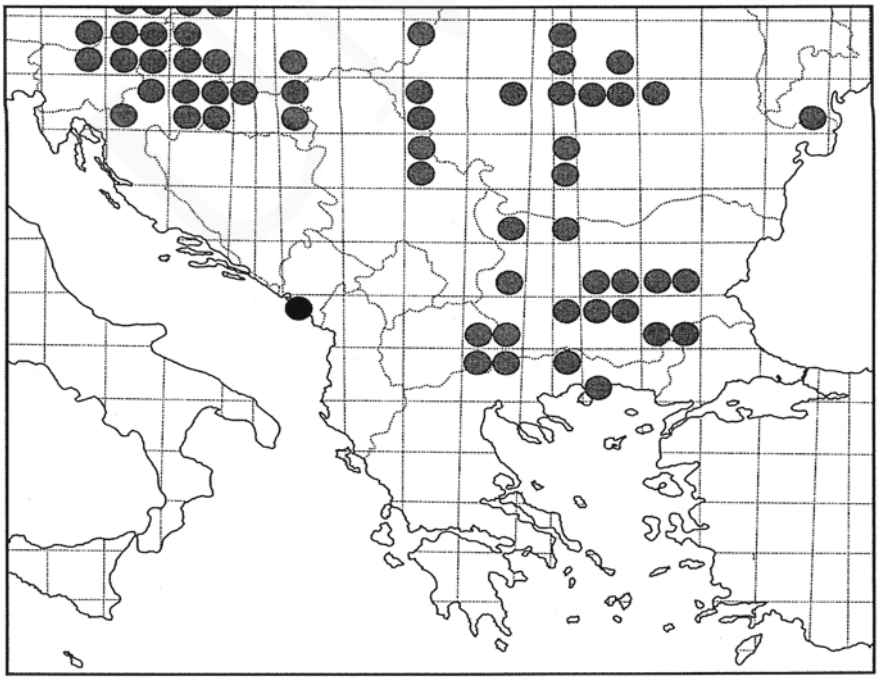

Fig. 2. The distribution of *Ophiogomphus cecilia* on the Balkan Peninsula and neighbouring areas. Dashed lines – the net of UTM (100x100 squares), dots correspond to UTM 50x50 km squares. Grey colour – data in the literature, black colour – a new site. Distribution of the species is based on synthetic works (Mediterranean area: 6, Romania: 40, Hungary: 42, Austria: 44), with the supplement of the data published later (5, 23, 26, 47, 49, 5).

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Caliaeschna microstigma and *Cordulegaster bidentata* were regarded as near threatened species (NT) in Europe and the European Union, with negative population trends (34). The same refers to their situation in the Mediterranean area (6). Both species prefer small courses, sensitive to degradation by acidification, regulations, deforestation and pollution. *C. bidentata* associated with mountains and highland areas eagerly inhabits the upper parts of the courses, including particularly sensitive spring areas. On the contrary, *C. microstigma* inhabits mainly low-lying areas where in warming climate small water bodies can completely dry out or become too temporary due to climate changes (6, 9). All the more valuable are the records of this species at 5 sites situated in different parts of the country. In general, they fit in the spectrum of typical habitats of *C. microstigma* ("strictly in streams" – 9, "brooks and small rivulets" – 6), except for untypical site in the River Zeta which is a middle-sized river. However, this could be the result of a drift from streams and springs, numerous and directly situated by the river in the valley of the River Zeta. In recent years, relatively high number of the sites of *C. microstigma* has been found in Montenegro (8, 16, 21, 27, data in this paper). This shows the significance of this country in preserving this species in Europe. This is particularly important since the area of occurrence of *C. microstigma* in the continent is limited to the southern and central Balkans (6, 9). The situation of European endemic species *Cordulegaster bidentata* is better in this respect – it occurs sometimes numerously, in many high-altitude areas of Europe (9). In countries close to Montenegro, numerous sites of this species are known from Bulgaria, Greece and Albania (6).

Our data confirms the importance of the region of Lake Skadar for dragonfly fauna of Montenegro and the Balkans. Summing up, the information given in this paper as well as in the literature (8, 15) shows that in the basin of the lake as many as 60 species of dragonflies were found, which accounts for 91% of the national odonatofauna. Some of these species have been found only here in Montenegro, or in this region they occur in greatest abundance and/or most often. This means that the basin of Lake Skadar is crucial for the protection of the species diversity of dragonflies in this country.

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