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ODONATA FROM MONTENEGRO, WITH NOTES ON TAXONOMY, REGIONAL DIVERSITY AND CONSERVATION

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The Odon. fauna of Montenegro was investigated during 2 field trips in 2009 and in 2011. In all, 105 localities were visited resulting in 50 observed spp. (52 taxa). Important populations of *Lindenia tetraphylla* and *Selysiothemis nigra* were found, that of the former is probably the most important one in Europe. The presence of *Lestes parvidens*, *Caliaeschna microstigma*, *Cordulegaster heros* and *C. bidentata* is confirmed. *C. heros* individuals show clear variation from the nominal type and are of an intermediate form with the ssp. *pelionensis*. Several populations of *Gomphus schneiderii*, which differ in thoracic and abdominal markings from typical *schneiderii*, were detected and criteria are given for the differentiation with *G. vulgatissimus*. *Epitheca bimaculata* is a new sp. for Montenegro and represents the southernmost observation in its European range. The first populations of *Trithemis annulata* were discovered. A major emphasis was on the survey and diversity of the Mediterranean region. This region has a greater diversity than the Alpine region and several spp. of the Balkans are confined to it. Skadar lake has the greatest diversity of dragonflies and is home to several threatened and European protected species. Many populations of rare spp. in the coastal area are threatened by an increasing demand for water consumption by tourists and for agriculture use.

INTRODUCTION

The Republic of Montenegro or Crna Gora as it is locally known covers an area of 13.812 km² and only became independent from Serbia in 2006. Before 2000, dragonfly research in Montenegro was rather poor and mostly concerned only isolated records with just a few surveys. The first substantial survey of Montenegro was made by DUMONT (1977) who investigated seven sites. In an over-

view of the dragonfly fauna of all former Yugoslavian states (ANDJUS, 1992) it is stated that many common species such as *Platycnemis pennipes* and *Anax imperator* are virtually absent from Montenegro. An exception is the dragonfly fauna of the Durmitor range, which has been well studied (ADAMOVIĆ et al., 1996).

Since independence, several papers dealing with surveys of the fauna of Montenegro have been published. A review of all data from Montenegro is published by JOVIĆ et al. (2008). In 2007 a project named Adriatic Montenegro was initiated and realised with the support of the International Dragonfly Fund (IDF) and yielded much more data for the Mediterranean region of the country (JOVIĆ, 2008). An inventory of the specimens present in the collection of the Natural History Museum of Montenegro has been published by JOVIĆ & MALIDZAN (2009). At the same time several papers dealing with the local fauna have been published. These include the dragonfly fauna of lake Skadar's drainage basin (GLIGOROVIĆ & PESIĆ, 2007), of the Gornji Crnci – Piperi area (GLIGOROVIĆ et al., 2008a), of the mountainous area of Lukavica (GLIGOROVIĆ et al., 2008b), of the river Brestica (GLIGOROVIĆ et al., 2009) and of the river Morača (GLIGOROVIĆ et al., 2010). Some papers contain only data about a small number of species, such as the paper on the dragonfly fauna

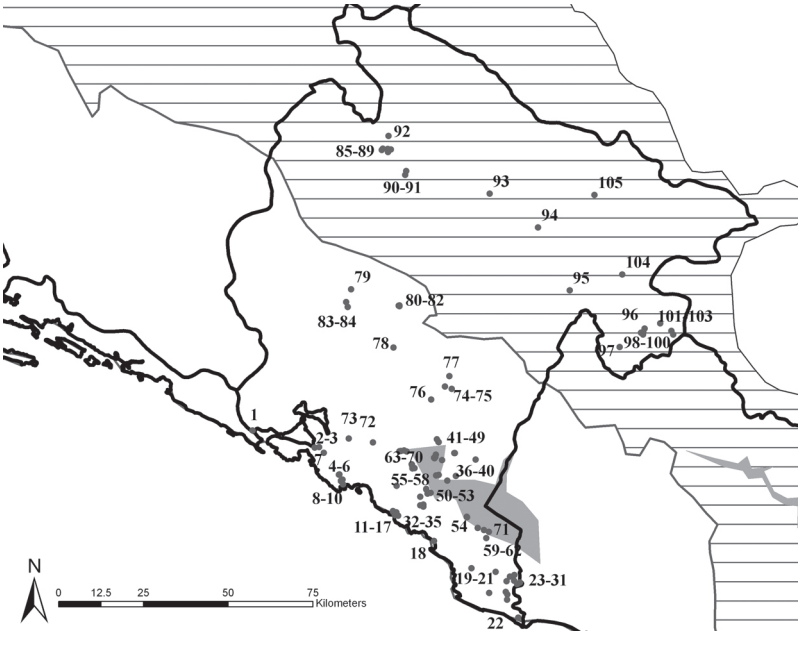

Fig. 1. Map of Montenegro showing the localities visited (1-105) during this study. The country is split into two biogeographical regions: Alpine (hatched) and south of it the Mediterranean region (without filling). The grey spot represents Skadar lake.

from lake Skadar's drainage basin (GLIGOROVIĆ & PESIĆ, 2007), where only records of five species are given, so that it merely can act as a survey of Skadar lake.

The current account is based on field work carried out by the authors in 2009 and 2011. An attempt was made to cover the different areas and zones of the country, with the major emphasis on the Mediterranean region, where no less than 84 localities were visited. The northern, Alpine region was rather sporadically investigated and was limited to the Durmitor National Park area in the north-western part of Montenegro and to Plav and the surroundings mountains in the southeast. Both trips took place from the end of June till the end of July. Therefore we were able to record most summer species and some late flying spring species. Accordingly several early spring species such as *Brachytron pratense* and *Erythromma najas* were missed, while late summer species (e.g. *Aeshna mixta*, *A. cyanea* and *Sympetrum striolatum*) were rarely observed.

We were interested in how far west several of the eastern Balkan species occur, in particular *Cordulegaster* species. Furthermore we tried to clarify the status of *Gomphus vulgatissimus* and *G. schneiderii*. The regional diversity of the Alpine and the Mediterranean biogeographical regions is illustrated. Finally, some priority areas for the conservation of dragonflies in Montenegro are discussed.

MATERIAL AND METHODS

Montenegro was first visited from 27 June 2009 till 11 July 2009. As little information was available at that time, visiting sites were chosen arbitrarily. A second trip was undertaken from 5 July 2011 until 30 July 2011, when sites were selected more carefully, with the intention of clarifying the status of some 'rare' species, especially species of *Cordulegaster* and *Gomphus*. A total of 105 localities were investigated for the presence of Odonata in Montenegro. Some of them were visited both in 2009 and in 2011, while others were visited several times within one year. The distribution of the visited localities is given in Figure 1. For each locality geographical coordinates are given based on the international WGS84 projection, as well as date(s) of visit and number of observed species. The initials of the observer(s) is given in brackets (GDK = first author, CVA = second author, HDM = third author).

STUDY AREA

Montenegro lies on the Adriatic coast, between Croatia and Albania. The broader coastal zone lies in the Mediterranean biogeographical region. The northern half of the country is mountainous and alpine, intersected by deep and narrow, fast-flowing river valleys, ravines, forests and glacial lakes and belongs to the Alpine region (*www.eea.europa.eu*). We further split up both biogeographical regions into four Mediterranean and two Alpine sub regions. The sub regions 'Coast', 'Ulcinj' and 'Skadar' are typical Mediterranean. The district 'Interior' has much in common with the Mediterranean region but contains several low mountains and is situated at mid altitude. They all form the Mediterranean biogeographical

region in Montenegro. The sub regions 'north-western mountains', further called 'Durmitor' and the 'south-eastern mountains' further called 'Plav' are part of the Alpine biogeographical region.

COASTAL ZONE – The narrow coastal district is mountainous and dotted with some beaches and adjacent marshland. This zone is separated from the Skadar district by a barren dry coastal mountain range of up to 1300 m. As a result of the ground's characteristic porosity, rain water rapidly disappears. Consequently, rivers are rare and often very short. They mostly rise at the foot of the mountains and flow some kilometres into the sea. Streams and rivers become partly dry in summer containing only very locally some water, often close to the foot of the mountains.

SKADAR LAKE – Skadar lake, only 40 km from the sea, is at 391 km² the largest lake in the Balkans and is designated as a National Park and Ramsar site for water birds. In winter, the water level rises and floods whole areas to the north so that it expands to 540 km². The lake is enclosed on three sides by karst mountains. The adjacent marshland to the north is one of the most extensive wetlands in the Mediterranean. It comprises extensive reed beds, *Scirpus* vegetation and low bushes and *Salix* forests. The southern shore of the lake goes abrupt over in a rocky coastline and is dotted with some very locally sandy beaches and wet grasslands. The lake itself is very difficult to approach due to the presence of marshland in the north and steep rocky terrain and maquis vegetation in the south and west.

ULCINJ DISTRICT – The southern part of the coastal zone differs significantly from the rest of the coastal area. Mediterranean mountains are absent and there are low hills and even flat land. Therefore, we considered this as a distinct subregion. Dunes stretch here over a distance of nearly 15 km long and border salty marshlands. Several rivers can be found, of which the most important is the Bojana river, forming the border with Albania. To the north lies the important Šasko jezero with adjacent reedbeds, marshlands and wet grasslands.

THE INTERIOR DISTRICT – This is the transition zone between the Mediterranean and Alpine biogeographical regions. The area is characterised by a high altitude plateau around Nikšić where several dam lakes have been constructed. From the plateau several rivers flow down into a steep valley and form the Zeta river. The Zeta is additional fed by several spring streams and small rivers arising from the karst mountains. At lower altitudes it forms the central plain where the capital is situated. Most rivers at lower altidtude are heavily polluted and harbour only some common species.

NORTH-WESTERN MOUNTAINS (DURMITOR) – We focused our investigations around Durmitor National Park. This zone is characterised by several peaks well above 2200 m a.s.l., alpine lakes and high altitude pastures. Several peat bogs and fens can be found in this area. This mountain zone is bordered by the Tara canyon, the longest and deepest in Europe. The river itself is as good as inaccessible from the road, so that it was scarcely surveyed by us.

SOUTH-EASTERN MOUNTAINS (PLAV) – The highest peaks of Montenegro are located in the Prokletije mountains on the border with Albania. Some alpine lakes and small peat bogs are present here. Several streams and small rivers have their source here in the mountains. At an altitude of around 920 m a.s.l. lies the broad valley of Plav and Gusinje with Plavsko jezero. The southern side is a huge wetland with hay meadows on peaty soil. The lake itself is bordered by a broad *Scirpus* and *Phragmites* zone.

For each species we determined the total number of localities for the six different geographical regions investigated.

LIST OF LOCALITIES

List of localities visited in Montenegro. For each locality, the geographical coordinates are given based on the international WGS84 projection, as well as date(s) of visit and number of observed species. The name of the observer(s) is given in brackets (GDK = first author, CVA = second author, HDM = third author).

Jezero = lake; – polje = large, flat-floored depression within karst limestone often becoming wet seasonal lake; – rijeka = river

Coastal region

Loc. 1: Igalo, stream; (42°27'18"N, 18°29'56"E); 28-vii-2011 (CVA); 5 spp.
Loc. 2: Durašević, Jaška rijeka; (42°23'28"N, 18°43'42"E); 4-vii-2009 (GDK & HDM); 2 spp.
Loc. 3: Durašević, ornitological reserve; (42°23'28"N, 18°42'46"E); 4-vii-2009 (GDK & HDM); 1 spp.
Loc. 4: Glavatske kucice, Jaška rijeka; (42°18'43"N, 18°47'16"E); 4-vii-2009 (GDK & HDM); 4 spp.
Loc. 5: Glavatske kucice; (42°18'46"N, 18°47'25"E); 4-vii-2009 (GDK & HDM); 3 spp.
Loc. 6: Jaz, Jaška rijeka; (42°17'07"N,18°47'56"E); 4-vii-2009 (GDK & HDM); 5 spp.
Loc. 7: Leševići, Jaška rijeka; (42°22'28"N, 18°44'35"E); 4-vii-2009 (GDK & HDM); 4 spp.
Loc. 8: Lastva Jaška rijeka; (42°17'39"N, 18°47'34"E); 24-vii-2011, (GDK & HDM); 8 spp.
Loc. 9: Jaz-Lastva, jezero Jaz; (42°17'44"N, 18°47'36"E); 24-vii-2011 (GDK & HDM); 8 spp.
Loc. 10: Jaz-Lastva, Mrcevo Polje; (42°17'52"N, 18°47'57"E); 24-vii-2011 (GDK & HDM); 7 spp.
Loc. 11: Buljarica, camping; (42°11'49"N, 18°57'58"E); (a) 27-vi-2009, (b) 29-vi-2009, (c) 5-vii-2011, (d) 6-vii-2011, (e) 12-vii-2011 (GDK & HDM); 12 spp.
Loc. 12: Buljarica, beach swamp; (42°11'13"N, 18°58'17"E); (a) 27-vi-2009 (GDK & HDM), (b) 6-vii-2011 (GDK), (c) 15-vii-2011 (GDK & CVA), (d) 21-vii-2011 (GDK & HDM); 14 spp.
Loc. 13: Buljarica, swamp; (42°11'25"N, 18°58'20"E); 3-vii-2009 (GDK & HDM); 5 spp.
Loc. 14: Buljarica, swamp & stream; (42°11'40"N, 18°58'36"E); (a) 6-vii-2011 (GDK), (b) 15-vii-2011 (GDK & CVA); 14 spp.
Loc. 15: Buljarica, stream; (42°11'06"N, 18°58'56"E); 15-vii-2011 (GDK & CVA); 9 spp.
Loc. 16: Buljarica, stream ; (42°11'40"N; 18°58'36"E); 18-vii-2011 (CVA); 8 spp.
Loc. 17: Buljarica, village; (42°11'55"N, 18°57'54"E); 21-vii-2011 (GDK & HDM); 1 sp.
Loc. 18: Bar, stream; (42°06'25"N, 19°05'55"E); 3-vii-2009 (GDK & HDM); 3 spp.

Ulcinj area

Loc. 19: Vukici, Medurecka river; (42°01'22"N, 19°13'11"E); 28-vi-2009 (GDK & HDM); 1 sp.
Loc. 20: Vukici, Krute-Vladimir road; (42°00'18"N, 19°18'14"E); 28-vi-2009 (GDK & HDM); 1 sp.
Loc. 21: Mozura, river parallel met E851; (41°57'05"N, 19°16'22"E); 28-vi-2009 (GDK & HDM); 4 spp.

Loc. 22: Gornji Štoj, dune pond; (41°52'37"N, 19°21'54"E); 19-vii-2011 (GDK & CVA); 7 spp.
Loc. 23: Ulcinska solana, swamp brackish; (41°55'41"N, 19°20'00"E); (a) 29-vi-2009 (GDK & HDM), (b) 19-vii-2011 (GDK & CVA); 11 spp.
Loc. 24: Ćurke, wett grasslands, brackish; (41°56'30"N, 19°20'09"E); (a) 28-vi-2009 (GDK & HDM), (b) 29-vi-2009 (GDK & HDM); 11 spp.
Loc. 25: Sveti Dorde, road; (41°56'55"N, 19°19'53"E); 19-vii-2011 (GDK & CVA); 3 spp.
Loc. 26: Franskanjel, Bojana river; (41°58'08"N, 19°23'04"E); (a) 28-vi-2009 (GDK & HDM), (b) 22-vii-2011 (GDK & HDM), (c) 23-vii-2011 (GDK & CVA); 3 spp.
Loc. 27: Franskanjel, wet grasslands and stream; (41°57'57"N, 19°22'29"E); 28-vi-2009 (GDK & HDM); 12 spp.
Loc. 28: Šasko, Šasko jezero; (41°58'36"N, 19°20'19"E); (a) 28-vi-2009 (GDK & HDM); (b) 22-vii-2011 (GDK & HDM), (c) 26-vii-2011 (CVA); 15 spp.
Loc. 29: Ambula, pond near road; (41°58'32"N, 19°21'54"E); 28-vi-2009 (GDK & HDM); 4 spp.
Loc. 30: Štodra, dried out stream; (41°59'27"N, 19°22'08"E); 22-vii-2011 (GDK & HDM); 2 spp.
Loc. 31: Štodra, stream; (41°59'16"N, 19°21'10"E); 22-vii-2011 (GDK & HDM); 2 spp.

Skadar region

Loc. 32: Crmničko polje, Litine Sutorman river; (42°12'03"N, 19°04'28"E); (a) 30-vi-2009 (GDK & HDM), (b) 12-vii-2011 (GDK & CVA); 10 spp.
Loc. 33: Crmničko polje, road; (42°12'24"N, 19°04'32"E); 30-vi-2009 (GDK & HDM); 3 spp.
Loc. 34: Crmničko polje, stream; (42°13'41"N, 19°04'05"E); (a) 30-vi-2009 (GDK & HDM), (b) 12-vii-2011 (GDK & CVA); 17 spp.
Loc. 35: Crmničko polje, wet grasslands; (42°12'18"N, 19°03'50"E); 30-vi-2009 (GDK & HDM); 2 spp.
Loc. 36: Plavnica, Skadar jezero; (42°16'16"N, 19°12'09"E); 30-vi-2009 (GDK & HDM); 5 spp.
Loc. 37: Vranjina, broad ditch; (42°16'48"N, 19°08'30"E); (a) 30-vi-2009 (GDK & HDM), (b) 1-vii-2009 (GDK & HDM); 11 spp.
Loc. 38: Donje Selo, stream; (42°19'00"N, 19°03'00"E); 1-vii-2009 (GDK & HDM); 4 spp.
Loc. 39: Mataguži, road; (42°18'30"N, 19°16'44"E); 1-vii-2009 (GDK & HDM); 1 sp.
Loc. 40: Rijecani, lagoon; (42°21'07"N, 19°02'17"E); 1-vii-2009 (GDK & HDM); 5 spp.
Loc. 41: Rijeka Crnojevića source; (42°21'17"N, 19°00'42"E); (a) 1-vii-2009 (GDK), (b) 10-vii-2011 (GDK & HDM); 13 spp.
Loc. 42: Virpazar, Crmnica lagoon; (42°14'43"N, 19°05'29"E); 1-vii-2009 (GDK & HDM); 5 spp.
Loc. 43: Vukovići, Morača gravel pit; (42°19'56"N, 19°12'21"E); 1-vii-2009 (GDK & HDM); 7 spp.
Loc. 44: Vukovići, Morača gravel pit; (42°19'56"N, 19°12'29"E); 1-vii-2009 (GDK & HDM); 1 sp.
Loc. 45: Vukovići, Morača river; (42°19'56"N, 19°12'29"E); 1-vii-2009 (GDK & HDM); 2 spp.
Loc. 46: Dodoši, ditch in wetland; (42°19'36"N, 19°07'57"E); 2-vii-2009 (GDK & HDM); 11 spp.
Loc. 47: Dodoši, Karatuna river; (42°19'29"N, 19°08'02"E); 2-vii-2009 (GDK & HDM); 9 spp.
Loc. 48: Dodoši, pond in village; 42°19'38"N, 19°08'12"E); 2-vii-2009 (GDK & HDM); 3 spp.
Loc. 49: Dodoši, road; (42°20'02"N, 19°08'22"E); 2-vii-2009 (GDK & HDM); 1 sp.
Loc. 50: Skadar jezero; (42°15'42"N, 19°10'12"E); 2-vii-2009 (GDK & HDM); 9 spp.
Loc. 51: Vranjina, pond near road; (42°16'44"N, 19°07'58"E); 2-vii-2009 (GDK & HDM); 3 spp.
Loc. 52: Godinje, road; (42°14'05"N, 19°06'21"E); (a) 8-vii-2011 (GDK & HDM), (b) 14-vii-2011 (GDK & CVA); 3 spp.
Loc. 53: Krnjice, road; (42°14'02"N, 19°05'42"E); 8-vii-2011 (GDK & HDM); 1 sp.
Loc. 54: Murići, Skadar jezero; (42°09'35"N, 19°13'28"E); 8-vii-2011 (GDK & HDM); 11 spp.
Loc. 55: Ovtočići, small stream; (42°15'51"N, 18°59'19"E); 10-vii-2011 (GDK & HDM); 4 spp.
Loc. 56: Rijeka Crnojevića, near bridge; (42°21'19"N, 19°01'46"E); 10-vii-2011 (GDK & HDM); 8 spp.
Loc. 57: Virpazar, Skadar jezero; (42°14'48"N, 19°05'33"E); (a) 12-vii-2011 (GDK & CVA), (b) 25-vii-2011 (GDK & HDM); 11 spp.
Loc. 58: Žabljak, Šegranica; (42°19'03"N, 19°09'35"E); 12-vii-2011 (GDK & CVA); 7 spp.
Loc. 59: Bljaca Pjajce, pond; (42°07'38"N, 19°15'30"E); 14-vii-2011 (GDK & CVA); 6 spp.

Loc. 60: Bobovište, Skadar jezero; (42°07‘10“N, 19°16‘47“E); 14-vii-2011 (GDK & CVA); 5 spp.
Loc. 61: Murići, Skadar jezero South; (42°09‘30“N, 19°13‘29“E); 14-vii-2011 (GDK & CVA); 10 spp.
Loc. 62: Runja, road; (42°05‘50“N, 19°17‘06“E); 14-vii-2011 (GDK & CVA); 1 sp.
Loc. 63: Rijeka Crnojevića; (42°21‘17“N, 19°01‘03“E); 17-vii-2011 (GDK & CVA); 15 spp.
Loc. 64: Donje Selo, springs; (42°18‘19“N, 19°03‘06“E); 20-vii-2011 (GDK, HDM & CVA); 10 spp.
Loc. 65: Donje Selo, stream down; (42°18‘45“N, 19°03‘05“E); 20-vii-2011 (GDK, HDM & CVA); 3 spp.
Loc. 66: Donje Selo, stream up; (42°18‘57“N, 19°03‘05“E); 20-vii-2011 (GDK & CVA); 8 spp.
Loc. 67: Kaluderovo, springlake; (42°22‘27“N, 19°08‘59“E); 20-vii-2011 (GDK, HDM & CVA); 8 spp.
Loc. 68: Malo Blato, lake; (42°21‘58“N, 19°09‘18“E); 20-vii-2011 (GDK, HDM & CVA); 5 spp.
Loc. 69: Poseljani, Zaliv Seljanska lug; (42°18‘20“N, 19°03‘31“E); 20-vii-2011 (GDK, HDM & CVA); 4 spp.
Loc. 70: Sinjac, pool; (42°22‘02“N, 19°09‘14“E); 20-vii-2011 (GDK, HDM & CVA); 5 spp.
Loc. 71: Sanall, Skadar jezero; (42°06’47”N, 19°17’47”E); 23-vii-2011 (GDK & CVA); 9 spp.

Interior

Loc. 72: Cetinje, city park; (42°23’12”N, 18°55’19”E); 10-vii-2011 (GDK & HDM); 1 sp.
Loc. 73: Cetinje, Lovćen jezero; (42°24’16”N, 18°50’13”E); 17-vii-2011 (GDK & CVA); 3 spp.
Loc. 74: Spuž, Zeta river; (42°30’39”N, 19°11’59”E); (a) 5-vii-2009 (GDK & HDM), (b) 13-vii-2011 (GDK & CVA); 7 spp.
Loc. 75: Spuž-Lopate, Zeta river; (42°30’09”N, 19°13’21”E); (a) 5-vii-2009 (GDK & HDM), (b) 13-vii-2011 (GDK & CVA); 9 spp.
Loc. 76: Bandička, stream; (42°28’52”N, 19°08’44”E); 13-vii-2011 (GDK & CVA); 6 spp.
Loc. 77: Gradina, picta site; (42°32’13”N, 19°13’11”E); 13-vii-2011 (GDK & CVA); 3 spp.
Loc. 78: Zagorak, Dobro polje; (42°37’49”N, 19°01’57”E); (a) 16-vii-2011 (GDK & CVA), (b) 27-vii-2011 (CVA); 10 spp.
Loc. 79: Nikšić, Krupačko jezero; (42°47’52”N, 18°54’16”E); 16-vii-2011 (GDK & CVA); 4 spp.
Loc. 80: Nikšić, Liverovićko jezero; (42°44’16”N, 19°04’14”E); 16-vii-2011 (GDK & CVA); 7 spp.
Loc. 81: Nikšić, Liverovićko jezero; (42°44’21”N, 19°04’02”E); 16-vii-2011 (GDK & CVA); 2 spp.
Loc. 82: Nikšić, Liverovićko jezero; (42°44’23”N, 19°04’13”E); 16-vii-2011 (GDK & CVA); 4 spp.
Loc. 83: Nikšić, Slansko jezero; (42°45’56”N, 18°52’52”E); 16-vii-2011 (GDK & CVA); 3 spp.
Loc. 84: Nikšić, Orlina; (42°45’09”N, 18°53’07”E); 30-vii-2011 (GDK & HDM); 6 spp.

Northwestern mountain region

Loc. 85: Durmitor, Barno jezero; (43°09’25”N, 19°05’33”E); 9-vii-2009 (GDK & HDM); 3 spp.
Loc. 86: Durmitor, Crno jezero; (43°08’55”N, 19°05’33”E); 9-vii-2009 (GDK & HDM); 4 spp.
Loc. 87: Durmitor, Otoka river valley; (43°09‘15“N, 19°06‘13“E); 9-vii-2009 (GDK & HDM); 8 spp.
Loc. 88: Durmitor, Govede jezero; (43°11’28”N, 19°06’02”E); 10-vii-2009(GDK & HDM); 3 spp.
Loc. 89: Durmitor, Mlinski valley; (43°09’33”N, 19°04’30”E); 10-vii-2009 (GDK & HDM); 4 spp.
Loc. 90: Durmitor, Riblje jezero; (43°05’32”N, 19°09’00”E); 10-vii-2009 (GDK & HDM); 1 sp.
Loc. 91: Durmitor, Vražje jezero; (43°04’58”N, 19°08’41”E); 10-vii-2009 (GDK & HDM); 4 spp.
Loc. 92: Durmitor, Zminje jezero; (43°09’21”N, 19°04’14”E); 10-vii-2009 (GDK & HDM); 7 spp.
Loc. 93: Tara, Bistrica; (43°00‘19“N, 19°26‘22“E); 9-vii-2009 (GDK & HDM); 1 sp.

Southeastern mountain region

Loc. 94: Biogradska, Biogradsko jezero; (42°54’01”N, 19°35’55”E); (a) 5-vii-2009, (b) 6-vii-2009 (GDK & HDM); 5 spp.
Loc. 95: Komovi, Tresnjevik, Eko Katun Stavna; (42°43’25”N, 19°41’03”E); 7-vii-2009 (GDK & HDM); 1 sp.
Loc. 96: Plav, Plavsko jezero pier; (42°35’48”N, 19°56’04”E); (a) 7-vii-2009, (b) 26-vii-2011 (GDK & HDM); 3 spp.
Loc. 97: Plav, Kolenovići, Vruja river; (42°33’23”N, 19°50’14”E); 8-vii-2009 (GDK & HDM); 1 sp.

Loc. 98: Plav, peat bog; (42°34'53"N, 19°55'34"E); (a) 8-vii-2009, (b) 26-vii-2011 (GDK & HDM); 5 spp.
Loc. 99: Plav, Plavsko jezero; (42°35'13"N, 19°55'10"E); (a) 8-vii-2009, (b) 26-vii-2011 (GDK & HDM); 9 spp.
Loc. 100: Plav, Plavsko jezero, Kula Damjanova; (42°35'18"N, 19°55'44"E); (a) 8-vii-2009, (b) 26-vii-2011 (GDK & HDM); 9 spp.
Loc. 101: Jara, Komaračka reka; (42°36'17"N, 19°59'33"E); 27-vii-2011 (GDK & HDM); 1 sp.
Loc. 102: Prokletije mountains, Hridsko jezero; (42°34'16"N, 20°02'01"E); 27-vii-2011 (GDK & HDM); 4 spp.
Loc. 103: Prokletije mountains; (42°34'52"N, 20°01'44"E); 27-vii-2011 (GDK & HDM); 3 spp.
Loc. 104: Marsenića rijeka, Sekularska river; (42°44'50"N, 19°52'43"E); 28-vii-2011 (GDK & HDM); 2 spp.
Loc. 105: Zurena, Lime river; (42°57'59"N, 19°48'53"E); 29-vii-2011 (GDK & HDM); 1 sp.

RESULTS

RECORDS OF SPECIES

Altogether 50 species (52 taxa) were recorded at 105 localities, totalling 686 records.

Calopterygidae

Calopteryx s. splendens (Harris, 1780)
Loc. 94(b):1 ♂

Calopteryx splendens balcanica (Fudakowski, 1930)
Loc. 8: 2 ♂, 1 ♀; loc. 26(a): 1000 adults, (b): 100 adults, (c): 30 adults; loc. 32(a): 10 adults, (b): 50 adults; loc. 34(a): 20 adults; loc. 37(a): 2 ♂, 1 ♀, (b): 30 adults; loc. 42: 4 ♂, 1 ♀; loc. 43: 4 ♂; loc. 47: 1000 adults; loc. 74(a): 1000 adults, copulae, oviposition, (b): 5000 adults, co, oviposition, tenerals; loc. 75(a): 1000 adults, copulae, oviposition, tenerals, (b): 200 adults

Calopteryx virgo festiva (Brullé, 1832)
Loc. 4: 1 ♂ oviposition; loc. 7: 2 ♂, 1 ♀; loc. 11(b): 1 ♂, (c): 1 ♂, (d): 10 adults; loc. 12(b): 1 ♂, 2 ♀; loc. 14(a): 1000 adults, copulae, oviposition, tenerals, (b): 1000 adults, copulae, oviposition, tenerals; loc. 15: 100 adults; loc. 16: 100 adults; loc. 19: 1 ♂, 2 ♀; loc. 20: 1 ♂; loc. 21: 10 adults; loc. 32(a): 50 adults, (b): 500 adults; loc. 34(a): 1000 adults, copulae, oviposition, tenerals, (b): 30 adults, tenerals; loc. 38: 10 adults; loc. 41(a): 50 adults; loc. 55: 3 ♂; loc. 63: 100 adults; loc. 64: 100 adults; loc. 66: 20 adults; loc. 74(a): 50 adults, (b): 500 adults, copulae, oviposition; loc. 75(a): 50 adults, (b): 20 adults; loc. 76: 500 adults, copulae, oviposition; loc. 77: 1 ♂, 1 ♀; loc. 78(a): 100 adults, (b): 1 ♀, 10 adults; loc. 79: adults; loc. 82: 3 ♂; loc. 93: 2 ♂; loc. 100(a): 1 ♂; loc. 105: 1 ♂

Lestidae

Lestes dryas Kirby, 1890
Loc. 24(a): 1 ♂; (b) 2♂, 4 oviposition; loc. 80: 1 ♂; loc. 91: 10 adults, loc. 99(a): 10 adults; (b): 15 adults

Lestes parvidens Artobolevskii, 1929
Loc. 11(a): 1 ♂; loc. 59: 50 adults

Lestes sponsa (Hansemann, 1823)
Loc. 46: 2 ♂, 3 ♀; loc. 88: 30 adults, 3 tenerals; loc. 99(b): 2 ♂

Lestes virens (Charpentier, 1825)
Loc. 23(a): 15 adults; (b): 30 adults; loc. 24(a): 25 adults, (b): 50 adults

Sympecma fusca (Vander Linden, 1820)
Loc. 23(b): 1 ♂

C o e n a g r i o n i d a e

Coenagrion hastulatum (Charpentier, 1825)
Loc. 87: 1 ♂; loc. 92: 2 ♂

Coenagrion puella (Linnaeus, 1758)
Loc. 76: 4 ♂; loc. 80: 3 ♂; loc. 87: 10 adults; loc. 96(a): 10 adults; loc. 100(a): 3 ♂

Coenagrion pulchellum (Vander Linden, 1825)
Loc. 14(a): 2 ♂; loc. 24(a): 1 ♂; loc. 28(a): 20 adults

Enallagma cyathigerum (Charpentier, 1840)
Loc. 84: 15 adults; loc. 85: 20 adults; loc.86: 50 adults; loc. 87: 1 ♂; loc. 88: 5 ♂; loc. 89: 10 adults; loc. 90: 10 adults; loc. 91: 30 adults; loc. 92: 100 adults, copulae, oviposition, tenerals; loc. 96(a): 1000 adults, (b): 5 ♂; loc. 98(a): 5 ♂, (b): 2 ♂; loc. 99(a): 100 adults, (b): 100 adults, tenerals; loc. 100 (a): 10.000 adults, (b): 50 adults, 5 tenerals; loc. 102: 50 adults, 10 copulae

Erythromma lindenii (Selys, 1840)
Loc. 9: 3 ♂; loc. 28(a): 10 ♂, 2 copulae, (b): 2 ♂; loc. 36: 1 ♂; loc. 40: 1 copula; loc. 43: 1 ♂; loc. 46: 10 adults; loc. 47: 5 ♂; loc. 50: 1000 adults, 20 copulae, oviposition; loc. 51: 3 ♂; loc. 54: 50 adults; loc. 60: 1 ♂; loc. 61: 2 ♂; loc. 63: 2 ♂, 1 ♀; loc. 65: 2 ♂; loc. 71: 1 ♂; loc. 75(a): 1 ♂, (b): 3 ♂, 2 copulae, 2 oviposition; loc. 76: 1 ♂, 1 ♀; loc. 84: 2 ♂

Erythromma viridulum (Charpentier, 1840)
Loc. 1: 10 adults; loc. 9: 3 ♂; loc. 22: 10 adults; loc. 28(a): 30 adults, (b): 3 ♂, (c): 20 adults, oviposition; loc. 36: 5 adults; loc. 37(a): 4 ♂, 1 copula; loc. 40: 8 ♂; loc. 42: 2 ♂; loc. 43: 3 ♂; loc. 46: 2 ♂; loc. 47: 2 ♂; loc. 50: 10 adults; loc. 54: 1 ♂, 2 ♀; loc. 56: 5 ♂, 2 ♀, 15 copulae; loc. 57(b): adults; loc. 58: 20 adults; loc. 61: 30 adults, 5 oviposition; loc. 63: 10 adults; loc. 67: 30 adults, 10 copulae, 10 oviposition; loc. 68: adults; loc. 70: 2 ♂; loc. 71: adults; loc. 83: 3 ♂

Ischnura elegans (Vander Linden, 1820)
Loc. 1: 5 adults; loc. 5: 1 ♂; loc. 8: 5 ♂; loc. 9: 15 adults; loc. 10: 3 ♂; loc. 12(a): 5 ♂, 1 ♀, 1 copula; loc. 22: 10 adults; loc. 23(a): 5 ♂, (b): 2 ♂, 1 ♀; loc. 24(a): 2 ♂, (b): 10 adults; loc. 27: 3 ♂; loc. 28(a): 20 adults, (b): 1 ♂, (c): 20 ♂; loc. 34(b): 2 ♂; loc. 36: 10 adults; loc. 37(a): 10 adults; loc. 40:

5 adults; loc. 41(a): 2 ♂; loc. 43: 3 ♂; loc. 46: 20 adults; loc. 50: 5 adults; loc. 54: 2 ♂, 1 ♀; loc. 56: 1 ♂; loc. 57(a): 2 ♂, 1 ♀; loc. 58: 2 ♂; loc. 59: 2 ♂; loc. 61: 3 ♂; loc. 63: 3 ♂, 1 ♀; 66: 2 ♂; loc. 67: 10 adults; loc. 68: adults; loc. 69: 5 adults; loc. 70: 5 adults; loc. 71: adults; loc. 74(b): 1 ♂; loc. 84: 50 adults, 5 copulae; loc. 100 (b): 5 ♂

Ischnura pumilio (Charpentier, 1825)
Loc. 23(b): 2 ♂; loc. 80: 10 adults; loc. 84: 2 ♀, 2 tenerals

Pyrrhosoma nymphula (Sulzer, 1776)
Loc. 92: 20 adults, 15 oviposition; loc. 94(b): 2 ♂; loc. 102: 2 ♂, 1 copula

Platycnemidae

Platycnemis p. pennipes (Pallas, 1771)
Loc. 87: 2 ♂; loc. 91: 1 ♂; loc. 92: 1 ♂

Platycnemis pennipes nitidula (Brullé, 1832)
Loc. 1: 10 adults, loc. 2: 1 ♂; loc. 4: 2 ♂, 1 ♀, 2 oviposition; loc. 6: 30 adults; loc. 7: 1 ♂; loc. 8: 50 adults; loc. 10: 20 adults; loc. 21: 50 adults; loc. 26(a): 1000 adults, (b): 1000 adults, copulae, oviposition, (c): 30 adults; loc. 27: 3 ♂; loc. 30: 5 adults; loc. 31: 2 ♂; loc. 32(a): 2 ♂, 1 copula, (b): 20 adults; loc. 34(b): 50 adults; loc. 37(b): 1 ♂, 4 ♀; loc. 40: 1 ♂, 2 ♀; loc. 42: 2 ♂ 1 ♀; loc. 46: 100 adults; loc. 47: 1000 adults; loc. 48: 1 ♂; loc. 54: 30 adults; loc. 57(a): 50 adults, (b): adults; loc. 61: 20 adults; loc. 64: 10 adults; loc. 66: 3 ♂; loc. 67: 5 adults; loc. 71: adults; loc. 74(a): 1 ♀, (b): 20 adults, 2 copulae; loc. 75(a): 100 adults, (b): 250 adults, 50 copulae; loc. 78(a): 2 ♂, 1 ♀, (b): 20 adults

Aeshnidae

Aeshna affinis Vander Linden, 1820
Loc. 6: 1 ♂; loc. 10: 2 ♂; loc. 11(a): 100 adults, 30 copulae, (c): 150 adults, (d): 50 adults; loc. 12(a): 50 adults, 5 copulae, (b): 50 adults, (c): 100 adults, (d): 50 adults; loc. 13: 30 adults; loc. 14(a): 100 adults, (b): 10 adults; loc. 15: 30 adults; loc. 16: 10 adults; loc. 23(a): 1 ♂, 1 copula; loc. 24(b): 3 ♂, 1 copula; loc. 25: 1 ♂; loc. 27: 10 adults; loc. 28(a): 10 ♂, 2 ♀, (b): 2 ♂; loc. 29: 3 ♂; loc. 34(a): 1 ♀, (b): 500 adults, copulae; loc. 37(b): 2 ♂; loc. 42: 1 ♂; loc. 57(a): 1 ♂; loc. 80: 10 ♂, 3 copulae; loc. 99(a): 2 ♂

Aeshna cyanea (Müller, 1764)
Loc. 63: 2 ♂; loc. 86: 1 ♂; loc. 103: 1 ♂

Aeshna isoceles (Müller, 1767)
Loc. 12(a): 1 ♂, (b): 4 ♂; loc. 14(a): 1 ♂; loc. 24(b): 3 adults; loc. 28(a): 3 ♂; loc. 33: 1 ♂; loc. 99(a): 5 adults; loc. 100(a): 10 adults

Aeshna juncea (Linnaeus, 1758)
Loc. 87: 2 ♂; loc. 89: 2 ♂; loc. 92: 1 ♂; loc. 102: 15 ♂, 3 ♀, 3 copulae, 1 oviposition

Aeshna mixta Latreille, 1805
Loc. 64: 1 ♂; loc. 72: 5 adults

Anax imperator Leach, 1815

Loc. 8: 2 ♂; loc. 9: 3 ♂, 1 oviposition; loc. 11(a): 1 ♂; loc. 12(b): 2 ♂, 1 ♀, (c): 1 ♂; loc. 18: 1 ♂; loc. 23(b): 2 ♂, 1 ♀; loc. 25: 1 ♂; loc. 28(c): 1 ♂; loc. 32(a): 1 ♂; loc. 37(a): 1 ♂, 1 copula; loc. 41(b): 1 ♂; loc. 46: 1 ♂; loc. 54: 3 ♂, 1 ♀, oviposition; loc. 61: 1 ♀; loc. 63: 2 ♂; loc. 67: 5 ♂, 2 oviposition; loc. 73: 1 ♂; loc. 75(b): 2 ♂; loc. 98(a): 2 ♂, 1 ♀; loc. 99(a): 20 adults; loc. 100(a): 30 adults, 3 oviposition; (b): 1 ♂

Anax parthenope (Selys, 1839)

Loc. 11(c): 1 ♂; loc. 23(b): 2 ♂; loc. 43: 2 ♂; loc. 50: 15 adults; loc. 54: 5 ♂, 1 copula; loc. 96(a): 1 ♂

Caliaeschna microstigma (Schneider, 1845)

Loc. 32(a): 1 ♂, (b) 1 ♂, 1 ♀; loc. 41(a): 1 ♂; loc. 63: 1 ♂; loc. 65: 1 ♀; loc. 78(a): 1 ♂, (b): 1 ♂, 1 ♀, 1 ♂; loc. 104: 2 ♂

Gomphidae

Gomphus schneiderii Selys, 1850

Loc. 27: 3 ♂: loc. 32(a): 1 ♂, (b): 2 ♂; loc. 34(a): 2 ♂; loc. 47: 2 ♂, 1 ♀; loc. 71: 1 exuviae; loc. 74(a): 1 ♀; loc. 75(a): 1 ♀, (b): 5 ♂, 1 ♀; loc. 78(a): 10 adults

Gomphus vulgatissimus / *schneiderii*

Loc. 94(b): 15 adults

Lindenia tetraphylla (Vander Linden, 1825)

Loc. 12(b): 1 ♂; loc. 14(a): 1 ♂; loc. 27: 15 adults; loc. 28(a): 20 adults, (c): 1 ♂; loc. 29: 2 ♂; loc. 33: 1 adults; loc. 34(a): 10 ♂, 1 teneral; loc. 35: 3 adults; loc. 37(a): 1 ♂; loc. 39: 1 adults; loc. 50: 2 ♂; loc. 51: 1 ♂; loc. 52(a): 5 adults, (b): 1 adults; loc. 53: 10 adults; loc. 54: 150 adults, 200 exuviae; loc. 59: 1 ♂; loc. 60: 10 adults, 1000 exuviae; loc. 61: 500 adults, copulae, tenerals, 10.000 exuviae; loc. 62: 5 adults; loc. 66: 2 adults; loc. 71: 10 adults, 100 exuviae

Onychogomphus forcipatus (Linnaeus, 1758)

Loc. 4: 1 ♂; loc. 7: 1 ♂; loc. 27: 1 ♂; loc. 32(a): 10 adults, (b): 30 ♂, 5 ♀; loc. 34(a): 10 adults; loc. 35: 10 adults; loc. 38: 2 ♂; loc. 41(a): 1 ♂, (b): 15 ♂; loc. 56: 1 ♂; loc. 63: 10 adults; loc. 66: 5 adults; loc. 74(b): 20 ♂, 2 ♀, 1 teneral; loc. 75(b): 1 ♂, 1 ♀; loc. 78(a): 10 adults, (b): 5 adults; loc. 82: 3 ♂; loc. 97: 1 ♂

Cordulegastridae

Cordulegaster bidentata Selys, 1843

Loc. 34(b): 1 ♂; loc. 64: 2 ♂, 5 exuviae; loc. 78(a): 5 ♂, 2 ♀, oviposition, (b): 3 ♂; loc. 94(b): 1 ♂; loc. 95: 1 adults; loc. 101: 1 ♂; loc. 103: 2 ♂; loc. 104: 1 oviposition

Cordulegaster heros Theischinger, 1979

Loc. 14(a): 2 ♂, (b): 2 ♂; loc. 15: 1 ♂; loc. 16: 3 ♂; loc. 32(a): 2 ♂; loc. 34(b): 2 adults; loc. 41(a): 2 ♂; loc. 55: 6 adults; loc. 78(a): 4 ♂, 1 ♀, (b): 2 ♂; loc. 103: 2 adults

Cordulegaster sp.

Loc. 38: 1 adults

Corduliidae

Cordulia aenea (Linnaeus, 1758)
Loc. 102: 3 ♂, 1 oviposition

Epitheca bimaculata (Charpentier, 1825)
Loc. 50: 1 adults

Somatochlora flavomaculata (Vander Linden, 1825)
Loc. 11(a): 3 ♂, (c): 1000 adults, (d): 70 adults, (e): 1 ♂; loc. 12(a): 500 adults, 100 copulae; (b): 200 adults, (c): 500 adults, (d): 10 adults; loc. 13: 30 adults; loc. 14(a): 50 adults, (b): 20 adults; loc. 15: 5 adults; loc. 16: 5 adults; loc. 34(b): 100 adults, copulae; loc. 98(a): 3 ♂; loc. 99(a): 100 adults, (b): 2 adults

Somatochlora meridionalis Nielsen, 1935
Loc. 11(a): 4 ♂; loc. 13: 10 adults; loc. 14(a): 150 adults, (b): 50 adults; loc. 15: 10 adults; loc. 16: 10 adults; loc. 34(a): 2 adults, (b): 50 adults, copulae; loc. 64: 1 adult; loc. 76: 10 ♂; loc. 77: 5 ♂; loc. 78(a): 1 adult, (b): 1 adult; loc. 94(a): 1 ♂, (b): 10 adults, copulae

Somatochlora metallica (Vander Linden, 1825)
Loc. 85: 3 ♂; loc. 86: 10 adults; loc. 87: 1 ♂; loc. 89: 1 ♂; loc. 92: 40 adults, tenerals, exuviae

Libellulidae

Crocothemis erythraea (Brullé, 1832)
Loc. 1: 1 adult; loc. 8: 5 ♂, 1 ♀; loc. 11(c): 1 ♂; loc. 12(a): 2 ♂, 1 ♀, (b): 3 ♂, 1 ♀, (c): 5 adults; loc. 13: 1 ♂; loc. 14(a): 1 ♂; loc. 15: 1 ♂; loc. 22: 1 ♂, 1 ♀; loc. 24(a): 1 ♂, 1 ♀; loc. 27: 3 ♂, 1 ♀; loc. 28(a): 100 adults, copulae, (b): 20 adults, (c): 4 adults; loc. 29: 2 ♂; loc. 36: 1 ♂; loc. 37(a): 1 ♂, (b): 3 ♂, 1 ♀; loc. 41(b): 1 ♂, 1 ♀; loc. 46: 10 adults; loc. 47: 1 ♂; loc. 48: 1 ♂; loc. 50: 1 ♂; loc. 54: 3 ♂, 2 ♀; loc. 56: 12 ♂, 20 ♀; loc. 57(a): 1 ♂, 1 ♀; loc. 58: 2 ♂; loc. 59: 10 ♂; loc. 60: 5 adults; loc. 61: 50 adults, copulae, oviposition; loc. 63: 1 ♂; loc. 64: 1 ♂; loc. 66: 1 ♂, 1 ♀; loc. 67: 10 ♂, 5 ♀; loc. 68: adults; loc. 69: 100 adults; loc. 70: 1 ♂; loc. 79: adults

Libellula depressa Linnaeus, 1758
Loc. 6: 1 ♀; loc. 9: 1 ♂; loc. 10: 1 ♂; loc. 31: 1 ♂; loc. 41(b): 1 ♂; loc. 55: 1 ♂; loc. 63: 1 ♂; loc. 64: 1 ♂; loc. 78(a): 1 ♂; loc. 80: 4 ♂; loc. 81: 1 ♂; loc. 82: 1 ♂; loc. 87: 4 ♂; loc. 89: 1 ♀; loc. 100(a): 3 ♂

Libellula fulva Müller, 1764
Loc. 2: 2 ♂; loc. 5: 2 ♂; loc. 6: 5 ♂; loc. 8: 5 ♂, 1 copula; loc. 12(c): 150 adults, (d): 1 copula; loc. 14(a): 500 adults, 50 copulae, (b): 100 adults; loc. 15: 50 adults, copulae, oviposition; loc. 16: 10 adults, copulae; loc. 21: 1 ♂; loc. 27: 1 ♀; loc. 28(a): 3 ♂; loc. 32(b): 500 adults; loc. 33: 30 adults; loc. 34(a): 30 ♂, (b): 50 adults, 5 copulae; loc. 41(b): 5 ♂; loc. 57(a): 1 ♂; loc. 58: 3 ♂; loc. 63: 10 adults; loc. 75(a): 1 ♀; loc. 78(a): 5 ♂, (b): 5 adults

Libellula quadrimaculata Linnaeus, 1758
Loc. 28(a): 1 adult; loc. 58: 1 adult, loc. 85: 10 adults; loc. 86: 10 adults; loc. 87: 2 adults; loc. 92: 100 adults, tenerals, exuviae

Orthetrum albistylum (Selys, 1848)

Loc. 22: 3 ♂; loc. 27: 5 ♂; loc. 28(a): 15 ♂, ♀, (c): 4 adults; loc. 34(a): 1 ♀; loc. 36: 1 ♂, 1 oviposition; loc. 41(b): 2 ♀; loc. 46: 200 adults, copulae, oviposition; loc. 47: 30 adults; loc. 50: 50 adults; loc. 54: 5.000 adults, copulae, oviposition, tenerals, exuviae; loc. 56: 2 ♂, 10 ♀; loc. 57(a): 3 ♂; loc. 58: 5 ♂, 2 ♀; loc. 59: 500 adults, copulae, oviposition, tenerals; loc. 60: 500 adults; loc. 61: 2.000 adults, copulae, oviposition, tenerals; loc. 63: 1 ♂; loc. 64: 3 ♂; loc. 69: 30 adults; loc. 70: 1 ♀

Orthetrum brunneum (Fonscolombe, 1837)

Loc. 1: 2 adults; loc. 4: 1 ♂; loc. 5: 1 ♂; loc. 7: 1 ♂; loc. 8: 3 ♂; loc. 10: 8 ♂, 2 ♀; loc. 11(a): 2 ♂; loc. 12(b): 2 ♂; loc. 14(a): 1 ♂; loc. 16: 1 ♂; loc. 18: 20 adults; loc. 34(a): 1 ♂, 1 ♀; loc. 37(b): 1 ♀; loc. 45: 1 copula; loc. 57(a): 2 ♂; loc. 81: 1 ♂; loc. 82: 10 ♂

Orthetrum cancellatum (Linnaeus, 1758)

Loc. 9: 20 adults; loc. 11(c): 2 ♂; loc. 12(a): 4 ♂, 1 ♀; loc. 22: 1 ♂; loc. 23(a): 5 ♂, 1 ♀, (b): 10 adults; loc. 24(b): 1 ♂; loc. 26(b): 2 ♂; loc. 27: 2 ♂; loc. 28(a): 15 ♂, 3 copulae, (b): 20 adults, (c): 10 adults; loc. 29: adults; loc. 37(b): 2 ♂; loc. 38: 3 ♂, 2 ♀; loc. 40: 1 ♂; loc. 41(a): 3 ♂, (b): 2 ♂, 1 ♀; loc. 42: 5 adults, loc. 43: 15 copulae, 1 teneral; loc. 45: 1 ♂; loc. 46: 5 adults; loc. 47: 10 adults; loc. 49: 10 adults; loc. 50: 20 adults; loc. 51: 1 ♂; loc. 52(a): 10 adults; loc. 54: 2000 adults, copulae, oviposition; loc. 56: 20 adults; loc. 57(b): adults; loc. 58: 10 ♂; loc. 59: 100 adults; loc. 60: 50 adults; loc. 61: 500 adults, copulae, oviposition, tenerals; loc. 63: 1 ♂; loc. 64: 10 adults; loc. 66: 3 ♂; loc. 67: 100 adults; loc. 68: adults; loc. 69: 50 adults; loc. 70: 10 adults; loc. 71: adults; loc. 83: 1 ♂; loc. 84: 2 ♂; loc. 100 (a): 5 ♂, 1 ♀

Orthetrum coerulescens (Fabricius, 1798)

Loc. 6: 3 ♂, 1 copula; loc. 8: 30 adults; loc. 9: 20 adults, 5 copulae; loc. 10: 30 adults, 3 copulae; loc. 11(a): 30 adults, 5 copulae, 1 oviposition, (d): 220 adults; loc. 12(a): 20 adults, (b): 20 adults, 2 copulae; loc. 13: 20 adults; loc. 14(a): 300 adults, (b): 50 adults; loc. 15: 50 adults; loc. 16: 100 adults, copulae, oviposition; loc. 18: 10 adults; loc. 21: 1 ♂; loc. 30: 10 adults; loc. 32(b): 40 adults; loc. 34(a): 2 ♀, teneral, (b): 100 adults; loc. 41(b): 1 ♂, 1 ♀; loc. 46: 10 adults; loc. 55: 1 ♀; loc. 63: 1 ♂; loc. 64: 20 adults; loc. 66: 3 ♂; loc. 74(b): 3 ♂; loc. 76: 1 ♂; loc. 79: adults; loc. 98(a): 5 ♂, 2 ♀, 1 oviposition

Selysiothemis nigra (Vander Linden, 1825)

Loc. 17: 1 ♂; loc. 22: 1 ♂; loc. 23(a): 1 ♂, 1 ♀; loc. 25: 80 adults; loc. 27: 3 ♂, 1 ♀; loc. 28(b): 500 adults, 15 copulae, 4 oviposition, teneral, (c): 40 adults, exuviae; loc. 44: 3 ♂, 1 ♀; loc. 46: 1 teneral ♀; loc. 52(a): 1 ♀; loc. 56: 1 ♂; loc. 57(a): 1 ♀; loc. 67: 1 adult; loc. 71: exuviae

Sympetrum flaveolum (Linnaeus, 1758)

Loc. 88: 2 tenerals; loc. 91: 2 ♀; loc. 98(a): 30 tenerals; loc. 99(a): 500 adults, tenerals, (b): 32 adults, 10 tenerals

Sympetrum fonscolombii (Selys, 1840)

Loc. 23(b): 1 ♀; loc. 24(a): 1 ♂; loc. 56: 1 teneral ♂; loc. 73: 1 ♂; loc. 83: 4 ♂, 2 ♀

Sympetrum meridionale (Selys, 1841)

Loc. 3: 10 adults; loc. 11(c): 3 adults; loc. 12(a): 50 adults, tenerals; loc. 14(a): 2 ♂; loc. 15: 1 ♂; loc. 24(a): 20 adults, (b): 30 tenerals; loc. 28(a): 1 teneral ♂; loc. 37(b): 3 adults; loc. 80: 1 teneral ♂

Sympetrum sanguineum (Müller, 1764)
Loc. 10: 1 ♂; loc. 14(b): 1 ♂; loc. 22: 1 ♂; loc. 23(b): 2 ♂; loc. 24(a): 1 ♂, (b): 1 ♂; loc. 27: 1 ♂; loc. 34(b): 5 ♂, 1 ♀, 1 copula; loc. 41(b): 100 adults; loc. 47: 1 ♂; loc. 48: 1 ♂; loc. 63: 2 ♂; loc. 65: 2 ♂; loc. 67: 3 ♂, 1 ♀; loc. 68: 1 adult; loc. 73: 1 ♂; loc. 76: 1 ♂, 2 ♀, 1 copula; loc. 77: 1 ♂; loc. 79: adults; loc. 80: 10 adults, 2 copulae; loc. 99(b): 2 ♂; loc. 100(b): 5 tenerals

Sympetrum striolatum (Charpentier, 1840)
Loc. 9: 1 teneral; loc. 12(a): 1 ♂, (b): 1 teneral ♂

Trithemis annulata (Palisot de Beauvois, 1807)
Loc. 43: 1 ♂; loc. 54: 1 ♂; loc. 57(a): 1 ♂; loc. 61: 1 ♀; loc. 71: exuviae.; loc. 75(b): 1 ♀

REGIONAL DIVERSITY

The number of localities per species for the six different investigated geographical regions of Montenegro is given in Table I. Despite the low number of prospected localities (n = 21) in the northern part, nine species can be distinguished to occur as good as only in the Alpine region. These are *Coenagrion hastulatum*, *Enallagma cyathigerum, Pyrroshoma nymphula*, *Aeshna juncea*, *Cordulia aenea, Somatochlora metallica* and *Sympetrum flaveolum*. The nominal subspecies of *Calopteryx splendens* and *Platycnemis pennipes* are also restricted to this region. The corresponding subspecies *Calopteryx splendens balcanica* (10 localities) and *Platycnemis pennipes nitidula* (31 localities) are confined to the Mediterranean region. In the latter, 84 localities were visited and 23 species show a clear preference for this region. Most of them are known as typical thermophile such as *Erythromma lindenii*, *E. viridulum*, *Aeshna affinis*, *Crocothemis erythraea*, *Orthetrum albistylum*, *O. brunneum, Sympetrum fonscolombii*, *S. meridionale* and *Trithemis annulata*. Also *Lindenia tetraphylla, Selysiothemis nigra* and *Gomphus schneiderii* are confined to the Mediterranean region. One of the most striking results was the overwhelming presence of *Orthetrum cancellatum* in the Mediterranean region and its nearly complete absence in the Alpine region.

DISCUSSION

COMMENTS ON SOME RATHER 'RARE' SPECIES

LESTES PARVIDENS – One male was captured on 27 June 2009 at the edge of the local campsite adjacent to the marshland of Buljarica, along the Adriatic coast and a population of at least 50 imagines was found on a pond just south of Skadar jezero on 14 July 2011. They all were typical *L. parvidens* and did not show any characteristics of hybridization. At both localities, individuals were found in very close wet forest, which was as good as impenetrable. It seems they were all hiding here from the heat of the summer. Our observations confirm the presence

of the species along the Adriatic coast in the Balkans (OLIAS et al., 2007). We were unable to find *L. viridis* in the northern mountain region. This was probably due to the time of the year of our investigations which was probably too early in the season to record a late summer species such as *L. viridis*.

CALIAESCHNA MICROSTIGMA – We found this very secretive aeshnid in very low numbers at six localities. Individuals were seen flying along brooks of 1-3 metres width, all flowing under a close forest canopy. An exuviae was found at a small spring stream at Zagorak (loc. 78). Imagines were especially seen in late afternoon, none was observed by us before midday. This eastern Mediterranean species occurs as far west as the southern Dalmatian coast in Croatia (BOUDOT et al., 2009). Surprisingly, two males were seen along the Sekularska river in the southeastern mountains. This is the first observation for this species for the Alpine biogeographical region in Europe.

CORDULEGASTER HEROS – It was found in nine localities in Montenegro. An undetermined *Cordulegaster* species, which was presumably also *C. heros*, was found at a small stream in Donje Selo (loc. 38). Populations were not only found in the Mediterranean region, but also in the Alpine region. The species was first discovered for Montenegro in 2007 near Petrovac (JOVIĆ et al., 2008). No coordinates of this locality are given but, based on the very short description, we can assume that the species was found in Buljarica. All localities in the Mediterranean region are typical brooks that rise from the karst mountains and flow over a relatively short distance. The water of the brooks is very cold and is running through close Mediterranean forest. Some populations of *C. heros* were found in the bay of Buljarica some hundred metres away from the Adriatic Sea. After leaving the mountains, the brooks flow here over several hundred metres through close wet, nearly impenetrable forest. Other rheophilic species nearly always present with *C. heros* along the different brooks in the Mediterranean region were *Calopteryx virgo festiva*, *Libellula fulva* and *Orthetrum coerulescens*. Also *Somatochlora meridionalis* was normally present. In the Alpine region, the species was found over a distance of several kilometres along a permanent stream in a wooded river valley.

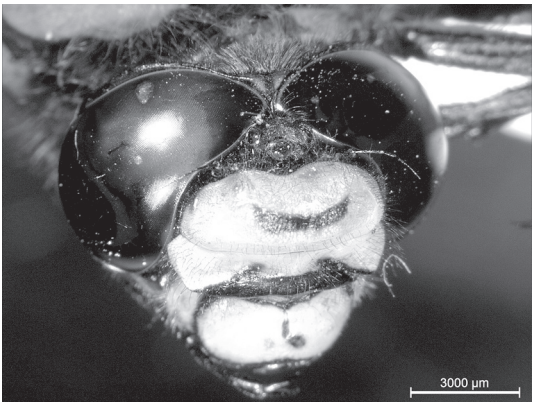

Fig. 2. Frontal view of the head of *Cordulegaster heros*, Buljarica, Montenegro (15 July 2011). A distinctive black bar on the frons is present and two yellow spots are present in the black occipital triangle.

Several specimens collected and/or photographed at

Table I

For each species is given the total number of localities for the six different investigated regions of Montenegro. The total number of localities and the number of species for each region is mentioned. The regions 'Coast', 'Ulcinj', 'Skadar' and 'Interior' form the Mediterranean biogeographical region in Montenegro. The 'Interior' contains several low mountains and is the transition area towards the Alpine zone. The regions 'Durmitor' and 'Plav' are part of the Alpine region. – [ALP = Alpine region, – MED = Mediterranean region. Species highlighted in pale grey shade have a preference for the Mediterranean region; species highlighted in dark grey are typical of the Alpine region]

	Coast	**Skadar**	**Ulcinj**	**Interior**	**MED**	**Durmitor**	**Plav**	**ALP**
Number of investigated localities	18	40	13	13	84	9	12	21
Number of observed species	27	36	29	29	44	14	27	31
Orthetrum cancellatum	3	28	7	2	40		1	1
Crocothemis erythraea	7	21	5	1	34			0
Ischnura elegans	6	21	5	2	34		1	1
Platycnemis pennipes nitidula	7	15	5	4	31			0
Orthetrum coerulescens	11	8	2	3	24		1	1
Erythromma viridulum	2	18	2	1	23			0
Lindenia tetraphylla	2	16	3		21			0
Libellula fulva	8	7	3	2	20			0
Orthetrum albistylum		17	3		20			0
Aeshna affinis	8	4	6	1	19		1	1
Erythromma lindenii	1	13	1	3	18			0
Orthetrum brunneum	11	4		2	17			0
Onychogomphus forcipatus	2	8	1	4	15		1	1
Selysiothemis nigra	1	7	5		13			0
Calopteryx splendens balcanica	1	6	1	2	10			0
Somatochlora meridionalis	5	2		3	10		1	1
Sympetrum meridionale	5	1	2	1	9			0
Gomphus schneiderii		4	1	3	8			0
Cordulegaster heros	3	4		1	8		1	1
Trithemis annulata		5		1	6			0
Sympetrum fonscolombii		1	2	2	5			0
Coenagrion pulchellum	1		2		3			0
Ischnura pumilio			1	2	3			0
Calopteryx virgo festiva	7	8	3	7	25	1	2	3
Sympetrum sanguineum	2	8	4	5	19		2	2
Anax imperator	5	8	3	2	18		3	3
Libellula depressa	3	4	1	4	12	2	1	3
Lestes parvidens	1	1			2			0
Lestes virens			2		2			0
Aeshna mixta		1		1	2			0
Sympetrum striolatum	2				2			0
Sympecma fusca			1		1			0
Cordulegaster sp.		1			1			0
Epitheca bimaculata		1			1			0
Gomphus vulgatissimus/schneiderii					0		1	1
Anax parthenope	1	3	1		5		1	1

Table I, continued

	Coast	Skadar	Ulcinj	Interior	MED	Durmitor	Plav	ALP
Caliaeschna microstigma		4		1	5		1	1
Somatochlora flavomaculata	6	1			7		2	2
Aeshna isoceles	2	1	2		5		2	2
Lestes dryas			1	1	2	1	1	2
Lestes sponsa		1			1	1	1	2
Aeshna cyanea		1			1	1	1	2
Coenagrion puella				2	2	1	2	3
Libellula quadrimaculata		1	1		2	4		4
Cordulegaster bidentata		2		1	3		5	5
Calopteryx s. splendens					0		1	1
Cordulia aenea					0		1	1
Coenagrion hastulatum					0	2		2
Pyrrhosoma nymphula					0	1	2	3
Platycnemis p. pennipes					0	3		3
Aeshna juncea					0	3	1	4
Sympetrum flaveolum					0	2	2	4
Somatochlora metallica					0	5		5
Enallagma cyathigerum				1	1	8	5	13

localities 14, 55 and 78 show a somewhat atypical dorsolateral margin of the antehumeral stripe. The stripe is especially less angular then typical for *C. heros*. Furthermore, the occipital triangle is not completely black but has two clearly visible yellow patches at the front side (Fig. 2). As the specimens are from different localities, we assume that this character is some kind of aberration and falls within the normal specific variability. These two characters are more typical for *C. picta* (VAN PELT, 2006) but the latter has much longer and more slender appendages (THEISCHINGER, 1979). The observed specimens have clear black markings on the frons and are more close to the subspecies *C. h. pelionensis* from Greece than to the subspecies *heros* from Austria. The rather atypical characteristics of the Montenegrin *C. heros* specimens can easily result in the conclusion that they are *C. picta*. This confusion most likely happened with the individuals of '*C. picta*' found by GLIGOROVIĆ et al. (2008a), especially as the picture given in this publication does not shown the characters of *C. picta* but rather that of *C. heros*, e.g. outer corners of antehumeral stripes that are angular. We visited the '*C. picta*' site (loc. 77) in the area of Gornji Crnci–Piperi on 13-VII-2011, exactly four years after the first sightings (GLIGOROVIĆ et al., 2008a). This zone is situated north of the capital Podgorica and is a typical dry, karst mountain area. Only completely dried up brooks and streams were found. Other possible habitats in the immediate vicinity were checked, but were also completely desiccated and without dragonflies. We were unable to find any pools or even wet mud in the streambed, a microhabitat where larvae of *Cordulegaster* can survive the hot and

dry summer. In 2007 when the species was discovered, larvae were collected from April and May and imagines were seen until late August. Larval development of *Cordulegaster* takes several years, so we assume that this local *Cordulegaster* population has already gone extinct or is restricted to a very small and well hidden brook. Further research is needed to clarify the status of *C. picta* in Montenegro.

GOMPHUS SCHNEIDERII – It is considered to be closely related to *G. vulgatissimus*, which it replaces in the southern Balkans and Greece (BOUDOT et al., 2009). The areas of both species overlap in mainland Greece (BOUDOT et al., 2009; LOPAU, 2010). The oldest citation of both species for Montenegro is from BARTENEV (1912). Since then, only *G. vulgatissimus* has been cited (e.g. ADAMOVIĆ, 1996; GLIGOROVIĆ et al., 2008a; JOVIĆ et al., 2008). Surprisingly DUMONT (1977) failed to observe any of either species during his extensive trip to Yugoslavia, but later found only *G. vulgatissimus* in Albania (DUMONT et al., 1993). *G. schneiderii* was recently rediscovered in Montenegro by JOVIĆ (2008), soon followed by more observations at the River Morača by GLIGOROVIĆ et al. (2010). Based on the characters given in DIJKSTRA & LEWINGTON (2006), identification in the field was often ambiguous. Diagnostic features such as the colour of the eyes, the amount of yellow markings on S8-S9 and the width of the antehumeral stripe turn out to be very variable. At some localities individuals with greenish eyes, green-blue eyes (loc. 47) and blue eyes (loc. 27) were found. All this resulted in typical *G. vulgatissimus* as well as typical *G. schneiderii* specimens but at first sight also intermediate forms which could not be attributed to either taxon. The individuals were somewhat less robust and with the terminal segments less dilated than central European specimens. This was also noticed by individuals from neighbouring Albania (DUMONT et al., 1993). Comparing with *G. vulgatissimus* from Belgium or northern France, individuals in Montenegro were generally less brightly yellow coloured.

An overview of the structural features for imagines between both taxa is given by SEIDENBUSCH (1997) and a detailed description and figures of *G. schneiderii* is given by DUMONT (1991) who considered it as a subspecies of *G. vulgatissimus*. Both authors focus more on the superior appendages and the vulvar scale as structural differences compared to other species. In *G. schneiderii*, the male superior appendages are more slender, look more wavy in lateral view because the apical tip is curved distinctly upwards, and the female vulvar scale has a rather rounded apex (DUMONT, 1991; SEIDENBUSCH, 1997). This rounded apex is also given by BUCHHOLZ (1954) in his description of a new subspecies *G. vulgatissimus helladicus*. In the original description of *G. schneiderii*, SELYS & HAGEN (1850) mention that the legs are mostly black and that the base of both the anterior and middle femora has a thin yellow line. The underside of the thorax, behind the posterior legs, is also mainly yellow. BARTENEV (1912) based his findings of *G. schneiderii* in Montenegro also on the superior appendages. He further mentions the presence of yellow on the underside of the thorax

behind the posterior legs and notes that the colour of the head and the legs are nearly similar as to those of *G. vulgatissimus*.

The different characters of our collected specimens in Montenegro are given in Table II. The coloration of the eyes is not stated as this cannot be inferred from our dried specimens. The superior appendages of the collected males are all curved upward and are widening towards the tip (Fig. 3a). The vulvar scale is clearly short, blunt and has a rounded tip (Fig. 3b). The underside of the thorax behind the posterior legs is always clearly yellow, much more in females (Fig. 4a) than in males (Fig. 4b). All our specimens have yellow spots on the dorsal part of the abdomen on S7, few also on S8 and none on S9. But those on S8 and S9 are not always present in *G. schneiderii* (J.P. Boudot, pers. comm.). In spite of the observed variation in the coloration of the eyes and the width of the antehumeral stripe (see also Fig. 4b), we conclude that the collected specimens all belong to the description of *G. schneiderii* given by SEIDENBUSH (1997) and DUMONT (1991). *G. schneiderii* is a variable species and identification based on the colour of the eyes, the design of the thorax and the abdomen are not reliable. Identification should be based on the structural characters of the genitalia. The correct identification at locality 94, the only locality in the Alpine region, cannot be given as

Table II
Diagnostic characters of the collected specimens of *Gomphus schneiderii* in Montenegro

Date – sex locality	**Appendages superiores**	**Vulvar scale**	**Colour femur, base of legs**	**Thorax underside**	**Antehumerale stripe**	**Colour S7-S8-S9**
28-VI-2009 – ♂ Franskanjel	curved upwards tip widening		femur black, yellow restricted to base, very few	yellow	yellow much smaller than adjoining black stripe	S7 = yellow S8 = yellow S9 = black
2-VII-2009 – ♂ Dodosi	curved upwards tip widening		femur some yellow, base yellow	yellow	yellow smaller than adjoining black stripe	S7 = yellow S8 = yellow S9 = black
2-VII-2009 – ♀ Dodosi		short, blunt rounded tip	femur black with yellow line base yellow	yellow	yellow smaller than adjoining black stripe	S7 = yellow S8 = very few yellow S9 = black
13-VII-2011 – ♂ Spuž-Lopate	curved upwards tip widening		femur black yellow restricted to base, very few	yellow	yellow much smaller than adjoining black stripe	S7 = yellow S8 = black S9 = black
16-VII-2011 – ♂ Zagorak	curved upwards tip widening		femur black base yellow and black	yellow	yellow much smaller than adjoining black stripe	S7 = yellow S8 = black S9 = black
16-VII-2011 – ♂ Zagorak	curved upwards tip widening		femur black yellow restricted to base, very few	yellow	yellow slightly smaller than adjoining black stripe	S7 = yellow S8 = black S9 = black
16-VII-2011 – ♀ Zagorak		short, blunt rounded tip	femur black base yellow and black	yellow	nearly as wide as black line behind	S7 = yellow S8 = black S9 = black

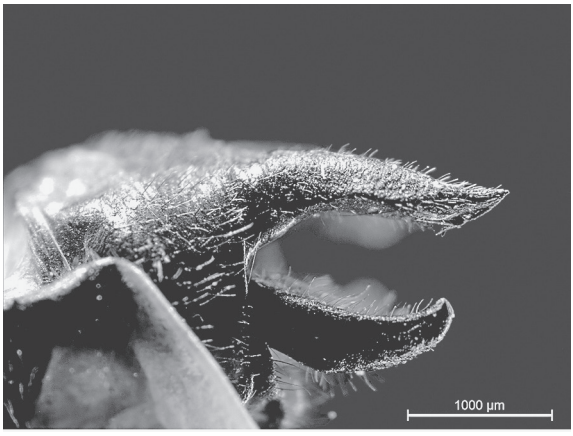

Fig. 3. *Gomphus schneiderii*, Montenegro: (a) superior appendages of a male from Zeta (16 July 2011); – (b) vulvar scale of a female from Dodosi (2 July 2009).

none of the observed individuals was collected or photographed. Therefore this observation is noted as *G. vulgatissimus/schneiderii*.

The differences between imagines of *G. vulgatissimus* and *G. schneiderii* are minimal. Further research in the Balkans is needed to reveal if there is a gradual variation between both taxa, if mixed populations occur and finally if both are valid species or subspecies. It is even possible that morphological characters alone will not resolve the problem and that molecular analysis is needed. GLIGOROVIĆ et al. (2010) give no consistent information on the criteria used for the distinction of both species, so no conclusion about the correct identification can be made. It is possible that *vulgatissimus* is confined to the Alpine region and that *schneiderii* is typical for the warm Mediterranean region of the Balkans. Very few data are available on the sympatric occurrence of both species (e.g. LOPAU, 2010). In that case, it might be that larvae have slightly different ecological preferences. Larvae of *G. vulgatissimus* can be separated of larvae of *G. schneiderii* by the presence of a lateral spine on segment 6. This is sometimes only clearly visible after cleaning the larva (C. Brochard, pers. comm.). We found one exuviae of *G. schneiderii* amidst many exuviae of *Lindenia tetraphylla* along the southern rocky shoreline of Skadar lake. As far as we know, this is the first mention of reproduction of *G. schneiderii* in a lake.

LINDENIA TETRAPHYLLA – This species was present at 21 localities, all situated in the Mediterranean region of Montenegro. Most of these localities are located

within the Skadar lake basin, especially along the south side. Huge numbers, up to several hundred imagines, were only found at the rocky southern part of Skadar lake. This was also the part of the lake where exuviae were found. The species was present over a distance of nearly 35 km along Skadar lake. We assume that the only sites in Montenegro where *L. tetraphylla* regularly reproduce are lake Skadar and lake Šasko. At all the other localities, numbers of observed individuals are rather low and probably only pertain to wandering individuals or to very small local populations, which act as a sink. The species was observed several times hunting along roadsides above Mediterranean shrub and rocks, sometimes more than six kilometres away from the lake. This behaviour was also noted by LOHMANN (1992), who observed the species several kilometres away from its breeding site. A male *L. tetraphylla* was noted twice in Buljarica along the Adriatic coast. Because of the complete absence of stagnant water along this part of the coast, potential breeding habitats are lacking. It seems quite probable that the observed individuals originate from Skadar jezero, at least 13 km away.

L. tetraphylla is already long known from Montenegro. The first citation of *L. tetraphylla* from Montenegro is from BARTENEV (1912), who collected two females on 23 and 24 June 1911. DUMONT (1977) observed many individuals over a distance of 20 km along the northern marshy side of Skadar lake. Specific search for exuviae by DUMONT (1977) in 1970 and 1974 remained unsuccessful. DUMONT et al. (1993) found the species also

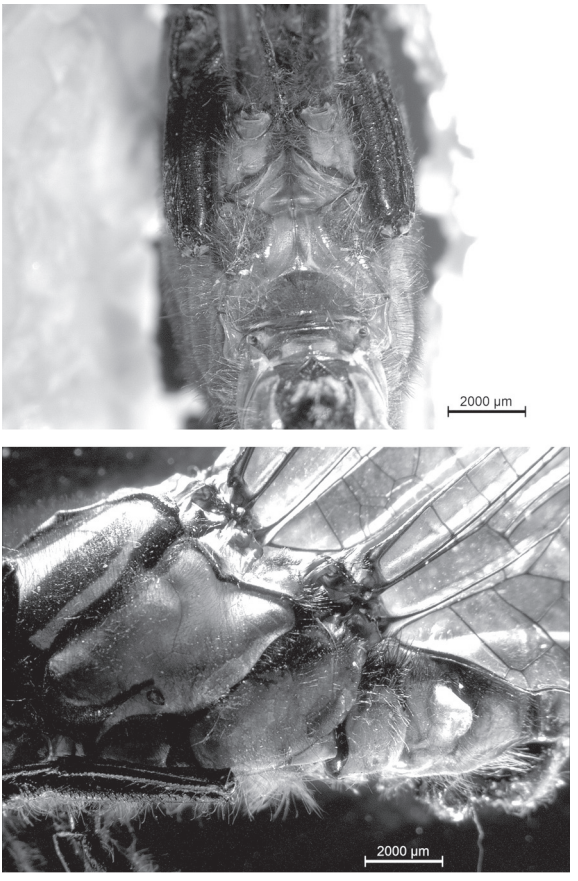

Fig. 4. *Gomphus schneiderii*, Montenegro, thoracic features of the same individuals as in Fig. 3: (a) female thorax, underside view; – (b) male thorax, lateral view.

along the Albanian side of Skadar lake. A review of the status and distribution of this species is given by SCHORR et al. (1998). The habitat of *L. tetraphylla* is described as lakes with extensive reed belts in the western part of its range, while it is found in nearly all types of water bodies in the eastern part of its range, with a preference for flood plains of large rivers (SCHORR et al., 1998). The two reproduction sites in Montenegro can be characterised as large, shallow lakes with extensive reed belts and with a partly rocky shoreline. Nearly all of the exuviae were found on big boulders along the rocky shoreline and only a few were on leaves of *Nymphaea*. No exuviae could be found on the sandy beaches or in reed (*Phragmites*) or *Typha* vegetation. Exuviae were found from 10 cm from the water level up to 3 m away. SCHORR et al. (1998) assume that emergence north of 40°N starts at the end of May. Emergence was only observed sporadically by us and occurred around midday, but many of the exuviae were still fresh. On 14 July 2011 we saw a freshly emerged individual with damaged wings as a consequence of emergence earlier the same day. We assume that emergence continues until the last part of July. The absence of freshly emerged imagines can be caused by the time of emergence, which is believed to occur at night (pers. com. A. Bilek in DUMONT, 1977). At four sites, exuviae were counted over several square metres with a maximum of 500 m² at one site, totalling on average roughly 20 exuviae per 1 m² of boulders. Emergence had taken place in vertical, horizontal and sloping positions. The rocky shore of Skadar lake is only accessible at some points, so looking for exuviae was not always possible. The whole southern shoreline looks similar to the visited parts. If we extrapolate our counted results over the southern lake shore alone, this result in more than 1 million exuviae of *L. tetraphylla*. These extreme high numbers of exuviae have never been reported before (SCHORR et al., 1998). We presume that the population at Lake Skadar is the origin of many observed individuals in the northern Adriatic region and acts as a source for many populations in the Mediterranean. The species seems to have relatively few strong populations in Europe (BOUDOT et al., 2009). *L. tetraphylla* is mentioned as Vulnerable on the European Red List (KALKMAN et al., 2010) and is one of the species in the Habitats Directive. Lake Skadar is probably the most important site for the conservation of this species in Europe.

SOMATOCHLORA FLAVOMACULATA – This species was found at nine localities in Montenegro, belonging to three major sites: the Buljarica swamp along the Adriatic Coast, the Crmničko polje to the west of Skadar lake and Plavsko jezero (or lake Plav) and its surrounding marshland and peatbogs. The species was first cited for Montenegro by KEMP (1989), but no exact locality or date of capture could be given. JOVIĆ et al. (2008) located this record to a village nearby the town of Petrovac along the Adriatic coast, which is approximately 5km north of Buljarica. This observation was also cited by WILDERMUTH (2008) and was until then the only locality for Serbia and Montenegro and one of the very few for the Balkans. We found no suitable reproduction sites at Petrovac. Hav-

ing observed large numbers at the swamp of Buljarica and the close distance, we assume that this specimen belonged to the population of Buljarica. The species was further seen at two nearby sites in the bay of Buljarica and at two localities in the Crmničko polje by JOVIĆ (2008) who observed several tens of individuals. At least 1000 individuals were counted on 5 July 2011 in Buljarica. The swamp of Buljarica stretches over a distance of 2 by 1 km and is only accessible at some points. Therefore numbers of *S. flavomaculata* should be in the region of several thousand (possibly as many as ten thousand) individuals. Densities were so high that at certain moments more than 100 individuals, including several tandems, could be seen flying over the sea while swimming and some even preferred sea water for oviposition. Besides their presence in the warm region of Montenegro, a population was also found at lake Plav at an altitude of 920 m a.s.l. The lake is completely surrounded by high snow-capped mountains and close to Albania and Kosovo, where more lakes occur. We expect that the species will also be present there. Specific fieldwork to remoter parts of the Balkans is needed to clarify its status.

EPITHECA BIMACULATA – On 2 July 2009 an adult was seen flying close by while on a boat trip on Skadar lake. It was observed some hundred metres from the shoreline and was flying at an altitude of about 1.5 m above the water. At this locality, the lake had well developed submerged and floating vegetation. The vegetation on the nearby shoreline alternates between shrub and *Salix* forest with belts of reed. The bottom of the lake, which was clearly visible, was estimated at between 1.5 and 4 m and consists here of coarse sand. Besides the dimensions of Skadar lake, this locality corresponds very well with the habitat requirements for the species given by TROCKUR & MAUERSBERGER (2000). The species is easily overlooked and the most effective way of detecting it is searching for exuviae in late April and beginning of May. Although we have no proof, we assume that the species reproduces here. *E. bimaculata* is an Eurosiberian species with a patchy distribution in central Europe. It becomes rare towards the south of its range and is only marginally present in the Mediterranean part of Europe (WILDERMUTH, 2008; BOUDOT et al., 2009). After it was discovered in northern Serbia (JOVIĆ & ANDJUS, 2003), several new localities were found in recent years (JOVIĆ et al., 2009). The nearest locality from lake Skadar is situated some 200 km to the north. Our observation represents the southernmost record of this species in Europe. We expect the species to be present at other sites in the Balkans.

ORTHETRUM COERULESCENS – This is a widespread and common species in Montenegro. Of the five phenotypes distinguished by MAUERSBERGER (1994), the majority of the individuals we checked belonged to type four which is a form with a tendency towards the subspecies *anceps*. However, phenotypes two and three which are intermediate between the two subspecies were often present. Individuals of type one, the typical *coerulescens* subspecies, and type five, the typical *anceps* subspecies, were not found in Montenegro.

SELYSIOTHEMIS NIGRA – This species has been observed in recent years in

several countries (BOUDOT et al., 2009) but nearly always in very low numbers. It can easily be overlooked, probably due to its small size and somewhat special behaviour. Prior to our observations, *Selysiothemis nigra* was only recorded twice in Montenegro. It was first discovered by R. Seidenbusch (pers. com. in JOVIĆ et al., 2008) in August 1990 at a single locality, south of Ulcinj near the Albanian border. Next, a teneral female was collected not far from the shore of Šasko Jezero (JOVIĆ, 2008). We found *S. nigra* at 11 localities, all situated in the Mediterranean region of Montenegro. A huge population, counting several hundreds of individuals, freshly emerged tenerals and exuviae, was found in July 2011 along the north side of Šasko jezero. The lake is bordered by a belt of *Scirpus* and reed (*Phragmites*) vegetation. Most individuals were seen in wet grasslands where it was the most common species. Surprisingly, we did not found the species here in late June 2009. On 19 July 2011 we observed a group of at least 80 mature individuals along the road near Sveti Dorde less than 2 km south from Šasko jezero. They were flying like a swarm over a distance of 150 metres at a height of 0.5 to 2 m along the road. The road was situated in a typical dry warm Mediterranean landscape consisted of maquis vegetation with locally some low trees. They showed no tendency to sit on the ground or on the vegetation and were only hunting in the air. This swarming behaviour was also noted by HOLUŠA (2011) on the island of Evia, Greece. Since it is a relatively short distance to the population at Šasko jezero, it is possible that they originated from that locality. Otherwise, it is possible that the swarm can be interpreted as a swarm's stop on their migration, as has been suggested by HOLUŠA (2011). We also found exuviae at Sanall along the southeastern side of Skadar lake, proving that they also reproduce there. At the other localities nearly always one adult *S. nigra* was observed, probably indicating that they all relate to wandering individuals. This is especially the case for the adult male seen along the major coastal road in Buljarica on 21 July 2011. Possible reproduction sites are not available in the bay of Buljarica, which is more than 30 km away from the known reproduction sites.

TRITHEMIS ANNULATA – This common Afrotropical species has expanded its range in Europe rapidly in the last few decades and is now a common species in the western Mediterranean (BOUDOT et al., 2009). In southeastern Europe, it is only known from southern Albania and Greece (BOUDOT et al., 2009; LOPAU, 2010). *T. annulata* was first found in Montenegro in 2008 at the northern border of Skadar lake but without proof of breeding (GLIGOROVIĆ et al., 2010). In 2009 we found one male of *T. annulata* near a gravel pit along the Morača river. In 2011 we observed the species at four different localities along Skadar lake and at one site along the Zeta river. Curiously enough, always one imagine could be seen, suggesting that they all belong to wandering specimens and not to a local population. At a sixth site along the southern border of Skadar jezero several exuviae of *T. annulata*, together with some of *Selysiothemis nigra* were collected, giving direct proof that the species reproduces in Montenegro.

DISCUSSION ON REGIONAL DIVERSITY

Montenegro is one of the few places in Europe where the Mediterranean region meets the Alpine biogeographical region and where the Alpine districts extend so far southward. The Balkans acted as a refugium, the so-called ponto-mediterranean refugium, for the re-colonisation of central Europe by dragonflies after the last glaciations and as a centre of speciation (STERNBERG, 1998). This becomes clear in the occurrence of two subspecies of *Calopteryx splendens* and *Platycnemis pennipes* in Montenegro and in the presence of intermediate forms of some taxa (e.g. *Orthetrum coerulescens*). The dragonfly fauna of Montenegro can be split up into an Alpine group and a Mediterranean one (Tab. I), with a number of species occurring in both regions. The species of the Alpine group have their major distribution in central and northern Europe and are often confined to oligotrophic (e.g. *Coenagrion hastulatum* and *Aeshna juncea*) or permanent standing waters (e.g. *Cordulia aenea*). Populations of *C. hastulatum*, *A. juncea*, *Cordulia aenea* and Somatochlora *metallica* are found here at their southern fringe of their distribution (BOUDOT et al., 2009). This is also the case for Bulgaria (MARINOV, 2007; BOUDOT et al., 2009). It seems that their occurrence in the Balkans is limited to the Alpine biogeographical region. *Somatochlora metallica* is restricted to nutrient poor alpine lakes in Montenegro, while *S. meridionalis* is confined to brooks and streams, especially in the Mediterranean region. The only site of *S. meridionalis* in the Alpine region is Biogradsko jezero (loc. 94), where it was found along the inlet of several streams at the lake at an altitude of 1120 m a.s.l. Populations at even higher altitude are known to occur in Bulgaria (MARINOV, 2007).

Many of the recorded species show a clear preference for the Mediterranean region in Montenegro, which can only be partly explained by the higher number of investigated sites. With an occurrence of more than 40% of the investigated sites, *Crocothemis erythraea* is the most common species in this region. In contrast to several countries in western and central Europe, where *C. erythraea* is also present in alpine lakes, we did not find it in the Alpine region. Moreover, *Orthetrum albistylum* is restricted to the Skadar basin and to the Ulcinj area. Both subspecies of *Calopteryx splendens* and of *Platycnemis pennipes* occur very close to of each other; merely 40 km between populations of *P. p. pennipes* and *P. p. nitidula* and roughly 50 km between *C. s. balcanica* versus *C. s. splendens*. We assume that the boundary corresponds with the sharp transition between the Alpine and Mediterranean regions.

CONSERVATION

The total number of species, often called biodiversity hot spots, is often used as a measurement for setting priorities in nature conservation (e.g. MYERS et al.,

2000; GOTELLI & COLWELL, 2001). However, this can lead to a ranking of sites due to the presence of many common species. The rareness and the number of threatened species on a national or European scale are even more important. Rare species have in general narrow habitat preferences and only occur in very specific habitats which seldom harbour a high number of species. A combination of the total number of species and the presence of rare species would be a better option in conservation policy. From the observed species, *Lindenia tetraphylla* and *Cordulegaster heros* are mentioned in the Annexes of the Habitats Directive. This means that Montenegro, which is a candidate for becoming member of the European Union, has to approve designated areas for the conservation of both species. Moreover, both species are also mentioned on the European Red List (KALKMAN et al., 2010) and on the Red List of the Mediterranean basin (RISERVATO et al., 2009). *L. tetraphylla* was assessed as 'endangered' and *C. heros* as 'near threatened' on the European List and changes categories on the Red List of the Mediterranean. Additionally, *Cordulegaster bidentata* is mentioned as 'near threatened' on the Mediterranean List.

The total number of species for the different regions in Montenegro is given in Table I. More than 70% (36) of the species occur in the Skadar lake basin. This can only partly be explained by the high number of investigated sites. The large surface area of the lake together with the variety in habitats, ranging from spring brooks, small rivers, marshland, to rocky shoreline, contribute to the high diversity of the lake for dragonflies. The lake is probably the most important site for the conservation of the European endangered *Lindenia tetraphylla* (see also SCHORR et al., 1998). Consequently, it is of high priority that the conservation and appropriate management of its habitat must be integrated in the conservation policy of the National Park, and that Skadar lake will be designated as a Natura 2000 site. *Cordulegaster heros*, *Gomphus schneiderii* and *Caliaeschna microstigma* are present along several brooks and streams within the Skadar basin and along some tributaries of the Zeta river. These brooks and streams are fed by many sources from the karst mountains. The most important zones for rheophile species along Skadar lake are Crmničko polje, Donje Selo and Rijeka Crnojevića. Several of them are found outside the national park and are not protected at all. The swamp and marshland of Buljarica, situated along the central coast, have a great diversity (21 species) and host some good populations of some rare species in the Balkans such as *Somatochlora flavomaculata*, *Libellula fulva* and *Coenagrion pulchellum*. In the brooks and streams, *Cordulegaster heros* and *Somatochlora meridionalis* are present. The ecosystem of the bay of Buljarica is under great human influence, especially during the summer tourist season (JOVIĆ, 2008). Just before we were there in 2011, the swamps had been sprayed with insecticides against the numerous mosquitoes by the local government. The increasing demand for water for consumption by the growing tourist population along the Adriatic coast, as well as the increased frequency and duration of hot and dry periods have led

to the construction of water pipes through the coastal mountains. The water is directly tapped from different sources leading as we witnessed several times to complete desiccation of brooks and streams. Streams and brooks in the Ulcinj area are also threatened by a growing increase in water consumption by the local and tourist population and for irrigation for agriculture. The area is home to 29 species and has several important sites for dragonflies such as Šasko jezero (15 species), the Bojana river and its delta. Šasko jezero holds important populations of *Selysiothemis nigra* and *Lindenia tetraphylla*. There are plans to create a protected area of the Bojana-Buna river delta (*http://www.euronatur.org/Publications.411.0.html*).

The total diversity of dragonflies in the Alpine region is less than in the Mediterranean region. Nevertheless, the south-eastern mountains around Plav with 24 species harbours a rich and diverse dragonfly fauna. The peat marshes around Plav lake are important for *Somatochlora flavomaculata*, *Sympetrum flaveolum* and *Lestes dryas*, species which are more common in northern parts of Europe. The nearby mountains of the Prokletije contain one of the few populations of *Aeshna juncea* (BOUDOT et al., 2009) in the Balkans. Since this is close to Albania, we expect it also to be present there. More alpine peatbog specialists such as *Aeshna subarctica*, *Somatochlora alpestris* and *S. arctica* are absent. The limit to their southern distribution in Europe seems to be the Carpathian mountains in Romania (DE KNIJF et al., 2011; FLENKER, 2011) and the Rila mountains in Bulgaria (MARINOV & SIMOV, 2004). In the nearby mountain streams *Cordulegaster bidentata*, *C. heros* and *Caliaeschna microstigma* occur. The lake of Plav area and the Prokletije mountains are not protected and suffer from intensification for agriculture use and forestry. The mountains ranges of Durmitor and Plav are home to several dragonfly species, which are found here at the southern edge of their distribution in Europe and can be considered as relics from former colder periods. Hence, these species are more prone to local extinction due to climate changes. Protection and proper management of their habitat is needed if we want to conserve those species at their range margins.

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