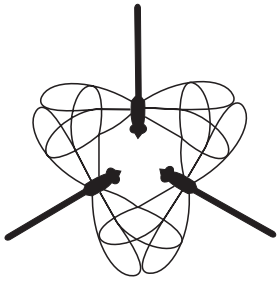

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ODONATA FROM MONTENEGRO, WITH NOTES ON TAXONOMY, REGIONAL DIVERSITY AND CONSERVATION

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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

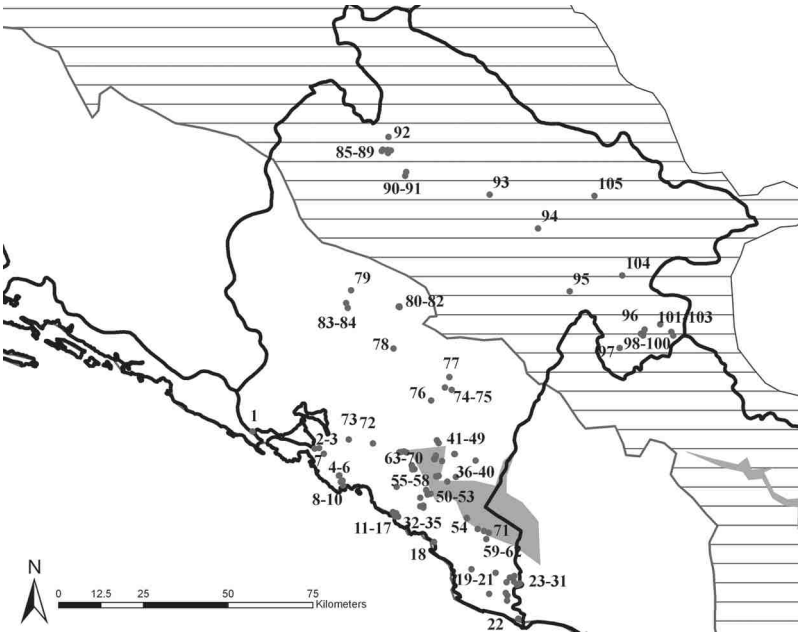

Fig. 1. Map of Montenegro showing the localities visited (1-105) during this study. The country is split into two biogeographical regions: Alpine (hatched) and south of it the Mediterranean region (without filling). The grey spot represents Skadar lake.

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 ♂

Coenagrionidae

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.

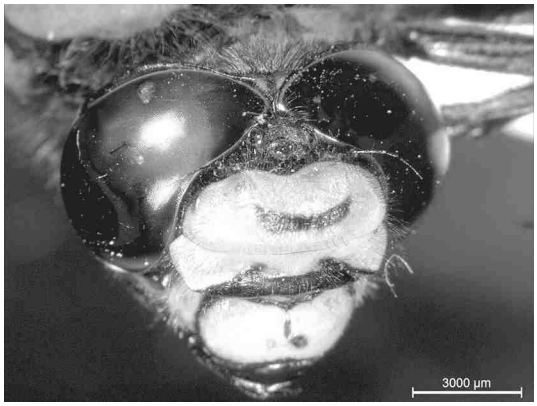

Fig. 2. Frontal view of the head of *Cordulegaster heros*, Buljarica, Montenegro (15 July 2011). A distinctive black bar on the frons is present and two yellow spots are present in the black occipital triangle.

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

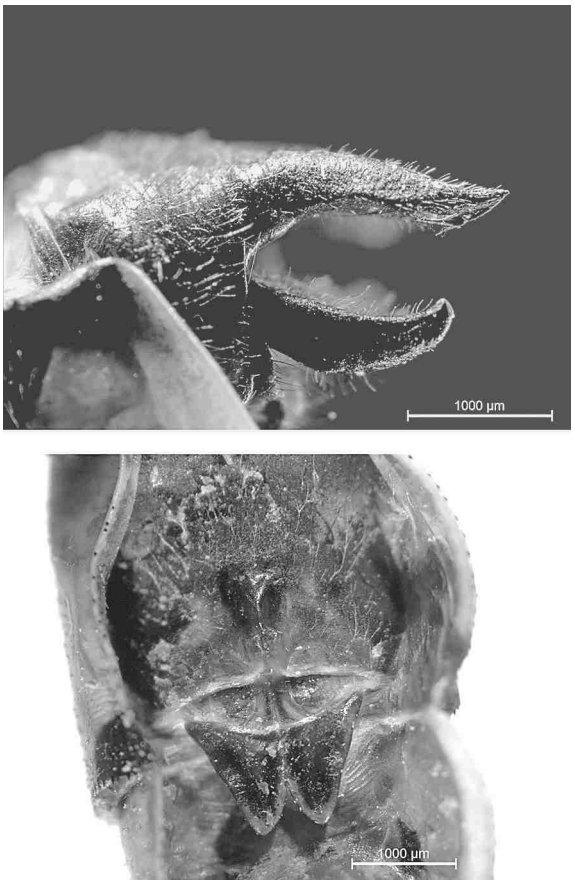

Fig. 3. *Gomphus schneiderii*, Montenegro: (a) superior appendages of a male from Zeta (16 July 2011); – (b) vulvar scale of a female from Dodosi (2 July 2009).

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

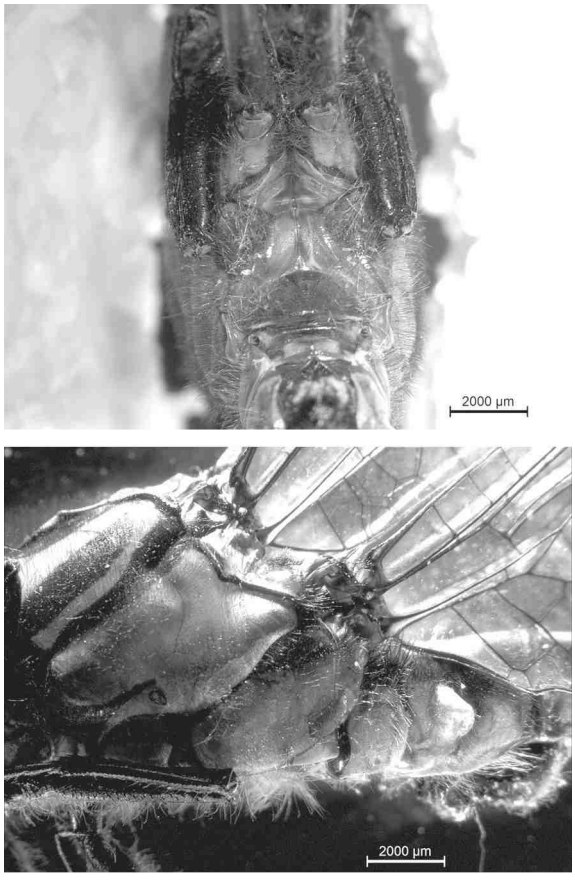

Fig. 4. *Gomphus schneiderii*, Montenegro, thoracic features of the same individuals as in Fig. 3: (a) female thorax, underside view; – (b) male thorax, lateral view.

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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TWO INTERESTING LARVAE OF *ONYCHOGOMPHUS* FROM MALAYSIA (ANISOPTERA: GOMPHIDAE)

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The larvae of *O. thienemanni* and *Onychogomphus* sp. are described and illustrated. Both spp. are clearly separated from each other principally by the shape of postclypeus, pronotum, size of ligula, and dorsal protuberance on abdominal segment 2. The most distinctive feature of these 2 larvae is the shape and position of the 3rd antennomere in a manner of a protecting shield in front of the head.

INTRODUCTION

Sundaland (Malay Peninsula, Sumatra, Java and Borneo) (ORR, 2003) contains ca 500 spp. of Odonata of which Malay Peninsula harbors 232 spp. (ORR, 2004). According to ORR (2004), Malay Peninsula has been well surveyed in the last two decades, with the recent discovery of several new species. However, the knowledge of larvae is still deficient and one example of this is the lack of descriptions of larvae of *Onychogomphus* from the Malay Peninsula. In this paper, we describe two species based upon F0 larvae. Although they were not reared to emergence, one of them contained a pharate adult which made possible its identification by the thoracic color pattern, as well as the male caudal appendages (ORR, 2005).

METHODS

Larvae were described under a stereomicroscope CARL ZEISS Stemi SV6. Mandibles formula and terminology for labium followed WATSON (1956) and CORBET (1953), respectively. S1-10 =

abdominal segments. Measurements, in mm, were made as follows: Total length, dorsally from anterior margin of labrum to apex of epiproct; abdominal length and maximum width, ventrally; hind femur, laterally; epiproct, dorsally, cerci and paraprocts, laterally. Drawings were made with the aid of a camera lucida, and photographs were taken with a digital camera Cannon PowerShot G10 mounted on a microscope CARL ZEISS STEMI 2000C.

ONYCHOGOMPHUS THIENEMANNI SCHMIDT

Figures 1a,c, 2-4, 5a, 6a, 8a, 10a

M a t e r i a l. – 2 F0 larvae (♂, ♀). MALAYSIA: Kelantan, Kuala Koh National Park, Lebir river, 53 m asl (5º 08' 50' N; 102º 05' 23" E), 27-IV-2005, C. Salmah leg. Deposited in Colección Entomológica del Instituto de Ecología, A.C. (IEXA) (♂), and in School of Biological Sciences, Universiti of Sains Malaysia (♀).

DESCRIPTION. – Body stout and bulky, coloration bright yellow (Fig. 1a), integument finely granulose, head large, legs short, abdomen enlarged.

H e a d. – Wider than long, densely granulose, wider than prothorax but narrower than synthorax and abdomen; frons and vertex mostly flat dorsally, with three moderately large ocelli; frons widely concave on anterior margin, laterally produced as a wide, rounded lobe to each side; postclypeus granulose, produced anteriorly as a semicircle (Figs 1a,c), anteclypeus short, very finely granulose; labrum granulose, with a dense brush of piliform setae on anterior border, apicoventral surface narrow and flattened, with a dense fringe of delicate, golden setae. Antennae 4-segmented, light yellow, scape twice wider than long, granulose, with

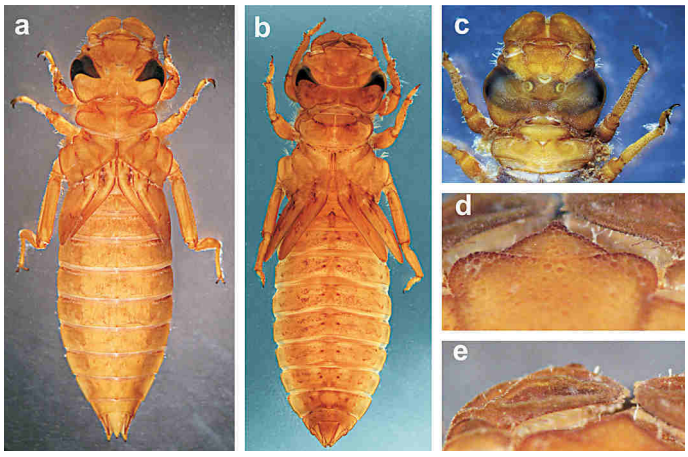
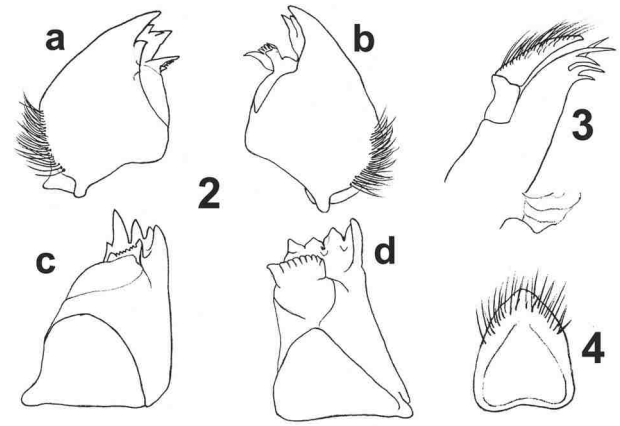
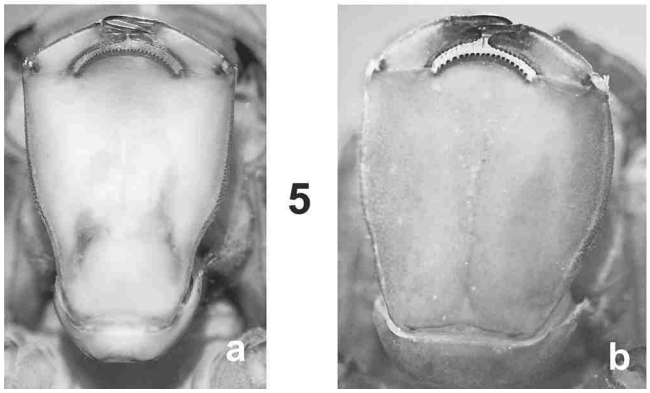


Fig. 1. Habitus (dorsal view) and details of the morphology of *Onychogomphus* spp. F0 larvae: (a) habitus of *O. thienemanni*, ♀; – (b) habitus of *Onychogomphus* sp., ♂; – (c) head and prothorax of *O. thienemanni*, dorsal view; – (d) detail of frons and postclypeus of *Onychogomphus* sp., dorsal view; – (e) detail of left antenna of *Onychogomphus* sp. showing raised granulose borders and depressed areas, dorsal view.

numerous scale-like setae on distal margin, pedicel short, irregular in shape with the external margin twice longer than internal one; 3rd antennomere the largest, subrectangular, scoop-shaped, dorsal (external) surface convex, strongly granulose, with some bare, small areas (Fig. 1c), dorsal, ventral and medial margins straight and beset with claviform setae and long, stiff setae, internal surface concave; 4th segment strongly reduced, almost imperceptible, placed on anterodorsal surface of the 3rd segment. Compound eyes relatively small, posterior margin widely concave (Fig. 1a). Occipital lobes bulging, finely granulose, occipital margin widely concave. Mandibles (Fig. 2) with formula: L 1234 0 a(m1-9)b / R 1234 y a(m1-7)b with a>b in both mandibles but notoriously larger in the right mandible. Maxillae: Galeolacinia with 7 moderately incurved teeth, the three dorsal teeth more or less of the same length and robustness, the three ventral teeth of different size (Fig. 3), the apical one the largest; stipes and palp very strongly setose. Ventral pad of hypopharynx subpentagonal (Fig. 4), basal third with a transverse, rectangular, light-amber plate, distal third with long, stiff setae arranged in a semicircle. Labium: Prementum--postmentum articulation reaching posterior margin of procoxae. Prementum subrectangular, longer than wide (Fig.





Figs 2-5. Details of larval morphology of *Onychogomphus* spp.: (2) mandibles: (a) and (c), right mandible, ventral and dorsointernal views, respectively; (b) and (d), left mandible, ventral and internal views, respectively; – (3) right maxilla, ventral view; – (4) ventral pad of hypopharynx; – (5) ventral view of prementa – [Figs 2-5a, *O. thienemanni*, 5b *Onychogomphus* sp.].

5a), sides straight on apical 0.60, convergent on basal 0.40, with 16-18 basidorsal spiniform setae, ventral surface with a week, longitudinal, medial sulcus along basal 0.70 of its length widening at apical end; basal margin widely concave; ligula moderately developed (Fig. 5a), its width comprising 52% of the maximum width of prementum, apical margin convex, with a ventral row of 31-33 short, subquadrate reddish-brown teeth, and dorsal rows of whitish piliform setae on apical border; labial palp mostly yellow, apical lobe reddish, widely rounded, its internal margin with a row of 17-18 small, low, squarely truncated teeth; movable hook reddish-brown, sharp and moderately incurved, 0.50 the palp's length.

T h o r a x. – Prothorax narrower than head, propleura bare, its inferior border with a dense brush of long, delicate, white setae; pronotum coarsely granulose except on large, bare, dorsolateral areas (Fig. 6a), anterior margin of anterior lobe more or less convex, anterior margins of posterior lobe straight, separated from anterior lobe by deep and wide grooves (Fig. 6a, arrow), posterior margin widely convex. Synthorax finely granulose; mesinfraepimeron not granulose but with abundant, long, delicate, white setae.

Legs yellow, stout and short (e.g. hind leg, when fully extended, reaching scarcely beyond posterior margin of S6) (Fig. 1a), densely granulose, with a dense brush of long, delicate, white setae on basidorsal surface of femora; pro- and mesotibiae with poorly developed burrowing hooks and numerous, reddish-brown tubercles on anterior surface (Fig. 1c), quite longer than respective femora; pro- and mesofemora short and bulky (Fig. 1a), metafemora slightly longer than metatibiae; tarsal formula 2-2-3, tarsi mostly bare dorsally, with some short, sparse, robust setae on ventral surface; claws simple with a pulvilliform empodium (Fig. 1c).

Wing pads divergent, anterior wing pads slightly surpassing anterior margin of S4, posterior ones reaching basal half of S4. Sterna granulose, no tubercles at all; prosternum with a transversal ridge beset with a row of long, stiff setae; a trapezoid bare area at middle part of mesosternum.

A b d o m e n. – Light yellow, densely granulose and lacking any kind of setae, reaching maximum width at S5-6 (Fig. 1a), ventral surface flat, no dorsal protuberances at all, only a low "hump" on S2 (Fig. 8a) and a rudimentary protuberance on S9 visible dorsally as a small "v" projection of the posterior margin (Fig. 1a); just a faint of rudimentary lateral spines on S8-9. Tergites without any definite color pattern, only a pair of small, brown dots along midline of tergites 3-8. Sternites finely granulose, yellow, sternite 8 divided in 5 plates (Fig. 9), remainder in 3 plates, median sutures of sternites convergent apically on 2, parallel on 3-5, slight and gradually divergent apically on 6-9, posterior margin of sternites 1-9 straight, wavy on 10. Caudal appendages yellow, sharply pointed (Fig. 10a), little more than twice as long as dorsal length of S10; male epiproct with tubercles at apical 0.24, size proportions: epiproct 1.0, paraprocts 0.94, cerci 0.74.

M e a s u r e m e n t s (in mm). – Total length (incl. app.) 18.4-19.8; abdomen: length 11.6-11.8, maximum width 5.7; maximum width of head 4.6-4.7; hind femur 3.2. Epiproct 1.2, paraprocts 1.1, cerci 0.95.

REMARKS. – Last instar larvae were collected in a third order stony stream in lowland dipterocarp forest reserve, only slightly shaded canopy, sparsely and altered riparian shrubs. Microhabitat: riffles of relatively rapid flowing water. Type of substrate: mixtures of cobbles, rough gravel, fine gravel, coarse sand with moderate amount of detritus.

ONYCHOGOMPHUS SPEC.

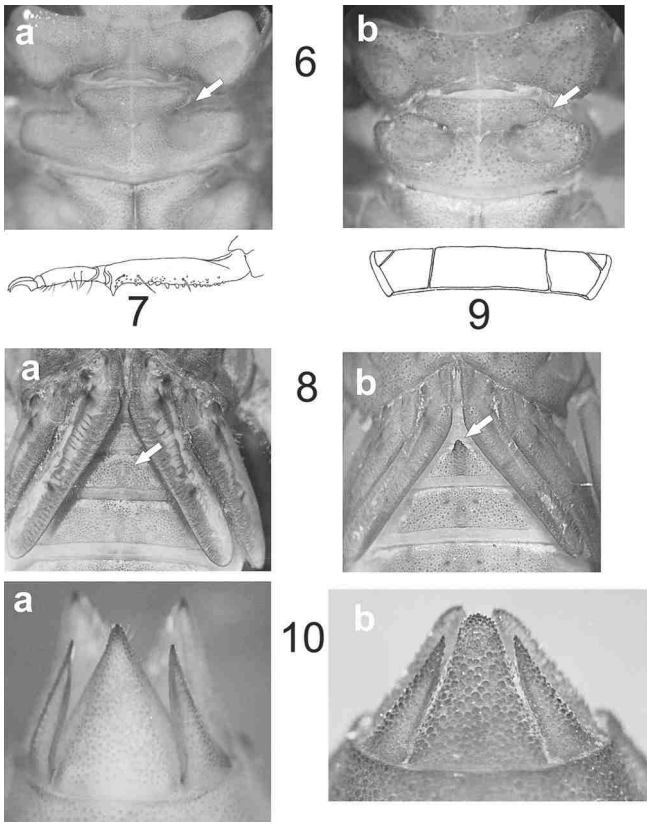
Figures 1b,d,e, 5b, 6b, 7, 8b, 9, 10b

M a t e r i a l. – 1 exuviae (♂), 2 F0 larva (♀). MALAYSIA: Perak, Banding, PITC Temengor Forest Reserve, 740 m asl (5° 31' 4" N; 101° 36' 26"E), 05-III-2009, C. Salmah leg. Additional material: 2 F0 larvae (♂,♀): THAILAND: Pattani province, Sai Khao, 135 m asl (6° 39' 26.14" N; 101° 05' 44.16" E,), 16-I-1995, Sites & Nichols leg. Deposited in Colección Entomológica del Instituto de Ecología, A.C. (IEXA) (2♂, 1♀), and in School of Biological Sciences, Universiti of Sains Malaysia (2 ♀).

DESCRIPTION. – Body stout and bulky, coloration reddish-yellow (Fig. 1b), integument granulose, with a combination of coarse and fine granules, head large, legs short, abdomen more or less spindle-shaped.

H e a d. – Similar to the previous species but differing on: Postclypeus produced anteriorly as a triangle, its tip nipple-shaped (Fig. 1d). Antennae reddish-yellow, dorsal (external) surface of 3rd antennomere strongly granulose, irregular, with some areas excavated and others raised (Fig. 1e), 4th segment a mere hemispheric rudiment placed on anterodorsal surface of the 3rd segment (Figs. 1b, e). Occipital lobes coarsely granulose. Prementum subquadrate (Fig. 5b), slightly longer than wide, sides convex, convergent basally, with 22-24 basidorsal spiniform setae; ligula poorly developed (Fig. 5b), its width comprising 40% of the maximum width of prementum, apical margin convex, with a ventral row of 18-20 short, subquadrate reddish-brown teeth, and dorsal rows of whitish piliform setae on apical border (Fig. 5b); labial palp yellowish-brown, apical lobe reddish-brown, widely rounded, its internal margin with a row of 11-12 small, squarely truncated teeth.

T h o r a x. – Propleura densely granulose, its inferior border with a row of long, stiff setae; anterior margin of anterior lobe of pronotum straight, anterior margins of posterior lobe wavy with some kind of "shoulder" (Fig. 1b), separated from anterior lobe by deep and narrow grooves (Fig. 6b, arrow), posterior margin strongly convex. Synthorax coarsely granulose, light yellow; mesinfraepimeron granulose, without any kind of setae; an isolated tuft of long stiff setae on inferior part of metapleura. Legs reddish, stout and shorter than previous species (e.g. when fully extended, hind leg scarcely surpassing posterior margin of S5) (Fig. 1b), densely granulose with some scattered, long, stiff setae mainly on femora and tibiae; pro- and mesotibiae with moderately developed burrowing hooks (Fig. 7); tarsi mostly granulose on dorsal surface.



Figs 6-10. Details of larval morphology of *Onychogomphus* spp.: (6) occiput and pronotum, dorsal view; arrows indicate the grooves separating anterior and posterior lobes of pronotum; – (7) left mesotibia and tarsus; – (8) wing pads and abdominal tergites 1-3; arrows indicate the low "hump" on tergite 2 (a), and the conical protuberance on tergite 2 (b); – (9) sternite 8 showing the 5 plates; – (10) caudal appendages, dorsal view: a, #; b, @ – [Figs 6a, 8a and 10a, *O. thienemanni*, 6b, 7, 8b, 9 and 10b, *Onychogomphus* sp.].

A b d o m e n. – Yellow to reddish-yellow, more or less spindle-shaped (Fig. 1b), dorsal surface convex with dorsal protuberances as follows: a subconical, forwardly directed protuberance on S2 (Fig. 8b), a very low and mound-like protuberance on S3-9, almost imperceptible on S3-6 (Fig. 1b); lateral margins lacking spines. Median sutures of sternites convergent apically on 2, parallel on 3, slight and gradually divergent apically on 4-9. Female g o n a p o p h y s e s very small, conical, bluntly-pointed, with a wide, U-shaped gap between each other. Caudal appendages reddish-yellow, short, twice as long as dorsal length of S10 (Fig. 1b), pyramidal, densely granulose; male epiproct roundly pointed (Fig. 10b), with tubercles very close to the tip, on apical 0.10, female epiproct roundly pointed, paraprocts with tips convergent and bluntly-pointed, cerci with tips convergent and sharply-pointed; size proportions: epiproct 1.0, paraprocts 0.82, cerci 0.72.

M e a s u r e m e n t s (in mm). – F0 female larvae: Total length (incl. app.) 17.4-17.8; abdomen: length 11.1-11.4, maximum width (ventral) 6.0-6.3; maximum width of head 4.8-4.9; hind femur 2.8-2.9. Epiproct 1.0, paraprocts 0.9, cerci 0.8. F0 male exuviae: Total lenght 17.9; abdomen: length 10.4, maximum width 5.6; maximum width of head 4.3; hind femur 2.8. Cerci 0.85.

REMARKS. – Larvae were found in a small, shallow, rocky first order pristine stream with rapidly flowing cool water and high oxygen content, mainly with closed canopy surrounded by undisturbed riparian shrubs. Microhabitat: riffles of sparsely scattered boulders, and a substrate composed mainly of rough gravel, cobbles and fine sand with a lot of detritus (±70%).

DISCUSSION

The most distinctive feature of the larvae of *Onychogomphus thienemanni* and *Onychogomphus* sp. is the shape and position of the 3rd antennomere in a manner of a protecting shield in front of the head. Both species are easily separated from each other by the following characters (those of *Onychogomphus* sp. in parentheses): 3rd antennomere appearing more or less uniformly granulose (with granulose raised areas and large, bare, excavated areas); postclypeus round shaped (triangular shaped); prementum subrectangular (subquadrate), sides straight (convex); ligula comprising 52% of the maximum width of prementum (comprising 40% of the maximum width of prementum). Propleura bare (granulose); anterior margins of posterior lobe of pronotum straight, grooves deep and wide (anterior margins of posterior lobe of pronotum wavy, with a "shoulder", grooves deep and narrow). Abdominal tergite 2 only with a low "hump" (with a subconical, forwardly-directed protuberance); epiproct sharply-pointed (roundly pointed).

In the general appearance, larvae of *O. thienemanni* and *Onychogomphus* sp. resemble the larva of *O. aequistylus* described by BUTLER (2004), mainly on: integument granulose, hypertrophied development of 3rd antennomere, frons laterally produced, legs short, fore and mid tibiae with short burrowing hooks and knoblike excrescences on fore tibiae, wing pads divergent. *O. aequistylus* agrees with *O. thienemanni* in the shape of postclypeus, pronotum and caudal appendages, and with *Onychogomphus* sp. in the integument coarsely granulate and by having a well-developed dorsal protuberance on S2. However, the mainly differences between the larvae here described and *O. aequistylus* are [those of *O. aequistylus* in brackets]: 3rd antennomere scoop-shaped, not rimmed (oval in shape with a distinctly expanded rim), 4th antennomere discernible (not discernible), ligula poorly developed (pronounced), abdomen with no discernible color pattern (abdomen heavily patterned), dorsal protuberances on S3-4 absent (large), lateral spines on abdomen absent (present on S5-9). The larvae of *O. thienemanni* and *Onychogomphus* sp. are smaller than other *Onychogomphus* larvae described to date (BUTLER, 2004), with *Onychogomphus* sp. being the smallest.

Finally, we speculate that probably our *Onychogomphus* sp. larva herein described could be *O. duaricus* Fraser or *O. castor* Lieftinck, both occurring in Peninsular Malaysia and Thailand, although we do not discard a new species.

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CEPHALAESCHNA XIXIANGENSIS SPEC. NOV., A NEW DRAGONFLY FROM SHAANXI, CHINA, WITH A KEY TO THE ADULTS OF THE CHINESE MEMBERS OF THE GENUS (ANISOPTERA: AESHNIDAE)

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The new sp. is described and illustrated. Holotype ♂: Maliu village (107°32' E, 32°43' N, altitude 1200m), Xixiang co., Shaanxi prov., China; deposited in the Shaanxi Bioresource Key Lab., Hanzhong, China. A key to the adults of the Chinese *Cephalaeschna* spp. is provided.

INTRODUCTION

The genus *Cephalaeschna* Selys, 1883, belonging to subtribe Brachytronini (Aeshnidae: Brachytroninae) (DAVIES & TOBIN, 1985), has 14 species listed globally (SCHORR et al., 2012). Species belonging to the genus are confined to Afghanistan, China, Bengal, Bhutan, India and Nepal. Within China several species of the genus have been described, including *Cephalaeschna chaoi* from Fujian (ASAHINA, 1982), *C. klotsi* from Fujian and Hongkong (ASAHINA, 1982; WILSON, 2006), *C. needhami* from Jiangxi, Fujian and Guangxi (ASAHINA, 1981b; WILSON, 2005), and *C. risi* from Fujian and Guangdong (ASAHINA, 1981b), *C. obversa* from Sichuan and *C. patrorum* from Sichuan and Shanxi (NEEDHAM, 1930), *C. dinghuensis* from Guangdong (WILSON, 1999) and *C. shaowuensis* from Fujian (XU, 2006).

TSUDA (2000) listed seven species of *Cephalaeschna* from China. HUA (2000) listed nine species of *Cephalaeschna*: *C. acutifrons*, *C. chaoi*, *C. klotsi*, *C. lugubris*, *C. masoni*, *C. needhami*, *C. obversa*, *C. patrorum* and *C. risi*, in his book, the catalogue of Chinese insects. WANG (2007) listed seven species of genus *Cephal-*

aeschna in China including the record of *C. acutifrons*. Both HUA (2000) and WANG (2007) had overlooked some aspects of Asahina's studies on the genus from the Himalayas and China (ASAHINA, 1978, 1981a, 1981b, 1982, 1983). In 1978 Asahina made a descripition of a new West Chinese *Periaeschna flinti* which had been mistaken as "*Cephalaeschna lugubri*" by Needham. ASAHINA (1981b) described *C. risi* from Chinese specimens previously identified as *C. acutifrons*. *Cephalaeschna magdalena* Martin 1909, known from China, was moved to the genus *Periaeschna*.

A new species of *Cephalaeschna* collected from Maliu village, Xixiang county, Shaanxi province in 1987 is described below. So, in total, there are now nine species of genus *Cephalaeschna* currently recognized from China, as listed below.

Cephalaeschna chaoi Asahina,1982
C. dinghuensis Wilson, 1999
C. klotsi Asahina,1982
C. masoni (Martin, 1909)
C. needhami Asahina,1981
C. obversa Needham,1930
C. patrorum Needham, 1930
C. risi Asahina,1981
C. shaowuensis Xu,2006

CEPHALAESCHNA XIXIANGENSIS SP. NOV.

Figures 1-6

M a t e r i a l – **Holotype** ♂: 31-VIII-1987, Maliu village (107^{0}32' E, 32^{0}43' N, altitude 1200m), Xixiang county, Shaanxi province, China, Yang Zu-de leg. **Paratype** 1♂, 31-VIII-1987, Maliu village (107^{0}32' E, 32^{0}43' N,, altitude 1200m), Xixiang county, Shaanxi province, China, Yang Zu-de leg. The holotype and paratype are deposited in the Shaanxi Bioresource Key Laboratory, Hanzhong, Shaanxi, China.

E t y m o l o g y: The new species name is from the type locality, Xixiang county, Shaanxi province.

GENERAL APPEARANCE. – Large dark brown dragonfly, head yellow with yellow green marking.

MALE. – H e a d (Fig. 1). – Labrum, labium, mandible and gena orange yellow. Anteclypeus, frons and face yellow. The center of anteclypeus with a pair of fine dark brown spots. The sides of postclypeus fresh yellow, the sides of down margin of postclypeus with fresh yellow trace and rest dark yellow. Between postclypeus and face with fresh yellow line. Top of frons tumid and pointed with dorsal surface brown. Anterior frons and upper frons without any marking. In frontal view the frons is bulged with upper, central thorn-shaped protuberance. Frons with dense hair. The width of face wider than half the width of head. Eyes black. Occiput black. The base of antenna blackish-brown, and the rest fresh orange yellow.

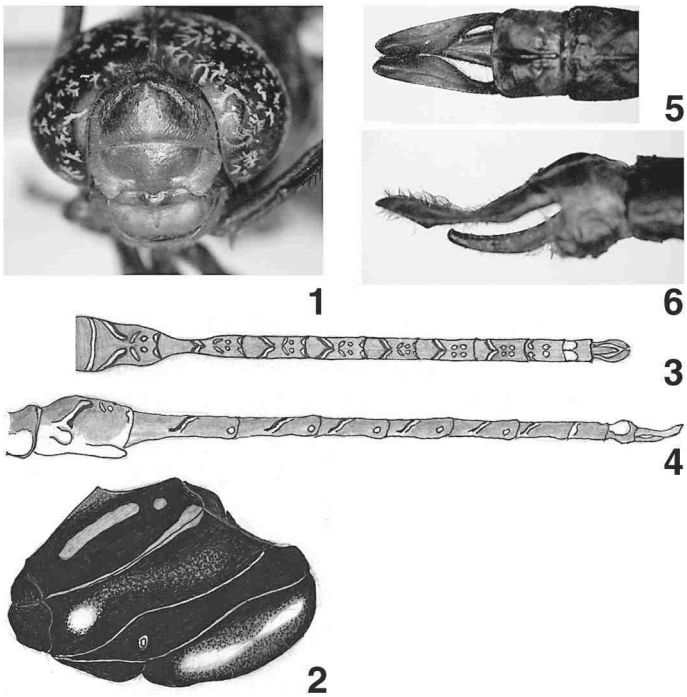
P r o t h o r a x and s y n t h o r a x (Fig. 2). – Prothorax yellow, and mid

lobe of prothorax with a black spot in sides and center with a pair of inconspicuous black spots. Synthorax brown, dorsal carina of synthorax raised with a distinct yellow edged peak. Antehumeral stripe dark green ending with a large posterior dark green spot (Fig 2). Humeral sutures marked with a fine dark yellow line, widening posteriorly. The lateral yellow marking of the synthorax is illustrated in Fig 2.

Legs. – Brown. Coxae, trochanters and base of femora pale.

Wings. – Hyaline. Margin of wing smoke gray. Costa and three primordial Ax fresh yellow. In Fw 25-27 Ax and 19-20 Px, 19-20 Ax and 19-21 Px in Hw. Pt yellow with brace, covering 4 cells. Anal loop 10 cells and anal triangle 5 cells.

A b d o m e n (Figs 3-4). – Brown with yellow markings. In dorsal view (Fig. 3), segment 1 with terminal yellow stripe, segments 2 to 6 with four pairs of markings, viz. basal stripe, middle stripe, spot and end stripe. Segment 2 between basal and middle stripes and segments 3 to 6 with a dark brown line before basal stripe. The basal stripes of segment 2 connected to dorsal carina, but segments 3 to 6 disconnected; segment 6 end stripe reduced to spot; segments 7 to 8 without end



Figs 1-6. *Cephalaeschna xixiangensis* sp. n.: (1) head; – (2) thorax, lateral view; – (3) abdomen, dorsal view; – (f) same, lateral view; – (5) caudal appendages, dorsal view; – (6) same, lateral view.

stripe, but with a dark brown line before basal stripe. Segment 9 middle stripe and spot converged forming a large marking. Segment 10 with basal half yellow and distal half brown; middle of dorsum pale. In lateral view (Fig. 4), segment 1 underside with a large yellow marking, and top blackish-brown. Segment 2 mainly yellow below which joins yellow dorsal markings. Segment 3 basal half dark yellow below. Sides of segments 3 to 7 with distal medial yellow spot**.**

Anal appendages (Figs 5-6). – Dark yellow. Supra anal appendages blackish--brown; tips obtuse without any protuberance. The inner margin of supra anal appendages angled downwards bulged and forming a triangular protuberance. Supra anal appendages almost twice as long as 10th segment. In lateral view inferior anal appendages length almost equal to two-thirds supra anal appendages length, and tip pointed up.

Measurements (mm). – Abdomen + appendages length 60.5-61.0 ; Hw 50.5-51.0

FEMALE unknown.

DIFFERENTIAL DIAGNOSIS. – The distinct thoracic and ventral markings of the new species differentiate it from all other species of *Cephalaeschna*.

REMARKS. – *Cephalaeschna* with markedly bulged and roundly outlined face. Obtusely angled tips of male superior appendages, simple tenth abdominal sternite. The presence of pterostigmal brace vein that is straight and aligned with the proximal side of pterostigma, and 4-5 celled anal triangle in male wings. *Periaeschna* narrow faced. Marginal hairs of frons not so long as in *Cephalaeschna.* Male caudal appendages with externally pointed apex. Pterostigma long, and the anal triangle is usually comprised of only three cells.

The male specimens belong by their characteristics to *Cephalaeschna* rather than to *Periaeschna*.

KEY TO CHINESE DRAGONFLIES OF THE GENUS *CEPHALAESCHNA*

1 Legs distinctly bicoloured. Trochanters and basal two-thirds of femora extremely pale brown, almost to whitish. Apical third of femora, tibiae and claws dark brown. Female cerci more than twice of segment 10 in length (2.0 mm) ..... ***Cephalaeschna dinghuensis***

– Legs mainly brown, not distinctly bicoloured. Cerci distinctly less than twice of segment 10 in length 2

2 Abdominal segment 2 without median transverse stripe ..... ***C. klotsi***

– Abdominal segment 2 with median transverse stripe 3

3 Abdominal segments 3 to 7 without median transverse stripe ..... ***C. chaoi***

– Abdominal segments 3 to 7 with median transverse stripe 4

4 Anterior end of antehumeral stripe with a spot. In dorsal view, abdominal segment 2 with four pairs of yellow stripes ..... ***C. xixiangensis*** sp. n.

– Anterior end of antehumeral stripe without spot. In dorsal view, abdominal segment 2 with three pairs of yellow stripes 5

5 Frons narrower than half of head width ..... ***C. risi***

– Frons equal to or more than half head width 6

6 Frons wider than half width of head 7

– Frons equal to half width of head 8
7 Antehumeral stripe arc. Side of synthorax yellow with only black brown stripe which cover second and third sutures ..... ***C. obversa***
– Antehumeral stripe cuneate. Metepismeron and mesepismeron mostly yellow green. Metepisternum with three yellow green spots ..... ***C. patrorum***
8 Antehumeral stripe arched. In dorsal view, abdominal segments 2 to 6 with medial, bifurcated transverse stripe and pair of posterior yellow spots ..... ***C. needhami***
– Antehumeral stripe small, diagonally furcated. In dorsal view, abdominal segments 1 to 2 with dorsal stripe and the rest without any markings ..... ***C. shaowuensis***

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Odonatologica 42(1): 45-53 *March 1, 2013*

SHORT COMMUNICATIONS

PARAGOMPHUS CAMPESTRIS SPEC. NOV., A NEW ENDEMIC DRAGONFLY FROM SRI LANKA (ANISOPTERA: GOMPHIDAE)

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The new sp. is described and illustrated. Holotype ♂: Mawanella, Hingula Oya; Kegalle distr., Sabaragamuwa prov.; 22-IV-1976; deposited in State Collection of Zoology, Munich. The currently known information on its distribution, phenology and ecology is provided and discussed.

DISCUSSION

Altogether 14 species of Gomphidae have so far been reported from Sri Lanka and with the exception of *Ictinogomphus rapax* (Rambur, 1842) all are endemic to the island (BEDJANIČ, 2004; BEDJANIČ et al., 2007; DE FONSEKA, 2000; FRASER, 1933, 1934). One of the commonest endemic representatives of the family is *Paragomphus henryi* (Laidlaw *in* Campion & Laidlaw, 1928), so far the only *Paragomphus* known from Sri Lanka. It is closely related to *P. lineatus* (Selys, 1850), an Oriental species with much wider distribution, found throughout India (FRASER, 1934; SUBRAMANIAN, 2009), in Myanmar, Nepal and reaching even southeastern Turkey and Syria in the West (BOUDOT et al., 2009).

Discussing *P. henryi*, FRASER (1933) described its Sri Lankan distribution as "*The commonest Gomphine in the island. I found it everywhere and at all elevations*…", while FRASER (1934) wrote that "*It is the commonest Gomphine found in the island, and is met in numbers on most streams in submontane areas*…". Almost eight decades later, due to diverse negative human influences on running waters, the situation is different and nowadays *P. henryi* is not so common anymore, being known from around 70 localities concentrated in central and southwestern

part of Sri Lanka (BEDJANIČ et al., 2013). Here, it inhabits fast to moderately slowly flowing streams and rivulets in hills and mountains. Since in the field *P. henryi* is easily recognized and well distinguished from other gomphids of the island, not much attention has been devoted to collecting and comparison of species' specimens in recent years.

In the frame of over a decade long work on the *Distribution atlas of the dragonflies of Sri Lanka* the only puzzling information falling out of the general ecological and distributional picture for the species has been the widely isolated record of a single male *P. henryi* from the northeastern plains of the island in Wilpattu National Park. The specimen was collected in 1976 by the Smithsonian insect project in Sri Lanka whose odonatological material was determined by M.A. Lieftinck. This dubious record was unresolved until my visit to the State Collection of Zoology in Munich, where in 2011 I came across a different looking *P. henryi* labeled specimen in the rich odonatological collection of G. von Rosen. Although its locality is not evidently isolated from records of *P. henryi*, the comparison with true *P. henryi* voucher specimens and photos surprisingly showed that it might belong to an undescribed species. Subsequent checking of the Smithsonian Institution material revealed that the mysterious Wilpattu specimen belonged to the same taxon. Checking of all available photographic material and some voucher specimens, as well as recent fieldwork on the island brought additional information and knowledge so it is possible to round up the story here with the description of the second endemic *Paragomphus* species from the lowlands of Sri Lanka.

PARAGOMPHUS CAMPESTRIS SP. NOV.

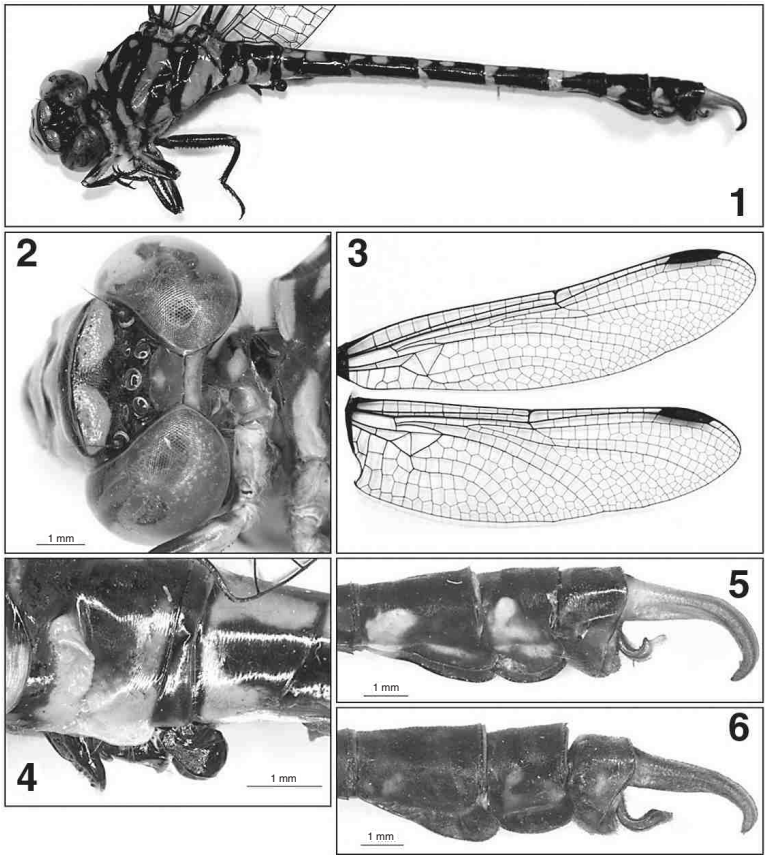
Figures 1-5

M a t e r i a l. – **Holotype**: 1♂ (mature male; from odonatological collection G. von Rosen: No. 4866, State Collection of Zoology, Munich, Germany), Mawanella, Hingula Oya; Kegalle district; Sabaragamuwa province; N7º 14.9', E 80º 27.9'; alt. 140 m; 22-IV-1976; G. von Rosen leg., M. Bedjanič det. – **Paratype**: 1♂ (mature male; from Entomological collection of NMNH, Smithsonian Institution, Washington DC, USA: USNM ENT 00360182); Wilpattu National Park, Kokmotte Bungalow; Puttalam district; North Western province; N 8º 31.7', E 80º 1.6'; alt. 30 m; 23/25-V-1976; K.V. Krombein, P.B. Karunaratne et al. leg., M. Bedjanič det. – The holotype is deposited at State Collection of Zoology (Munich, Germany). The paratype is deposited in the entomological collection of the National Museum of Natural History, Smithsonian Institution (Washington DC, USA).

E t y m o l o g y. – The species epithet *campestris* (Latin) is an adjective referring to the occurrence of the new species in the lowlands of Sri Lanka.

DIAGNOSIS. – Medium-sized *Paragomphus*, with common black and yellow generic colouration, and the shape of superior anal appendages characteristic for the genus. Closely related to *P. henryi*, from which it can be differentiated by two isolated squarish black spots instead of a black line on the ventral border of postclypeus, by broader and more rounded yellow spots on frons, by yellowish oval spot behind the occeli and yellowish instead of black occiput, by narrow yel-

low humeral stripes, which are absent in *P. henryi* and by the upwards bent black line bordering metepimeron not reaching posterior end of thorax. Abdominal markings of both species are clearly different, *P. campestris* having two pairs of subdorsal spots on segments 4-6 instead of only one in *P. henryi*. Also anal appendages in males clearly different, with superior appendages more curved and inferior appendages shorter and strongly bent upwards in *P. campestris*. Eyes in males of the new species are blue in life, whilst they are greyish or bluish green in males of *P. henryi*. From the widely distributed and very variable *P. lineatus*, the new species is distinguished at a glance based on different thoracic markings and differences in anal appendages. Apart from thoracic and abdominal colour pattern also the vulvar scales are differently shaped in females of both species.



Figs 1-5. *Paragomphus campestris* sp. n., holotype ♂: (1) whole body, lateral view; – (2) head and prothorax; – (3) wings, right pair; – (4) accessory genitalia, lateral view; – (5) anal appendages, lateral view; – Fig. 6. *P. henryi*: anal appendages, lateral view.

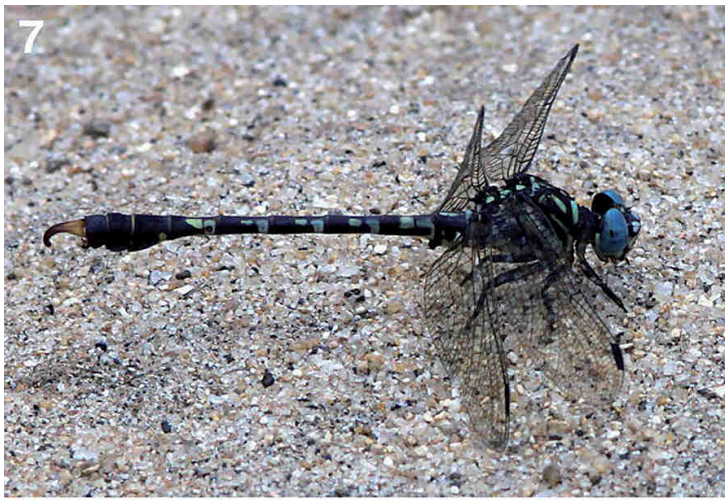
MALE (**holotype**, dried specimen). – H e a d . – Maxilla and labium light yellow, mandibles dark brown, with yellow dorsolateral portions towards labrum and anteclypeus. Labrum yellow, with only the edge bordered with black and with blunt triangular black area extending one third of its width from the base dorsally. Ventral part of genae yellow, dorsal part greyish. Anteclypeus and postclypeus yellow, the latter with two isolated squarish black spots on its ventral border. Anterior surface of frons shiny black, except of very narrow yellow line on the border to postclypeus. Dorsally, frons with two large semielliptical yellow spots, with straight anterior and evenly rounded posterior borders (Fig. 2). Bases of antennae black, scapus with yellowish anterior ring, other segments black. Vertex black, with ill-defined yellowish oval spot behind the occeli crest. Occiput yellowish, its posterior border upturned and brownish at the top. Eyes in preserved specimen brown (Fig. 2).

T h o r a x . – Black, marked with yellow as in Figures 1 & 2. Prothorax with a pair of elongated yellow spots on dorsum of posterior lobe from which a tuft of long setae is growing and a pair of larger yellow spots laterally (Fig. 2). Mesothoracic collar stripe yellow and interrupted with black dorsal line. Middorsal carina black, except of small yellow spot anterior of pointed carina crest. Antehumeral stripes yellow, short and pointed. Small yellow upper humeral spots distinctly separated from narrow yellow humeral stripes, which are almost continuous with yellow mesinfraepisternum. Sides of thorax with broad yellow stripe on mesepimeron and broadly yellow metepimeron, with three yellow spots between them and a triangular spot above posterior coxa. Anterior and ventral border of metepimeron rimmed with black line, which is bent upwards posteriorly and doesn't reach posterior end of the segment. Under surface of thorax yellowish. Legs dark brown to black on tibiae and tarsi, inner surfaces of femorae brown, outer sides striped yellowish, as are trochanters and coxae (Fig. 1).

Wings hyaline, venation black. Forewings with 12 Ax and 7 Px, hindwings with 9 Ax and 7/8 Px. Pterostigma elongate and very dark brown, braced by thick black veins, covering 3 and 3½ underlying cells in forewings and 3½ and 4 cells in hindwings. 4 cells in anal triangle. From discoidal cell to the wing border a row of 8 undevided and 3 devided cells between veins A_1 and CuP. Wing venation of the holotype male is shown in Figure 3.

A b d o m e n . – Black, marked with yellow as shown in Figure 1. Segment 1 with pointed yellowish dorsal apical spot and large latero-apical yellow spot on each side. Segment 2 with elongated dorsal yellow spot, sharply conical in basal third and markedly constricted in the middle of remaining two thirds of its length. Ventro-lateral parts of segment 2 yellow, including auricles. Segments 3-6 with two pairs of subdorsal spots on basal halves of segments. The basal pair triangular and except on segment 4 connected to basal latero-ventral yellow markings. The apical pair biggest and almost squarish on segment 3, becoming gradually smaller and narrower towards segment 6. Segment 7 with yellow basal annulus and

elongate subdorsal spot, both covering the basal two-thirds of the segment and interrupted dorsally by a thin black line. Segments 8 and 9 black dorsally, with yellow intersegmental joint between them. Both with latero-ventral basal yellow spots and broad rounded projections, which are yellowish basally and broadly bordered with dark brown. Segment 10 black dorsally with small yellowish spot, sides and ventral parts dark brownish.



Figs 7-8. *Paragomphus campestris* sp. n., life colouration: (7) ♂, Gal Oya, 1-VIII-2010; photograph by K. Conniff; – (8) teneral ♀, Mahiyangana, 29-X-2012, photograph by M. Bedjanič.

Accessory genitalia black, shown in Figure 4. Basal half of anal appendages yellow, becoming brown towards apex. Superiors long, double the length of segment 10, terminal half curved regularly downwards as in Figure 5. Seen from above, superiors separated at base, converging to the point of curving after which again slightly divergent. Inferior appendages one third of the length of superiors, brownish basally and yellowish apically, strongly curved in a downward and then upward direction, with small tubercle pointing straight upwards to the superiors and bifid apical part directed caudally towards curved section of superiors (Fig. 5).

FEMALE (photographs of freshly emerged animals only, see Fig. 8]. − Colouration in life very similar to male with more extensive yellow markings. Face yellow, with very restricted black markings, postclypeus without black line. Frons dorsally with two large semi-elliptical yellow spots, as in male. Yellow oval spot behind the occeli crest more pronounced, occiput yellow.

Thorax marked as in male. Yellow spot anterior of pointed middorsal carina crest bigger. Narrow yellow humeral stripes clearly defined, the black line bordering metepimeron is bent upwards posteriorly and doesn't reach posterior end of the segment as in male. Wings hyaline, venation black. Forewings in two specimens with 14 Ax and 9 Px and 13/12 Ax and 8 Px, hindwings with 9/8 Ax and 8/7 Px. Pterostigma elongate and dark brown, covering 4-5 underlying cells.

In general, abdominal markings similar to male, but more extensive (Fig. 8). Segments 3-6 with two pairs of large subdorsal spots extending clearly over halves of the segments. Basal spots on these segments prolonged laterally in form of narrow whitish annules which are ventro-laterally extending apically over two thirds of the segments. Segment 7 similar, with broader basal latero-ventral annule and two pairs of yellow subdorsal spots connected. Segments 8-10 whitish to yellowish on sides. Vulvar scale short, triangularly shaped towards apex, with almost rectangular deep notch medio-apically.

M e a s u r e m e n t s (in mm). ♂ – head width: 6.2; abdomen length, with appendages: 32.8; fore- and hindwing length: 26.2, 24.4; fore- and hindwing pterostigma length: 3.6, 3.5; superior appendages: 3.3; inferior appendages: 1.1.

FAUNISTIC RECORDS. – **(1)** Mawanella, Hingula Oya rivulet; Kegalle district; Sabaragamuwa province; N 7°14.9', E 80°27.9'; alt. 140 m; 22-IV-1976; G. von Rosen leg.; 1♂; – **(2)** Wilpattu National Park, Kokmotte Bungalow; Puttalam district; North Western province; N 8°31.7', E 80°1.6'; alt. 30 m; 23-25-V-1976; K.V. Krombein, P.B. Karunaratne et al. leg.; 1♂; – **(3)** Mahiyangana, Mahaweli Ganga 300 m N of the bridge on the Hasalaka-Mahiyangana road; Badulla district; Uva province; N 7°20.4', E 80°59.1'; alt. 80 m; 29-X-2012; M. Bedjanič; 1 ten. ♀ (photograph); – **(4)** Minneriya, surroundings; Polonnaruwa district; Northern Central province; N 8°7.5', E 80°53.5'; alt. 100 m; 9-VI-2011; 1 ten. ♀ (photograph submitted by N. van der Poorten); 10-VI-2011; 1 juv. ♀ (photograph submitted by N. van der Poorten); 1-VIII-2011; 1 juv. ♀ (photograph submitted by N. van der Poorten); – **(5)** Maha Oya, Maha Oya river under the bridge on the road Batticaloa-Mahiyangana; Ampara district; Eastern province; N 7°32.3', E 81°21.9'; alt. 50 m; 10-VII-2012; M. Bedjanič; 1 ten. ♂ (observed at emergence); – **(6)** Small rivulet 12km SE of Bulupitiya, before the inflow into the Senanayake Samudra Lake, Nilgala, Gal Oya National Park; Monaragalla district; Uva province; N 7°11.4', E 81°25.3'; alt. 100 m; 1-VIII-2010; K. Conniff; 1♂, 1 juv. ♂ (photographs).

DISTRIBUTION, PHENOLOGY AND ECOLOGICAL NOTES

All currently known faunistic records for *P. campestris* are summarized under species description section and presented in Figure 9. All six localities of the new species lie exclusively in the lowlands of Sri Lanka, with altitude ranging from only 30 m in Wilpattu National Park to 140 m in Hingula Oya near Mawanella. It is interesting that some of these localities, especially Mahaweli Ganga in Mahiyangana, lie in only a few kilometres distance to the hills in which the *Paragomphus* records were confirmed as *P. henryi*.

Based on the current knowledge it can be speculated that *P. campestris* is more widely distributed in the northern lowland part of the island, whereby its congener *P. henryi* occurs in the hilly and mountainous regions of central and southern Sri Lanka (Fig. 9). It is possible, although not very likely, that some of the records for the latter species in the northern and eastern border sections actually belong to *P. campestris*, however, this can only be established with future fieldwork. Since the odonatological coverage of northern and eastern lowland parts of Sri Lanka had many white spots in the past and far more attention has been devoted to endemic species rich southwestern part of the island (BEDJANIČ et al., 2013), I expect that through additional fieldwork *P. campestris* will be discovered at more localities.

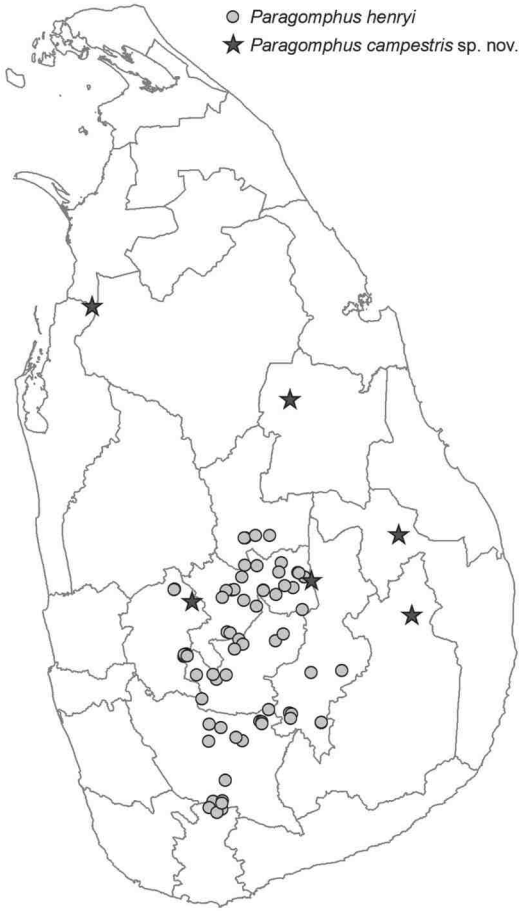


Fig. 9. Currently known distribution of *Paragomphus campestris* sp. n. and *P. henryi* in Sri Lanka, modified from BEDJANIČ et al., 2013.

As the northern and eastern lowland parts of Sri Lanka are quite dry and not very rich with streams and rivers the search strategy for the

species is obvious and simple, especially if available phenology data are considered. Based on the hereto known records, the adults of *P. campestris* can obviously be seen at least from April till October and emergence has been observed in June, July, August and October.

Although current knowledge on the habitat requirements of *P. campestris* is scarce, it seems that the species has quite wide ecological tolerance. It inhabits slowly flowing streams and rivulets as well as large lowland rivers like Mahaweli Ganga. The locality in Gal Oya National Park, where an adult and a juvenile male were observed in August 2010, can be described as a rocky rivulet with sandy banks surrounded by large evergreen trees and a few small shrubs and vines over the water (K. Conniff, pers. comm.). At least during the dry season, when emergence of *P. campestris* was observed in July 2012, Maha Oya river can be described as a small slowly flowing shallow sandy river with shrubs and some trees on the banks.

Due to the fact that *Paragomphus* specimens have not been carefully checked or extensively collected by researchers in the past and that only individual photographs or specimens are present in collections, it is almost impossible to speculate on the species abundance at certain localities. However, at least in Mahaweli Ganga, very numerous *Paragomphus* larvae, most probably belonging to *P. campestris*, were observed in July 2012 in the shallow sandy bottom near the banks north and south of the bridge on the Hasalaka-Mahiyangana road. If the larval identity speculation, based on observation of a just emerged female in October 2012 is correct, then the population of *P. campestris*, at least in the section of Mahaweli around and north of Mahiyangana is huge. But to convert the above speculations into solid facts, also for this Sri Lankan endemic, a detailed assessment of its distribution, estimation of population sizes and future monitoring are needed.

ACKNOWLEDGEMENTS

Thanks are due to Dr ERNST-GERHARD BURMEISTER and Mrs KATJA NEVEN (ZSM Munich, Germany) for loan of material from Mr GERT VON ROSEN collection in ZSM and kind hospitality. Dr OLIVER FLINT (NMNH, Smithsonian Institution, Washington, USA) kindly enabled examination of the paratype in the Entomological Collection of Smithsonian Institution. Dr KAREN CONNIFF (Kathmandu, Nepal) and Mrs NANCY VAN DER POORTEN (Toronto, Canada) kindly contributed photos and shared data. Dr MATJAŽ KUNTNER (Ljubljana, Slovenia) helped with equipment and photos of the paratype, while Mr ALI ŠALAMUN (Ljubljana, Slovenia) helped with distribution maps. Part of author's fieldwork has been conducted in the frame of the Rufford Small Grant No. 11448-1 "*Distribution atlas of the dragonflies of Sri Lanka: focus on the globally endangered species included on the IUCN Red List of Threatened Species*" funded by the Rufford Small Grants Foundation.

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FIRST EVIDENCE OF THE OCCURRENCE OF *CORDULEGASTER INSIGNIS* SCHNEIDER, 1845 IN SERBIA (ANISOPTERA: CORDULEGASTRIDAE)

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Two *C. insignis* specimens from Serbia were found in the collection of the National Museum of Bosnia and Herzegovina. These constitute both the first record of the sp. in Serbia and its north-westernmost record worldwide. The distribution of the sp. in Europe and the taxonomic characters of the specimens are presented and discussed.

INTRODUCTION

The knowledge of the genus *Cordulegaster* has been subjected to strong changes during the last decades. According to the structure of the anal appendages, two groups of species are recognized in Europe, the group *boltonii* and the group *bidentata*. BOUDOT (2001) presented a synthesis of the knowledge on this genus in the Western-Palaearctic and gave an illustrated key for the identification of the various species in this area.

Cordulegaster insignis belongs to the *bidentata* group, whose distribution is restricted to southeastern Europe and southwestern Asia. Because of strong variations in the yellow abdominal pattern, a number of subspecies have been described but their validity is still debated and the details of their ranges remain poorly known (DIJKSTRA & LEWINGTON, 2006; BOUDOT et al., 2009).

In Europe, *C. insignis* is distributed in the South of Romania, Bulgaria, the Greek and Turkish Aegean islands and the European part of Turkey (DIJKSTRA

& LEWINGTON, 2006; BOUDOT et al., 2009; DARAŻ, 2009). According to DIJKSTRA & LEWINGTON (2006), this species is confined to small streams but occasionally inhabits larger and deeper waters. Details of the habitat were given also by D'AGUILAR et al. (1998) and MARINOV et al. (2007). Differences in habitat preferences exist between regions but, although LEIPELT (2005) showed that the species suffers from long drift during highflow events, and thus remains confined to waters with low discharge and current velocity, namely springs and springbrooks, its ecology is still insufficiently studied (MARINOV et al., 2007). According to published data, the western border of Bulgaria constitutes the western limit of the range of *C. insignis*. NEDELKOV (1923) was the first to report the presence of the species in this country. Later, populations were discovered in the Black Sea region as well as at several localities along the Danube river. Recent records from western Bulgaria confirm the occurrence of this species along the Danube river, close to the border with Serbia (MARINOV et al., 2007). All *C. insignis* records, including species biology and ecology data for Bulgaria, were given and discussed by MARINOV et al. (2007).

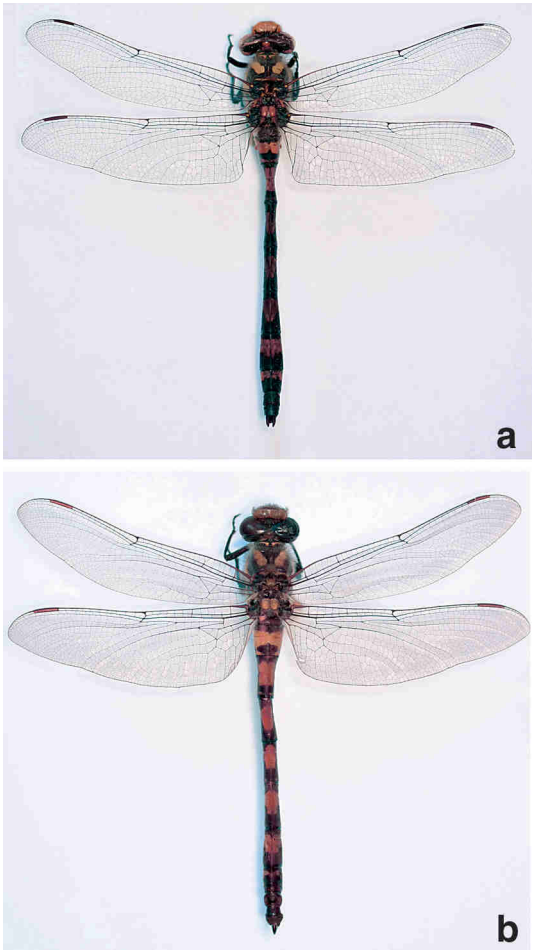


Fig. 1. *Cordulegaster insignis* from Požarevac: (a) male; – (b) female.

Taking into account that the Danube flows from Serbia to Bulgaria and that populations of *C. insignis* exist close to the Serbian border, it can be expected that this species could also inhabit either some Danube tributaries in Serbia or the Danube itself, taking advantages of relevant micro-habitats on its shores as in Bulgaria. That was also suspected by MARINOV et al. (2007), who discussed the possibility that the species

can exist further to the west in Serbia and Montenegro.

According to the most recent data given by BOUDOT et al. (2009), 60 species are recorded in Serbia. Data on the dragonfly fauna of Serbia is still relatively poor and the amount of available data is very low (JOVIĆ et al., 2008, 2009).

In this paper we present the first record of *Cordulegaster insignis* from Serbia.

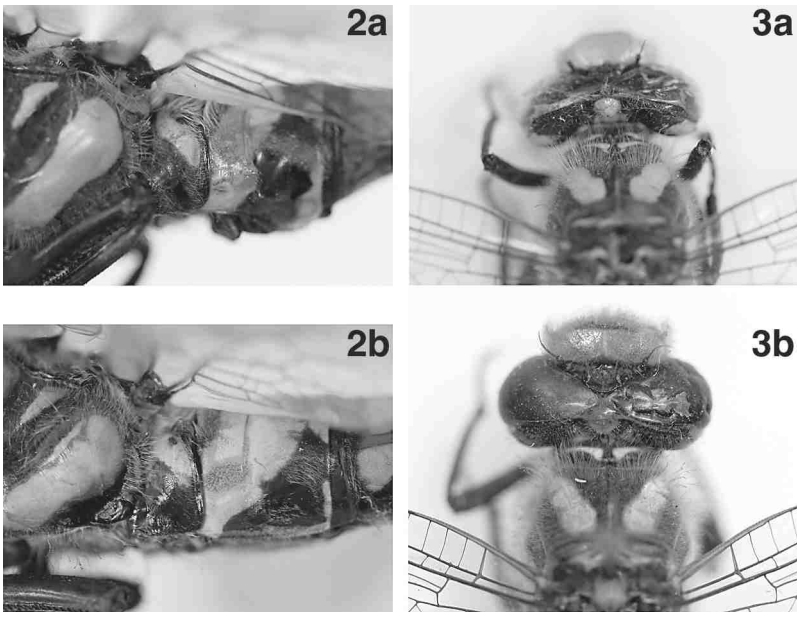
MATERIAL AND METHODS

During the revision of the Odonata in the entomological collection of the National Museum in Sarajevo, all dragonflies were re-examined by the first author and two specimens of *Cordulegaster insignis* were found, together with several specimens of *C. bidentata*. Keys from BOUDOT (2001) and DIJKSTRA & LEWINGTON (2006) were used for their determination.

These two specimens have printed labels with both locality and collector names but lack the date of collection. They are located in the entomological collection of the Balkan Peninsula in the above Museum, a collection with more than a thousand dragonflies from the Balkan Peninsula, collected mainly from 1888 to 1932. As they had no inventory number, numbers APF 12869 & APF 12870 were given.

RESULTS

The two *Cordulegaster insignis* specimens, a male and a female, were collected in the city of Požarevac or in its vicinity in northeastern Serbia (44°37'N, 21°11'E).



Figs 2-3. *Cordulegaster insignis* from Požarevac, (a) male, (b) female: (2) club-shaped yellow patch on the sides of the first abdominal segment; – (3) yellow occipital triangle.

They were stored together with a number of dragonfly specimens from the same area, all collected in 1894 by Moricz Hilf. The latter, an Austro-Hungarian military officer and amateur entomologist, collected insects in several localities in Bosnia and Herzegovina, Croatia and Serbia and sent his specimens to Viktor Apfelbeck, an entomologist in the National Museum in Sarajevo at that time (ADAMOVIĆ et al., 1992).

No details of the precise locality or habitat are available. There are several rivers and streams in the Požarevac region. This city is situated in a lowland area at around 80 m above sea level in the Velika Morava river valley, a significant right--bank tributary of the Danube river. It is situated 13 km from the Danube river and stands 165 km as the crow flies to the NW from the westernmost locality of the species on the Danube in Bulgaria. Following the watercourse of the Danube, it is 325 km upstream from the nearest Bulgarian locality.

The Velika Morava river runs between the Carpathian mountains in the East and the Dinaric Alps in the West. This area is open to Mediterranean influences through the Morava and Vardar river valleys and to eastern Balkans influences through the Danube valley (JOVIĆ et al., 2009).

The two *C. insignis* specimens were identified by the extended yellow pattern on the abdomen (Fig. 1a & 1b), the club-shaped morphology of the yellow patch on the sides of the first abdominal segment (Fig. 2a & 2b), the colour and shape of the occipital triangle, of which the posterior edge is characteristically oval and swollen as in a small rugby ball (Fig. 3a & 3b), the male venation (anal trian-

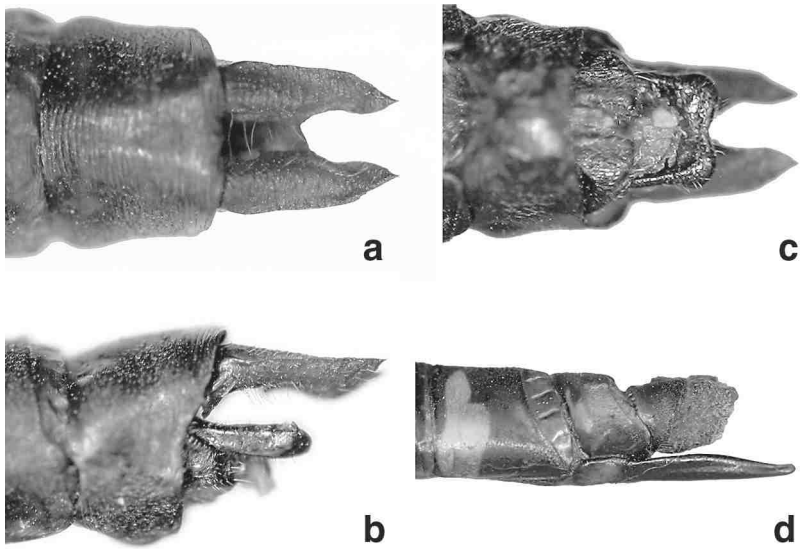


Fig. 4. *Cordulegaster insignis* from Požarevac: (a) male appendages, upper, dorsal view; – (b) same, upper lateral view; – (c) same, lower, ventral view; – (d) female ovipositor, lateral view.

gle 3-celled), the structure of the male upper abdominal appendages, which are straight with two teeth visible in lateral view, with the first one very basal (Fig. 4a), the squarish shape of the male lower appendage (lateral sides parallel, not tapering as in *C. bidentata*) (Fig. 4b) and the characteristics of the female ovipositor, which shows a basal yellow spot clearly distinct from its overall blackish colour (Fig. 4c) .

DISCUSSION

The two *C. insignis* specimens constitute both the first record of this species in Serbia and its north-westernmost record in Europe and worldwide (Fig. 5). This record shifts the western limit of the species in Europe by 123 km to the West.

By checking the literature, we found that these specimens had been reviewed in the past by the Serbian entomologist Ž.R. Adamović in 1948, who, unfortunately, did not determine them satisfactorily. In his paper (ADAMOVIĆ, 1948), he mentioned them under the name "*Cordulegaster annulatus* Latr." with the subsequent remark: "Izgled ovih egzemplara ne poklapa se sasvim sa opisom srednjeevropskih. Vjerovatno se radi o nekoj nižoj sistematskoj kategoriji, ali usljed nedostatka literature ostavio sam ih, za sada, sa ovakvom etiketom" ["These specimens do not completely match in their appearance with the description of central European ones. It is probably a lower taxonomic category but because of the lack of literature I have left them, for now, with this label"].

The reason for this mistake was probably, as he stated, the lack of appropriate literature for the determination of European *Cordulegaster*. It is certain that Adamović referred to these two specimens of *C. insignis*, because this old dragonfly collection is in the same condition as it was when Adamović visited the Museum in 1948. Furthermore, only two *Cordulegaster* specimens came from Požarevac in this collection, namely the male and the female recorded by Adamović as *C. annulatus*. All other *Cordulegaster* specimens in this collection are from Bosnia and Herzegovina and belong to *C. bidentata*.

Based on the identification made by Adamović, ST. QUENTIN (1952) suggested that these specimens may belong to the so-called "*C. annulatus charpentieri* (Kolenati, 1846)", that was followed later by ADAMOVIĆ (1967). DUMONT (1976) resolved the confusion concerning this incorrect nomenclature, and demonstrated that the name *charpentieri* applies only to a subspecies of *C. insignis*, the initial imbroglio originating to changing descriptions over time by Selys. DUMONT (1976) made the assumption that these specimens could be *C. picta* Selys 1854, a taxon which was subsequently redefined through comparison with *C. heros* Theischinger, 1979 (THEISCHINGER, 1979). Finally, ADAMOVIĆ et al. (1992) reassigned all the Serbian specimens of *Cordulegaster* previously reported as belonging to the group *boltonii* as *C. heros*, without new examinations of these specimens.

Here we establish that these specimens are actually *Cordulegaster insignis* and state that the species was present in the past in Serbia. This record shows that this species went much more to the West than currently believed, taking advantage

Fig. 5. Distribution of *Cordulegaster insignis* in Europe and western Anatolia (modified from BOUDOT et al., 2009). White dots represent records before 1980, black dots records from 1980 onward, and the white triangle the new Serbian locality.

of the Danube to cross the southern Banat hills by the Iron Gate gorge ("Portile de Fier"), illustrating again the well known eastern Balkan influence in the lower Velika Morava river. Clearly, the Danube acts as a corridor and connects this area with the main range of this species in the East. Given that most of the localities where *C. insignis* occurs along the Danube in the neighbouring Bulgaria were discovered just recently, the present records were not unforeseeable.

As these Serbian records date from 1894, we can assume that the recent western Bulgarian *C. insignis* populations are not the consequence of a recent expansion of the species to the West but are just due to former insufficient field investigations.

Considering that the species today is present along the Bulgarian stretch of the Danube close to the Serbian border and that a well developed population exists at Barzartsi river in NW Bulgaria, less than 40 km from the border with Serbia, it seems reasonable to suspect that *C. insignis* could be still present in eastern Serbia. New field work is needed to confirm its existence in this country today.

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PALAEOSYNTHEMIS ELEGANS SPEC. NOV., A NEW DRAGONFLY FROM PAPUA NEW GUINEA (ANISOPTERA: SYNTHEMISTIDAE)

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The new sp. is described from the upper Sepik Basin in northern Papua New Guinea. Holotype ♂: Papua New Guinea, West Sepic prov., Temporary Camp in upper Sepic Basin, alt. 290 m asl, during Feb. 2010; deposited in Mus. & Art Gallery, Darwin, Australia. Characters of the adult ♂ are illustrated and the affinities of the new species are discussed.

INTRODUCTION

Nine species of Synthemistidae of the old persuasion are known from Papua New Guinea. Eight of them were described in the genus *Synthemis* Selys, 1870, and one in *Eusynthemis* Förster, 1903.

The *Synthemis* species were introduced by FÖRSTER (1903), CAMPION (1915), and LIEFTINCK (1935, 1938, 1953). Whereas FÖRSTER (1903) established the subgenus *Palaeosynthemis* for *Synthemis primigenia* Förster, 1903, Campion and Lieftinck described their *Synthemis* species without subgeneric assignment. CARLE (1995) accorded generic rank to *Palaeosynthemis* Förster and united in it all Papuan species described in *Synthemis* and one from Guadalcanal. A male synthemistid recently collected in northern Papua New Guinea by S.J. Richards was found to be closely related to, but specifically different from, *Palaeosynthemis gracilenta* (Lieftinck). It is described as *P. elegans* sp. n. below.

MATERIAL AND METHODS

The descriptive terminology largely follows CHAO (1953) and WATSON & O'FARRELL (1991). Coloration is given as detectable from the preserved material. Measurements are given in millimetres (mm). All illustrations were done with the aid of a camera lucida and are not to scale.

The holotype of *Palaeosynthemis elegans* sp. n. is deposited in the collection of the Museum and Art Gallery of the Northern Territory (NTM)

PALAEOSYNTHEMIS ELEGANS SP. NOV.

Figures 1-4, 6-7

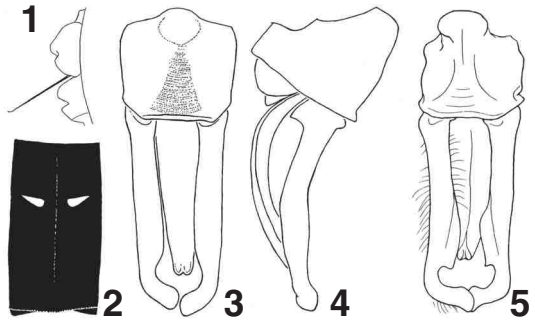
M a t e r i a l. – Holotype ♂ (NTM I008601): Papua New Guinea, West Sepik province, Temporary Camp in upper Sepik Basin (4°38.841, 141°47.876; 290 m asl during Feb. 2010) by S.J. Richards.

E t y m o l o g y. – The specific name (Latin elegans for elegant) refers to the slenderness of the species and the elegant shape of its male anal appendages.

MALE (**Holotype**). – H e a d. Labium and mandibles yellowish grey to brownish black; labrum black; anteclypeus and genae greyish yellow; postclypeus black with a brownish yellow transverse comma-shaped mark each side adjacent to the anterior frons; anterior frons greyish brown to brownish black; top of head including top of frons, vertex, occiput and antennae black; postgenae black.

T h o r a x. – Pronotum black with only rim of anterior lobe and median portion of rim of posterior lobe bright yellow. Trochanter greyish brown, leg otherwise as given below (under synthorax). Synthoracic pleura black with metallic reflections, a patch in anterolateral corner of mesanepisternum and a stripe along intersegmental suture and covering metastigma bright yellow; mid-dorsal carina and most of antealar sinus bright yellow; poststernum yellowish grey with patch of blackish brown each side. Coxae greyish brown, remainder of legs black.

W i n g s. – Basal sclerites black with tiny bit of yellow, venation black and membrane hyaline; antenodals 12/8, postnodals 7/9; medial crossveins 1/1; cubital crossveins 4/3; triangles and subtriangle free of crossveins; supertriangles with one crossvein; discoidal field of forewing beginning with 1 row of cells for 5-6 cells, discoidal field of hindwing beginning with 1 row of cells for 4-5 cells; anal loop containing 4 cells, no central cell; anal triangle with one crossvein; mebranule pale grey ap-



Figs 1-4. *Palaeosynthemis elegans* sp. n., holotype ♂: (1) secondary genitalia, lateral view; – (2) tergum 8, dorsal view; – (3) anal appendages dorsal view; – (4) same, lateral view. – Fig. 5. *P. gracilenta* (Lieftinck) ♂: male, anal appendages, dorsal view.

Figs 6-7. *Palaeosynthemis elegans* sp. n., holoytype ♂: (6) specimen; – (7) in life.

proximately 2/3 to 3/4 as long as anal triangle; pterostigma black, 3-4 times as long as wide, slightly longer in forewing than in hindwing, overlying one cell (2 veins) and parts of a cell each end.

A b d o m e n. – Terga black, marked with yellow as follows. Tergum 2 with a pair of elongate streaks above and along auricles and a pair of semicircular spots on transverse carina; terga 3 and 4 with pair of anterodorsal and pair of mediodorsal spots, tergum 5 similar but with only a tiny spot on one side left of the anterodorsal pair; terga 6-8 with pair of almond-shaped mediodorsal spots only, those on 8 hardly larger than the ones on the preceding terga but more widely separated; tergum 9, segment 10 and anal appendages black. Superior anal appendages approximately twice as long as segment 10, slender and straight

with apex strongly curved inward, about 15% longer than the widely and evenly curved, apically slightly bilobed inferior appendage.

Measurements (mm). – Hindwing 31.7, abdomen (including appendages) 38.5.

FEMALE unknown.

HABITAT. – The only known specimen was perched on low vegetation (~ 1 m high) over a small, clear but slow-flowing and shaded stream in foothill rainforest. While only known from the type locality, given the extent of suitable habitat in northern New Guinea the new species almost certainly has a broad distribution in the region.

DISCUSSION. – *Palaeosynthemis elegans* sp. n. is most similar to *P. gracilenta* (Lieftinck) (Fig. 5). It differs from this species mainly by the presence of a bright yellow antehumeral patch, by its richer colour pattern of segment 2, by the smaller, more widely separated yellow spots on tergum 8 and by lacking an apically cornered inner keel of the superior appendages (Fig. 3).

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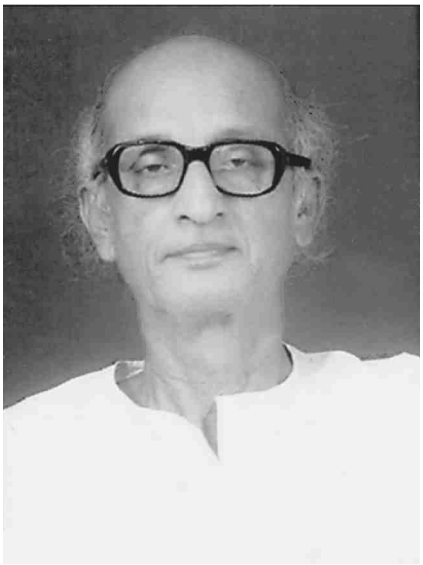
OBITUARY

TRIDIB RANJAN MITRA

A brief biography and appreciation of the work of Dr T.R. Mitra (19 Feb. 1942-3 July 2012), the doyen of Indian odonatology, are followed by his odonatological biblio-graphy (1967-2013). He described 6 new taxa from India and his works on the Indian odonate fauna will remain important references for a long time to come.



Dr TRIDIB RANJAN MITRA, M.Sc., Ph.D., one of the most distinguished odonatologists in India, passed away unexpectedly at Kolkata on 3rd July, 2012. With his sudden demise, India has lost one of the giants among the pioneers who did yeoman service for Indian odonatology and fostered the development of the subject in the country.

Dr Mitra's ancestry traces back to Bangladesh. His great grandparents emigrated to India from Faridpur, Bangladesh before partition and he was born at Calcutta on 19th February 1942; one of four sons and four daughters of Mr Nihar Ranjan Mitra and Mrs Sudha Rani Mitra. He is survived by his wife Chhanda, son Tamoghna, daughter Amrita and son-in-law Rudrarup Mukherjee.

Dr Mitra was educated in Calcutta. He graduated from the University of Calcutta and was a post-graduate at North Bengal University, West Bengal. He was awarded his Doctoral Degree from the University of Calcutta.

He began his career at the Zoological Survey of India, Calcutta in November, 1963 and was selected for training in environmental monitoring at Tottenham College of Technology, London. In February 2000, Dr Mitra fulfilled the legal conditions for retirement, but continued his association with the ZSI.

Fig. 2. Dr T.R. Mitra at a conference in Allahabad, February 2001. – (Photo Dr V.K. Srivastava)

In his long stint at the Zoological Survey of India he participated in several faunal surveys and saw that the results were speedily published. He established long associations with many European and other workers. Although Dr Mitra worked mostly on the Odonata of eastern India he did not miss a chance to record odonates during his travels all over the Indian peninsula. He surveyed the deserts of Rajasthan (1977, 1980), Darjeeling (1978, 1981), North Sikkim (1979, 1988) and Gujarat (1980) and almost the whole of West Bengal (1964-1988). His survey covered the states of Madhya Pradesh (1970, 1971), Maharashtra (1970, 1971), Orissa (1972), Assam (1973), Uttar Pradesh (1974,

1990), Jharkhand (1975), Andhra Pradesh (1976), Karnataka (1976), Tamil Nadu (1976), Mizoram (1991), Tripura (1996) and Uttaranchal. The new species he described from the Indian subcontinent are *Elattoneura nihari* Mitra, 1995, *Calicnemia sudhaae* Mitra, 1994, *Oligoaeschna andamani* Chhotani, Lahiri & Mitra, 1983, *Gynacantha rammohani* Mitra & Lahiri, 1975, *Gomphidia ganeshi* Chhotani, Lahiri & Mitra, 1983 and *G. leonorae* Mitra, 1994.

Dr Mitra was highly cultured and an aristocrat among scientists. In his heyday he was virtually an autocrat in whose towering personality many an upstart shriveled. Though reserved in manner, he never hesitated to express an opinion.

He published almost seventy papers on various aspects of odonate taxonomy, ecology and biogeography, along with two books and four technical monographs. His detailed work on the geographical distribution of Odonata of eastern India, published in 2002, remains very widely used by researchers. A versatile person, apart from odonatology he has to his name seven publications on soil dwelling invertebrates, five publications on the ecology of wild animals, five on museology and four on various aspects of conservation, ecology and the history of science. He regularly contributed in English (The Statesmen), in the Bengali daily newspaper (Anand bazaar patrika) and in various periodicals on topics as varied as 'on the relevance of religion' 'wrong arithmetic' and comments on Pythagoras and Aristotle.

He was among the pioneers starting the South Asian Chapter of SIO in India along with Drs B.K. TYAGI, B.K. SRIVASTAVA and D.B. TEMBHARE. He was the most sought after person at the Indian and South Asian Symposia of Odonatology. He participated in the 9th International Symposium of Odonatology (Madurai, India; 1988), and his papers were presented (in his absence) in the 6th and the 13th International Symposia of Odonatology (Chur, Switzerland, 1981; and Maribor, Slovenia, 1997 respectively).

Dr Mitra was on the editorial boards of *Odonatologica* (Odonatological Abstracts), *Indian Odonatology* and *Fraseria* (South Asian bulletin of Odonatology). He was an active executive member of the SIO Regional Office in South Asia.

The books and papers which carried his name in one capacity or other made valuable contributions to our knowledge of Indian odonatology. He encouraged and guided a younger generation of scientists. Until his death he was closely associated with the Zoological Survey of India and was up to date with the latest developments in the field. His name will always be remembered in Indian odonatology for the quality of his work and scientific publications.

We pay our respectful homage to Dr Mitra and express our deepest sympathy and gratitude to his bereaved family.

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(1967-2013)

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1996d (G.D. MUKHERJEE) Studies on the area of wings of female Palpopleura sexmaculata sexmaculata (Fabricius) (Odonata: Libellulidae) of Sikkim. *J. Bengal nat. Hist. Soc.* 15: 40-44.
1997 (−, M.L. DE, & I.J. GUPTA) Ecological reconnaissance of Odonata (Insecta) of eastern India. *Rec. zool. Surv. India* 96: 237-241.
1998 Development of Indian odonatology. *Fraseria* 5: 9-14.
1999a Geographical distribution and zoogeography of Odonata (Insecta) of Meghalaya, India. *Rec. zool. Surv. India* (Occ. Pap.) 170: 1-63.
1999b Biology and ecology of dragonflies (Insecta: Odonata) with note on their adaptations in different ecosystems of India. *Rec. zool. Surv. India* 97: 173-188.
1999c Diversity and zoo-centers of Indian Odonata. *Fraseria* 6: 21-28.
2000 A note on an Odonata collection from Orissa, India. *Notul. odonatol.* 5(5): 60-61.
2002a A note on zoogeography of Odonata (Insecta) of Nicobar Islands, Indian Ocean. *Rec. zool. Surv. India* 100(3/4): 183-188.
2002b Endemic Odonata of India. *Rec. zool. India* 100(3/4): 189-199.
2002c Geographical distribution of Odonata (Insecta) of eastern India. *Mem. zool. Surv. India* 19(9): xi+208.
2002d (−, M. PRASAD & C. SINHA) A note on Odonata recorded from Nagaland, India. *Opusc. zool. flumin.* 201: 1-6.
2003a Odonata. *St. Fauna Ser.* (Fauna of Sikkim) *Zool. Surv. India.* 9: 125-164.
2003b Ecology and biogeography of Odonata with special reference to Indian fauna. *Rec. zool. Surv. India* (Occ. Pap.) 202: 1-41.
2004 A check-list of the Odonata of Sikkim, with some new records. *Opusc. zool. flumin.* 206: 1-8.
2005a Evolutionary adaptation in morphology and ecology of Tholymis tillarga (Fabricius) and Bradinopyga geminata (Rambur) (Insecta: Odonata). *Rec. zool. Surv. India* 104: 101-104.
2005b Calicnemia miniata doonensis Sagal & Tyagi a synonym of Calicnemia carminea pyrrhosoma (Insecta: Odonata: Platycnemididae). *Rec. zool. Surv. India* 104: 161-162.

2005c Taxonomic assessment of insects recorded in Kālidāsa's works. *Rec. zool. Surv. India* 105(1/2): 97-103.
2006a *Handbook of common Indian dragonflies (Insecta: Odonata)*, Zoological Survey of India, Calcutta.
2006b Insecta: Odonata. (Fauna of Arunachal Pradesh) *St. Fauna Ser., Zool. Surv. India* 13(2): 67-149.
2006c (−, M. PRASAD & C. SINHA) Insecta: Odonata. (Fauna of Nagaland) *St. Fauna Ser.,Zool. Surv. India* 12: 75-87.
2008a (− & R. BABU) Numerical density of adult odonates in Arunachal Pradesh, India. *Fraseria* (N.S.) 7: 51-54.
2008b (−, R. BABU & S. NANDY) Numerical density of adult odonates in Nagaland, India. *Fraseria* (N.S.) 7: 19-23.
2008c (ANDREW, R.J. & −) *Indian Odonatological Bibliography*. Occasional Publication, South Asian Council of Odonatology (SACO), 18th Int. Symp. Odonatol., Nagpur.
2009 (− & R. BABU) Previously unrecorded Odonata from Salt Ranges and Sind in Pakistan. *Notul. odonatol.* 7 (4): 42-44.
2010 (− & R. BABU) Revision of Indian species of the families Platycnemididae and Coenagrionidae (Insecta: Odonata: Zygoptera) − Taxonomy and zoogeography. *Rec. zool. Surv. India* (Occ. Pap.) 315: 1-103.
2011 Remarks on Lamarckian concept of animal evolution and philosophy of biology. *Rec. zool. Surv. India* 111(1): 5-9.
2013 (−, R. BABU & K.A. SUBRAMANIAN) Anax panybeus Hagen 1867: an addition to the Odonata (Aeshnidae) of India. *J. threatened Taxa* 5(2): 3682-3683.

Portrait on p. 67 dated early 2012

Zoological Servey of India,
Southern Regional Centre, Chennai-600 028, India — R. BABU

Zoological Survey of India,
Prani Vigyan Bhavan, M-Block,
New Alipore, Calcutta-700 053, India — K.A. SUBRAMANIAN

Department of Zoology, Hislop College
Civil Lines, Nagpur-440 010, MS, India — R.J. ANDREW

ODONATOLOGICAL ABSTRACTS

2008

(19264) BALZAN, M.V., 2008. The distribution of Orthetrum trinacria Selys, 1841 and Trithemis annulata Palisot de Beauvois, 1807 in the Maltese Islands (Odonata: Libellulidae). *Bull. ent. Soc. Malta* 1: 91-96. – (Int. Envir. Inst., 3rd Floor, Chemistry Bldg, rm 311, Univ. Malta, Msida, Malta).
The distribution of these 2 spp. in Malta is documented and it is tentatively suggested their introduction to Malta could have been favoured by recent changes in the climate.

(19265) BANBARADENIYA, C.N.B. & J.P. EDIRISINGHE, 2008. Composition, structure and dynamics of arthropod communities in a rice-agroecosystem. *Ceylon J. Sci.* (Bio Sci.) 37(1): 23-48. – (Second Author: Dept Zool., Univ. Peradeniya, Sri Lanka).
19 odon. spp. are reported from the rice fields of Bathalagoda, Kurunegala distr. (Intermediate Zone, Sri Lanka).

(19266) CAPUTO, F.P. & R.C. VOGT, 2008. Stomach flushing vs fecal analysis: the example of Phrynops rufipes (Testudines: Chelidae). *Copeia* 2008(2): 301-305. – (First Author: Via Gabrio Sorbelloni 115, I-00176 Roma).
This turtle feeds on a great variety of macroinvertebrates and fish. The stomachs of 32 individuals from a small black-water stream in the Reserva Ducke (Bolivia) were examined. The gomphid larvae represent the greatest proportion of the total volume. The other odon. remains found were referable to Megapodagrionidae, Dicteriadidae and Calopterygidae.

(19267) [DE SELYS LONGCHAMPS, M.E.] CAULIER-MATHY, N. & N. HAESENNE-PEREMANS, 2008. *Une vie au fil des jours: Journal d'un notable politicien et naturaliste Michel Edmond de Selys Longchamps (1823-1900)*. Tome 1 *(1823-1877)*, lxiii+xiv+1-958 pp., Tome 2 *(1878-1900)*, xx+xiv+959-1747 pp., Annexe 1-2 excl. Commission Royale d'Histoire, Bruxelles. Softcover (16.0×24.5 cm), ISBN none. Price: euro 78.- net, postage extra. – (Publishers: Commission Royale d'Histoire, Palais des Académies, rue Ducale 1, B-1000 Bruxelles).
This is the Selys diary; the first entry is dated on 27 Aug. 1823, the last on 26 Nov. 1900. During most of this period it was kept almost daily and contains hundreds of references to Odon. and the odonatologists. The consultation is facilitated by the inclusion of 3 very comprehensive indices: of persons (with biographic information), of taxa and a subject index. Genealogical trees are appended. The diary presents and illucidates countless hitherto unknown aspects and details of the Selysian odonatological work and of that of the contemporary workers in many parts of the world. His first odonatol. entry is that of 13 July 1824 (when the author just reached the age of 11 yr, and clearly had a perfect command of taxonomic nomenclature!), whereas the last one on the subject is from 22 Oct. 1900 and refers to F. Foerster and E.B. Williamson.

(19268) HARP, G., P. HARP & S. McCORD, 2008. Aquatic macroinvertebrates collected from thirty-two Missouri Ozarak streams. *J. Ark. Acad. Sci.* 62: 61-74. – (First Author: Dept Biol. Sci., Arkansas St. Univ., State University, AR 72467, USA).
Records of 56 odon. spp.; – USA.

(19269) HEINO, J., 2008. Pattern of functional biodiversity and function-environment relationships in

lake littoral macroinvertebrates. *Limnol. Oceanogr.* 53(4): 1446-1455. – (Finnish Envir. Inst., P.O. Box 413, FIN-90014 Univ. Oulo, Oulo).
In the Oulankajoki drainage basin (NE Finland), 48 lakes of various types were studied. For Coenagrion, Aeshna and Somatochlora, the frequency of occurrence (number of lakes) and the abundance (at occupied lakes) are stated and discussed in terms of habitat structure.

(19270) JAKOB, C., 2008. [Parc Naturel Régional de Camargue]: *Résultats du suivi odonates pour la période de mai à octobre 2008*. Parc Naturel Régional de Camargue. 18 pp. – (Stn Biol. Tour de Valat, Le Sambuc, Aries, France).
Assessment of species abundance and population structure; – France.

(19271) JORCIN, A. & M.G. NOGUEIRA, 2008. Benthic macroinvertebrates in the Parapanema reservoir cascade (southeast Brazil). *Braz. J. Biol.* 68(4, Suppl.): 1013-1024. (With Port. s.). – (Depto Zool., Inst. Biociênc., Campus Rubião Júnior, Univ. Estad. Paulista, BR-18600-000 Botucatu, SP).
The Parapanema is a tributary of the Paraná river, La Plata Basin, on the border between the states of Paraná and São Paulo. Aphylla and Progomphus are reported from the bottom samples.

(19272) JUNG, S.W., V.V. NGUYEN, Q.H. NGUYEN & Y.J. BAE, 2008. Aquatic insect faunas and communities of a mountain stream in Sapa Highland, northern Vietnam. *Limnology* 9: 219-229. – (First Author: Dept Biol., Seoul Women's Univ., Seoul, Korea).
9 (unidentified) odon. spp. from 8 (identified) gen. are recorded from the Mounghoa stream, 375 km NW of Hanoi (average elevation ca 1500 m).

(19273) KOTARAC, M. & A. ŠALAMUN, 2008. Kačji pastirji. – [Dragonflies]. *In*: D. Tome, [Ed.], *Naravovarstveno vrednotenje izbranih vojaških območij v Sloveniji: primerjalna študija z referenčnimi območji*, pp. 106-119, Natn. Inst. Biol., Ljubljana (Slovene). – (Authors: CKFF, Klunova 3, SI-1000 Ljubljana).
The odon. fauna is outlined assessed of the military polygon Mlake in the Vipava Valley (W Slovenia). Out of the 35 spp., 8 spp. are of particular conservation importance.

(19274) MEYER, C.K. & M.R. WHILES, 2008. Macroinvertebrate communities in restored and natural Platte river slough wetlands. *Jl N. Am. benthol. Soc.* 27(3): 626-639. – (First Author: Dept Biol. & Envir. Sci., Simpson Coll., Indianola, IA 50125, USA).
3 natural wetland sites and 4 restored sites were studied in central Nebraska (USA). Odon. (mostly Enallagma, Lestes, Anax and Sympetrum) were more abundant in restored than in natural sites.

(19275) POBOLJŠAJ, K., 2008. [*Technical groundwork for assessment of the impact to be triggered on the protected Natura 2000 area by the scheduled extension of the Okroglica-II clay-marl-flysh mine to Šempas*]. CKFF, Ljubljana. 55 pp. (Slovene). – (CKFF, Klunova 3, SI-1000 Ljubljana).
The locality is situated in the Nova Gorica district (W Slovenia). 19 odon. spp. are recorded and discussed.

(19276) SMILJAKOV, S., V. SLAVEVSKA-STAMENKOVIĆ, D. PRELIĆ & M. PAUNOVIĆ, 2008. Distribution of benthic macroinvertebrates in Mantovo Reservoir (South-East part of the r. Macedonia). *Proc. Conf. Balkan Water Observ. & Inf. Syst. for Decision Support [BALWOIS]*, Ohrid (12): 1-12. – (First Author: Inst. Biol., Fac. Nat. Sci. & Mathem., Univ. Skopje, P.O. Box 162, MK-1000 Skopje).
Calopteryx splendens and Ischnura elegans larvae are brought on record; – Macedonia river, Macedonia.

2009

(19277) GOVEDIČ, M., S. AMBROŽIČ, M. CIPOT, A. KAPLA, A. LEŠNIK, F. REBEUŠEK, A. ŠALAMUN & A. VREZEC, 2009. [*A survey of selected animal groups […] at the Pohorje Winter Sport Centre*]. CKFF, Ljubljana. 64 pp. (Slovene). – (CKFF, Klunova 3, S-1000 Ljubljana).
An assessment of habitat conditions and the occurrence of Cordulegaster bidentata and C. heros; – Pohorje Mts, Slovenia.

(19278) JORCIN, A., M.G. NOGUEIRA & R. BELMONT, 2009. Spatial and temporal distribution of the zoobenthos community during the filling up period of Porto Primavera Reservoir (Paraná river, Brazil). *Braz. J. Biol.* 69(1): 19-29. (With Port. s.). – (First Author: Depto Zool., Inst. Bioiênc. Campus Rubião Júnior, Univ. Estad. Paulista, BR-18600-000 Botucatu, SP).
Aphylla sp. occurred in samples taken from the bot-

tom of gravel, fine sand and silt/clay; – São Paulo.

(19279) KATO, Y., Y. TAKEMON & M. HORI, 2009. Invertebrate assemblages in relation to habitat types on a floating mat in Mizorogaike Pond, Kyoto, Japan. *Limnology* 10: 167-176. – (First Author: Lab. Anim. Ecol., Dept Zool., Gr. Sch. Sci., Kyoto Univ., Kitashirakawa-oiwake, Sakyo, Kyoto, 606-8502, JA).
9 odon. spp. are recorded. For Ceriagrion melanurum and Lestes sponsa, Pearson's correlation coefficients between environmental variables and number of individuals on the floating mat of the pond are stated.

(19280) KELLER, D., S. BRODBECK & R. HOLDEREGGER, 2009. Characterization of microsatellite loci in Leucorrhinia caudalis, a rare dragonfly endangered throughout Europe. *Conserv. genet. Resour.* 1: 179-181. – (WSL Swiss Fed. Res. Inst., Zürcherstr. 111, CH-8903 Birmensdorf).
In the 1980s, in Switzerland L. caudalis survived in a single population. However, recently it spread and colonised new ponds. In order to study its contemporary migration, 8 new microsatellite markers were developed and tested on 24 individuals from 6 Swiss ponds. The names and geographic positions of these are not stated. – See also *OA* 18968 and 19302.

(19281) KŘIVAN, V., 2009. [*Locality mapping of the Somatochlora arctica occurrence in the Czechomoravian highlands*]. Ochrana Biodiversity, Knežice. 16 pp. (Czech). – (Knižice 109, Okrišky, Czech Republic).
Detailed habitat descriptions (with photographs) and topographic maps of 13 localities. The region is situated NE of České Budějovice, Czech Republic.

(19282) LINGENFELDER, U., 2009. Der Saarbach, die Libellen und die Wasserpest. *Pollichia-Kurier* 25(4): 44-49. – (Seebergstr. 1, D-67716 Heltersberg).
The nature conservation value of the Saarbach stream (Palatinate, W Germany) is discussed based on Ophiogomphus cecilia. During 2008-2009, 24 odon. spp. were recorded there, 17 of which also in larval stage, but the list of spp. is not provided.

(19283) MAGNUSSON, A.K. & D.D. WILLIAMS, 2009. Top-down control by insect predators in an intermittent pond: a field experiment. *Ann. Limnol./Int. J. Limnol.* 45: 131-143. – (Dept Biol. Sci., Univ. Toronto, 1265 Military Trail, Scarborough, ON, M1C 1A4, CA).
The study was conducted in Vandorf Pond, located in the Oak Ridges Moraine, S Ontario (Canada). The effects of Sympetrum costiferum and S. internum larvae on the constitution of prey community are reported.

(19284) MILNE, J., 2009 [?, no date]. *Dragonflies and damselflies: a distribution atlas for Aberdeenshire, Aberdeen city, Moray and the Cairngorms, 1900-2008*. North East Scotland Biological Records Centre, Aberdeen. ii + 44 pp. Softcover (14.7 × 20,8 cm). ISBN none. – (Author & Publishers: NESEReC, Room G25, Univ. Aberdeen, 23 St Machar Dr., Aberdeen, AB24 3RY, Scotland, UK).
Information is presented on regional occurrence and breeding status of 15 spp. For 14 of these, distribution maps, detailed information on their occurrence in NE Scotland and the identification features are provided. It is requested to send all confidently identified records to the author, at the above address.

(19285) SIMAIKA, J.P. & M.J. SAMWAYS, 2009. Reserve selection using Red Listed taxa in three global biodiversity hotspots: dragonflies in South Africa. *Biol. Conserv.* 142: 638-651, – (Dept Conserv. Ecol. & Ent., Fac. AgriSci., Univ. Stellenbosch, P.B. XI, Matieland-7602, SA)
The Red List can be used a gauging too by conservations to assess which spp. require focused conservation attention. Mapping the relative distributions of spp. and identification of centres of richness, endemism and threat are a first step towards site-oriented conservation action. Here a specially developed biodiversity index was used, based on weighted subcomponents assigned to each sp. geographical distribution, Red List status, and sensitivity to habitat change. This approach is tested using what is called here the Dragonfly Biotic Index (DBI) to prioritize sites for conservation action, with special emphasis on sp. occurrence in 3 global hotspots in S Africa. Using a selected set of the 23 top prioritized sites, the DBI-s performance is compared to that of a rarity--complementarity algorithm. As with several other taxa, local endemism levels are highest in the Cape Floristic Region (CFR), while richness is highest in the NE, particularly in the stream systems of the Maputaland-Pondoland-Albany (MPA) hotspot. Red Listed Odon. spp. are also concentrated in the CFR, while richness is highest in the MPA hotspot. Site prioritization using the DBI reveals that CFR sites protect Red Listed taxa rather well, despite the fact that catchments are only partially protected.

The DBI demonstrates high levels of redundancy in representing Red Listed spp., in other words the spp. are represented in several catchments. The value in the DBI thus lies in maximizing redundancy (i.e. representation) of globally Red Listed spp. The rarity--complementarity algorithm represents all spp., but without greater emphasis on the rare and threatened (i.e. Red Listed) spp. It is concluded that the DBI is of great value in selecting biodiversity hotspots, while the algorithm is useful for selecting complementarity hotspots. Protection gaps are identified and continued searches in centres of endemism and existing reserves as well as gap areas are recommended. These searches will hone Red List assessments and identify priority sites, as well as monitor already-identified sites for changes in quality of habitat.

(19286) TOYOSAKI, I., K. YAMADA & K. ÔHARA, 2009. Records of Trithemis aurora (Odonata, Libellulidae) in Tokushima prefecture, Shikoku, Japan. *Bull. Tokushima pref. Mus.* 19: 39-44. (Jap., with Engl. title). – (Tokushima Prefect. Mus., Bunka-no--Mori Park, Hachiman-cho, Tokushima, 770-8070, JA).

(19287) VAN SCHAIK, V.A. & R.P.G. GERAEDS, 2009. The emergence period of Gomphus vulgatissimus. *Natuurh. Maandbl.* 98(8): 153-158. (Dutch, with Engl. s.). – (First Author: Hoosveld 56, NL-6075 DB Herkenbosch).
The study was conducted (2001-2003) along a 150 m stretch of the Roer river, SW of Herkenbosch (Roerdalen, the Netherlands), and 1585 exuviae were collected. Over the years, the emergence period was very constant lasting 31-35 days. It took 8(9)-11(12) days (average 9) for 50% of the population to emerge (EM_{50}). During the 3 yr, the overall sex ratios were 1.0 (49,9% ♀), 0.7 (57.3% ♀) and 0.8 (55.2% ♀), respectively. The sex ratios changed during the period of emergence from 1.5 (40.6% ♀), 1.1 (48.4% ♀) and 0.9 (52.5% ♀) prior to the EM_{50} condition was reached, to 0.6 (63,5% ♀), 0.4 (71.6% ♀) and 0.7 (59.2% ♀) afterwards and to the end of the emergence period. The predominance of ♀♀ in the latter period was significant in all 3 yr.

(19288) VINKO, D., 2009. [Report on the work of the Odonata, Amphibia and Reptilia Working Groups]. *In*: I. Kodele Krašna, [Ed.], *Biološko raziskovalni tabor "Budanje 2008"*, pp. 34-55, Zavod RS za varstvo narstvo narave, Ljubljana. ISBN 978-961-92304-5-9. (Slovene). – (Slovenska 14, SI-1234 Mengeš).
The locality is situated in the Vipava Valley (W Slovenia). A commented list of 29 odon. spp.

(19289) ZHANG, H.-j. et al., 2009. Odonata resources in Shaanxi province. *J. Anhui agric. Sci.* 37(24): 11565-11567. (Chin., with Engl. s.). – (Bio-Resour. Key Lab. Shaanxi Prov., Shaanxi Univ. Technol., Hanzhong-723000, Shaanxi, China.).
A checklist of 117 spp.

(19290) ZHAO, H.-x. & Z. ZHONG, 2009. Research advance in mechanics of dragonfly wings. *Chin. Q. Mech*. 30(3): 398-404. (Chin., with Engl. s.). – (Sch. Aerospace Eng. & Appl. Mech., Tongji Univ., Shanghai-200092, China).
A review paper, presenting a summary of the current research on odon. wing mechanics.

2010

(19291) BEDJANIČ, M., 2010 [*Inquiry into distribution and conservation values of Coenagrion ornatum population in … Natura 2000 area near Mirna*]. Oikos, Domžale. 26 pp. (Slovene). – (Author: Rakovlje 42/A, SI-3314 Braslovče).
A general outline of C. ornatum biology, ecology and threats in Slovenia followed by the assessment of conditions in the vicinity of Mokronog. A list of 17 odon. spp. from 11 localities in the area is also provided.

(19292) BEDJANIČ, M., 2010. [On Austropotamobius torrentium (Crustacea: Decapoda), Cordulegaster bidentata and C. heros (Odonata: Anisoptera) in the community Dol pri Ljubljani]. *Zborn. Občine Dol pri Ljubljani* 2: 320-339. (Slovene). – (Rakovlje 42/A, SI-3314 Braslovče).
Within the community territory (central Slovenia), A. torrentium is recorded from 11 localities, C. bidentata and C. heros from 6 and 20 sites, respectively. Their habitats are described and the threats they are exposed to are outlined. The topographic position of the localities is mapped and some habitat photographs are provided.

(19293) CAULIER-MATHY, N. & N. HAESENNE--PEREMANS, 2010. *Inventaire des archives provenant du château d'Halloy*. Bibliothèque générale de Philosophie et Lettres, Univ. Liège, Liège/Belgium. 92 pp. ISBN none.

The inventory of the collection of documents, deposited in the Halloy castle (Brabant, Belgium), from the personal archives of JEAN BAPTISTE JULIEN d'OMALIUS d'HALLOY (1783-1875) and of various members of the de SELYS LONGCHAMPS family, viz.: MICHEL LAURENT (1759-1837), MICHEL EDMOND (1813-1900; the famous odonatologist), EDGARD (1882-1951) and WALTER (1915-1987). − J.B.J. d'Omalius d'Halloy was the original owner of the castle, he was the father-in-law of M.E. baron de Selys Longchamps, who subsequently inherited the property, which remains in the possession of the descendants of the odonatologist. − The other Selysian archive material is deposited in the University of Liège, Belgium. The 2 archives contain a large number of documents of considerable odonatological interest.

(19294) CHAPUT-HARDY, A., A. GRÉGOIRE, M. BAGUETTE, A. PAGANO & J. SECONDI, 2010. Condition and phenotype-dependent dispersal in a damselfly, Calopteryx splendens. *PLoS ONE* 5(5): 7 pp.; e10694; − DOI: 10.1371/journal.pone.0010694. − (First Author: Lab. Etud. Environ., Univ. d'Angers, Angers, France).
Individual dispersal decisions may be affected by the internal state of the individual and the external information on its current environment. Here, the influence of dispersal on survival is estimated and it is investigated whether individual phenotype (sex and wing length) and environmental conditions (conspecific density and sex ratio) affected dispersal decisions in C. splendens. It is shown that the proportion of dispersing individuals was higher in ♀♀ than in ♂♂. The negative density-dependent dispersal in both sexes and influence of sex ratio on dispersal were also found. Individuals moved less when sex ratio was ♂-biased. These observations are consistent with a lek mating system, where ♂♂ aggregate in a place and hold mating territories. Contrary to the expectations, neither dispersal nor survival were affected by wing length. Nevertheless, the mean adult survival was about 8% lower in dispersing individuals than in residents. This might reflect a mortality cost due to dispersal.

(19295) CHERTOPRUD, M.V., 2010. Biogeographic zonation of the Eurasian fresh waters based on the macrobenthic fauna. *Zh. obshch. Biol.* 71(2): 144-162. (Russ., with Engl. s.). − (Fac. Biol., Moscow Lomonosov St. Univ., Leninskie Gory, RUS-119992 Moscow).
Spatial distribution of the Eurasian freshwater faunas is analysed based on original and published data on ca 8800 spp. of freshwater insects, crustaceans and molluscs. The schemes of biogeographic zonation are constructed for the 9 large macrobenthic taxa, incl. Odon.

(19296) DIEHL, D.A. & Y.A. LUCKE, 2010. Die aktuelle Situation der Libellen im Landkreis Darmstadt-Dieburg. *Collurio/Z. Vögel Naturschutz Südhessen* 28: 122-130. − (Naturk.-Inst., Breuberger Weg 4, D-64832 Langstadt).
A checklist is presented of the 48 spp. known from the district of Darmstadt-Dieburg (Germany), with comments on selected spp.

(19297) ELONO, A.L.M., M. LIESS & S. DUQUESNE, 2010. Influence of competing and predatory invertebrate taxa on larval population of mosquitoes in temporary ponds of wetland areas in Germany. *J. Vector Ecol.* 35(2): 419-427. − (Dept. System Ecotoxicol., UFZ Helmholtz Cent. Envir. Res., Permoserstr. 15, D-04318 Leipzig).
The study was conducted at 27 sites in the federal states of Brandenburg, Saxony and Saxony-Anhalt (central Germany). The results of the Principal Component Analysis showed that the abundance of Aedes spp. larvae was associated negatively with the abundance of antagonists and more specifically of (1) some for food competing taxa (e.g. Daphnia, Chironomidae larvae), (2) some strict predatory taxa (such as larval Dytiscidae, Hydrophilidae, Zygoptera and Anisoptera), and (3) intraguild predators (Cyclopoida spp.). They were also associated negatively with the abundance of other mosquito larvae. The influence of these natural antagonists on Aedes spp. larvae was stronger in ponds with higher levels of dissolved oxygen (53 ± 4%) than in those with lower levels (16 ± 1%).

(19298) GARRISON, R.W., N. VON ELLENRIEDER & J.A. LOUTON, 2010. *Damselfly genera of the New World: an illustrated and annotated key to the Zygoptera*. John Hopkins Univ. Press, Baltimore. xiv + 490 pp., 24 col. pls excl. Hardcover (18.4 × 24.4 cm). ISBN 0-8018-9670-3. − (Publishers: 2715 North Charles St., Baltimore, MD 21218-4363, USA).
This is the companion volume to the Anisoptera work described in *OA* 16339: a monumental treat-

ment of the Zygoptera, in every aspect as authoritative and splendid as the former. The 125 genera are keyed and their descriptions enhanced by detailed diagnostic illustrations. For each genus are provided the synonymy, distribution map, bibliographic references to the descriptions of larvae and a checklist of the known spp. The book includes 2586 figs and a comprehensive bibliography. − An indispensable reference work of excellence for a long time to come.

(19299) HAESLOOP, U., 2010. Nachweis der Westlichen Geisterlibelle Boyeria irene in Norddeutschland. *Lauterbornia* 70: 33-35. (With Engl. s.). − (Jenaer Str. 10, D-28215 Bremen).
A B. irene larva was caught (26-V-2009) in the lower section of the Oertze, a tributary of the Aller, located in the Weser river catchment. This is the first record of this sp. from N. Germany. The habitat and the larva are described and a photograph of the latter is included.

(19300) HERMANS, J. & G. SENNERT, 2010. Die Libellenfauna des Naturparks Maas-Schwalm-Nette. *Natuurh. Maandbl.* 100(10): 216-225. (With Engl. s.). − (First Author: Hertestraat 21, NL-6067 ER Linne).
The odon. fauna (57 spp.) of the German/Dutch Maas-Schwalm-Nette Nature Park is reviewed. One of the most important reasons for the large number of spp. is the diversity of biotopes and habitats. The developments in the distribution patterns of some spp. are briefly outlined.

(19301) KAZANCI, N., 2010. Contribution to the knowledge of Odonata(Insecta) fauna of Turkey: eastern and southeastern Anatolia. *Rev. Hydrobiol.* 3(1): 1-11. (With Turk. s.). − (Hydrobiol. Sect., Dept Biol. Sci Fac., Hacettepe Univ., Beytepe, Ankara, Turkey).
A commented list of 18 spp., of which Ischnura senegalensis is new to the Turkish fauna.

(19302) KELLER, D., S. BRODBECK, I. FLÖSS, G. VONWIL & R. HOLDEREGGER, 2010. Ecologial and genetic measurements of dispersal in a threatened dragonfly. *Biol. Conserv.* 143: 2658-2663. − (First Author: WSL Swiss Fed. Res. Inst., Zürcherstr. 111, CH-8903 Birmensdorf).
Leucorrhinia caudalis was formerly widespread in the Swiss lowlands, but only a single population remained in the 1980s. However, a spread has recently been observed, with additional ponds being colonised, sometimes at considerable distance. Despite this evidence of recent long-distance dispersal, it is unknown whether L. caudalis regularly moves among ponds or this is a rather rare event. A combination of an ecological mark-resight and a population genetic study was applied to investigate contemporary dispersal and the genetic footprint of the recent population history of L. caudalis in Switzerland. DNA for genetic micro-satellite analysis was extracted from exuviae. The mark-resight study and the genetic analysis gave congruent results. They showed that L. caudalis is mostly a sedentary sp., with only a few contemporary dispersal events over distances up to 5 km being observed. The genetic analysis was in agreement with the recent population history of the Swiss populations. The oldest and largest population showed large genetic diversity and acted as source population for the recent spread of L. caudalis in Switzerland. Recurrent gene flow among this source population and close populations caused substantial local genetic variation in the latter, as well as low population differentiation. The 2 recently founded distant populations (≥ 30 km distance) were genetically less diverse and highly differentiated. These distant populations and another recently colonised population also expressed signatures of genetic bottlenecks. − See also *OA* 18968 and 19280.

(19303) KOCH, L., 2010. Neu entstandene Kleingewässer entwickeln sich zu Libellen-Biotopen. *Beitr. Heimatk. Schwelm* (N.F.) 59: 19-38. − (Author's address not provided).
17 spp. are reported from 2 water bodies in the vicinity of Schwelm, Germany.

(19304) KODELE KRAŠNA, I., S. AMBROŽIČ, A. RIJAVEC & D. VINKO, 2010. *Popis rastlinstva in živalstva Zaloškega bajerja*. − [*Inventory of the plant- and animal world of the Zaloški Bajer*]. Rdeči apolon, Vipava. 30 pp. (Slovene). − (Publishers: Budanje 1/J, SI-5217 Vipava).
Lists 19 odon. spp. from the area (Vipava distr., Slovenia), 6 spp. of which were recorded from the Bajer pond itself.

(19305) ŁABĘDZKI, A., A. CHRZANOWSKI, R. KUŹMIŃSKI, A. MAZUR & P. RUTKOWSKI, 2010. The Natura 2000 system and the problem of dragonfly protection in Poland. *Zarzadzanie Ochrana Przyrody w Lasach* [ISSN 2081-1438] 4: 94-104. (Pol.,

with Engl. s.). – (First Author: Kat. Ent. Lesnej, Akad. Rolnicza, ul. Wojska Polskiego 71/c, PO-60-625 Poznan).
An analysis is presented of the 2006-2007 odon. habitat survey of the state forests in Poland and the results are discussed with special reference to Coenagrion ornatum, Ophiogomphus cecilia and Leucorrhinia pectoralis.

(19306) MAGOBA, R.N. & M.J. SAMWAYS, 2010. Recovery of benthic macroinvertebrate and adult dragonfly assemblages in response to large scale removal of riparian invasive alien trees. *J. Insect Conserv.* 2010: 10 pp.; – DOI: 10-1007/sl0841-010-9291-5. – (Dept Conserv. Biol. & Ent., Univ. Stellenbosch, P/Bag XI, Matieland-7602, SA).
Invasive alien organisms can impact adversely on indigenous biodiversity, while riparian invasive alien trees (IATs), through shading of the habitat, can be a key threat to stream invertebrates. Here it is asked whether stream fauna can recover when the key threat of riparian IATs is removed. Specifically, the question is addressed whether IAT invasion, and subsequent IAT removal, changes benthic macroinvertebrate and adult odon. assemblages, for the worse or for the better respectively. Natural riparian zones were controls. There were statistically significant differences between stream reaches with natural, IAT-infested and IAT-cleared riparian vegetation types, based on several metrics: immature macroinvertebrate taxon richness, average score per macroinvertebrate taxon (ASPT), a macroinvertebrate subset (Ephemeroptera, Plecoptera, Trichoptera and Odon. larvae; EPTO), and adult odon. species richness. Reaches with natural vegetation, or cleared of IATs, supported greater relative diversity of macroinvertebrates than reaches shaded by dense IATs. Greatest macroinvertebrate ASPT and EPTO were in reaches bordered by natural vegetation and those bordered by vegetation cleared of IATs and the lowest where the riparian corridor was IATs. Highest number of adult odon. spp. was along streams cleared of dense IATs. Overall, results showed that removal of a highly invasive, dense canopy of alien trees enables recovery of adequatic biodiversity. As benthic macroinvertebrate scores and adult odon. species richness are correlated and additive, their combined use is recommended for river condition assessment.

(19307) MIŠIKOVÁ ELEXOVÁ, E. et al. [17 joint authors], 2010. Checklist of taxa examined at localities monitored in the Slovak surface water bodies: benthic macroinvertebrates. *Acta environ. Univ. comenianae* 18(1): 5-335. (Slovak, with Engl. s.). – (L. Svobodu 5, SK-812 49 Bratislava).
Among 828 taxa from 355 localities in 31 Slovakian river catchments, 30 identified odon. spp. are listed along with the respective localities.

(19308) NÖSSING, T.B., F. WINKLER WERTH, 2010. *Die Libellen in den Naturparks Trudner Horn und Rieserferner-Ahrn*. Amt für Naturparks, Bolzano, 54 pp. ISBN none. – (Publishers: Rittner Str. 4, I-39100 Bolzano).
General on dragonflies, with special reference to the fauna of South Tyrol/Alto Adige (Italy) and to the work of the regional working group, "Libella". An account is presented of the 24 spp. so far recorded from the 2 Nature Parks.

(19309) ŠALAMUN, A., M. GOVEDIČ, M. PODGORELEC & M. KOTARAC, 2010. [*Supplement to the proposal of the areas to be included in the Natura 2000 network. Dragonflies (Odonata), Final report*]. Cent. Cartogr. Fauna Flora, Ljubljana. 64+4 pp. (Slovene). – (CKFF, Klunova 3, SI-1000 Ljubljana).
Slovenia.

(19310) ŠALAMUN, A. & M. KOTARAC, 2010. [*Supplement to the proposal of the areas to be included in the Natura 2000 network. Dragonflies (Odonata): Ophiogomphus cecilia. Final report*]. Cent. Cartogr. Fauna Flora, Ljubljana. 36 pp. (Slovene). – (CKFF, Klunova 3, SI-1000 Ljubljana).
Slovenia.

(19311) SEVER, V., 2010. Biološka raznovrstnost. – [Biodiversity]. *Življenje Tehnika* 61(9): 66-69. (Slovene). – (Author's address not stated).
A report on the "Green Week" (Brussels, 1-4 July 2010), with reference to the current situation of Aeshna juncea in southern regions of central Europe and Cordulegaster helladica in Greece.

(19312) VAN DIJK, T.C., 2010 *Effects of neonicotinoid pesticide pollution of Dutch surface water on non-target species abundance*. MSc. Thesis, Sustainable Development (SD:LEB), Univ. Utrecht. 76 pp.
It was hypothesized that there is a correlation between the use of neonicotinoid pesticides and their

residues in surface water and the distribution and number of individuals per non-target spp. In the Netherlands. Where neonicotinoid pesticides are used and/or where there are significant amounts of residues in the soil and surface water, several non-target spp. are less abundant. The results of the investigation show that the odon. (represented by Ischnura elegans) are negatively influenced by the presence of imidacloprid, thus the hypothesis was confirmed for this order, though the effects on dragonflies are less strong than those on Diptera.

(19313) VINKO, D., 2010. [Report on the work of the Odonata Working Group]. *In*: I. Kodele Krašna, [Ed.], *Biološko-raziskovalni tabor "Budanje 2009"*, pp. 16-23, Zavod RS za varstvo narave, Ljubljana. ISBN 978-961-92304-7-3. (Slovene). − (Slovenska 14, SI-1234 Mengeš).
The locality is situated in the Vipava Valley (W Slovenia). A commented list of 30 spp. is presented.

(19314) WALDHAUSER, M. & M. MIKÁT, 2010. [Coenagrion ornatum, a surprise from a coal mine dump]. *Ochrana Prirody* 2010(2): 15-17. (Czech, with Engl. s.). − (First Author: Petrovice 136, CZ-47125 Jablonné v Podještědi).'
A review, with a map and habitat descriptions, of C. ornatum distribution in the Czech Republic. The 1890-1901, 2001-2007 and 2009 records are distinctly marked.

(19315) ŽALOHAR, J., M. KRIŽNAR, T. HITIJ & E. GRMŠEK, 2010. *Fosili iz okolice Kamnika*. − [*Fossils from the environs of Kamnik*]. Medobčinski Muzej Kamnik, 48 pp. ISBN 978-961-6599-15-3. (Slovene). − (Second Author: Nat. Hist. Mus. Slovenia, Prešernova 20, SI-1000 Ljubljana).
Includes a note on the recently described Sloveniatrum robici (see *OA* 17083) with 2 photographs of the holotype and the reproduction of its reconstruction.

2011

(19316) ARULPRAKASH, R. & K. GUNATHILAGARAJ, 2011. Odonate (Insecta) fauna of temporary water bodies of Salem, Tamil Nadu. *Bugs R All* 17: 30. − (Dept Agric. Ent., Tamil Nadu Agric. Univ., Coimbatore-641003, India).
15 spp. are reported from 6 temporary water bodies in the Salem distr., India.

(19317) BAGACHANOVA, A.K., N.N. VINOKUROV, T.G. EVDOKAROVA, Yu.V. ERMAKOVA, S.N. NOGOVITSYNA & A.A. POPOV, 2011. Taxonomic diversity of insects from the relic steppes of the mid-Lena river valley (central Yakutia). *Arid Ecosyst.* 1(1): 38-45. [Original Russ. paper (2011) in: *Aridnye Ecosistemy* 17(1): 64-74]. − (Inst. Biol. Problems of the Cryolithozone, Siber. Br., Russ. Acad. Sci., pr. Lenina 41, RUS-677007 Yakutsk).
In the Tuimaada valley steppe, 12 odon. spp. were reported from the steppe habitats and 28 spp. from the meadows; − Russia. In the present paper the odon. are not considered.

(19318) BRYA, J. et al., [Eds], 2011. *Zoologické dny Brno 2011: Sbornik abstractů*. Ustav Biologie Obratlovcú, AV CR, Brno. ISBN 978-80-87189-09-2. Price: Kč 150.- net (Czech). − (Publishers: Květná 8, CZ-603 65 Brno).
[Odonatol. papers]: *David, S.*: A new record of Coenagrion ornatum (Selys, 1850) from Slovakia (p. 50); − The bionomy of Crocothemis erythraea (Brullé, 1832) in Slovakia (p. 50).

(19319) BUCZYŃSKI, P. & K. LEWANDOWSKI, 2011. Dragonfly (Odonata) fauna of Olsztyn (Poland). *In*: P. Indikiewicz et al., [Eds], *Urban fauna*, pp. 109-119, UTP Bydgoszcz. − (First Author, Dept Zool., UMCS, Akademicka 19, PO-20-033 Lublin).
49 spp. are brought on record, most noteworthy of which are Lestes viridis, Sympecma paedisca, Aeshna cyanea and Sympetrum striolatum. The first 3 of these are recorded from the Olsztyn Lakeland (Poland) for the first time.

(19320) CABANA OTERO, M., A. ROMEO BARREIRO & A. CORDERO RIVERA, 2011. Primeras citas de Lestes sponsa (Hansemann, 1823) y nuevas observaciones de Aeshna juncea (Linnaeus, 1758) (Odonata) en Galicia (noroeste de la Peninsula Ibérica). *Boln Soc. ent. aragon.* 49: 341-343. (With Engl. s.). − (First Author: Depto Biol. Animal & Ecol., Fac. Cien., Univ. Coruña, Campus de Zapateira s/n, ES-15071 A Coruña).
L. sponsa is reported from 4 localities; it is new to Galicia (NW Spain). Some comments are provided concerning new observations on A. juncea, which was previously recorded only once from the region.

(19321) CARRICO, C., J.M. COSTA, T.C. SANTOS & D. ANJOS-SANTOS, 2011. Description of

the last instar larva of Phyllocycla gladiata (Hagen in Selys) (Anisoptera: Gomphidae). *EntomoBrasilis* 4(1): 26-29. (With Port. s.). – (Depto Ent., Museu Nac., UFRJ, Quinta da Boa Vista, São Cristóvão, BR-20940-040 Rio de Janeiro, RJ).
The description and illustrations are based on a single exuviae from the Camorim river, RJ (Brazil) and compared with the congeneric larvae.

(19322) CHOVANEC, A. & M. SCHINDLER, 2011. Gewässertypspecifische Bewertung von Restrukturierungsmassnahmen an einem Tieflandbach durch libellenkundliche Untersuchungen (Insecta: Odonata). *Beitr. Entomofaunistik* 12: 25-40. (With Engl. s.). – (First Author: Krotenbachgasse 68, A-2345 Brunn am Gebirge).
The ecological status of a restored stretch of a small river (Stronsdorfer Graben, Mottschüttelbach) in the lowlands of E Austria (Niederösterreich prov.) is assessed based on the odon. survey. In the restored section, 21 spp. (16 autochthonous) were recorded, as to 6 spp. (5 autochthonous) occurring in 2 canalised and straightened stretches.

(19323) CONTRERAS-CARDUÑO, J., A. CORDOBA-AGUILAR, M. AZPILICUETA-AMORIN & A. CORDERO-RIVERA, 2011. Juvenile hormone favors sexually-selected traits but impairs fat reserves and abdomen mass in males and females. *Evol. Ecol.* 25: 845-856. – (Second Author: Depto Ecol. Evolutiva, Inst. Ecol., UNAM, Apdo Postal 70-275, MX-04510 México, D.F.).
The physiological mechanism underlying resource allocation in sexual selection studies has been little studied. One candidate is hormones as these favour resource allocation to reproductive traits but impair survival due to a resource over-expenditure directed to the former traits. Here it was investigated whether a juvenile hormone analog (JHa, methoprene) administrated topically is involved in the resource allocation to wing pigmentation (an ornamental trait), fat reserves and flight muscle mass in both sexes of Calopteryx haemorrhoidalis and C. virgo, and the possible negative effect of such implementation on abdomen mass (an indirect measure of egg production) and field-based survival in adult ♂ C. haemorrhoidalis and C. splendens. It was found that ♂♂ and ♀♀ treated with JHa, against a control group, developed higher wing pigmentation and showed reduced fat reserves but had no change in muscle mass. In ♀♀, JHa decreased abdominal weight (an indicator of fecundity) and in ♂♂, survival was impaired only in C. splendens. These results support the idea that JH induces resource allocation to wing pigmentation, a sexually selected trait in both sexes. Thus, this study suggests that the action of JH could be a mechanistic link between ornaments and physiological condition in both ♂♂ and ♀♀.

(19324) CRAVES, J.A. & D. O'BRIEN, 2011. Tramea calverti (Odonata: Libellulidae): new for Michigan, with notes on other new reports for the Great Lakes region. *Great Lakes Ent.* 44(1/2): 78-82. – (First Author: Rouge River Bird Observ., Univ. Michigan-Dearborn, Envir. Interpretive Cent., Dearborn, MI-48128, USA).
Beginning in late summer 2010, T. calverti was observed in major northward movement in eastern N. America. It appeared for the first time in 3 Great Lakes states and in Ontario (Canada). A specimen from Michigan is the first and only voucher in the Great Lakes, and an observation in Minnesota provided a new northernmost record of this sp. for N. America.

(19325) DAVIS, R.B., D.B. NICHOLSON, E.L.R. SAUNDERS & P.J. MAYHEW, 2011. Fossil gaps inferred from phylogenies after the apparent nature of diversification in dragonflies and their relatives. *BMC evol. Biol.* 2011: 10 pp. + additional files 1-6. 11,252. http://www.biomedcentral.com/1471-2148/11/252 – (First Author: Dept Biol., Univ. York, York, YO10 5YW, UK).
The fossil record has suggested that clade growth may differ in marine and terrestrial taxa, supporting equilibrial models in the former and expansionist models in the latter. However, incomplete sampling may bias findings based on fossil data alone. To attempt to correct for such bias, we assemble phylogenetic supertrees on one of the oldest clades of insects, the Odonatoidea and their extinct relatives, using MRP and MRC. The trees are used to determine when, and in what clades, changes in taxonomic richness have occurred. Then it is tested whether equilibrial or expansionist models are supported by fossil data alone, and whether findings differ when phylogenetic information is used to infer gaps in the fossil record. There is broad agreement in family-level relationships between both supertrees, though with some uncertainty along the backbone of the tree regarding Anisoptera. "Anisozygoptera" are shown to be paraphyletic when fossil information is taken

into account. In both trees, decreases in net diversification are associated with species-poor extant families (Neopetaliidae, Hemiphlebiidae), and an upshift is associated with Calopterygidae + Polythoridae. When ghost ranges are inferred from the fossil record, many families are shown to have much earlier origination dates. In a phylogenetic context, the number of family-level lineages is shown to be up to twice as high as the fossil record alone suggests through the Cretaceous and Cenozoic, and a logistic increase in richness is detected in contrast to an exponential increase indicated by fossils alone. This analysis supports the notion that taxa, which appear to have diversified exponentially using fossil data, may in fact have diversified more logistically. This in turn suggests that one of the major apparent differences between the marine and terrestrial fossil record may simply be an artefact of incomplete sampling. The results also support previous notions that adult colouration plays an important role in odon. radiation, and that Anisozygoptera should be grouped in a single inclusive taxon with Anisoptera, separate from Zygoptera.

(19326) *ERJAVECIA*. Bulletin of the Slovenian Odonatological Society (ISSN 1408-8185), No. 26 (31 Oct. 2011). (Slovene & Engl.). – (c/o M. BEDJANIČ, Rakovlje 42/A, SI-3314 Braslovče).
The first part of the issue (pp. 1-20) presents an account on the First Balkan Odonatological Meeting, which took place in Slovenia (11-18 July 2011) and includes records of 50 spp. from 47 localities in Slovenia and 3 in Croatia. Other important papers were contributed by *A. Pirnat* (on the odon. fauna of the Kolpa river (pp. 21-26), *A. Šalamun* (Bela krajine / White Carniola, pp. 26-31) and by *M. Bedjanič* (Rudniško lake nr Kočevje, pp. 32-37 and on new records of Somatochlora arctica and Leucorrhinia dubia from Pohorje, pp. 37-42). *B. Kumar* is reporting on some Sympecma fusca observations (pp. 52-54), which sp. is brought on record from Pohorje by *M. Bedjanič* (pp. 54-56). The 26 Additions to the odonatol. literature of Slovenia (entries 810-850) are concluding the issue (*M. Bedjanič*, pp. 63-68).

(19327) FORBES, M.R., J.J. MLYNAREK, J. ALLISON & K.R. HECKER, 2011. Seasonality of gregarine parasitism in the damselfly, Nehalennia irene: understanding unimodal patterns. *Parasitol. Res.* 2011: 6 pp.; – DOI: 10.1007/s00436-011-2478--1. – (Dept Biol., Carlton Univ., 209 Nesbitt Bldg, 1125 Colonel By Dr., Ottawa, ON, K1S 5B6, CA).
The parasitism by gut protozoans (Apicomplexa: Eugregarinidae) was studied. It was tested whether there was any seasonal pattern, as has been found for other parasites of Zygopera and which has implications for selection on emergence and breeding. Using aggregate data from 12 date-by-site comparisons involving 5 sites, it was found that both prevalence and intensity of gregarine parasitism were seasonally unimodal. Parasitism first increased and then declined seasonally after peaking mid-season. N. irene has shown seasonal increases in density followed by declines at several sites including a site sampled in this study. Therefore, similar seasonal changes in a directly transmitted parasite were expected and are now confirmed. Other factors that might account for seasonal changes in parasitism by gregarines are either unlikely or can be discounted including sampling of older individuals mid-season but not late in the season, or sex biases in parasitism and overrepresentation of more or lex biases in parasitism and overrepresentation of the more parasitized sex mid-season.

(19328) GLIGOROVIĆ, B., V. PEŠIĆ & A. GLIGOROVIĆ, 2011. Contribution to the knowledge of the dragonflies (Odonata) of the Plavsko Lake area (Montenegro). *Natura montenegrina* 10(3): 237-243. (With Serb. s.). – (First Author: Dept Biol., Fac. Sci., Univ. Montenegro, Cetinjski put b.b., ME-81000 Podgorica).
A commented list of 15 spp., among which Coenagrion hastulatum, C. puella and A. juncea are dominant, whereas Aeshna affinis, Anax imperator, Somatochlora meridionalis and Libellula quadrimaculata are rare.

(19329) GLIWA, B. & V. STUKONIS, 2011. Erythromma viridulum (Odonata: Coenagrionidae), a new species to Lithuania. *Naujos Retos lietuvos Vabzdžiu Rūšis* 23: 5-7. (With Lithuan. s.). – (First Author: Lithuan. Ent. Soc., Akademijos 2, LT-08412 Vilnius).
A population of ca 50 individuals is reported from the man-made pond Juodupio Tvenkinys (Radviliškis distr., 29-VIII-2011), and 7 individuals from Lake Kragai (24-VII-2008).

(19330) GOVEDIČ, M. & A. BABIČ, 2011. *Dodatne raziskave kvalifikacijskih vrst Natura 2000 ter vzposavitev in izvajanje monitoring ciljnih vrst rakov v letih 2010 in 2011*. – [*Additional investigations on the*

characteristic Natura 2000 species and establishment and execution of monitoring of the target crab species during 2010 and 2011 (Crustacea: Decapoda)]. Cent. Cartogr. Fauna & Flora, Ljubljana. 86 pp. (Slovene). – (Authors & Publishers: CKFF, Klunova 3, SI-1000 Ljubljana).
Includes some information on Calopteryx splendens, C. virgo, Onychogomphus forcipatus, Cordulegaster bidentata and C. heros; – Slovenia.

(19331) HARDERSEN, S. & P. LEO, 2011. Dragonflies of Iglesiente (SW Sardinia) and additional records of rare or poorly known species from Sardinia (Odonata). *Conserv. Habitat Invert.* 5: 243-253. (With Ital. s.). – (First Author: Cent. Naz. Studio Conserv. Biodiv. Forestale "Bosco Fontana", Strada Mantova 29, I-46045 Marmirolo, MN).
A commented review is presented of the 28 spp. currently known from the Iglesiente, and new data are provided for other areas of Sardinia (Italy) for Lestes macrostigma, Sympecma fusca, Coenagrion scitulum, Lindenia tetraphylla, Orthetrum nitidinerve, O. trinacria and Brachythemis impartita.

(19332) HARITONOV [KHARITONOV], A.Yu. & O.N. POPOVA, 2011. Dragonfly (Odonata) migrations in the southern West-Siberian plain. *Zool. Zh.* 90(3): 302-310. (Russ., with Engl. s.). – (Inst. Anim. Syst. & Ecol., Russ. Acad. Sci., Frunze 11, RUS-630091 Novosibirsk).
The information on odon. mass migrations in Russia, particularly in western Siberia, is presented, with reference to the 1969-2009 studies by the Authors on the dynamics of odon. populations, their spatial distribution and displacement in the West-Siberian forest-steppe. An original general classification of dragonfly displacement is proposed.

(19333) HASSALL, C. & D.J. THOMPSON, 2011. Study design and mark-recapture estimates of dispersal: a case study with the endangered damselfly Coenagrion mercuriale. *J. Insect Conserv.* 2011: 10 pp.; – DOI: 10.1007/s10841-011-9399-2. – (First Author: Dept Biol., Carleton Univ., 1125 Colonel By Drive, Ottawa, ON, K15 5B6, CA).
Accurate data on dispersal ability are vital to the understanding of how spp. are effected by fragmented landscapes. However, 3 factors may limit the ability of field studies to detect a representative sample of dispersal events: (1) the number of individuals monitored, (2) the area over which the study is conducted and (3) the time over which the study is conducted. Using sub-sampling of mark-release-recapture data from a study on the endangered C. mercuriale, it is shown that maximum dispersal distance is strongly related to the number of recaptured individuals in the mark-release-recapture study and the length of time over which the study is conducted. Median dispersal distance is only related significantly to the length of the study. Spatial extent is not associated with either dispersal measure in our analysis. Previously consideration has been given to the spatial scale of dispersal experiments but here it is demonstrated conclusively that temporal scale and the number of marked individuals also have the potential to affect the measurement of dispersal. Based on quadratic relationships between the maximum dispersal distance, recapture number and length of study, it is concluded that a previous study was of sufficient scale to characterise the dispersal kernel of C. mercuriale. This method of analysis could be used to ensure that the results of mark-release-recapture studies are independent of levels of spatial and temporal investment. Improved confidence in dispersal estimates will enable better management decisions to be made for endangered spp.

(19334) HEIJLIGERS, H., 2011. De Ravenvennen, het eerste libellenreservaat in Limburg. – [The Ravenvennen, the first dragonfly reserve in Limburg]. *Limburgs Landschap* 38(3) 14-15. (Dutch). – (c/o Eds: Stichting het Limburgs Landschap, Rijksstraatweg 1, Lomm, postbus 4301, NL-5944 ZG Arcen).
The location of the Reserve is almost adjacent to the Maasduinen National Park, in the Venlo-Gennep area, Limburg (the Netherlands). The history of the Ravenvennen is briefly outlined, its nature described, and references are made to various local odon. spp. A brochure, describing the marked visitor route through the Reserve is available from the above address.

(19335) HESOUN, A.P. & A. DOLNÝ, 2011. Vážky. – [Dragonflies]. *In*: R. Tropek & J. Rehounek, [Eds], *Bezobratli postindustriálnich stanovišt: význam, ochrana a management*, pp. 85-97, ENTU BC AV CR & Calla, České Budějovice. ISBN 978-80-86668-20-8. (Czech). – (First Author: Bednáreček 58, CZ-378 42 Nová Včelnice).
The features of the post-industrial habitats are outlined, with emphasis on Sympecma paedisca, Libellula fulva and Orthetrum brunneum; – Czech Republic.

(19336) HOLUŠA, O., 2011. A dark colour form of Cordulegaster heros (Odonata: Cordulegastridae). *Čas. slez. Muz. Opava* (A) 60: 235-237. − (Dept Forest Prot. & Wildl. Mngmt, Fac. Forestry & Wood Technol., Mendel Univ., Zemědělská 3, CZ-613 00 Brno).
Among 40 ♂ and 5 ♀ found (11-VII-2010) at the Kamenný potok, Modra-Piesok village, southern Malé Karpaty Mts (W Slovakia), there was a ♂ with an abnormally dark abdomen. Detailed description and a drawing are provided.

(19337) JEZIORSKI, P. & O. HOLUŠA, 2011. Gomphus pulchellus Selys, 1840 does not belong to the dragonfly (Odonata) fauna of the Czech Republic. *Čas slez. Muz. Opava* (A) 60: 217-222. (With extensive Czech s.). − (First Author: Na Bělidle 1, CZ-735 64 Havířov-Suchá).
The sp. is not documented by any museum or private collection specimen and, based on 2 decades of faunal surveys by the Authors, it does not occur in the Czech Republic, therefore it is suggested to delete it from the national list.

(19338) KAZANCI, N., 2011. Species records of order Odonata (Insecta) and their habitat quality from Turkey. *Rev. Hydrobiol.* 4(1): 47-58. (With Turk. s.). − (Hydrobiol. Sect., Dept Biol., Sci. Fac., Hacettepe Univ., Beytepe, Ankara, Turkey).
10 spp. are listed, incl. Caliaeschna microstigma and Cordulegaster picta that are considered threatened in Turkey. Information on the ecology of all of these is presented and the physiochemical properties of the habitats are stated.

(19339) KEBE, J., 2011. *Lake Cirknica and the people who live on its shore*. Ognjišče, Koper/Capodistria. 759 pp. Hardcover, with flappers (22.0 × 30.5 cm). ISBN 978-961-263-075-1. Price: Euro 30.- net. (Slovene, with Engl. s.).
Includes a list of 36 odon. spp. recorded from the lake, for 12 of which the photographs are also provided; − Slovenia.

(19340) LI, Y.-j., A. NEL, D. REN, B.-l. ZHANG & H. PANG, 2011. New discoveries of Neogene hawker dragonflies (Insecta, Odonata Aeshnidae) from Shandong province in China. *Zoosystema* 33(4) 577-590. (With Fr. s.). − (Second Author: Entomologie, Mus. Natn. Hist. Nat., CP 50, 57 rue Cuvier, F-75231 Paris).
Epiaeschna matutina is redescribed and its diagnosis is amended. Aeshna shanwangensis sp. n. and A. forficatum sp. n. are described from the Middle Miocene deposit of Shanwang Formation, Shandong prov., E China. A comparison with the related fossil and extant spp. is provided.

(19341) LORENZO-CARBALLA, M.O., C.D. BEATTY, R. HAITLINGER, A.G. VALDECASAS, C. UTZERI, V. VIEIRA & A. CORDERO-RIVERA, 2011. Larval aquatic and terrestrial mites infesting parthenogenetic Ischnura hastata (Odonata: Coenagrionidae) from the Azores islands. *Exp. appl. Acarol.* 54: 225-241. − (Third Author: Dept Invert. Syst. & Ecol., Inst. Biol., Wroclaw Univ. Envir. & Life Sci., Kozuchowska 5/b, PO-51-631 Wroclaw).
The prevalence is reported of parasitism by water mites (Arrenurus sp.) and terrestrial mites (Leptus killingtoni) on parthenogenetic I. hastata. L. killingtoni was only found on the island of Pico, and the prevalence of infestation was highly variable among the different ponds studied, ranging from 0 to 41%. It was observed on 3 of the 4 odon. spp. from the archipelago: I. hastata, I. pumilio and Sympetrum fonscolombii, all of them new hosts for this sp. Aquatic mites have been found parasitizing I. hastata ♀♀ on the island of São Miguel. The prevalence of mite parasitism by Arrenurus sp. on I. hastata was very low, ranging from 12% (2003) to 1% (2008), and in most of the studied ponds, no mites were found attached to ♀♀. Although I. hastata coexists with a sexual congeneric sp. in the Azores (I. pumilio), they are syntopic in only a small fraction of ponds. Therefore, a comparison between I. hastata and I. pumilio was insufficient to test the predictions of the Red Queen Hypothesis.

(19342) MAKER, P., 2011. Vagrant Emperor Anax ephippiger (Burmeister) in Cornwall. *Atropos* 43: 44-45. − (2 Southleigh St., Grampound Rd, Truro, TR2 4D7, UK).
A sighting at Dodman Head, southern Cornwall, 14-X-2010, is documented by a photograph. This is followed by 2 mid-winter sightings in Pembrokeshire and Cornwall, whereafter, in April 2011, many more sightings were reported form Cornwall, a ♂ from Windmill Farm NR (24-IV-2011) is brought on record. − Aside of these Cornwall records (UK), 2 A. ephippiger sightings are reported from 2 localities in the Atlas Mts (Morocco), mid-Nov. 2010.

(19343) NAGEL, L., J.J. MLYNAREK & M.R. FORBES, 2011. Immune response to nylon filaments in two damselfly species that differ in their resistance to ectoparasitic mites. *Ecol. Ent.* 36: 736-743. – (Dept Biol., Carlton Univ., 1125 Colonel By Dr., Ottawa, ON, K1S 5B6, CA).
Insects commonly resist parasites using melanotic encapsulation. Many studies measuring immune response use the amount of melanin deposited on an artificial object that has been inserted into the animal as a proxy of the amount of resistance that the host is capable of mounting to natural parasites. The relevance of this methodology to immune response in natural insect populations needs further study. Here, Lestes disjunctus and L. forcipatus were examined to elucidate the relationships among odon. size, natural resistance to mites (Arrenurus planus, A. pollictus), and the immune response mounted by the same odon. against nylon filaments. L. forcipatus that had high rates of melanotic encapsulation of mites in nature deposited more melanin on the nylon inserts than L. disjunctus with low rates of natural resistance. In ♀♀, those that had resisted mites naturally melanised the nylon filament more aggressively than those that did not resist mites. These results show some support for the use of nylon filaments to assess natural patterns of immune response in the 2 Lestes spp., but also suggest that caution should be used in interpreting the responses.

(19344) NAGEL, L., M. ZANUTTIG & M.R. FORBES, 2011. Escape of parasitic water mites from dragonfly predators attacking their damselfly hosts. *Can. J. Zool.* 89: 312-318. (With Fr. s.). – (Dept Biol., Carlton Univ., 1125 Colonel By Dr., Ottawa, ON, K1S 5B6, CA).
Many parasites are transmitted trophically, whereas others can either succumb to, or escape from, the predators of their hosts. The extent was examined to which larval water mites (Arrenurus planus and A. pollictus), were parasitizing on Lestes forcipatus and L. disjunctus, escape from predatory libellulid dragonflies that are consuming their hosts. It was hypothesized that the brightly coloured mites would be avoided by feeding dragonflies. However, all partially engorged A. pollictus were eaten while their host was being consumed in staged predation trials. In contrast, half of the fully engorged mites detached and therefore escaped consumption. Trials with A. planus showed that they detached more readily than their congenerics, which may be due to selection on those temporary pond mites to survive desiccation stress following detachment. The effect of dragonfly predation on transitioning of mites from parasitic larvae to their free-living aquatic stages therefore depends on the degree of engorgement and the mite species.

(19345) NATIONALPARK HAINICH, [Publishers], 2011. *Artenbericht 2010: Tiere, Pflanzen und Pilze im Nationalpark Hainich*. Nationalparkverwaltung Hainich. 148 pp. – (Bei der Marktkirche 9, D-99947 Bad Langensalza).
Includes a checklist of 44 odon. spp.; – Thüringen, Germany.

(19346) NESEMANN, H., G. SHARMA & R.K. SINHA, 2011. Benthic macro-invertebrate fauna and „marine elements" sensu Annandale (1922) highlight the valuable dolphin habitat of river Ganga in Bihar, India. *Taprobanica* 3(1): 18-30. – (First Author: Cent. Envir. Sci., Central Univ. Bihar, BIT Campus, Patna-800 014, India).
Unidentified Protoneuridae, Coenagrionidae and Libellulidae spp. are listed from the Ganga r. at Patna, India.

(19347) NGOI, P.S., J. TAN & R.W.J. NGIAM, 2011. New record of a dragonfly, Zyxomma obtusum Albarda, 1881, in Singapore (Odonata: Anisoptera: Libellulidae). *Nature Singapore* 4: 241-244. – (Last Author: Natn. Biodiv. Cent., Natn Parks Board, 1 Cluny Rd, Singapore 259569).
In addition to Z. petiolatum (cf. *OA* 18941), this is the second member of the gen. recorded from Singapore (3♂, 2♀, Pulau Ubin, 20-III to 20-IV-2011). Photographs of the habitat and both sexes are included.

(19348) NOSE MAROLT, M., 2011. *Ohranjanje in upravljanje sladkovodnih mokrišč v Sloveniji: WETMAN. – [Conservation and management of freshwater wetlands in Slovenia: WETMAN*]. Zavod RS za varsvo narave, Ljublana. 7 pp. (Slovene). – (Addresses not stated).
Deals with several odonatol. important odon. sites in Slovenia, though no reference is made to the Odon. A map is included.

(19349) *ODONATOLOGICAL ABSTRACT SERVICE* (ISSN 1438-0269), No. 33 (54 pp., Dec. 2011). – (Distributor: M. Schorr, Schulstr. 7/B, D-54314 Zerf).
Abstract Nos 10679-11029.

(19350) PINTO, A.P. & C.J.E. LAMAS, 2011. Description of the female of Navicordulia aemulatrix Pinto & Lamas and additional notes on the male (Odonata: Corduliidae). *Neotrop. Ent.* 40(6): 698-703. – (Mus. Zool., Univ. São Paulo, Av. Nazaré 481, BR-04263-00 Ipiranga, São Paulo, SP).
The descriptions are based on material from São Bento do Sul, SC, Brazil. A modification in couplet 6 of A.B.M. Machado & J.M. Costa (1995, *Odonatologica* 24: 187-218) is provided in order to allow the separation of N. aemulatrix ♀ from N. longstyla and N. mielkei.

(19351) PINTO, N.S., 2011. Ocorrência de Orthemis cultiformis (Calvert) (Odonata: Libellulidae) para estado de Goiás (Brasil). *EntomoBrasilis* 4(1): 36-37. (Port., with Engl. s.). – (Lab. Ecol. Teórica & Sintese, Inst. Cien. Biol., Univ. Fed. Goiás, Campus Samambaiam, Goiânia, GO, Brazil).
1 ♂, a pond on the Samambaia Campus, Goiânia, Brazil, VIII-2009. The sp. was not previously recorded from the state of Goiás.

(19352) RAEBEL, E.M., T. MERCKX, R.E. FEBER, P. RIORDAN, D.W. MACDONALD & D.J. THOMPSON, 2011. Identifying high-quality pond habitats for Odonata in lowland England: implications for agri-environment schemes. *Insect Conserv. Divers.* 2011: 11 pp.; – DOI 10.1111/j.1752-4598.2011.00178.x. – (First Author: Wildl. Conserv. Res. Unit, Recanati-Kaplan Cent., Dept Zool., Univ. Oxford, Tubney House, Abingdon Rd, Tubney, Oxfordshire, OX13 5QL, UK).
Agricultural intensification has contributed to severe declines in odon. populations. The objective of this study is to benefit current measures for the odon. conservation by establishing the conditions favourable to Odon. and focusing on ponds within agricultural land. The landscape-scale study used exuvial counts and habitat measurements from 29 ponds across a catchment in England, over 3 yr, to determine key factors affecting odonate abundance and species richness. Ponds dominated by floating and submerged vegetation were the most transparent, supported the highest abundance and species richness of exuviae and were always fully or partially surrounded by buffer strips. Ponds lacking vegetation were turbid, yielding no exuviae even if they were buffered. English agri-environment schemes (AES) currently support pond and buffer strip creation and management. Abundance of exuviae was higher in recently created ponds compared to older ponds, whereas ponds that had dried out the previous summer had fewer exuviae. Species richness of exuviae decreased with increasing distance to the nearest viable pond, falling by more than 40% for distances over 100 m. It is concluded that odon. conservation would be more effective if AES would consider the spatial scale at which ponds are created and the location, type, and quality of ponds targeted for buffer strips.

(19353) RELYEA, C.D., G.W. MINSHALL & R.J. DANEHY, 2011. Development and validation of an aquatic Fine Sediment Biotic Index [FSBI]. *Envir. Mngmt* 2011: 10 pp.; – DOI: 10.1007/s00267-011-9784-3. – (First Author: Dept Biol. Sci., Idaho St. Univ., Pocatello, ID, USA).
The FSBI is a regional stress-specific biomonitoring index to assess fine sediment (<2 mm) impacts on macroinvertebrate communities in northern US streams. It is developed based on macroinvertebrate assemblages and substrate particle sizes for 1139 streams, spanning 16 western US Level III Ecoregions. Octogomphus is the sole odon. taxon considered (from 27 streams; FSBI 5).

(19354) ROMAY, C.D., A. CORDERO-RIVERA, A. ROMEO, M. CABANA, D.X. CABANA & M.A. FERNÁNDEZ-MARTINEZ, 2011. Nomes galegos para as libélulas (orde Odonata) da Peninsula Iberica. *Chioglossa* 3: 21-36. (Galician). – (Second Author: Depto Ecol. Biol. Animal, E.U.E.T.F., Univ. Vigo, Campus Universitario s/n, ES-36005 Pontevedra).
A proposal of Galician (Spain) vernacular names for 77 spp. of the Iberian Peninsula.

(19355) SANG, A. & T. TEDER, 2011. Dragonflies cause spatial and temporal heterogeneity in habitat quality for butterflies. *Insect Conserv. Divers.* 4: 257-264. – (Dept Zool., Inst. Earth Sci., Univ. Tartu, Vanemuise 46, EE-51014 Tartu).
Mortality caused by natural enemies is an essential but largely overlooked aspect of habitat quality for herbivorous insects. Quantitative data on mortality sources and their spatiotemporal variation are especially scarce for adult insects. Here, a report is presented on the results of an extensive field study aimed to quantify spatial and seasonal variation in dragonfly predation on adult butterflies in their natural habitats in temperate calcareous grasslands, based on direct observations of actual predation events

during standardised transect walks in W Estonia. Odon. were found to exert high mortality in butterflies. Their impact on butterflies was dependent on predator abundance, which strongly varied among habitat patches and during the season. This suggests that dragonflies can generate substantial spatiotemporal heterogeneity in habitat quality for butterflies in terms of survival. Obtaining prior knowledge of where and when predators are abundant, and avoiding such sites for butterfly conservation, could considerably improve the efficiency of butterfly conservation practices.

(19356) SANTOLAMAZZA, S., E. BAQUERO & A. CORDERO-RIVERA, 2011. Incidence of Anagrus obscurus (Hymenoptera: Mymaridae) egg parasitism on Calopteryx haemorrhoidalis and Platycnemis pennipes (Odonata: Calopterygidae, Platycnemididae) in Italy. *Ent. Sci.* 14(3): 366-369. – (First Author: Depto Genet. Vegetal, P.O. Box 28, ES-36080 Pontevedra).
This is the first time that this sp is described as an egg parasitoid of odon., and that the egg parasitoid of C. haemorrhoidalis and P. pennipes is identified. The data suggest that egg parasitism might be a significant selective factor for both odon. spp. in the studied locality (Pontecorvo, Frosinone prov., central Italy), affecting ♀ oviposition behaviour.

(19357) SCHMIDT, E.G., 2011. Lestes virens: eine leicht zu übersehene Libelle. *Virgo/Mitt. ent. Ver. Mecklenburg* 14(1): 10-14. – (Coesfelder Str. 230, D-48249 Dülmen).
On habitats and habits of L. virens in N. Germany.

(19358) SCHMIDT DALZOCHIO, M., L.O.I. DE SOUZA, M.A. UCHOA & J.M. COSTA, 2011. First records of Odonata (Insecta) from the Bodoquena mountains, Mato Grosso do Sul, Brazil. *EntomoBrasilis* 4(3): 135-138. (With Port. s.). – (First Author: Lab. Ecol. & Conserv., Ecosist. Aquát., Univ. do Vale do Rio dos Sinos, Av. Unisinos 950, BR-93022-000 São Leopoldo, RS).
Records of 21 spp.

(19359) SCHMIDT DALZOCHIO, M., Y. URAKAMI & I.F. MACHADO, 2011. Mecistogaster amalia (Burmeister) (Odonata: Pseudostigmatidae): first record from Rio Grande do Sul state, Brazil. *EntomoBrasilis* 4(2): 78-79. (With Port. s.). – (First Author: Lab. Ecol. & Conserv. Ecosist. Aquát., Univ. do Vale do Rio dos Sinos, Av. Unisinos 950, BR-93022-000 São Leopoldo, RS).
2 ♂, Palanquinhos Canyon, 10-V-2010. This record extends the range of the sp. for ca 630 km from the Paranaense Forest (Misiones prov.).

(19360) SLUKA, K., 2011. Träume verleihen Flügel. *Westfalen Spiegel* 60(4): 22-23. – (Author's address not stated).
It includes a reference to the Leonardo da Vinci's (1452-1519) draft of a flying machine, based on his study of dragonfly flight mechanics, which is often suggested (but not actually experimentally confirmed !) that it could take off vertically and manoeuvre in the air similarly to the modern helicopter.

(19361) ŠTIH, A., M. ZADRAVEC, D. HLAVATI & T. KOREN, 2011. First data on dragonfly (Insecta, Odonata) fauna in the Vugrovec area, Zagreb and the first checklist of the dragonflies of Zagreb. *Entomol. Croat.* 15(1/4): 223-235. (With Croat. s.). – (Last Author: Inst. Biodiv. Stud., Sci & Res. Cent. Koper., Univ. Primorska, Garibaldijeva 1, SI-6000 Koper/Capodistria).
A commented checklist of 44 spp. Orthetrum coerulescens is for the first time recorded from Zagreb (Croatia).

(19362) SUĆESKA, S. & J. KARAČIĆ, 2011 Lesser Emperor dragonfly Anax parthenope (Selys, 1839) (Insecta, Aeshnoidea, Aeshnidae), a new species of Odonata of Bosnia and Herzegovina. *Natura montenegrina* 10(4): 467-472. (With Serb. s.). – (Dept Biol., Fac. Sci., Univ. Sarajevo, Zmaja od Bosne 33-35, BA-71000 Sarajevo).
1 ♂, Boracko Lake, 29-VII-2011.

(19363) SYCHRA, J. & Z. ADÁMEK, 2011. The impact of sediment removal on the aquatic macroinvertebrate assemblage in a fishpond littoral zone. *J. Limnol.* 70(1): 129-138. – (First Author: Dept Bot. & Zool., Fac. Sci., Masaryk Univ., Kotlarska 2, CZ-61137 Brno).
3 identified odon. spp. are recorded from the Štěpánek fishpond in the E Bohemian-Moravian highlands, alt. 430 m a.s.l. (Czech Republic), but the odon. are not further considered in the text.

(19364) TAKAHASHI, Y., S. MORITA, J. YOSHIMURA & M. WATANABE, 2011. A geographic cline induced by negative frequency-depend-

ent selection. *BMC Evol. Biol.* 2011: 10 pp.; – DOI: 10.1186/1471-2148-11-256. – (First Author: Div. Ecol. & Evol. Biol., Grad. Sch. Life Sci., Tohoku Univ., 6-3, Aoba, Aramaki, Aoba, Senai, Miyagi, 980-8578, JA).

Establishment of geographic morph frequency clines is difficult to explain in organisms with limited gene flow. Balancing selection, such as negative frequency-dependent selection (NFDS), is instead suggested to establish a morph frequency cline on a geographic scale at least theoretically. Here it was tested whether a large-scale smooth cline in morph frequency is established by NFDS in the ♀-dimorphic Ischnura senegalensis, where andromorphs and gynomorphs are maintained by NFDS. A large-scale latitudinal cline in the morph frequency was found: andromorph frequency ranged from 0.05 (South) to 0.79 (North). Based on the empirical data on the numbers of eggs, the number of ovariole, abdomen length and latitude, the potential fitness of andromorphs was estimated to be lower than that of gynomorphs in the South, and higher in the North, suggesting the gene-by-environment interaction. From the morph-specific latitudinal cline in potential fitness, the frequency of andromorphs was expected to shift from 0 to 1 without NFDS, because a morph with higher potential fitness wins completely and the 2 morphs will switch at some point. In contrast, NFDS led to the coexistence of 2 morphs with different potential fitness in a certain geographic range along latitude due to rare morph advantage, and resulted in a smooth geographic cline of morph frequency.These results provide suggestive evidence that the combination of NFDS and gene-by-environment interaction, i.e. multi-selection pressure on colour morphs, can explain the geographic cline in morph frequency in the current system.

(19365) TAKAHASHI, Y. & M. WATANABE, 2011. Male mate choice based on ontogenetic colour changes of females of the damselfly Ischnura senegalensis. *J. Ethol.* 29: 293-299. – (First Author: Grad. Sch. Life & Envir. Sci., Univ. Tsukuba, 1-1-1 Tennodai, Tsukuba, Ibaraki, JA).

While ♂ mate choice behaviour has been reported in many taxa, little is known about its plasticity and evolutionary consequences. In I. senegalensis, ♀♀ exhibit colour dimorphism (gynomorph and andromorph). The body colour of gynomorphs changes ontogenetically in accordance with sexual maturation, while little change occurs in andromorphs. To test the ♂ mate choice between sexually immature and mature ♀♀ of both morphs, binary choice experiments were conducted. Virgin ♂♂ that were reared separately from ♀♀ after emergence did not show significant preference between sexually immature and mature ♀♀ for both morphs, indicating that virgin ♂♂ were unable to discriminate ♀ reproductive status. On the other hand, ♂♂ that had experienced copulation with gynomorphs preferred sexually mature gynomorphs to sexually immature ones. However, ♂♂ that had experienced copulation with andromorphs could not discriminate between sexually immature and mature andromorphs, probably due to the absence of significant ontogenetic change in their thoracic colour. Therefore, ♀ body colour is an important cue for ♂♂ in discriminating between sexual maturation stages. Learned mate discrimination depending on copulation experience might help ♂♂ to detect potential mates effectively and avoid sexually unreceptive immature ♀. The adaptive significance of the ontogenetic colour change in ♀♀ is discussed.

(19366) TESKE, A., 2011. Herbstlebensräume von Sympecma paedisca (Brauer, 1877) und S. fusca (Vander Linden, 1820) im Bereich Thülsfelder Talsperre (LK Cloppenburg). *Drosera* 2010: 149-158. (With Engl. s.). – (AG Terrestr. Oekol., Inst. Biol. u. Umweltwiss., Fak. V, Univ. Oldenburg, D-26111 Oldenburg).

In the studied area in the distr. of Cloppenburg, Lower Saxony (Germany), in the autumn of 2010, one large and 2 smaller occurrences of S. paedisca were found. S. fusca was found only in the area of the large paedisca occurrence. The sites are microclimatically favourable: open forest areas with withered grass, Calluna vulgaris, withered Tanacetum vulgare and piles of dead wood. Whether these sites are only late summer habitats or they are properly autumn/winter habitats remains uncertain.

(19367) VAN HARDENBROEK, M., O. HEIRI, M.F. WILHELM & A.F. LOTTER, 2011. How representative are subfossil assemblages of Chironomidae and common benthic invertebrates for the living fauna of lake De Waay, the Netherlands? *Aquat. Sci.* 73: 247-259. – (First Author: Lab. Palaeobot. & Palynol., Inst. Envir. Biol., Univ. Utrecht, Budapestlaan 4, NL-3594 CD Utrecht).

The distribution of benthic invertebrates and their subfossil remains was examined within the basin De

Waay, a hypertrophic hardwater lake (surface 1.3 ha, max. depth 15 m), situated ca 15 km S of Utrecht. The lake is a scour hole, originating in a dike breach in 1496. (For more details see E. Kirilova et al., 2010, *J. Paleolimnol.* 43: 829-842). Here, the living Ischnura elegans and Aeshna mixta, and the unidentified subfossil "Odonata" are brought on record from the lake.

(19368) VAN SWAAY, C.A.M., T. TERMAAT & C.L. PLATE, 2011. *Monitoring butterflies and dragonflies in the Netherlands in 2010*. Rapport VS2011.004, De Vlinderstichting, Wageningen. 36 pp. (Dutch, with Engl. s.). – (De Vlinderstichting, P.O. Box 506, NL-6700 AM Wageningen).
De Vlinderstichting (Dutch Butterfly Conservation) and Statistics Netherlands coordinate the monitoring schemes for butterflies and dragonflies in the Netherlands. The odon. scheme started in 1998. – In 2010, approx. 370 odon. transects were counted. Like in most yr, Ischnura elegans, Coenagrion puella, Enallagma cyathigerum, Libellula quadrimaculata and Orthetrum cancellatum were the most common spp. The trends of most spp. are presented, 23 spp. show a significant increase, 7 are stable and 12 spp. are declining. The strong decline of Coenagrion hastulatum, Aeshna viridis and Leucorrhinia albifrons is alarming.

(19369) VINKO, D., 2011. [Report of the Odonata Working Group at the Research Camp of the biology students, 2010: Most na Soči]. *In*: D. Vinko, [Ed.], *Raziskovalni tabor študentov biologije: Most na Soči, 2010*, pp. 50-55, Društ. Štud. Biol., Ljubljana. ISBN 978-961-91041-9-4. (Slovene, with Engl. s.). – (Slovenska 14, SI-1234 Mengeš).
33 spp. are recorded from 33 localities; – W. Slovenia.

(19370) VINKO, D., 2011. Report of the Odonata Working Group on the ecosystems of the Adriatic: delta of the Neretva, 2011. *In*: N. Krivic et al., [Eds], *Ekosistemi Jadrana: delta Neretve, 2011*, 3 pp., Društ. Štud. Biol., Ljubljana. (Slovene, with Engl. s.). – (Slovenska 14, SI-1234 Mengeš).
The records are presented of 17 spp. The occurrence of Anax ephippiger was confirmed and Libellula quadrimaculata was rediscovered in the region after more than 150 yr; – Croatia.

(19371) WELLENREUTHER, M., R.A. SÁNCHEZ-GUILLÉN, A. CORDERO-RIVERA, E.I. SVENSSON & B. HANSSON, 2011. Environmental and climatic determinants of molecular diversity and genetic population structure in a coenagrionid damselfly. *PLoS ONE* 6(6): e20440; – DOI: 10.1371/journal.pone.0020440. – (First Author: Dept Biol., Lund Univ., Lund, Sweden).
Identifying environmental factors that structure intraspecific genetic diversity is of interest for both habitat preservation and biodiversity conservation. Recent advances in statistical and geographical genetics make it possible to investigate how environmental factors affect geographic organisation and population structure of molecular genetic diversity within species. Here is presented a study on Ischnura elegans, which has been the target of much ecological and evolutionary research. The following questions are addressed: (i) is the population structure affected by longitudinal or latitudinal gradients?; (ii) do geographic boundaries limit gene flow?; (ii) does geographic distance affect connectivity and is there a signature of past bottlenecks?; (iv) is there evidence of a recent range expansion and (v) what is the effect of geography and climatic factors on population structure? It was found low to moderate genetic sub-structuring between populations (mean F_{ST} = 0.06, D_{est} = 0.12) and an effect of longitude, but not latitude, on genetic diversity. No significant effects of geographic boundaries (e.g. water bodies) were found. F_{ST} and D_{est}-values increased with geographic distance; however, there was no evidence for recent bottlenecks. Finally, no molecular signatures of range expansions or an effect of geographic suitability were detected, although local precipitation had a strong effect on genetic differentiation. The population structure of this small insect has probably been shaped by ecological factors that are correlated with longitudinal gradients, geographic distances, and local precipitation. The relatively weak global population structure and high degree of genetic variation within populations suggest that I. elegans has high dispersal ability, which is consistent with this species being an effective and early coloniser of new habitats.

(19372) XU, Q.-H. & H.-M. ZHANG, 2011. The last-stadium larva and systematic status of Planaeschna suichangensis Zhou & Wei, 1980 (Odonata: Anisoptera: Aeshnidae). *Zootaxa* 3049: 64-68. – (First Author: Dept Biol. & Envir. Engineering, Zhangzhou City Univ., Zangzhou, Fuian-363000, China).
The larva is described and illustrated. Its morpho-

logical features indicate that the sp. is closer to P. risi than to P. taiwana.

(19373) ZESSIN, W., 2011. Neue Insekten aus dem Moler (Paläozön/Eozön) von Dänemark, 1 (Odonata: Epallagidae, Megapodagrionidae). *Virgo/Mitt. ent. Ver. Mecklenburg* 14(1): 64-73. (With Engl. s.). − (Lange Str. 9, D-19230 Jasnitz).
Morsagrion ansorgei gen. n., sp. n., Furagrion morsi sp. n., Hanklitia hankliti gen. n., sp. n. (all Megapodagrionidae) and Ejerslevia haraldi gen. n., sp. n. and Solveigia witecki gen. n., sp. n. (both Epallagidae) are described and illustrated from the Paleocene/Eocene Fur formation (Mo clay) of the Isle of Fur and Mors, Denmark.

(19374) ZHANG, Z.-Q., 2011. Editorial. Describing unexplored biodiversity: *Zootaxa* in the International Year of Biodiversity. *Zootaxa* 2768: 1-4. − (Landcare Res., P.B. 92170, Auckland-1142, NZ).
In 2009 and 2010, 3070 papers and 163 monographs were published in 765 issues, i.e. on 61188 pp. of *Zootaxa*. These include the descriptions of 30 new spp. and 3 new gen. of Odon.

2012

(19375) BALZAN, M.V., 2012. Associations of dragonflies (Odonata) to habitat variables within the Maltese Islands: a spatio-temporal approach. *J. Insect Sci.* 12(87): 18 pp. Available online *insectscience-org/12.87*. − (Inst. Life Sci., Scuola Superiore Sant'Anna, Piazza Martiri della Libertà, Pisa, PI, Italy).
The results are presented of the investigations how odon. assemblage structure and diversity are associated with habitat variables of local breeding habitats and the surrounding agricultural landscapes. The findings from this study have several implications for the use of Odon. as biological indicators, and for current trends with respect to odon. diversity conservation within the Maltese Islands.

(19376) BEDJANIČ, M., 2012. [*Dragonfly fauna inventarisation of the Vrbje fishpond near Žalec and its environs*]. DPPVN, Rače. 32 pp. (Slovene). − (Publishers: Ptujska 91, SI-2327 Rače).
29 spp., with extensive considerations on their protection and conservation; − central Slovenia.

(19377) BEDJANIČ, M., 2012. [*The expected extension of the clay-pit Tondach in Boreci (district Križevci nr Ljutomer, Slovenia): preparation of the directives for the improvement of life conditions for the protected animal species, with emphasis on Leucorrhinia pectoralis*]. Pro Natura, Slovenska Bistrica. 27 pp. (Slovene). − (Author: Rakovlje 42/A, SI-3314 Braslovče, Slovenia).
Includes a list of 17 recorded spp.

(19378) BEDJANIČ, M. & D. VINKO, 2012. New records of Epallage fatime (Charpentier, 1840) in Macedonia (Odonata: Euphaeidae). *Natura Sloveniae* 14(1): 15-22. (With Slovene s.). − (First Author: Rakovlje 42/A, SI-3314 Braslovče, Slovenia).
The autochthonous occurrence is reported from 3 localities in S and SE Macedonia, and a review is presented of E. fatime known distribution in Macedonia and the neighbouring countries.

(19379) BLAND, L.M., B. COLLEN, C.D.L. ORME & J. BIELBY, 2012. Data uncertainty and the selectivity of extinction risk in freshwater invertebrates. *Diversity Distrib.* 2012: 1-10. − (First Author: Inst. Zool., Zool. Soc. London, Regent's Park, London, NW1 4RY, UK).
The impact of different treatments of the IUCN Data Deficient (DD) category on taxonomic and geographical patterns of extinction risk was investigated in Odon. (527 DD spp.; not listed), crayfish and freshwater crabs. Contingency tables were used to evaluate taxonomic and geographical selectivity of data deficiency and extinction risk based on their IUCN Red List status. Investigated were differences in patterns of data deficiency and extinction risk among taxonomic families, geographical realms and taxonomic families within geographical realms for each of the 3 groups. At each level, the Authors evaluated the impact of uncertainty conferred by the conservation status of DD spp. on extinction and risk patterns exhibited by the group. Evaluated were 3 scenarios, viz.: (1) excluding DD spp., (2) treating all DD spp. as non-threatened, and (3) treating all DD spp. as threatened. At the global scale, DD spp. were taxonomically and geographically non-randomly distributed. Although the presence of under- or over-threatened families and biogeographical realms was generally unchanging, the strength of taxonomic and geographical selectivity of extinction risk varied. There was little consistent evidence for taxonomic selectivity of extinction risk at sub-global scales in Odon., either among biogeographical realms

or among scenarios. Global patterns of taxonomic and geographical selectivity were generally consistent with one another and robust to different treatments of DD spp. However, sub-global scale conservation prioritization from these types of data sets will require increased investment to make accurate decisions. Given the current levels of data uncertainty, the relative importance of biological characteristics and threatening processes in driving extinctions cannot be easily determined. It is recommended, therefore, that DD spp. should be given high research priority to determine their true status.

(19380) *BULETIN INDONESIA DRAGONFLY SOCIETY*, No. 1 (March 2012). 4 pp. ISSN none. (Bahasa Indonesian). – (c/o the IDS President: Mr W. Sigit, IDS, Jalan Gresik 14, Malang, East Java-65115, Indonesia).

The issue contains reports on the IDS activities, by *N. Christian* and *T. Makitan*, a list of local folk appellations for dragonflies in various regions of Java ("*gantrung*", "*kutrik*", "*kinjeng*", "*kijang*", "*papatong*"), and information on the availability of IDS stickers and T-shirts. – From the above address is also available an Engl. text on the objectives and programs of the Society including the names of the Board members.

(19381) BÜSSE, S., P. VON GRUMBKOW, S. HUMMEL, D.N. SHAH, R.D.T. SHAH, J.LI, X. ZHANG, K. YOSHIZAWA, S. WEDMANN & T. HÖRNSCHEMEYER, 2012. Phylogeographic analysis elucidates the influence of the Ice Ages on the disjunct distribution of relict dragonflies in Asia. *PLoS ONE* 7(5): e38132; – DOI: 10.1371/journal.phone.0038132. – (First Author: Blumenbach Inst. Zool. & Anthropol., Dept Morphol., Syst. & Evol. Biol., Univ Göttingen, Göttingen, Germany).

Unusual biogreographic patterns of closely related groups reflect events in the past, and molecular analyses can help to elucidate these events. While ample research on the origin of disjunct distributions of different organism groups in the W Palaearctic has been conducted, such studies are rare for E Palaearctic organisms. A phylogeographic analysis of the disjunct distribution pattern of the extant spp. of the strongly cool-adapted Epiophlebia dragonflies from Asia is presented. Sequences of the usually more conserved 18 S rDNA and 28 S rDNA genes and the more variable sequences of ITS1, ITS2 and CO2 of all 3 currently recognised Epiophlebia spp. and of a sample of other odon. spp. were investigated. In all genes investigated the degrees of similarity between Epiophlebia spp. are very high and resemble those otherwise found between different populations of the same sp. in Odon. This indicates that substantial gene transfer between these populations occurred in the comparatively recent past. These analyses imply a wide distribution of the ancestor of extant Epiophlebia in SE Asia during the last ice age, when suitable habitats were more common. During the following warming phase, its range contracted, resulting in the current disjunct distribution. Given the strong sensitivity of these spp. to climatic parameters, the current trend to increasing global temperatures will further reduce acceptable habitats and seriously threaten the existences of these last representatives of an ancient group of Odon.

(19382) CARLE, F.L., 2012. A new Epiophlebia (Odonata: Epiophlebioidea) from China with a review of epiophlebian taxonomy, life history and biogeography. *Arthr. Syst. Phylog.* 70(2): 75-83. – (Dept Ent., Rutgers St. Univ. N.J., 96 Lipman Dr., New Brunswick, NJ 08901, USA).

E. diana sp. n. is described from larval specimens. Holotype: ultimate ♀ larva, Mts of W. Sichuan, no date; deposited in D.C. Graham coll., Cornell Univ. Insect Coll. Adult unknown.

Epiophlebian taxonomy, life history, and biogeography are reviewed and keys provided for determination of the known adults and larvae of Epiophlebia Calvert, 1903. Classification of Epiophlebia is revised as follows: Epiophlebia s. str. with E. superstes (Selys, 1889) [type species] and E. sinensis Li & Nel, 2012 and Rheoepiophlebia subgen. n. with E. laidlawi Tillyard 1921 [type species] and E. diana sp. n. Behavioural, ecological and paleontological information is also evaluated and members of Epiophlebia acknowledged to have inhabited small high elevation streams of the E Palaearctic for possibly 180 million years. Likely reasons are proposed for the enduring survival of Epiophlebia, its lack of the E Palaearctic for possibly 180 million years. Likely reasons are proposed for the enduring survival of Epiophlebia, its lack of a fossil record and the extinction of related groups.

(19383) CHE SALMAH, M.R., S.A. AL-SHAMI, A. SHAH, R.M. SHAH, A. ABU-HASSAN & A. MAN, 2012. Effects of herbicides on Odonata communities in a rice agroecosystem.

Toxicol. environ. Chem. 2012: 11 pp.; – DOI: 10.1080/02772248.2012.689837. – (First Author: Sch. Biol. Sci., Univ. Sains Malaysia, 11800 Minden, Penang, Malaysia).
The effects of propanil, quinclorac, molinate/propanil, 2,4-D amine, and bensulfuron on Odon. diversity and abundance at the experimental rice plots in Malaysia were investigated. A total of 13 morphospp. of 2 fam. have been identified. Treated plots exhibited higher species richness (up to 12 spp.) than the control plot (8 spp.). Ischnura was the most abundant sp. in the treated plots with a mean density of 194.2 ind/m^{-2}, followed by Brachythemis contaminate (152 ind/m^{-2}) and Agriocnemis (124 ind/m^{-2}). In the control plots, Agriocnemis was dominant (153 ind/m^{-2}), followed by Ischnura (143 ind/m^{-2}) and Neurothemis fluctuans (59 ind/m^{-2}). In the propanil-treated plot, the highest number of odon. spp. (10 spp.) was recorded, followed by the plots treated with quinclorax and molinate/propanil (9 spp.). On the 2,4-D amine or bensulfuron-treated plots as well as the control plot, only 8 spp. were recorded. This study reveals that herbicide application had a positive effect on odon. diversity. This seems reasonable as odon. are non-target organisms for herbicides. The decomposed weeds resulting from herbicide application would enrich the water with organic matter.

(19384) CORRÊA, C.C.D. & L.H.G. AZEVEDO, 2012. Biodiversidade de insectos aquáticos de Ilha Grande, RJ. *2º Simp. Pesquisa em Mata Atlantica*, pp. 19-20. (Port.). – (Authors' postal address not stated: Depto Biol., Univ. Rio de Janeiro, Brazil).
Among the 4670 specimens, pertaining to 8 orders of aquatic insects, the Odon. are represented by 12 specimens, referable to Coenagrionidae, Megapodagrionidae, Gomphidae and Libellulidae. Names of the spp. are not provided; – Ilha Grande, Rio de Janeiro (Brazil).

(19385) DIJKSTRA, K.-D.B. & V.J. KALKMAN, 2012. Phylogeny, classification and taxonomy of European dragonflies and damselflies (Odonata): a review. *Org. Divers. Evol.* 2012: 19 pp.; – DOI: 10.1007/s13127-012-0080-8. – (Naturalis, P.O. Box 9517, NL-2300 RA Leiden).
A review is presented of the extensive but fragmentary literature on the subject, providing summary phylogenies for well-studied groups and an ecological, biogeographic and evolutionary context, where possible. Priorities for further taxonomic, phylogenetic and biogeographic research are also listed and discussed.

(19386) [DOBRZAŃSKA, J.], 2012. *Plenary lectures 22nd Congr. pol Hydrobiologists*, Cracow, 19-22 Sept., – www.iop.krakow.pl/zhp
Dobrzańska, J.: Global changes in the local scale, or about climate of cities and dragonflies (Odonata) (1 p.; not paginated). – On the city of Warsaw, as an "urban hot centre". [Abstract only]. – (Address: Fac. Civic & Envir. Engin., Warsaw Univ. Life Sci., Nowoursynowska 159, PO-02 776 Warsaw).

(19387) DOW, R.A. & A.G. ORR, 2012. Telosticta, a new damselfly genus from Borneo and Palawan (Odonata: Zygoptera: Platystictidae). *Raffles Bull. Zool.* 60(2): 361-397. – (First Author: Naturalis, P.O. Box 9517, NL-2300 RA Leiden; – Second Author: Griffith Sch. Environment, Griffith Univ., Nathan, Q-4111, AU).
The genotype of the new gen. is Protosticta feronia Lieftinck. Other previously named spp. transferred to Telosticta are Drepanosticta dupophila Lieftinck, Protosticta paruatia Van Tol and P. tubau Dow. 11 new spp. are described and illustrated, viz.: T. belalongensis, T. berawan, T. bidayuh, T. dayak, T. gading, T. janeus, T. kajang, T. longigaster, T. santubong, T. serapi, and T. ulubaram. The relationships of Telosticta within the Platystictidae are discussed.

(19388) Ekipa NRŠZ, 2012. [Notes fom "Škocjanski zatok" Nature Reserve]. *Svet Ptic* 18(3): 55. (Slovene).
A note on the discovery of Selysiothemis nigra in the Reserve, near Koper, Istria (Slovenia). – (*Abstractor's Note*: This seems to be the very first reference to the occurrence of this sp. in Slovenia, therefore it is absolutely unpardonable that the taxonomic name is not stated and the sp. is mentioned solely by its newly created Slovenian nickname. Generally, the ever increasing trend of replacing taxonomic nomenclature by ad hoc nicknames makes much of recent faunistic literature practically worthless or, at most, very hard to use. It seems, many non-professional workers are systematically heading for the pre-linnaean times …).

(19389) F[ERKO], L., 2012. Dragulji narave, ki so nad vodo le deset dni. – [Jewels of nature …]. *Primorske Novice* 66(160): 8; issue of 13 July). (Slovene). – (c/o S. Polak, Notranjski Muzej, Kolodvorska 3, SI-6320 Postojna).

On S. Polak's exhibit of dragonfly photographs in the Inner Carniolan Mus., Postojna, Slovenia (summer 2012). The title of the exhibit was "*Dragonflies, jewels of two worlds*". His portrait is included.

(19390) FLECK, G. & U.G. NEISS, 2012. A new species of the genus Aeschnosoma Selys, 1870 (Odonata: Anisoptera: Corduliidae s.s.). *Zootaxa* 3159: 47-58. − (Second Author: Inst. Nac. Pesquisas Amazônia, COEN, Avenida André Aranújo 2936, Caixa Postal 478, BR-69011-970 Manas, Amazonas).
The larva and the adults of both sexes of A. hamadae sp. n. are described, illustrated and compared with A. elegans and A. marizae. Holotype ♂: Brazil, Amazonas, Presidente Figueiredo, Ramal Urubui, Sitio Vivenda Fênix, a small blackwater stream, alt. ca 78 m a.s.l., reared from larva, 14-V-2008; deposited in INPA, Manas.

(19391) GLITZ, D., 2012. *Libellen in Norddeutschland: Geländeschlüssel*. NABU, Hamburg-Mecklenburg-Vorpommern-Niedersachsen-Schleswig-Holstein. 373 pp. + DVD. Paperback (14.4 × 21.0 cm). ISBN 978-3-9810793-6-4. Price: euro 19.90 net. − (Publishers: NABU, Hamburg, Osterstr. 58, D-20259 Hamburg).
The book deals with the adults only and comprises 4 main parts, viz.: (1) "classical" keys to the 76 N German spp., where the couplets are extended by the (unusual) inclusion of brief statements on habitats, phenology and distribution of the respective spp., 140 numbered drawings facilitate the identification (pp. 47-167); − (2) field keys to the N German fauna, organised in tabs and unnumbered illustrations (pp. 168-191); − (3) colour photos of all 81 German spp. (pp. 192-256); and − (4) an account of the 81 spp., with brief information on their respective habitats distribution and phenology, richly illustrated with unnumbered drawings (pp. 257-361). − In its original set-up and treatment the book is unique and refreshing in the European literature. All (probably over 300) high-quality drawings are original, and they will much facilitate the identification both in the field and in the laboratory though, for the sake of citation, it is unfortunate that more than half of them are not numbered. − In *Abstractor*'s opinion, the principal shortcoming of the book is the emphasis on the German nick ("common") names, of which the "classical" appellations and those proposed by A. Wendler et al. (1995, see *OA* 10332) are used throughout. The taxonomic nomenclature is stated solely in the classical keys, in the captions of col. photos and in the accounts of the German spp. (pts 1, 2 and 4 above). Unusual is also a strict application of German terminology for morphological features. Some of the terms seem to have been coined by the Author (e.g. "Flügelrandmal" for pterostigma) and some are used wrongly (e.g. "Schulter" = shoulder for thorax; since insects have no arms with which a shoulder is associated; they also do not have shoulders). Figs in pt 4 have no captions. Last but not least, the book is intended for use in the field, therefore its make-up as a paperback is inconvenient as it will inevitably cause the damage of the volume under field conditions. − Despite of these shortcomings, this is a good work that is likely to gain soon a certain degree of popularity.

(19392) HARABIŠ, F. & A. DOLNÝ, 2012. Human altered ecosystems: suitable habitats as well as ecological traps for dragonflies (Odonata): the matter of scale. *J. insect Conserv.* 16: 121-130. − (First Author: Dept Ecol., Fac. Envir. Sci., Czech Univ. Life Sci., CZ-165 21 Prague-6).
Habitat loss and degradation can be considered as major threats to freshwater invertebrates. These often irreversible processes lead to reduction of habitat patch quality and cause local extinctions of dragonflies, notably of habitat specialists. However, the biodiversity of specific secondary habitats is very high. Here are presented findings from a 10-yr study that intensively monitored odon. fauna in the Upper Silesian industrial coal region having many secondary habitats characterized by very frequent disturbances due to soil instability. Qualitative changes in the assemblages on 10 patches are evaluated using a modified odon. biotic index. Data analysis was supplemented by a model examining population dynamics of the threatened Leucorrhinia pectoralis, using the capture-mark-recapture method, as an effective indicator of habitat quality. It is shown that dynamics of environmental conditions in secondary habitats are reflected in population dynamics of odon. populations and assemblages. As frequency of L. pectoralis population extinctions within the patch is considerable and independent of size and spatial isolation of single habitats, these can be regarded as ecological traps. Nevertheless, the metapopulation dynamics may be a key adaptation of odon. to frequent freshwater habitat disturbances. It is suggested that local extinctions are effectively balanced with (re-)colonization of newly emerging freshwater habi-

tats. These findings have implications for potential conservation management of specific human-made habitats, because secondary habitats with a great diversity of succession stages arising directly as a consequence of environmental instability may be considered as partial alternatives to natural habitats in cultural landscapes.

(19393) *IDF-REPORT*. Newsletter of the International Dragonfly Fund (ISSN 1435-3393), Vols 43-51 (Feb.-Oct. 2012). – (c/o M. Schorr, Schulstr. 7/B, D-54314 Zerf).
[Vol. 43]: *Umar, D.M., M.G. Marinov, M. Schorr & H.M. Chapman*: Odonata attracted by light, a new topic for myth-busters (pp. 1-52); – [Vol. 44]: *Dow, R.A. & R.W.J. Ngiam*: Odonata collected in the Hose mountains, Kapit division, Sarawak, Malaysia in April 2011 (pp. 1-18); – [Vol. 45]: *Kosterin, O.E.*: Odonata of the Cambodian coastal region in late rain season of 2011 (pp. 1-102); – [Vol. 46]: *V. Ananian & M. Tailly*: Cordulegaster vanbrinkae Lohmann, 1993 (Odonata: Anisoptera) discovered in Armenia (pp. 1-11); – [Vol. 47]: *Jödicke, R.*: Die Libellensammlung Lopau: Imagines (Odonata) (pp. 1-8); – [Vol. 48]: *Kulijer, D.*: Odonata species and habitats at Livanjsko polje Karst wetland area (pp. 1-38); – [Vol. 49]: *Villanueva, R.J.T., M. van Weerd & H. Cahilog*: Odonata recorded in February 2012 in Isabela and Aurora provinces, Luzon island and Polillo island, Philippines (pp. 1-42); – [Vol. 50]: *Dow, R.A.*: Odonata collected around the Borneo Highlands resort on Gunung Penrissen, Kuching division, Sarawak, Malaysia in July 2012 (pp. 1-12); – [Vol. 51]: *Schneider, W. & M.E. Simons*: Ein Brief von Michel-Edmond Baron de Selys Longchamps (1813-1900) an Friedrich Förster (1864-1918) (pp. 1-8).

(19394) KELLER, D., M.J. VAN STRIEN & R. HOLDEREGGER, 2012. Do landscape barriers affect functional connectivity of populations of an endangered damselfly? *Freshw. Biol.* 57: 1373-1384. – (First Author: WSL Swiss Federal Research Inst., Zürcherstr. 111, CH-8903 Birmensdorf).
Landscape genetic approaches were used to assess functional connectivity of the Coenagrion mercuriale populations in a fragmented agricultural landscape in the Oberaargau region (Switzerland). Spatial genetic clustering methods combined with interpolation by kriging and landscape genetic corridor analysis were applied to identify landscape elements that enhance or hinder dispersal and gene flow. Spatial genetic clustering analysis divided the sampled populations into a northern and a southern genetic group. The boundary between the 2 groups coincided with a hill ridge intersecting the study area. Landscape corridor analysis identified 5 landscape elements that significantly affected gene flow. Elevation change, Euclidian distance, patches of forest and flowing waterbodies acted as barriers, whereas open agricultural land enhanced gene flow between populations of C. mercuriale. The study showed that movement of this sp. was not restricted to its preferred habitat (i.e. streams). Populations linked via continuous open agricultural land were functionally well connected if they were not more than about 1.5-2 km apart. In contrast, substantial elevation change and larger forest patches separated populations. These findings may serve as a basis to define conservation units and should be considered when planning connectivity measures, such as determining the locations of stepping stones, or the restoration of streams.

(19395) KLEUKERS, R., [Ed.], 2012. [EIS] Jaarverslag 2011. – [Annual report of the European Invertebrate Survey Nederland]. *NieuwsBr. europ. invert. Surv. Nederland* 55: 6. (Dutch). – (Bureau EIS-Nederland, P.O. Box 9517, NL-2300 RA Leiden).
Includes a statement on the 2011 discovery of a Coenagrion mercuriale population in Midden-Limburg. The exact locality is not given. Since 1929, this is the first documented record of this sp. from the Netherlands.

(19396) KODELA KRAŠNA, I., 2012. *Natura 2000 v dolini Branice*. – [*Natura 2000 in the Branica valley*]. Zavod za varstvo narave, Nova Gorica. 27 pp. ISBN none. – (Addresses not stated).
The Branica river is located S of the town of Ajdovščina (W Slovenia). A chapter deals with the Cordulegaster heros habitats, biology and local threats.

(19397) LOJKOVÁ, S., 2012. Seventy years of odonatological research of Bratislava. *Folia faun. slovaca* 17(3): 231-245. (Slovak, with Engl. s.). – (Dept Zool., Fac. Nat. Sci., Comenius Univ., Mlynská dolina B-1, SK-84215 Bratislava).
A commented review of 51 spp. recorded from Bratislava (Slovakia) in the period 1938-2008. Onychogomphus forcipatus is for the first time reported from the area.

(19398) NOVELO GUTIÉRREZ, R., 2012. The larva of Libellula foliata (Kirby, 1889) (Odonata: Libellulidae). *Organ. Divers. Evol.* 13: 307-311. – (Inst. Ecol., A.C., Aptdo Postal 63, MX-91070 Xalapa, Veracruz).
The description and illustrations are based on mature larvae from a locality in the state of Chipas. After this, only the larvae of L. gaigei Gloyd and L. nodisticta Hag. remain undescribed from the Mexican Libellula spp.

(19399) *ODONATOLOGICAL ABSTRACT SERVICE* (ISSN 1438-0269), Nos 34 (68 pp., Apr. 2012), 35 (70 pp., Sept. 2012). – (Distributor: M. Schorr, Schulstr. 7/B, D-54314 Zerf).
Abstract Nos 11030-11395 and 11396-11766, respectively.

(19400) OTT, J., 2012. Die Speer-Azurjungfer, ein seltener Bewohner von Moorgewässern. *HeimatsJb. Kaiserslautern* 2L12: 91-93. – (L.U.P.O., Friedhofstr. 28, D-67705 Trippstadt).
On Coenagrion hastulatum in Rhineland-Palatinate (W Germany).

(19401) PINTO, A.P. & A.L. CARVALHO, 2012. Taxonomic and distributional notes on Telebasis Selys, 1865, with a redescription of T. pallida Machado, 2010, and an evaluation of the T. racenisi Bick & Bick, 1995 „complex" of species (Odonata, Coenagrionidae). *Dt. ent. Z.* 59(2): 189-200. – (First Author: Mus. Zool., Univ. São Paulo, Av. Nazaré 481, BR-04263-000 Ipiranga, São Paulo, SP).
A total of 325 specimens, representing 19 spp. were studied, incl. 10 new records for various Brazilian states and a new record of T. carminita Calv. for Surinam. T. pallida is redescribed and diagnosed, based on 14 ♂ collected near the type locality and ist genital ligula is described and illustrated for the first time. The status of the 3 spp. of the T. racenisi complex is evaluated. Of these, T. pareci Machado, 2010 is proposed as a junior synonym of T. lenkoi Machado, 2010, and the possible synonymy of the 3 spp. is discussed under T. racenisi.

(19402) ŠALAMUN, A., 2012. [New data on Slovenian dragonflies]. *Trdoživ* 1(2): 26. (Slovene). – (CKFF, Klunova 3, SI-1000 Ljubljana).
The attention is drawn to the information presented on „*Fotonarava*", with reference to Chalcolestes viridis, Aeshna mixta, Sympetrum pedemontanum, S. striolatum and Selysiothemis nigra.

(19403) SKALON, N.V., [Ed.; – A.Yu. Haritonov & O.E. Kosterin are among the 21 joint authors], 2012. *Krasnaya kniga Kamerovskoy oblasti* – [*Red Data Book of the Kamerovo province*], Vol. 2. Departament prirodnyh resursov i ekologii Kamerovskoy oblasti, Kamerovo. 192 pp. ISBN 5-85119-080-9. – (Russ.).
The province is located E and NE of Novosibirsk (Russia). The odon. spp. listed are: Calopteryx japonica, Anax parthenope, Stylurus flavipes, Macromia amphigena fraenata, Somatochlora alpestris (all „rare) and Gomphus vulgatissimus („status unknown").

(19404) TAYLOR, D.J., J.T. McQUILLAN & A.M. BAUER, 2012. Diet of Chalcides ocellatus (Squamata: Scincidae) from southern Egypt. *Bull. Peabody Mus. nat. Hist.* 53(2): 383-388. – (Dept Biol., Villanova Univ., 800 Lancaster Ave., Villanova PA 19085, USA).
In this burrowing skink (Reptilia), ♂♂ and ♀♀ differ somewhat in their diets. The odon. occur in the ♀ diet only. ♂♂ have relatively larger head widths than ♀♀, but this is likely to be related to sexual selection rather than dietary segregation.

(19405) TERZANI, F., S. ROCCHI, S. CIANFANELLI, F. CIANFERONI, F. FABIANO, G. MAZZA & F. ZINETTI, 2012. Invertebrati della Riserva naturale biogenetica di Camaldoli. *In*: A. Bottacci, [Ed.], *La Riserva naturale biogenetica di Camaldoli*, pp. 285-316, CFS/UTB, Pratovecchio, ISBN 978--88-96140-26-0. – (First Author: Mus. Zool. „La Specola", Univ. Firenze, Via Romana 17, I-50125 Firenze).
Lists 9 odon. spp. from the Reserve, Tuscany, central Italy.

(19406) VRHOVNIK, M. & D. VINKO, 2012. [A search for Sympetrum flaveolum in Bloke]. *Trdoživ* 1(2): 27. (Slovene). – (Second Author: Slovenska 14, SI-1234 Mengeš).
S. flaveolum was not sighted, but the sightings of Sympecma fusca and Ophiogomphus cecilia are brought on record; – 18/19-VIII-2012, Bloke Plateau, central Slovenia.

2013

(19407) *FAUNISTIC STUDIES IN SOUTH-EAST ASIAN AND PACIFIC ISLAND ODONATA*

(ISSN 2195-4534), Vol. 1 (1 Jan. 2013). Edited by M. Schorr, published by the International Dragonfly Fund, Zerf. – (Orders to: M. Schorr, Schulstr. 7/B, D-54314 Zerf).
The new series intends to contribute to the knowledge of the regional odon. fauna by facilitating cost--efficient and rapid dissemination of faunistic data. – Vol. 1: *Marinov, M.*: Contribution to the Odonata of the Kingdom of Tonga (pp. 1-18).

(19408) OTT, J., 2013. Citizen Science in Naturschutz und Landesforschung: Informationen zur Gruppe der Libellen (Odonata). *Mitt. Pollichia* 97 (Suppl.): 5-8. – (LUPO, Friedhofstr. 28, D-67705 Trippstadt).
A brief outline of / considerations on various kinds of odon. work that could be carried out under the Citizen Science principles by non-professionals and the results of which could be of considerable help in conservation and landscape research.

(19409) OTT, J., 2013, Eine Europaweit geschützte Libelle: die Grosse Moosjungfer has sich im Raum Kaiserslautern angesiedelt. *Heimat jb. Kaiserslautern* 2013: 90-92. – (LUPO, Friedhofstr. 28, D-67705 Trippstadt).
A brief outline of biology and habitat requirements of Leucorrhinia pectoralis in the district of Kaiserslautern (Germany), with a discussion on the possible origin of the recently established local populations.

(19410) OTT, J., 2013. Moorbewohnerin auf dem Rückzug. *Südwestdeutsche Ztg* 2013(4): 1 p., issue of 5 Jan. – (LUPO, Friedhofstr. 28, D-67705 Trippstadt).
Coenagrion hastulatum was selected as "the dragonfly of 2013" in Germany.

(19411) ROSARIO, K., M. PADILLA-RODRIGUEZ, S. KRABERGER, S. STAINTON, D.P. MARTIN, M. BREITBART & A. VARSANI, 2013. Discovery of a novel mastrevirus and alphasatellite--like circular DNA in dragonflies (Epiprocta) from Puerto Rico. *Virus Res.* 171: 231-237. – (Last Author: Sch. Biol. Sci., Univ. Canterbury, P.B. 4800, Christchurch-8140, NZ).
Geminiviruses have emerged as serious agricultural pathogens. Despite all the species that have been already catalogued, new molecular techniques continue to expand the diversity and geographical ranges of these single-stranded DNA viruses and their associated satellite molecules. Since all geminiviruses are insect-transmitted, examination of insect vector populations through vector-enabled metagenomics (VEM) has been recently used to investigate the diversity of geminiviruses transmitted by a specific vector in a given region. Here is used a more comprehensive adaptation of the VEM approach by surveying small circular DNA viruses found within top insect predators, specifically odon. This 'predator-enabled' approach is not limited to viral groups transmitted by specific vectors since dragonflies can accumulate the wide range of viruses transmitted by their diverse insect prey. Analysis of 6 odon. individuals, referable to various spp., collected from an agricultural field in Puerto Rico culminated in the discovery of the first mastrevirus (Odon.-associated mastrevirus; DfasMV) and alphasatellite molecule (Odon.-associated alphasatellite; Dfas-alphasatellite) from the Caribbean. Since DfasMV and Dfas-alphasatellite are divergent from the limited number of sequences that have been reported from the Americas, this study unequivocally demonstrates that there have been at least 2 independent past introductions of both mastreviruses and alphasatellites to the New World. Overall, the use of predacious insects as sampling tools can profoundly alter our views of natural plant virus diversity and biogeography by allowing the discovery of novel geminiviruses and associated satellite molecules without a priori knowledge of the types of viruses or insect vectors in a given area.

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ASANA, J.J. & S. MAKINO, 1935. A comparative study of the chromosomes in the Indian dragonflies. *J. Fac. Sci. Hokkaido Univ*. (VI) 4: 67-86.

COWLEY, J., 1935. Remarks on the names of some odonates. *Entomologist* 26: 154-156.

FRASER, F.C., 1957. *A reclassification of the Odonata*. R. zool. Soc. N.S.W., Sydney.

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