New records of *Cordulegaster bidentata* and *Somatochlora alpestris* in the Ukrainian Carpathians (Odonata: Cordulegastridae, Corduliidae)

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Abstract

During 2005 and 2006, a detailed research of freshwater habitats in the catchment of the Chrepeliv River and in a part of the catchment of the Bistricja Nadvirnjanska River in the Nadvirna district in the Ivano-Frankivsk Oblast, Ukraine, was carried out. *Cordulegaster bidentata* was found at four localities. Its occurrence in the Ukrainian Carpathians is discussed, and all hitherto published records of *S. alpestris* and *C. bidentata* from the territory of the Ukraine are summarised.

In August 2004 and 2006, male adults of *Somatochlora alpestris* were recorded at two sites on the massif of Mt. Pip Ivan Maramorosky in the Zakarpattia Oblast, Ukraine. One recording site was in the vicinity of Mt. Berlebashka, and the other on the foot of Mt. Obniž. The occurrence of permanent populations is discussed.

Zusammenfassung

Neue Funde von *Cordulegaster bidentata* und *Somatochlora alpestris* in den Ukrainischen Karpaten (Odonata: Cordulegastridae, Corduliidae) — In den Jahren 2005 und 2006 konnte *C. bidentata* an drei Lokalitäten im Einzugsgebiet des Flusses Chrepeliv in der Umgebung des Ortes Zelena sowie an einer Stelle im Einzugsgebiet der Nadwirnaer Bystryzja in der Nähe des Ortes Maksimec im Distrikt Nadwirna (Ukraine, Oblast Iwano-Frankiwsk) nachgewiesen werden. Das Vorkommen der Art in den Ukrainischen Karpaten wird diskutiert. Alle bisher bekannten Nachweise der beiden Arten aus dem Gebiet der Ukraine werden zusammengestellt.

Im August 2004 und im August 2006 wurden Männchen von *S. alpestris* an insgesamt zwei Orten im Pip Ivan Maramoroski-Massiv (Ukraine, Oblast Transkarpatien) nachgewiesen, und zwar am Fuße des Berges Berlebashka sowie am Fuße des Berges Obniž. Die Bodenständigkeit an diesen Fundorten wird diskutiert.

Introduction

Within Europe, the Ukraine belongs to the most poorly investigated territories as far as dragonflies are concerned, which is caused by its large area and also by a low intensity of odonatological researches (cf. Gorb et al. 2000). However, in the last decade the number of publications dealing with distribution or other aspects of dragonflies has risen (overview in Khrokalo 2005; Matushkina 2006). Whereas the knowledge about odonate distribution has significantly increased in some parts of the Ukraine, e.g. in southern provinces like the Oblasts of Odessa, Mykolaiv and Kherson (Dyatlova & Kalkman 2008), information on dragonflies of the western part of the country has remained scarce. This western region is dominated by the Ukrainian Carpathians and adjoining uplands, which are completely different from other parts of the Ukraine in geological and geomorphological structure. Most of the odonatological records of this area originate from historical times (Dzięddzielewicz 1883, 1890, 1904; Hrabar 1933), while few records are recent.

Species like *Cordulegaster bidentata* and *Somatochlora alpestris*, which are often regarded as rare or at least as challenging to detect, are of particular interest to me. Both species are known from the territory of the Ukraine solely from the Ukrainian Carpathians and, according to the records hitherto known, they belong to the rarest dragonfly species in this country. According to Wildermuth (2008) the distribution range of *S. alpestris* in the Carpathians, especially in the Romanian and Ukrainian parts, is poorly investigated. In order to fill some of these gaps, I conducted odonatological surveys at several locations in the Ukrainian Carpathians during the years 2004 to 2007, and the records of *C. bidentata* and *S. alpestris* are presented here. In addition, other recent records of the two species taken in the Ukraine by other authors are summarised.

Study species

Cordulegaster bidentata is a European endemic occurring on slopes and foothills, from the Pyrenees in the west to the Carpathians and the Balkan and Rhodope Mountains in the east. The southernmost records originated from Sicily, Calabria and central Greece, the northernmost ones from the Weser Hills and the Harz Mountains (Boudot 2001). This running water species is limited to springs and narrow spring brooks in forested areas, however, at higher altitudes it may also occur in alpine grassland (Kotarac 1997; Sternberg et al. 2000).

Somatochlora alpestris has an arcto-alpine and, to a lesser extent, a boreo-montane distribution and occurs in three disjunct regions: Fennoscandia and adjoining parts of northern Russia, mountainous regions of central and eastern Europe, and northeastern Asia (Wildermuth 2008). In central Europe, typical habitats of this species are montane and alpine peat bogs developed at flat saddles or table-lands with peat pools or small pits, mostly surrounded by forest stands (*Picea abies*, *Pinus* x *pseudopumilio*) (Holuša 1995, 1997). Larval microhabitats are often inconspicuous puddles, small pools or seepages, but also tarns (Wildermuth 2006). Sometimes adults are also present at dry pools, i.e. only moist peat. In Fennoscandia and at higher altitudes of the Alps, the species is more eurytope and inhabits a wider spectrum of waterbodies (Wildermuth 2008).

Study area and Methods

The Ukrainian Carpathians, as a part of the Carpathian Arch, cover an area of approximately 22,000 km^2 and can be divided into several regions. They comprise nearly the whole territory of the Zakarpattia Oblast, the southern parts of the Lviv Oblast, the Ivano-Frankivsk Oblast, and the Chernivtsi Oblast. The highest peaks are Hoverla (2061 m above sea level, a.s.l.), Petros (2020 m a.s.l.) and Pip Ivan Chornohirsky (2020 m a.s.l.). During the last Ice Age, only the highest peaks underwent glaciation. The massifs of the highest peaks belong to the regions with the coldest climate and with the highest amount of precipitation – approximately 1600-1750 mm per year – in the whole Carpathians (Hrubý 2001). Some parts, especially the massif of Pip Ivan Maramorosky, are widely covered by forest, with a high presence of natural forests (Holuša 2008).

Intensive investigations of water habitats were carried out from 2004 to 2006 during July and August, respectively, in the mountain range of Pip Ivan Maramorosky, in the Rakhiv district in the Zakarpattia Oblast. The localities were situated at elevations of 750 to 1,650 m a.s.l. Further investigations were carried out from 2005 to 2007, respectively, during June, August, and September, in the forest district of Buchtivěc and Chrepeliv, in the Nadvirna district in the Ivano-Frankivsk Oblast. This study area covered elevations from 420 to 1,500 m a.s.l.

Cordulegaster bidentata was searched for at complete systems of streams, from springs to lower parts of streams. Primarily, I looked for adults. In all types of watercourses, however, I also searched for larvae and exuviae in a 5 m-section of each stream. Adults were caught or photographed for identification, while larvae were caught by sieving the sediment.

Somatochlora alpestris was searched for in the following habitats: peat-bogs, peaty margins of springs and streams, and muddy pools with *Sphagnum* sp. at stream margins. I looked for adults, larvae and exuviae.

Results

Records of *Cordulegaster bidentata* and *Somatochlora alpestris* taken by the author in the Ukraine are summarised, followed by records found in the literature. All investigations during the year 2007 did not yield any records. All voucher material leg., det. et coll. Otakar Holuša.

Cordulegaster bidentata

Records (Fig. 1):

1. Ivano-Frankivsk Oblast [Івано-Франківська область], Nadvirna district, [Надворнянський район], Maksymets village [Максимець], valley of the Bystrytsia-Nadvirnyanska river [Бистриця Надвирнянська], 48°34´10.49´´N, 24°18´14.28´´E, 920 m a.s.l., 25-vi-2006: one adult male collected and one additional male and one female observed in a seepage area, at a narrow stream with individual shrubs of *Coryllus avellana*.
2. Ivano-Frankivsk Oblast [Івано-Франківська область], Nadvirna district, [Надворнянський район], Zelena village [Зелена], valley of the Chrepeliv river [Хрепелів], 830-890 m a.s.l., 48°34´10.49´´N, 24°18´14.28´´E, 07-ix-2005, two adult

males collected at a 20 cm wide stream at the edge of a forest clearing. In the stream bed there were individual bunches of *Juncus* and stands of *Eleocharis* and *Caltha palustris*, at the banks there were moss mats. The stretch of the stream consisted of small, shallow pools ca 2-3 cm in depth, and the clearing was surrounded by a forest of *Picea abies.*

3. Ivano-Frankivsk Oblast [Івано-Франківська область], Nadvirna district, [Надвірнянський район], Zelena village, catchment of the Chrepeliv river [Хрепелів], mountain range of Mt. Ripna [Ріпна], 48°35´25.44´´N, 24°16´52.56´E´, 1,020 m a.s.l., 08-ix-2005 (Fig. 2): two male adults collected at a 30 cm wide stream in a sunny forest clearing with a slope of ca 15-20°. The stretch of the stream consisted of pools with an area of 15 x 30 cm, dominated by sandy sediments. The flow rate was 5 $cm \cdot s^{-1}$. On the banks there were bunches of *Juncus* spp., in clear-cuttings stands of *Rubus idaeus.*

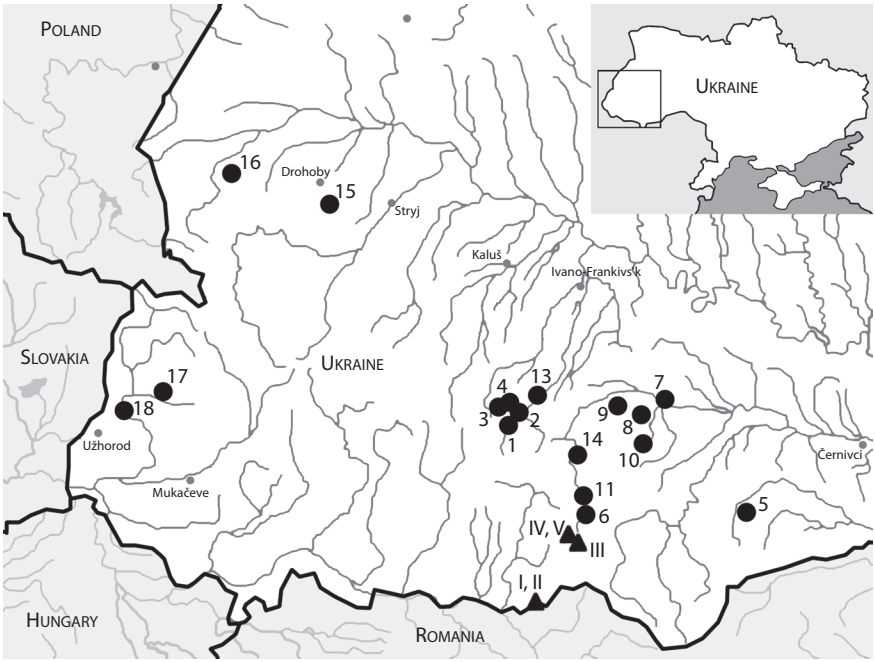

Figure 1: Records of *Cordulegaster bidentata* (●) and *Somatochlora alpestris* (▲) in the Ukraine. 1-4: new records of *C. bidentata* in this study, 5-18: literature records (12 could not be located); I, II: new records of *S. alpestris* in this study, III-V: literature records. — Abbildung 4: Fundorte von *Cordulegaster bidentata* (●) und *Somatochlora alpestris* (▲) in der Ukraine. 1-4: neue Nachweise von *C. bidentata* in dieser Arbeit, 5-18: Literaturangaben (12 konnte nicht lokalisiert werden); I, II: neue Nachweise von *S. alpestris* in dieser Arbeit, III-V: Literaturangaben.

4. Ivano-Frankivsk Oblast [Івано-Франківська область], Nadvirna district, [Надворнянський район], Zelena village, valley of the Chrepeliv river [Хрепелів], mountain range of Mt. Chortka [Чортки], 48°35´20.36´´N, 24°18´01.27´´E, 1,150 m a.s.l., 10-ix-2005 (Fig. 4): one adult male, one adult female during oviposition and and two larvae collected, and two additional adult males observed, in a rocky spring area. There was a small stream consisting of several shallow pools with an area of 10 x 15 cm. The substrate of the pools was dominated by soft mud and fine sand, to a lesser extent there were also patches with coarser sand. The flow rate in pools was 1-2 $cm \cdot s^{-1}$, in riffles 5-7 $cm \cdot s^{-1}$.

Literature records (Fig. 1):

5. Chernivtsi Oblast [Чернівецька область], Vyzhnytsia district [Вижницький район], Myhove village [Мигово] (St. Quentin 1932)
6. Ivano-Frankivsk Oblast [Івано-Франківська область], Jaremča district [Яремчанський район], Tatariv village [Татарів], valley of the Jablunickij Prutěc river [Прутец Яблуницкий] (Martynov & Martynov 2004)
7. Ivano-Frankivsk Oblast [Івано-Франківська область], Kolomyia district [Коломийський район], Kolomija village [Коломия] (Dzięndzielewicz 1883, 1890, 1904)
8. Ivano-Frankivsk Oblast [Івано-Франківська область], Kolomyia district [Коломийський район], Nižne village [Нижне] (Dzięndzielewicz 1883, 1890, 1904)
9. Ivano-Frankivsk Oblast [Івано-Франківська область], Kolomyia district [Коломийський район], Molodjatin village [Молодятин] (Dzięndzielewicz 1883, 1890, 1904)
10. Ivano-Frankivsk Oblast [Івано-Франківська область], Kosiv district [Косівський район], Ljuča village [Люча] (Fudakowski 1932)
11. Ivano-Frankivsk Oblast [Івано-Франківська область], Nadvirna district, [Надворнянський район], Vorochta village [Ворохта] (Dzięndzielewicz 1883, 1890, 1904)
12. Ivano-Frankivsk Oblast [Івано-Франківська область], Nadvirna district, [Надворнянський район], Kremenci [Кременци] (Dzięndzielewicz 1883, 1890, 1904). This locality could not be traced and is not depicted on the map (Fig. 1).
13. Ivano-Frankivsk Oblast [Івано-Франківська область], Nadvirna district, [Надворнянський район], Pasična village [Пасічна] (Dzięndzielewicz 1883, 1890, 1904)
14. Ivano-Frankivsk Oblast [Івано-Франківська область], Nadvirna district, [Надворнянський район], Mikuličin village [Микуличин] (Dzięndzielewicz 1883, 1890, 1904)
15. Lviv Oblast [Львівська область], Drohobych district [Дрогобицький район], Truskavec town [Трускавець] (Fudakowski 1932)
16. Lviv Oblast [Львівська область], Staryj Sambir district [район Старый Самбір], Strashevitchi village [Страшевичі] (Martynov & Martynov 2004)
17. Zakarpattia Oblast [Закарпатська область], Perechyn district [Перечинський район], Turicja village [Туриця] (Hrabar 1933)
18. Zakarpattia Oblast [Закарпатська область], Uzhhorod district [Ужгородський район], Nevicke villlage [Невицьке] (Hrabar 1933)

Figure 2: Habitat of *Cordulegaster bidentata* near Zelena, Mt. Ripna, catchment of river Chrepeliv, Nadvirna district, Ivano-Frankivsk Oblast, Ukraine (08-ix-2005). — Abbildung 2: Fundort von *Cordulegaster bidentata* bei Zelena im Bergmassiv des Ripna, Einzugsgebiet des Flusses Chrepeliv, Oblast Iwano-Frankiwsk, Distrikt Nadvirna, Ukraine (08.09.2005).

Somatochlora alpestris

Records (Fig. 1)

I. Zakarpattia Oblast [Закарпатська область], Rakhiv district [Рахівський район], mountain range of Pip Ivan Maramorosky [Піп Іван Мараморoський], Mt. Obniž [Обниж], 47°57′23.97′′N, 24°17′23.97′′E, 1,320 m a.s.l., 12-viii-2004 (Fig. 3): four adult males collected and two additional males observed at a small, shallow pool in a stream with swamp vegetation stands composed of *Sphagnum* sp., *Polytrichum* sp., *Carex* sp., and *Equisetum* sp. In a small inlet of the pool there were stands of *Scirpus sylvaticus*. The water was very clear and sluggish, the depth of the pool was ca 10 cm.

II. Zakarpattia Oblast [Закарпатська область], Rakhiv district [Рахівський район], mountain range of Pip Ivan Maramorosky [Піп Іван Мараморoський], foot of Mt. Berlebashka [Берлебшка], mountain pasture, 47°57′15.40′′N, 24°17′56.68′′E, 1,350 m a.s.l., 01-viii-2006: one adult male collected at a narrow muddy spring area surrounded by mountain pasture.

Figure 3: Habitat of *Somatochlora alpestris* at the foot of Mt. Obniž in the mountain range of Pip Ivan Maramorosky, Rakhiv district, Zakarpattia Oblast, Ukraine (12-viii-2004). — Abbildung 3: Fundort von *Somatochlora alpestris* am Fuß des Berges Obniž im Pip Ivan Maramoroski-Massiv, Distrikt Rachiw, Oblast Transkarpatien, Ukraine (12.08.2004)

Literature records (Fig. 1)

III. Zakarpattia Oblast [Закарпатська область], Carpathians, Chornohora ridge [Чорногора], Nesamovite lake [Несамовите] up to Mt. Turkul [Туркул] (Dziędzielewicz 1919)

IV. Zakarpattia Oblast [Закарпатська область], Carpathians, Chornohora ridge [Чорногора] – Pozhizhevska mountain pasture [Пожижевска] up to Mt. Breskul [Брескул] (Dziędzielewicz 1919)

V. Zakarpattia Oblast [Закарпатська область], Carpathians, Chornohora ridge [Чорногора], southern slope of Mt. Breskul [Брескул] (Martynov & Martynov 2004)

Discussion

Cordulegaster bidentata has been recorded historically from several sites on the northern slopes of the Ukrainian Carpathians and their uphills, and from two sites on the southern slopes (Fig. 1). Recent records derive from one locality in the uphills in the Lviv Oblast, and at one locality in the Ivano-Frankivsk Oblast (Martynov & Martynov 2004; Fig. 1). Altogether, the occurrence of *C. bidentata* is now known from 14 localities in the Ukrainian Carpathians. One historical locality, 'Kremenci' in the Nadvirna district (Dziędzielewicz 1883, 1890, 1904), could not to be traced.

In general the investigated localities seem to fit the ecological demands of the species, although at three localities only adult males were recorded, and additionally at one locality only an ovipositing female and larvae. Probably the suitable microhabitats of larvae were not found. Springs and spring brooks in the mountain range of Pip Ivan Maramorosky were also intensively checked, but the species seemed to be absent there. My records and also most of the records from the literature derive from the region of Carpathian flysch, which is composed of a series of sandstone, slate and claystone rock. The absence of the species at Pip Ivan Maramorosky, which is composed of metamorphic rock – mica schist and phyllite – could confirm a theory of Holuša (2005) about the absence or only rare occurrence of *C. bidentata* in regions built of crystalline and metamorphic rock. The records from the Bukovské Vrchy Hills (OH unpubl.) and the Vihorlat Mountains (Holuša 1996) in north-eastern Slovakia, which are not far from the localities 13 and 14 (Fig. 1), seem to confirm this theory – the largest populations are found in the geological regions of flysch zones as the western Carpathians (Holuša 2000, 2005, 2007a, 2007b), which have the same geological structure as large parts of the Ukrainian Carpathians. On the other hand, the absence of *C. bidentata* could also be caused by very cold water in springs during the whole year (Fränzel 1985), but unfortunately I did not measure the water temperature in the springs.

In Romania, records of *C. bidentata* exist from the eastern Carpathians – Cluj, Ploieşti and Suceava – and from the southern Carpathians – Banat, Braşov, Hunedoara and Oltenia (Cîrdei & Bulimar 1965). Recently, the species was confirmed at several localities in the Banat region (OH unpubl.).

I expect that *C. bidentata* may be widely present in large parts of the Ukrainian Carpathians, especially in the Carpathian flysch. Nevertheless, in my opinion it remains one of the rarest species of Odonata in the Ukraine.

Somatochlora alpestris has been recorded previously at two sites of the Chornohora ridge, i.e. the massif of Mt. Hoverla, in the Zakarpattia Oblast (Dzięzielewicz 1919). In this region it was reconfirmed recently by Martynov & Martynov (2004), hence altogether the species was hitherto known from three localities. The new records presented in this study were taken in a region situated 26 km to the south-east of the Chornohora ridge. The nearest occurrences outside the Ukrainian Carpathians are located to the west in the Tatra Mountains in Slovakia and in Poland at a distance of 350 km (Straka 1990; Holuša 1995; Mielewczyk 2004), and to the south at a distance of 300 km at Mt. Bucegi in the southern Carpathians in Romania (Cîrdei & Bulimar 1965).

At the locality at the foot of Mt. Obniž only adult males were recorded and no females or larvae were found. Nevertheless, I expect the occurrence of a permanent population there. The investigated localities do not represent 'typical' habitats for this species, compared to those sites inhabited by the species in montane and alpine zones of the Bohemian Massif, i.e. large peat bogs with pools (Holuša 1995, 1997). In the entire Carpathians upland peat bogs are almost non-existent, only pools at peaty margins of streams, and *S. alpestris* inhabits these. The lack of peat bogs in the Carpathians is primarily due to the geological age of the mountains and, hence, the geomorphology of the landscape – places suitable for the development of peat bogs are very rare. The occurrence of *S. alpestris* can be expected also in other higher regions of the Ukrainian Carpathians, even though 'typical' habitats are not developed as in other parts of central Europe.

Figure 4: Perching male *Cordulegaster bidentata* near Zelena, Mt. Chortka, valley of river Chrepeliv, Nadvirna district, Ivano-Frankivsk Oblast, Ukraine (10-ix-2005). — Abbildung 4: Männchen von *Cordulegaster bidentata* auf Sitzwarte bei Zelena im Bergmassiv des Chortka, Tal des Flusses Chrepeliv, Distrikt Nadvirna, Oblast Iwano-Frankiwsk, Ukraine (10.09.2005).

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