Distribution and current status of *Coenagrion armatum* (Charpentier, 1840) in Ukraine

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Abstract

The 14 known localities of *Coenagrion armatum* in Ukraine are listed and the 27 dragonfly species recorded are presented. An expedition devoted to revisit 10 of them in spring 2007 did not result in a confirmation at any of them. Here, all localities are described in detail and possible reasons for the absence of the species are discussed. These include habitat alterations because of anthropogenic impact, such as agricultural activity, as well as decreasing competitiveness against Mediterranean species that spread in response to altered climatic conditions. Proposed measures of conservation of *C. armatum* in Ukraine include a) the inclusion into the Red Data Book of Ukraine under category I (Endangered) and b) additional studies, monitoring and habitat conservation.

Introduction

Coenagrion armatum is of East Siberian origin (St. Quentin 1960; Belyshev & Kharitonov 1981) and is distributed in Siberia (Russia), northern and eastern Europe. In Europe it is recorded from England, Norway, Sweden, Finland, Denmark, the Netherlands, Germany, Poland, Belarus, Ukraine (Dijkstra & Lewington 2006). This species has become extinct in England in the second part of the 20th century (Brownett 2005). The same situation was observed in Czech Republic (Hanel & Zelený 1999). In the Netherlands, *C. armatum* was found at three sites at the beginning of the 20 century and recently rediscovered in the same region (Parr 1999). In Poland, 38 localities of this species are known, six of them were confirmed after 1980 (Buczynski 2000).

Methods

In order to examine the current status and distribution of *Coenagion armatum* in Ukraine expeditions were made to sites where the species was found previously. Field work in the Sumy region (village Vakalovschyna) was carried out by colleagues from Sumy Pedagogical University, the material of their collections were identified by the authors of this paper. Localities were revisited from the end of April to beginning of June 2007 (Table 1).

Results

Literature review

In Ukraine, *C. armatum* was recorded at 14 sites (Table 1, Fig. 1).

Figure 1: Records of *Coenagrion armatum* in Ukraine based on literature sources. Numbers are mapped according to the localities characterised in Tab.1.

It always seems to have been a rare species except in the northwestern part (Volynska oblast') where it was more common. Most records are more than 30 years old, some even 100. The most recent records in northern Ukraine were in 2000-2003. These, however, only concerned sporadic records of individual specimens but not large populations.

Table 1: Records of *Coenagrion armatum* in Ukraine. For detailed description of the sites see text. If year or date are not provided, they are unknown.

	Site	Dates and numbers of collected males (m) and females (f)	Reference	Coordinates	Dates revisited in 2007
1	Kholoniv village	28.05.1970 17m, 28f	Pavlyuk 1990	50°28'30"N 24°50'E	9.-10., 14.05
2	Zhuravnyky village River Lypa, bog	27.05.1970 12m, 16f	Pavlyuk 1990	50°25'30''N 24°41'E	11.05.
3	Berestechko town Bog	27.05.1981: 12m, 3f 30.05.1982: 3m	Pavlyuk 1990	50°22'N 25°08'	12.05.
4	Potorytsya village river Bug	16.05.	Dziedzielewicz 1891, 1919	50°27'40"N 24°17'E	13.05.
5	Peniaky village pond on river Seret	mid May	Dziedzielewicz 1891, Dziedzielewicz 1919	48°53'30"N 25°12'10"E	-
6	river Gnyla Lypa	mid May	Dziedzielewicz 1891	49°41'N 24°34'E 15-	16.05
7	Korelichi village (newly created pond in Dusaniv village)	Mid May	Dziedzielewicz 1891, 1919	49°32'18"N 24°35'20"E	-
8.	Lviv city,Park near Botanical Garden	1965-1987	Pavlyuk 1987	49°51'N 24°04'E	17.05.
9	Ivano-Frankivsk city	02.05.1967	Pavlyuk 1990	48°57'25"N 24°44'E	-
10	Around Kyiv city (labels without precise location)	1m	Artobolevsky 1927	-	-
11	Kyiv city, river Dnieper Truchaniv island	1f	Tytar, 2003	50°28'N 30°32'25"E	30.04, 27.05.
12	Lake in Supiy valley	May11,	Gorb, Pavlyuk & Spuris 2000	50°14'N 31°46'E	6., 26.05.
13	Osischyna village	17.05.1997, 26.04.2000 3f	Matushkina 2006	50°35'N 30°33'20"E	4.05., 3.06.
14	Vakalivschyna village	17.05.1996, 1m	Gnelytsya & Khrokalo 1988, Khrokalo, 2003	51°02'N 34°56'E	20-24.05, 8-13.06.

Field work

Each of the investigated localities is described and discussed below. The numbers refer to those in Table 1. One additional location (4a) was visited. This site is close to a previous record in the literature. The list of Odonata species recorded at these localities is presented in Table 2.

(1) Kholoniv village (Volynska oblast', Gorokhiv district)
Several fish ponds are situated in the surroundings of the village Kholoniv as described by Pavlyuk (1990). We visited four small and one big pond (about 5 ha)

Figure 2: Small ponds near Kholoniv.

The ponds had been created on rivers and connected by streams and were surrounded by fields and pastures for oxen. The banks contained rich emergent vegetation with *Phragmites australis* and *Carex elata* (det. O. Abduloeva) (Fig. 3) abundant. *Caltha palustris* and *Heracleum* sp. grew on a meadow and banks. All observed ponds were relatively clean eutrophic waterbodies.

Figure 3: Emergent vegetation of a pond in Kholoniv.

(2) Zhuravnyky village (Volynska oblast', Gorokhiv district)

In the valley of the river Lypa two brooks and a bog were studied.

Figure 4: Fish pond upstream of the river Lypa near Zhuravnyky.

The water supply for one fish pond (Fig. 4) strongly reduced the water level of the brook nearby. Emergent vegetation consisted of *Typha sp.*, *Carex sp.* and *Acorus calamus*, submerged plants mainly of *Elodea canadensis* and the water moss *Fontinalis*. The bed of the second brook, north of the first one, was about 1.5 m, its depth about 0.7 m. The banks of the river were swampy with abundant hummocks of *Carex sp.*. The river bank was pasture for horses. At some places the moss *Fontinalis* was found.

(3) Berestechko town (Volynska oblast')

The relatively large river Styr crosses this town.

Figure 5: Swamped area at the right bank of river Styr.

The width of the river bed was about 25 meters (Fig. 5), its vegetation was little developed except in some swampy places. There were some islands near the bridge of the town, on one of which a park was surveyed. In this park a big maple, oak and willow trees were close to the river, as well as *Phragmites australis, Typha sp.*. One km upstream we visited a swamp in a flooded area. The puddles had a small size, their depth was less then 0.5 m, mud covered the bottom and the colour of the water was yellow.

Figure 6: River Zakhidny Bug near Sokal' city

(4a) Sokal' city (Lviv oblast')

The large river Zakhidny Bug flows through Sokal' city (Fig. 6). This river, unlike other Ukrainian rivers, runs from the south to north and belongs to the Baltic Sea catchment. The river near the bridge, and puddles and lakes in its flood plain were visited. The width of the river was about 40 m. Flooded meadows and areas of rich emergent vegetation (*Typha sp.*, *Carex sp.*) on 300 m of the bank were surveyed. An oxbow lake had well developed emergent and submerged vegetation.

(4) Potorytsya village (Lviv oblast' Sokal' district)

Potorytsya village (where Dzięddzielewicz 1891, 1919 recorded *C. armatum*) is situated 3 km south of Sokal' city. Here, the river Zakhidny Bug is divided in three arms (Fig. 7). Banks were swampy and very much transformed into an intensively used pasture. *Acorus calamus* was most abundant from shore vegetation. Retarded flow and sewage disposal lead to strong euthrophication of water.

Figure 7: Branches of river Zakhidny Bug near Potorytsya.

(6) River Gnyla Lyna, Peremyshlyany town (Lviv oblast')

The river Gnyla Lyna and all waterbodies in its valley at the northern surroundings of Peremyshlyany town up to the village Syvorohy were surveyed.

Figure 8: Fish pond at the river Gnyla Lypa near Peremyshlyany.

One fish pond (about 2,5 ha) (Fig. 8) and several canals were created by the river making its bed narrow. There was rich vegetation at the pond such as *Typha angustifolia*, *Phragmites australis, Scirpus sp.*. The nothwestern side of the pond was a flooded meadow.

(8) Lviv city

Pavlyuk (1987) reported *C. armatum* from the pond in the park Pogulyanka near the Botanical garden at the southeastern part of city. Three small concrete-walled ponds were constructed at the site where *C. armatum* had been found previously by Pavlyuk (1987) in the Forest Park "Pogulianka" (Fig. 9).

Figure 9: Pond near Forest Park "Pogulianka"

No vascular plants, only algae were found in the pond. No Odonata were found at a stream nearby with yellow water and much accumulated leaf litter. Visits to ponds situated not far from the Forest Park and Centre of Arts for Youth and on the territory of the Botanical Garden (Fig. 10) also yielded no Odonata sightings.

Figure 10: Pond in the Botanical garden of Lviv.

(11) Kyiv city Trukhaniv island

A large part of Thrukhaniv island, one of big islands in the Dniepr river within the boundary of Kyiv city, is used as a recreational area. The southern bank of the biggest lake of the island, Lake Banyne (Fig. 11, 12), was a swamp and the water surface covered by duckweed. A new bridge was just being built in the northern part. Typical vegetation consisted of *Stratiotes aloides, Hydrocharis morsus-ranae, Butomus umbellatus* and *Sagittaria sagittifolia*. There were several small lakes on the island.

Figure 11: Lake Babyne on Trukhaniv Island (Kyiv)

Figure 12*:* Small lake in the flood-plain of river Drieper on Trukhaniv Island (Kyiv).

(12) Lake in Supiy valley, Yagotyn town (Kyiv oblast')

In the surroundings of the town of Yagotyn several connected lakes and channels of the river Supiy were visited. One lake near the railway line was particularly intensively surveyed because *C. armatum* was found at this location by S. Gorb in 1999. This lake, situated in the floodplain of the river Supiy, had well-developed bank and water vegetation (Fig. 13) including abundant *Phragmites australis* and *Stratiotes aloides.*

Figure 13*:* Lake in the flood plain of river Supiy near Yagotyn.

(13) Osischyna village (Vyshgorod district Kyiv oblast')

Oxbows of the Desna river were visited around the village of Osischyna. The two adjacent lakes differed in size and water plant community. The small lake was covered by *Stratiotes aloides*, *Sagittaria sagittifolia* and *Polygonum amphibium* (Fig. 14), the large lake mainly by *Nuphar lutea* and *Nymphaea alba* (Fig. 15).

Figure 14: Water vegetation in a small lake near Osischyna.

Figure 15: Water vegetation in large lake near Osischyna.

(14) Vakalivschyna village (Sumy oblast')

In the surroundings of Vakalivschyna village there is the Biological Research Station of the Sumy Pedagogical University. A large pond fed by streams (Fig. 16) was studied as were puddles and meadows situated nearby in mixed forest.

Figure 16: Pond in the village Vakalivschyna (Sumy oblast')

The banks of the pond were covered by rich vegetation such as *Typha sp.*, *Scirpus sp.*, *Phragmites australis* and submerged plants *Elodea canadensis, Ceratophyllum demersum.* Springs and swamp meadows in the forest were also monitored.

Table 2: Odonata species recorded in the areas visited during this study. If only larvae were collected this is indicated by +(l).

	Site / Species	(1) Kholoniv	(2) Zhuravnyky	(3) Berestechko	(4a) Sokal'	(4) Potorytsya	(6) Peremyshlyany	(8) Lviv	(11) Kyiv	(12) Osishyna	(13) Yagotyn	(14) Vakalivschyna
1	*Calopteryx splendens*		+(l)						+		+	
2	*Calopteryx virgo*		+(l)				+					
3	*Sympecma fusca*	+		+			+					
4	*Sympecma paedisca*	+	+						+			+
5	*Lestes sponsa*								+(l)	+		
6	*Platycnemis pennipes*						+		+		+	+
7	*Coenagrion puella*	+	+(l)		+		+	+	+	+	+	+
8	*Coenagrion pulchellum*	+	+(l)	+	+	+	+			+	+	+
9	*Coenagrion hastulatum*	+										+
10	*Coenagrion ornatum*		+(l)									
11	*Ischnura elegans*				+	+	+	+	+	+	+	+
12	*Ischnura pumilio*				+							
13	*Erythromma najas*	+	+		+			+		+		+
14	*Erythromma viridulum*								+			+
15	*Pyrrhosoma nymphula*						+					
16	*Aeshna isosceles*			+					+	+	+	
17	*Aeshna cyanea*							+(l)				
18	*Brachytron pratense*								+			
19	*Anax imperator*								+	+	+	
20	*Gomphus vulgatissimus*			+	+							+
21	*Cordulia aenea*	+			+		+	+	+	+	+	
22	*Epitheca bimaculata*	+			+		+		+	+		+
23	*Libellula depressa*										+	+
24	*Libellula quadrimaculata*	+							+	+	+	
25	*Orthetrum albistylum*										+	
26	*Orthetrum cancellatum*								+(l)	+		+
27	*Leucorrhinia pectoralis*	+								+	+	
Total number		10	7	4	8	2	9	5	14	12	12	12

Discussion

We surveyed the locations of *C. armatum* in 2007 during the main known flight season in May-June. However, the species was not found at any of the sites. This could be for several reasons. First, several of the sites showed large anthropogenic pressure and agricultural works may have altered the habitats in disfavour of *C. armatum* such as by fertilisers, eutrophication by horses and cows (sites (1) Kholoniv, (2) Zhuravnyky, (4) Potorytsya). In addition, lifestock use waterbodies as watering places and often destroy the bank and its vegetation. A second possible reason is more global. *C. armatum* declines in large parts of Europe (Dijkstra & Lewington 2006) and this may be related to secondary causes of climate change such as rising eutrophication, habitat alterations, invasion of more competitive Mediterranean species (Ott 2001). Global warming may also shift forward the flight period of *C. armatum* towards the end of April and early May and so may be overlooked at some sites. However, while this may in general be possible, it is unlikely to have happened in our survey. In 2007, spring was so late and the April so cold in the western Ukraine that most adult Coenagrionidae were not observed before the second decade of May.

If the habitat preference of *C. armatum* were largely determined by climate, the range in Ukraine can potentially be expected to expand into the entire forest and forest-steppe zone of Ukraine. Therefore, special attention should be paid to areas without agricultural activity in this area such as nature reserves in the Ukrainian Polissia zone.

In neighbouring Poland *C. armatum* is also protected and has the status CR (Critically Endangered) (Polska czerwona ksiega, 2004). *C. armatum* is a very rare species in Ukraine and its extinction in some areas has now been documented. This should be reflected in its classificiation in the Ukrainian Red Data Book. We, therefore, propose that *C. armatum* should be included into the Red Data Book and classified as Endangered I.

One of the great problems in Ukrainian odonatology are insufficient data on distribution in some regions and that most previous information needs updating. The brief flight period of *C. armatum* makes the search for the species even more complicated. Monitoring of this species requires to summarise all available information from specialists and amateurs. Such information could be facilitated by the publication of booklets and field guides for members of the public interested in dragonflies. A web site devoted to Ukrainian dragonflies launched by Olena Dyatlova (Odessa National University) last year is a great help in spreading and collecting information. Monitoring and the subsequent conservation of biotopes are very important measures to stop the declining of *C. armatum* in whole area of its distribution.

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