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Preliminary data on the distribution and phenology of *Eubranchipus grubii* (Dybowski 1860) (Crustacea: Anostraca) in the Wielkopolska region

Wstępne wyniki badań rozmieszczenia i fenologii dziwogłówki wiosennej *Eubranchipus grubii* (Dybowski 1860) (Crustacea: Anostraca) na terenie Wielkopolski

SUMMARY

The paper presents preliminary data on phenology and distribution of *Eubranchipus grubii* in the Wielkopolska region (W Poland) collected in 2008. In total, 211 water bodies were sampled during a field survey and *E. grubii* was recorded in 38 out of them (18%). On ten localities the species was recorded for the first time.

The occurrence of the species was recorded already at the beginning of February, in five of the seven ponds sampled in two-week intervals. This has been the earliest observation of *E. grubii* ever recorded in Poland. Individuals from two of the studied populations had already well formed sexual traits, indicating that hatching might have occurred already in December. The maximum occurrence period of the species recorded in studied populations was 12 weeks. Two of the sampled populations became extinct before reaching maturity, ca. 3 weeks after hatching.

STRESZCZENIE

Artykuł prezentuje wstępne pochodzące z 2008 roku, wyniki badań nad rozmieszczeniem i fenologią dziwogłówki wiosennej (*Eubranchipus grubii*) w Wielkopolsce.

Dziwogłówka wiosenna została stwierdzona w 38 spośród 211 jednorazowo przebadanych zbiorników (18%). Dziesięć spośród tych stanowisk nie było wcześniej znanych.

Gatunek ten odnotowano już na początku lutego 2008 roku w pięciu spośród siedmiu zbiorników kontrolowanych w odstępach dwutygodniowych. Jest to jak dotąd najwcześniejsze fenolo-

gicznie stwierdzenie dotyczące występowania *E. grubii* na terenie Polski. W dwóch zbiornikach zaobserwowano wówczas osobniki z wyraźnie zaznaczonymi cechami płciowymi. Zdaje się to wskazywać, że do wyklucia doszło już w grudniu poprzedniego roku. Zarejestrowana maksymalna długość pojawu *E. grubii* w zbiorniku wynosiła 12 tygodni. Dwie spośród badanych populacji wymarły przed osiągnięciem dojrzałości płciowej osobników, około trzy tygodnie po ich wykluciu.

K e y w o r d s: large branchiopods, Anostraca, vernal pools, temporary waters

INTRODUCTION

Fairy shrimps (Branchiopoda: Sarsostraca: Anostraca) constitute a relatively small taxonomic group of crustaceans. About 300 species were described so far (most of them highly endemic, Brendonck et al. 2008) and 50 species are known from Europe (Brtek and Thiéry 1995) including seven reported from Poland (Jurasz 2008). They are mostly habitat specialists inhabiting temporary water bodies and only a few species occur in permanent aquatic systems. Like other so-called large branchiopods, Anostraca are considered to be threatened worldwide, mainly by the decline of their natural habitats (Biggs et al. 2004) enhanced by the excessive use of chemical agents in agriculture (Löffler 1993). All the large branchiopod species have been included into national Red Data Lists and/or became strictly protected in the Czech Republic, Germany, Denmark and Sweden. In Poland only one large branchiopod species, namely *Branchinecta paludosa* (Anostraca), is red listed and protected. It was known from one locality in the Tatra Mts and has been considered extinct since the late 1960's (Kownacki et al. 2002). The conservation status of other large branchiopod species in the country remains uncertain, mainly due to the lack of recent studies concerning their distribution and biology.

In Poland, although current data are very scarce, the most frequent large branchiopod species seems to be anostracan *Eubranchipus grubii* (Dybowski, 1860) (Biggs et al. 2002, Gołdyn et al. 2007). Systematic position of *E. grubii* is not certain, being assigned to *Siphonophanes* or *Eubranchipus* genus, with the later generic name prevailing in current literature (Belk and Brtek 1995). In older publications from the area of Poland the species occurred under *Branchipus*, *Chirocephalus* and *Chirocephalopsis* generic names.

The distribution of this species extends from eastern France in the west to the Volga Basin in the east and between 45°N and 55°N (Brtek and Thiéry 1995). In Polish literature, *E. grubii* is regarded as a typical spring form, occurring from late March to mid-May (e.g. Zwolski 1956, Kołodziejczyk and Koperski 2000). This statement is somewhat contrary to the reports from other European countries, where *E. grubii* is known to occur already in February (e.g. the Czech Republic and Slovakia, Brtek 1962; Denmark, Mossin 1986; Germany, Engelmann and Hahn 2004), and even autumnal, wintering populations are known (Saiah and Perrin 1990). The species is red listed in Germany, Czech Republic and Denmark and proposed for the Red list in Austria.

The current paper presents preliminary results of a study on distribution and phenology of *E. grubii* in the Wielkopolska region (W Poland).

MATERIAL AND METHODS

A survey for new localities of *E. grubii* was conducted between late February and beginning of May 2008. Thirty areas 10 x 10 km each (basing on UTM/MGRS grid) were randomly selected in the area of the Wielkopolska region. At least three astatic water bodies per such a square (177

in total) were inspected once, using a hand-held dip net (mesh diameter 4 mm) towed along all the available microhabitats for 15 minutes per pond. Moreover, 34 localities of *E. grubii* known before (Gołdyn et al. 2007) were rechecked. In total 211 temporary pools, ditches, large puddles, flooded meadows etc. were studied.

Seven astatic pools located in surroundings of Kaźmierz (52°29'14'' N; 16°36'50'' E) were selected for a detailed study on phenology and biology of *E. grubii*. In all pools the species was observed at least twice during occasional inspections in the preceding years (2002–2007). The ponds differed in their hydroperiod: from semi-permanent one, drying occasionally only in the years of severe drought, to ephemeral, inundated usually for four months. Catchment areas of all the pools included exclusively arable lands and the distance between two most outlying ponds was about 1.5 km. The pools were visited biweekly, starting on 11 February 2008.

The water bodies were checked using above described methods. In four ponds where only small puddles on the bottom were present at the beginning of sampling, abundance of juvenile specimens was estimated by taking a 1.5 l sample of water using a plastic container. Length and sex (when possible) of the specimens captured were recorded and the animals were released at the end of the inspection. The basic physico-chemical parameters of water (pH, conductivity, dissolved oxygen contents and temperature) were measured with the use of HACH HQ30d portable meter.

RESULTS

The species was recorded in 38 of 211 water bodies sampled during the field survey (18%), situated in 10 out of 30 studied areas. Only ten new localities of *E. grubii* were found (in 7 areas), and the species was absent from six pools, where it was recorded in the previous years.

In large populations (14 pools), the sex ratio was always close to 1:1. Females prevailed at localities where only few individuals were found. In the majority of the water bodies, *E. grubii* populations consisted of individuals with similar body lengths. Two distinct cohorts (juvenile and adult specimens) were recorded in four pools.

The species occurred in water bodies with pH ranging between 6.2 and 7.76, conductivity between 101 and 1270 µS/cm and dissolved oxygen contents between 2.57 and 17.1 mg/l. *E. grubii* was absent from the water bodies surrounded by coniferous forests and from the puddles on dirt roads and fields.

In five of seven pools selected for a detailed study *E. grubii* was recorded already during the first sampling (11 February 2008). In two pools all the specimens had already subadult body length (12–15 mm) and most of them had sexual traits well developed. The maximum body length (24 mm) was recorded during the third sampling, on 10 March. In those two pools, *E. grubii* was observed until the last decade of April (last record: 21.04; recorded occurrence period: 10 weeks) and beginning of May (05.05; recorded occurrence: 12 weeks), respectively.

In three pools only juvenile specimens (about 3–5 mm long) were found during the first sampling, reaching large densities up to 30 individuals per liter. Populations from two of those pools did not reach maturity in 2008 and the last, still juvenile individuals (up to 7 mm long) were recorded during the second sampling (25 February, occurrence period < 4 weeks). The third population was observed until the beginning of May (05.05; recorded occurrence: 12 weeks). During all the sampling events specimens from this pool were considerably smaller than those recorded in other pools, reaching the maximum length of 13 mm in April. Nevertheless, they had all the sexual traits well developed already during the third sampling (10 March) and a small number of eggs was observed in the female brood pouches starting on 25 March.

The species was absent from two pools: the most permanent one and the one with the densest vegetation cover. In both pools, *E. grubii* was recorded during the previous spring (2007), but it did not reappear until now (September 2008).

During all the sampling events, the specimens from particular pool were always similarly large. The sex ratio during first four samplings was near to 1:1 at all localities. Beginning from the fifth sampling females prevailed and during the last event (05 May) all but one specimens recorded were females.

During first five samplings, the water conductivity was considerably higher (344–701 μS/cm) in two pools where populations collapsed being immature than in the remaining five pools (75–155 μS/cm). There were no other significant differences in the recorded parameters of water between those two groups of pools as well as between the pools inhabited and uninhabited by *E. grubii*.

DISCUSSION

Observations of the winter occurrence of *E. grubii* are phenologically the earliest ever reported from Poland being consistent with the data from other European countries (Brtek 1962, Mossin 1986, Engelmann and Hahn 2004). What is more, it is possible that in some ponds *E. grubii* hatched already in the late autumn and survived the winter freezing of water table. Such a situation might have occurred in the two pools where subadult individuals were already present at the beginning of the the sampling period and in four pools where adult animals coexisted with juvenile ones (polyphenism). This phenomenon was observed by Saiah and Perrin (1990) in Switzerland where two cohorts of *E. grubii* co-occurred in one pond: the former hatched at the beginning of December and the latter in March.

In the vast majority of the water bodies, all individuals had similar body lengths within a particular population indicating only one hatching event. Such a situation is typical of the species (Mossin 1986) and of most Anostraca in general (Williams 2006). Highly synchronized hatching is a consequence of a species

specific environmental stimulus, usually connected with the change of physico-chemical parameters of water. In his experiments, Mossin (1986) found out that a sudden change of pH value connected with decrease in dissolved CO_2 contents following ice thawing could be the factor inducing hatching of cysts of *E. grubii*.

According to present results, the period following hatching seems to be the most critical, determining the occurrence of *E. grubii* population in a particular year. Unfavorable conditions at the beginning of spring caused the collapse of population in two ponds and probably prevented hatching in at least two other water bodies, where the species was recorded in the preceding years. Habitat conditions in small, astatic pools are often a subject of sudden, unpredictable changes caused by variable weather events or human activities (Williams 2006). No significant changes in the water chemistry were recorded in the ponds with juvenile *E. grubii* extinct. However, the high water conductivity could indicate an intensive inflow of chemical substances from the agricultural catchment. The collapse of the populations could have been also caused by unfavorable nutritional conditions suggested by the significantly smaller phytoplankton abundance in those two ponds (Celewicz-Gołdyn, unpubl.).

Results of the field survey show that *E. grubii* is not so widespread and common in the Wielkopolska region as it could be assumed basing on the data from a relatively small area (Gołdyn et al. 2007). However, since our study was spread in time between February and May, it is possible that the species was overlooked in some of the pools that were sampled later, especially if the populations collapsed, like it was observed in two ponds sampled biweekly. Nevertheless, with 52 recent localities known, it is still the most frequent large branchiopod species in the region. Five other species representing this group have been recorded in Wielkopolska so far (Gołdyn et al. 2007 supplemented with unpublished data): *Lepidurus apus* (Notostraca, 22 recent localities), co-occurring *Triops cancriformis* (Notostraca) and *Branchipus schaefferi* (Anostraca), both found only in puddles along a tank road in the Biedrusko military area), *Lynceus brachyurus* (Laevicaudata, 13 recent localities) and *Cyzicus tetracerus* (Spinicaudata, 7 localities). In the past, *E. grubii*, *L. apus*, *L. brachyurus* and *C. tetracerus* were reported from two localities in Wielkopolska by Mielewczyk (1966).

The present study will be continued in a more intensive form in the two following years. The data on distribution and biology of *E. grubii* and other large branchiopods in the region will be used for the assessment of their conservation status and for the preparation of species action plans. The data collected so far prove that like other large branchiopods, *E. grubii* deserves special care. However, conservation measures should not only be concentrated on policy-based actions such as the implementation of legal protection of the species. Priority must be given to habitat and site-based actions. Active forms of habitat protection, like retaining the vegetation buffer zones surrounding the ponds (Kalettka et al. 2001)

or even preparing new vernal pools (Rogers 1998), should be promoted. Most of all however, researchers carrying out studies of water fauna are strongly encouraged to report the occurrence of large branchiopods from the area of Poland.

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