

Preliminary studies on the durability of damselfly (Odonata: Zygoptera) exuviae

Wstępne badania nad trwałością wylinek ważek równoskrzydłych (Odonata: Zygoptera)

Michal STRAKA

Institute of Botany and Zoology, Faculty of Science, Masaryk University, Kotlářská 2, Brno, Czech Republic;
e-mail: michal.straka@centrum.cz

Introduction

Dragonfly (Odonata) exuviae have been collected for ecological studies since the 1960s (e.g. KORMONDY, GOWER 1965; JACOB 1969). However, the boom in exuviae collecting began some thirty years later with the increasing ability to correctly identify larvae and with the publishing of good-quality keys (for Europe e.g. CARCHINI 1983; ASKEW 1988; NORLING, SAHLÉN 1997; GERKEN, STERNBERG 1999; HEIDEMANN, SEIDENBUSCH 2002). Recently exuviae have been used as an additional tool for faunistic studies (e.g. JAKAB et al. 2002; KALKMAN et al. 2004; DOLNÝ et al. 2007) and autecological studies (e.g. FERRERAS-ROMERO, CORBET 1995; WESTERMANN 2002; SONNTAG 2005; HARDENSEN 2008) and also as an indicator of habitat condition (CHOVANEC, RAAB 1997; D'AMICO et al. 2004). Collection of

exuviae also has use in the mapping of endangered species and further planning of site management (FOSTER, SOLUK 2004). To evaluate the population density correctly it is necessary to visit the study site regularly throughout the emergence period, but even so some losses will occur due to weather conditions. The first survey carried out to fill this methodological gap was performed by ALIBERTI LUBERTAZZI and GINSBERG (2009). They recorded the exuvial persistence of several anisopteran species using nail polish to mark individual exuviae. I report here the results of a similar survey in which I studied the durability of damselfly (Zygoptera) exuviae. This preliminary study should lead to more detailed methodological research that is needed to refine the estimation of population density based on exuviae collection.

Tab. 1. Losses of exuviae of *C. puella* over time. The first column gives the number of days from the beginning of monitoring, the middle column shows the total number of exuviae, and the third gives the percentage of lost individuals.

Tab. 1. Spadek liczby wylinek *C. puella* w czasie. Pierwsza kolumna zawiera liczby dni od rozpoczęcia obserwacji, środkowa ukazuje ogólną liczbę wylinek, zaś trzecia podaje procent straconych osobników.

Days	Number of exuviae	% of lost exuviae
0	20	0
1	16	20
7	12	40
14	8	60
23	6	70

Study site and methods

The study was done in a small pool (surface area 100 m²) near the town Hustopeče (South Moravia, Czech Republic) at an altitude of approximately 200 m a.s.l. at the following geographical coordinates:

48°55'48" N, 16°44'48" E. Ninety percent of the pool surface was covered with the common reed (*Phragmites australis*) and with cattail (*Typha* spp.). On June 4, 2005, the mass emergence of the Azure damselfly, *Coeanagrion puella* (LINNAEUS, 1758)

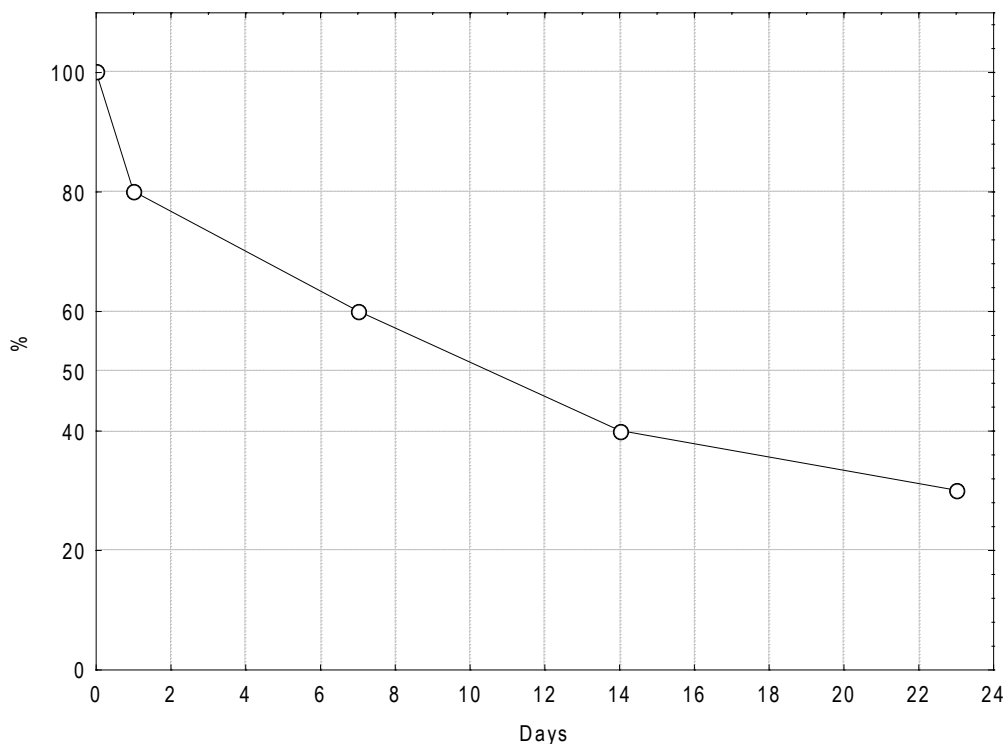


Fig. 1. Proportion of exuviae remaining attached to the cattail stem over time.

Ryc. 1. Część wylinek, która pozostała przyczepiona do łodygi trzciny po określonym czasie.

was observed. Twenty exuviae that were found on *Typha angustifolia* were marked by coloured ribbon that was attached to the plant stem 5 cm below the exuviae. All exuviae were positioned between 10 and 20 cm above the water surface. The presence of marked exuviae was monitored at the intervals shown in Tab. 1. The weather conditions were not accurately recorded, but the most noticeable event was a night storm after beginning the experiment (4.6.2005).

Results

The numbers of re-found exuviae are shown in Tab. 1. After only one day after the start of the experiment one fifth of the exuviae was lost. This loss continued and 23 days later only 30% of the marked exuviae were found, and they were so weather-worn that they would have been overlooked during ordinary collecting and it would have been impossible to identify them. It is interesting that most of lost exuviae were not blown away by the wind but were submerged after the whole cattail stem they were attached to broke and fell into the water. The loss of exuviae was most rapid soon after emergence (Fig. 1). From the curve in Fig. 1 it can be extrapolated that if exuviae collection was carried out at ten-day intervals only half of the total emerged damselflies would be counted.

Discussion

The results presented here are consistent with the study of Aliberti LUBERTAZZI and GINSBERG (2009). They found different rates of exuviae loss among different species, but in general they found about 60% loss of exuviae from the vegetation substrate over three weeks.

The rapid loss of exuviae should be borne in mind in studies that count the absolute

number of individuals. Unfortunately the results do not indicate how to correct the data obtained from non-daily studies or the ideal collecting design. A more detailed survey is needed, in particular to discover the influence of weather conditions (wind, rain) on exuviae loss.

Acknowledgement

The paper was supported by a grant from The Ministry of Education of the Czech Republic (MSM 0021622416).

Literature

- ALIBERTI LUBERTAZZI M.A., GINSBERG H.S. 2009. Persistence of dragonfly exuviae on vegetation and rock substrates. *Northeast. Nat.*, 16(1): 141–147.
- ASKEW R.R. 1988. *The Dragonflies of Europe*. Harley Books Colchester.
- CARCHINI G. 1983. A key to the Italian Odonata larvae. *Soc. Int. Odonatol. rapid Commun. Suppl.* 1: 1–100.
- CHOVANEC A., RAAB R. 1997. Dragonflies (Insecta, Odonata) and the ecological status of newly created wetlands: Examples for long-term bioindication programmes. *Limnologica*, 27: 381–392.
- D'AMICO F., DARBLADE S., AVIGNON S., BLANCMANEL S., ORMEROD S.J. 2004. Odonates as Indicators of Shallow Lake Restoration by Liming: Comparing Adult and Larval Responses. *Restor. Ecol.*, 12(3): 439–446.
- DOLNÝ A., BÁRTA D., WALDHAUSER M., HOLUŠA O., HANEL L. et al. 2007. *Vážky České republiky: Ekologie, ochrana rozšíření. The dragonflies of the Czech Republic: Ecology, Conservation and Distribution. Český svaz ochránců přírody Vlašim, Vlašim.*
- FERRERAS-ROMERO M., CORBET P.S. 1995. Seasonal Patterns of Emergence in Odonata of a Permanent Stream in Southwestern Europe. *Aquat. Insects*, 17(2): 123–127.
- FOSTER S.E., SOLUK D.A. 2004. Evaluating exuvia collection as a management tool for the federally endangered Hine's emerald dragonfly, *Somatochlora hineana* Williamson (Odonata: Cordulidae). *Biol. Conserv.*, 118: 15–20.

- GERKEN B., STERNBERG K. 1999. Die Exuvien Europäischer Libellen (Insecta Odonata). Arnika & Eisvogel, Höxter – Jena.
- HARDENSEN S. 2008. Dragonfly (Odonata) communities at three lotic sites with different hydrological characteristics. Ital. J. Zool., 75(3): 271–283.
- HEIDEMANN H., SEIDENBUSCH R. 2002. Die Libellenlarven Deutschlands. Handbuch für Exuviensammler. Goecke & Evers, Keltern.
- JACOB U. 1969. Untersuchungen zu den Beziehungen zwischen Ökologie und Verbreitung heimischer Libellen. Faun. Abh. Staatl. Mus. Tierk. Dresden, 2: 197–239.
- JAKAB T., MÜLLER Z., DÉVAI G., TÓTHMÉRÉSZ B. 2002. Dragonfly assemblages of a shallow lake type reservoir (Tisza-tó, Hungary) and its surroundings. Acta zool. Acad. Sci. Hung., 48(3): 161–171.
- KALKMAN V., KOP A., VAN PELT G.J., WASSCHER M. 2004. The dragonflies of the surroundings of lake Köyceğiz and the river Eşen, Muğla province, SW Turkey (Odonata). Libellula Suppl. 5: 39–63.
- KORMONDY E.J., GOWER J.L. 1965. Life history variations in an association of Odonata. Ecology, 46(6): 882–886.
- NORLING U., SAHLÉN G. 1997. Odonata, Dragonflies and Damselflies. In: A.N. NILSSON (ed.): Aquatic Insects of North Europe – A Taxonomic Handbook (2). Apollo Books, Stenstrup: 13–65.
- SONNTAG H. 2005. Schlupfbiologische Freilanduntersuchungen an *Sympecma paedisca*. Mercuriale, 5: 2–5.
- WESTERMANN K. 2002. Zur Phänologie der Emergenz bei der Gebänderten Prachtlibelle (*Calopteryx splendens*) an südbadischen Altrheinen. Naturschutz südl. Oberrhein, 3: 193–200.

Summary

Twenty exuviae of *Coenagrion puella* were marked and observed for three weeks in 2005. The number of marked exuviae rapidly declined and after 23 days there were only 30% of exuviae left; these were so weather-worn that it was impossible to identify them. To collect 50% of the exuviae it would be necessary to visit a locality 10 days after emergence.

Streszczenie

W okresie trzech tygodni 2005 r. oznakowano i obserwowano 20 wylinek *Coenagrion puella*. Liczba wylinek szybko spadła i po 23 dniach pozostało tylko ich 30%. Były one tak zniszczone wskutek warunków pogodowych, że nie można ich było oznaczyć. Zebranie 50% wylinek jest możliwe tylko przy kontroli stanowiska najpóźniej 10 dni po wylęgu.

Key Words. Dragonflies, Odonata, damselflies, Zygoptera, exuviae, durability, study methods.