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EMERGENCE OF THE DRAGONFLY *AESHNA GRANDIS* (L.) IN NORTHERN ENGLAND (ANISOPTERA: AESHNIDAE)

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Abstract — Daily collections of exuviae of *A. grandis* were made from a small pond throughout the emergence period. The sex ratio at emergence was heavily female biassed (38.7% males). Mean male emergence date was 7 days earlier than mean female emergence date. In both males and females, head width of the exuvium was negatively correlated with emergence date.

Introduction

In their paper on population regulation in animals with complex life-histories, CROWLEY et al. (1987) listed a number of topics in which information was missing or sparse, which if supplied would improve our understanding of odonate population dynamics. One such topic was the structure of the population at emergence. In particular Crowley et al. were concerned with the means, variances, and seasonal trends (by sex) in size at emergence. Their damselfly population model was sensitive to development rates of later instars, which, if variable, are reflected in a spread of emergence dates.

Despite the large amount of data published about odonate emergence in scientific literature and in the reports of local natural history groups, there are relatively few studies in which all the individuals emerging from a site in a season have been caught and measured as adults or exuviae (see CORBET, 1962; LAWTON, 1972). The aim of this short communication is to provide one such study on the emergence of the dragonfly *Aeshna grandis* (L.) from a small pond in northern England, near the north-western edge of the range of the species in Europe.

Study site and methods

The study was made in June and July 1983 at Bungalow Pond, Wirral, northern England, Nat. grid ref. SJ234857. Bungalow Pond is a small, roughly circular pond with a perimeter of about 60 m. The emergent vegetation is mostly *Glyceria* spp. with one small patch of *Iris pseudacorus*. Aeshnids emerged on this vegetation and on the trunk of a hawthorn tree (*Crataegus monogyna*) in one corner of the pond.

The emergent vegetation around the pond was searched twice daily. All aeshnid exuviae were collected and returned to the laboratory where they were sexed and identified. In addition the head width (the greatest distance between the eyes) was measured using a microscope with a micrometer eyepiece.

Results

The first exuvium was found on 20 June and the last on 28 July. In all, 119 exuviae were found. Only two adults were seen with their exuviae during the daylight searches and each of these had sustained wing damage. *Aeshna grandis* clearly follows the familiar anisopteran pattern of emerging during the hours of darkness.

The sex ratio was statistically significantly female biassed (38.7% males, χ^2, = 6.13, $P < 0.05$)

The percentage frequency distributions for the emergence for males and females are shown in Figure 1. Taking 20 June as day 1, mean male emergence time was approximately 7 days earlier than that for females (males 15.9 ± 1.1 (S.E.) days; females 22.6 ± 1.0 (S.E.) days; $d_{117} = 4.34$ $P < 0.001$). The mode for females was 17 days (6 July) and for females 25 days (14 July).

In both males and females, head width was negatively correlated with date of emergence ($r = -0.557$, $P < 0.001$ for females, and $r = -0.473$, $P < 0.001$ for males). Individuals of both sexes that emerge early in the season are larger than those that emerge late. Females were on average larger than males (mean female head width 8.97 mm, mean male head width 8.71 mm).

Discussion

The emergence of *Aeshna grandis* at Bungalow

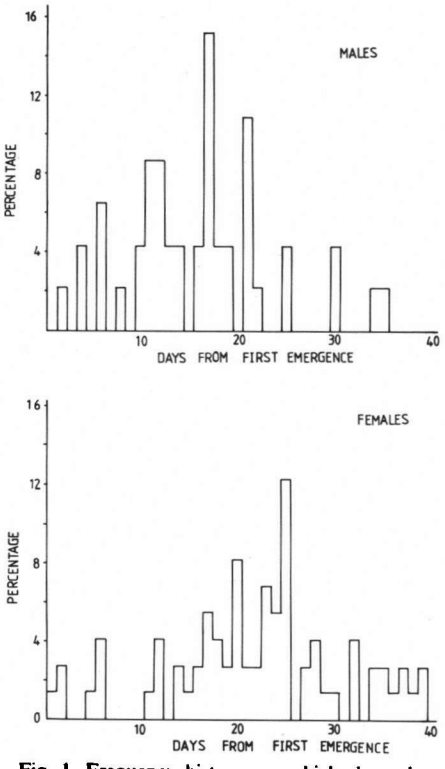

Fig. 1. Frequency histograms which show the percentage of the population of *Aeshna grandis* which emerged daily throughout the summer of 1983. Day 1 = 20 June; day 39 = 28 July.

Pond is similar to that described for other members of the genus in England (*A. cyanea*, CORBET, 1959). Figure 2 shows the emergence data replotted as cumulative percentage emerged against time. The emergence curve is shallow, which is typical of a summer species, though steeper than that for *A. cyanea* (CORBET & CORBET, 1958). The sex ratio at emergence was significantly female biassed. Although the sample size is relatively small (n=119), the trend in sex ratio is similar to all the data on sex ratios in Anisoptera presented in CORBET's (1962) and in LAWTON's (1972) reviews. In these reviews the most biassed sex ratio was found for *Oplonaeschna armata* Hagen (JOHNSON, 1968) in which 37.7% of the population was male. This figure is close to the sex ratio found in the present study. The merit of collecting all the exuviae rather than a sample based on a few day's collecting is clear. In the present study, if the collection had been restricted to the first 18 days of the emergence period (of 39 days) the sex ratio would have appeared male biassed (60.4% males).

There are few data available on relative emergence times of the sexes in the Odonata. WOLFE (1953) showed that males of *Uropetala carovei* emerged earlier than females and TIENSUU (1953) had similar data for *Leucorrhinia dubia* (both cited by CORBET, 1962).

CORBET (1962, based on WALKER, 1953) has used the fact that one sex may return to breed before the other to imply that the sexes have different emergence times, but has pointed out that these indications may not be completely reliable. BANKS & THOMPSON (1985) have shown that the immature period of adult Zygoptera can differ significantly between the sexes. They showed that *Coenagrion puella* females emerged significantly earlier than males, but that males had a significantly shorter pre-reproductive period.

The data provided by WOLFE (1953), TIENSUU (1935) and the present study suggest that there may be real differences in relative emergence times between the sexes in zygopterans and anisopterans. It is possible in the long-lived, strongly territorial anisopteran species, in which population densities are usually much

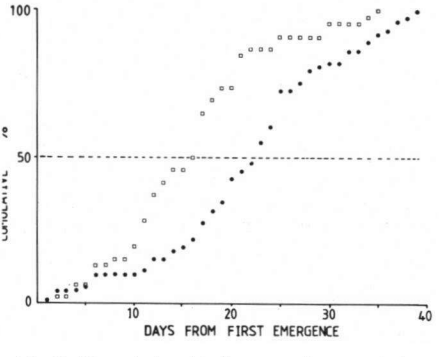

Fig. 2. The relationship between the cumulative percentage of the annual population of *Aeshna grandis* emerging and time; (□) males, (•) females.

reduced below the levels typically found in the Zygoptera, that there is considerable selection pressure for males to emerge early and establish territories both in suitable feeding areas and, more important, at potential breeding sites.

What are needed at present are data on the lengths of the pre-reproductive period (by sex) in anisopterans, analagous to the data provided by BANKS & THOMPSON (1985) for zygopterans. The consequences for the population dynamics of the different structures of anisopteran and zygopteran populations at emergence could then be investigated by models such as those envisaged by CROWLEY et al (1987).

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