Hydrobiologia vol. 58, 3, pag. 277-280, 1978

EMERGENCE PATTERNS OF THREE SPECIES OF CAENIS STEPHENS (EPHEMEROPTERA : CAENIDAE).

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Received September 20, 1977

Keywords: Ephemeroptera. *Caenis*. Emergence.

Abstract

Information on the emergence patterns of *Caenis macrura* Steph. *C. horaria* (L.) and *C. robusta* Etn. collected by means of a Rothamsted light trap is given. *C. macrura* and *C. horaria* showed two peaks of emergence but the numbers of *C. robusta* emerging were fairly evenly spread over the whole emergence period. Two types of adaptive strategy for avoiding predation were identified in these emergence patterns. In the first, predation was avoided by synchronising emergence and consequently satiating predators. In the second predation was avoided by the small numbers emerging at any one time lowering the probability of encounters between predator and prey.

Introduction

Although some information on the flight periods of the British Ephemeroptera is available (Kimmins, 1950, 1954; Kite, 1962) and the life histories of many species are known (Macan, 1970) little detailed information on the emergence patterns of the subimagines/imagines is available in the literature. This note gives data on the emergence patterns of three species of *Caenis* Stephens which were collected in 1971 during a light trap study of the seasonal distribution of the Chironomidae of the River Thames.

Methods

A Rothamsted light trap (Williams, 1948) was run on the south bank of the River Thames in the grounds of the University of Reading River Studies Centre, some 30 m from the water's edge. The trap was emptied weekly and the Ephemeroptera picked out from subsamples taken by means of a Motoda subsampler. Details of the subsampling technique are given by Mackey (1973). Results were recorded as numbers occurring in each standard week of the Rothamsted Insect Survey (Lewis & Taylor, 1967).

Results

Three species were attracted to the light: *Caenis macrura* Steph., *C. horaria* (L.) and *C. robusta* Etn. and their emergence patterns are shown in Fig. 1. *C. macrura* was by far the most abundant and had the longest emergence period, from week 22 to week 34, with two major peaks in abundance in weeks 25 and 28 which together accounted for 76% of the total emergence. *C. horaria* and *C. robusta* had emergence periods of the same length although *C. robusta* started emerging a week later than *C. horaria*. *C. horaria* was twice as abundant as *C. robusta* and showed two peaks of emergence, in weeks 25-26 and weeks 28-29, which accounted for 79% of total emergence: a pattern and figure similar to those for *C. macrura* but the emergence peaks in *C. horaria* continued twice as long as in the former species. *C. robusta* showed a slight peak in abundance in weeks 25-26 but emergence in this species was fairly evenly spread over the whole emergence period. Peaks of abundance generally coincided in the three species but cumulative catch curves indicated the median points of emergence to be at week 25.2 *(C. macrura)*, week 25.6 *(C. horaria)* and week 26.1 *(C. robusta)* thus showing a slight staggering (Fig. 1).

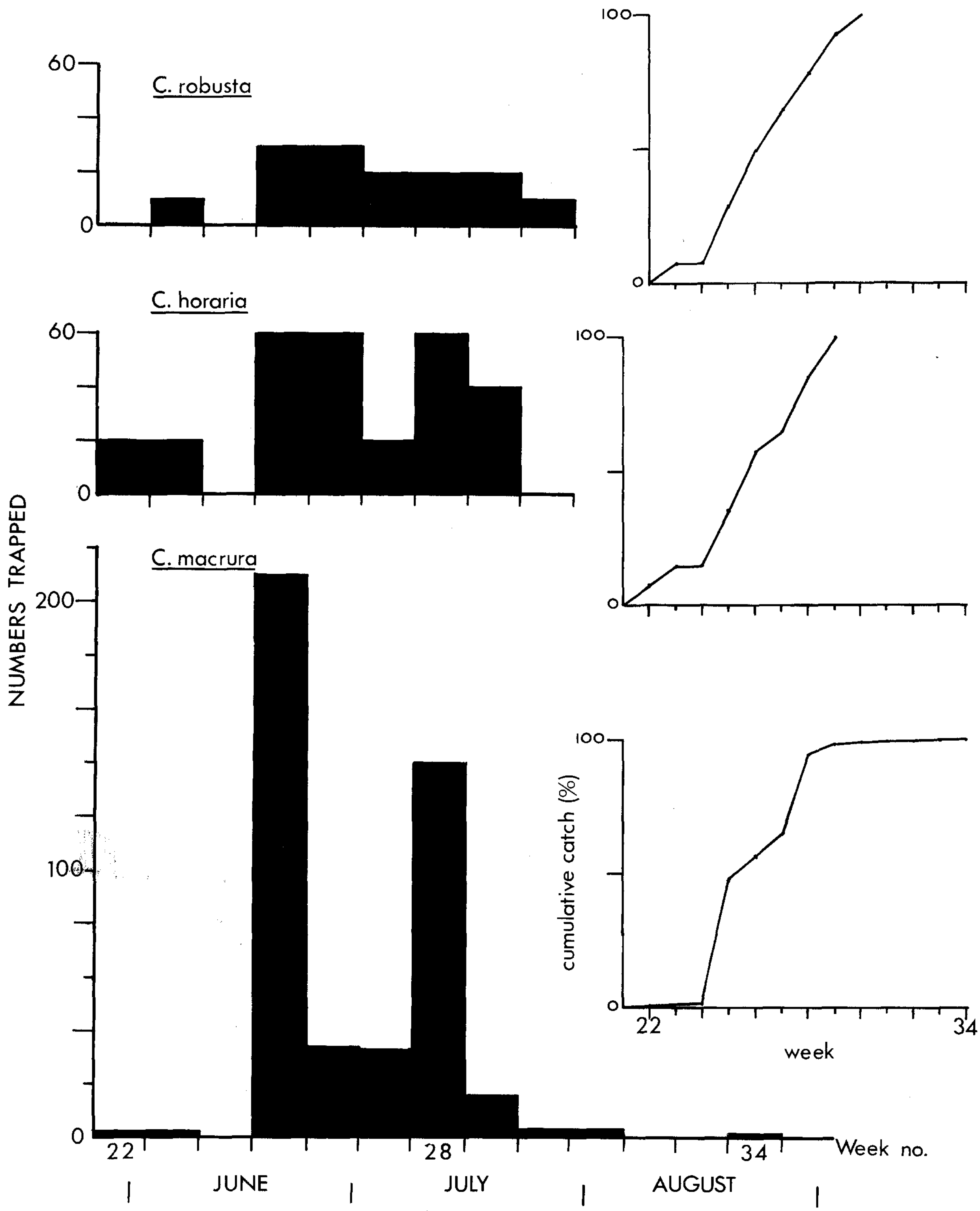

Fig. 1. Seasonal emergence patterns and cumulative catch curves for three species of *Caenis*.

Discussion

C. macrura and *C. horaria* are known to be nocturnal fliers (Kimmins, 1950) which accounts for their presence in the light trap. The flight time of *C. robusta* is not known but it is presumably nocturnal. Macan (1970) records *C. horaria* as occurring in soft mud in flowing water and *C. macrura* as occurring on gravel and large stones in rivers. Both these substrata are found in the River Thames in the region where the light trap was situated and it seems reasonable to assume that these two species originated from the river. *C. robusta* has only been recorded from still water (Macan, 1970) and the Thames record would be the first for this species from running water in the U.K. However, there were extensive gravel pits on the north bank of the Thames opposite the light trap and it is possible that *C. robusta* came from there.

Typical *r* selected organisms, such as most insects, have few mechanisms for reducing interspecific competition, and high mortality rates, with their main defence against predators being synchrony of the life cycle (Southwood, 1976). The emergence patterns shown in Fig. 1 should be looked at with reference to these characteristics.

When congeners occur together in the same habitat some niche displacement to reduce interspecific competition may be expected to occur. Thus the two Hydropsychid Trichoptera *Hydropsyche pellucidula* Curt. and *H. siltalai* Döhl. occur in mixed populations but there is a difference in timing of peak populations of near mature larvae and *H. pellucidula* emerges earlier than *H. siltalai* (Badcock, 1976). The three species of *Caenis* showed no such niche separation as they had overlapping flight periods, peaks of abundance occurred simultaneously in each species and median points of each emergence period were separated by only a few days. Thus as might be expected, interspecific competition in this context is unimportant and their flight patterns should be viewed as mechanisms for reducing mortality.

The emergence pattern of *C. macrura* suggests an adaptive strategy for minimising predation by means of a mass emergence providing a glut of food which satiates predators. The low numbers of emerging *C. robusta* would be unsuitable for such a strategy and this together with the spacing out of emergence over a long period indicates predators are being avoided because the low densities involved reduce the probability of predators finding their prey. Such a mechanism has also been proposed in mantids (Eisenberg & Hurd, 1977). *C. macrura* also emerges in very low numbers over long periods as well as at mass emergences, and it would appear that both adaptive strategies are found in the life cycle of this species. Emergence of *C. horaria* is difficult to categorise as elements of both strategies are present: numbers are low but peaks of emergence are seen. Due to the small numbers involved it is unlikely that predators would be swamped by synchronous emergences and in addition peaks were spread over two weeks in this species, not one as in *C. macrura,* so the second strategy seems dominant.

The question arises whether these mechanisms are found in other species of Ephemeroptera. Data are scarce in the literature but Macan (1957) records patterns of emergence for *Rhithrogena semicolorata* (Curt.), *Baetis rhodani* (Pict.) and *B. pumilus* (Burm.). *B. rhodani* and *B. pumilus* have two peaks of emergence representing two generations and *R. semicolorata* two peaks of emergence but only one generation. In each case emergence also occurs sporadically at a low level over several months. Thus the pattern of emergence of these three species is similar to that described for *C. macrura* and this suggests that the two strategies for avoiding predation described above are also operative in these species; indeed they may well be operative throughout the Ephemeroptera.

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