Seasonal Synchronization of the Life-Cycle of Pterostichus oblongopunctatus (Coleoptera: Carabidae)

Pieter G. van Schaick Zillesen

Received: 1985-04-15
Accepted: 1985-07-07

The influence of the photoperiod on the duration of pre-adult development in the beetle Pterostichus oblongopunctatus (Fabricius 1787) was investigated under experimental conditions. A facultative dormancy governed by photoperiod was found to occur during the third larval stage. Dormancy in larvae of spring-breeding Carabidae has not been described before. The duration of pre-adult development in the field was simulated with a mathematical model in which the driving variables were photoperiod and temperature. Results of simulations with the model conform very well with observations made under semi-natural conditions. The results of the simulation model indicate also that the observed dormancy synchronizes the life-cycle of P. oblongopunctatus with the season.

1 Introduction

Pterostichus oblongopunctatus (Fabricius 1787) is a spring-breeding beetle with summer larvae. Young adults emerge late in summer and autumn and hibernate during winter.

Thiele [1977] described the regulation of annual rhythms in relation to external factors in Carabidae. He distinguished 5 types of annual rhythms. In this system the life-cycle of spring breeders with summer larvae, such as P. oblongopunctatus, is synchronized with the season in the course of adult hibernation. Any form of larval dormancy in this group of beetles is ruled out. Heessen et al [1982] investigated the duration of the development of P. oblongopunctatus at temperatures [T] resembling those in the field. The rate of development in this species was found to depend upon T. However, the rate of development of the third larval stage [L₃]² depended less strongly upon T than did the developmental rates of the other stages. They found a large deviation from the mean rate of development of the L₃.

In this study the influence of photoperiod [Pp]³ on the duration of pre-adult development [PA-D]⁴ in P. oblongopunctatus is investigated under experimental conditions. A mathematical simulation model for the duration of PA-D in the field is constructed on basis of the data obtained from these experiments and data published by Heessen et al.

---

1 temperature(s); in further text: T
2 first, second, third larval stage; in further text: L₁, L₂, L₃
3 photoperiod(s): in further text: Pp
4 pre-adult development; in further text: PA-D