SHORT NOTE

Eur. J. Entomol. **90**: 95–98, 1993
ISSN 1210–5759

Role of temperature and photoperiod in diapause regulation in Czech populations of *Dolycoris baccarum* (Heteroptera: Pentatomidae)

Ivo HODEK and Magdalena HODKOVÁ

Institute of Entomology, Czech Academy of Sciences,
Branišovská 31, 370 05 České Budějovice, Czech Republic

Ecophysiology, diapause induction, pre-oviposition period, longevity, fecundity

Abstract. *Dolycoris baccarum* (L.) populations from the Prague region (52°N) display a facultative adult diapause. The induction of diapause is governed by photoperiod, long day averting it. High temperature tends to prevent diapause even under a short-day photoperiod.

Introduction

Dolycoris baccarum (L.) (Pentatomidae: Heteroptera), like other related species [*Aelia acuminata* (L.), *Eurygaster integriceps* Putn.], is a polyphagous bug which may cause economic damage in wheat fields, particularly in warmer regions. The life-history has been studied in southern Russia, Israel and Turkey (Perepelitsa, 1969; Yathom, 1980; Karsavuran, 1986). Knowledge of the regulation of the adult diapause is essential for the management of this pest.

In a preliminary experiment (Babrakzai & Hodek, 1987) the diapause of ovipositing females was induced by 12L : 12D photoperiod and terminated by 20L : 4D at 25 ± 2°C in *D. baccarum* from Prague, central Europe. These findings contrast with a preliminary report on a Scandinavian population (Conradi-Larsen & Sømme, 1978) according to which the photoperiod did not play a role. Later analysis confirmed the role of the photoperiod in the regulation of diapause also in the population from the Oslo region (Hodková et al., 1989).

Since group cultures only were used in the previous study of the Czech population, the effect of photoperiod was studied on three series of individual pairs at two temperatures.

Material and Methods

The experimental animals originated from the region of Prague (52°N, 15°E). The parents (3rd laboratory generation) were kept under diapause-promoting photoperiod (12L : 12D). The offspring used in experiments (4th lab. generation) was constituted by their eggs, laid by females of 4 to 4.5 months age, and hence assumed to be post diapause.

Isolated pairs were kept in plastic boxes of 4 × 4 × 6 cm, with a nylon-covered hole in the lid for aeration. A bunch of wheat leaves maintained adequate humidity inside the boxes and served as food, together with shelled sunflower seeds. Food was supplied every 7 days. Oviposition was recorded twice per week.

Experimental series were exposed as follows: (1) photoperiod of 18L : 6D at 26 ± 3°C (long day, warm), (2) 12L : 12D at 20 ± 3°C (short day, cool). After 66 days the insects were transferred from (2) to (3) 12L : 12D at 26 ± 4°C (short day, warm). The conditions in (2) were no longer available; thus all individuals had to be transferred to (3). Larvae were reared at (3) and transferred to the experimental conditions early in the 4th instar.

Results

Long-day, warm conditions

All 27 females oviposited at 18L : 6D, but after a rather long pre-oviposition period (x = 37.1, med. = 38, range 21–66 days). (Fig. 1)

The longevity of females ranged between 45 and 212 days (x = 89.7, med. = 74 days) (Fig. 2). The females usually died soon after depositing their last batches of eggs, at most 2 weeks after the end of egg laying. The post-oviposition period was long, 66 and 76 days, in only two females. These two females also lived much longer (167 and 212 days) than other individuals. The fecundity averaged 266 eggs (2–671) (Fig. 3).

Short-day, cool conditions

No female (n = 30) laid eggs at 20°C. After transfer to 26°C at 66 days of age 18 females (60%) oviposited after a pre-oviposition period (counted from adult ecdysis) of 73–115 days (x = 90.2, med. = 94). (Fig. 1).

The fecundity of the females ovipositing at greater ages was rather low; it averaged 40 eggs (2–154) (Fig. 3).

Short-day, warm conditions

More than half of the females (62.9%; n = 27) oviposited despite the short photoperiod. The pre-oviposition period amounted to 31–78 days (x = 55.2, med. = 54) (Fig. 1). Fecundity averaged 96 eggs (12–286), slightly more than one third of the fecundity of long-day females (Fig. 3).

Longevity

The longevity was shortest under long-day conditions (med. = 74, range 45–212), slightly longer under warm short-day conditions (med. = 86, range 58–63+) and longest under cool short-day conditions (med. = 108, range 87–180+) (Fig. 2).

Discussion

Warm long-day conditions prevented diapause in all females reared in individual pairs, a similar result to the preliminary finding for group cultures of the Czech population (first laboratory generation) (Babrakzai & Hodek, 1987). However, the oviposition delay was about more than twice as long (pre-oviposition period 21–66 days rather than 9–11 days). Shorter photoperiod, slightly lower temperature and the decreased vitality of the fourth laboratory generation might be the reason for this increase in oviposition delay. Thus, photoperiod was confirmed as an important factor for diapause regulation in the population of *D. baccarum* from central Bohemia.

The importance of photoperiod for diapause induction was recorded also in the populations of *D. baccarum* from southern Russia (Perepelitsa,

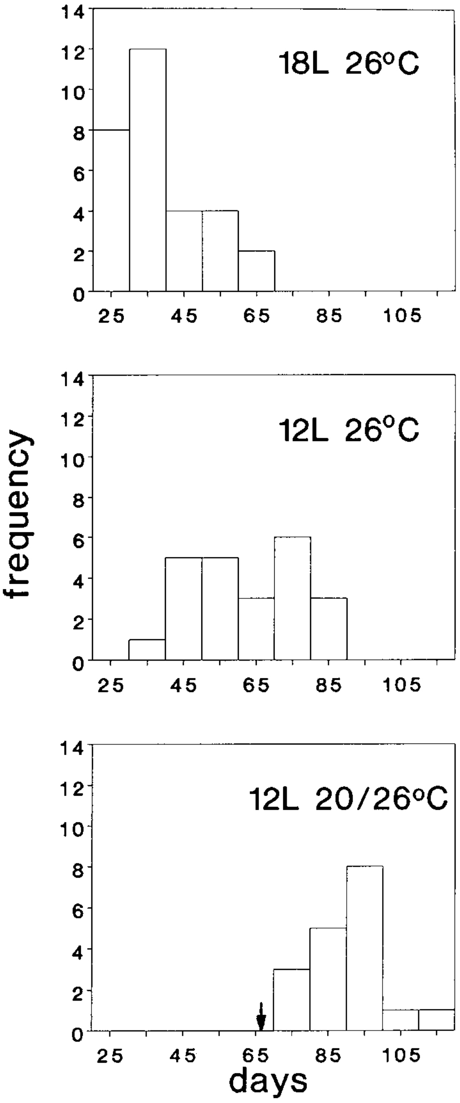
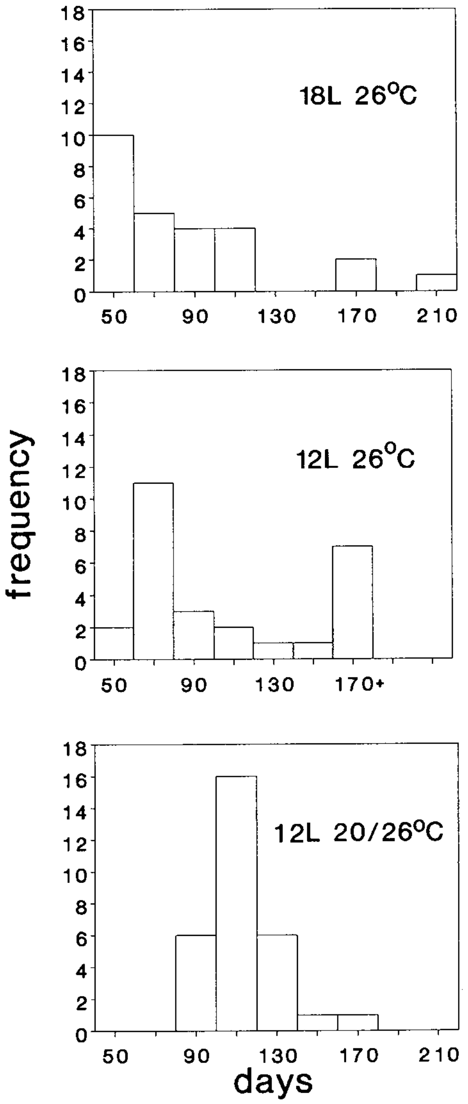


Fig. 1: Distribution of duration of pre-oviposition period under three laboratory conditions. Horizontal axis: days from adult ecdysis, vertical axis: number of individuals.



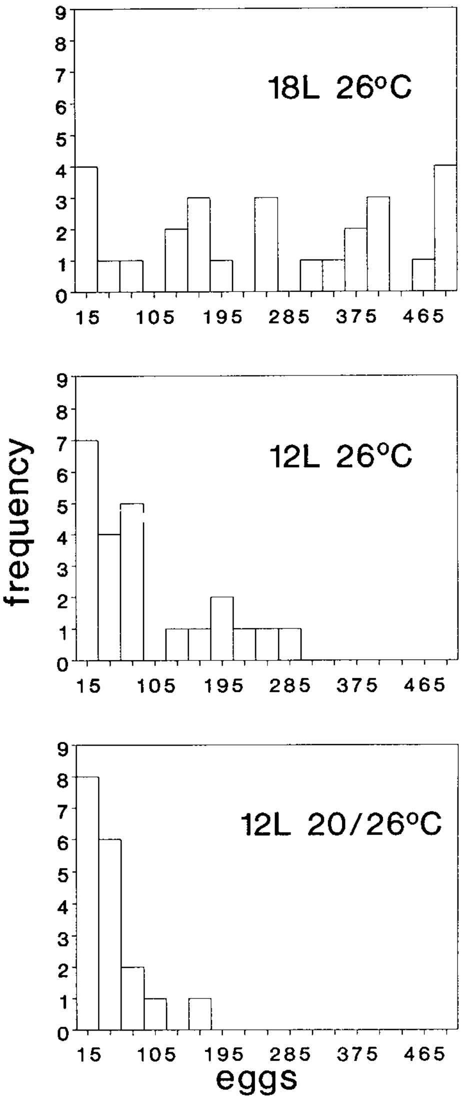


Fig. 2: Distribution of longevity in the Czech population of *Dolycoris baccarum* under three laboratory conditions. Horizontal axis: time, vertical axis: number of individuals.

Fig. 3: Distribution of fecundity in the Czech population of *Dolycoris baccarum* under three laboratory conditions. Horizontal axis: number of eggs laid, vertical axis: number of individuals.

1969) and southern Norway (Hodková et al., 1989).

Temperature can modify strongly the photoperiodic response in this population of *D. baccarum*. More than half of the females oviposited even at short-day photoperiods when reared at 26°C or after an increase in temperature from 20° to 26°C. High temperature or increase in temperature tend to prevent diapause in many other long-day insects; examples have been listed in recent surveys (Tauber et al., 1986; Danks, 1987; Hodek & Hodková, 1988; Zaslavski, 1988).

Thus, the Czech population of *D. baccarum* appears to differ in this respect from the population originating from the Krasnodar region in southern Russia (45°N, 40°E), where diapause was induced by a photoperiod of 12L : 12D even at temperatures of 25–30°C (Perepelitsa, 1969). Such a response would enable the induction of diapause in *D. baccarum* in late summer and autumn when the temperatures are still high in this warmer region.

As was expected, lower values of longevity were recorded at long days. At short days, low temperature of 20°C prevented early mortality and delayed the peak of average longevity. The relatively numerous occurrence of long living females recorded at constant temperature of 26°C was suppressed in the sample stimulated by the temperature increase from 20° to 26°C.

References

Babrakzai Z.H. & Hodek I. 1987: Diapause induction and termination in a population of Dolycoris baccarum (Heteroptera, Pentatomoidea) from central Bohemia. *Věstník Čs. Spol. Zool.* **51**: 85–88.

Conradi-Larsen E.-M. & Sømme L. 1978: The effect of photoperiod and temperature on imaginal diapause in Dolycoris baccarum from southern Norway. *J. Insect Physiol.* **24**: 243–249.

Danks H.V. 1987: *Insect Dormancy: an Ecological Perspective.* Biological Survey of Canada, Ottawa, 439 pp.

Hodek I. & Hodková M. 1988: Multiple role of temperature during insect diapause: a review. *Entomol. Exp. Appl.* **49**: 153–165.

Hodková M., Hodek I. & Sømme L. 1989: Cold is not a prerequisite for the completion of photoperiodically induced diapause in Dolycoris baccarum from Norway. *Entomol. Exp. Appl.* **52**: 185–188.

Perepelitsa L.V. 1969: The breeding of Dolycoris baccarum in the laboratory. *Zool. Zh.* **48**: 757–759 (in Russian).

Tauber M.J., Tauber C.A. & Masaki S. 1986: *Seasonal Adaptations of Insects.* Oxford Univ. Press, New York, Oxford, 411 pp.

Zaslavski V.A. 1988: *Insect Development – Photoperiodic and Temperature Control.* Springer, Berlin, Heidelberg, 187 pp.

Received May 19, 1992; accepted September 28, 1992