

Possibility of producing *Coccinella septempunctata* L. (Col., Coccinellidae) without a diapause

MATTI HÄMÄLÄINEN and MARTTI MARKKULA

Agricultural Research Centre, Department of Pest Investigation
Tikkurila, Finland

HÄMÄLÄINEN, M. & MARKKULA, M. 1972. Possibility of producing *Coccinella septempunctata* L. (Col., Coccinellidae) without a diapause. — Ann. Ent. Fenn. 38, 193 – 194.

In natural conditions in Finland *Coccinella septempunctata* L. has one generation a year. The females of the new generation, which become adult in July-August, fall into diapause and do not lay eggs until the following summer. When reared continuously in an 18-hour photoperiod at a temperature above 20°C the ladybirds produced 10 generations during a year, all or almost all the females of every generation laying eggs. After this, the hatching rate decreased and larval and pupal mortality increased to such an extent that the stock could no longer be maintained after the thirteenth generation.

In Finland the seven-spotted ladybird (*Coccinella septempunctata* L.) is univoltine in natural conditions. The adults of the new generation emerge in July and August, but do not lay eggs until the following summer. The Central European populations have been found to be heterogeneous in regard to the obligate nature of this diapause. Diapause was obligate for about 80 % of the specimens of the new generation, and facultative for the rest (HODEK and ČERKASOV 1961, HODEK 1962, BONNEMAISON 1964). In *C. septempunctata* reared in a long photoperiod (16 – 18 h) at a temperature above 20°C, the ratio of females falling into obligate diapause was gradually reduced, and after 4 – 6 generations only a small proportion of the females fell into diapause.

The purpose of the present study was to ascertain whether it would be possible to break the diapause of Finnish *C. septempunctata* too, and to rear this species all the year round for use in the biological control of aphids in greenhouses.

Material and methods

Seven-spotted ladybirds were gathered from their hibernation sites at Kärkölä (60° 51' N, 25° 17' E) at the end of May 1970. They were reared in the insectary

of the Department of Pest Investigation in approximately natural conditions. The progeny of the hibernated beetles — the first generation — were transferred to the laboratory after they had become adult. Thirteen generations were reared in the laboratory, each generation originating from the eggs of many females.

The average diurnal temperature of the laboratory was 20 – 28°C, and the relative humidity 30 – 60 %. The diurnal photoperiod was 18 hours: when necessary, the natural light period was prolonged by means of mercury lamps.

The larvae were reared separately in small glass tubes. The adults of each generation were initially kept together for a couple of weeks for copulation. When laying began, the females were placed separately in transparent glass jars. The ladybirds were fed on the green peach aphid (*Myzus persicae* Sulz.) and the pea aphid (*Acyrtosiphon pisum* Harris).

In keeping with the proposal of HODEK and ČERKASOV (1961), females that did not lay eggs and that had undeveloped ovaries were regarded as being in diapause.

Results and discussion

All the females of the first generation started to lay eggs, while in the subsequent generations the proportion of females laying eggs varied between 78 and 100 % (Table 1). The number of females in diapause was consequently quite small. In Czechoslovakia, according to HODEK (1962), only 14 – 68 % (on average 27 %) of the first generation reared in the laboratory

Table 1. Percentage of females laying eggs in successive generations.

Generation	Date of emergence	Number of females	Number of females laying eggs	%
1st	4 - 10 Aug. 1970	19	19	100
2nd	23 Sept. — 13 Oct. 1970	13	11	85
4th	25 Dec. 1970 — 2 Jan. 1971	12	10	83
7th	18 - 28 April, 1971	29	26	90
9th	12 - 23 July, 1971	7	7	100
10th	1 - 4 Sept. 1971	14	11	79

had developed ovaries, and even fewer, i.e. 7 - 16 %, of the specimens gathered in nature. Thus there appears to be a difference between the Finnish and Central European populations, but our material is too limited for any estimation of the percentage of females with facultative diapause in Finnish populations. SUNDBY (1966) had no success whatsoever in breaking the diapause of Norwegian specimens.

After 10 generations, the rate of hatching of the eggs declined and the mortality of larvae and pupae increased to such an extent that the population could no longer be maintained after the thirteenth generation. Comparable degener-

ation occurred in the cultures reared by HODEK and ČERKASOV (1961).

The present investigation shows that *C. septempunctata* can produce at least ten generations a year if the photoperiod is long enough (here, 18 hours per day) and the temperature high enough (here, above 20°C). The population can be renewed every year from specimens gathered in nature.

A c k n o w l e d g e m e n t s. This study is part of a project supported by a grant from the Foundation for Research in Natural Resources in Finland (Suomen Luonnonvarain Tutkimussäätiö).

References

- BONNEMAISON, L. 1964 Observations écologiques sur la Coccinelle à 7 points (*Coccinella septempunctata* L.) dans la région parisienne (Col.). — Bull. Soc. Ent. France 69, 64 - 83.
- HODEK, I. 1962. Experimental influencing of the imaginal diapause in *Coccinella septempunctata* L. (Col., Coccinellidae) 2nd part. — Acta Soc. Ent. Čechoslov. 59, 297 - 313.
- HODEK, I. & ČERKASOV, J. 1961. Prevention and artificial induction of imaginal diapause in *Coccinella septempunctata* L. (Col.: Coccinellidae). — Ent. Exp. Appl. 4, 179 - 190.
- SUNDBY, R. A. 1966. A comparative study of the efficiency of three predatory insects *Coccinella septempunctata* L. (Coleoptera, Coccinellidae), *Chrysopa carnea* St. (Neuroptera, Chrysopidae) and *Syrphus ribesii* L. (Diptera, Syrphidae) at two different temperatures. — Entomophaga 11, 395 - 404.

Received 18. X. 1972.