

ART. IX.—*Life-history of Plutella cruciferarum, Zeller.*

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THE diamond-back moth is referred to in every work on agricultural entomology, but the best notices occur in "Farm Insects" (Curtis, p. 85), and in a "Special Report to the Board of Agriculture, London," by Charles Whitehead, 1891. In neither of these, however, is the life-history given with any degree of completeness, and to supply this omission is the object of this paper.

The diamond-back moth and the ravages of its larva on cruciferous crops are well known. I found larvæ, pupæ, and adults on cabbage-plants all the year round. In winter their numbers are small, and do not increase rapidly till December and January, when the turnip-crops become available as food. Rape is hardly touched, but in February and March of this year clouds of the moths infested the turnip-fields on the College farm. The larvæ destroyed all the foliage, so that the turnips put forth new leaves, and this checked the root-growth so seriously as to diminish the crop by nearly 75 per cent.

In the adult the male and female can be distinguished, with the aid of a pocket-lens, by the fact that the male has the antennæ more setose, and therefore less distinctly notched, than the female. Of the specimens I employed for breeding, gathered in late autumn, the females were about twice as numerous as males. The adults lived, on an average, fourteen days when confined in a glass box 4 ft. by 3 ft. by 2 ft. in which turnip-plants were growing. For purposes of closer observation the specimens were kept in bell-jars about 1 ft. high, and here their average life was ten days, the longest life being that of a female who lived for thirteen days, in company, most of the time, with another female.

When a male and a female were placed under a bell-jar, with a piece of cabbage-leaf to encourage laying, the following was found to be the normal course of events: Copulation took place on the second day of adult life; eggs (about seven in number) were laid on the third day; copulation again on the fourth day; eggs (averaging six in number) laid on the fifth day; copulation again on the sixth day; eggs (about four in number) laid on the seventh day. One or two more eggs may be laid, but the death of both male and female occurred

usually on the ninth and tenth days of life. Thus about eighteen eggs were laid, and oviposition was continued for five or six days. The eggs are small, white, iridescent, crinkled; and when the caterpillar emerges it does so by a small, regular opening at one end. Before I clearly distinguished males and females two females were occasionally put together. In this case nothing happened till about the eighth day of adult life, when one or both of the moths laid all her eggs (eighteen to twenty in number) in a few hours, and shortly afterwards died. These unimpregnated eggs were yellowish in colour, and never developed. The eggs are scattered about the leaf on which they are laid; the female has great difficulty in extruding them, as they cling to the genital aperture, and have to be rubbed off against the leaf. It frequently takes over fifteen minutes to lay a single egg.

The eggs hatched in from eight to ten days in a uniform temperature of 60° Fahr.

The appearance of the caterpillar is well known. In an equable temperature and with an abundant food-supply its active life lasted for twenty-two days; by this time it is full-fed, and spins its delicate white network cocoon.

The time of pupation averaged seventeen days in a room rather cooler than that used for hatching and feeding.

SUMMARY.

Length of life of adult (average of thirty-five), ten to fifteen days; eggs laid (average of nine pairs), on third to seventh day of life; number of eggs (average of nine pairs), eighteen; eggs hatched (average of about forty), on the ninth day; life of caterpillar (average of nineteen), twenty-two days; pupation period (average of twenty five), seventeen days: duration of cycle, fifty-three days.

The proportion of larvæ that reached adult life was very large—fully 80 per cent. Only one specimen of the common parasitic *Hymenoptera* was obtained from thirty pupæ, though in England about 70 per cent. of the pupæ have been found to produce parasites.
