GENETIC VARIATION IN THE PATTERN OF INITIAL OVIPOSITION BEHAVIOUR OF LEPTOPILINA HETEROTOMA THOMSON (=PSEUDEUCOILA BOCHEI WELD), A PARASITE OF DROSOPHILA MELANOGASTER

by

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SUMMARY

Females of the strains Leiden and Storrs and of the F1 and F2 offspring of the cynipid wasp Leptopilina heterotoma Thomson (= Pseudeucoila bochei Weld) were compared in parasitization behaviour during 15 successive ovipositions in larvae of the fruit fly Drosophila melanogaster. Host mortality was high in the Leiden strain, low in the Storrs strain and intermediate in the F1. The F2 generations tended to their female parental strain, which indicates additive genetic effects on mortality. The success of reproduction estimated by the number of parasite eggs related to the number of larvae presented showed the same kind of variation between the strains. The strains did not differ in mean duration of searching before oviposition. Experience obtained during the successive parasitizations did not influence the mean searching time. A number of larvae was not accepted for oviposition by the wasps in all groups. The rejection frequency increased in all groups during the experiment; probably by the improvement of the capacity to examine the host. The duration of an oviposition act decreased during the experiment in all groups. The sequences of two ovipositions resulting in dead larvae (D-D) or living larvae (L-L) were more frequent than might be expected, except for the Storrs strain. The clustering was related to the experience obtained. Preening of abdominal parts was more frequent in the Storrs strain than in the Leiden strain. It appeared to be an element of the oviposition behaviour and occurred most frequently immediately upon an oviposition act and in particular if the larva stayed alive. Frequencies of preening in the hybrid generations may be explained by dominance of the high preening tendency in the Storrs strain.

INTRODUCTION

To study the genetical basis of behavioural variation in animals inbred strains are frequently used, e.g. in mice (Lindzey & Thiessen, 1970) and in Drosophila (Ehrman & Parsons, 1976). The genetical components of observed strain differences may be detected by comparing the behaviour of various crosses.

Samson-Boshuizen et al. (1974) observed differences in parasitization behaviour between two strains of the parasitic wasp Leptopilina heterotoma Thomson, formerly called Pseudeucoila bochei Weld (see Nordlander, 1980). The Leiden strain (originally from Switzerland) was found
to be less efficient in the initial oviposition acts as the Storrs strain. After having traced and paralyzed the host, a larva of *Drosophila melanogaster*, the Leiden females spent on an average more time on the oviposition act itself, killed a higher proportion of hosts and did not always deposit an egg within the larval body. Improvement of these efficiency parameters was obtained after experience with more larvae. Comparisons between the two strains and their hybrids were made by Samson-Boshuizen et al. (1974) and Veerkamp (1980b). In the first study females from the 5th generation of a cross Storrs/Leiden were found to behave intermediate between the parental strains. Veerkamp (1980b) could affirm this result for the F1 generations of the cross Storrs/Leiden. Wasps from the Leiden and Storrs strain and F1 wasps from the two reciprocal crosses were given the opportunity to parasitize during 10 successive hours. Every hour, the wasps were transferred to new vials with unparasitized host larvae. In the first hour, the Leiden and Storrs wasps showed large differences in host mortality and production of progeny; the F1 hybrids were intermediate between the parents. At the end of the experiment the Leiden and Storrs wasps still showed differences, but the F1 wasps resembled the Storrs wasps with respect to parasitization efficiency. These results prompted us to study the parasitization behaviour of individual females in greater detail in an attempt to specify which behavioural differences exist between the various strains. Females of each strain that had never parasitized before were watched until 15 oviposition acts were observed. The larvae that were seen to be parasitized were removed from the experimental petri dish and examined on the next day for the presence of parasite eggs. The behavioural acts and the success of these first 15 ovipositions were analyzed in the Leiden and Storrs strain and in the F1 and F2 generations.

**MATERIALS AND METHODS**

*Designation of the strains*

The genetic origin of the wasps is notated according to the method used in Veerkamp (1980b). Due to the haploid/diploid system of reproduction the males and females are designated with one or two strain characters, respectively. Six groups of wasps were used:

1. from the Leiden strain: \( \text{LL} \times \text{LS} \) (LL \( \times \) L)
2. from the Storrs strain: \( \text{SS} \times \text{Sd} \) (SS \( \times \) S)
3. from the cross \( \text{LL} \times \text{LS} \), giving a F1 generation consisting of \( \text{LS} \) and \( \text{Ld} \) (F1LL \( \times \) S)
4. from the reciprocal cross \( \text{SS} \times \text{LS} \), giving a F1 generation consisting of \( \text{LS} \) and \( \text{Sd} \) (F1SS \( \times \) L)