COMPARISON OF THE BEHAVIOURAL RESPONSE OF TWO LEPTOPILINA SPECIES (HYMENOPTERA: EUCOILIDAE), LIVING IN DIFFERENT MICROHABITATS, TO KAIROMONE OF THEIR HOST (DROSOPHILIDAE)

by

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SUMMARY

This paper reports on a comparative study on the response of two related parasitoids to kairomone of their hosts. Leptopilina heterotoma (Thomson) attacks larvae of Drosophila in fermenting fruits and Leptopilina fimbriata (Kieffer) attacks larvae of mainly Scaptomyza pallida (Zetterstedt) in decaying plants. In both species the response to water-soluble kairomone involves a reduction in walking speed and an increase in the frequency with which the substrate is probed. However, essential differences in some of the behavioural parameters between the two species were also discovered. Upon encountering a substrate with kairomone L. heterotoma starts to walk more with longer strolls, whereas L. fimbriata is arrested more strongly and starts to walk less with shorter strolls. The differences in response are possibly adaptations to differences in natural host distribution and density as found in the two microhabitats.

INTRODUCTION

Parasitic Hymenoptera may use a diversity of stimuli to orientate themselves towards potential hosts. This process of host searching has been the subject of many behavioural studies in recent years (see for a review VINSON, 1981; WESELOH, 1981). After parasitoids have searched for and selected a suitable habitat, the sequence of responses is often continued with a reaction to chemical stimuli deposited by their hosts (or caused by the host's activity) in or on the substrate (JONES, 1981; WESELOH, 1981). There are only a few studies on the actual behavioural mechanisms that are involved in the parasitoid’s response to such so-called kairomones (see for a definition of kairomone BROWN et al., 1970). WAAGE (1978) and STRAND & VINSON (1982) showed that response of several species to kairomones is characterized by a change in walking speed (orthokinesis) and an increase in the rate of turning (klinokinesis or klinotaxis). As reproductive success, i.e. fitness, in parasitoids is dependent on the number of suitable hosts found, searching efficiency is likely to be under strong natural selection. Parasitoids living under different ecological circumstances may have
evolved behavioural responses as specific adaptations to their environment (Vet & van Alphen, 1984). Response to kairomone is only one of the factors involved in host location. In this paper we analyse the specificity of this response in two related parasitoids that attack larvae of Drosophilidae in different microhabitats. Leptopilina heterotoma (Thomson) is one of several Leptopilina species that attack Drosophila species in fermenting fruits van Alphen et al. (1984) gave proof of its behavioural response to a kairomone of D. melanogaster. Leptopilina fimbriata (Kieffer) searches for hosts in decaying plant materials where it attacks mainly Scaptomyza pallida (Zetterstedt). Like all Leptopilina species these parasitoids regularly probe the substrate with their partly extended ovipositor when searching for host larvae. In a previous paper (Vet & van Alphen, 1984) the host detection behaviour in several Eucoilidae species, including the genus Leptopilina was analyzed, which led to the conclusion that L. fimbriata, the only Leptopilina species attacking hosts in decaying plants, has a searching behaviour which differs from other Leptopilina species. Its behaviour is more variable and it uses the antennae in searching. Results of Vet & Bakker (1984), who studied host detection behaviour in these species more quantitatively, suggested that L. fimbriata may also respond differently to water-soluble kairomone of host larvae. The present study involves a detailed measurement of the response of L. heterotoma and L. fimbriata to kairomone of their host in a comparative experimental setup.

MATERIALS AND METHODS

Parasitoids

Leptopilina heterotoma (strain Rosenburgh '81) originated from females reared from fruit/yeast baited traps in a coppice wood in Voorschoten, The Netherlands. In the laboratory they were reared on Drosophila melanogaster as described by van Strien-van Liempt & van Alphen (1981).

Leptopilina fimbriata originated from decaying beet leaves, collected in commercial beet fields (Beta vulgaris L.) in Abbenes, The Netherlands. In the laboratory they were reared on Scaptomyza pallida in decaying beet leaves in the same way as described for Asobara rufescens (Foerster), another parasitoid of S. pallida (Vet et al., 1984).

Behavioural Experiments

One day prior to the experiments female parasitoids (two weeks old, stored at 13°C) were allowed to oviposit by presenting them an abundance of hosts for about 1.5 h at 20°C.

During the experiments individual females were allowed to search on a round food patch (Ø 5 cm) on top of a layer of agar (Ø 5 cm) which was placed in a petridish (Ø 9 cm). For L. heterotoma this food patch consisted of a viscous yeast paste of 0.4 g of baker's yeast. For L. fimbriata it consisted of 3 g of finely ground pulp of decayed beet leaves.