ENCOUNTERS WITH PARASITIZED HOSTS: TO LEAVE OR NOT TO LEAVE A PATCH

by

J.C. VAN LENTEREN

(Department of Population Biology, University of Leiden, P.O. Box 9516, 2300 RA Leiden, The Netherlands.
Present address: Laboratory of Entomology, Wageningen Agricultural University, P.O. Box 8031, 6700 EH Wageningen, The Netherlands)

SUMMARY

Several factors determine the amount of foraging time which the parasitoid Leptopilina heterotoma will spend on a patch with hosts, like the composition of the host medium, the age and size of the host patch, the number of searching conspecifics, and the number and quality of host larvae. How encounters with already parasitized hosts influence foraging time is the topic of this paper.

When parasitized hosts are stung early during a visit to a patch, an increase in foraging time is the result compared with visit times on patches without hosts. Frequent contacts with parasitized hosts, however, lead to a decrease of foraging time. When a host patch is being exploited by L. heterotoma the ratio of parasitized hosts to unparasitized hosts increases. In such a situation, with a low density of unparasitized and a high density of parasitized hosts, visit times were shorter than on patches with only a low density of unparasitized hosts. The difference in searching time could not be attributed to the parasitoid measuring an increase in interval time between contacts with unparasitized hosts in the situation where a combination of parasitized and unparasitized hosts was offered: interval times were the same whether parasitized hosts were present or absent. The shorter visit times on patches with a combination of parasitized and unparasitized hosts could neither be attributed to a difference in the structure of the patch nor to differences in kairomone composition. It is the contacts with parasitized hosts which causes a shortening of the searching time on patches where a large proportion of the hosts is parasitized.

KEY WORDS: Leptopilina, parasitoid, patch-time allocation.

INTRODUCTION

The problem of how parasitoids allocate foraging time to patches of different quality has received much interest over the past two decades, particularly in the context of optimal-foraging theory and population dynamics (e.g. Waage, 1979, and Hassell, 1978, respectively). The allocation of foraging time involves two decisions: (1) which patch to visit (patch selection), and (2) how long to stay in a patch (patch time). Bakker’s research group has previously published about both aspects (e.g. van Alphen, 1982; van Alphen & Vet, 1986; Bakker et al.,

After arrival of a parasitoid on a patch, a number of factors may influence the allocation of time to this patch. For Leptopilina heterotoma (Thomson) (= Pseudeucoila bochei Weld), a parasitoid of Drosophilia larvae living in fermenting patches on fruit, sap fluxes and other microhabitats (Janssen et al., 1988), possible factors are:

- previous foraging experience with host patch (Van Lenteren, 1976)
- previous foraging experience on a certain host-food substrate (M.T.T. Poolman Simons & L.E.M. Vet, pers. comm.; Vet & Schoonman, 1988)
- yeast composition and age of a fermenting patch (Vet, 1984)
- structure of the patch (this paper)
- size of the patch (Van Lenteren & Bakker, 1978)
- presence of host-related materials, e.g. larval skins, kairomones (Dicke et al., 1985)
- presence and number of hosts (Dicke et al., 1985; Van Lenteren & Bakker, 1976, 1978)
- presence of other parasitoids (Van Alphen & Visser, 1990; Visser et al., 1990; Bakker et al., 1990)
- presence of a mark applied to the host’s environment by adult wasps (Dicke et al., 1985).

In this paper I will limit myself to one factor regarding the quality of the hosts: the influence of the presence of parasitized hosts on patch-time allocation. Several hypotheses have been proposed for patch-leaving mechanisms. They can be summarized as follows: (1) Hunting by expectation - fixed number expectation; a patch is left after a fixed number of hosts is parasitized, (2) Hunting by expectation - fixed time expectation; the parasitoids leave the patch after a fixed period of time, either total time or searching time, and (3) Threshold-rate models; wasps depart when, for example, the host-encounter rate falls below a certain value (Gibb, 1962; Krebs, 1973; Murdoch & Oaten, 1975; Waage, 1979).

Both fixed number and fixed time mechanisms can only be adaptive if the variance in host numbers in a patch is small (Iwasa et al., 1981).