FEEDING BY *SITONA DISCOIDEUS* AFTER EXPOSURE TO THE PARASITOID *MICROCTONUS AETHIOPOIDES*

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ABSTRACT

The impact of the parasitoid *Microctonus aethiopoides* Loan (Hymenoptera: Braconidae) on the feeding activity of its adult weevil host *Sitona discoideus* Gyllenhal (Coleoptera: Curculionidae) was studied in the laboratory. Feeding by parasitised *S. discoideus* showed a distinct pattern with no significant feeding during the first two days after exposure to the parasitoids, peak feeding six days before parasitoid emergence and no feeding on the day of parasitoid emergence. Reproductive female *S. discoideus* consumed significantly more lucerne than parasitised weevils, unparasitised males, or non-reproductive females.

Keywords: *Sitona discoideus*, *Microctonus aethiopoides*, parasitism, feeding

INTRODUCTION

Sitona discoideus Gyllenhal is a univoltine pest of lucerne (*Medicago sativa* L.) that was first discovered in New Zealand in 1974 (Esson and Hartley, 1975). In 1982 the parasitoid *Microctonus aethiopoides* Loan was introduced (Stufkens *et al.* 1987) and it has established throughout the major lucerne growing areas of New Zealand (Stufkens *et al.* 1987; Ferguson *et al.* 1994), providing sustained control of *S. discoideus* in Canterbury lucerne crops (Goldson *et al.* 1990).

Barratt *et al.* (1996) found that exposure to *M. aethiopoides* significantly reduced the percentage of lucerne leaf area consumed by caged groups of *S. discoideus*, but the authors were unable to differentiate between the feeding patterns of parasitised weevils and those exposed but not parasitised. The effects of parasitoid exposure on host feeding has rarely been studied, especially for parasitoids of adult hosts. In some previous studies of larval hosts, parasitised hosts ate significantly less (e.g. Kumar and Ballal 1992; Marris and Edwards 1995), and in others more (e.g. Beach and Todd 1986) than unparasitised hosts.

The objective of this study was to determine the impact of *M. aethiopoides* exposure on *S. discoideus* feeding.

METHODS

The experiment was conducted in an insect rearing laboratory at 20±2°C with a 14 hours light:10 hours dark photoperiod at Invermay Agricultural Research Centre.

S. discoideus adults were collected during late August/September 1995 using a Jonsered BV32 blower-vac from two lucerne crops in the Strath Taieri. The weevils were held in the laboratory for 31 days to allow any *M. aethiopoides* present to emerge from their hosts. The parasitoids and unparasitised weevils were used in the experiment.

Four groups of 20 *S. discoideus* were each exposed to 3 mated female *M. aethiopoides* for 48 hours in rearing cages 160x150x75mm high (Barratt *et al.* 1996). Four similar groups of weevils were not exposed to *M. aethiopoides* and served as controls. After the parasitoids were removed, the weevils were placed individually into vials (75 mm high x 25 mm diameter) fitted with gauze lids. Each vial was supplied with a single lucerne leaflet and a moist cotton dental roll to maintain humidity within the vial and supply water for the weevil.

Feeding by individual weevils was measured by laying each lucerne leaf on 1 mm

graph paper and measuring the area (mm^2) of lucerne leaf removed. A new lucerne leaflet was given to the individual weevils daily. Eggs laid in the vials by reproductive female *S. discoideus* were also counted and removed daily.

Parasitoid pupae were counted and removed from the vial as they appeared. The experiment ran until two days after no further parasitoids had emerged.

The weevils were dissected at the conclusion of the experiment to determine their sex, and parasitism status. Female weevils were classed as reproductive if any eggs were laid during the course of the experiment. Females that laid no eggs were classed as non-reproductive. Parasitised females were considered non-reproductive as parasitism is considered to stop reproductive output (Loan and Holdaway 1961).

Total feeding within each category of parasitoid exposure (exposed, unparasitised, unexposed) was compared using an analysis of variance. Daily parasitised weevil feeding was calculated by working retrospectively from the day of parasitoid emergence. The unexposed and unparasitised data ranges were selected using the mean emergence date of parasitoid larvae (Fig. 1).

RESULTS

Parasitised weevils of both sexes consumed similar amounts of lucerne prior to parasitoid emergence (Table 1). Parasitised weevils also ate similar total amounts to unparasitised males and unparasitised non-reproductive females, but less than half of that eaten by unparasitised reproductive females. Reproductive females ate significantly more than non-reproductive females in both unexposed and unparasitised groups.

TABLE 1: Total lucerne leaf area eaten (mm^2) per *Sitona discoideus* after exposure to the parasitoid *Microctonus aethiopoulos*.

	n	Total leaf area removed	95% CI
Parasitised			
Males	7	74.4	50.87-97.98
Females	18	77.7	67.62-87.77
Unparasitised (exposed)			
Males	20	52.1	39.75-64.48
Females (non-reproductive)	13	36.9	8.7-65.1
Females (reproductive)	9	179.4	97.3-261.6
Mean		75.5	59.9-91.1
Unexposed			
Males	24	53.1	39.00-67.13
Females (non-reproductive)	34	48.7	29.09-68.26
Females (reproductive)	20	208.5	156.2-260.7
Mean		91.0	68.9-113.1

The amount of feeding by unexposed weevils (males and females combined) was consistent throughout the experiment at a mean of $5.4 \pm 0.2 \text{ mm}^2$ per day (Fig. 1). Feeding by parasitised weevils showed a distinct pattern between parasitoid exposure and parasitoid emergence (Fig. 1) and ranged from 0 to greater than 12 mm^2 per day.

Little feeding by parasitised *S. discoideus* was observed during the first two days after exposure to the parasitoids. Feeding peaked six days before parasitoid emergence. Weevils did not feed on the day of parasitoid emergence. Feeding by exposed but unparasitised *S. discoideus* was initially lower than that of unexposed weevils, but after 6 days the difference had disappeared and subsequent levels were similar to that of unexposed weevils.

Mean parasitoid pre-pupal emergence times were 17.2 ± 0.4 and 18.2 ± 0.1 days after

FIGURE 1: Mean feeding by parasitised, unparasitised (exposed) and unexposed *Sitona discoideus* before parasitoid emergence. Error bars are SEMs

parasitoid exposure for male and female wasps, respectively. Feeding was not recorded on days 5 and 6 after parasitoid exposure. As a result of this and the varied parasitoid emergence dates, the data for parasitised host feeding on the 16th days before emergence in particular is highly variable.

DISCUSSION

Feeding patterns of parasitised weevils were different from unparasitised exposed weevils and weevils unexposed to *M. aethiopoides*, suggesting direct or indirect influence on the hosts' feeding behaviour by the parasitoid. Previous studies have suggested that although feeding rates in parasitised insects may decline, the assimilation rate of the food ingested is higher (Thompson 1983). We found that *S. discoideus* feeding varied over time and parasitised and unparasitised but non-reproductive hosts ate similar quantities of food. Patterns of feeding appear not to have been investigated previously for any host/parasitoid system as most researchers have looked at total feeding only (e.g. Beach and Todd 1986; Kumar and Ballal 1992; Marris and Edwards 1995). The initial depression in feeding by parasitised hosts corresponds to the time before the parasitoid has hatched from the egg (approximately 5 days at 74°F (23°C) (Loan and Holdaway 1961)), after which feeding rapidly increases as the parasitoid develops.

Parasitism reduced the numbers of actively feeding reproductive females by over 50% relative to the controls. There was a trend towards reduced overall feeding in the exposed weevils and this effect can explain the significant feeding reduction described in Barratt *et al.* (1996).

The initial reduction in feeding by exposed but unparasitised *S. discoideus* may be an impact of exposure to parasitoids on host populations. Barratt *et al.* (1996) suggested that associative effects on host feeding, oviposition and survival may be acting on both *S. discoideus* and *Listronotus bonariensis* (Kuschel) exposed to the parasitoids *M. aethiopoides* and *Microctonus hyperodae* Loan, respectively. The associative effects

could be due to failed oviposition attempts or a host behavioural response to the presence of the parasitoid. The results of this experiment suggest the existence of associative effects, especially in the period immediately after parasitoid exposure.

This experiment indicated that the observed reduction in feeding of caged groups of weevils (Barratt *et al.* 1996) may have resulted from a decrease in the number of actively feeding reproductive females after *M. aethioides* exposure, and not a drop in total feeding by parasitised hosts.

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