Life history parameters of the rove beetle *Atheta coriaria* and efficacy against the fungus gnat *Bradysia* sp. nr. *coprophila*

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Abstract

Fungus gnats (*Bradysia* spp.) are major insect pests in greenhouse production systems throughout the USA. A number of biological control agents are commercially available for use against fungus gnats, including the rove beetle *Atheta coriaria*. However, despite initial evidence associated with its potential as a biological control agent, there is no quantitative information available on efficacy of *A. coriaria* against the fungus gnat *Bradysia* sp. nr. *coprophila*. Prior to determining efficacy, however, it is important to understand the life history parameters of a biological control agent in order to assess potential effectiveness. As such, the overall objective of this study was to determine if *A. coriaria* is a viable biological control agent against fungus gnats under laboratory conditions. Life history parameters were determined based on visual observations including fecundity and longevity. Efficacy was evaluated using growing medium as a substrate and different predator and prey densities. The total development time from egg to adult was 18.4 0.5 days at 26 C. Fecundity was 90.2 eggs per female while adult longevity was 53.7 days. Rove beetle prey consumption was higher as fungus gnat larval density increased. Based on the results, it appears that *Atheta coriaria* may be a viable biological control agent against fungus gnats.

Introduction

- ✓ Fungus gnats are major insect pests of many greenhouse-grown vegetable and ornamental crops, bedding plants and vegetable transplants (Jagdale et al. 2004).
- ✓ Historically, fungus gnat control in greenhouses has involved the use of pesticides (Harris et al. 1996).
- ✓ Current management strategies involve monitoring techniques, cultural control (water management and sanitation) insecticides (pyrethroids, neonicotinoids, insect growth regulators, and *Bacillus thuringiensis* spp. *israelensis*) and biological control including predatory mites and entomopathogenic nematodes (Cloyd, 2008)
- ✓ *Atheta coriaria* has been reported to feed on fungus gnat and shore fly larvae, and thrips pupae (Carney, 2002).

Objectives

- ✓ Determine the life history, longevity and reproduction of the rove beetle *Atheta coriaria* under laboratory conditions.
- ✓ Evaluate the efficacy of *Atheta coriaria* against the fungus gnat, *Bradysia* sp. nr*. coprophila* under laboratory conditions.

Materials and Methods

- ✓ A fungus gnat colony was maintained in a laboratory using moist LC1 growing medium and potato as a substrate and raw oatmeal as a supplemental food source (Fig. 1).
- ✓ Rove beetles were recovered by sieving the growing medium with #5 and #10 sieves (Fig. 2), then adults were collected into a 9-dram plastic vial.
- ✓ Rove beetles were maintained in an environmental growth chamber at 12:12 (L:D); 26 C; 50-60% RH.
- ✓ Rove beetle pairs were maintained separately in a Petri dish with LC1 growing medium and oatmeal (Fig. 3). Eggs were counted daily.
- ✓ Efficacy was determined in Petri dishes and 473 mL deli squat containers using different predator:prey ratios. A yellow sticky card was glued to the inside of the lid and the number of fungus gnat adults was counted (Fig. 4 and 5). This method was used as an indirect way to estimate prey consumption.

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Results

- ✓ Development time from egg to adult was 18.4 0.5 days while duration of life stages was 2.8 0.2 (egg), 8.9 0.3 (larva), and 6.7 0.2 (pupa).
- ✓ Adult longevity was 53.7 3.4 days. Minimum adult longevity was 31 days and maximum adult longevity was 86 days. There were two generations per month.
- ✓ Fecundity was 90.2 8.9 eggs per female.
- ✓ There was no difference in consumption rate after 24 hours between second instar and third instar fungus gnat larvae. In addition, no difference was found between starved and non starved rove beetles (Fig. 6).
- ✓ At prey densities of 10, 20, 30 and 40 fungus gnat larvae, the number of fungus gnat adults recovered when using one and three rove beetle adults increased (Fig. 7 and 8).
- ✓ As rove beetle density increased, more fungus gnat larvae were consumed and the number of fungus gnat adults recovered decreased (Fig. 9 and 10).

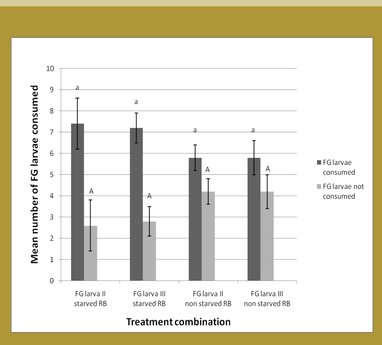


Fig. 6

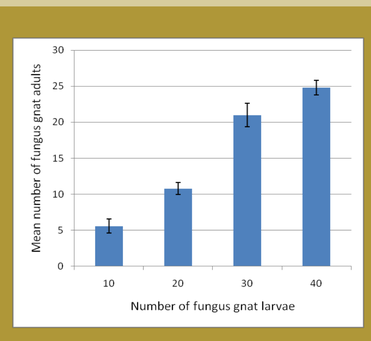
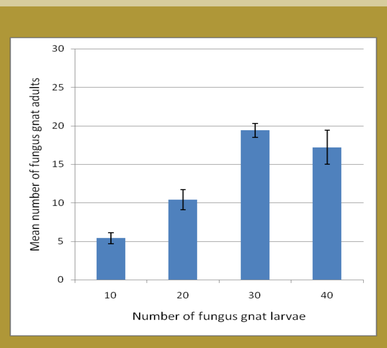


Fig. 7



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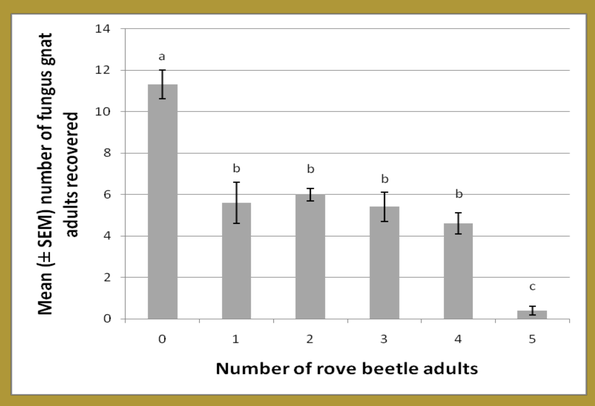

Fig. 9

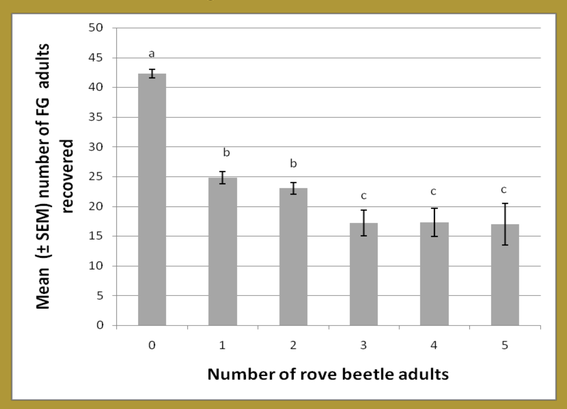

Fig. 10

Conclusions

- ✓ Rove beetle development time from egg to adult is 18-20 days at 26 C.
- ✓ Female rove beetles lay 50-138 eggs during her life-time (90.2 eggs on average).
- ✓ There was no difference in rove beetle feeding when using second and third instar fungus gnat larvae and, starved and non-starved rove beetles.
- ✓ Rove beetle consumption was similar when using 10, 20, and 30 fungus gnat larva, and one and three rove beetle adults; however, there may be a threshold between 30 and 40 fungus gnat larvae at which rove beetle adults may undergo satiation.
- ✓ Higher rove beetle adult densities are associated with a decrease in fungus gnat larval population.

References

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