

Refinement of Release Techniques for Whitefly Parasitoids

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Abstract

Although they are currently effectively controlled by chemicals, sweet potato whiteflies have the potential to once again be a dominant pest in Arizona vegetables. We need to explore alternatives such as biological control so that we are not reliant solely on pesticides. We have been examining dispersal by the whitefly parasitoid *Eretmocerus* sp. in order to find more effective ways to deploy these agents in the field. We have learned in the laboratory that these wasps are efficient flyers since they are capable of moving into strong winds for more than 30 min. We also now know that most flight takes place within a short distance of the release point. We also have a better understanding of differences between male and female flight. This, along with other information we have obtained, will lead to our ability to effectively release these and parasitoids of other insect pests as well.

Introduction

The sweet potato whitefly, *Bemisia tabaci*, maintains the potential to once again be a principal insect pest of agriculture in Arizona. Currently, much of our acreage is protected through the use of imidachloprid (Admire®). It is never a good policy, however, to rely solely on a single insect management technique such as chemical control. Consequently, efforts to search out alternatives have become increasingly important. An integrated pest management strategy that has held promise is the deployment of parasitoid wasps. We are specifically interested in this report in the genus *Eretmocerus*. Groups of these wasps have been experimentally introduced inside fields in the form of inoculative releases. Unfortunately, few studies provide data concerning the movement of these wasps. This is in spite of the fact that over 1,000,000,000 have been used in the Southwest to manage whiteflies. It is important to understand a number of things: how far do they disperse from a release site, what is the best time of the day for releases, do weather conditions effect dispersal and is their movement influenced by whitefly density? These questions need to be addressed if we are interested in improving ways to release *Eretmocerus*. Our goals are to 1) evaluate the flight characteristics and dispersal capabilities of *Eretmocerus* in the laboratory and 2) identify the within field range and distribution of these wasps following dispersal from release sites. This information will move us forward when refining strategies for the release of whitefly parasitoids

Methods and Materials

E. eremicus were examined in the laboratory in a vertical flight chamber in order to examine factors affecting their flight behavior. This apparatus consisted of a large (79 cm x 81 cm x 90 cm high) chamber (Fig. 1). A mercury vapor light illuminated the chamber from above. Insects in previous studies that sustained flight were thought to be responding to the ultraviolet portion of the spectrum supplied by this light that simulated skylight. An airstream was directed from the top of the chamber by means of a circular air intake fan. A manually manipulated intake damper controlled the velocity of the airstream inside the chamber. An anemometer measured velocity. The construction of the flight chamber ensured that the wasps were engaged in active flight by flying into the downwardly directed airstream.

Field studies during 1998 were conducted at the Maricopa Agricultural Center from June until September. In these experiments whiteflies in a cantaloupe field were marked with fluorescent dust. Traps were placed at varying distances away from the cantaloupe field. Complimentary studies are being conducted this year at the Marana Agricultural Center.

Results and Discussion

Our initial results indicate a sex-biased flight behavior in the vertical flight chamber with females flying three times longer than the male average. Unmated females flew for a mean time of more than 30 min (Table 1). Males (mated or unmated) and unmated females flew for significantly shorter periods of time. Both sexes were subjected to a downwardly directed air stream of 15.6 ± 2.0 cm/sec.

Work in the laboratory continue in 1999. We have evidence of the following.

- Peak emergence appears to occur between 11:00 p.m. and 5:00 am.
- Sex-ratios of emerging wasps varies during the day with peak male bias occurring in the evening (8:00 p.m. to 11:00 p.m., possibly later) and female bias peaking during the day (5:00 am and possibly earlier to 4:00 p.m.)
- The majority of flight appears to occur between 6:00 am and 10:00 am with very little occurring between 10:00 am to 12:00 p.m.

In spite of our efforts in the field, we were unable to collect useful information on dispersal by *E. eremicus* in 1998. This was primarily due to logistical problems resulting from our experimental design. Although we did find a small number of wasps that has dispersed 1,100 ft in a four-hour period, this was rare. Studies being conducted currently are being done so on a much smaller scale. Preliminary results from these studies indicate the following.

- Male and female parasitoids have different patterns of distribution following dispersal.
- Dispersal appears to be wind-aided.
- Males and females fly at different heights.

Information collected in both the laboratory and the field will contribute to our efforts to provide instructions as to how to best release whitefly parasitoids. We have hope that these will lead to our ability to effectively release these and parasitoids of other insect pests as well.

Table 1. Flight duration, in minutes, for the whitefly parasitoid *Eretmocerus eremicus*, as determined in a vertical flight chamber (from Bellamy et al., 1999).

	Mating Status	
	Unmated	Mated
Males	6.68 a,c,e ¹	0.68 a,c,f
Females	34.35 b,d,f	10.15 b,c,e

¹Numbers followed by the same letter are not significantly different according to a Tukey-Kramer multiple comparisons test.

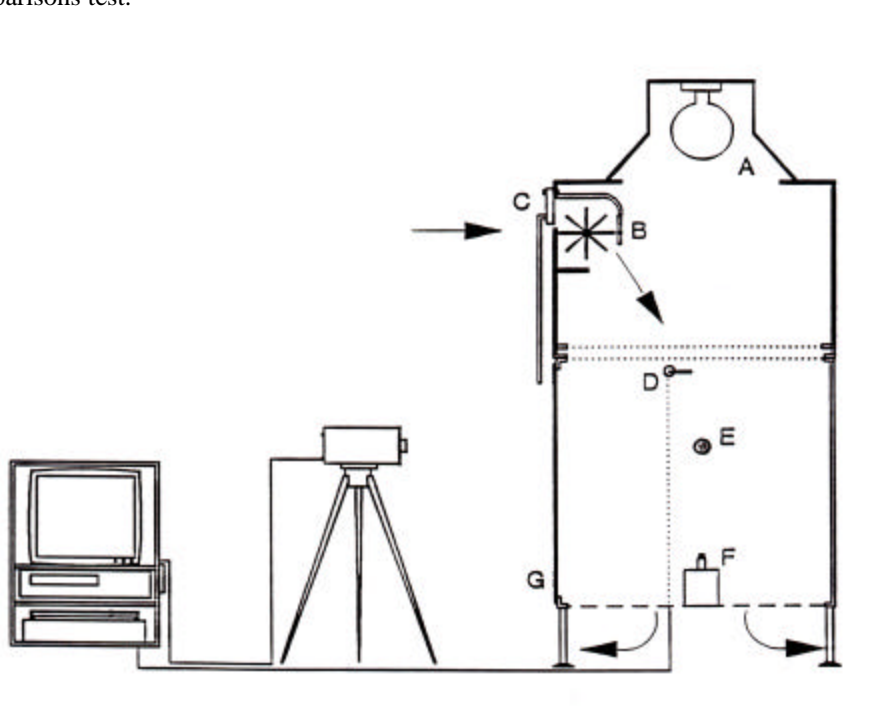


Figure 1. Vertical flight chamber employed in examining flight behavior by *Bemisia tabaci* and *Eretmocerus eremicus*; A = mercury vapor lamp, B = air intake port, C = air intake fan, D = anemometer, E = 550 nm light, F = platform, G = door.