

PROJECT TITLE: Have We Underestimate Dispersal by the Sweet Potato Whitefly?

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Wild and Colonized Populations of Bemisia tabaci Display Dramatically Different Patterns of Dispersal Ability.

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Introduction: Along with other members of our laboratory, I have been examining various aspects of dispersal and migration by *Bemisia tabaci*, the sweet potato whitefly, for approximately 15 y. We have determined a number of things including: the fact that *B. tabaci* engages in behavior that fits historical definitions of migration; how wing loading relates to wingbeat frequency; and descriptions of *B. tabaci* and *Eretmocerus eremicus* flight behavior in the laboratory and field. Our latest laboratory and field experiments concerning the flight behavior of *B. tabaci* from colony and wild populations are perhaps among our most revealing.

Methods:

Populations: The dispersal behavior of three populations of *B. tabaci* were examined in the laboratory using the vertical flight chamber (Blackmer and Byrne 1993). The three populations were: members of a colony maintained in a laboratory since 2000 (approximately 56 generations); insects captured directly from the leaves of field crops (primarily cantaloupe, *Cucumis melo* L., or cotton, *Gossypium hirsutum* L.); and animals caught in fan traps placed 100 to 200 m away from these same crops.

Laboratory trials: All whiteflies were maintained on leaf disks of the same plant from which they originated. Disks were placed in Petri dishes, 4 cm-diameter, which were partially filled with agar. For introduction into the chamber, the whiteflies were removed from disks using a pooter. Individuals were placed in plastic vials for transfer to the chamber. After examination, this process was reversed. Eclosion dates were available for animals from the colony, i.e., insects were of known adult age when examined. Wild insects were adults of undetermined age.

In the chamber individual whiteflies are released at the bottom and allowed 3 min to fly toward a sky cue, which was represented by a sodium vapor lamp. Trials were terminated in the absence of flight during this time period. Wind was introduced into the chamber at varying speeds forcing insects to fly (against the wind) in an approximately single plane. Wind speed was used as an indirect measure of rate of ascent. At the side of the chamber a yellow/green light (550 nm) was illuminated for 10 sec every 1 min. This represented a vegetative cue. Responding to this light demonstrated that insect flight was non-migratory (Kennedy 1985). Flights were timed and rate of ascent recorded electronically.

Field trials: Field trials were conducted during the summer of 2008 in Yuma County, AZ.

Results: The initial question was whether whiteflies from the three populations flew on multiple days. If so, original estimates of dispersal range would have to be reexamined (Byrne et al. 1996). Secondly, we wanted to see how flight duration of colony-reared *B. tabaci* compared with those of the wild type, both from crops and traps. Finally, we wanted to determine what portion of each population engaged in migratory flight

Multiple day flights:

Laboratory population: One hundred and fifty *B. tabaci* from our colony were shown to engage in a form of dispersal (range 3 to 933 sec [15 min, 13 sec]). Forty-one individuals flew the day following eclosion. Of the 32 that flew Day 2, 10 had flown the previous day; on Day 3, 14 of the 24; on Day 4, 7 of 14; on Day 5 2 of 6. Following Day 5, very few repeat flights were observed.

Crop population: A total of 73 adults taken directly from leaves of crops were examined in the chamber. Sixty-seven percent flew their first day in the laboratory. Thirty-three percent of those flew on Day 1 also flew on Day 2; on Day 3 33%; and there were no repeat flights on Day 4.

Trap population: A total of 109 adults taken from traps placed 100m or > from fields were examined in the chamber. Sixty-three percent flew their first day in the laboratory. Forty-one percent of those flew on Day 1 also flew on Day 2; after Day 2 there were no repeat flights on Day 4.

Flight duration:

The flights of animals from the colony took place during the first 3 d following eclosion. The means for these days did not exceed 3 min, 20 sec. Animals from crop plants flew almost exclusively on Days 1 and 2. On the first day the mean duration of flights was 10 min. The mean for Day 2 exceeded 50 min (This was strongly influenced by an outlier that flew more than 1 h.

Migratory behavior:

Only 3.3% of individuals from our colony exhibited migratory behavior, i.e., they ignored 50% of vegetative cues versus 6.8% from field crops and 6.2% from traps. The parameters were not significantly different because so few insects displayed migratory behavior.

Conclusions: Colony members flew significantly less often, had flights of shorter duration, and rarely engaged in migratory flight when compared to wild whiteflies. It is very likely that life in a colony selects against migratory behavior since this is a very costly process. These resources may be shifted to reproductive activity.

Flight duration for insects captured from traps were significantly greater than those selected directly from the field. The duration of flights from both colonies were significantly greater than those from colonized populations. Again, It is likely that traits relating to migration were selected against in colony populations. Egg counts were taken, which may address this question.

Impact: We think that by examining animals directly from field crops we have the truest measures and flight and migratory propensity. Estimates derived based on observations made of colonized insects provide useful starting points when examining insect dispersal (e.g., Blackmer and Byrne 1993), but are limited in their usefulness. New information will allow us to more accurately predict the dispersal range of *B. tabaci* between crops.

References:

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