HOST SPECIFICITY TESTING FOR *ENCARSIA* SPP., PARASITOIDS OF THE SILVERLEAF WHITEFLY, *BEMISIA ARGENTIFOLII* BELLOWS & PERRING, IN HAWAI'I

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ABSTRACT. We describe host specificity studies for four *Encarsia* spp. (Hymenoptera: Aphelinidae) parasitoids used in the biological control of the silverleaf whitefly, *Bemisia argentifolii* Bellows & Perring (Homoptera: Aleyrodidae), in Hawai'i. The problems encountered in determining non-target test species are described with respect to the potential impact on Hawaiian Lepidoptera. The misidentification of an *Encarsia* sp. in the scientific literature suggested that one of the four *Encarsia* spp. parasitoids would parasitize lepidopteran eggs. This information created confusion and cast doubt on our test results. An authority on *Encarsia* parasitoids re-examined the misidentified species and corrected its identity.

Key words: Aleyrodidae, Aphelinidae, *Bemisia*, biological control, *Encarsia*, host specificity tests, lepidopterous eggs, non-target species, silverleaf whitefly

The silverleaf whitefly, *Bemisia argentifolii* Bellows & Perring (Homoptera: Aleyrodidae), is a major pest of many vegetable crops in Hawai'i. In 1992, the Hawai'i Department of Agriculture began a biological control program for the silverleaf whitefly. Some species of *Encarsia* (Hymenoptera: Aphelinidae) are well known as biological control agents of whiteflies and other Homoptera and are generally host specific. The department's exploratory entomologist collected four species of *Encarsia* parasitoids; *E. lutea* (Masi) and *E. mineoi* Viggiani from Egypt in 1992, and *E. hispida* DeSantis and *E. pergandiella* Howard from Brazil in 1994.

There is an increasing awareness and concern regarding the potential of biological control agents to attack non-target hosts (Howarth 1991). In Hawai'i, host specificity studies usually require testing of non-target species. Since all whitefly species in Hawai'i are immigrants (there are no natives or beneficial species), testing was not considered necessary as long as the potential agent was known to be specific in host selection. However, *Encarsia lutea* had been reported as an egg parasitoid of the bollworm, *Heliothis zea* (Boddie) (Lepidoptera, Noctuidae) and the cabbage looper, *Trichoplusia ni* (Hubner) (Lepidoptera, Noctuidae) in Arizona cotton fields (Stoner and Butler 1965). Female parasitoids emerged from whiteflies, while male parasitoids emerged from the moth eggs.

Egg parasitism in this genus is not as rare as had been thought. Polaszek (1991) summarized lepidopteran egg hosts of *Encarsia* and found records of 18 species of Lepidoptera from six different families that were parasitized by *Encarsia*. *Encarsia* and other genera in the family Aphelinidae have complex natural histories in which males and females of the same species have different host relationships (Walter 1983). In some *Encarsia* species, females will develop almost always as primary parasitoids of whitefly hosts. Males, however, can develop in one of three ways:

1. as primary parasitoids of whitefly hosts;
2. as hyperparasitoids, developing at the expense of female larvae or pupae of their own species, other primary parasitoid species, or both; and,
3. as primary parasitoids of lepidopteran eggs.

The potential non-target host species included exotic, beneficial, and native species. We conducted tests to determine if the presumed *E. lutea* from Egypt would parasitize lepidopteran eggs to produce male parasitoids as the *E. lutea* from Arizona was reported to do. The four species of Lepidoptera used were the cabbage looper, *Trichoplusia ni* (Hubner); tobacco budworm, *Heliothis virescens* (Fabricius); tomato pinworm, *Keiferia lycopersicella* (Walsingham) (Lepidoptera, Gelichiidae); and diamondback moth, *Plutella xylostella* (L.) (Lepidoptera, Plutellidae).

Our results showed that the Egyptian strain of *E. lutea* did not parasitize the eggs of any of the Lepidopteran species tested, raising the question of why the Arizona strain but not the Egyptian strain was able to parasitize lepidopteran eggs. Further examination of the voucher specimens from the 1965 Arizona study found that this *Encarsia* sp. had been misidentified; it was not *E. lutea*, but an undescribed species (Williams and Polaszek 1996). Excellent taxonomic work and related studies resolved the dilemma and cleared *E. lutea* as a parasitoid of potential harm to Hawaiian Lepidoptera.

LITERATURE CITED

Howarth, F.G. 1991. Environmental impacts of classical biological control. *Annual Review of Entomology* **36:** 485-509.

Polaszek, A. 1991. Egg parasitism in Aphelinidae (Hymenoptera: Chalcidoidea) with special reference to *Centrodora* and *Encarsia* species. *Bulletin of Entomological Research* **81:** 97-106.

Stoner, A. and G.D. Butler. 1965. *Encarsia lutea* as an egg parasite of bollworm and cabbage looper in Arizona cotton. *Journal of Economic Entomology* **58:** 1148-50.

Walter, G.H. 1983. Divergent male ontogenies in Aphelinidae (Hymenoptera: Chalcidoidea): a simplfied classification and a suggested evolutionary sequence. *Biological Journal of the Linnaean Society* **19:** 63-82.

Williams, T. and A. Polaszek. 1996. A re-examination of host relations in the Aphelinidae (Hymenoptera: Chalcidoidea). *Biological Journal of the Linnaean Society* **57:** 35-45.