

Monitoring and Biological Control of Citrus Blackfly¹ in South Texas

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Abstract. Parasitoids of the citrus blackfly, *Aleurocanthus woglumi* were released in citrus orchards in the Lower Rio Grande Valley of Texas in 1989 to augment a biological control program. Release sites were monitored for citrus blackfly and parasitoids using leaf examination. Results suggested that a successful initial establishment of *Amitus hesperidum* and *Encarsia opulenta* was attained, however a December 1989 freeze halted further study.

Abstracto. Parasitos de la mosca negra cítrica, *Aleurocanthus woglumi* se liberaron en huertos de cítricos en la parte baja del Valle del Río Bravo de Texas en 1989 para aumentar un programa de control biológico. Los sitios de liberación se revisaron en cuanto a la presencia de la mosca negra cítrica y parasitos utilizando la examinación de hoja. Los resultados sugieren que un establecimiento inicial con éxito de *Amitus hesperidum* y *Encarsia opulenta* fue obtenido, sin embargo una helada de Diciembre 1989 puso un alto a más estudio.

Introduction

The citrus blackfly (CBF), *Aleurocanthus woglumi* Ashby, first invaded the Lower Rio Grande Valley (LRGV) of Texas in 1955 on dooryard citrus (Smith et al. 1964), and again in Brownsville in 1971 in both residential and commercial orchards (Hart et al. 1973). The initial infestation was reported to be eradicated in 1956 (Smith et al. 1964), but the second infestation was not eradicated. Beginning in 1974, three parasitoid species, *Amitus hesperidum* Silvestri (Hymenoptera: Platygasteridae), *Encarsia* (= *Prospaltella*) *opulenta* Silvestri, and *E. clypealis* Silvestri (Hymenoptera: Aphelinidae) from laboratory-reared (USDA-APHIS) and field-collected (USDA-ARS) colonies in Mexico, were released in the LRGV (Hart 1978). Citrus blackfly populations declined by 1978, although it had dispersed as far west as Mission, TX.

(Meyerdirk et al. 1979). Surveys of CBF and parasitoid densities from 1977-1982 indicated a widespread distribution of *E. opulenta*, but few *A. hesperidum*, and no *E. clypealis*, suggesting local competitive displacement by *E. opulenta* in orchards with effective parasitoid regulation (Summy et al. 1983).

Citrus blackfly population densities had remained stabilized under excellent biological control until the mid 1980's. Following a severe freeze in December 1983, citrus blackfly densities surged in central LRGV orchards while concomitant parasitoid densities have been low. Citrus blackfly populations reached damaging levels during the 1988 and 1989 seasons, especially in central valley orchards. A biological control program of parasitoid augmentation was started in June, 1989. Parasitoids (*E. opulenta* and *A. hesperidum*) from Florida and Mexico were released and citrus orchard release sites were monitored using leaf examination.

Materials and Methods

Orchards. Grapefruit and orange orchards selected for this study were all located in the central area of the LRGV, Hidalgo Co., Texas. Five orchards were located near Donna [Donna 83 (9.7 ha; 'Ruby Red' grapefruit, 'Marrs' and 'Valencia' orange), Donna Victoria (4.0 ha; 'Ruby Red' grapefruit), Donna 6.5 (7.7 ha; 'Ruby Red' grapefruit), Donna 7.5 (6.1 ha; 'Ruby Red' grapefruit), and Donna 493 (16.2 ha; 'Ruby Red' and 'Star' grapefruit)], two orchards near Weslaco

[Weslaco 6 (4.0 ha) and Weslaco 88 (8.1 ha) (both containing 'Ruby Red' grapefruit and 'Marrs' orange)], and one orchard near Mercedes (16.2 ha; 'Ruby Red' grapefruit and 'Valencia' orange).

Parasitoid Releases. Several parasitoid sources were used during 1989. Beginning June 28, air shipments were received from a beneficial insect rearing facility in Gainesville, Florida Department of Agriculture, Division of Plant Industry. *Amitus hesperidum* adults were placed in wax cups with a honey and water (1:1) food source, and shipped in styrofoam mailers (Hart et al. 1978, French et al. 1990). *Encarsia opulenta* adults were field collected in the Linares-Montemorelos area of Nuevo Leon, Mexico by personnel from Secretaria de Agricultura y Recursos Hidraulicos and transported to the border. After inspection by USDA-APHIS-PPQ (Plant Protection and Quarantine), parasitoids were brought into the U.S. under a special permit at Hidalgo, TX. Beginning in mid-September, *A. hesperidum* and *E. opulenta* shipments from Florida were both insectary and field collections. Cups containing parasitoids were taped to tree branches with foliage supporting heavy citrus blackfly infestations. Releases were made in orchards during the early morning or late afternoon hours beginning June 28 and ending October 19, 1989.

To augment the releases of Florida and Mexico parasitoids, citrus leaves with parasitized CBF from two Brownsville orchards were collected and redistributed into central valley orchards during September, 1989. Established populations of both *A. hesperidum* and *E. opulenta* were identified in these orchards during a survey in early January 1989. These orchards became the "field nurseries" from which parasitized CBF-infested leaves were obtained for redistribution. Leaves with a preponderance of 4th-stage ("pupae") hosts were selected and placed in paper bags (ca. 50 leaves/bag). The bags were stapled shut and each day's collection of ca. 150 bags were transported in large coolers to the Texas A&I University Citrus Center insectary, Weslaco, TX. The bags were placed in orchards by stapling them at arms-length inside the canopy on the northwest quadrant of the tree. Holes cut near the top of each bag allowed the emerging parasitoids to disperse into the tree. Subsamples of leaves from each day's collection were held for a 2-week period in the laboratory to estimate the number of parasitoids released.

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Field Monitoring. Orchards were sampled every other week from early October to mid-December 1989. In each orchard, six sample sites of approximately one ha. were chosen. At each site, leaves from the most recent flush were collected from the three trees which were randomly selected within three rows around the sample site. Three leaves were collected from the northeast, northwest, southeast, and southwest quadrants, yielding 12 leaves per tree, 36 leaves per site. Leaves from each site were placed in separate paper bags, transported to the laboratory in coolers, and examined for presence or absence of CBF. Levels of parasitism were estimated by observing parasitoid exit holes in CBF pupae and percent leaves with parasitized CBF, then calculated by dividing the number of leaves with parasitized pupae by the number of leaves with pupae. Parasitism was not separated by parasitoid species.

Results

Field Monitoring. The December 1989 freeze interrupted the study and our results show only partial population dynamics for CBF and parasitism. Percent citrus blackfly-infested leaves and percent leaves with parasitized CBF were variable across orchards. Both the Donna 6.5 and Donna 7.5 orchards had a relatively high percentage of citrus blackfly-infested leaves (> 80%) with an increase towards the end of sampling (Figs. 1a, 1b). Also, both showed increases in leaves with parasitized CBF to a level of ca. 20%. The Donna Victoria orchard showed a rise in infested leaves and leaves with parasitized CBF until the last sampling date (Fig. 2a). The Mercedes orchard showed an early decline then an increase in infested leaves (78.7%), but generally low levels of leaves with parasitized CBF (6.4%) (Fig. 2b). The Donna 493 orchard had samples with over 80% infested leaves (except for the

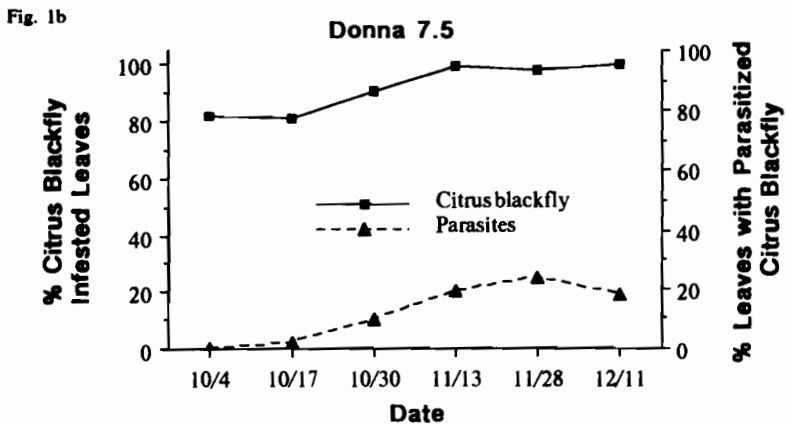
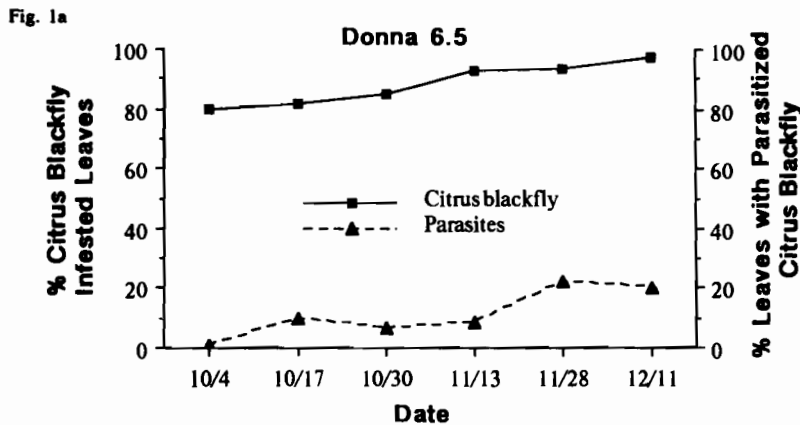


Fig. 1 a, b. Percent citrus blackfly-infested leaves and percent leaves with parasitized citrus blackfly by sampling date in the Donna 6.5 and 7.5 citrus orchards.

Fig. 2a

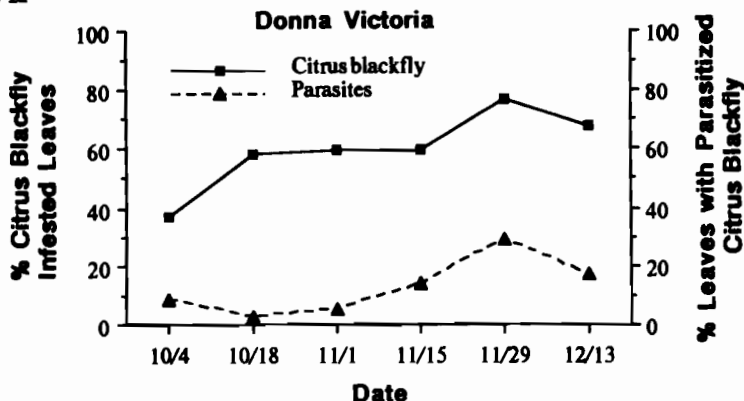


Fig. 2b

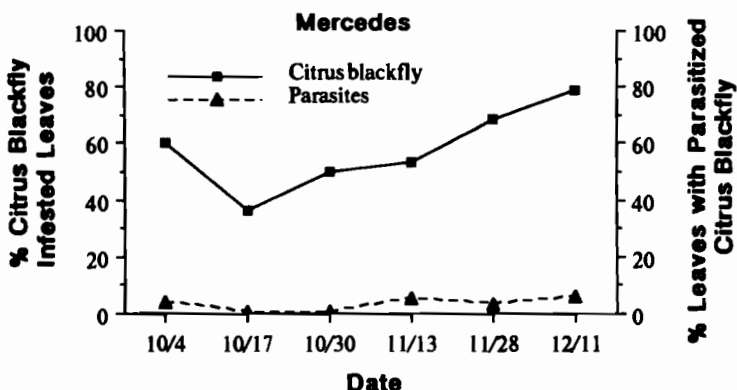


Fig. 2 a, b. Percent citrus blackfly-infested leaves and percent leaves with parasitized citrus blackfly by sampling date in the Donna Victoria and Mercedes citrus orchards.

first sampling date), but only a high of 8.1% leaves with parasitized CBF (Fig. 3a). The Weslaco 88 orchard showed a decline in infested leaves through October, but then infestation levels increased until the end of sampling (Fig. 3b). There was also a slow but steady rise in leaves with parasitized CBF, reaching 17.4% in mid-December. Results from Donna 83 and Weslaco 6 were the most inconsistent, especially in level of citrus blackfly infestation. The Donna 83 orchard ranged from 43.1 to 80.0% infested leaves, but contained the highest level of leaves with parasitized CBF (68.3%). However, both infested leaves and leaves with parasitized CBF had declined sharply at the last sampling date (Fig. 4a). The Weslaco 6 orchard ranged from 40.3 to 79.2% CBF-infested leaves, while leaves with parasitized CBF reached only 10.0% (Fig. 4b).

Discussion

Release of these and other exotic parasitoid species against citrus blackfly in Mexico during the early 1950's formed the resource for future releases in the western hemisphere. By the end of 1953 over 300 million adults (242 million of *A. hesperidum* alone) were dispersed in Mexico (Flanders 1969). The introduction and redistribution of 500,000 *E. opulenta* from Mexico to El Salvador in the early 1970's controlled citrus blackfly in all citrus growing areas (Quezada 1974). The discovery of the pest in Ft. Lauderdale, FL residential citrus during January, 1976 led to the release of *A. hesperidum*, *E. opulenta* and *E. clypealis* (Hart et al. 1978). Parasitoid-induced mortality reduced the *A. woglumi* infestation 98%

Fig. 3a

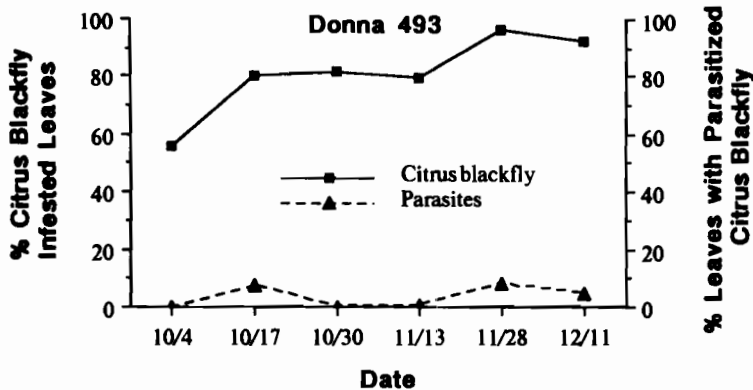


Fig. 3b

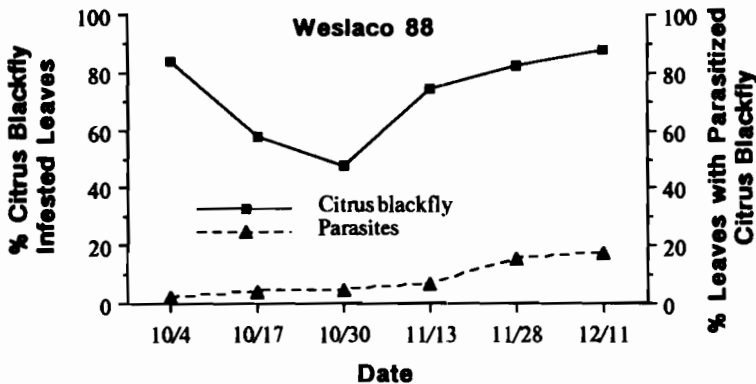


Fig. 3 a, b. Percent citrus blackfly-infested leaves and percent leaves with parasitized citrus blackfly by sampling date in the Donna 493 and Weslaco 88 citrus orchards.

Acknowledgment

during an eight-month period (Dowell et al. 1979). Since then, over 250,000 parasitoids from laboratory colonies, field collections, and movement of infested and parasitized citrus leaves were released in three central and southern Florida counties from October 1979 through May 1980 (Nguyen et al. 1983).

Our results suggest the successful augmentation of *A. hesperidum* and *E. opulenta* and the potential for citrus blackfly population decline. However, since the life cycle of citrus blackfly and the associated parasitoids is long (74 days at 27°C, 133 days at 21°C, Dowell & Fitzpatrick 1978, Dowell 1979), due to the December 1989 freeze we were not able to document a possible sharp decline of CBF noted in other studies.

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Fig. 4a

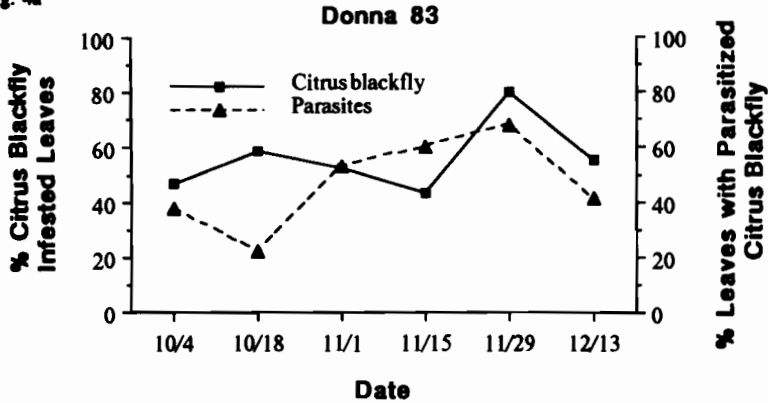


Fig. 4b

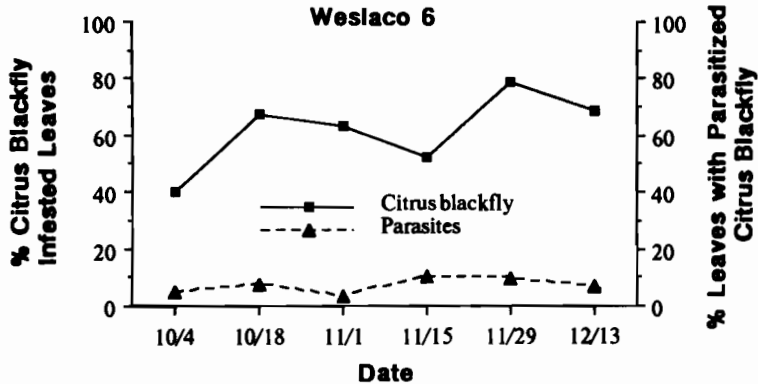


Fig. 4 a, b. Percent citrus blackfly-infested leaves and percent leaves with parasitized citrus blackfly by sampling date in the Donna 83 and Weslaco 6 citrus orchards.

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