

**SPATIAL AND TEMPORAL DISTRIBUTION
OF THE SILVERLEAF WHITEFLY
IN THE SAN JOAQUIN VALLEY 1994-1996**

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Abstract

The Silverleaf whitefly (SLWF) was first found in the San Joaquin Valley, in some cotton fields near Bakersfield, in 1992. Since then it has expanded throughout the Valley usually at low to moderate levels but occasionally at levels high enough to cause economic damage. This study looked at whitefly population growth from 1994 through 1996 using three inch by three inch yellow sticky cards along four east-west valley transects. SLWF populations in the San Joaquin Valley were higher and more widespread in 1996 than in the other two years. Populations of SLWF were lowest in 1995, possibly due in part to a much cooler, wetter spring and the influence of high numbers of other pests. Distribution along east-west lines was not similar for all the trap lines but instead seemed to be related to local geographical features such as proximity to foothills and crop makeup and diversity.

Introduction

The silverleaf whitefly (SLWF), is a potentially serious and devastating pest of cotton in the California San Joaquin Valley (SJV). The occurrence of the SLWF (*Bemisia argentifolii*) in the 1990's in the California desert valleys resulted in an estimated \$130 million crop loss in 1991 (Gruenhagen *et al.*, 1993). The SLWF has been present in San Joaquin Valley fields since 1992 when it was discovered in cotton fields in Kern Co. (southern SJV) at low to moderate levels of infestation. SLWF distribution expanded in 1993 and 1994 throughout much of the SJV and, in 1993, northward into parts of the Sacramento Valley. Since then the SLWF has established itself throughout the SJV occasionally at levels high enough to cause economic damage.

There are several problems associated with high levels of SLWF. The removal of plant sap by direct feeding from high numbers of nymphs and adults can damage the host

plant enough to cause a loss of yield. Also, large numbers of SLWF adult and nymphs can excrete a considerable amount of "honeydew" which is a sticky, sugary, substance that is associated with the growth of black sooty mold. Another potential problem associated with whiteflies is the transmission of harmful plant viruses.

One reason the SLWF is so successful is its wide range of crop and weed hosts. Previous research from 1993-1995 (Godfrey *et al.*, 1996) has shown that the SLWF has a host range in the San Joaquin Valley of over 30 different crop plants and 40 different weed species. The SLWF overwinters on cole crops, ornamentals, weeds, and citrus and then moves onto spring crops, especially cucurbits, and weeds as temperatures warm up in the spring. Populations build and then move into the chief summer host crops such as cotton, tomatoes, and beans. After defoliation and harvest the SLWFs move onto other available hosts such as alfalfa, fall weeds, and fall vegetables and then eventually move to their overwintering sites in late fall and early winter.

Material and Methods

This study took place in the San Joaquin Valley, in central California. Three trap lines were in Kern County and one cut across Tulare, Kings and Fresno Counties. Three inch by three inch yellow sticky cards, sticky on both sides, were placed approximately six inches off the ground on wooden stakes along roadsides near fields. Sticky traps were placed every two miles along east west transects in the following areas:

- Southern Kern County (Hwy. 46-from Hwy. 65 west to 9 miles west of interstate 5).
- Central Kern County (Panama Lane -from Tejon Highway west to Hwy. 43)
- Northern Kern County (Hwy. 166-from Legray and Weedpatch Hwy. west to 16 miles west of Interstate 5). Only done in 1996.

Traps were also placed every mile on a central valley transect through Tulare, Kings, and Fresno Counties (starting near Yettum going west to Interstate 5). All sticky traps were left out for a period of 24 hours, collected, and then the number of SLWF adults were counted under 50X magnification and recorded. Traps were put out every two weeks from June to November and once a month from December to May.

Results

SLWF populations in the San Joaquin Valley were higher and more widespread in 1996 than in the previous two years. In most of the areas sampled by the sticky traps, 1996 SLWF counts were equal to or higher than 1994 and much higher than in 1995 (Figures 1-3). The only trap line that had a higher average count in a year other than 1996

was the central Kern Co. trap line in 1994. This area had high 1994 mean sticky trap counts that were in part due to just a couple of severely infested spring melon and cotton fields. None of those fields were planted in 1995 and 1996 and the sticky trap numbers for the overall transect have gone down. The two northern lines that had especially high SLWF counts in 1996 compared to the previous two years. The central valley transect had a 1996 peak count of 409.2 SLWF/sticky trap which was over 10 times greater than the previous high of 39.6 SLWF/sticky trap in 1994. Also, the northern Kern Co. trap line 1996 peak count of 241.0 SLWF/sticky trap was over six times greater than the previous high of 37.2 SLWF/sticky trap from 1994.

The highest number of SLWF/sticky trap from all three years was from the 1996 southern Kern Co. transect. SLWF were especially heavy in the central part of the trap line in an area dominated by spring melons and cotton, especially pima. This trap line was only sampled in 1996 but our observations during previous research (Godfrey et al, 1996) have seen the SLWF populations in this area go from low levels in 1994, to moderate levels in 1995 to the moderately high levels we saw in 1996.

The differences in SLWF population from 1994 through 1996 appears to be related in part to winter and spring environmental conditions. In 1995 there was a harsh winter and a cool wet, spring that resulted in significantly lower degree day accumulation and the two to four week delay of the planting of key SLWF hosts crops such as spring melons and cotton. Another factor contributing to the low 1995 SLWF numbers could have been the influence of high numbers of other pests. In 1995 there were high levels of spider mites, lygus bugs, and cotton aphids in San Joaquin Valley cotton; frequent treatments for these pests may have had an influence on SLWF numbers. Also, the high numbers of spider mites and cotton aphids may have "crowded out" the whiteflies in some of the more heavily infested fields.

One of the factors in individual field population levels appears to be the proximity to potential overwintering hosts. Early SLWF finds on the sticky traps frequently came from traps that were near overwintering sites such as citrus orchards and urban areas. Later in the year the crop fields close to these areas frequently had the highest SLWF populations.

Each trap line was different in terms of east-west distribution of SLWF numbers due to the unique set of geographical characteristics particular to the areas where the traps were placed. The most northern line, the central valley

transect, had its highest individual trap counts grouped together in the eastern section of the trap line. This area is very diverse in terms of the crops that are grown giving the whiteflies a large number of host choices both early and late season. Also, this trap line starts near the foothills of the Sierra Nevada, running through a small "citrus belt" where winter temperatures may be more favorable to SLWF survival. The northern Kern Co. trap line had the highest SLWF counts at the opposite end of the line, in the west. The earliest finds tended to be in the east where there is citrus but the numbers here did not increase dramatically possibly due to fact that the area is almost all grapes, citrus and almonds-none which are spectacular SLWF hosts. The high counts in the west are possibly influenced by the fact that there is a high concentration of SLWF favorable hosts such as cotton as well as a large amount of residential area where the whiteflies have ornamentals as well as crops and weeds to overwinter on. The central Kern Co. trap line is also heavily influenced by the agriculture-urban interface. This trap line runs through the south end of Bakersfield and the highest individual trap counts came from this central area that is a mixture of residential neighborhoods and crop fields. The trap line farthest south, the southern Kern Co. line, had high numbers through out the whole trap line by the end of the 1996 season. This is another area bordered by foothills, this time to the south, that may play a role in providing the whiteflies with a more favorable climate to survive the winter. This area also has the wide diversity of crops that can help build SLWF populations. There are melons in the spring, cotton in the summer, many other crops including tomatoes, citrus, beans, and carrots to fill in the other times as well as a variety of weeds found favorable by the SLWF.

Acknowledgments

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References

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North Kern Co. Trap Line 1994-1996

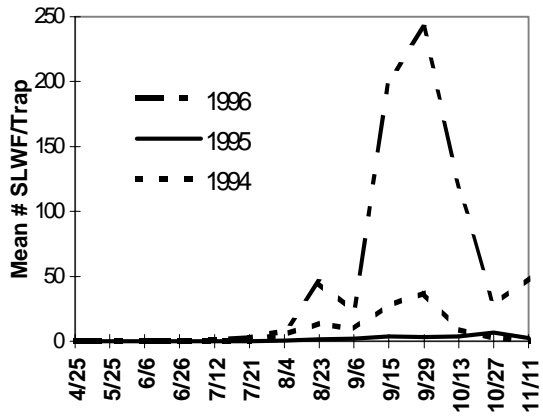


Figure 1. Mean number of silverleaf whiteflies per sticky trap for the northern Kern County (Hwy. 46) sticky trap line 1994-1996.

Central SJV Trap Line 1994-1996

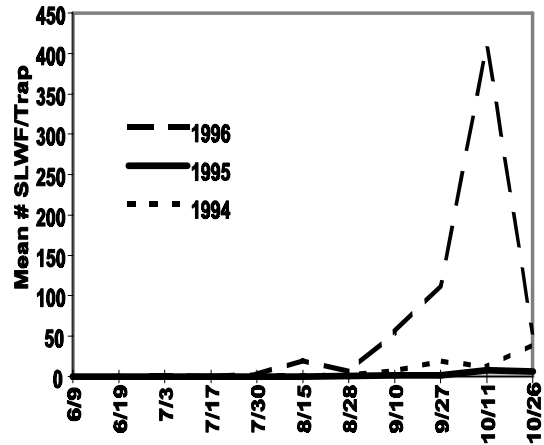


Figure 3. Mean number of silverleaf whiteflies per sticky trap for the central San Joaquin Valley trap line 1994-1996.

Central Kern Co. Trap Line 1994-1996

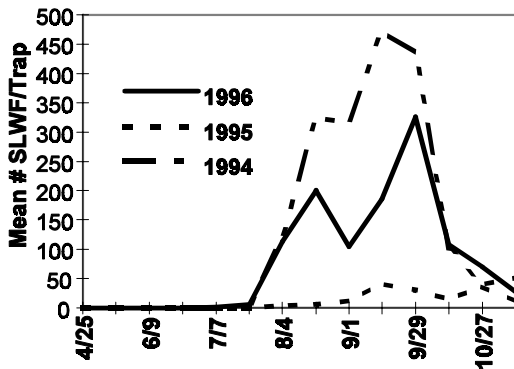


Figure 2. Mean number of silverleaf whiteflies per sticky trap for the central Kern County (Panama Lane) sticky trap line 1994-1996.

Kern County Trap Lines - 1996

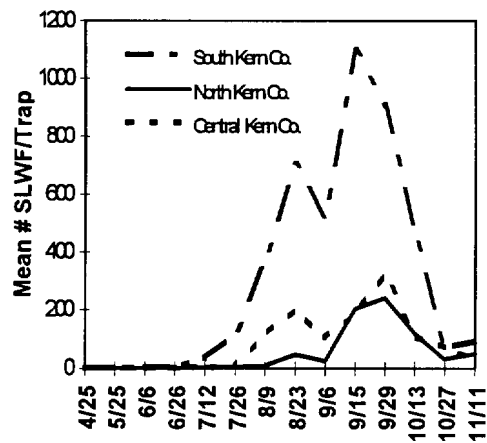


Figure 4. Mean number of silverleaf whiteflies per sticky trap for all three Kern County trap lines in 1996.