Insect Pests in Yuma Winter Vegetables: Review of the 2003-2004 Season

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Abstract

Insect pest populations seemed to be exceptionally abundant on our desert vegetable crops this past growing season. It is difficult to explain why some insect populations occurred in larger numbers this year, but the weather we experienced may have had a significant role. Hot, dry weather in the early fall and spring, coupled with moderate winter temperatures provided ideal conditions for some insect pests.

Introduction

Insect pest populations seemed to be exceptionally abundant on our desert vegetable crops this past growing season. It is difficult to explain why some insect populations occurred in larger numbers this year, but the weather we experienced may have had a significant role. Hot, dry weather in the early fall and spring, coupled with moderate winter temperatures provided ideal conditions for some insect pests. In other cases, pest pressure was down from previous years. Of course there are other biotic and abiotic factors (i.e., natural mortality, cropping patterns, and pest control practices) that influence pest abundance, and those change from year to year.

Nonetheless, this report is an attempt to review the pest pressures we observed in the Yuma Valley during the 2003-2004 growing season. This was accomplished by summarizing data that we collected annually from untreated head lettuce plots and yellow sticky traps. What you will find in this report is a comparison of the abundance of whiteflies, worms, thrips and aphids this past season with numbers from previous years. Data for the most part is specific for the Yuma Valley and Yuma Ag Center where the studies were conducted, but in general the information should reveal trends and relative differences among insect pests for most Yuma growing areas.

Weather Patterns

Weather plays an important role in the development and regulation of insect populations. In particular, temperatures are the driving force for their biological development and behavior. Insects are poikliothermic (cold blooded), and thus generally develop at a more rapid rate when temperatures are at 85-90ºF. Insect flight, mating and ovipositional activity is generally greatest when temperatures are warm. Conversely, when temperatures are cool (i.e., 50ºF), biological activity is much slower. For example, beet armyworm larvae can complete development from a newly hatched 1st instar larvae to a pupa in about 7 days at temperatures averaging 86ºF, but would require almost 12 days to complete development at 75ºF. But not all insects are the same. As you know, many of the aphid species that infest lettuce and cole crops are most active during the winter and spring when temperatures are cooler. However, they also have developmental limits that are influenced by a range of temperatures.

Rain and wind also influences insect population dynamics, usually by modifying their environment. Rain can influence the buildup of weeds and other alternate hosts that harbor large insect populations. Once the plants dry up, insects can disperse directly onto cultivated crops. Rain can also cause direct mortality to some insects that are washed off plants and suffocated in the soil. High winds can limit the insects' ability to move or fly. A good example of this is the poor pollination by honeybees that occurs in windy conditions. Consequently, many of the differences in pest pressure we experience each season are determined to some degree by differences in weather conditions.

Figures 1 and 2 show average daily temperatures for the produce growing season during the past 6 years (data was summarized from AZMET weather station located at the Yuma Agricultural Center, http://cals.arizona.edu/azmet/). Temperatures varied quite a bit from year to year during this period, and in some cases average temperatures varied as much as 15º F. In most cases it is difficult to see clear trends in temperature. However, what is very clear were the two extremes in temperatures experienced in 2003-2004. The first occurred during October where average daily temperatures were 10-15º F warmer than observed in the previous years (Figure 1). The second extreme occurred at the end of the 2004 growing season where similar differences were observed during much of March (Figure 2). As you will recall, both of these extremes had a marked influence on produce crop growth and maturity, and directly influenced the markets. Rainfall appeared to be less than average, where only the 2001-2002 season produced less rain (Table 1). This past season was unusual because most of our measurable rainfall occurred during November, which is generally a dry month. Finally, this past season seemed to be windier than normal, but AZMET measurements would suggest that it was not. Interestingly though, winds were light during the two temperature extremes in October and March. The significance of these weather extremes will be speculated upon in the discussions below.

Fig 1. Avg. Daily Temperatures during the 2003-2004 Fall-Winter Growing Season.

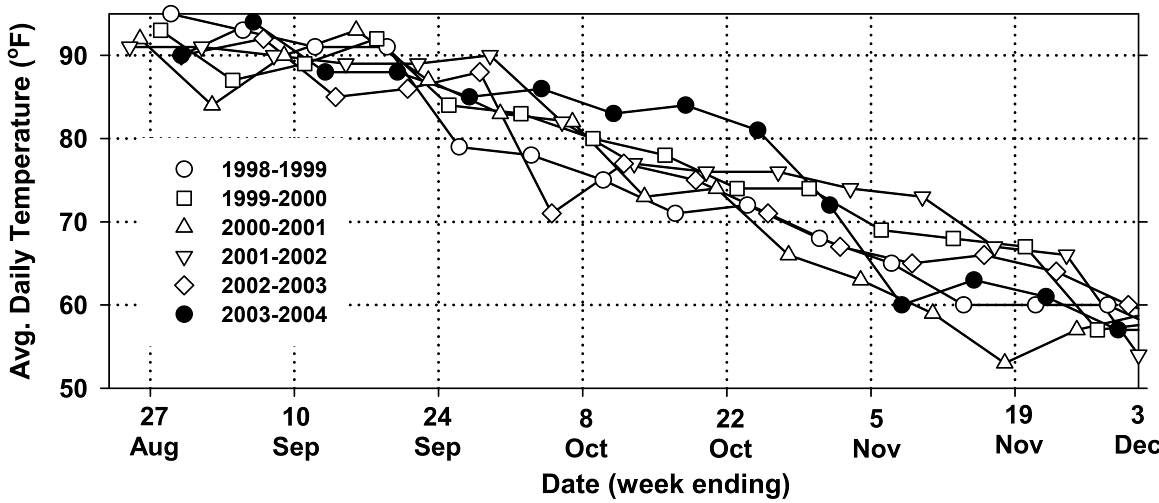


Fig 2. Avg. Daily Temperatures during the 2003-2004 Winter-Spring Growing Season.

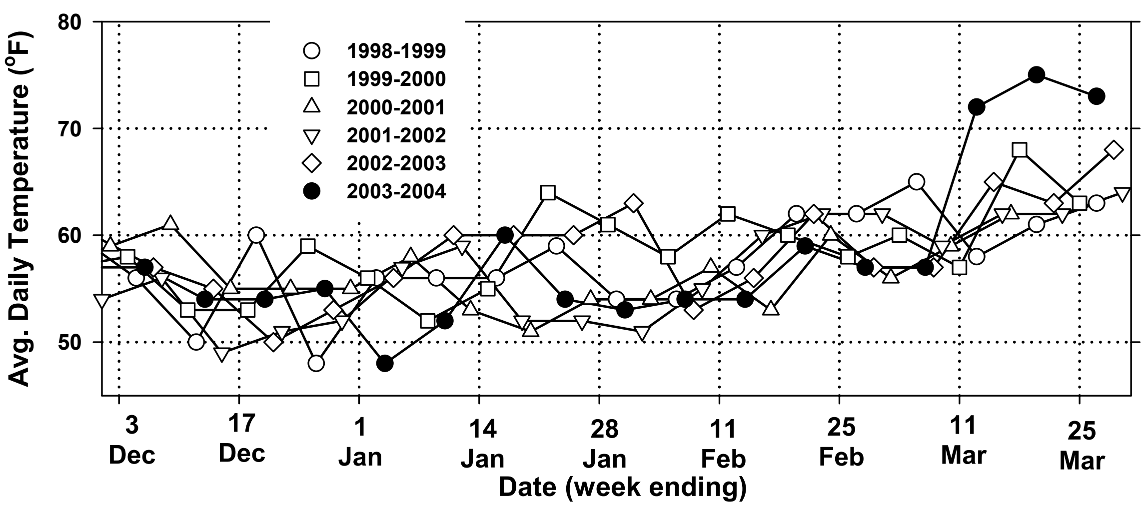


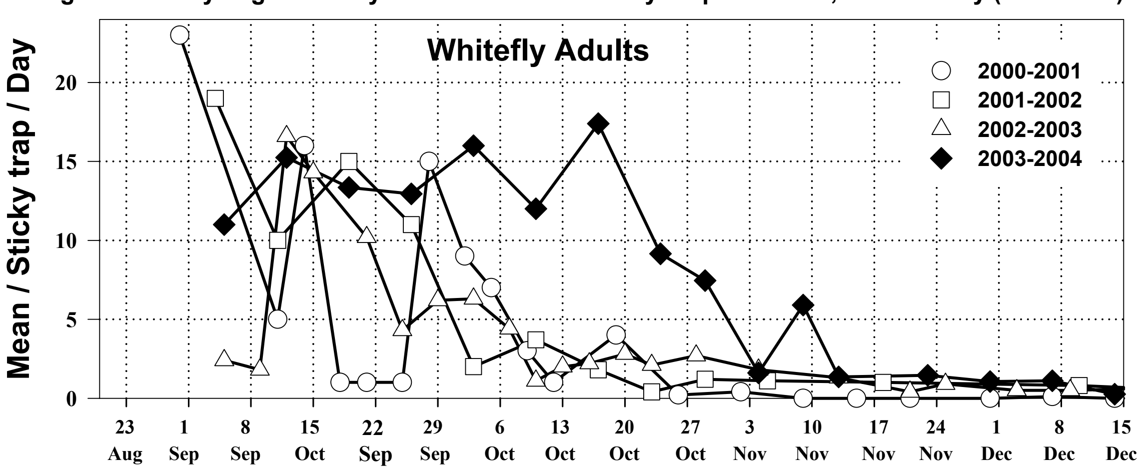
Table 1. Seasonal Avg. rainfall recorded at the Yuma Ag Center.

	Avg Seasonal Rainfall (in.)							
Yr	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Avg.**
98-99	1.01	0	0.26	0.05	0	0.53	0	1.85
99-00	0.80	0	0	0	0	0.05	0.21	1.06
00-01	0.02	0.63	0	0	0.31	0.02	2.54	**3.52**
01-02	0	0.10	0.01	0.01	0	0	0	0.12
02-03	0.02	0	0.02	0	0	0.57	0.64	1.25
03-04	0.05	0	0.40	0	0.10	0.20	0.10	0.85
Avg.	**1.9**	0.73	0.69	0.06	0.41	1.37	**3.49**	

Whiteflies

Based on our experiences over the past decade, whiteflies are most abundant during the fall. This is a result of their numbers building up on cotton and other crops during the summer when temperatures are ideal for biological development. As cotton and other crops are terminated, whiteflies disperse throughout the growing areas in search of suitable host plants like melons and cole crops. For several years we have placed yellow sticky traps in a grid from Gadsden to the North Yuma Valley throughout the season, collecting traps weekly and counting the number of whiteflies, aphids, leafminers and thrips on each trap. Figure 3 below shows whitefly flight activity during the fall, as determined by sticky traps, over the last 4 years. Historically, we have observed that whiteflies move throughout the area in August and September. We typically experience a considerable decline in movement in October when temperatures begin to decline. However, last fall flight activity extended well into October as illustrated in Figure 3. It is probably no coincidence that these extended flights correlate strongly with the higher temperatures we experienced in October (Figure 1). These temperatures also allowed for rapid whitefly development on our cole crops and melons where we observed high densities infesting untreated crops. Another factor which may have influenced this movement was the light winds that were associated with the higher temperatures. Winds averaged less than 4 mph during the first 3 weeks in October, compared to previous years when winds consistently averaged over 6 mph (AZMET).

Fig. 3 Whitefly Flight Activity Based on Yellow Sticky Traps Catches, Yuma Valley (2000-2004)



Worms (Beet Armyworm and Cabbage Loopers)

Without a doubt, the fall of 2003 was one of the heaviest worm years that we've seen in quite awhile. Anecdotal reports of PCAs spraying insecticides to control beet armyworm (BAW) and/or cabbage loopers (CL) twice a week were common during September and October. There was good reason for this. Historical data generated from the untreated controls of small plot efficacy trials conducted similarly each season from 1997 to 2003 at the Yuma Ag Center shows the large numbers of worms present on lettuce plants in 2003 compared with previous years (Figure 4). At their peak, BAW and CL averaged almost 16 larvae/plant. That's a lot of worms. Again, higher than average temperatures (Figure 1) likely influenced the buildup of this unusually large abundance of worms. Worm pressure usually subsides during October when the weather breaks. However, as shown in Figure 5, average daily temperatures in 2003 remained at or near 85ºF during most of October resulting in 3-4 times greater numbers of worms than measured in our 2002 trials. Average daily temperatures differed by as much as 15ºF during this time. Worm pressure finally declined as temperatures broke in late October. Consequently, we are convinced that the high worm pressure seen on fall produce in 2003-2004 was directly influenced by weather. Temperatures had a significant impact on worm abundance by accelerating larval development on plants. Larvae were able to complete development at a more rapid rate (optimal temperature for development has been shown to be 86ºF). This resulted in more generations of worms than normally observed. Furthermore, higher night time temperatures likely provided an ideal environment for moth flight and oviposition. This would result in greater egg lays. It was not unusual to see multiple eggs and egg masses on larger plants throughout October. Finally, as discussed above, the light winds probably enhanced moth flight activity.

Fig 4. Worm populations (total larvae / plant) in untreated head lettuce over several experimental trials per season, Yuma Ag Center (1997-2004)

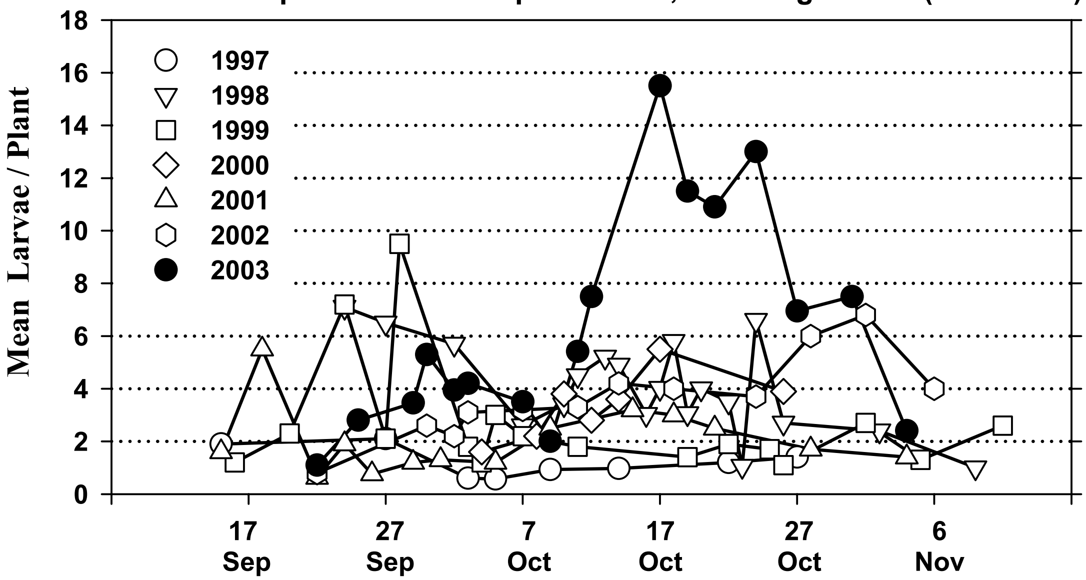
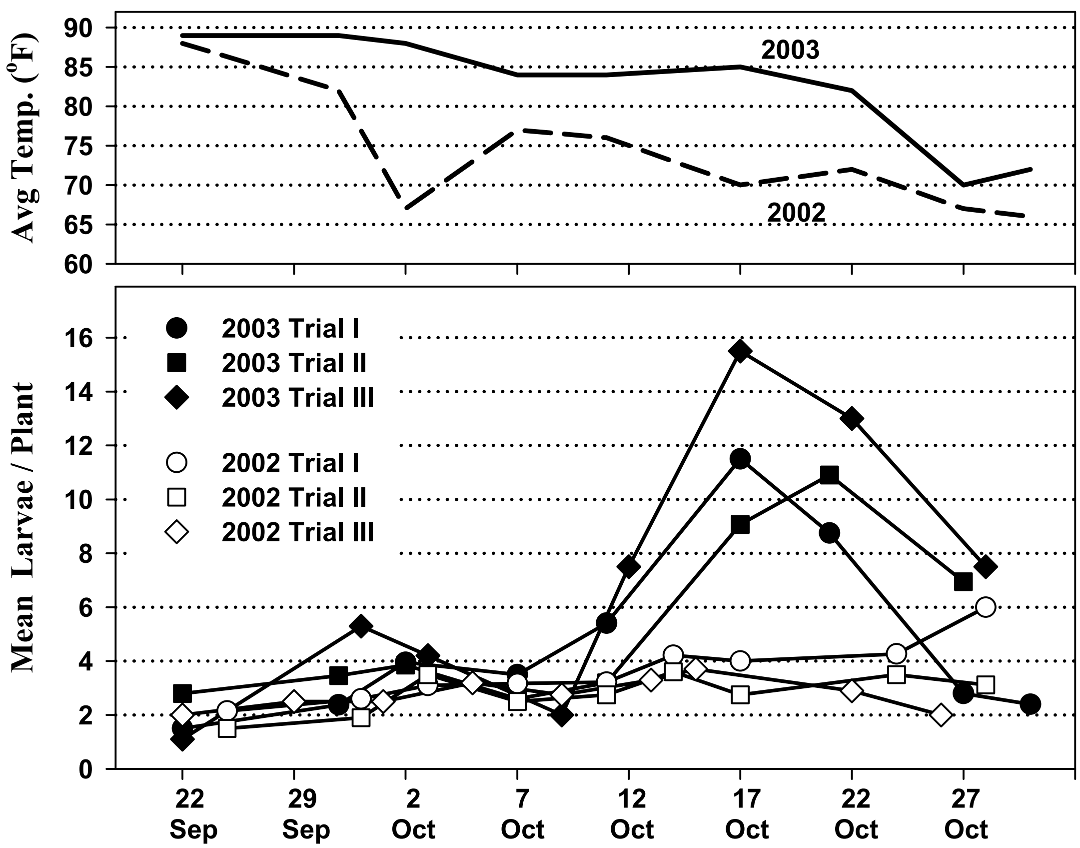


Fig 5. Total worm populations (small and large beet armyworm and cabbage looper larvae) relative to temperatures in untreated head lettuce plots at the Yuma Ag Center, 2002-2003



Western Flower Thrips

Over the past several years western flower thrips have become a common and often serious pest of lettuce. However, thrips abundance in Yuma lettuce during 2003-2004 was lighter than what we have experienced the past several years. We have been conducting trials at the Yuma Ag Center for the past several years to study the influence of planting dates on thrips population growth. Figure 6 shows the results of those studies to date. Thrips abundance never exceeded greater than 100 thrips/plant last season with the exception of 1 planting (December 12 wet date). However, thrips populations exceeded 100/plant in 3 and 4 plantings respectively in 2002 and 2003. Thrips pressure is generally low during November, December and January, the exception occurring during 2002-2003 where populations grew at rapid rates during this period. This can be explained in part to higher temperatures during the winter, particularly in January, 2003 (Figure 2). Temperatures may have also influenced thrips flight activity as shown in Figure 7. Trap catches of thrips were similar throughout the Yuma Valley for all years until late in the season. This year thrips dispersal at the end of the season was relatively lower than what we've seen in past years. Also, anecdotal reports from PCAs suggest that thrips pressure was lighter this year. This may be due to some extent to high temperatures in March, but was more likely a result of heavy insecticide usage for aphids, and difference in cropping patterns. In general, we feel that thrips abundance and flight activity is generally highest in March as a result of optimal temperatures for development and flight, the rapid harvest of lettuce, and the reduced number of produce acres (Figures 6 and 7). Finally, to confirm what most PCAs and growers already believe, our data set suggests that thrips population development in lettuce is generally greatest in late November and December plantings.

Fig 6. Seasonal Western Flower Thrips Populations in Several Plantings of Head Lettuce , Yuma Ag Center, 2000-2004

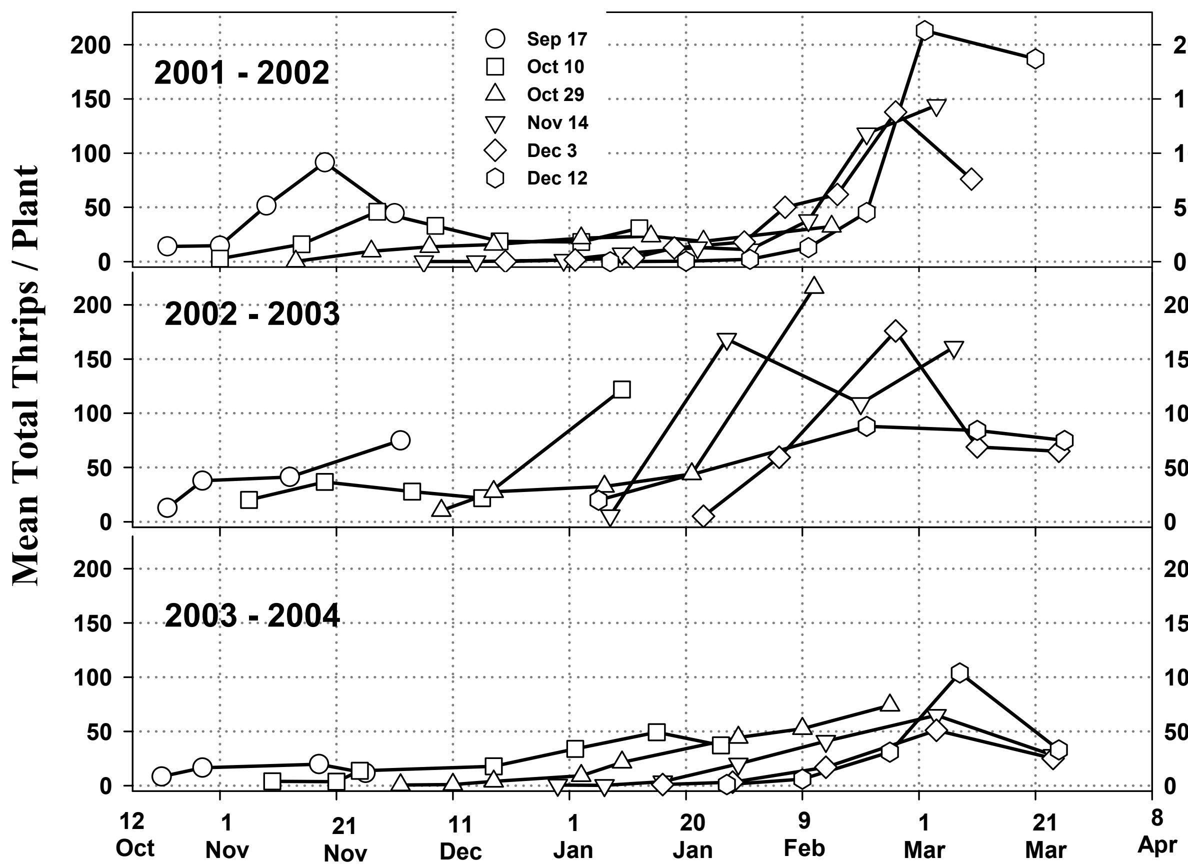
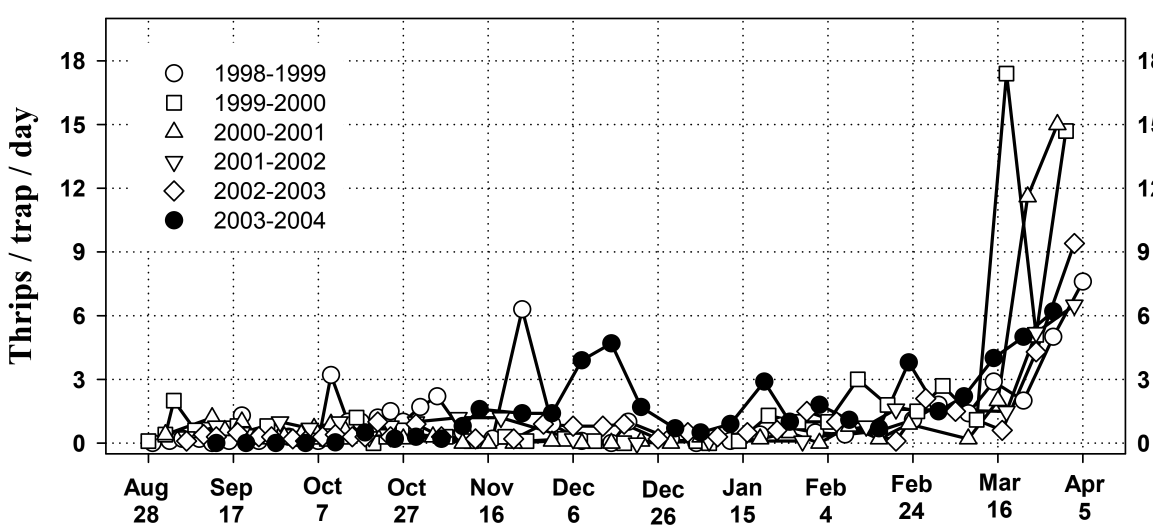


Fig 7. Thrips Flight Activity Based on Yellow Sticky Trap Catches, Yuma Valley 1998-2004



Aphids

Aphid pressure was heavy for a second consecutive year in 2003-2004. Surprisingly, green peach aphids (GPA) were the predominant species throughout the area, relative to the last few years where it has been almost non-existent. PCAs reported seeing GPA colonizing lettuce and cole crops in early November. Many populations required insecticide treatments to prevent economic infestations. Similar to our work with thrips, we have been conducting trials at the Yuma Ag Center for the past several years to study aphid population development across the season in several lettuce plantings (not treated with insecticide). The results from this work showed that over the past 5 growing seasons GPA populations were greatest last year, with GPA peaking at over 400/plant at harvest in our early November planting window (Figure 8). GPA continued to be abundant throughout the spring until March when populations quickly crashed due to high temperatures (Figure 2). We are not certain why GPA was so abundant in 2004, as we are not sure how temperatures influence population growth during the winter. Average daily temperatures ranged between 50-55ºF for most of December, January and February, but it is more likely that the unusual GPA abundance in 2004 was a result of a complex of both abiotic and biotic factors.

Comparisons within wet dates show that seasonal aphid abundance differed by species. Whereas GPA appears to be prevalent in early November plantings, potato aphids are heaviest in late November to early December plantings. Potato aphids were particularly heavy in 2003 as was lettuce aphid and foxglove aphids. Lettuce aphid tends to be most abundant late in the season when temperatures average >60ºF. Although we only have 3 years information for foxglove aphids, our information suggests that this aphid species has the wide range of activity. Compared with the other aphids, foxglove aphid has occurred in large numbers throughout the November and December plantings. Although we have seen heavy aphid pressure on produce the past 2 seasons, we are less certain as to what factors contributed to these outbreaks. As we collect more data, we may be able to associate cropping practices or weather patterns that influence their abundance.

Acknowledgements

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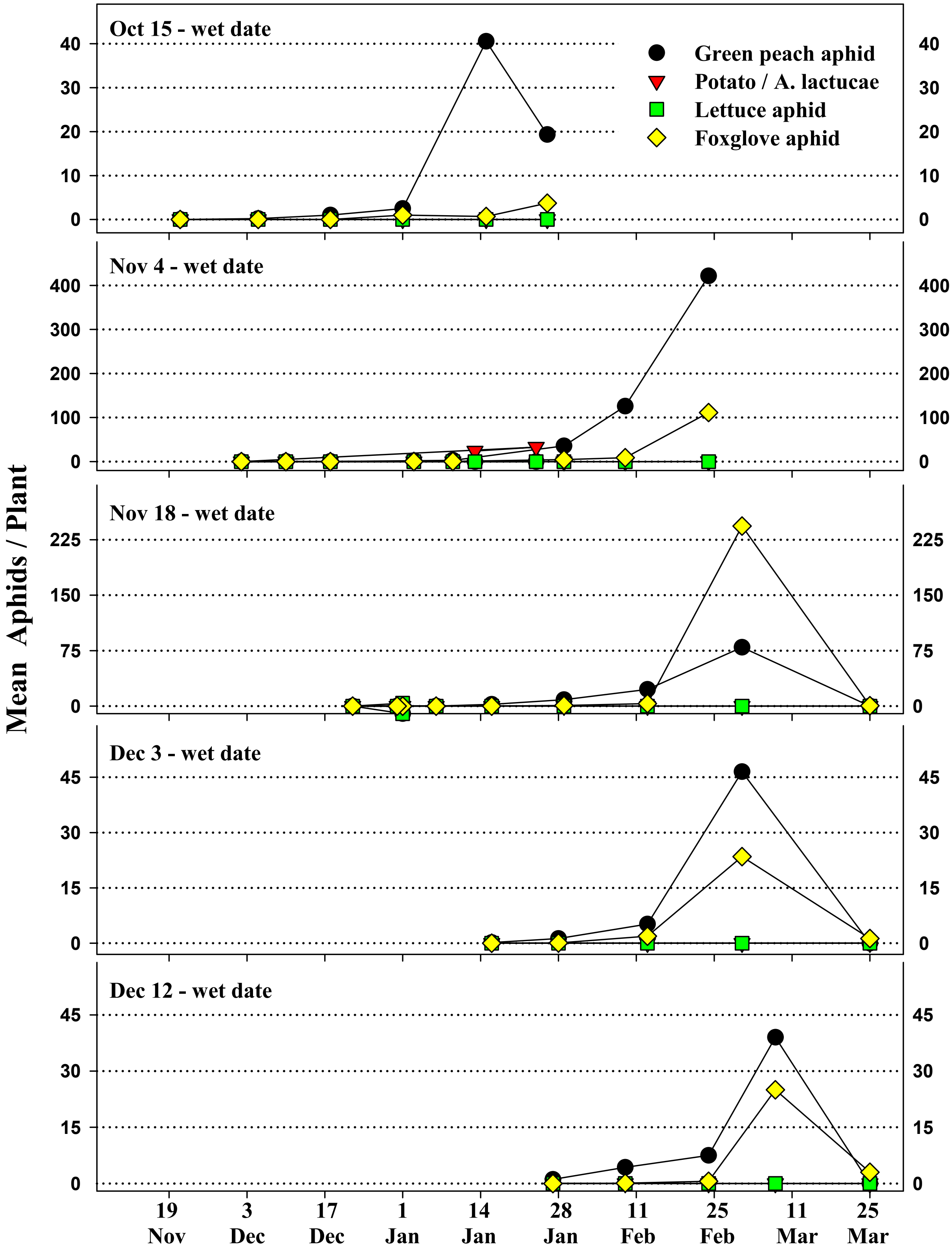
Oct 15 - wet date
Green peach aphid
Potato / A. lactucae
Lettuce aphid
Foxglove aphid
Nov 4 - wet date
Nov 18 - wet date
Dec 3 - wet date
Dec 12 - wet date
Mean Aphids / Plant
19 Nov
3 Dec
17 Dec
1 Jan
14 Jan
28 Jan
11 Feb
25 Feb
11 Mar
25 Mar

Fig 8. Seasonal population trends for Green Peach Aphids in untreated head lettuce for three planting windows over a five year period, YAC