Preliminary Examination of the Population Dynamics and Control of the Lettuce Aphid on Romaine

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Abstract

Several small plot studies were conducted during the spring of 1999 to examine the population growth, distribution and control of the lettuce aphid on romaine. The lettuce aphid population developed to greater numbers more quickly and spread among plants more rapidly when compared with other aphids species under late spring growing conditions. Most of the lettuce aphids sampled were found on the hearts of the plants rather than the frame and wrapper leaves. Our preliminary efficacy studies suggest that foliar sprays, when timed properly and with proper coverage, can provide adequate control of the lettuce aphid for up to 14 days. Furthermore, significant suppression of apterous lettuce aphid populations was observed in plots where pyrethoid treatment were sprayed for thrips control. The implications of these results for future research and management of lettuce aphids in desert lettuce is discussed.

Introduction

A new aphid species, the currant-lettuce aphid, *Nasonovia ribisnigri* (Mosley), has been creating problems for lettuce growers throughout the western United States. Commonly referred to as the lettuce aphid, the pest was found in Salinas in 1998 causing economic losses to summer head and leaf lettuce crops. Infestations of this species were also reported on lettuce in the Imperial Valley , central Arizona, and Sonora, Mexico in early 1999. The first reported incidence of the lettuce aphid in Yuma was on an untreated head lettuce field in mid- March in the Gila Valley, and from head lettuce plots at the Yuma Ag Center. Specimens were collected and sent to Tucson, where they we positively identified as *N. ribisnigi*. In early April, the lettuce aphid was found again on Romaine lettuce at two locations in the Yuma Valley and at the Yuma Ag Center.

This aphid species is quite different from green peach aphid (GPA) and potato aphid (PA) we commonly find on leafy vegetables in the desert. First, the lettuce aphids deposit their young near the terminal growing points of the plant. The aphids collected from head lettuce in Yuma were found predominantly on the cap leaf and within the head. Furthermore, the aphid looks distinctively different than any other aphid found locally on lettuce. The apterous aphids we observed were orange- pink in color with dark bands across their abdomen and on their legs. Their legs are quite spindly, giving them almost a spider-like appearance. Alate adults were similarly distinct from either GPA or PA.

There is much uncertainty surrounding this new species, and its ability to thrive within our desert growing conditions. We are not sure how or when the lettuce aphid moved into the Yuma area, but it seems likely that it arrived via transplants or harvest equipment. Because this species primarily utilizes lettuce as its host, we are uncertain whether it can successfully bridge the gap in lettuce seasons during the summer months. In terms of management, control with foliar aphicides is difficult because of the aphids preference for the protected terminal growth. Considerable research is being conducted in Salinas to answer some of these questions and by next fall, we should have a better idea of what to expect. We had the opportunity to conduct a limited amount of field research to learn more about it's population growth, distribution, damage potential and control on desert lettuce.

Materials and Methods

Studies to examine lettuce aphid field ecology and control were conducted on romaine lettuce plots at the

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Yuma Agricultural Center, Yuma, Arizona. A two-acre block of Romaine lettuce, *Lactuca sativa* var. *longifolia* Lam., 'Mardi Gras' was planted on February 19, 1999 for a thrips trial. A population of lettuce aphid was detected about 60 days after planting (mid-April) and the block was then subdivided into two separate test areas. One area, 0.5 acres, was used initially for a thrips trial, and the second, 1.5 acres in size, was used exclusively for the study of lettuce aphids.

Distribution and Population Growth. A small study was initiated to examine the population growth and inter-and intra-plant distribution of lettuce aphid relative to GPA and PA also found on the plants. A one-acre area of the test block was evenly stratified into 12 subplots. On each sampling date (15, 21, 26, and 30 April), 5 untreated plants were randomly selected from each subplot To minimize pesticide exposure, plants were selected from areas no closer than 6 rows from the test area used for insecticide trials. Plants were examined for intra-plant (within-plant) distribution by counting all the aphids on whole plants , but recording the location within the plant that were observed. We separated the plant in to frame/wrapper leaves (older growth, lower 75% of plant foliage) and hearts (terminal growth, upper 25% of foliage). Plants had 22-24 fully expanded leaves at the initiation of the study. Inter-plant (between-plant) distribution was determined by calculating the percentage of plants infested with each aphid species on each sampling date. Population growth was calculated by comparing the mean number of aphids per plant for each sampling date and comparing through time.

Foliar Insecticide Efficacy. A small plot study was initiated on 15 April to evaluate the residual efficacy of a standard foliar aphicide combination, Provado 1.6F (imidacloprid) at 3.8 oz/acre plus Thiodan 3EC (endoisulfan) at 36 oz /acre, and an unregistered systemic aphicide, Aphistar 50W (triazimate) at 4 oz/acre, presently under development. Plots for the insecticide trial were four beds wide by 75 ft long (two seed lines/ beds; 42 " centers); bordered by four untreated beds. Four replications of each treatment in a randomized complete block design. Foliar applications were made on Apr 15 and 29 with a tractor-mounted hydraulic boom sprayer operated at 50 psi and 30 gpa. A directed spray (~75% band, with rate adjusted for band) was delivered through 3 nozzles (TX-8) per bed. The following treatments were applied: 1) a single application (Apr 15) of Aphistar , 2) two applications (Apr 15, 29) of Aphistar, 3) two applications (Apr 15, 29) of Provado+Thiodan, 4) a single application (Apr 15) of Provado+ Thiodsan, followed by an application (Apr 29) of Aphistar, and 5) an untreated control.

Plots were evaluate by sampling 10 plants per plot at 7, 10 and 14 days following each application. The total number of lettuce aphids per whole plants were recorded following the 1st application. Based on our distribution studies from above, aphids counts were restricted to hearts only following the 2nd application. Mean lettuce aphis per plant were analyzed for each sample date using ANOVA, and means differences separated using $LSD_{(P<0.05)}$.

Influence of Thrips Insecticide Efficacy on Lettuce Aphid Suppression. About two weeks following the completion of a separate insecticide trial for thrips within the 2 acre romaine block, we observed that certain treated plots had very few lettuce aphids relative to the untreated areas. The plots had received no insecticide other than the treatment combinations used in the thrips trial. Thus, we chose to evaluate these replicated plots for lettuce aphid abundance. The thrips trial consisted of plots four beds wide by 40 ft long and bordered by two untreated beds. Four replications of each treatment were arranged in a randomized complete block design. Three foliar applications had been made with a tractor-mounted hydraulic boom sprayer operated at 50 psi and 30 gpa on 31 Mar, 9 and 17 Apr. A directed spray (~75% band, with rate adjusted for band) was delivered through 3 nozzles (TX-8) per bed. The following treatment/rate combinations had been applied: 1) Success 2 SC (spinosad) at 6 oz/acre; 2) Success+Warrior T (lambda-cyhalothrin) at 6 oz+3.5 oz; 3) Lannate SP (methomyl) at 0.83 lb; 4) Lannate + Warrior at 0.83 lb + 3.5 oz; 5) Warrior at 3.5 oz; and 6) an untreated check. On May 2, (15 days after the final thrips application) we sampled each plot for the presence of Lettuce aphids. Estimates were made by counting all aphids in the hearts of 7 plants per replicate. Mean lettuce aphis per plant were analyzed for each sample date using ANOVA, and means differences separated using $LSD_{(P<0.05)}$.

Results and Discussion

Lettuce aphid developed rapidly on Romaine when compared with the GPA/PA complex under late spring growing conditions (mean temp. = 73 °F). We assumed that conditions conducive to buildup of the GPA/PA complex

would be similar for the lettuce aphid. However, our preliminary assessment on romaine suggests that this species may respond differently. During the two week period in April, we measured a 15-fold population increase compared with a 3-fold increase in the GPA/PA population (Figure1). The population of lettuce aphid went from an average of 6.1 aphids/plant when we found the infestation to >90 aphids/ plant. Unfortunately our data leads us to believe that this species can do quite well under our moderate spring growing conditions. Furthermore, the lettuce aphid spread much more rapidly among plants in the plot than the GPA/PA complex (Figure 2). However, it is important to consider that the plot size was only 1 acre in size, and within field distribution of lettuce aphid populations in large commercial fields may vary. Perhaps the most important behavior observed was how this aphid distribute itself within Romaine plants.

Most of the aphids we sampled were found on the hearts of the plants rather than the frame and wrapper leaves (Figure 3). This is consistent with reports from Salinas and from the little scientific literature available.

Results from our spray trial showed that Aphistar provided 14-21 days residual control of lettuce aphid on Romaine (Figure 4). Provado/endosulfan sprays provided 7-10 days of efficacy under these conditions. The treatments receiving 2 applications of Aphistar, and the Provado/Thiodan and Aphistar regime provided the best overall control of aphids during the 28 day trial. This is encouraging since repeated applications of the same active ingredient are discouraged. It is important to note that the from of the plant at the time of these application were open and the terminal growth was exposed. We're not certain whether similar results could be expected later in plant growth when the terminal growth is enclosed by wrapper leaves

Following the completion of the thrips trial several treatments in that test were infested with lettuce aphid. Fifteen days following the 3rd thrips spry we sampled for the presence of lettuce aphid on Romaine heats. Significant suppression of apterous lettuce aphid populations was observed in the treatments containing Warrior (Figure 5). This strongly suggests that pyrethroids may have an impact on lettuce aphid populations. We speculate that this aphis species is susceptible to many insecticide through contact by foliar sprays or ingested through plant feeding. What is more likely in this case is that the pyrethroids were actually preventing lettuce aphid colonization by direct mortality to alate (winged) adults moving onto the plants.

The results of these simple studies emphasis the importance of frequent monitoring and scouting for lettuce aphid. PCAs know to examine the undersides of older leaves on lower portions of the plant when looking for GPA/PA. However, because lettuce aphid populations can increase very rapidly proper sampling will be critical for detecting early infestations of lettuce aphid. Sampling should be focused almost entirely on leaves found in the terminal growth of this plant. This may entail examining more plants than they normally would. In addition, when alate (winged) aphids are first detected on plants, an attempt should be made to identify them to species. Their presence is usually an indicator of aphid movement and subsequent colonization within the field. Finally, it is important to detect aphid presence before the head closes up, because if the aphids are allowed to become established after head formation or the leaves begin to wrap tightly, they are very difficult to reach with conventional foliar sprays.

Our preliminary efficacy studies suggest that foliar sprays, when timed properly and with proper coverage, can control the lettuce aphid for up to 14 days. However, we don't have enough experience with this species in the desert to really know how effective a foliar spray program will be throughout the season, especially if lettuce aphids migrate into fields late in the season near harvest. Perhaps a more important question is: Will Admire soil applications provide seasonal control of the lettuce aphid ? Admire should provide good control of the lettuce aphid, as it does other species. It has been the standard product used for aphid control in lettuce for the past 6 years. A single at-planting application usually provides season-long control of GPA/PA. This is achieved by preventing aphid colonization early-mid season when these aphids feed on leaves lower on the plant where Admire has systemically moved to.

However, we are not sure how long the residual control will be for the lettuce aphid on spring crops that grow for greater than 70 days. It's probably not a coincidence that the lettuce aphid didn't appear in Yuma lettuce until late in the season when Admire residual on crops began to decline. The head lettuce fields where this aphid was found had not been treated with Admire. The romaine fields had been treated with Admire, but the infestations weren't observed until March, some 80 days or so after planting. At that time, we assumed much of the Admire residual in the soil had diminished. The aphids immediately attack the new terminal growth which may not have acquired any Admire.

In conclusion, there is much we do not know about this aphid species, particularly how it will behave on head lettuce in the desert and how our current management practices will impact it's occurrence. We have plans to conduct several trials next spring to address many of these questions and hopefully can begin developing a cost-effective management approach should lettuce aphid become an established pest.

Figure 1. Population Growth of Lettuce Aphid on Romaine After 14 days

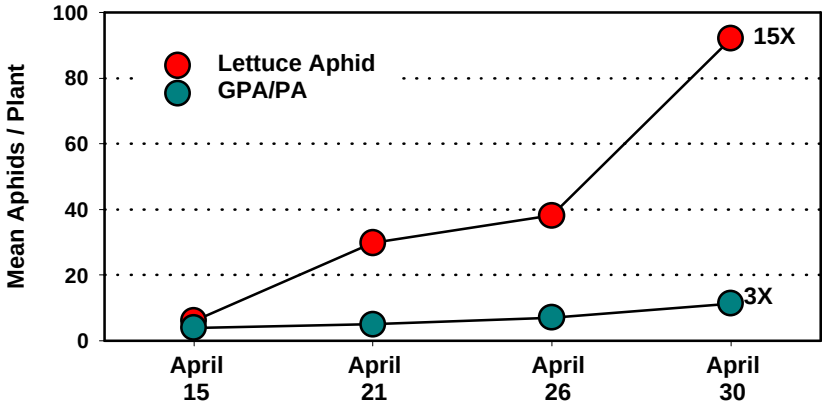


Figure 2. Inter-plant (Within Field) Distribution of Lettuce Aphid on Romaine 14 days after Detection, April 1999

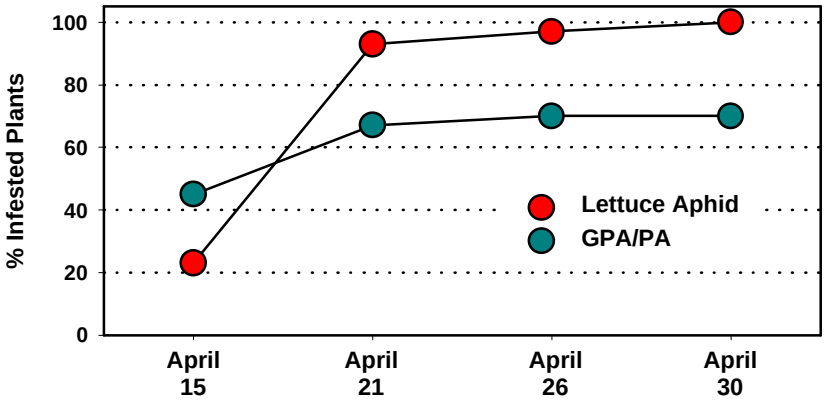


Figure 3. Within-Plant Distribution of Lettuce Aphid on Romaine After 14 days

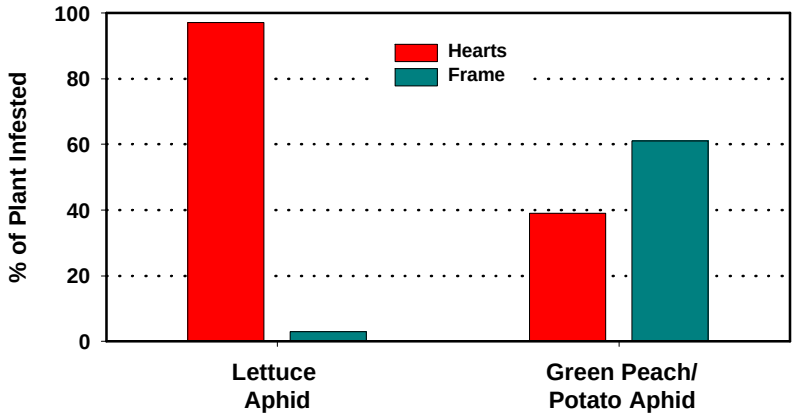
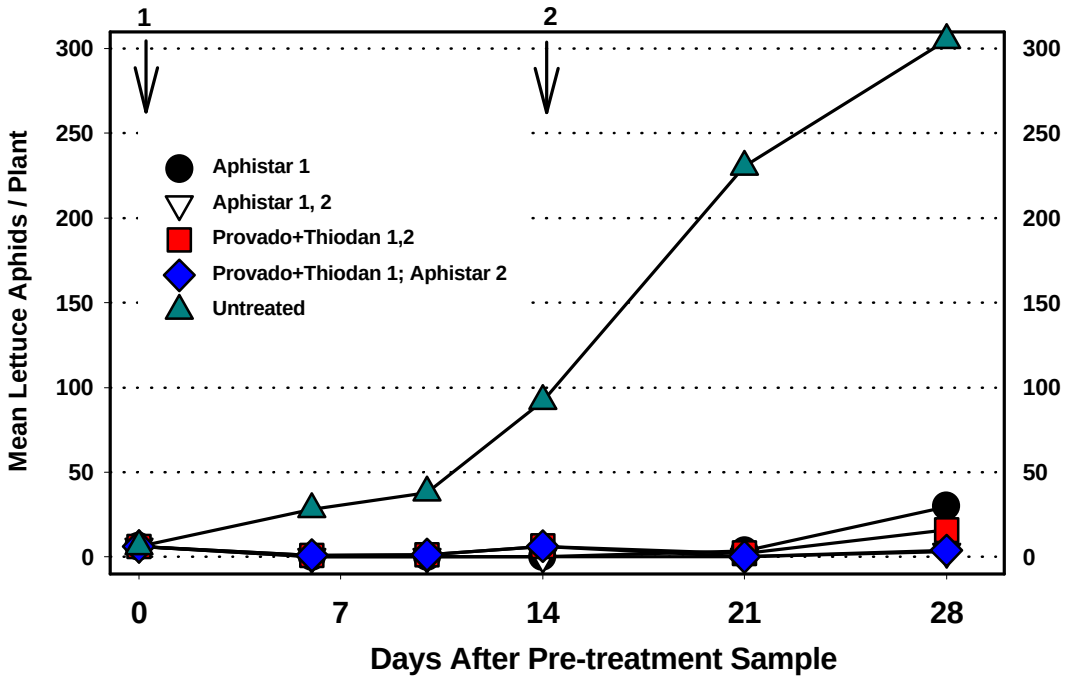


Figure 4. Lettuce Aphid Control on Romaine in the Desert; Yuma Ag Center, Mar/Apr 1999



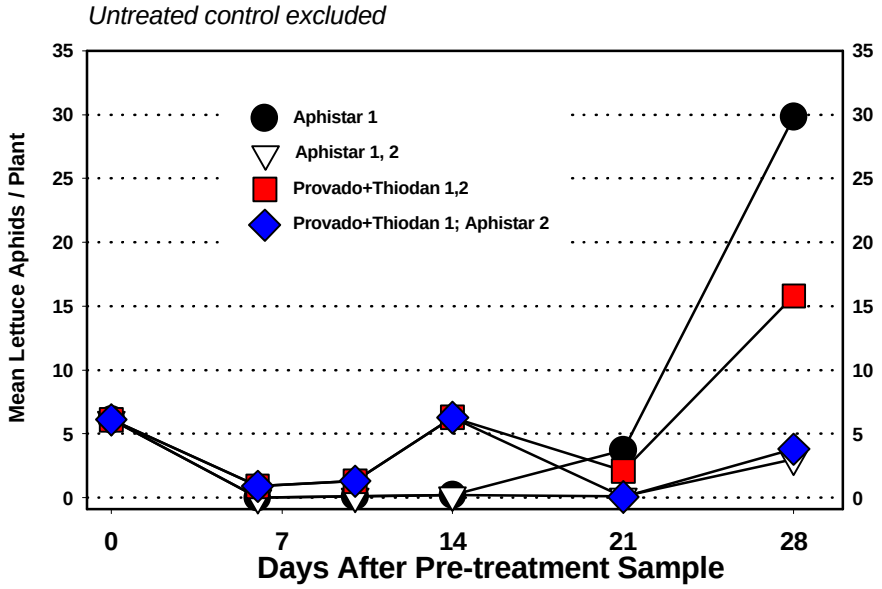


Figure 5. Lettuce Aphid Populations on Romaine 15 Days After Sprays for Thrips Control (3 applications) Ended , May 2, 1999, YAC