

<b>Determination of the biology and methods for monitoring and treatment of the Asian woolly hackberry aphid (<i>Shivaphis celti</i>) in California. (04XN026)</b>			
<b><u>Program</u></b>	Exotic Pests and Diseases Research Program		
<b><u>Principal investigators</u></b>	A.B. Lawson, Entomology, California State University, Fresno P.M. Geisel, UCCE, Fresno Co.		
<b><u>Host/habitat</u></b>	Landscape Trees and Shrubs: Chinese Hackberry		
<b><u>Pest</u></b>	Asian Hackberry Woolly Aphid <i>Shivaphis celti</i>		
<b><u>Discipline</u></b>	Entomology		
<b><u>Review panel</u></b>	Natural Systems	<b><u>Start year (duration)</u></b>	2004 (Four Years)
<b><u>Objectives</u></b>	<p>Refine and demonstrate the method of monitoring insect honeydew as an indicator of population density using Asian woolly hackberry aphid as the model.</p> <p>Compare the efficacy of four treatments in controlling <i>Shivaphis celti</i> in Chinese hackberry trees in a field setting.</p> <p>Observe and document the year-round lifecycle of <i>S. celti</i> in the San Joaquin Valley.</p> <p>Monitor existing natural enemies of <i>S. celti</i> to make management recommendations such as pesticide management to minimize impact on existing natural enemies and opportunities to introduce hackberry aphid-specific parasitoids in the future.</p>		
<b><u>Project Summary</u></b>	<p>The Asian hackberry woolly aphid (<i>Shivaphis celti</i> Das) was introduced into California in summer 2002. The aphid has spread quickly on Chinese hackberry trees throughout the state, creating a honeydew nuisance and causing complaints in many urban settings. To date, little is known about the biology, impact and management options for this aphid in California. This project proposes, through field research, to develop effective and efficient monitoring procedures using water sensitive cards and foliar sampling to relate honeydew production to aphid density. Efficacy of four treatments for the aphid will be tested. The lifecycle of the aphid and existing natural enemies will be documented to provide basic information which may be used to plan and time treatments, as well as aid future efforts in classical biological control for the aphid.</p>		
<b><u>Final report</u></b>	<p>In 2005 and 2006, three field sites (Woodland, North Fresno, and Central Fresno) were sampled to evaluate monitoring techniques and to document seasonal aphid population fluctuations. Five trees at each site were monitored for aphids by taking foliar samples and measuring honeydew produced by the aphids using water sensitive cards. Honeydew production reflected aphid populations at each site, however, considerable variability exists with this technique. The honeydew monitoring technique may be useful for determining the need for treatment, but it is too variable to be used by itself to document the effectiveness of treatments.</p> <p>Although there was some variability between sites and years, aphid populations tend to peak in late April or early May, then decline to low numbers during July and August before increasing again in September.</p> <p>Three field sites in 2005 and an additional three sites in 2006 were used to determine the effects of systemic treatments of imidacloprid (Mertit 2F) and abamectin (Vivid II) on the aphid. Imidacloprid treatments applied as a soil drench or as a soil injection using a Kioitz injector were equally effective. Imidacloprid</p>		

	<p>treatments applied at bud break provided season-long control, as did those applied in either May or late June after populations had been confirmed by foliar sampling.</p> <p>Treatments as low as 1/8 of the recommended label rate provided control comparable to label rates. Abamectin trunk injections also provide season-long control, however, trunk injections wound the tree, which may increase the risk of disease. Imidacloprid treatments provide control of the aphids the year following treatment, but not two years after. Abamectin treatments did not provide control the following year.</p> <p>Existing natural enemies largely consist of generalist predators such as coccinelids, flower flies, and lacewings, however, they do not occur in densities high enough to control the aphids. Contact with Baoping Li, Nanjing Agricultural University, China, was made for eventual collaboration in a classic biological control program.</p>
<p><a href="#"><u>Third-year progress</u></a></p>	<p>The Asian hackberry woolly aphid (<i>Shivaphis celti</i> Das) was introduced into California in summer 2002 and spread quickly on Chinese hackberry trees throughout the state. This project seeks to develop effective and efficient monitoring procedures as well as evaluate efficacy of systemic chemical controls as short-term management options. The potential for classical biological control will be evaluated for a long-term solution. In 2006, three field sites monitored in 2005 (Woodland, North Fresno, and Central Fresno, CA) were sampled to evaluate monitoring techniques and document seasonal aphid population fluctuations. Five trees at each site were monitored for aphids by taking foliar samples and measuring honeydew produced by the aphids. Honeydew production reflected aphid populations at each site, however considerable variability exists with this technique and although it may be appropriate for determining the need for treatment, it cannot be used by itself to document the effectiveness of treatments. An additional three sites were established in Fresno to determine efficacy of below label rate systemic imidacloprid treatments for control of the aphid. Treatments applied in mid-May after populations had been confirmed by foliar sampling provided effective season long control. Treatments as low as 1/8 of the recommended label rate provided control comparable to higher rates. Sites will be monitored on 2007 to determine any differences in carryover activity between the rates. Existing natural enemies largely consist of generalist predators such as coccinelids and lacewings. Preliminary research for a classical biological control program for the aphid has begun.</p>
<p><a href="#"><u>Second-year progress</u></a></p>	<p>The Asian hackberry woolly aphid, <i>Shivaphis celti</i> Das, was introduced into California in summer 2002 and spread quickly on Chinese hackberry trees throughout the state. This project seeks to develop effective and efficient monitoring procedures, as well as evaluate the efficacy of systemic chemical controls as short-term management options. The potential for classical biological control will be evaluated for a long-term solution. In 2005, three field sites were established in Woodland, North Fresno, and Central Fresno, Calif. to evaluate monitoring techniques and document seasonal aphid population fluctuations. Five trees at each site were monitored for aphids by taking foliar samples and measuring honeydew produced by the aphids. Honeydew production reflected aphid populations at each site, however, considerable variability still exists and the technique must be further refined before this method can be used to determine finer scale measurements of aphid density.</p> <p>An additional three sites were established in the cities of Fresno, Turlock, and Davis to determine efficacy of systemic insecticide treatments for control of the</p>

	<p>aphid. No difference was found between imidacloprid treatments applied as a soil drench vs. soil injection. Imidacloprid treatments applied at bud break provided season long control as did those applied in late June. No difference in treatment efficacy was found between imidacloprid applied at 0.15 oz/inch diameter at breast height (DBH) than those treated at one third of that rate. Existing natural enemies largely consist of generalist predators such as coccinellids and lacewings. Preliminary research for a classical biological control program for the aphid has begun.</p>
<p><a href="#"><u>First-year progress</u></a></p>	<p>The Asian hackberry woolly aphid, <i>Shivaphis celti</i> Das, was introduced into California in summer 2002 and spread quickly on Chinese hackberry trees throughout the state, creating a honeydew nuisance and causing complaints in many urban settings. This project seeks to develop effective and efficient monitoring procedures using water-sensitive cards and foliar sampling to relate honeydew production to aphid density. In addition, efficacy of eight treatments for the aphid will be tested, and the potential for biological control will be evaluated.</p> <p>In March 2005, three field sites were established in the cities of Woodland, Fresno, and Tulare, Calif. Five trees at each site are being monitored for aphids by taking foliar samples and measuring honeydew produced by the aphids. An additional three sites were established in the cities of Fresno, Turlock, and Davis. At these sites, various treatments will be examined for control of the aphid.</p> <p>To date, two treatments have been applied at each of the sites and are being compared to untreated controls. Other treatments will be applied and evaluated later in the season. It is too early to determine any treatment effects. Twig and foliar samples taken during winter and spring 2005 have revealed that the aphids overwinter as dark oval eggs on the hackberry twigs.</p> <p>The predators most commonly found feeding on the aphids are lady bird beetles and lacewings. Several aphids were found parasitized, however, the <i>Hymenopteran</i> parasitoids have not yet been identified.</p>

<b>Biological control of the Asian hackberry woolly aphid, <i>Shivaphis celti</i>, in California. (06XU020)</b>		
<b><u>Program</u></b>	Exotic Pests and Diseases Research Program	
<b><u>Principal investigator</u></b>	A.B. Lawson, Entomology, CSU Fresno	
<b><u>Host/habitat</u></b>	Chinese Hackberry; Landscape Trees and Shrubs	
<b><u>Pest</u></b>	Asian Hackberry Woolly Aphid <i>Shivaphis celti</i>	
<b><u>Discipline</u></b>	Entomology	
<b><u>Review panel</u></b>	Urban Systems	<b><u>Start year (duration)</u></b> 2006 (Two Years)
<b><u>Objectives</u></b>	<p>Collect parasitoids of <i>Shivaphis celti</i> (Das) in Asia, and ship the moth to the UC Berkeley quarantine facility.</p> <p>In quarantine, screen collected parasitoids for hyperparasitoids and conduct host specificity tests to complete USDA and CDFA quarantine release permit process.</p> <p>Document seasonal population dynamics of <i>Shivaphis celti</i> at six sites in California to establish prerelease populations.</p> <p>Release parasitoids and continue monitoring <i>Shivaphis celti</i> populations as well as percent parasitism to document the effectiveness of biological control.</p>	
<b><u>Project Summary</u></b>	<p>The Asian hackberry woolly aphid (<i>Shivaphis celti</i> Das) was first discovered in California in summer 2002 and quickly spread throughout the state. Research previously funded by the program has examined efficacy of systemic insecticides as short-term controls, however, long-term sustainable controls are needed. This project proposes to carry out a classical biological control program for the aphid. Parasitoids previously described in the literature will be collected from Asia. Parasitoids collected will be screened for hyperparasitoids, and host specificity testing will be done at the UC Berkeley quarantine facility. Parasitoids will be released at sites in Fresno, Tulare and Davis, Calif., with populations of aphids, and later parasitoids, monitored bi-weekly throughout the project to document aphid populations before and after the release.</p>	
<b><u>Third-year progress</u></b>	<p>In 2008, aphid densities were generally similar to 2007, although densities were different between and within sites. Population trends do not appear to be predictable based on the previous year's densities.</p> <p>This project seeks to establish a colony of natural enemies of the Asian hackberry woolly aphid in quarantine and to provide researchers the necessary information so that releases of identified parasitoids, or predators, may eventually be made. The establishment of a successful biological control agent will provide long-term sustainable control of the aphid for municipalities, agencies, and landscape professionals at no cost to the end user.</p>	
<b><u>Second-year progress</u></b>	<p>The Asian hackberry woolly aphid (<i>Shivaphis celti</i> [Das]), is an invasive pest that was first detected in California in 2002, primarily on the commonly planted Chinese hackberry (<i>Celtis sinensis</i> Pers.). The aphid appears to be restricted to hackberry trees (<i>Celtis</i> spp.) and produces copious amounts of honeydew that makes it an intolerable pest in areas where the tree is used to shade parking lots and walkways.</p> <p>Lawson and Daane traveled to Nanjing, China on April 4 to 12, 2007 to search for</p>	

	<p>natural enemies of the aphid. Adult parasitoids, as well as parasitized aphids, were brought to the quarantine facility in Berkeley to be reared and screened for harmful hyperparasitoids.</p> <p>Unfortunately, the parasitoids did not reproduce in the quarantine, and a colony was not established in 2007. In June 2008, Baoping Li at the Nanjing Agricultural University in China shipped parasitized aphids to the quarantine in Berkeley. We are currently rearing this material, and we hope to establish a colony of parasitoids in summer 2008.</p> <p>In 2007 and 2008, three areas in the Central Valley of California were monitored for aphid populations, as well as any existing natural enemies. These areas are Woodland/Davis, Fresno, and Tulare/Lemoore. In each area, two plots with a minimum of five trees each have been monitored to determine prerelease populations. In 2007, aphid densities were generally higher in the spring and fall, however, some sites at Woodland and the Fresno State campus had high numbers of aphids in August.</p>
<p><a href="#"><u>First-year progress</u></a></p>	<p>The Asian hackberry woolly aphid, <i>Shivaphis celi</i>(Das), is an invasive pest that was first detected in California in mid-summer 2002, primarily on the commonly planted Chinese (Japanese) hackberry (<i>Celtis sinensis</i> Pers.). The aphid appears to be resitricated to hackberry trees (<i>Celtis spp.</i>) and produces copious amounts of honeydew that makes it an intolerable pest in residential and business districts where the tree is widely used to shade parking lots and walkways.</p> <p>This project seeks to collect natural enemies for the aphid in Asia, and complete the necessary screening and host specificity tests in quarantine with the eventual goal of establishing biological control for the aphid.</p> <p>Three areas in California's Central Valley have been identified and will be monitored for aphid populations, as well as any existing natural enemies. These areas are Davis, Fresno, and Hanford/Lemoore. In each area, two plots with a minimum of five trees each will be monitored to determine pre-release populations. These sites have been identified, and monitoring will begin in the first week of April 2007.</p> <p>Potted trees have been established with aphid populations at greenhouse facilities at California State University, Fresno, and will be transferred to the quarantine facility at UC Berkeley in the first week of April.</p> <p>Travel arrangements have been made, and Lawson and Daane will search for parasitized aphids in the area of Nanjing, China, April 4 through 12, 2007. All necessary import permits have been obtained.</p>