The Glassy-winged sharpshooter - a new threat for California citrus as a potential vector of CVC

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As a vector of the bacterial plant pathogen *Xylella fastidiosa*, the glassy-winged sharpshooter, *Homalodisca coagulata* Say (Homoptera: Cicadellidae), likely poses a significant threat to California's citrus industry. Introduced from the southeastern United States or northeastern Mexico around 1990, this insect was first observed as a novelty on eucalyptus windbreaks in Ventura County lemon orchards near Santa Paula. By 1992 this author observed adults on the stems of young lemon trees and in 1993 the first egg masses in lemon tree foliage were observed. Adults were collected in the early spring of 1994 and sent to Jerry Davidson, entomologist with the Santa Barbara County agricultural commissioner's office. Formal identification was made by Dr. Ray Gill, CDFA, confirming the establishment of *H. coagulata* in California for the first time.

The glassy-winged sharpshooter (GWSS) is a large insect (~0.5 inch) whose general color is brown to black when viewed from the side or above with a whitish underside. The upper aspect of the head and thorax are brown or black with numerous ivory to yellowish spots which distinguish this insect from its native southern California relative, smoke tree sharpshooter (*H. lacerta* Fowler), which has pale, wavy lines instead of the spots.

Since the early 1990's, the GWSS has proceeded to expand its numbers and range within southern California, and is now found in all southern California counties. During 1998 the GWSS was found in commercial citrus and grapes Kern County and by June of this year populations had been found in urban settings in Tulare and San Joaquin Counties.

The GWSS has rapidly gone from novelty status to being a very serious pest. Sharpshooters are xylem feeders, generally accessing the water conductive xylem tissue of their host plant through the stem or major leaf veins using their strong stylet-like piercing mouth parts. As xylem feeders, sharpshooters as a group can be effective vectors of bacterial plant pathogens, particularly the xylem-limited bacterium *Xylella fastidiosa.* More notable among the many leaf scorch-type diseases for which this bacterium is the causal organism are the recently discovered oleander leaf scorch in southern California, Pierce's disease of grapes, phoney peach disease, almond leaf scorch, and variegated chlorosis of citrus (CVC, Brazil). CVC is somewhat unique in that the symptoms are not a leaf scorching but a blotchy chlorosis, hence the name variegated chlorosis. Once injected by the sharpshooter vector into the host plant's xylem tissues, this bacterium multiplies. In several Xylella caused diseases, gums and gel-like materials produced within the xylem in response to the invading bacteria along with the multiplying bacteria themselves combine to block the water conductive xylem tissue. For CVC these gel-like materials have not been observed within the infected xylem tissues of citrus. This blockage initially causes a die-back of leaves and shoots distal to the point of infection. As the bacterial infection goes system within the infected host plant, the entire plant eventually collapses and dies within a year or two (grape vines) or longer for larger woody plants (citrus).

At present there are no known bacterial pathogens of citrus existing in California that could be vectored by the GWSS. However, a closely related sharpshooter species along with several other species of sharpshooter and spittle bugs have a twelve year history of vectoring the CVC strain of *X. fastidiosa* to citrus in Brazil, causing considerable damage and production loss. Currently CVC is managed by radical pruning of infected limbs and systemic insecticide use to reduce vector numbers. Citrus in Argentina, Uruguay, and Paraguay also suffers from this disease. If this South American CVC strain of *X. fastidiosa* is ever introduced into California, the host-vector-pathogen triangular relationship will be completed and California citrus will be in serious jeopardy.

Unlike California's native sharpshooter vectors associated with *X. fastidiosa* (blue-green, green, and red-headed), the GWSS is much larger, has greater dispersal tendencies and flies much further and in greater numbers into commercial agricultural plantings. It also has a much broader host range, allowing it to build much larger populations within diverse plantings such as agricultural/urban interface areas.

The current host list of the GWSS continues to expand and is currently more than 130 plant species (www.cdfa.ca.gov/pests/Glassy%20Winged%20Sharpshooter.html). In Ventura County the GWSS has been observed feeding on native plants such as laurel sumac, tree tobacco, sycamore, and oak. It also attacks numerous ornamental and crop hosts, including commercial tree crops like macadamia, apricot, peach, avocado and citrus. Adult GWSS can over-winter on common weed species such as malva (*Malva parviflora*) and sowthistle (*Sonchus oleraceus*). The GWSS excretes copious amounts of liquid during its feeding, and within infested citrus orchards, the tree canopies take on a whitewashed appearance by mid-summer due to the buildup of mineral salts left after the watery excretions have evaporated day after day for several months.

Until the late summer of 1998, no significant oviposition into citrus fruit rinds had been observed. During late summer 1998 harvests, several lemon orchards in Ventura County had notable levels of egg masses laid into the fruit rinds. One lemon orchard located between Santa Paula and Fillmore reported 8 percent of the fruit from a September harvest with GWSS egg mass scars noted on the packing line during fruit grading. Occasional old egg mass rind scarring of orange fruit has been observed, but no economic losses have been reported. All egg masses observed on harvested fruit have been old, non-viable masses that have either hatched or been killed by parasites.

High populations of this insect are possible within commercial citrus orchards. Breeding within citrus as evidenced by fresh egg masses can occur all year. However, most egg masses occur at specific times during the two distinct generations a year in southern California. After a peak in adult activity during the winter months, oviposition begins in late winter (although occasionally a few egg masses are laid in mid-winter following periods of warm weather), peaking in early May. Adults live several months. They prefer to lay their small, sausage-shaped eggs into the underside of newly expanded, younger leaves five to six inches from the cane terminals. Eggs are laid side-by-side in masses averaging 10 to 11 eggs each. These eggs are laid just under the lower leaf epidermis of host plants and look like greenish ribbed water blisters beneath the leaf. Nymphs hatch in about two weeks and proceed to feed into leaf petioles or small stems while they progress through four molts before becoming winged adults. A second peak in adult activity occurs in the summer during the months of June, July and August. Oviposition from these first generation adults begins in July and continues through

September. After the eggs have hatched, the old egg mass blister appears as a tan to brown scar. GWSS's preference for laying its eggs into young foliage makes young, heavily flushing cirrus trees especially vulnerable.

Only one biological control agent of any significance has been noted to date. A small egg parasite, *Gonatocerus ashmeadi* Girault (Hymenoptera: Mymaridae), attacks the GWSS egg masses. Three other *Gonatocerus* species have also been observed, *G. incomptu, G. novifasciatus*, and *G. morrilli*. Up until 1998 these latter three accounted for only about 5 percent of the observed egg parasitism. During the summers of 1999 and 2000 GWSS egg parasitism by *G. morrilli* increased considerably. Starting in the spring, egg parasite activity peaks in May, and again from July through early October, with the latter peak being the greatest when as much as 80-95% of the GWSS eggs can be parasitized. Parasitized eggs are evident by the small circular hole left by the emerged parasite at one end of the GWSS egg. Although parasitism rates have been quite high over the last several years, there have been ample numbers of over-wintering adult sharpshooters to produce problematic populations each following season.

If the GWSS becomes distributed throughout California's citrus production areas and the citrus variegarted chlorosis strain of *X. fastidiosa* is introduced into California, the glassy-winged sharpshooter may play a pivotal role in CVC's rapid spread throughout California citrus with potentially devastating results. Before GWSS becomes distributed throughout California, more work on the biology, management and biological control of this important vector is needed in California agriculture.

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