EVALUATION OF GLASSY-WINGED SHARPSHOOTER MORTALITY FOLLOWING EXPOSURE TO INSECTICIDES AND AGED INSECTICIDE RESIDUES

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Background

One of the cornerstones of glassy-winged sharpshooter (GWSS) management is the use of regionally-coordinated applications of insecticides to populations in citrus. These areawide treatment programs have been highly successful at reducing GWSS populations for nearly a decade, but have been losing some effectiveness in some regions over the past few years, possibly due to reliance on neonicotinoids (imidacloprid and acetamiprid) as primary control agents. This project was designed to provide assistance by evaluating alternative insecticides that have the potential to be incorporated into these areawide management programs. The project also evaluated insecticides that are used to control other pests, such as Fuller rose beetle and Asian citrus psyllid, to see if they might also impact GWSS. Acetamiprid, which is the primary GWSS treatment is not effective against Asian citrus psyllid. It would be ideal economically, environmentally and to minimize impacts on natural enemies to utilize a single insecticide application to control all three pests, when treatment timing coincides, rather than individual treatments for each.

Contact bioassay

During 2014 we conducted a trial to evaluate the effectiveness of insecticides sprayed directly onto adult GWSS. For this contact bioassay 336 GWSS were collected from an organic citrus orchard in Kern County on 24 Sept and were placed into 28 petri dishes that each contained twelve mixed-gender adults. Petri dishes were assigned randomly to one of the seven treatments and insects within those petri dishes were sprayed to light runoff with insecticides mixed to concentrations shown in Table 1 using a hand-held squirt bottle. After approximately 30 minutes in the petri dishes, GWSS were transferred to twenty-eight 5-gal paint strainer bags that were caged onto individual limbs of a lemon tree. Mortality of GWSS inside the bags was evaluated 1 DAT and 7 DAT. Data were analyzed by ANOVA with means separated by Fisher's Protected LSD ($P = 0.05$).

Data showed that there was 100% mortality of GWSS that were sprayed directly with Actara (thiamethoxam), Bexar (tolfenpyrad, not registered) and Sequoia (sulfoxaflor, not registered) (Fig. 1). This trial included the Actara rate typically used for control of Asian citrus psyllid (4 oz in 200 GPA of water) as well as the rate for Fuller rose beetle (5.5 oz in 500 GPA of water). The OMRI-certified organic insecticide Pyganic (pyrethrins) + oil provided moderate contact efficacy whereas Entrust (spinosyn) had no effect compared to the water check.

Residue studies

The effects of aged residues from insecticide treatments on GWSS mortality were evaluated in the fall of 2013 and 2014 using 35 potted citrus trees. Each year the trees were organized into a completely randomized design with 5 reps of 7 treatments (Table 1, 2). On 3 Oct 2013 and 24 Sep 2014 a squirt bottle was used to spray each tree with 160 ml (runoff) of an insecticide solution that was equivalent to the field rate concentrations shown in Table 1 and 2.

The effects of insecticide residues on GWSS mortality were evaluated at weekly intervals by caging adult GWSS onto the treated surfaces. Each week, we collected 350 to 420 adult GWSS from the field and placed them into thirty-five 5-gal paint strainer bags that each contained 10-12 adults. On the day of treatment the residues were allowed to dry for approximately one hour and then one bag containing GWSS was placed onto each of the 35 citrus trees. Mortality of GWSS within the bags was recorded 7 days later (1 WAT). This caging process was repeated on a weekly basis using newly collected GWSS each week for 4-5 weeks after application. Data were analyzed by ANOVA with means separated by Fisher's Protected LSD (P = 0.05).

During the 2013 study the most effective insecticide was Danitol that provided 94% mortality 1 WAT and 100% mortality thereafter (Table 1). Both concentrations of Actara consistently provided 93 to 98% mortality from 1-4 WAT. In week 5 the higher concentration of Actara (4 fl oz in 200 GPA) maintained control at 98% while the lower concentration of Actara (5.5 fl oz in 500 GPA) dropped off to 70%. Mortality in plots treated with Assail ranged from 83-98% during 1-4 WAT. Mortality due to Assail was significantly higher than the water check on all evaluation dates through 4 WAT, but less than the Danitol or Actara 4 oz treatments 2 WAT. Mortality of GWSS treated with Exirel ranged from 83-88% for weeks 1-4 and then declined. Mortality in plots treated with Pyganic + 0.5% 415° Oil was statistically equivalent to the water check on all evaluation dates.

During the 2014 study the most effective insecticide tested was Actara. Residues from the lower rate (but higher concentration of 4 oz in 200 gal) provided 96 to 100% mortality through 2 WAT whereas the higher rate (but lower concentration of 5.5 oz in 500 gal) provided 82 to 93% mortality. Residues of the 4 oz rate of Actara maintained a higher mortality (43% compared to 27%) through 3 WAT, but not thereafter. Two new insecticides Bexar and Sequoia (not registered) resulted in a moderate amount of GWSS mortality (28-88%) 1 and 2 WAT, but not thereafter. Residues from the organic products Pyganic + Oil and Entrust + Oil did not have any effect on GWSS mortality.

Conclusions

Results from these trials suggest that there is value incorporating Actara into GWSS areawide treatment programs at application rates already used by some citrus growers for control of Asian citrus psyllid or Fuller rose beetle. Data also suggest that the current use of acetamiprid (Assail) within treatment programs is justified and that two new products still in the process of being registered in CA containing tolfenpyrad (Bexar) and sulfoxaflor (Sequoia) are highly effective if they have direct contact with GWSS adults, but are less persistent than Actara if the GWSS land on residues on foliage. In addition to GWSS, research trials have shown that Bexar and Sequoia also have contact activity for citrus thrips, Asian citrus psyllid, katydids and citricola scale and when registered will be utilized for those pests in citrus. Greater persistence of the residues of the insecticides resulting in high mortality of GWSS was observed in 2013 (5 WAT) versus 2014 (2 WAT), however, control mortality was higher in 2013 (25-69%) compared to 2014 (12-33%). The 2014 data suggest that residues sufficient for killing GWSS persist for several weeks. A primary concern with areawide treatment programs continues to be organic citrus orchards. Our studies confirmed that PyGanic can control many of the adults of GWSS that it contacts directly, but that it provides a lower level of residual control compared to conventional insecticides. We were not able to identify any alternatives to PyGanic that would be as effective for use against GWSS in organic citrus.

Disclaimer: Discussion of research findings necessitates using trade names. This does not constitute product endorsement, nor does it suggest products not listed would not be suitable for use. Some research results included involve use of chemicals which are currently registered for use, or may involve use which would be considered out of label. These results are reported but are not a recommendation from the University of California for use. Consult the label and use it as the basis of all recommendations

Figure 1. The effects of direct exposure to insecticides on GWSS mortality 1 and 7 days after exposure

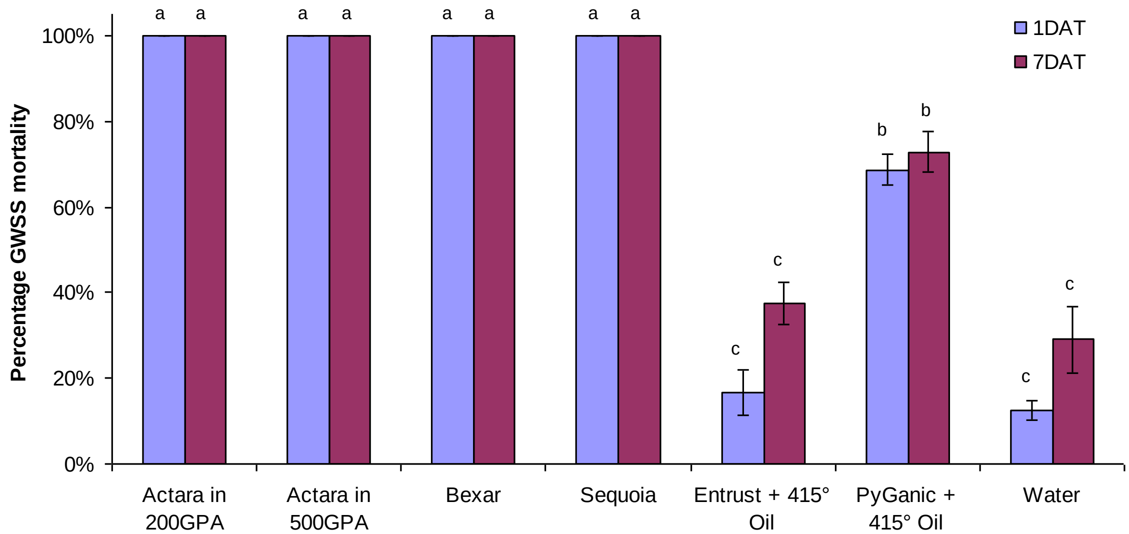

Table 1. The effects of insecticide residues on mortality of glassy-winged sharpshooter, 2013.

	Treatment	Concentration[2]	Mean GWSS mortality (%)[1] 1WAT	2WAT	3WAT	4WAT	5WAT
2013	Danitol 2.13EC	21.33 fl oz in 200 gal	94a	100a	100a	100a	100a
	Actara 25WG	4 oz in 200 gal	94a	98ab	96a	96ab	98a
	Actara 25WG	5.5 oz in 500 gal	96a	93abc	94a	96ab	70b
	Assail 30SG	4.5 oz in 200 gal	96a	83c	85a	98ab	77ab
	Exirel EC	16 fl oz in 200 gal	84a	83bc	85a	88b	56b
	PyGanic EC 5.0 II + 415 Oil	17 fl oz + 1 gal in 200 gal	46b	33d	47b	62c	
	Water	4.5 oz in 200 gal	47b	25d	39b	69c	57b
		F	23.57	36.38	12.47	13.18	5.49
		P	<0.0001	<0.0001	<0.0001	<0.0001	0.0016
2014	Actara 25WG	4 oz in 200 gal	100a	96a	43a	14	-
	Actara 25WG	5.5 oz in 500 gal	93a	82a	27b	16	-
	Bexar	27 fl oz in 200 gal	57c	28c	15b	16	-
	Sequoia	5.75 fl oz in 200 gal	88ab	48b	18b	16	-
	Entrust2SC + 415 Oil	10 fl oz + 1 gal in 200 gal	33d	18c	15b	16	-
	PyGanic EC 1.4 II + 415 Oil	64 fl oz + 1 gal in 200 gal	72bc	26c	20b	18	-
	Water	-	33d	12c	15b	12	-
		F	16.19	26.66	3.48	0.09	
		P	<0.0001	<0.0001	0.0108	0.9970	

Means in a column followed by the same letter are not significantly different (*P* > 0.05, Fisher's Protected LSD)

[1] Percentage mortality of GWSS exposed to pesticide residues for 7-day periods during the first, second, third, fourth or fifth weeks after treatment.

[2] Rate of formulated product per volume of water