Refereed Manuscript

Proc. Fla. State Hort. Soc. 123:109–112. 2010.

Ground Application of Foliar Insecticides to 'Valencia' Oranges for Control of *Diaphorina citri* Kuwayama (Hemiptera: Psyllidae)

Jawwad A. Qureshi*, Barry C. Kostyk, and Philip A. Stansly

University of Florida, IFAS, Southwest Florida Research and Eductaion Center, Immokalee, FL 34142

Additional index words. Asian citrus psyllid, *Citrus sinensis*, chemical control, huanglongbing, citrus greening disease

The Asian citrus psyllid *Diaphorina citri* Kuwayama is an economically important insect pest of citrus due primarily to its role as vector of *Candidatus* Liberibacter asiaticus, a bacterium that causes huanglongbing or citrus greening, a devastating disease of citrus. Insecticidal control is needed to reduce vector populations and slow the spread of huanglongbing. Therefore, foliar sprays of broad spectrum and selective insecticides, both with and without adjuvants, were evaluated against ACP in 14-year-old 'Valencia' orange trees during the growing season. Delegate WG, Requiem 25 EC, Micromite 80 WGS, Movento 240 SC, and Portal 0.4 EC applied with FL-435-66 spray oil, Movento 240 SC with Induce and 435 oil applied alone during bloom in March were all effective in reducing psyllid populations for up to two months compared to the untreated control. Orocit was less effective than 435 oil in enhancing the effectiveness of Micromite 80 WGS. The addition of 435 oil enhanced the effectiveness of Actara 25 WG in June and Movento 240 SC + 435 oil was not different from 435 oil alone. Treatments of Actara 25 WG + 435 oil, Agriflex + 435 oil, and Warrior 1SC + Actara 25 WG were all equally effective and reduced psyllid populations for up to 5 weeks. In an August experiment, Delegate WG + 435 oil or Induce and Kocide, Movento 240 SC + 435 oil, Requiem 25 EC + 435 oil or alone, Sil-Matrix and 435 oil alone all reduced psyllid adults for 2 to 3 weeks compared to the untreated control. Requiem 25 EC with 435 oil or alone, 435 oil alone, Sil-Matrix and Delegate WG + Induce were less effective than other treatments against nymphs. Danitol 2.4 EC, Warrior 1SC, Dimethoate 4 EC, Lorsban 4 E, and Imidan 70 W all applied alone in September provided effective psyllid control for up to 5 weeks. Treatment effects on adults were more pronounced and longer lasting than those seen on immatures, in part because of new flush growth. Consequently, the magnitude and duration of psyllid reduction did not compare with that observed applying foliar sprays during the dormant winter period when trees were not producing new growth upon which psyllids depend to mature eggs and for oviposition. Therefore, adults should be monitored regularly and targeted with insecticides at times when trees are not producing new growth.

Diaphorina citri Kuwayama (Hemiptera: Psyllidae), also known as the Asian citrus psyllid (ACP), is an economically important insect pest in many citrus-growing regions of the world, mainly due to its role as vector of the bacterium *Candidatus* Liberibacter asiaticus, causal organism of "huanglongbing" (HLB) or citrus greening disease (Halbert and Manjunath, 2004). HLB is one of the world's most devastating diseases of citrus, responsible for the decline and death of infected trees (Bové, 2006; Roistacher, 1996). First detection in Florida for ACP was 1998 and for HLB in 2005 (Halbert, 1998, 2005). Both pest and disease have now spread throughout the citrus growing region of the state (FDACS-DPI, 2008; Qureshi et al., 2009a).

The advent of HLB has greatly intensified insecticide use in Florida citrus (Rogers, 2008; Rogers et al., 2008). The systemic insecticides thiamethoxam and imidacloprid are allowed in Florida citrus but are subject to rate restrictions that limit their use to young trees (Qureshi et al., 2009b). Aldicarb has also been labeled for use in Florida citrus during the dry season from 15 Nov. through April, but effectiveness is sometimes compromised by lack of rain required for activation of the insecticide (Qureshi and Stansly, 2008). This product is being phased out and will not be available for use after 2011. Therefore, foliar applied insecticides are required to suppress *D. citri* in most Florida citrus and are continually tested in the field (Qureshi and Stansly, 2009a; Qureshi et al., 2009b). Field tests under different conditions are warranted to evaluate effectiveness against psyllids and provide growers with sufficient modes of action to effectively manage psyllids and reduce selection for resistance. The objective of our experiments was to evaluate the efficacy of foliar ground applications of insecticides with or without adjuvants against adults and immatures of ACP in mature citrus trees during spring, early and late summer.

Materials and Methods

Four separate experiments designed as randomized complete blocks were conducted during 2009 in the citrus orchard of Southwest Florida Research and Education Center (SWFREC) in Immokalee, FL. The experimental block consisted of 14-year-old *Citrus sinensis* (L.) Osbeck 'Valencia' orange trees planted on double-row raised beds at a density of 326 trees/hectare (132 trees/acre). Trees were irrigated by micro-sprinklers and subjected to conventional cultural practices (Jackson, 1999). Experiment 1 was conducted in blooming citrus with sufficient flush. Bed and swale

Acknowledgments. We are thankful to R. Riefer, T, Stansly, J. Mendez, and M. Triana for technical assistance. Funds were provided by Gowan Company, Valent USA Corporation, Bayer CropScience, Syngenta Crop Protection, Dow Agrosciences, Cheminova, AgraQuest, PQ Corporation, Helena Chemical, Du Pont de Nemours and Company, ORO Agri, Uniroyal Chemical Company, Drexel Chemical Company, and the Citrus Research and Development Foundation (CRDF).

*Corresponding author; phone: (239) 248-6836; email: jawwadq@ufl.edu

sides of the trees were pruned with a hand-held hedger prior to Experiments 2, 3, and 4 to induce new flush and encourage ACP infestation. Treatments were applied to both bed and swale sides of the trees using a Durand Wayland 3P-10C-32 air blast speed sprayer operating between 1400 and 1500 rpm with an array of five stainless steel T-Jet #5 nozzles per side delivering between 1122 and 1402 L/ha (120–150 gal/acre).

For the first experiment, 10 treatments and an untreated control were randomly distributed across four replicates in 21 rows that included a buffer row on either side of every treated row. Each replicate contained 11 five-tree treatment plots. Treatments were applied on 10 Mar. and evaluated at 3, 10, 17, 24, 31, 48, 58, and 64 d after treatment (DAT). Three central trees per plot were included in post-treatment evaluations. Ten to 12 shoots were tagged in each plot 1 d prior to treatment application. Ten randomly selected shoots per plot were collected and examined under a stereoscopic microscope in the laboratory to count ACP nymphs. Density of ACP adults was estimated from a "tap" sample made by counting the number falling on a 22 cm × 28 cm (8.5 inches × 11 inches) laminated white sheet held on a clipboard horizontally under randomly selected branches that were struck three times using a PVC pipe (Qureshi and Stansly, 2007; Qureshi et al., 2009a). Four such tap samples were conducted per tree. The second, third, and fourth experiments were conducted at different times, with nine, nine and eight treatments, respectively, and an untreated control randomly distributed across five-tree plots per treatment in each of four replicates covering 19 rows that included a buffer row on either side of every treated row. Treatments for the second experiment were applied on 24 June and evaluated at 2, 8, 15, 22, 29, and 36 DAT. Applications for the third experiment were made on 10 Aug. and evaluated at 3, 10, 17, and 24 DAT. For the fourth experiment, treatments were made on 21 Sept. and evaluated at 3, 10, 17, 24, and 31 DAT. Three randomly selected shoots per plot were examined under a stereoscopic microscope to estimate nymphal density in the second experiment and nine shoots per plot examined for the third and fourth experiments. Otherwise treatment application and evaluation procedures were as described above for Experiment 1.

The Shapiro Wilk W test and normality plots were used to test data for assumptions of parametric analysis using the Univariate procedure (SAS Institute, 2004). Data with normal distribution were subjected to ANOVA using the GLM procedure to evaluate treatment effects on ACP and treatment means separated using LSD contingent on a significant treatment effect ($P < 0.05$) (SAS Institute, 2004). Non-normal data were log transformed to reduce heterogeneity of variances. Data that could not be thus normalized were analyzed by using the non-parametric Kruskal–Wallis test.

Results and Discussion

Experiment 1

All treatments significantly reduced ACP nymphal density at 10 and 17 DAT compared to the untreated control, except for the low rate of Requiem alone at 10 DAT and both low and high rates at 17 DAT (Table 1). None of the treatments except Movento + 435 oil at 17 DAT were significantly better than 435 oil alone for control of nymphs.

Adult populations were not reduced by any treatments containing Requiem or Micromite at 10 DAT or thereafter except for Requiem + 435 oil at 24 and 48 DAT and Micromite + 435 oil at 48 DAT (Table 1). Fewest adults were seen from 10 to 24 DAT on trees treated with Portal + 435 oil, although not different from treatments with Movento, Delegate, or 435 oil alone. All treatments significantly reduced adult ACP compared to the untreated control at 24 DAT except Requiem alone and Micromite with Orocit or 435 oil. Requiem and Delegate both applied with 435 oil and Movento with Induce provided control for a month and a half, whereas Movento and Portal both applied with 435 oil provided adult control for about 2 months. No treatment at any time provided significantly better control than oil alone except Portal + 435 oil at 31 DAT and Movento + 435 oil at 48 DAT. Micromite + 435 oil provided significantly better control than Micromite + Orocit at 10 DAT and tended to be better at other dates. However, no differences were seen at any time between Movento with 435 Oil or with Induce. No treatments resulted in significantly fewer adults compared to the untreated control at 64 DAT.

Table 1. Mean number of *Diaphorina citri* nymphs per shoot and adults per tap sample in 14-year-old 'Valencia' orange trees untreated or treated with foliar sprays of insecticides on 10 Mar. 2009 at Southwest Florida Research and Education Center, Immokalee, FL.

Treatment/ formulation	Rate amt product/ acre or % v/v	ACP nymphs/shoot 10 DAT	ACP nymphs/shoot 17 DAT	ACP adults/tap sample/tree 3 DAT	10 DAT	17 DAT	24 DAT	31 DAT	48 DAT	58 DAT	64 DAT
Untreated control		2.88a	3.93b	0.42a	0.73bc	0.83a	1.25ab	1.79bc	1.65a	1.13ab	0.52bc
435 Oil	2%	0.25def	1.38cd	0.08bc	0.23def	0.44abc	0.40d	1.40ab	1.17abc	0.54bc	0.35bc
Delegate WG + 435 Oil	4 oz + 2%	0.00f	0.60de	0.02c	0.08ef	0.06c	0.52d	0.88bc	0.58cd	0.69bc	0.48bc
Requiem 25 EC	4 qt	1.35bc	5.48ab	0.15bc	1.46a	0.92a	1.04abc	1.81ab	1.77a	1.65a	1.06a
Requiem 25 EC	2 qt	1.55ab	7.30a	0.10bc	0.54bcd	1.06a	1.81a	2.75a	1.25a	0.85ab	0.69abc
Requiem + 435 Oil	2 qt + 2%	0.33def	1.28cd	0.02c	0.38cde	0.33abc	0.50cd	1.17bc	0.60cd	0.56bc	0.21c
Micromite 80 WGS + 435 Oil	6.25 oz + 2%	0.10def	0.93cde	0.23ab	0.38cde	0.21bc	0.69bcd	1.08bc	0.67bcd	0.96bc	0.42bc
Micromite 80 WGS + Orocit	6.25 oz + 64oz	0.88cd	3.05c	0.21b	0.81ab	0.83ab	1.27abcd	2.48ab	1.38ab	1.19ab	0.69ab
Movento 240SC + 435 Oil	10 oz + 2%	0.03ef	0.25e	0.15bc	0.13ef	0.21c	0.42d	0.75bc	0.29d	0.33c	0.42c
Movento 240SC + Induce	10 oz + 0.25%	0.50d	0.73de	0.08bc	0.19ef	0.19c	0.44d	0.85bc	0.60cd	0.52bc	0.33bc
Portal 0.4EC + 435 Oil	4 pts + 2%	0.80de	1.80cde	0.02c	0.02f	0.15c	0.33d	0.56c	0.56cd	0.33c	0.48bc

Means in a column followed by the same letter are not significantly different ($P > 0.05$).

Experiment 2

More nymphs but fewer adults were observed compared to Experiment 1. Significantly fewer ACP nymphs compared to untreated trees were observed on all treated trees through 22 DAT except for Movento + 435 oil, 435 oil alone and intermediate rate of Actara at 22 DAT (Table 2). No differences among sprayed treatments were seen at 2 and 8 DAT except that all were better than Movento + 435 oil or 435 oil alone which did not differ at 8 DAT. However, 435 oil alone performed better than Movento + 435 oil at 2 DAT. These two treatments also did not differ from each other at 15 and 22 DAT. All treatments compared to the untreated control reduced ACP adults at 36 DAT except for 435 oil at 29 and 36 DAT and the intermediate rate of Actara at 29 DAT (Table 2). The greatest reduction in nymphal and adult densities was observed with Warrior + Actara (both rates), Actara + 435 oil, and Agriflex + 435 oil.

Experiment 3

Significantly fewer ACP nymphs compared to the untreated control were observed on all treated trees through 17 DAT, although those receiving 435 oil alone, Delegate + Induce, or Requiem alone were not different at 17 DAT (Table 3). Only Movento + 435 oil, Delegate + 435 oil, and Delegate + Induce + Kocide provided better control of nymphs than 435 oil alone at 17 DAT. Adult numbers were again low and all treatments compared to the untreated control provided significant reduction in adult numbers except Requiem alone at 10 DAT, and 435 oil alone at 24 DAT when no adults were observed on trees sprayed with Movento or Delegate + 435 oil (Table 3). No differences were seen at any sample date among treatments including Delegate, regardless of adjuvants.

Experiment 4

All treatments significantly reduced ACP nymphs compared to untreated trees through 17 DAT, with no difference among treatments at 3 DAT (Table 4). Less reduction was seen with Danitol compared to other treatments at 10 DAT and with Lorsban and an experimental product at 17 DAT. Significant reduction in adult numbers from all treatments compared to the untreated control was observed through 31 DAT (Table 4). There were no differences among treatments except at 24 DAT when high rates of Warrior and Imidan resulted in fewer adults than Danitol.

The most effective treatments tested reduced psyllid populations for 1 to 2 months at best. Application of 435 oil alone provided significant reduction in psyllid populations, in many cases indistinguishable statistically from the most effective insecticides.

Table 2. Mean number of *Diaphorina citri* nymphs per shoot and adults per tap sample in 14-year-old 'Valencia' orange trees untreated or treated with foliar sprays of insecticides on 24 June 2009 at Southwest Florida Research and Education Center, Immokalee, FL.

Treatment/	Rate amt product/	ACP nymphs/shoot				ACP adults/tap sample/tree					
formulation	acre or % v/v	2 DAT	8 DAT	15 DAT	22 DAT	2 DAT	8 DAT	15 DAT	22 DAT	29 DAT	36 DAT
Untreated control		31.5a	16.65a	14.3a	17.90a	0.58a	0.77a	0.63a	0.85a	0.77a	0.55a
Movento 240SC + 435 Oil	10 oz + 2%	9.33b	1.13b	6.35bc	12.25a	0.33b	0.31bc	0.21bc	0.29bc	0.23bc	0.21bcd
435 Oil	2%	2.17c	0.80b	7.55b	7.65ab	0.21bc	0.35b	0.31b	0.42b	0.52a	0.38ab
Actara 25WG	5.5 oz	0.17d	0.23c	0.78e	5.58cd	0.07cd	0.10cd	0.06cd	0.13cd	0.13cd	0.17bcde
Actara 25WG + 435 Oil	5.5 oz + 2%	0.58d	0.00c	0.08e	1.43e	0.07cd	0.00d	0.00d	0.06cd	0.00d	0.02de
Actara 25WG	4 oz	0.17d	0.03c	3.60d	6.95abc	0.07cd	0.17bcd	0.19bcd	0.21bcd	0.40ab	0.25bc
Actara 25WG	2.75 oz	0.83d	0.08c	3.43cd	6.38bc	0.07cd	0.10cd	0.15bcd	0.21bcd	0.10cd	0.08cde
Agriflex + 435 Oil	8.5 oz + 2%	0.50d	0.03c	0.18e	0.88e	0.02d	0.06d	0.02d	0.02d	0.02d	0.00e
Warrior 1SC + Actara 25WG	2.875 oz + 4 oz	0.00d	0.00c	0.03e	1.98de	0.02d	0.00d	0.08bcd	0.04d	0.04cd	0.02de
Warrior 1SC + Actara 25WG	2.875 oz +5.5 oz	0.08d	0.00c	0.50e	0.78e	0.02d	0.00d	0.04cd	0.08cd	0.10cd	0.06cde

Means in a column followed by the same letter are not significantly different ($P > 0.05$).

Table 3. Mean number of *Diaphorina citri* nymphs per shoot and adults per tap sample in 14-year-old 'Valencia' orange trees untreated or treated with foliar sprays of insecticides on 10 Aug. 2009 at Southwest Florida Research and Education Center, Immokalee, FL.

Treatment/	Rate amt product/	ACP nymphs/shoot			ACP adults/tap sample/tree			
formulation	acre or % v/v	3 DAT	10 DAT	17 DAT	3 DAT	10 DAT	17 DAT	24 DAT
Untreated control		32.97a	25.92a	10.20a	0.60a	0.31a	1.65a	0.73a
435 Oil	2%	4.83bc	9.64b	8.08abc	0.25b	0.06c	0.23bc	0.64ab
Movento 240SC + 435 Oil	10 oz + 2%	2.64de	0.61c	0.64d	0.06bcd	0.00c	0.04c	0.00c
Delegate WG + 435 Oil	4oz	1.67de	0.31c	1.56d	0.02cd	0.02c	0.04c	0.00c
Delegate WG + 435 Oil + Kocide	4oz + 2% + 3lbs	1.72de	2.72c	3.48cd	0.04cd	0.02c	0.10bc	0.19bc
Delegate WG + Induce	4 oz	0.36e	2.92c	10.5ab	0.00d	0.00c	0.10bc	0.10c
Delegate WG + Induce + Kocide	4oz + 2% + 3lbs	4.25cd	0.50c	1.17d	0.04cd	0.02c	0.06c	0.23bc
Requiem 25EC	3 qts	8.47b	10.94b	10.92ab	0.13bcd	0.27ab	0.25bc	0.19bc
Requiem 25EC + 435 Oil	3 qts + 2%	6.44b	9.89b	4.14cd	0.19bc	0.08bc	0.12bc	0.23bc
Sil-Matrix	4 qts	9.36b	9.83b	5.03bc	0.17bcd	0.04c	0.52b	0.23bc

Means in a column followed by the same letter are not significantly different ($P > 0.05$).

Table 4. Mean number of *Diaphorina citri* nymphs per shoot and adults per tap sample in 14-year-old 'Valencia' orange trees untreated or treated with foliar sprays of insecticides on 21 Sept. 2009 at Southwest Florida Research and Education Center, Immokalee, FL.

Treatment/	Rate	ACP nymphs/shoot			ACP adults/tap sample/tree				
formulation	prod/acre	3 DAT	10 DAT	17 DAT	3 DAT	10 DAT	17 DAT	24 DAT	31 DAT
Untreated control		4.55a	12.04a	18.02a	0.19a	0.30a	0.34a	0.38a	0.30a
Danitol 2.4 EC	16 oz	0.28b	2.67b	1.14cd	0.00b	0.00b	0.02b	0.19b	0.08b
Warrior 1SC	1.44 oz	0.00b	0.06c	2.58cd	0.00b	0.00b	0.00b	0.17b	0.04b
Warrior 1SC	2.88 oz	0.00b	0.03c	0.00d	0.00b	0.04b	0.00b	0.00c	0.00b
Dimethoate 4EC	1 pint	0.58b	0.11c	0.22d	0.00b	0.00b	0.02b	0.02bc	0.02b
Lorsban 4E	5 pints	0.00b	0.75c	4.08b	0.00b	0.06ab	0.00b	0.10bc	0.04b
Imidan 70 W	1 lb	0.00b	0.08c	1.78cd	0.00b	0.04b	0.02b	0.06bc	0.10b
Imidan 70 W	1.5 lb	0.00b	0.00c	0.11d	0.00b	0.00b	0.00b	0.00c	0.00b
Experimental	6.6 oz	0.00b	0.50c	2.69bc	0.00b	0.08ab	0.02b	0.00c	0.02b

Means in a column followed by the same letter are not significantly different ($P > 0.05$).

As an adjuvant, 435 oil enhanced the effects of insecticides, particularly Delegate, Movento, Actara, Micromite, and Requiem. However, the impact of effective insecticides with or without adjuvants lasted longer than 435 oil applied alone. Nevertheless, frequent applications of oil during the growing season may be an option to reduce both psyllids and insecticide use, thus helping conserve some of the most effective biological control agents of citrus pests (McCoy, 1985; Qureshi and Stansly, 2009b; Stansly and Qureshi, 2008).

Treatment effects on adults were more marked and longer lasting than those seen on nymphs. This may be because eggs and young nymphs inside unexpanded leaves are inaccessible to most insecticides, and also that new shoots growing after the application are not protected. The magnitude and duration of reduction in psyllid populations observed in these experiments was much less than seen with foliar sprays made during dormant winter period that suppressed psyllids for up to 6 months (Qureshi and Stansly, 2010; Stansly et al., 2009a). During winter, mature citrus trees are dormant and do not produce new growth upon which the psyllid depends for reproduction. Thus, overwintering adult populations are in continual decline and vulnerable to foliar applications of insecticides. An analogous tactic of preemptive foliar sprays can be used during the growing season by targeting adult psyllids prior to anticipated new flush which otherwise would provide protection to immatures. Therefore, adult populations should be monitored regularly to determine the need for and impact of insecticide treatments (Stansly et al., 2009b).

Literature Cited

Bové, J.M. 2006. Huanglongbing: A destructive, newly-emerging, century-old disease of citrus. J. Plant Pathol. 88:7–37.

Florida Department of Agriculture and Consumer Services, Division of Plant Industries (FDACS-DPI). 2008. Huanglongbing (HLB)/citrus greening disease. Available from: http://www.doacs.state.fl.us/pi/chrp/greening/citrusgreening.html.

Halbert, S.E. 1998. Entomology section. Tri-ology (May–June 1998) 37:6–7.

Halbert, S.E. 2005. Pest alert: Citrus greening/huanglongbing. Florida Dept. of Agr. and Consumer Serv., Dept. of Plant Ind.

Halbert, S.E. and K.L. Manjunath. 2004. Asian citrus psyllids (Sternorrhyncha: Psyllidae) and greening disease of citrus: A literature review and assessment of risk in Florida. Florida Entomol. 87:330–353.

Jackson, L.K. 1999. Citrus growing in Florida. Univ. Florida Press, Gainesville. p. 408.

McCoy, C.W. 1985. Citrus: Current status of biological control in Florida, p. 481–499. In: M.A. Hoy and D.C. Herzog (eds.). Biological control in agricultural IPM systems. Academic, Orlando, FL.

Qureshi, J.A. and P.A. Stansly. 2007. Integrated approaches for managing the Asian citrus psyllid *Diaphorina citri* (Homoptera: Psyllidae) in Florida. In: Proc. Fla. State Hort. Soc., 3–4 June 2007. Palm Beach, FL, p. 110–115.

Qureshi, J.A. and P.A. Stansly. 2008. Rate, placement, and timing of aldicarb applications to control Asian citrus psyllid, *Diaphorina citri* Kuwayama (Hemiptera: Psyllidae), in oranges. Pest Mgt. Sci. 64:1159–1169.

Qureshi, J.A. and P.A. Stansly. 2009a. Insecticidal control of Asian citrus psyllid *Diaphorina citri* (Hemiptera: Psyllidae). Proc. Fla. State Hort. Soc. 122:172–175.

Qureshi, J.A. and P.A. Stansly. 2009b. Exclusion techniques reveal significant biotic mortality suffered by Asian citrus psyllid *Diaphorina citri* (Hemiptera: Psyllidae) populations in Florida citrus. Biol. Contr. 50:129–136.

Qureshi, J.A. and P.A. Stansly. 2010. Dormant season foliar sprays of broad-spectrum insecticides: An effective component of integrated management for *Diaphorina citri* (Hemiptera: Psyllidae) in citrus orchards. Crop Protection 29:860–866.

Qureshi, J.A., M.E. Rogers, D.G. Hall, and P.A. Stansly. 2009a. Incidence of invasive *Diaphorina citri* (Homoptera: Psyllidae) and its introduced parasitoid *Tamarixia radiata* (Hymenoptera: Eulophidae) in citrus groves of Florida. J. Econ. Entomol. 102:247–256.

Qureshi, J.A., B. Kostyk, and P.A. Stansly. 2009b. Control of *Diaphorina citri* (Hemiptera: Psyllidae) with foliar and soil applied insecticides. Proc. Fla. State Hort. Soc. 122:189–193.

Rogers, M.E. 2008. General pest management considerations. Citrus Ind. 89:12–17.

Rogers, M.E., P.A. Stansly, and L.L. Stelinski. 2008. Florida citrus pest management guide: Asian citrus psyllid and citrus leafminer. Entomol. Nematol. Dept., Fla. Coop. Ext. Serv., Inst. Food Agr. Sci., Univ. Fla., ENY-734. Available from: <http://edis.ifas.ufl.edu/IN686>.

Roistacher, C.N. 1996. The economics of living with citrus diseases: huanglongbing (greening) in Thailand. In: J.V. da Graça, P. Moreno, R.K. Yokomi (eds.). Proc. 13th Conf. Intl. Org. Citrus Virolog. (IOCV). University of California Press, Riverside, CA, p. 279–285.

SAS Institute. 2004. SAS for Windows, Version 9.1. SAS Inst., Cary, NC.

Stansly, P.A. and J.A. Qureshi. 2008. Controlling Asian citrus psyllid: Sparing biological control. Citrus Ind. 89:20–24.

Stansly, P.A., H. Arevalo, M. Zekri, and R. Hamel. 2009a. Cooperative dormant sprayprogram against Asian citrus psyllid in SW Florida. Citrus Ind. 90:14–15.

Stansly. P., J. Qureshi, and A. Arevalo. 2009b. Why, when and how to monitor and manage Asian citrus psyllid. Citrus Ind. 90:24,26,34.