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A comparison of sticky traps for monitoring Asian citrus psyllid (*Diaphorina citri* Kuwayama)

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ABSTRACT

Six types of sticky card traps differing in color and trapping adhesive were evaluated for monitoring Asian citrus psyllid in citrus in the United States (Florida and Texas). We coded the six traps as ASYellow, GLYellow, RWYellow, ASACP, ASGreen and MGGreen. The ASYellow, GLYellow and RWYellow traps were a bright yellow color to the human eye but the yellow color of these traps varied in intensity. To the human eye, the ASACP traps were a lime-green color, the MGGreen trap was a fluorescent yellow-green color, and the ASGreen trap was a green color. Spectral reflectance measurements were taken to categorize the color (wavelength) spectrum of each trap. Percent reflectance in the green and yellow wavelength regions was similar among the ASYellow, GLYellow, RWYellow and ASACP traps. Three of the six sticky traps (GLYellow, RWYellow and MGGreen) were treated with a traditional gluey adhesive material. The other three traps were treated with *No Mess Sticky Card*™ adhesive, a hot-melted, pressure-sensitive adhesive material. Trapping studies were conducted in Florida and Texas during April–May comparing four of the traps and during September–October comparing all six traps. Data collected during April–May indicated there were no significant differences in numbers of adults captured on ASGreen, ASYellow, ASACP and GLYellow traps. In seven comparisons of all six traps during September–October, the GLYellow and RWYellow traps each captured significantly fewer adults in one comparison, the MGGreen trap captured fewer adults in two comparisons, and the ASGreen trap captured fewer in three comparisons. There was no evidence that any one of the six traps would be best at detecting psyllids when adult populations are scarce. There was no significant difference between the two adhesive materials with respect to numbers of adults captured on traps.

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1. Introduction

The Asian citrus psyllid [*Diaphorina citri* Kuwayama (Hemiptera: Psyllidae)] is an important pest of citrus, primarily because it is a vector of *Candidatus* Liberibacter asiaticus (Gottwald et al., 2007). This and other species of *C.* Liberibacter are phloem-limited, non-culturable bacteria responsible for huanglongbing disease (also known as citrus greening or yellow shoot disease) (Halbert and Manjunath, 2004; Hung et al., 2004). Huanglongbing is considered to be one of the world's most serious diseases of citrus (Gottwald et al., 2007). Citrus trees infected by this devastating disease may only live for up to several years, during which time they decline in productivity and produce misshapen, inedible fruit (Bové, 2006). The geographic origin of *D. citri* is thought to be Southern Asia, but the psyllid has spread throughout Asia and into many countries around the world. Huanglongbing has subsequently been discovered in many of these areas. In the United States of America, *D. citri* was first found in the state of Florida during June 1998 (Tsai and Liu, 2000) and is now established throughout this state's citrus-growing region (Michaud, 2004). Huanglongbing was not found in Florida until late August 2005 (Bové, 2006). Subsequent surveys by the State of Florida and USDA-APHIS revealed the disease was already present in many residential areas and commercial citrus groves, especially in southern areas of the state. The psyllid was found in Texas during 2001 (French et al., 2001) but, by early 2010 when this report was prepared, huanglongbing had not yet been discovered in Texas.

Simple and efficient detection and sampling procedures for *D. citri* are vital to identifying geographical areas being invaded by the psyllid and for the development of successful IPM programs aimed at controlling the psyllid and huanglongbing. Growers can

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sample trees for psyllids to determine if psyllids are present and to evaluate psyllid management tactics. Some information is available on methods of monitoring population levels of *D. citri*. For example, citrus flush can be sampled to detect and count eggs, nymphs and adults (Hall and Albrigo, 2007; Sétamou et al., 2008). A stem-tap sampling method can be used to monitor adults in citrus (Hall and Hentz, 2010). Yellow sticky traps can also be used to detect and monitor infestations of adults in citrus (Hall and Hentz, 2010).

Yellow sticky card traps have been widely used to monitor adult *D. citri* (Aubert and Quilici, 1988; Aubert and Hua, 1990; Flores et al., 2009). Hall et al. (2007) reported that a bright yellow sticky trap (Great Lakes IPM, Vestaburg, MI) captured more adults than blue sticky traps. This particular yellow trap has been used to assess the seasonal phenology of adult *D. citri* (Hall et al., 2008) and investigated as an indicator of absolute densities of adults (Hall, 2009). A sampling protocol for estimating relative densities of adults using sticky traps was developed based on data obtained with this yellow trap (Hall and Hentz, 2010). However, many sticky traps of various yellow and green colors are available that have not been compared to this particular yellow trap. Some of these might be more attractive to adult *D. citri* than others, which could be valuable especially for detecting adults when populations are scarce.

A lime-green sticky trap marketed under the name ACP Trap was recently introduced by AlphaScents™ (Bridgeport, NY). In addition to being a different color, the ACP Trap adhesive material is different than the gluey adhesive traditionally used on sticky card traps. The ACP Trap is treated with *No Mess Sticky Card*™ adhesive, a new hot-melted, pressure-sensitive adhesive material. Yellow and green versions of the ACP trap are also available from AlphaScents. There are other sticky traps of slightly different shades of yellow and green that have not been evaluated for monitoring adult *D. citri*, for example a yellow corn rootworm trap and the MultiGuard fluorescent green rootworm trap (both available at Great Lakes IPM, Vestaburg, MI).

The objective of research presented here was to compare numbers of adult *D. citri* captured in citrus using the aforementioned six sticky traps. Of particular interest was whether one of the traps might be more effective than others for detecting the psyllid when adults are at low densities.

2. Materials and methods

2.1. Trap descriptions, color and percent reflectance

Six types of sticky traps differing in color and trapping adhesive were evaluated for monitoring *D. citri* in citrus (Table 1). The traps ranged from green to yellow in color to the human eye. The color of each of the traps was characterized by measuring the reflectance of the trap as described below. To the human eye, the ASGreen trap color was a medium green hue similar to Glidden 32GY 51/432 (Glidden Paint Co., Cleveland, OH). The ASACP trap color was a lime-green hue similar to Glidden 60YY 48/748. We did not find a good color match for the fluorescent yellow-green MGGreen trap, although it was somewhat similar to Behr DC4B-30-5 (Behr Process Corp., Santa Ana, CA). There were minor differences between the hues of the yellow traps. The ASYellow trap was a bright yellow hue similar to Behr 380B-7^{D}. The RWYellow trap was a bright yellow hue similar to Behr 370B-7^{D}. The GLYellow trap was a bright yellow hue similar to Behr S-G-390. This particular trap was the smallest, 7.62 × 12.7 cm in size with 7.6 × 12.1 cm sticky surface on each side. For the studies presented here, all of the traps were cut so that they were the same size as the GLYellow trap, 7.6 × 12.1 cm sticky surface on each side. The RWYellow and MGGreen traps were large traps sticky on only one side. Therefore, we cut these traps into three 7.6 × 12.1 strips and folded each strip in half (sticky surface exposed on each side) yielding a trap the same size as the GLYellow. Each folded strip was stapled to keep it from unfolding.

Spectral reflectance of the test traps was measured using a USB UV–VIS S2000 spectrometer with a DT-1000-MINI tungsten light source (Ocean Optics, Dunedin, FL). Percent reflectance was determined for one trap of each type in comparison to a white Spectralon standard provided by Ocean Optics. Reflectance was restricted to 350–650 nm, as this is the spectral sensitivity range reported for most insects (Menzel, 1979). Color (wavelength) was categorized according to Bohren and Clothiaux (2006): violet (400–450 nm), blue (450–490 nm), green (490–560 nm), yellow (560–590 nm), orange (590–635 nm) and red (635–700 nm).

2.2. Field studies

Two trapping studies were conducted in Florida and three were conducted in Texas to compare numbers of adult *D. citri* captured on the sticky traps. The studies were similar in trapping procedures. The double-sided sticky traps were suspended 1–1.5 m above ground near the outside of a tree canopy from a branch using a twist tie (18 cm long, #91734L3, Consolidated Plastics Company, Stow, OH). A hole was placed near the center of the upper edge of each trap in order to hang the traps. When traps were retrieved, they were placed in re-closable plastic bags (20 × 20 cm, accepted two traps per bag) (#90051L3, Consolidated Plastics Company, Inc., Stow, OH). No insecticides were applied to any of the trees sampled for at least eight weeks prior to sampling, and none were applied during any study. For each week of each study, each type of trap was randomly assigned to a tree along a row (with a tree without a trap between each tree with a trap). Traps were similarly deployed along each of six rows (replicates) within each grove. Traps were deployed and retrieved one week later.

2.2.1. Florida study 1 – April and May 2009

Four types of sticky traps were compared: ASYellow, ASACP, ASGreen and GLYellow. Three blocks of citrus were selected for evaluations, two blocks of 'Valencia' sweet orange trees (*Citrus sinensis* (L.) Osbeck) and one block of mature (>15-year-old) 'Marsh' grapefruit trees (*Citrus paradisi* Macf.). One of the 'Valencia'

Table 1
Sticky card traps studied for monitoring adult Asian citrus psyllid.

Trap code	Source	Adhesive material	Original trap dimensions (cm)	Base color	Peak wave length (nm)	Sticky sides	Price per trap (US$)[a]
GLYellow	Great Lakes IPM	Traditional	8 × 13	Yellow	547	Two	0.25
ASYellow	AlphaScents	*No Mess Sticky Card*™	14 × 20	Yellow	545	Two	1.20
ASACP	AlphaScents	*No Mess Sticky Card*™	14 × 20	Lime-green	538	Two	1.20
ASGreen	AlphaScents	*No Mess Sticky Card*™	8 × 13	Green	518	Two	0.80
RWYellow	Great Lakes IPM	Traditional	23 × 28	Yellow	618	One[b]	1.24
MGgreen	GreatLakes IPM	Traditional	23 × 28	Lime-green	521	One[b]	1.24

[a] Prices as of fall 2009.
[b] The MGYellow and MGGreen commercial traps in practice are folded for collecting corn rootworms, yielding a two-sided sticky trap 14 × 23 cm in size.

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blocks contained mature (>15 years old) trees and one contained young (5-year-old) trees. A total of eight weeks of trapping data was obtained.

2.2.2. Florida study 2 – September and October 2009

All six types of sticky traps were compared. The same three Florida citrus blocks described above were selected for the study. A total of six weeks of trapping data was obtained.

2.2.3. Texas study 1 – April and May 2009

Four types of sticky traps were compared: ASYellow, ASACP, ASGreen and GLYellow. Three blocks of citrus were selected for evaluations of the traps, a block of 'Valencia' orange, a block of 'Marrs' sweet orange, and a block of 'Rio Red' grapefruit. All of the blocks contained mature citrus. A total of six weeks of trapping data was obtained.

2.2.4. Texas study 2 – September 2009

Four types of sticky traps were compared (ASYellow, ASACP, ASGreen and GLYellow) in two Texas citrus blocks, one block of mature 'Valencia' orange and one block of mature 'Rio Red' grapefruit. A total of three weeks of trapping data was obtained.

2.2.5. Texas study 3 – October 2009

All six types of sticky traps were compared in two different blocks of citrus, one block of mature 'Valencia' orange and one block of 6-year-old 'Rio Red' grapefruit. A total of five weeks of trapping data was obtained.

2.3. Statistical analyses

For each study, log-transformed data on number of adult *D. citri* per trap per week were analyzed using a multi-observational (measurements over time) *F*-protected analysis of variance (PROC ANOVA, SAS Institute, 2008), and Fisher's LSD test was used to determine significant differences ($P = 0.05$) among trap types. Correlation analyses (Pearson's correlation coefficient) were conducted to determine if there were significant relationships between numbers of adults trapped and color (percent reflectance as determined above for one of each trap type) with respect to (1) the six color regions (violet, blue, green, yellow, orange and red) and (2) wavelength ratios among the three primary colors (red to blue, yellow to red, and yellow to blue) using PROC CORR (SAS Institute, 2008) (analyses on log-transformed counts of adults). For each correlation analysis there was a total of 2232 potential data pairs (a count of adults on a trap paired with the specific color variable associated with a trap).

3. Results

3.1. Trap color and percent reflectance

The spectrum of reflectance across wavelengths of 350–650 nm for each trap is presented in Fig. 1. In the green range of 490–560 nm, the spectral patterns for all traps indicated an average relative intensity of reflectance of 55–70% with the exception of the very high reading for the MGGreen trap (118%) (Fig. 2). In the yellow range of 560–590 nm, ASGreen had the lowest average relative intensity (41%); three of the traps were intermediate (61–78%) (ASYellow, ASACP, and GLYellow); and the MGGreen and RWYellow traps had the highest yellow intensity (86–93%). Percent reflection was greater within the green than yellow spectra for both MGGreen and ASGreen while the reverse was true for all other traps. Percent reflectance within the orange (590–635 nm) and red (635–700 nm) regions was similar to

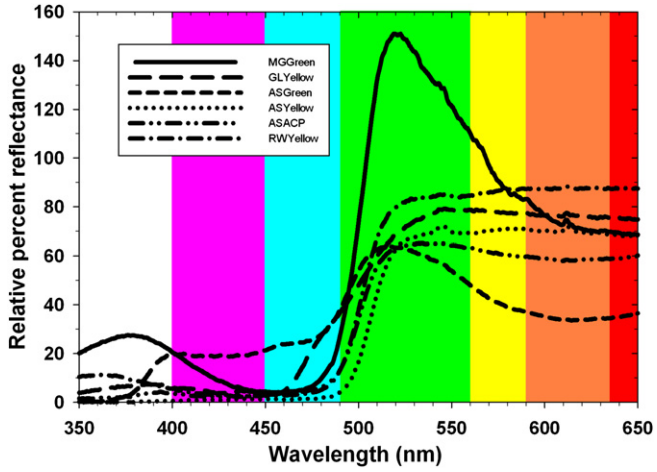

Fig. 1. Percent reflectance of the sticky card traps across different wavelengths. The background of the figure is color-coded to indicate average wavelength hue.

percent reflectance of yellow for all traps except ASGreen and especially MGGreen, which had lower reflectance in the orange and yellow regions. Reflectance in the violet (400–450 nm) and especially the blue (450–490 nm) spectra of wavelengths was greater for the ASGreen, GLYellow and MGGreen traps than the other traps.

Numbers of adults captured on traps were weakly but positively correlated with percent reflectance in the yellow ($r = 0.04$, $P = 0.04$), orange ($r = 0.06$, $P = 0.004$) and red ($r = 0.06$, $P = 0.003$) color regions, and weakly but negatively correlated with reflectance in the blue region ($r = -0.09$, $P = <0.0001$) ($n = 2227$ for each correlation analysis, down from 2232 potential observations because five traps were found to be missing during the studies). Stronger positive and negative correlations for these wavelength regions were observed during some individual studies. Over all data, weak positive correlations were found between number of adults captured and primary color region ratios of red to blue ($r = 0.07$, $P = 0.001$) and yellow to blue ($r = 0.07$, $P = 0.001$) ($n = 2227$ for each analysis) – stronger positive correlations were observed in some individual studies. Also over all data, a weak negative correlation was found between number of adults and the ratio of yellow to red ($r = -0.06$, $P = 0.009$, $n = 2227$) – stronger negative correlations between these variables were observed in some individual studies.

3.2. Field studies

3.2.1. Florida study 1 – April and May 2009

Low numbers of adult *D. citri* were captured on traps in the mature block of 'Marsh' grapefruit trees and moderate numbers were collected in the block of mature 'Valencia' oranges. Large numbers of adults were captured on traps in the young 'Valencia' trees. There were no significant differences among the four types of traps with respect to mean number of adult *D. citri* captured per trap per week (Table 2). ANOVA results: for the mature 'Valencia' orange trees $F_{3,15} = 0.71$, $\Pr > F = 0.54$; for the mature grapefruit trees $F_{3,15} = 2.38$, $\Pr > F = 0.07$; and for the young 'Valencia' trees $F_{3,15} = 2.35$, $\Pr > F = 0.07$.

3.2.2. Florida study 2 – September and October 2009

Low numbers of adults were captured on traps in the mature 'Marsh' grapefruit trees, moderate numbers were captured on traps in the mature 'Valencia' trees, and large numbers were collected in the young 'Valencia' orange trees. There were no significant

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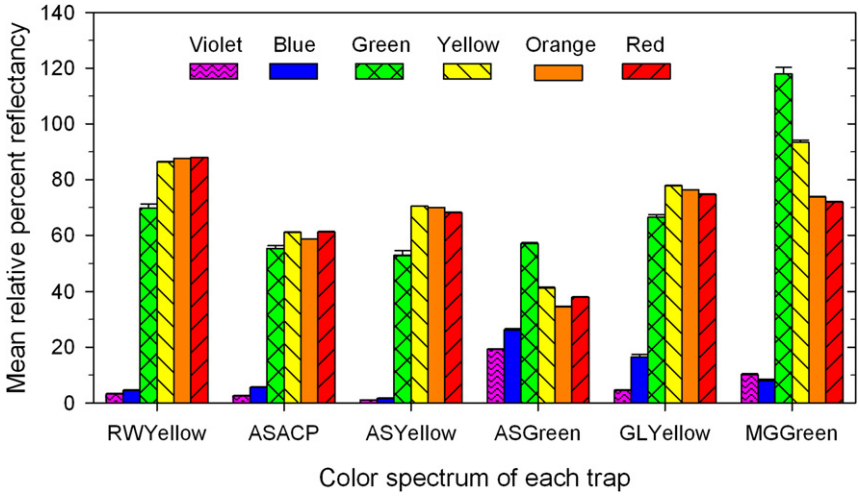

Fig. 2. Mean percent reflectance of the sticky card traps within each of six color categories.

differences among the six types of traps with respect to mean number of adult *D. citri* captured per trap per week in the mature orange or grapefruit trees (Table 2). In the young 'Valencia' trees, the ASGreen, RWYellow and MGGreen traps captured significantly fewer adults than the ASACP and GLYellow traps. There were no significant differences in numbers of adults captured on the following traps, which captured the largest numbers of adults: ASYellow, ASACP and GLYellow traps. ANOVA results: for the mature 'Valencia' orange trees $F_{5,25} = 2.13$, Pr $> F = 0.06$; for the mature grapefruit trees $F_{5,25} = 2.08$, Pr $> F = 0.07$; and for the young 'Valencia' trees $F_{5,25} = 2.29$, Pr $> F = 0.05$.

3.2.3. Texas study 1 – April and May 2009

Low numbers of adult *D. citri* were captured on traps in the mature 'Rio Red' grapefruit trees and moderate numbers were captured in the two blocks of mature orange trees. No significant differences were found among the four traps with respect to numbers of adults captured (Table 3). ANOVA results: for the mature 'Valencia' orange trees $F_{3,15} = 1.04$, Pr $> F = 0.38$; for the mature grapefruit trees $F_{3,15} = 1.28$, Pr $> F = 0.29$; and for 'Marrs' orange trees $F_{3,15} = 0.96$, Pr $> F = 0.41$.

Table 2
Mean (SEM) number adult Asian citrus psyllids captured per week on different sticky card traps deployed in citrus in Florida. All traps measured 7.6 × 12.1 cm and were sticky on both sides.

Trap	Mature 'Valencia' orange	Mature 'Marsh' grapefruit	Young 'Valencia' orange
Study 1 – April/May 2009			
ASYellow	2.4 (0.4)a	1.3 (0.3)a	22.8 (3.6)a
ASACP	3.6 (1.2)a	1.2 (0.3)a	30.1 (5.2)a
GLYellow	2.3 (0.5)a	1.4 (0.2)a	9.9 (2.8)a
ASGreen	2.3 (0.7)a	0.9 (0.3)a	19.0 (5.3)a
Study 2 – September/October 2009			
ASYellow	2.6 (0.6)a	1.0 (0.3)a	13.5 (2.2)ab
ASACP	2.3 (0.4)a	0.5 (0.1)a	16.8 (4.0)a
GLYellow	1.4 (0.3)a	0.2 (0.1)a	12.5 (1.9)a
ASGreen	1.1 (0.3)a	0.3 (0.1)a	7.8 (1.5)c
RWYellow	2.4 (0.6)a	0.5 (0.2)a	8.4 (1.4)bc
MGGreen	1.9 (0.4)a	0.5 (0.2)a	11.4 (2.6)c

For each study, means in the same column followed by the same letter are not significantly different ($P \leq 0.05$), *F*-protected ANOVA Fisher's LSD test. Analyses on log-transformed data, untransformed means presented.

3.2.4. Texas study 2 – September 2009

Very few adult *D. citri* were captured in either of the study blocks, and there were no significant differences in numbers captured among the six traps (Table 3). ANOVA results: for the mature 'Valencia' orange trees $F_{5,25} = 0.49$, Pr $> F = 0.79$; and for the mature grapefruit trees $F_{5,25} = 0.35$, Pr $> F = 0.88$.

3.2.5. Texas study 3 – October 2009

Relatively larger numbers of adult *D. citri* were captured in each block studied compared to the previous two Texas studies (Table 3). Significantly fewer adults were captured on ASGreen traps than on the ASACP and GLYellow traps in the block of mature 'Valencia' trees. In the block of six-year-old 'Rio Red' grapefruit trees, ASYellow traps captured significantly greater numbers of adults than the GLYellow, ASGreen and MGGreen traps. In these trees there were no significant differences in numbers of adults captured on ASYellow,

Table 3
Mean (SEM) number adult Asian citrus psyllids captured per week on different sticky card traps deployed in citrus in Texas. All traps measured 7.6 × 12.1 cm and were sticky on both sides.[a]

Trap	'Valencia' orange	'Rio Red' grapefruit	'Marrs' orange
Study 1 – April/May 2009			
ASYellow	5.1 (1.4)a	0.3 (0.1)a	2.1 (0.6)a
ASACP	3.4 (0.9)a	0.4 (0.1)a	1.8 (0.4)a
GLYellow	3.2 (0.7)a	0.2 (0.1)a	0.9 (0.2)a
ASGreen	2.1 (0.5)a	0.4 (0.1)a	0.9 (0.2)a
Study 2 – September 2009			
ASYellow	0.2 (0.1)a	0.0 (0.0)a	–
ASACP	0.1 (0.1)a	0.1 (0.1)a	–
GLYellow	0.2 (0.1)a	0.1 (0.1)a	–
ASGreen	0.1 (0.1)a	0.1 (0.1)a	–
RWYellow	0.2 (0.2)a	0.2 (0.2)a	–
MGGreen	0.1 (0.1)a	0.0 (0.0)a	–
Study 3 – October 2009			
ASYellow	5.8 (0.9)ab	5.4 (0.7)a	–
ASACP	8.4 (1.2)a	4.0 (0.8)ab	–
GLYellow	10.9 (1.6)a	1.5 (0.3)c	–
ASGreen	3.1 (0.4)b	1.7 (0.3)bc	–
RWYellow	9.0 (1.5)ab	4.2 (1.1)abc	–
MGGreen	5.5 (0.6)ab	3.6 (0.9)bc	–

For each study, means in the same column followed by the same letter are not significantly different ($P \leq 0.05$), *F*-protected ANOVA Fisher's LSD test. Analyses on log-transformed data, untransformed means presented.

[a] All mature trees except Study 3 'Rio Red' trees were moderately young (six years old).

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ASACP and RWYellow traps. ANOVA results: for the mature 'Valencia' orange trees $F_{5,25} = 12.13$, $Pr > F = <0.0001$; and for the mature grapefruit trees $F_{5,25} = 8.61$, $Pr > F = <0.0001$.

4. Discussion

No significant differences were observed in numbers of adult *D. citri* captured on ASACP, ASYellow, GLYellow and ASGreen traps in either Florida or Texas during the April and May studies. Among seven studies of all six-trap types made during September–October, in four studies no significant differences among traps were observed in numbers of adults captured. Adult densities were low in each of these four studies. Significant differences among the six traps in numbers of adults captured were observed in one study in Florida and two studies in Texas. Adult densities were relatively large in these three studies. The GLYellow and RWYellow traps each captured significantly fewer adults in one study, the MGGreen trap captured fewer adults in two studies, and the ASGreen trap captured fewer adults in three studies.

Numbers of adults captured on traps generally increased as trap reflectance increased in the yellow, orange and red wavelength regions but decreased as reflectance increased in the blue wavelength region. Among the primary colors, numbers of adults captured generally increased as ratios of red or yellow to blue increased but decreased as the ratio of yellow to red increased. The ASYellow and ASACP traps consistently captured the highest number of adults during the September and October studies, and for each of these traps percent reflectance in the yellow wavelength region was greater than reflectance in the green region. However, the GLYellow trap also had greater reflectance in the yellow than green region –inconsistencies in numbers of adults captured at this trap during September and October may have been a consequence of this trap having higher reflectance in the blue region than the ASYellow and ASACP traps. Blue traps were previously shown to capture fewer adult *D. citri* than yellow traps (Hall et al., 2007). The ASGreen and MGGreen traps sometimes caught fewer numbers of adults, and for each of these two traps reflectance in the green region was greater than reflectance in the yellow region. Additionally, reflectance in the blue region was greater for the ASGreen trap and, to a lesser extent the MGGreen trap, which may have negatively influenced captures of adults. Quilici and Trahais (1990) identified yellow and green as more attractive to psyllids than orange or red. However, our data indicate that having some red and orange in the color spectrum of a trap enhances numbers of adults captured. Yellow is apparently the most important color only to the human eye (the ACYellow, ACACP and RWYellow traps are each yellow to the human eye with no hint of orange or red). There was no evidence that captures of adults were influenced by adhesive material, as no consistent differences were found among numbers of adults captured on ASYellow, ASACP, GLYellow and RWYellow traps.

The biology of *D. citri* is closely related to young flush leaves of its host plants, as young flush is required for both oviposition and nymph development (Husain and Nath, 1927). Patt and Sétamou (2010) reported that adult *D. citri* are attracted to volatiles associated with young flush leaves. If there is also a visual component involved in adults finding flush, investigations into the color spectrum of flush could be fruitful in identifying a specific trap color that would be most attractive to adult *D. citri*.

In light of the research results pertaining to the GLYellow trap, the attractiveness of a particular trap color spectrum to adult *D. citri* may be inconsistent over time. Attractiveness could change depending on time of year (perhaps depending on direction and intensity of sunlight and its interaction with trap color). Seasonal changes in the background color of trees in which traps are deployed might also affect the attractiveness of a particular trap color, rendering it more difficult or easier for psyllids to see a trap – tree color can vary depending on numbers of young and old leaves and the overall density of leaves in a canopy.

Of interest would be a trap that captures more adult *D. citri* than other traps when population levels of the psyllid are low. Such a trap would be useful in situations where monitoring is conducted to determine if psyllids are present, particularly in areas where the psyllid may be close to invading. There was no evidence during these studies that any one of the six traps as modified for size would be best at detecting psyllids when adult populations are low. Whether larger traps might be more effective for catching adult *D. citri* than smaller traps remains to be investigated.

As a side note to these studies, empirical observations and at least one published report (Sétamou et al., 2008) indicate that population levels of *D. citri* are generally lower in mature grapefruit trees than mature sweet orange trees. Coincidentally, the blocks of mature 'Valencia' orange and 'Marsh' grapefruit trees studied in Florida were adjacent to each other, of the same age, and subjected to the same tree management program. *D. citri* trapping data from these blocks supported that populations of *D. citri* are lower in mature grapefruit trees. In contrast, Tsai and Liu (2000) reported that *D. citri* laid greater numbers of eggs and exhibited significantly higher reproductive rates on young potted grapefruit than on three other host plants: orange jasmine [*Murraya paniculata* (L.) Jack], sour orange (*Citrus aurantium* L.) and rough lemon (*Citrus jambhiri* Lush). Perhaps grapefruit becomes a less favorable host for *D. citri* as trees mature.

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