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DEVELOPMENT OF THRIPS TRAPS FOR *FRANKLINIELLA OCCIDENTALIS* AND *SCIRTOTHRIPS DORSALIS*

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ABSTRACT: Studies were conducted to develop thrips traps for detecting and identifying *Scirtothrips dorsalis* (Hood). Traps were developed in Arizona where *Frankliniella occidentalis* (Pergande) are established in the field, and they were tested in southern Taiwan where *S. dorsalis* thrips are found. Addition of a one square centimeter of dichlorvos (Vapona®) pest strip as a killing agent in CC traps increased the catches of western flower thrips 5-fold as compared to standard CC traps. The increased thrips catches are attributed to increased mortality and retention of thrips that entered the traps as opposed to increased attractiveness of the trap. Average CC trap catches in Taiwan were 0.07 *S. dorsalis* per CC trap per week.

KEY WORDS: chilli thrips, western flower thrips, CC trap sticky traps, dichlorvos.

RÉSUMÉ: Des études furent conduites afin de développer un piège qui permet de détecter et d'identifier le thrips *Scirtothrips dorsalis* (Hood). Le piège fut développé en Arizona où le thrips *Frankliniella occidentalis* (Pergande) est établi et testé dans le sud de Taiwan où *S. dorsalis* se trouve. L'ajout d'un centimètre carré de l'agent insecticide dichlorvos (Vapona®) au piège CC a permis d'attraper un plus grand nombre de thrips 5X comparé au piège standard. Cette augmentation est attribuée à un plus haut taux de mortalité et rétention des individus qui entrent dans le piège plutôt qu'à une attirance accrue. Le nombre hebdomadaire moyen de *S. dorsalis* attrappé par le piège CC à Taiwan était de 0.07.

INTRODUCTION

The objective of the study was to develop thrips traps that would be utilized by USDA-APHIS and Ministries of Agriculture in the Caribbean for detection and monitoring efforts for *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae). *S. dorsalis* is a new invasive thrips species to the Western Hemisphere, recently detected in the Caribbean region (Skarlinsky 2003, Ciomperlik and Seal 2004). During the course of developing whitefly traps in 1996-97 we found that the trap, named the CC trap, also caught *S. dorsalis* when the trap base color was white, yellow or green (Chu et al. 2000). We report here six of 14 experiments in which we tested the efficacy of traps in Arizona where *Frankliniella occidentalis* (Pergande) thrips were established in the field and tests in southern Taiwan where *S. dorsalis thrips* were found.

MATERIALS AND METHODS

The experiments were conducted using a randomized complete block design with 4-10 replicates in *F. occidentalis* infested field crops in Arizona in 2004. The experiments were: 1) blue and yellow sticky card traps in broccoli, 2) blue sticky card traps in cotton, 3) three different

trap base colors of CC trap in alfalfa, 4) thrips capture sites on individual CC trap parts using a blue trap base (Figure 1), 5) CC traps with dichlorvos (Vapona®) modification in alfalfa, and 6) Vapona® dispensers with a blue stripe modification in alfalfa. Subsequently the developed traps were tested in a factorial randomized complete block experiment with 15 replicates for their trapping efficacy for *S. dorsalis* in a lemon grove in Taiwan in 2004-05 (Figure 2).

Data were analyzed by season by ANOVA (Anonymous 1989) using Tukey's HSD for mean separations for the comparison of three trap base color CC traps and orthogonal comparison for the Blue-D vs. CC traps comparison.

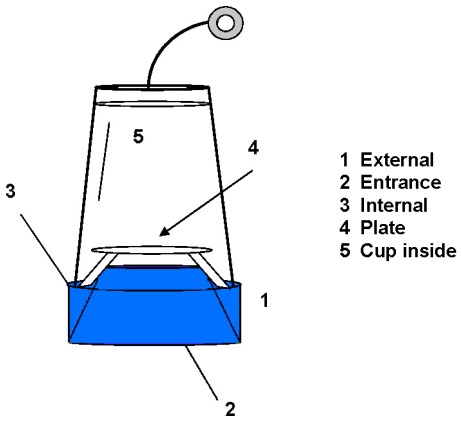

Fig. 1. CC trap with blue trap base. Numbers indicate different trap base surfaces.

RESULTS AND DISCUSSION

Blue sticky card traps caught more *F. occidentalis* as compared to yellow (Table 1). More *F. occidentalis* were caught on the 458 nm blue color cards than the 444 nm and 446 nm blue colors (Table 2). White and blue trap base CC traps caught more *F. occidentalis* than the yellow (Table 3). Over 80% of the *F. occidentalis* attracted by the blue colored CC trap base stayed on the external base surface (Table 4). Inclusion of the one square centimeter Vapona® strip in the CC traps increased the catches of *F. occidentalis* by 5 fold (Table 5). The Vapona® dispenser modified with blue stripes caught more *F. occidentalis* than CC traps with the Vapona® cube and the non-modified Vapona® disperser (Table 6).

Fig. 2. Vapona® dispenser modification with blue stripe and sample collecting bag placed in the upper canopy of a lemon tree in Neipu, Pingtung County, Taiwan.

Table 1. Seasonal mean numbers of *Frankliniella occidentalis* (Pergrande) caught on blue and yellow sticky card traps in a broccoli field, Maricopa, AZ 2004.

Sticky trap color	Spectrum reflectance	No. of thrips/193 cm^2/wk
Blue 458 nm	167.5 a	
Yellow	560 nm	69.0 b

[a] Means not followed by the same letter are significantly different by t – test, $P = 0.05$.

Table 2. Mean numbers of *Frankliniella occidentalis* (Pergrande) caught on blue sticky card traps with different peak wavelengths in a cotton field, Maricopa, AZ 2004.

Peak	No. thrips/200 cm^2 blue sticky card trap/wk				
wavelength	1st	2nd	3rd	4th	Mean
444 nm	53 b[a]	63 b	31 c	15 b	40 c
446 nm	616 a	190 b	157 b	126 b	272 b
458 nm	369 b	499 a	286 a	533 a	422 a

[a] Means not followed by the same letter are significantly different by Tukey's HSD, $P = 0.05$.

Table 3. Mean numbers of *Frankliniella occidentalis* (Pergrande) caught in white, blue and yellow trap base CC traps in an alfalfa field, Maricopa, AZ, 2004.

Trap base color	Peak wavelength	No./CC trap/3-day 8/9	8/12	8/15
White	430-700 nm154 a[a]	108ab	209 a	
Blue	448 nm 129 a	157 a	170 b	
Yellow	610 –700 nm16 b	31 b	59 c	

[a] Means in a column not followed by the same letter are significantly different by Tukey's HSD, $P = 0.05$.

Table 4. Mean numbers of *Frankliniella occidentalis* (Pergrande) caught in an alfalfa field on CC traps coated with Tanglefoot® on different trap parts, Maricopa, AZ, 2004.

Tanglefoot coating at	Cumulative no. /trap 1 day	4 days	6 days	8 days
None 1.5 b[a]	0.5b	0.8 b	0.5 b	
External base	14.4 a	85.8 a	97.3 a	113.8 a
Entrance of base	1.3 b	1.3 b	6.5 b	11.3 b
Internal base	1.5 b	0.3 b	1.0 b	3.0 b
Deflector plate	2.8 b	4.0 b	2.5 b	2.0 b
Cup inside	0.5 b	1.0 b	4.8 b	8.5 b
Total 22.0	92.9	112.9	139.1	
% for external base	65.5	92.4	86.2	81.8

[a] Means in a column not followed by the same letter are significantly different by Tukey's HSD, $P = 0.05$.

Table 5. Mean numbers of *Frankliniella occidentalis* (Pergrande) caught in CC traps contained one cm^2 Vapona® cube in an alfalfa field, Maricopa, AZ, 2004.

Vapona®		No./CC trap/3-day 7/15	7/16	7/19	7/20	7/21	Mean
No	2.1 b	1.2 b	15.8 b	9.4 b	16.2 b	8.9 b	
Yes	15.8 a	19.6 a	70.1 a	46.1 a	56.2 a	41.6 a	

[a] Means in a column not followed by the same letter are significantly different by Tukey's HSD, $P = 0.05$.

Studies in Taiwan confirmed the efficacy of the Vapona® dispenser modified with blue stripes in catching *S. dorsalis*. The average CC trap catches was 0.07 *S. dorsalis* per trap per week, which was nearly 20% of the average catches using the modified Vapona® dispenser. Both the white and yellow base color CC traps caught more *S. dorsalis* than the blue, but the differences are not statistically significant. Both type of traps caught more *Frankliniella intonsa*, *Thrips hawaiiensis*, and *Megalurothrips usitatus* than the catches of *S. dorsalis*.

Table 6. Mean numbers of *Frankliniella occidentalis* (Pergrande) caught in three different trap types in an alfalfa field, Maricopa, AZ, 2004.

Trap type	No./trap/day				
	8/24	8/25	8/26	8/27	Mean
CC trap + one cmPP[2PP] Vapona® strip	11.2 a[b]	53.4 b	41.8 b	23.9 a	32.6 b
Vapona® dispenser	6.0 b	60.3 b	75.2 a	8.4 a	37.5 b
Vapona® dispenser + blue strips	7.5 ab	113.5 a	80.6 a	12.0 a	53.4 a

[a]Means in column not followed by the same letter are significantly Tukey's HDS, Df = 2, 18, P = 0.05.

USDA, APHIS guidelines suggested survey in one square mile areas with 2,280 CC traps when one or more adults were found at original infestation sites at the first delimiting survey (USDA 2004). Thus, a total of 160 *S. dorsalis* would be caught in CC trap per week in the area under conditions similar to those in southern Taiwan.

It appears that the CC trap can be used for detection, but not for monitoring *S. dorsalis*. Future research for detecting and monitoring *S. dorsalis* should consider investigating alternative traps, improvement of CC traps, *S. dorsalis* behavior, female sex pheromones and other attractants.

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