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DEVELOPMENT OF THE MOST EFFECTIVE TRAP TO MONITOR THE PRESENCE OF THE CACTUS MOTH *CACTOBLASTIS CACTORUM* (LEPIDOPTERA: PYRALIDAE)

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ABSTRACT

Various trap specifications were evaluated to identify the most effective trap for capturing wild male *Cactoblastis cactorum* (Berg). All traps were baited with virgin female *C. cactorum* and, except for the first comparison of trap type, a standard wing trap was used in all experiments. Although wing traps captured more males than did the other trap types (delta or bucket), the differences were not significant. However, significantly higher numbers of males were captured in wing traps placed 2 m above ground than traps at 1 m or 0.5 m, and wing traps baited with four virgin females caught significantly more males than wing traps baited with a single female. Differences in number of males captured by young and old females were not significant, but more than twice as many males were captured in traps baited with one-day-old females than traps baited with four day old females. In addition, there were no significant differences in number of males caught in unpainted, white, wing traps and wing traps painted one of eight different colors (flat white, black, dark green, fluorescent green, yellow, fluorescent yellow, orange, or blue), although, more males were captured in the unpainted wing traps. The results presented here suggest that the best trap currently available to monitor *C. cactorum* is a standard (unpainted) wing trap, placed at a height of 2.0 m aboveground, and baited with four newly emerged females.

Key Words: population monitoring, trapping, trap design, invasive species, opuntia

RESUMEN

Se evaluaron varios tipos de trampas con el objetivo de identificar la tampa mas efectiva para la captura de machos silvestres de *Cactoblastis cactorum* (Berg). Todas las trampas fueron evaluadas utilizando hembras virgenes de *C. cactorum* como cebo atractivo. Todos los ensayos a excepción del primero (donde se evaluaron tipos distintos de trampas) emplearon la trampa "wing". A pesar de que las trampas wing capturaron un mayor número de machos que ninguna de las otras trampas evaluadas (delta o cubeta) las diferencias en captura de machos no fueron estadisticamente significativas. Tambien, se capturaron un número mayor de machos en las trampas wing colocadas a una altura de 2 metros que en trampas colocadas a una altura de 1 metro o 0.5 metros, y las trampas con 4 hembras como cebo atractivo capturaron un mayor número de machos que las trampas con solamente una hembra. Las diferencias en el número de machos capturados en trampas con hembras de 1 dia de edad en comparación con trampas con hembras de 4 dias de edad no fueron estadisiticamente significativas, pero se capturaron mas del doble del número de machos en trampas con hembras jovenes. No se encontraron diferencias estadiaticas en el número de machos capturados en trampas wing de color estandard o en trampas wing de ocho colores diferentes (blanco mate, negro, verde oscuro, verde fluorescente, amarillo, amarillo fluorescente, naranja o azul), aunque se capturaron mas machos en las trampas wing de color estandard (blanco). Nuestros resultados sugieren que la mejor trampa que se tiene al momento para uso en el monitoreo de *C. cactorum* es la trampa wing de color estandard colocada a una altura de 2.0 metros y con 4 hembras jovenes como cebo atractivo.

Translation provided by the authors.

The cactus moth, *Cactoblastis cactorum* (Berg), was accidentally introduced into Florida in 1989 (Habeck & Bennett 1990; Dickel 1991), and its rapid spread along the Atlantic and Gulf Coasts has heightened concerns about its imminent impact on native *Opuntia* cacti in the southern

United States and Mexico (Johnson & Stiling 1998; Zimmermann et al. 2001). Recent publications suggest that *C. cactorum* is dispersing over a distance of about 50-75 km per year in North America (Stiling 2002; based on data reported in Johnson & Stiling 1998; and Hight et al. 2002). Recent data suggest that the dispersal rate for *C. cactorum* is closer to 160 km per year (S. D. Hight, unpublished data). Establishment of the cactus moth in the southwestern United States and Mexico would likely have serious detrimental effects on the landscape, biodiversity, and stability of native desert ecosystems, and on the vegetable, fruit and forage *Opuntia* industries in these areas (Soberón et al. 2001; Zimmermann et al. 2001, 2004).

The ability to quickly detect new pest infestations, accurately delineate their size and boundaries, and assess the pest's seasonal population trends is of critical importance in the successful application of any pest control strategy. The objective of this research is to develop an optimum monitoring system for adult *C. cactorum* by evaluating various trapping parameters. An efficient adult trapping system is necessary for the development and application of the Sterile Insect Technique (SIT), a control strategy that may be used to study and manage the spread of *C. cactorum* (Carpenter et al. 2001a, b) in North America. SIT is a species-specific pest control tactic that could be used to establish a barrier to prevent further geographic expansion of *C. cactorum* into the western states and Mexico, eradicate new or localized infestations when and where they occur, and/or protect environmentally sensitive areas from attack by the cactus moth. Unfortunately, although female *C. cactorum* produce a pheromone that attracts males (Hight et al. 2003), no synthetic pheromone is currently available to monitor populations of *C. cactorum*.

Hight et al. (2002) were the first to report on the use of sticky traps baited with virgin females to corroborate field damage and better understand the current distribution of *C. cactorum* in Florida and Georgia. More recently, Bloem et al. (2003) showed that sticky traps could be baited with reproductively sterilized females (treated with 200 Gy of gamma radiation) to monitor populations beyond the leading edge without the concern of accidentally establishing a breeding population if females escaped into the environment. The objective of our study was to conduct further field evaluations to ensure that the best monitoring trap is being used to detect the presence of *C. cactorum* and accurately assess its geographical expansion. In this paper we report the results of a series of field experiments conducted during 2003-2004 to evaluate trap types, trap placement heights, and trap colors, as well as the age and number of females for their ability to capture wild male cactus moths. Our results are discussed in the context of developing an area-wide control strategy for *C. cactorum* in North America.

Materials and Methods

Test Insects

Cactoblastis cactorum used in these experiments came from a laboratory colony kept at the USDA-ARS Crop Protection and Management Research Unit in Tifton, GA. Insects were reared on cladodes of *Opuntia stricta* (Haworth) Haworth inside rectangular plastic boxes and maintained at 26°C ± 1°C, a 14:10 (L:D) photoperiod and 70% relative humidity as described in Carpenter et al. (2001b). Cocoons with pupae were collected every two to three days, and pupae were extracted from the cocoons and sorted by gender. Female pupae were placed in a screened cage (30.5 by 30.5 by 30.5 cm) and allowed to emerge at the above mentioned conditions. Emerged adult females were placed inside modified translucent, plastic, film canisters (35 mm, with two 2 by 2-cm screen windows, perforated tops and Velcro fasteners to attach the canister to the top of an insect trap) with a small (1 by 1 cm) piece of *O. stricta*. A moistened cotton dental wick was placed through the perforated canister top to provide moisture to the caged females. Canisters with females were transported to the field in a small cooler and used to bait all treatments in these experiments. All experiments were conducted to coincide with peak flight activity of adult moths (Zimmermann et al. 2004).

Evaluation of Trap Type

Three commercially available insect traps—Pherocon 1-C Wing trap, Pherocon-VI Delta trap (both Trécé Incorporated, Salinas, CA), and Universal moth trap (Unitrap, Great Lakes IPM, Vestaburg, MI)—were evaluated for their effectiveness at capturing wild *C. cactorum* males. Experiments were conducted during the summer of 2003 at coastal locations in Florida and Georgia.

In Florida, three replicates (three traps, one of each type = one replicate) were placed at each of two different coastal locations: Alligator Point (N 29°54', W 84°23') and St. Marks National Wildlife Refuge (NWR) (N 30°04', W 84°10'). Abundant naturally occurring patches of native *O. stricta* that were heavily damaged by *C. cactorum* were present at both sites. Infested *O. ficus-indica* (L.) Miller was also common at Alligator Point as a planted and naturalized species. Hollow metal stakes were placed in the ground in groups of three in the vicinity of infested plants. Within each replicate, metal stakes were separated by no less than 3.0 m from one another and buried so that the top of each stake was at a height of approximately 1.0 m. Each trap was mounted to the top of a stake. Distance between replicates at each location was no less than 50 m. A single virgin female (<48 h post emergence) was used to bait each trap type. The experiment was initiated on 10 July 2003 and ended on 31 July 2003. Traps were checked every 72 h at which time the number of male *C. cactorum* caught per trap was recorded, traps were re-baited with new virgin females, and the position of each trap was changed in a clockwise manner.

In Georgia, six additional replicates were placed in the proximity of a salt marsh estuary at the southern banks of the Brunswick River in Glynn County, Georgia, west of US Highway 17 (N 31°05', W 81°31'). Within the estuary, a large area of naturally occurring patches of *O. stricta* plants was chosen. One replicate was assigned to each of six patches with cactus plants between 0.5-1.5 m in height. Traps were arranged and serviced as previously described. The experiment was conducted from 2-26 May 2003.

Evaluation of Trap Height

Based on the results from the evaluation of trap type, Pherocon 1-C Wing traps were used in all subsequent experiments. Traps placed at three different heights above ground (2.0, 1.0, and 0.5 m) and were evaluated for their effectiveness at capturing wild *C. cactorum* males. As above, experiments were conducted during the summer of 2003 at coastal locations in Florida and Georgia. In Florida, six replicates (three traps, one trap at each height = one replicate) were placed at St. Marks NWR. Hollow metal stakes were placed in the ground in groups of three close to infested *O. stricta* cactus plants and buried so that the top of each stake was at a height of approximately 1.0 m. Plastic (PVC) poles of a slightly smaller diameter than the hollow metal stakes were cut to the appropriate height and slipped inside each metal stake. A Pherocon 1-C trap was mounted to the top of each plastic pole. Within each replicate, traps were separated by no less than 3.0 m from one another, and distance between replicates at each location was 25-75 m. A single virgin female (<48 h post emergence) was used to bait each trap. The experiment was initiated on 15 July 2003 and ended on 2 August 2003. Traps were checked every 72 h at which time the number of male *C. cactorum* caught at each height was recorded, the positions within replicates of PVC poles with traps were rotated in a clockwise manner, and the traps were re-baited with new virgin females. Six additional replicates were placed at the salt marsh estuary location in Glynn Co., Georgia described above. Six patches with cactus plants between 0.5-1.5 m in height were selected and three hollow metal stakes were placed in the ground within the patches separated by no less than 3.0 m from one another at a height of approximately 1.0 m. As above, one trap was placed on a pole and one pole of each height was placed per patch and checked, serviced, and rotated every 72 h. The experiment was initiated on 29 July 2003 and ended on 28 August 2003.

Evaluation of One Versus Four Females

Pherocon 1-C Wing traps were baited with either one or four virgin female *C. cactorum* (<48 h post emergence) and evaluated for their effectiveness at capturing wild *C. cactorum* males. The experiment was conducted at St. Marks NWR between 24 July 2003 and 5 August 2003. Seven replicates (two traps, baited either with one or four females = one replicate) were completed. Hollow metal stakes were placed in groups of two in close proximity to infested *O. stricta*. Poles were separated by no less than 3.0 m from one another and buried so that the top of each stake was at a height of approximately 1.0 m. A Pherocon 1-C Wing trap was placed on the top of each stake. Distance between replicates at each location was no less than 50 m. Traps were checked every 72 h and the number of male *C. cactorum* caught per trap was recorded, traps re-baited with new virgin females, and trap positions rotated.

Evaluation of Females of Different Ages

Pherocon 1-C Wing traps were baited with single virgin *C. cactorum* females that were either 24 h or 120 h post emergence and evaluated for their effectiveness at capturing wild males. Experiments were conducted at St. Marks NWR from 16-23 April 2003 and at Alligator Point from 28 July-1 August 2003. A total of eleven replicates (each replicate consisted of two traps, one baited with a 24-h-old female and one with a 120-h-old female) were completed: six replicates at St. Marks NWR and five at Alligator Point. As above, hollow metal stakes with a trap on top were placed in the ground in groups of two in the vicinity of infested *O. stricta* and *O. ficus-indica* plants. Within each replicate, metal stakes were separated by no less than 3.0 m and buried so that the top of each stake was at a height of approximately 1.0 m. Distance between replicates at each location was no less than 65 m. Traps were checked at 24 h intervals at which time the number of male *C. cactorum* caught per trap was recorded, traps re-baited with new females, and trap positions rotated.

Evaluation of Trap Color

The outside top and bottom of Pherocon 1-C Wing traps were either left unpainted (controls) or painted with two coats of the following commercially available paints: Gloss White (#7792), Gloss Black (#7779), Dark Hunter Green (#7733), Fluorescent Green Marking (#207464), Sunburst Yellow (#7747), Fluorescent Yellow (#1942) (Rust-Oleum Corp., Vernon Hills, IL), Pumpkin Orange Gloss (#2411), and True Blue Gloss (#1910) (Krylon Products Group, Cleveland, OH). Color selections were based on reported evaluations of trap colors influencing the attraction of various Lepidoptera (Hendricks et al. 1972; Mitchell et al. 1989; Pair et al. 1989; Hendrix & Showers 1990; Lopez 1998; Meagher 2001). Trap surfaces were given two coats of Plastic Primer (Rust-Oleum Corp., Vernon Hills, IL) before painting with experimental colors to increase coverage and adherence of the paint. Experiments were conducted from 14-26 April 2004 on a dike located at St. Marks NWR. Hollow metal stakes were placed in the ground along the dike, separated by no less than 4 m from one another, at a height of approximately 1.5 m, and in the proximity of infested *O. stricta*. Two traps of each color plus two unpainted traps (18 traps total) were deployed randomly in two separate groups (= replicates) on 14 April 2004. All trap bodies were oriented with trap openings in the direction of the prevailing wind. Traps were first baited with two virgin females (<48 h post emergence) on 15 April 2004. Thereafter, traps were serviced, cotton wicks rewetted, and trap location re-randomized every 24 h until 26 April 2004. Females were changed every 48 h. At each trap servicing we noted the status of the female (alive or dead) and the number of male *C. cactorum* captured per trap.

Spectral Reflectance

The spectral reflectance of the painted traps, the standard unpainted trap, and of healthy *O. strica* pads (<1 year-old) was measured with a FieldSpec® Handheld spectroradiometer (Analytical Spectral Devices, Inc., Boulder, CO—spectral range of 325-1075 nm). Two readings were taken, one before the traps were placed in the field (15 April 2004 at 1400 h) and one after the experiment was completed (25 May 2004 at 1415 h). Cactus pad reflectance also was measured twice at the same times as the traps.

Statistical Analysis

All statistical analyses were performed with PROC ANOVA (SAS Institute 1989). The effect of trap type (Wing trap, Delta trap, and Universal moth trap) on the number of *C. cactorum* males captured was examined using analysis of variance with trapping date, field site (Brunswick River, Alligator Point and St. Marks), replication, and trap type as sources of variation. Because a significant three-way interaction was found between date, field site, and trap type, the number of males captured was sorted by field site and analyzed with trap type as the main effect, replication as a blocking effect, date as a superblock, and interaction between the trap type and trapping date as an error term. The effect of trap height on the number of male cactus moths captured in Pherocon 1-C Wing traps was analyzed with trap height (2.0, 1.0, and 0.5 m) as the main effect, replication as a blocking effect, field site as a superblock, and interaction between the trap height and field site as an error term. Because no interaction was detected, the data were pooled and ANOVA was conducted by orthogonal contrasts to compare the response of males to the different trap heights. The number of *C. cactorum* males captured in traps baited with one or four virgin females was analyzed with the number of females as the main effect, replication as a blocking effect, date as a superblock, and interaction between the number of females and replication as an error term. The number of *C. cactorum* males captured in traps baited with females that were either 24 or 120 h post emergence was analyzed with trapping date, field site (St. Marks and Alligator Point), and female age as sources of variation. Finally, the effect of trap color on the number of *C. cactorum* males captured in traps was analyzed with trap color as the main effect, replication as a blocking effect, date as a superblock, and interaction between the trap color and date as an error term. All data meet the assumptions for the ANOVA model and were not transformed. Estimates of central tendencies are reported as mean ± standard deviation (SD).

Results

All three trap types (Wing, Delta, and Universal) were successful in capturing males of *C. cactorum* (Table 1). Although the highest mean number of males was captured in the Pherocon 1-C

Table 1. Influence of trap type on the number of male *Cactoblastis cactorum* captured at three different sites. Each trap was baited with a single virgin *C. cactorum* female.

	Mean (± SD) number of males captured at each trap site**			
Trap type	Alligator Point, FL	St. Marks NWR, FL	Brunswick River, GA	Pooled means
Universal moth trap	0.83 ± 1.4	1.67 ± 3.2	0.53 ± 1.2	0.89 ± 1.9
Delta trap	0.39 ± 0.9	1.33 ± 1.7	0.92 ± 1.7	0.92 ± 1.6
Wing trap	1.11 ± 1.6	1.06 ± 2.5	1.33 ± 2.4	1.12 ± 2.2

**Differences among means are not significant, $P > 0.05$ (PROC ANOVA, SAS Institute 1989).

Wing traps tested at Alligator Point, FL and Brunswick River, GA, this type of trap recorded the lowest mean number of captures at St. Marks NWR, FL. Overall, Pherocon 1-C Wing traps captured more males than did the other trap types. However, differences among the means for each trap type were not significant overall or at any of the three field sites. The height at which Pherocon 1-C wing traps were placed above ground (F = 2.73; df = 2, 272; $P < 0.0352$) influenced the number of male *C. cactorum* captured per trap (Table 2). The number of males captured at a height of 2 m was almost twice as many as those captured at 0.5 m. When Pherocon 1-C Wing traps were baited with one or four virgin females, the number of cactus moth males captured was higher (F = 8.18; df = 1, 22; $P < 0.0091$) in traps baited with four females (1.88 ± 2.4) than when baited with single females (0.62 ± 1.1). Furthermore, the age of the female (24 or 120 h post emergence) influenced the number of males captured in Pherocon 1-C Wing traps. Traps baited with a young female (0.84 ± 1.63) captured more than twice the number of males than traps baited with an older female (0.36 ± 0.90). Although the difference between means was not significant, analysis of the data suggests that female age influenced the number of males captured (F = 3.22; df = 1, 72; $P < 0.0768$).

Finally, Pherocon 1-C Wing traps left unpainted (controls) or painted white, black, dark green, fluorescent green, yellow, fluorescent yellow, orange, or blue, and baited with two females were all successful at capturing *C. cactorum* males. Overall, most males were captured in the unpainted Pherocon 1-C Wing traps (1.42 ± 1.8) and the fewest were captured in traps painted gloss white (0.50 ± 0.7), though the differences were not significant (F = 0.71; df = 8, 214; $P <$ 0.6819). In addition, we found no difference in the spectral reflectance readings made on unpainted or painted traps at the beginning compared with the end of the field test. Peak wavelengths for traps of different colors ranged between 0 and 638 nm, and cladode readings were 552 and 759 nm.

TABLE 2. INFLUENCE OF TRAP HEIGHT ON THE NUMBER OF *CACTOBLASTIS CACTORUM* MALES CAPTURED IN PHEROCON 1-C WING TRAPS BAITED WITH A SINGLE VIRGIN FEMALE.

Trap height (m)	Mean (± SD) number of males captured**
0.5	1.13 ± 2.3a
1.0	1.92 ± 3.3b
2.0	2.14 ± 3.3c

**Means followed by a different letter are significantly different, $P \leq 0.05$ (PROC ANOVA using orthogonal contrasts, SAS Institute 1989).

Nevertheless, traps varied widely in their individual spectral reflectance (Table 3). Traps that were painted black, dark green and blue had the lowest reflectance values (all below 50%), as did the cladodes of *O. stricta*. Traps painted orange, fluorescent green, yellow, white and fluorescent yellow, as well as the unpainted control, had high reflectance values (above 50%). Even though the white and the unpainted traps had the same peak wavelength (425 nm) the unpainted trap had the highest spectral reflectance.

DISCUSSION

Trap optimization is of vital importance in developing useful and reliable monitoring systems for pest insects. Habeck and Bennett (1990) were the first to report the presence of *C. cactorum* in the Florida Keys. That initial finding of *C. cactorum* consisted of one adult female collected in a mercury vapor lamp and larvae from infested *O. stricta*. From 1989-2002 cactus moth populations were recorded at different locations along both coasts and at inland sites as far north as Folly Island, SC and as far west as St. Vincent Island, FL (Dickel 1991; Johnson & Stiling 1998; Hight et al. 2002). All of these reported infestations were based on finding damaged cactus plants and/or the presence of immature stages (eggsticks, larvae, pupae) of *C. cactorum* at these locations.

Our group deployed the first virgin female-baited sticky traps used to detect *C. cactorum* in May 2002. As a result of this work, we determined that this insect completes three non-overlapping generations per year in Florida. Each generation has distinct periods of flight activity followed by periods of larval development during which no adults are flying (Zimmermann et al. 2004). In 2003, Hight et al. (2003) reported that the new western limit of *C. cactorum* was at Pensacola Beach, FL, based on visual inspection of highly infested prickly pear plants found during a larval development period. Positive confirmation of *C. cactorum* infestation is relatively easy when larval stages are present and causing heavy damage to *Opuntia* plants. However, determination of the presence of *C. cactorum* can be easily overlooked when infestations are new or small, or the immature stages are not active. Traps baited with adult sexual attractants are effective when the target species is at a low population level (Hanula et al. 1984), the adults are expanding into new areas (Walters et al. 2000), and at times when immature stages are not present (Lalone 1980). Therefore, we wanted to conduct evaluations of our female virgin-baited sticky traps to ensure that the best monitoring tool is being used to detect the presence of *C. cactorum*. While three of the characteristics tested did not reveal significant differences (trap color, trap type, and female age), the trend for each characteristic indicated

TABLE 3. MEAN PEAK WAVELENGTHS (IN NM) AND SPECTRAL REFLECTANCE (IN %) FOR FRESH CLADODES OF *OPUNTIA STRICTA* AND FOR PHEROCON 1-C TRAPS EITHER UNPAINTED (STANDARD) OR PAINTED WITH TWO COATS OF EIGHT DIFFERENT COLORS.

Trap color	Mean peak wavelength (nm)	Reflectance
Gloss Black	0	0.025
Dark Hunter Green	537	0.095
True Blue Gloss	462	0.382
O. stricta cladode	552-759	0.386
Pumpkin Orange Gloss	638	0.667
Fluorescent Green Marking	515	0.926
Sunburst Yellow	557	0.985
Gloss White	425	1.088
Fluorescent Yellow	501	1.219
Unpainted	425	1.286

that unpainted, wing traps baited with 24 h post emergence females resulted in the highest mean capture rate. Considering the overall trap design, the results presented here suggest that the best trap currently available to monitor *C. cactorum* is a standard (unpainted) Pherocon 1-C Wing trap, placed at a height of 2.0 m aboveground, and baited with four newly emerged (24 h post emergence) females.

Trapping studies on other Pyralidae report results similar to ours. For example, Ahmad (1987) and Hanula et al. (1984) found that Pherocon 1-C Wing traps captured the highest number of male almond moth *Cadra cautella* (Walker) and male coneworm *Dioryctria* spp., respectively, when field tested against other trap designs. It is interesting to note that traps placed at a height of 2.0 m captured significantly higher numbers of male *C. cactorum* than did traps placed at 0.5 or 1.0 m. This trap height (2.0 m) is about 0.5-1.0 m higher than the tallest *O. stricta* host plant present at Brunswick River, GA and St. Marks NWR, FL. For some economically important Pyralidae the most effective trap heights are those at or just above host canopy level. This is true for male coneworm captured in pheromone-baited traps (Hanula et al. 1984) and male pickleworm *Diaphania nitidalis* (Stoll) captured in virgin female-baited traps (Valles et al. 1991), but it is not true for almond moth males (Ahmad 1987). One possible explanation for our results is that traps placed at 2.0 m might be "escaping" the competition from pheromone emitting virgin females present in the vegetation. The pheromone plume emitted above the layer of vegetation may be more distinct and attractive to male *C. cactorum*.

Our results suggest that female *C. cactorum* are ready to mate within 24 h of emergence. In recent field experiments Hight et al. (2003) used virgin female *C. cactorum* that were <24 h post emergence in mating tables and observed females emitting pheromone and forming mating pairs. In our Wing traps, the concentration of pheromone from four females is likely to be higher and more attractive to males than the pheromone concentration from a single female *C. cactorum*. Furthermore, the advantage of using more than one female per trap might be that each female actively emits pheromone at slightly different times, thus extending the attractiveness of traps baited with multiple rather than with single females.

Trap color had no influence on male cactus moth captures. However, more males were captured in the unpainted trap which had the highest spectral reflectance of all traps tested. Trap color has been shown to improve trapping efficiency in other economically important Lepidoptera. Knight and Miliczky (2003) found that painted Delta traps captured significantly more male codling moths (*Cydia pomonella* L., Lepidoptera: Tortricidae) than did unpainted traps. In addition, Meagher (2001) showed that traps that had contrasting colors captured more fall armyworm *Spodoptera frugiperda* (J.E. Smith) males than did traps of only one color.

The results presented here give us confidence that we are currently using the most effective trap to detect the presence of cactus moth infestations in North America. Using the best available trapping tool is crucial to determining the best location to deploy a barrier of sterile insects to prevent further westward spread of *C. cactorum*. In addition, and as suggested by Bloem et al. (2003), this same monitoring tool can be deployed beyond the leading edge of infestation by baiting the traps with reproductively sterilized females. While progress is being made on the identification and synthesis of the cactus moth sexual pheromone by colleagues at the USDA-ARS laboratories in Miami and Gainesville FL, no commercial lure is currently available. When experimental pheromone blends do become available, the data presented here will be extremely useful in the field-testing of synthetic lures for cactus moth.

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