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Comparison of three trap types for catching adult *Bemisia tabaci* whitefly and its parasitoid *Eretmocerus mundus* in tomato greenhouse

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Abstract: The attractiveness of three trap types to *Bemisia tabaci* (Gennadius) B-biotype (= *Bemisia argentifolii* Bellows & Perring) and *Eretmocerus mundus* Mercet adults was compared in two choice experiments in a greenhouse at the Centro de Ciencias Medioambientales, Madrid, Spain. Yellow sticky cards equipped with light-emitting-diodes (LED-YC) caught more adults per trap per day than yellow sticky card (YC) traps. YC traps caught significantly more *B. tabaci* and *E. mundus* adults than plastic cup traps equipped with light-emitting diodes (LED-plastic cup traps). However, the LED-plastic cup traps caught fewer *E. mundus* than the YC traps. The results suggest that LED-plastic cup traps are compatible with *E. mundus* parasites in greenhouses in which parasites are released to reduce the *B. tabaci* nymph population.

Keywords: *Bemisia tabaci*, biological control, *Eretmocerus mundus*, tomato, traps

Introduction

Insecticides have traditionally been the main means of *B. tabaci* control in Spain. However, biological control systems are economically and environmentally more acceptable and often include the use of yellow sticky card (YC) traps to monitor *B. tabaci* population changes. The impact of YC trap catches on *B. tabaci* populations is unknown, and YC traps also catch parasitoids released to control *B. tabaci* nymphs in greenhouses. Chu *et al.* (2003) recently reported that equipping yellow-base plastic cup *B. tabaci* traps with green light-emitting diodes (LEDs) increased trap efficacy by 100% in mixed-crop greenhouses. More importantly, few *Eretmocersus eremicus* Rose and Zolnerowich and *Encarsia formosa* Gahan, (both *B. tabaci* parasitoids) were caught in these LED-plastic cup traps compared with the YC traps, suggesting a potential use for the LED plastic cup trap in greenhouse farming with little or no impact on *B. tabaci* parasitoids.

The objective of this study was to compare LED-plastic cup, YC, and LED-YC *B. tabaci* and *E. mundus* Mercet trap catches in a tomato greenhouse in order to determine the feasibility of developing a compatible *B. tabaci* adult nymph parasite trap control system.

Material and methods

Traps

Three different trap types were compared. The LED-YC trap was a 12.5 x 7.5 cm yellow sticky card (YC) equipped with two 530 nm 10 lumen LEDs (Nichia America Corp. Mountville, PA, USA). One LED was located on each side of each YC trap. The LED-plastic cup (LED-CC) trap (Chu *et al.* 2003) was a yellow-base plastic cup trap with a Tanglefoot® coating on the inside of the cup to catch arthropod insects. Each trap was

equipped with a downward-lo directed 530 nm lime green LED. Standard dimension (12.5 x 7.5 cm) YC traps were considered controls.

The traps were suspended from two parallel steel wires installed horizontally and placed 30 cm apart and approximately one meter above each bench. Electricity for the LEDs was supplied by a 220 volt wall-plug unit with a direct current adapter. Trap locations were re-randomized every five days throughout the experiments to avoid position effects.

Experiment 1 (LED-YC traps* vs. *YC traps)

Tomato seeds cv. Marmande VR were germinated in a climatic chamber under a temperature regime of 25°C: 16 °C (day: night), a photoperiod of 16 L: 8D (light: dark) h, and a relative humidity of 68-75%. Plants were grown in 1:1 soil/perlite mixtures in one-litre plastic pots irrigated with water every other day.

When the potted plants were two-month old, 30 pots were placed on each of the four greenhouse benches. Plants were infested with *B. tabaci* (B-biotype) by releasing large numbers of mature adults in the centre of the greenhouse. Two days later, traps were placed on the wires above the benches in a randomized complete block design with eight replications. One day after placing the traps, , the number of adult *B. tabaci* on each trap were counted *in situ* and these counts were repeated on a daily basis for 20 days. All the traps were removed immediately after the adult count on day 20. Average greenhouse conditions were 20.17 ± 0.18°C and 69.05 ± 1.22% r.h.

Experiment 2 (LED-CC traps* vs. *YC traps)

When the plants were 106-d-old, about 3,000 adult *E. mundus* parasitoids (Eretline, Syngenta Bioline Ltd., Essex, England) were released among the *B. tabaci* infested tomato plants. The traps were suspended above the benches as previously described and daily counts started on the day after trap placement. Numbers of *B. tabaci* and parasitoid adults on each trap were counted for 15 days once numbers of *E. mundus* had decreased to insignificant levels. The YC traps were replaced every five days because of the large number of trapped insects. Average greenhouse conditions were 19.6 ± 0.1°C and 72.3 ± 0.7% r.h.

The number of trapped adult insects was $\log_{10}(x+1)$ transformed and percentages (p) were transformed to arcsine $(p/100)^{0.5}$ before analysis. Data from different trap types were compared using a one-way ANOVA (Statsoft, 1994).

Results and discussion

There were no significant differences in the numbers of adult *B. tabaci* caught in either trap type on a daily basis, except on day 19. However, the mean number of *B. tabaci* captured for all trap days in the LED-YC traps was higher than with the YC traps (Table 1). The average percentage (57%) of the total catches for all trap days in the LED-CC traps was also greater than the 43% caught in the YC traps.

These results suggested that LED-YC traps could perhaps serve an ecological purpose as barriers for adult *B. tabaci* and other insects migrating into greenhouses. The peak wavelength of 530 nm emitted by lime green LEDs is within the range of the peak *Bemisia* spp. phototactic response (El-Helaly *et al.* 1981, Chu *et al.* 2000). The addition of LEDs to the plastic cup traps and YC traps appeared to attract more adults to the traps, particularly at night when adults do not appear to be very active (Liu *et al.* 1994, Chu *et al.* 1998).

YC traps caught significantly more *B. tabaci* adults on a daily basis than LED-CC traps through the whole period of experiment 2 (Table 1). However, the LED plastic cup trap caught fewer *E mundus* per trap per day than the YC trap (Table 1).

Table 1. Average numbers of *Bemisia tabaci* and *Eretmocerus mundus* captured per trap type per day in greenhouse experiments.

Experiment	Trap type	Number of adults per trap per day [a]	
		B. tabaci	*E. mundus*
1	LED-YC	9.6 a	
	YC	8.3 b	
2	YC	77.2 a	8.6 a
	LED-CC	20.9 b	0.3 b

[a] Means in a column for a given experiment followed by a different letter differ significantly ($P<0.05$) by one-way ANOVA

The LED plastic cup trap may be an acceptable alternative to YC traps in greenhouses in which it is aimed to conserve parasitoids. We would recommend the simultaneous use of LED plastic cup traps and biological controls of *B. tabaci* in IPM systems. Our results in a tomato greenhouse confirm an earlier report that the LED plastic cup trap does not attract other *B. tabaci* parasitoids in mixed-crop greenhouses (Chu *et al.* 2003). YC traps used to capture *B. tabaci* adults also trapped *Eretmocerus* sp. and *Diglyphus* sp. in greenhouses in the Almeria area (F. García-Jiménez, pers. comm., 2002) and would probably also do the same in other areas of Spain. Critical questions appear to be: (1) Do the YC traps have an adverse impact on the *B. tabaci* population? and (2) Do the YC parasite trap catches significantly reduce the effectiveness of biological controls?

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References

Chu, C.C., Henneberry, T.J. & Boykin, M. A. 1998: Response of *Bemisia argentifolii* (Homoptera: Aleyrodidae) adults to white fluorescent and incandescent light in laboratory studies. Southwest. Entomol. 23: 169-181.

Chu, C.C., Printer Jr., P.J., Henneberry, T.J., Umeda, K., Natwick, E.T., Wei, Y., Reddy, V. R. & Shrepatis, M. 2000: Use of CC traps with different trap base colors for silverleaf whiteflies (Homoptera: Aleyrodidae), thrips (Thysanoptera: Thripidae), and leafhoppers (Homoptera: Cicadellidae). J. Econ. Entomol. 93: 1329-1337.

Chu, C.C., Jackson, C.G., Alexander, P.J., Karut, K. & Henneberry, T.J. 2003: Plastic cup traps equipped with light –emitting diode for monitoring adult *Bemisia tabaci* (Homoptera: Aleyrodidae). J. Econ. Entomol. 98: 543-546.

El-Helaly, M.S., Rawash, I.A. & Ibrahim, E.G. 1981: Phototaxis of the adult whitefly, *Bemisia tabaci* Gennadius to visible light. I. Effect of the exposure period on the insects response to different wavelengths of the visible light spectrum using a devised simple technique. Acta Phytopathol. Acad. Sci. Hungar. 16: 181-188.

Liu, T.X., Oetting, R.D. & Buntin, D. 1994: Temperature and diel catches of *Trialeurodes vaporariorum* and *Bemisia tabaci* (Homoptera: Aleyrodidae) adults on sticky traps in the greenhouse. J. Entomol. Sci. 29: 222-230.

StatSoft 1994: Statistica Version 4.5 for the Windows Operating System. Reference for statistical procedures. StatSoft, Tulsa,OK.