RESPONSE OF MALE TARNISHED PLANT BUGS TO TRAPS BAITED WITH DIFFERENT NUMBERS OF VIRGIN FEMALES W. P. Scott and G. L. Snodgrass Research Entomologists, USDA-ARS Southern Insect Management Research Unit Stoneville, MS

Abstract

The response of adult tarnished plant bugs, *Lygus lineolaris* (Palisot de Beauvois), to sticky traps baited with 1, 5, or 10 virgin adult females was studied in a weedy field near Indianola, MS during June 1997. Capture of male tarnished plant bugs increased significantly as the number of females used as bait in the traps was increased. These results show that the use of a synthetic female pheromone (once the female pheromone is identified) to capture males at pheromone concentrations higher than that produced by a single female is possible. A white non-UV reflecting sticky cardboard panel used to capture plant bugs was found to be very attractive to plant bugs.

Introduction

The tarnished plant bug, Lygus lineolaris (Palisot de Beauvois), can be a pest of several crops (Snodgrass et al. 1984, Young 1986). Female plant bugs release a pheromone (which has not been identified) to attract males for mating (Scales 1968, Graham 1987). In several studies (Scales 1968, Slavmaker & Tugwell 1984, Graham 1987) virgin females have been used to attract males for capture in sticky traps. Slaymaker & Tugwell (1984) found that virgin females used as bait were attractive to males for two weeks. They also found, as did Scales (1968), that virgin females older than one week were more attractive to males than those younger. Mated females of L. hesperus Knight are less attractive than virgin females of this species in traps (Strong et al. 1970, McLaughlin 1996). However, Strong et al. (1970) also found that on the fifth day after mating the females became attractive again.

Female tarnished plant bugs have a low level of response to traps baited with females. Scales (1968) captured 171 *L. lineolaris* adults in traps in eight tests, and only seven of the 171 adults captured were females. Graham (1987) caught a mean of 2.2 female *L. lineolaris* per site (as compared to a mean of 43.2 males per site) in traps baited with females of this species. Slaymaker & Tugwell (1984) captured 596 adult *L. lineolaris* in traps baited with virgin females, and 42 of those captured were females.

Trap height can affect trap capture, and traps placed 1-2 m above the surface of the soil capture more adults than when placed at higher or lower heights (Prokopy et al. 1979,

Capinera 1980, McPherson et al 1983). Trap color has also been shown to affect trap capture. Prokopy et al. (1980) caught significantly more *L. lineolaris* adults with sticky coated non-UV reflecting white or Zoecon Yellow rectangles as compared to several other colors of sticky coated rectangles.

The effect on trap capture of having different numbers of females as bait has not been evaluated in any study. This information would be useful in the development of trap lures containing a synthetic pheromone when the pheromone of the adult female is identified. The goal of the present study were to provide part of this information.

Materials and Methods

The test was conducted from 6 June through 1 July 1997 in a weedy field ≈6 ha in area located near Indianola in Sunflower County, MS. Tarnished plant bugs were abundant on wild host plants in the field, and the main host was annual fleabane, Erigeron annuus (L.) Persoon. Treatments in the test were replicated 4 times and traps were baited with 1, 5, or 10 virgin adult female tarnished plant bugs. Check traps were identical to traps baited with females but had no adult females as bait. Traps were placed in two lines of 8 traps with the traps spaced 30 m apart and the two lines were 50 m apart. The support stake for each trap was made from 2.54 cm wide angle iron 2.44 m in length, with the top 0.31 m of the stake bent at a right angle to form a horizontal arm. The stake was unpainted and was driven ≈ 0.3 m into the ground when used. Adults used as bait in a trap were held in a container made from a 20 cm long section of 2.54 cm diameter PVC pipe. Two or three whole green beans, Phaseolus vulgaris L., were placed in the container for food for the adult bugs. The pipe had 3 slots (1.50 by 12.50 cm) cut in it to allow air circulation, and each slot was covered with 2 mm mesh plastic screen. The ends of the pipe were closed with removable PVC caps, and into each cap a screw eye (5 mm diameter by 4 cm long) was screwed. The top cap was permanently attached to the end of the horizontal trap arm by opening the eve and placing it through a hole drilled in the arm end, then bending it shut. A cardboard panel coated with an adhesive was used to capture adults that responded to the trap. Each panel (unpainted white non-UV reflecting cardboard commercially available from Gemplers, Mt. Horeb, WI) came folded with the inner surface coated with an adhesive. In use, the panel was unfolded and then refolded inside out with the two sticky sides (each 19.7 by 15.9 cm) exposed. A flexible wire (1 mm diameter by ≈ 20 cm long) was placed through a hole near each top corner and twisted upon itself to hold the two sides together at the top. The other ends of the wires were used to attach the panel to the eve in the bottom cap of the adult container. The wires were adjusted in length so that the long side of the panel hung straight below the adult container, and were flexible enough to allow movement of the panel in the wind. The panel was \approx 1.5 m from the ground. In each test weeds as tall or taller

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than the cardboard panel of the traps were cleared for a radius of ≈ 1.5 m around each trap.

Green beans were changed in the adult container of the trap every 2 or 3 d. To change the beans or check for mortality of the adults used as bait, the adult container was removed from the top PVC cap. Mortality in adult females used as bait was determined each time a trap was checked (1-3 d intervals), and dead females were replaced with females of the same age. Adults used as bait in the traps were 7-14-dold and were from a laboratory colony. They were sexed as 5th instar nymphs, after which each gender was reared separately. They were sexed again as adults when they were 1-3-d-old (too young to mate, Bariola 1969) to make sure virgin females were used in the traps. Wild adults that responded to the trap and were captured on the sticky panel were counted and taken back to the laboratory where their sex was determined.

Experimental design was completely random, and data from traps in which mortality in the adults used as bait exceeded 20% (or if the single adult female used in one treatment was dead) during a test time period were not used. Trap capture data from those time periods in which numbers of adults captured were low (usually periods of rain or windy conditions) were not used in the statistical analyses. Numbers of adults by sex captured in each treatment were compared using analysis of variance with the PROC MIXED proceedure of SAS (Littell et al. 1996). Mean comparisons were made using least significant difference. Data from the test were also analyzed over time to test for a treatment by time interaction.

Results and Discussion

The date by treatment interactions were not significant for mean numbers of males (F = 1.68, df = 16, 58, P = 0.08) or females (F = 1.46, df = 16, 70, P = 0.14) captured in the different trap treatments. Therefore, data were analyzed using overall mean numbers of males or females captured (Table 1). Significant differences (F = 8.11, df = 3, 11, P = 0.04) were found between the treatments in mean numbers of males captured, and all treatments captured significantly higher mean numbers of males compared to the unbaited check. Mean numbers of males captured in traps baited with 1 or 5 females were not significantly different, although the mean number captured (1.817) using 5 females as bait was numerically higher (30.4%) than the mean number captured (1.393) using 1 female as bait. Traps baited with 10 females captured significantly higher mean numbers of males than in all other treatments, although the difference was significant at P = 0.10 in the comparison with traps baited with 5 females. These results showed that the number of males captured by the traps was increased by increasing the number of virgin females used as bait. This was probably due to increased amounts of female pheromone being released around the traps. This information will be useful when the female pheromone is identified, since it shows that a synthetic female pheromone dispensed in amounts higher than that produced by a single female could still be attractive to males.

Female plant bugs had a moderate response to the female baited traps and unbaited check traps (Table 1). Females made up 41% of the adults captured in the check traps and 24, 26, and 24% of the adults captured in the traps baited with 1, 5, or 10 females, respectively. No significant differences (F = 1.66, df = 3, 11, P = 0.23) were found between all treatments in numbers of females captured in the traps. The response of females to the female baited traps was greater than that reported in other studies. Females made up 24-26% of all adults captured in this study, but only comprised 4, 7, and 5% of all adults captured in studies by Scales (1968), Slaymaker and Tugwell (1984), and Graham (1987), respectively. Increased female response in this study was probably due to the attractiveness of the white non-UV reflecting sticky panel used to capture adults. The unbaited check traps captured 11.6% of all adults that were captured in the test. In comparison, check traps used in previous studies by Scales (1968) (sticky coated vinyl plastic), Strong et. al (1970) (2.27 liter ice cream cartons), and Slaymaker and Tugwell (1984) (sticky coated laminated cardboard). captured 4% or less of all adults captured.

In summary, the results of the test showed that trap capture of male tarnished plant bugs can be increased significantly by increasing the number of adult virgin females used as bait. This increased male response, probably caused by increased amounts of female produced pheromone, had never been previously demonstrated for the tarnished plant bug. This is important since it shows that the use of a synthetic produced female pheromone to capture males at concentrations higher than that produced by a single female is possible. The capture of higher numbers (as compared to the total number captured in all traps) of male and female tarnished plant bugs in check traps in the present study, than were captured in check traps used in previous studies, indicated that the white non-UV reflecting stick panel used in the traps might be more attractive than the traps used in the other studies.

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Table 1. Capture of tarnished plant bug adults using sticky traps baited with 1, 5, or 10 adult virgin females.

Trt (mean ^a)	_		% all adults	
Trt	Comparison	Diff.	P > F	captured
Males				
Check(0.571)				59
1 9 (1.393)	check	0.822	0.07	76
5 9 (1.817)	check	1.246	0.02	74
	1 ♀	0.424	0.35	
10 9 (2.610)	check	2.039	0.001	76
	1 9	1.217	0.02	
	5 ¥	0.793	0.10	
	F	emales		
Check(0.429)			NS	41
1 9 (0.431)	check	0.002	NS	24
5 9 (0.583)	check	0.154	NS	26
	1	0.152	NS	
10 9 (0.867)	check	0.438	NS	24
	1	0.436	NS	
	5 ¥	0.284	NS	

NS, no significant differences. Mean comparisons were made using least significant difference (SAS Institute 1996).

a. Means are numbers of males or females captured in 4 traps in each treatment. The number captured was determined at 1-3 d intervals, and the traps were run a total of 11 d.