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EVALUATION OF STICKY TRAPS FOR MONITORING COTTON FLEAHOPPER MOVEMENT INTO COTTON

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Abstract

Field studies were initiated in 2001 to determine the feasibility of using sticky or malaise traps to detect cotton fleahopper, *Pseudatomoscelis seriatus* (Reuter), movement into cotton. Yellow and white sticky traps were positioned at three heights (ground level, 1 and 2 m above the soil surface) on the field border, and immediately above the plant canopy on the 30th row. Malaise traps were placed only on the field border. Despite the use of kill strips, entrances to malaise capture containers were frequently blocked by large insects or spider webs, and predation on captured fleahoppers was commonly observed. Consequently, counts of captured fleahoppers in each trap were low (≤ 5) and many counts were zeros. Based on these observations, the malaise traps used have little potential for monitoring cotton fleahopper movement into cotton. In contrast, commercially available sticky traps show considerable promise for this use. Border sticky traps set at ground level tended to capture more cotton fleahoppers than border traps set at the other heights, but captured significantly fewer fleahoppers than sticky traps placed inside the field. Yellow traps generally captured more fleahoppers than white traps for in-field and border traps. Based solely on the magnitude of trap captures, yellow sticky traps maintained just above the crop canopy in the field interior exhibited the greatest potential for monitoring fleahopper movement into cotton. Should field operations or trap access restrict trap placement to field borders, yellow traps placed at ground level would provide the best alternative to in-field traps. Our preliminary results identify several trapping parameters (e.g, trap placement and color) that should be considered in the development of a trap-based fleahopper monitoring system and suggest continued investigations are warranted.

Introduction

The cotton fleahopper, *Pseudatomoscelis seriatus* (Reuter), is an important early-season pest of cotton. In 1999, it was the most economically damaging insect pest of U.S. cotton, causing an estimated $196 million in costs and losses to U.S. farmers (Williams 2000). In 2000, the cotton fleahopper was the 9th most damaging insect pest of cotton, infesting approximately 42% of U.S. cotton acreage (Williams 2001). In Texas and bordering states, fleahoppers have consistently been one of most important insect pests of cotton.

The cotton fleahopper prefers wild weed hosts (Reinhard 1926, Holtzer and Sterling 1980), but migrates to cotton as weed hosts begin to mature and become less attractive (Almand et al. 1976). Currently, producers typically rely on one or more early-season insecticide treatments to control fleahoppers. Although treatment thresholds and effective insecticides are available, most producers do not scout for fleahoppers because of the considerable labor and time required for accurate sampling. Consequently, treatment decisions are often based on other factors including plant phenology and the need for overwintered boll weevil sprays. Because the timing and intensity of fleahopper migration into cotton is variable, economic infestations may go undetected and untreated, or insecticide applications may be mistimed or unnecessary. Development of a practical trapping system could improve cotton fleahopper management efforts by alerting growers of fleahopper movement into fields. Our objectives were to examine the potential of sticky and malaise traps as tools for monitoring cotton fleahopper movement into cotton.

Materials and Methods

In 2001, cotton fleahoppers were monitored using border and in-field traps in five fields; two fields each in Brazos and Wharton Counties, and one in Dallas Co. Texas. Border traps were arranged in four sets along one edge of each field. Each set consisted of yellow Pherocon AM sticky traps (Trécé, Salinas, CA) set at ground level, 1 m, and 2 m above the soil surface on a single support (PVC pipe slipped over electrical conduit), white sticky traps (bottoms of Pherocon 1C wing traps, Trécé, Salinas, CA) at similar heights on another support, and a white nylon-screen malaise trap centered between the sticky trap supports (Fig. 1). Sticky traps were folded in half around the PVC pipe and ends were stapled together so that each trap was upright with one side of the trap facing directly outward from the field. Sticky traps placed at ground level were supported by the soil surface and were restrained from rotating by a wire placed in the soil. Sticky traps at the 1- and 2-m heights were held in place by passing a nail through the traps and PVC pipe. Sticky trap supports within each set were separated by 4 m, and trap sets were spaced 15 m apart. The malaise trap was positioned with the opening facing away from the field, and the capture container was equipped with a kill strip (18% Dichlorovos [w/w], Plato Industries, Houston, TX). Traps were placed on the upwind border according to the prevailing wind direction. In-field traps were also arranged in four paired sets spaced identically to border traps. Each pair consisted of a yellow and a white sticky trap on separate supports placed on the 30th row from the field margin. Trap supports were similar to those of border traps but were shorter, and the bottom of each trap was positioned 5-10 cm above the plants.

Traps were serviced twice weekly from approximately 3-leaf stage until first-bloom. Sticky traps were removed from the supports and wrapped individually in clear plastic wrap. Capture containers of malaise traps were removed, closed with a cork, and placed in a sealable plastic bag. Sticky traps and malaise capture containers were replaced as existing traps were removed. Because of concern for possible position effects within trap sets, trap color was randomly assigned to positions (left or right) in two or three of the border and in-field trap sets. Depending on the outcome, trap colors were assigned in the remaining sets so that each color occurred in each position with equal frequency (Fig. 1). Fleahoppers on sticky traps and in malaise capture containers were counted under a dissecting microscope.

The Brazos and Wharton Co. data were combined, but were analyzed separately from Dallas Co. data because of the longer sampling period in Dallas Co. Also, separate analyses were conducted for border and in-field traps. Because trapping intervals were unequal (either 3 or 4 d), fleahopper counts were converted to captures per day before analysis. In each analysis, effects of trap color and height (border traps) or trap color (in-field traps) were compared by analysis of variance (PROC GLM, SAS Institute 1998). In addition to these factors, ANOVA models for the Brazos and Wharton Co. data contained terms for field, sample date, and all possible main-effect interactions. The main effect of field was omitted from the ANOVA model for the Dallas Co. data because only a single field was sampled. Additional analyses compared fleahopper captures by in-field traps and ground-level border traps. ANOVA model statements were similar to those previously described except the term for trap height was replaced with trap location (border or in-field). In each analysis, means of the main effects were separated using the REGWQ option (SAS Institute 1998), and differences among levels of significant interactions were examined using the ADJUST = TUKEY option of the LSMEANS statement of PROC GLM (SAS Institute 1998).

Results and Discussion

Despite the use of kill strips, entrances to the malaise capture containers were frequently blocked by large insects or spider webs, and predation on captured fleahoppers was commonly observed. Consequently, many counts of captured fleahoppers were likely not valid. Thus, malaise trap data were not analyzed. Regardless, counts of captured fleahoppers were low (• 5) in each trap and many counts were zeros. Based on these observations, the malaise traps we used exhibited little potential for monitoring cotton fleahopper movement into cotton.

Data from border sticky traps in Brazos and Wharton Counties indicated yellow traps captured significantly more fleahoppers than white traps (F = 123.04; df = 1, 717; P < 0.01), and captures by traps at ground level were significantly higher than at other trap heights (F = 196.98; df = 2, 717; P < 0.01). Examination of the height-by-color interaction (F = 92.24; df = 2, 717; P < 0.01) indicated the influence of trap height varied between trap colors, with differences among heights tending to be more pronounced for yellow than white traps (Table 1). Respective effects of color and height also varied among sample dates (color-by-sample date interaction, F = 5.07; df = 9, 717; P < 0.01; height-by-sample date interaction, F = 7.77; df = 2, 717; P < 0.01). In each case, effects of color or height on fleahopper captures were not detectable when captures were very low. Data from border traps in Dallas Co. also indicated higher captures for yellow traps (0.57 fleahoppers/trap day) compared with white traps (0.23 fleahoppers/trap day; F = 67.92; df = 1, 270; P < 0.01), but differences among trap heights were not observed (F = 1.09; df = 2, 270; P = 0.34; Table 1). In addition, variation in the influence of trap color among sample dates (color-by-sample date interaction, F = 4.71; df = 14, 270; P < 0.01) was similar to that observed in Brazos and Wharton Co.

On average, yellow in-field traps in Brazos or Wharton Co. (F =12.45; df = 1, 240; P < 0.01), and in Dallas Co. (F = 66.16; df = 1, 90; P < 0.01) captured about three times more fleahoppers than white in-field traps (Table 1). In both sets of data, significant color-by-sample date interactions (Brazos and Wharton Co., F = 12.45; df = 9, 240; P < 0.001; Dallas Co., F = 3.05; df = 14, 90; P < 0.01) indicated this relationship was not consistent among the sample dates. Similar to the border traps, differences among colors were not detected when trap captures were very low.

Observations from Brazos and Wharton Co. indicated in-field traps captured more cotton fleahoppers than border traps set at ground level (F = 22.36; df = 1, 479; P < 0.01). However, the significant trap placement-by-date interaction (F = 11.04; df = 9, 479; P < 0.01) indicated differences in captures between trap placements varied among sample dates. Also, the significant trap placement-by-color interaction (F = 17.29; df = 1, 479; P < 0.01) indicated the effect of trap location was apparent only for yellow traps. In Dallas Co., in-field traps captured about three times more fleahoppers than border traps (F = 130.12; df = 1, 180; P < 0.01; Table 1). As in the case with Brazos and Wharton Co., effects of trap placement were not consistent among sample dates (trap placement-by-sample date interaction, F = 5.98; df = 14, 180; P < 0.01). The trap placement-by-color interaction (F = 34.08; df = 1, 180; P < 0.01) indicated the effects of trap placement varied with trap color. However, in contrast with observations from Brazos and Wharton Co., significant effects of trap placement were observed for both trap colors (Table 1).

In summary, our observations indicate malaise traps offer limited potential for monitoring fleahoppers entering cotton. In contrast, commercially available sticky traps show considerable promise for this use. Based solely on the magnitude of trap captures, our results suggest yellow sticky traps maintained just above the crop canopy in the field interior may be superior to other trap colors and locations for monitoring cotton fleahoppers. Should field operations or trap access restrict trap placement to field borders, yellow traps placed at ground level would provide the most acceptable alternative to in-field traps. Our preliminary results identify several trap operational parameters (e.g., placement, color) that should be considered in development of a trap-based fleahopper monitoring system and suggest continued investigation is warranted.

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Disclaimer

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Table 1. Mean ±SE daily captures of cotton fleahoppers on sticky traps from 3-leaf stage until first-bloom, 2001.

County (Dataset)	Color	Sticky trap location: Border, set at heights (m) of: [a] 0	1	2	In-field [b]
Brazos and Wharton	Yellow	1.46 ± 0.16 a	0.44 ± 0.05 b	0.41 ± 0.05 b	1.86 ± 0.18 A
	White	0.57 ± 0.07 a	0.32 ± 0.04 b	0.43 ± 0.05 ab	0.60 ± 0.06 B
Dallas	Yellow	0.64 ± 0.09 a	0.49 ± 0.07 a	0.57 ± 0.08 a	2.19 ± 0.24 A
	White	0.21 ± 0.04 a	0.22 ± 0.04 a	0.26 ± 0.05 a	0.71 ± 0.10 B

[a] Within each row, values followed by different small letters are significantly different (Tukey-Kramer test, $P \leq 0.05$)
[b] Within each dataset, values followed by different capital letters are significantly different (Tukey-Kramer test, $P \leq 0.05$)

Figure 1. Placement and orientation of traps on the border and interior of a cotton field, Wharton Co., TX.