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SCREEN BARRIERS FOR REDUCING INTERPLOT MOVEMENT OF THREE ADULT PLANT BUG (HEMIPTERA: MIRIDAE) SPECIES IN SMALL PLOT EXPERIMENTS

Mark S. Wipfli[1], John L. Wedberg[2] and David B. Hogg[2]

ABSTRACT

Fiberglass screen barriers 1.2 m high were erected around small (7.3 x 3.7 m) plots of birdsfoot trefoil, *Lotus corniculatus*, to study the effectiveness of screen barriers in reducing adult plant bug migration into small field plots. Screened and unscreened (control) plots were sprayed with an insecticide at the onset of the experiment, and subsequent adult mirid migration into these trefoil plots was measured by sweep net samples during the following 24 day period. Combined adult *Adelphocoris lineolatus, Lygus lineolaris,* and *Plagiognathus chrysanthemi* densities were significantly lower in screened versus unscreened plots with 37%, 28%, and 23% fewer adults at 7, 17, and 24 days, respectively, following insecticide application. Although these barriers were inexpensive and simple to construct, we conclude that they were not practical and effective enough for reducing adult mirid migration in small plot experiments of this type.

The alfalfa plant bug, *Adelphocoris lineolatus* (Goeze), tarnished plant bug, *Lygus lineolaris* (Palisot de Beauvois), and *Plagiognathus chrysanthemi* (Wolff) are common insect pests of birdsfoot trefoil, *Lotus corniculatus*, in northern sections of the United States and southern Canada (Copeland et al. 1984, Guppy 1958, MacCollom 1967, Neunzig and Gyrisco 1955, Wipfli et al. 1989, 1990). These and other adult mirids frequently disperse short and long distances (Hughes 1943, Craig 1963, Guppy 1963, Khattat and Stewart 1980), but fly relatively low. Ridgway and Gyrisco (1960) found that 93% and 69% of *L. lineolaris* fly within 1.8 and 0.9 m respectively, above the ground. Crosby & Leonard (1914) reported that few *L. lineolaris* adults flew over a 1.8 m cloth-wire fence erected around a nursery. McPherson et al. (1983) showed that 70% adult *L. lineolaris* fly 2.0 m or less, and 35% fly 1.0 m or less from the ground. They also reported that *Plagiognathus* spp. fly even lower, with nearly 50% adults flying within 1.0 m from the ground.

Adult *A. lineolatus, L. lineolaris,* and *P. chrysanthemi* are capable of quickly dispersing into insecticide-treated plots from untreated areas thus confounding treatment effects (Wipfli 1987). An effective and economical means of reducing mirid movement into and out of plots is necessary to prevent masking of treatment effects in small experimental plots. The purpose of this study was to evaluate the effectiveness and practicality of 1.2 m high screen barriers in preventing adult mirid movement into small, insecticide-treated plots.

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MATERIALS AND METHODS

The study was conducted in a 2 ha field of birdsfoot trefoil (cultivar Leo), at the University of Wisconsin Agricultural Research Station-Ashland, Wisconsin.

The experiment consisted of two treatments, screened and unscreened, applied across four blocks. The screened treatment consisted of barriers constructed out of 1.2 m high, gray fiberglass insect netting (1.6 mm mesh), which was erected around the plot perimeters. The netting was supported vertically with six 1.5 m metal fence posts driven 0.3 m into the soil. The unscreened treatment (=control) contained no netting barrier. Plots were 7.3 x 3.7 m, and a randomized complete block design was employed.

On 23 June 1986, malathion (57% emulsifiable concentrate) was applied to all plots at a rate of 1.4 kg/ha using a knapsack sprayer. On this date, the majority of mirids in the trefoil were fourth and fifth instars, with adults comprising less than 10% of the population. The trefoil was approximately 40 cm tall.

Mirid migration into the study plots was measured by sweep samples taken at 1, 7, 17 and 24 d after insecticide application. Sweep samples consisted of 20 pendulum sweeps each and were taken with a 38 cm diameter sweep net while walking a "U-shaped" pattern through each plot. In addition, ten samples of 20 sweeps each were taken in the trefoil surrounding the plots just prior to insecticide application to estimate potential "mirid migration pressure" on the study plots. Samples were transfered to nylon bags and placed in a freezer until mirids were counted.

Sweep count data were transformed (square root [x+1]) to homogenize sample variance, and analyzed using two-way analysis of variance (two treatments x four blocks). Means were compared using Duncan's multiple range test at $P = 0.05$ (Duncan 1955).

RESULTS AND DISCUSSION

Adelphocoris lineolatus and *P. chrysanthemi* comprised the majority (>90%) of mirid species present in the plots and surrounding trefoil. Combined mirid populations consisted mostly (>80%) of nymphs at the time of insecticide application, but adults were most abundant at 7, 17 and 24 d following insecticide application.

Mirid densities in the trefoil surrounding the study plots averaged 16.5 plant bugs/sweep at the time of insecticide application, which is a relatively high density in trefoil (Wipfli et al. 1989), thus providing high "migration pressure". The insecticide reduced mirid densities to nearly zero for adults, (1 d post-insecticide-application) and nymphs of all three species (Table 1). Movement of nymphs into plots following insecticide application was negligible in both screened and unscreened treatments.

The screen barriers significantly reduced adult plant bug movement into sprayed plots throughout the study (ANOVA, $P < 0.05$) (Fig. 1). At 7 d post-insecticide application, there were 37% fewer total adult mirids in the screened versus unscreened plots. Seventeen days after treatment, screened plots had 28% fewer total adult mirids than unscreened plots. On the last sampling date, screened plots had 23% fewer adults than unscreened plots.

The barriers were most effective in reducing *P. chrysanthemi* movement, as adult densities in screened plots were significantly lower than unscreened plots at 17 and 24 d post-insecticide treatment (Table 1). This greater effectiveness is probably a reflection of the flight height differences between the three species. *Plagiognathus* spp. fly closer to the ground than *L. lineolaris* and *A. lineolatus* (McPherson et al. 1983). Adult *A. lineolatus* densities in screened plots were significantly lower only at 7 d after insecticide application. *Lygus lineolaris* numbers remained low in both treatments throughout the entire sampling period with densities in screened plots significantly lower than unscreened only at 24 d after insecticide application. These barriers were simple to construct and required approximately 4 h for two people to

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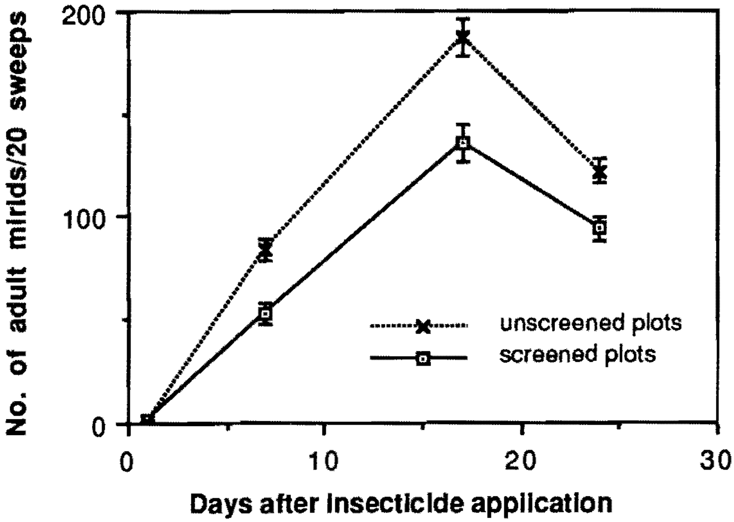

Figure 1. Sweep counts of combined *Adelphocoris lineolatus, Lygus lineolaris*, and *Plagiognathus chrysanthemi* adults in screened and unscreened plots of birdsfoot trefoil following insecticide application (Bars indicate ± SEM).

Table 1.—Adult densities of *Adelphocoris lineolatus* (*A. l.*), *Lygus lineolaris* (*L. l.*) and *Plagiognathus chrysanthemi* (P. c.) in birdsfoot trefoil at various post-insecticide-application intervals in screened (S+) and unscreened (S-) plots.

Mirid Species	Mean Number of Plant Bugs per 20 Sweeps.[a]							
	1 d[b]		7 d		17 d		24 d	
	S+	S-	S+	S-	S+	S-	S+	S-
A. l.	0.5a	0.0a	17.5a	35.8b	46.2a	61.0a	33.0a	30.0a
L. l.	0.0a	0.0a	0.5a	1.0a	3.0a	4.8a	3.2a	7.2b
P. c.	0.8a	0.5a	34.8a	47.0a	86.0a	121.0b	57.5a	84.5b

[a]Means in respective rows for each date followed by the same letter are not significantly different using ANOVA and Duncan's (1955) multiple range test ($P \geq 0.05$).
[b]Number of days following insecticide application.

assemble 88 linear m. However, their overall practicality is questionable. Moderate winds (30–40 km/h) frequently resulted in sagging and torn screen, requiring daily repair. The decreasing effectiveness from 37% to 23% at 7 d to 24 d respectively, was probably a result of torn and sagging screen, along with adults, given enough time, eventually find their way into the plots.

We conclude that these barriers were not sufficiently practical and effective to justify their use in small plot experiments of this type. However, these barriers may be more effective in reducing immigration with lower flying insects. Taller barriers would probably be more effective in reducing immigration, but at an increase in time and cost.

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