EVALUATION OF PHEROMONE TRAPS FOR MONITORING LESSER CORNSTALK BORER[1/] ADULTS IN BEANS

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ABSTRACT

Pheromone traps were used to monitor adult populations of the lesser cornstalk borer, Elasmopalpus lignosellus (Zeller), in beans, Phaseolus vulgaris L., near Rio Bravo, Tamaulipas, Mexico. Pherocon 1C® pheromone traps baited with 10 µg of lesser cornstalk borer pheromone in rubber septa were most effective when placed at a height of 0.5 m above the soil surface. Placement of traps within the field, along the edge of the field, within the row, or across rows produced comparable captures of adult males. Pie plate sticky traps were more effective than Pheromone 1C® traps at 0.5 m. These two trap types captured comparable numbers of males at 1.0, 1.5, and 2.0 m trap heights. The practicality of these results for monitoring lesser cornstalk borer adults throughout the growing season for beans is discussed.

INTRODUCTION

The lesser cornstalk borer (LCB), Elasmopalpus lignosellus (Zeller), is a polyphagous feeder common on legumes and grasses and is a major pest in the southern United States and subtropical countries (Luginbill and Ainslie 1917, Tippins 1982). In Mexico, however, the LCB is relatively unknown and is seldom reported attacking agricultural crops. In northeast Mexico, the LCB has occasionally produced economic damage in seedling corn, Zea mays (L.) by reducing plant population density and subsequently reducing yield (Loera 1983). However, in 1979, beans, Phaseolus vulgaris L., became one of the major agricultural crops in northeastern Mexico, and the LCB was often found infesting the crop. LCB infestations developed rapidly in beans, and by the time that larvae were detected, damage had often exceeded the economic level for control. Thus, the LCB became the key insect pest of beans in northeastern Mexico (Loera 1983).

The subterranean behavior of the LCB makes it difficult to detect infestations prior to economic damage. Most sampling procedures involve time-consuming manual search of plants and soil (Womack et al. 1981). Jones and Bass (1979) evaluated pitfall traps for sampling LCB larvae and concluded that this technique more accurately sampled larger LCB larvae than smaller larvae.

For insects such as the LCB that are difficult to sample in the larval stage, pheromone trapping of adult insects provides a means to estimate population densities prior to the damaging stage. Simple detection of the initial occurrence of adults can be important if prophylactic treatments are to be applied or to determine if more intensive sampling of

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damaging stages is required. Lynch et al. (1984) identified and evaluated the sex pheromone of the LCB which can be used to monitor LCB populations. Therefore, research was conducted to determine the potential for LCB pheromone traps for monitoring adult populations in beans.

MATERIALS AND METHODS

Tests were conducted near Rio Bravo, Tamaulipas, Mexico, in 1983 during the primary growing season for beans, from mid-September to early December. Three bean fields, each ca. 10 ha, were utilized for the research.

Pheromone trap height and placement were studied in a split plot arrangement of treatments in a randomized complete block design with three replications; each field served as a replicate. Whole plots were trap heights of 0.5, 1.0, 1.5, and 2.0 m above the ground. Subplots were trap placement within a row in the central portion of the field, across the rows in the central portion of the field, within a row along the edge of the field, and across the rows along the edge of the field. Pherocon 1C® pheromone traps were used and installed ca. 5 m from each other. Replicates were separated by ca. 50 m. The LCB pheromone consisted of 36.8% (Z)-7-tetradecen-1-ol acetate, 19.7% (Z)-9-tetradecen-1-ol acetate, 38.8% (Z)-11-hexadecen-1-ol acetate, and 4.7% (Z)-9-tetradecen-1-ol. Ten µg of the synthetic pheromone were evaporated from rubber septa (Arthur Thomas Co., cat. no. 8753-D22) after being placed in the center of the 'stickum' on the lower portion of the pheromone trap. Septa were replaced every 10 days, and adults were removed from the traps at each observation. Data were recorded on the number of males captured ca. every 3 days.

A second experiment was designed to compare Pherocon 1C® traps with pie plate sticky traps described by Sparks et al. (1979). The experiment was designed in a split-split-plot arrangement of treatments in a randomized complete block design with four replications and was conducted in one 10 ha field with treatments and replicates separated as above. Whole plots were types of pheromone traps, i.e., Pherocon 1C vs. pie plate. Subplots were the trap heights, i.e., 0.5, 1.0, 1.5, and 2.0 m. Sub-subplots were trap placements within a row in the center of the field, across the rows in the center of the field, within a row along the edge of a field, and across the rows along the edge of a field. Trap locations, pheromone, pheromone replacement, adult removal, and data collected were as described in the previous experiment.

RESULTS AND DISCUSSION

LCB population densities varied considerably between fields (replications). Considerably more adults were captured in field 1 than in the other two fields, and ca. twice as many adults were captured in field 3 as were captured in field 2 (Table 1). These differences may reflect variations in soil type between fields or variation in the stage of bean development between fields, since both soil type and plant stage are important determinants for LCB infestations (Tippins 1982).

Comparison of the mean number of LCB adults captured at different trap heights also showed highly significant differences. Significantly more ($P < 0.05$) adults were captured in traps placed 0.5 m above the ground than were captured in traps 1.0, 1.5, or 2.0 m above the ground. Similarly, significantly more adults were captured in the 1.0 m traps than were captured in the 1.5 and 2.0 m traps. Lynch et al. (1984) reported a variable response by LCB adults to trap height from 0.3 to 1.2 m in peanut fields. However, they reported that the greatest number of males were captured in traps placed at 0.9 m. The present results show that 0.5 m traps were significantly better than 1.0 m traps in capturing LCB adult

males. Although both beans and peanuts are approximately the same height, pheromone trap height appears to be much more important for monitoring LCB populations in beans than for monitoring populations in peanuts.

Table 1. Mean Number of Lesser Cornstalk Borer Adults Trapped in Pherocon 1C® Traps of Different Heights and in Different Fields of Beans.

Trap height (m)	No. of adults captured per trap[a]/	Field	No. of adults captured per trap[a]/
0.5	6.62a	1	24.96
1.0	1.99b	2	5.03
1.5	1.10c	3	10.66
2.0	0.45c		

a/ Means followed by different letters are significantly different at the $P \leq 0.05$ level using Duncan's multiple range test.

Traps placement had little influence on the number of males captured in pheromone traps. There were no significant differences ($P < 0.05$) in LCB capture when traps were placed within a row versus across rows or when traps were placed along the edge of a field versus traps placed in the center of a field. These results for LCB capture in pheromone traps in beans differ somewhat from the captures in peanuts reported by Lynch et al. (1984). They found that more adults were captured within peanut fields than were captured along the edge of a field, in grass adjacent to the peanut field, or along the edge of a corn field.

The interaction between trap height and trap placement was not significant. Thus, traps of a given height were just as effective in capturing males at the edge of a field as they were in the center of the field, and traps were just as effective within a bean row as across bean rows.

Fig. 1 presents a comparison of the number of LCB males captured per trap for the four trap heights during the duration of the experiment. Traps placed at 0.5 m were much more effective in capturing LCB males than were traps placed at 1.0, 1.5, and 2.0 m. Furthermore, it appears from the pheromone trap capture from 17 September through 11 November that three generations of LCB adults were produced. The first peak of adult capture occurred on ca. 18 September and probably represents the decline from a previous population peak. The second population peak occurred on ca. 30 September, and the third on ca. 3 November.

Comparison of Pherocon 1C® pheromone traps with pie plate sticky traps showed that pie plate traps were significantly ($P < 0.05$) more effective in capturing adult LCB males (Table 2). The interaction of trap type and trap height was also significant. Analyses of the interaction showed that pie plate traps caught significantly more ($P < 0.05$) males than Pherocon 1C® traps when the traps were placed at 0.5 m, but that the two types of traps were equally effective at 1.0, 1.5, and 2.0 m. Trap placement within a field, along the edge of the field, within a row, or across rows produced nonsignificant results ($P > 0.05$) as in the previous experiment.

Fig. 2 presents a comparison of the pie plate and Pherocon 1C® trap captures at the different heights. Pie plate pheromone traps captured more LCB adults than Pherocon 1C® traps at all sampling dates in the 0.5 m traps. However, both types of traps captured considerably fewer adult LCB males when placed at 1.0, 1.5, and 2.0 m, and the results of one type trap versus the other were more variable.

Pheromone traps offer a unique opportunity to monitor adult population densities of insects such as the LCB prior to the damaging stages.

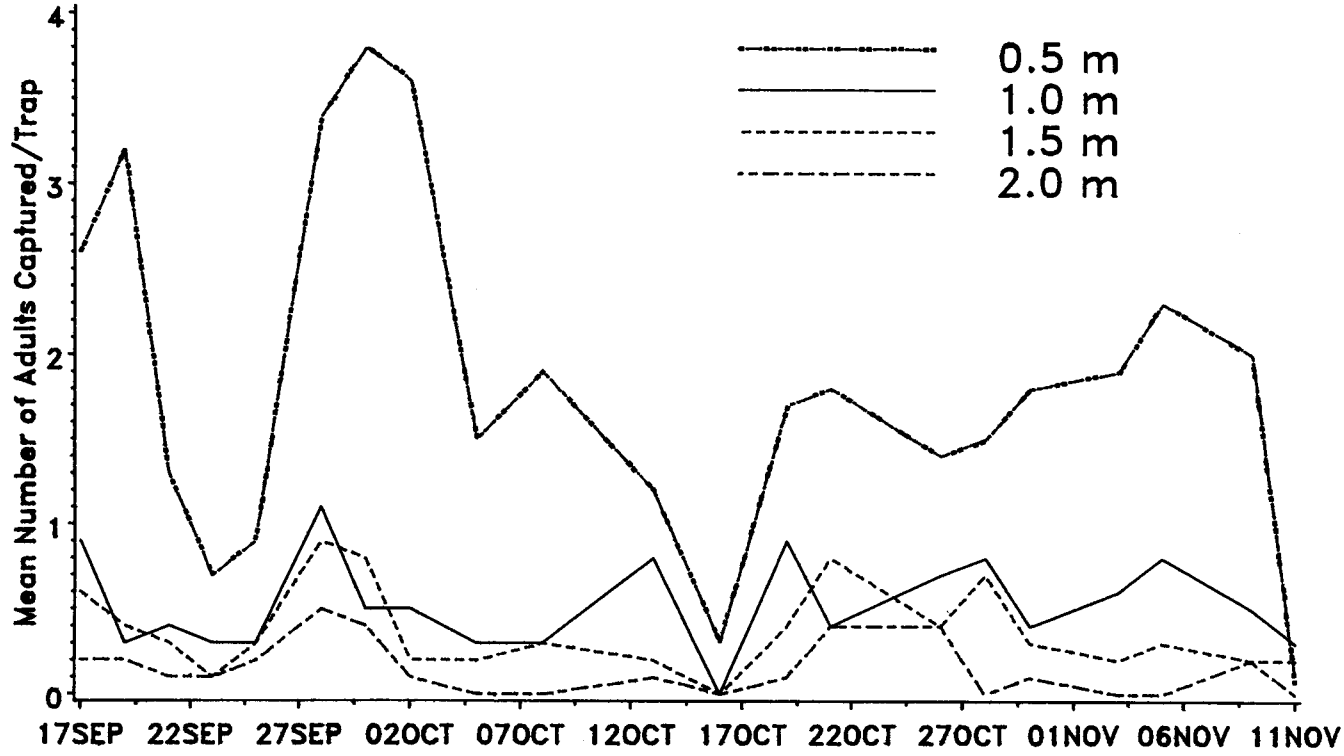

FIG. 1. Mean number of lesser cornstalk borer males captured in Pherocon 1C traps at four heights

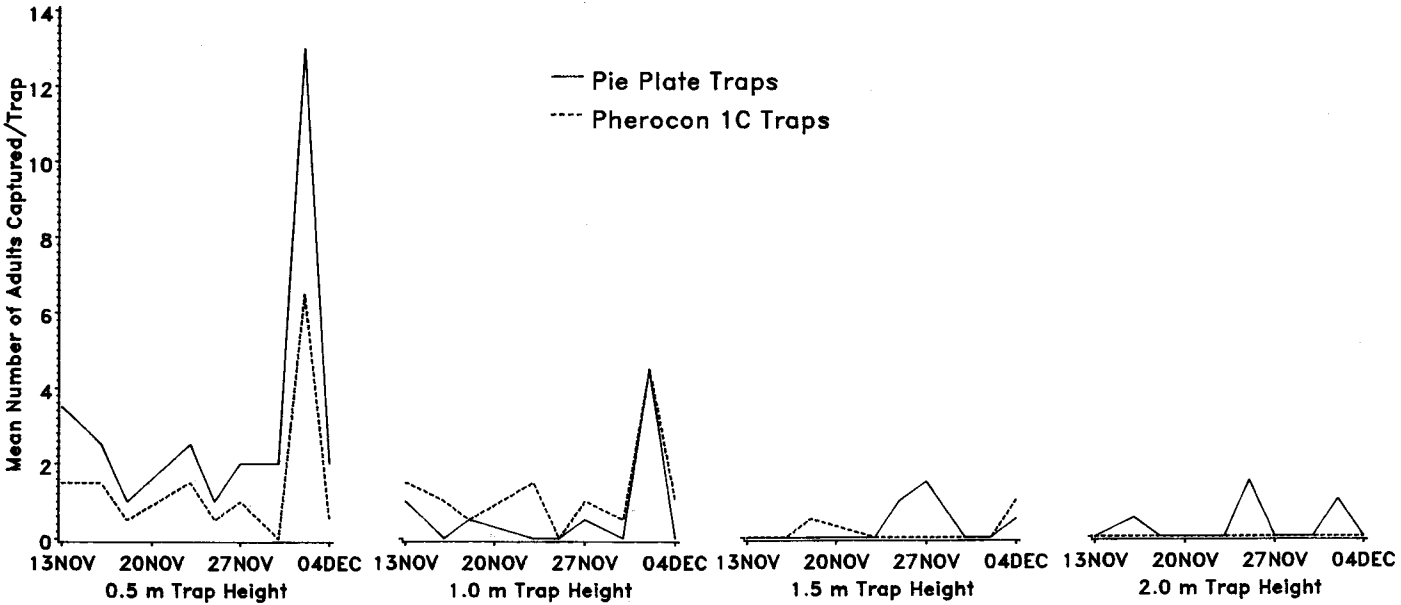

FIG. 2. Mean number of lesser cornstalk borer males captured in Pherocon 1C or pie plate pheromone traps at four heights

Table 2. Mean Number of Lesser Cornstalk Borer Adults Trapped in Pherocon 1C® and Pie Plate Pheromone Traps of Different Heights.

Trap height (m)	Pherocon 1C® traps[a/]	Pie-plate traps[a/]
0.5	1.50b	3.39a
1.0	1.23bc	0.73cd
1.5	0.17d	0.33d
2.0	0.00d	0.22d

a/ Means followed by different letters are significantly different at the $P \leq 0.05$ level using Duncan's multiple range test.

Results indicate that Pherocon 1C® pheromone traps baited with 10 µg of LCB pheromone were most effective in beans when placed at a height of 0.5 m above the soil than when traps were placed at 1.0, 1.5, and 2.0 m above the soil. Placement of traps within the field or within the row versus across rows had little effect on capture of LCB males. Pie plate traps were more effective than Pherocon 1C® traps at 0.5 m, but a plot of the captures throughout the growing season produced very similar population curves. Thus, LCB pheromone traps placed 0.5 m high within a row of beans would be most practical since the bean plants usually grow to a height of ca. 0.5 m. Such placement would not interrupt the movement of farm machinery through the field. These traps could be maintained in place throughout the growing season to monitor adult LCB populations, since larvae may damage beans from the seedling stage through the pod-fill stage.

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