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SEASONAL POPULATION FLUCTUATIONS OF LIRIOMYZA SATIVAE BLANCHARD[1/] IN BELL PEPPER[2/]

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ABSTRACT

Liriomyza sativae Blanchard larval populations and damage were found to be somewhat snychronized to bell pepper growth stages. Populations remained low and fairly constant from seedling emergence to bloom. Damage during the cotyledon plant growth stage was considered important because of the few leaves and small amount of leaf area available for oviposition and mining activities. The rapid plant growth following the cotyledon stage was a major factor in limiting leafminer induced damage before plant bloom. Highest larval leafminer populations occurred from plant bloom through maturity and harvest with some corresponding increases in foliar damage.

INTRODUCTION

Liriomyza sativae Blanchard is a common insect pest of many vegetable crops, especially bell peppers, in the Lower Rio Grande Valley of Texas (LRGV) (Chandler 1981). Currently, the exact economic injury inflicted by this pest on peppers is unknown, but most growers feel that it poses enough of a threat to warrant at least 10 seasonal insecticide applications. Damage resulting from leaf drop caused by increased leafminer population levels can render a crop unsalable due to fruit sun scald. Secondary fungal invasion through L. sativae mines also poses a problem. An understanding of the ecology of this pest is necessary in order to develop a management system for peppers. The purpose of this study was to determine seasonal population trends of larval L. sativae and its resulting foliar damage on untreated plantings of bell peppers, and to relate the established population patterns and damage to host plant growth stages.

MATERIALS AND METHODS

Intensive within field sampling of Grande Rio 66® bell peppers was conducted in the LRGV from the Spring of 1980 through the Fall of 1982, utilizing two growing seasons/year. The study site consisted of an untreated planting (0.4 ha) on USDA facilities at Weslaco, TX. Five 84 m^2 plots were established in each corner and the center of the field. The corner plots were a minimum 31 m from the field edge. Sampling was initiated at seedling emergence and continued weekly through harvest. On each sample date, 10 randomly selected plants/plot were counted with the following information recorded for each plant: height, number of leaves (cotyledon or primary), mines containing live larvae, empty mines, and a damage rating on a scale of 0 (no damage) to 10 (91-100% leaf area mined). Computations, including live larvae/leaf, total mines/plant (mines either empty and/or occupied) and total live larvae/ha, were also made. Means for all variables were calculated and standard deviations (SD) determined.

1/ Diptera: Agromyzidae

2/ Mention of a proprietary product does not constitute endorsement by USDA.

RESULTS AND DISCUSSION

Figures 1-3 present the total number of mines, mines containing live larvae (active mines), and leaves/plant for all seasons. Live larvae/ plant averaged from 0.1 ± 0.4 SD to 1.0 ± 1.0 SD during the cotyledon plant growth stage in all years. During the cotyledon stage the reduced amount of leaf area available for oviposition and mining may have been a significant limiting factor in the number of live larvae and total mines/plant present at that time. However, larval populations remained fairly constant throughout the study indicating leaf area may not be as important as once thought. Populations increased at or near the bloom stage and continued to increase through maturity and harvest. The highest numbers of live larvae (18 ± 10 SD) and total mines (160 ± 91 SD)/plant/sample date were noted in the 1981 Fall study. This converts to 102,260 individual larvae/ha. Most increases in L. sativae populations were associated with bloom and fruit maturity, which indicated a possible relationship between host plant physiology changes due to reproduction and leafminer population increases. The increased leaf area available for oviposition during plant maturity could also have contributed to some increases in leafminer populations. No definite trend in number of L. sativae generations/season was noted. Constant adult leafminer immigration makes delineation of distinct generations difficult.

Mean leafminer foliar damage ratings are shown in Table 1. Damage ranged from 0.5 to 3.4 at Weslaco during seasons of greatest leafminer activity. Generally, leafminer damage was fairly low during cotyledon plant growth, but was important due to reduced leaf area available for mining. Damage increased from bloom through maturity and harvest, usually being highest at or near harvest. Increases in foliar damage appeared initially to be associated with increases in total mines/plant. However, linear regression analyses of damage vs. total mines/plant/season resulted in coefficients of determination (r^2) ranging from 0.08 to 0.62 for each season. Tests of the null hypothesis that damage was related to total number of leafminer mines resulted in the null hypothesis being rejected ($pr < 0.05$). Therefore, total mines/plant alone do not appear to be a good indication of the amount of damage inflicted. Since the r^2 values were highly variable a more precise damage determination technique seems to be needed.

The data show that L. sativae larval populations were somewhat synchronized with bell pepper plant growth stages as well as the nature of the growth. Leafminer larval populations/plant remained low and fairly constant from the cotyledon growth stage to bloom. However, damage occurring during the cotyledon stage was important because fewer leaves were available for oviposition. Foliar damage remained low until bloom, a period of approximately 8 weeks. This probably was due to the rapid plant growth (increases in number of leaves/plant) that allowed the plant to withstand greater damage and population pressure. This phenomenon was also reported in cantaloup (Chandler and Thomas 1983). Leafminer larval populations then increased somewhat with some corresponding increases in damage after blooming was initiated. The increase in damage at plant maturity can result in severe leaf drop due to weakening of the plant and may increase chances of disease activity through pathogen invasion of the damaged leaf mesophyll. This was most noticeable during the Fall of 1981. The present study suggests that control of L. sativae during the cotyledon and bloom through maturity and harvest plant growth stages may be important and prevent damage and possible loss of yield due to leaf drop at maturity. The 10 or more insecticide applications/season usually made by producers is probably excessive. Knowledge of the peak activity periods of L. sativae and improved management strategies could significantly limit the amount of pesticide needed to economically control this pest. Insecticide applications should be held to a minimum to minimize the adverse effects on naturally occurring leafminer parasite populations (Chandler 1984). Further studies are needed to document the exact losses infliced by L. sativae on bell pepper and to optimize management strategies.

LITERATURE CITED

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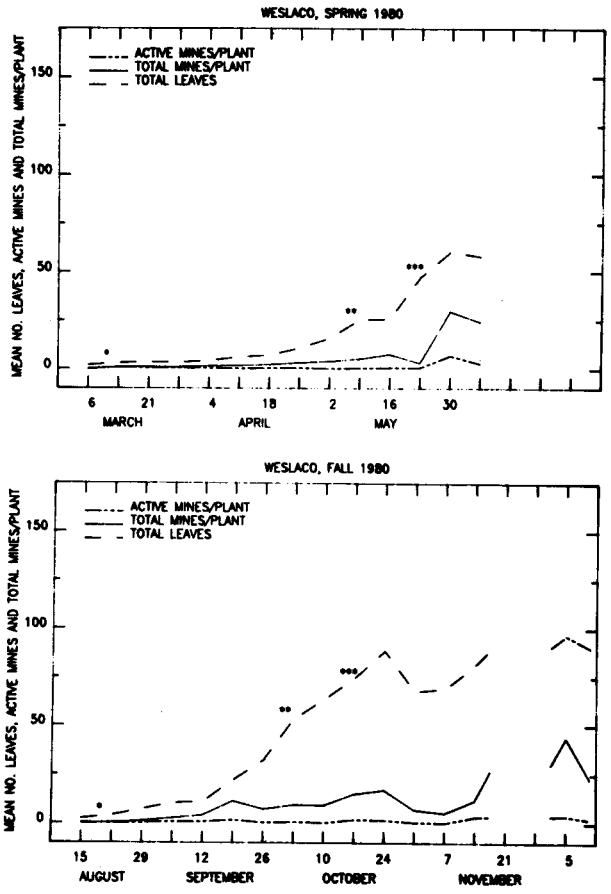

FIG. 1. Mean number of active mines, total mines, and total leaves/plant on dates indicated at Weslaco, TX during 1980. Peppers planted Feb. 16 and Aug. 3, respectively. * = cotyledon stage; ** = bloom; and *** = fruit maturity. Gaps in data due to missed samples caused by inclement weather.

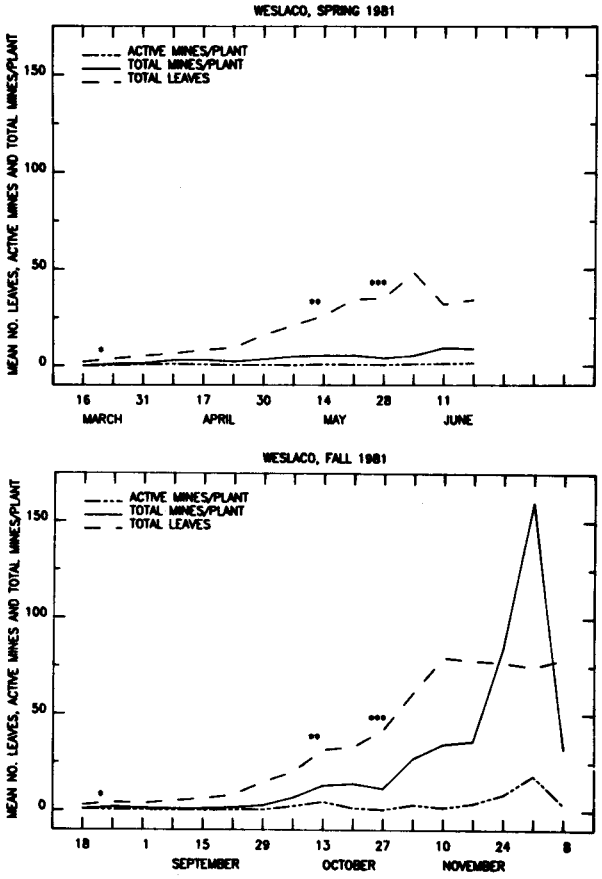

FIG. 2. Mean number of active mines, total mines and total leaves/plant on dates indicated at Weslaco, TX during 1981. Peppers planted Mar. 1 and Aug. 2, respectively. * = cotyledon stage; ** = bloom; and *** = fruit maturity.

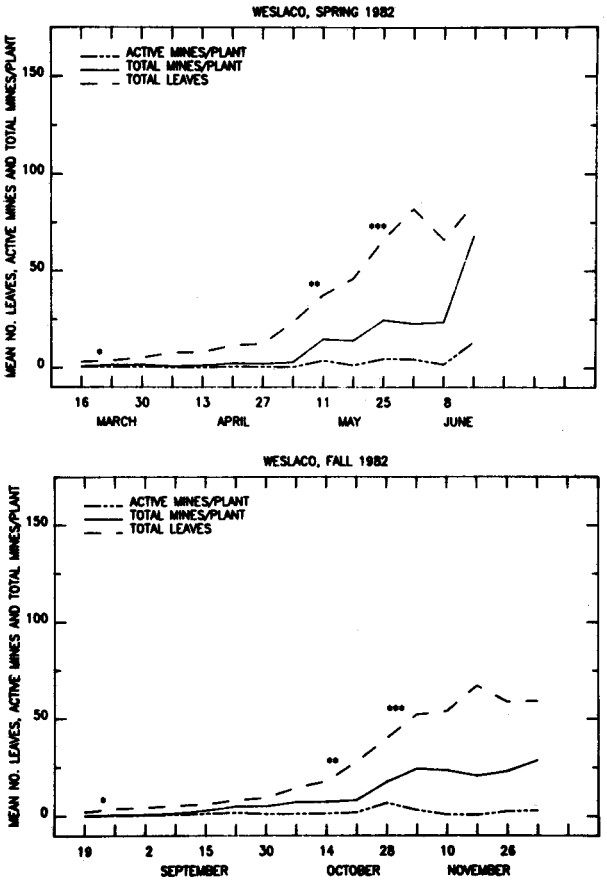

FIG. 3. Mean number of active mines, total mines and total leaves/plant on dates indicated at Weslaco, TX during 1982. Peppers planted Feb. 28 and Aug 4, respectively. * = cotyledon stage; ** = bloom; and *** = fruit maturity.

TABLE 1. Mean Foliar Damage Rating ± SD/Plant Inflicted by L. sativae on Dates Indicated at Weslaco, TX.

Spring 1980		Fall 1980		Spring 1981		Fall 1981		Spring 1982		Fall 1982	
Date	Damage Rating	Date	Damage Rating	Date	Damage Rating	Date	Damage Rating	Date	Damage Rating	Date	Damage Rating
3-6	0	8-15	0	3-16	0	8-18	1.2±1.5	3-16	0.7±1.2	8-19	0
13	1.3±1.6	22	0.5±1.0	25	0.6±0.5	25	1.5±1.0	22	1.7±1.9	26	0.9±1.4
21	1.7±1.6	29	0.8±0.4	31	0.7±0.5	9-1	0.7±0.5	30	1.3±1.4	9-2	0.4±0.6
28	1.7±1.6	9-51	1.0±0	4-9	1.2±0.5	8	0.5±0.5	4-6	0.5±0.5	9	0.6±0.6
4-4	1.2±0.7	12	1.0±0.2	17	0.9±0.2	15	0.5±0.5	13	0.6±0.6	15	1.0±0.8
11	0.9±0.7	19	1.0±0.1	22	0.8±0.4	23	0.6±0.5	20	0.8±0.4	23	1.2±0.5
18	1.2±0.6	26	1.1±0.3	30	0.9±0.3	29	0.8±0.4	27	0.8±0.4	30	1.2±0.5
25	1.1±0.4	10-3**	1.0±0	5-8	1.0±0.3	10-6	1.0±0	5-4	0.9±0.3	10-7	1.0±0
5-2	1.1±0.4	10	1.0±0	14**	0.9±0.2	13**	1.0±0	11**	1.1±0.4	14**	1.0±0.2
9**	1.1±0.4	17***	1.0±0	21	1.0±0.2	20	1.1±0.3	18	1.0±0.2	21	1.0±0
16	1.1±0.3	24	1.0±0.2	28***	0.9±0.4	27***	1.0±0.1	25***	1.1±0.2	28***	1.2±0.6
23***	0.7±0.5	31	1.0±0	6-3	0.9±0.2	11-4	1.1±0.3	6-1	1.0±0.1	11-4	1.2±0.4
30	1.4±0.6	11-7	1.0±0.2	11	0.9±0.3	10	1.0±0.2	8	1.0±0.2	10	1.2±0.9
6-6	1.9±0.5	14	1.0±0.1	18	1.0±0	17	1.0±0.2	15	1.7±1.1	18	1.0±0.1
		-	-			24	1.4±0.6			26	1.0±0.2
		-	-			12-1	2.8±0.8			12-2	1.1±0.2
		12-5	2.9±0.6			8	3.4±0.5				
		12	1.0±0.2								

** = Bloom; and *** = fruit set.