Reprinted from
ENVIRONMENTAL ENTOMOLOGY, VOL. 12, NO. 3, JUNE 1983

Dispersal of Western Bean Cutworm Larvae from Egg Masses as Measured by Damage to Beans[1]

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Environ. Entomol. 12: 902–904 (1983)

ABSTRACT Beans, *Phaseolus vulgaris* (L), were infested with egg masses of 50, 100, and 200 eggs of the western bean cutworm, *Loxagrotis albicosta* (Smith), and the dispersal of larvae was measured in terms of damage. Linear regression indicated dispersal of 3.05 to 3.66 m in the release row and 2.45 to 3.05 m across rows. At the higher egg levels, dispersal across rows was also indicated as up to 3.66 m. However, 72% of the damage occurred within a smaller area, 1.83 m (three rows) wide and 3.66 m long. This confirms general observations of spotty damage in the field and has implications for sampling.

The western bean cutworm, *Loxagrotis albicosta* (Smith), lays eggs in groups on the undersurface of bean, *Phaseolus vulgaris* L., leaves and usually on the upper surface of corn, *Zea mays* L., leaves in the whorl or top of the plant. The number of eggs per mass is variable and has been reported as ranging from 3 to 79 on beans (Hoerner 1948), from 5 to 225 on beans (Douglass et al. 1955), and from 21 to 195, with an average of 52 on corn (Hagen 1962).

The dispersal of larvae from a single egg mass has been reported on corn as "a circle that may be 10 or more feet in diameter" (Douglass et al. 1957) and as "an area of infestation 6 to 10 feet (1.83 to 3.05 m) in diameter" (Hagen 1962). Hagen also indicated that larvae migrate more readily in the row than across rows.

Low-level infestations obviously result in concentrations or "hot spots," and this is of concern in sampling for damage. Reported here are the results of a study conducted on beans in 1981 in Kimberly, Idaho, to measure the dispersion of larvae from egg masses as measured by damage.

[1]Received for publication 17 September 1982.

Table 1. Relationship between number of bean seed damaged per 0.61 m of row (Y) and distance from release site (X) of eggs of the western bean cutworm

Distance from release (m)	Infestation rate ($\bar{x} \pm$ SE)		
	50 eggs	100 eggs	200 eggs
In release row			
0 – 0.61	4.12 ± 2.38	11.50 ± 2.23	17.12 ± 5.35
0.62 – 1.22	2.75 ± 0.92	13.50 ± 4.40	12.12 ± 3.71
1.23 – 1.83	5.75 ± 3.52	4.50 ± 1.72	15.50 ± 4.40
1.84 – 2.44	0 ± 0	6.43 ± 3.03	6.75 ± 2.14
2.45 – 3.05	0.88 ± 0.48	1.29 ± 1.04	3.38 ± 1.77
Correlations[a]			
r (5 means)	−0.6243 ns	−0.8664 ns	−0.8940*
r (40 samples)[b]	−0.2253 ns	−0.4340**	−0.3950*
Regressions			
a	5.01	14.32	19.19
b	−1.52	−4.51	−5.39
Across rows			
0	4.12 ± 2.38	11.50 ± 2.23	17.12 ± 5.35
0.61	2.88 ± 1.12	13.62 ± 4.70	8.88 ± 3.48
1.22	1.62 ± 1.09	3.75 ± 1.42	4.62 ± 1.99
1.83	2.00 ± 1.10	2.50 ± 1.56	3.88 ± 2.12
2.44	0.12 ± 0.12	2.62 ± 1.29	1.38 ± 0.84
3.05	0 ± 0	0.75 ± 0.49	1.00 ± 0.93
Correlations			
r (6 means)	−0.9564**	−0.8754*	−0.9132*
r (48 samples)	−0.3832**	−0.5545**	−0.5101**
Regressions			
a	3.84	12.10	13.58
b	−1.36	−4.13	−4.87

[a]*, Significant at $P < 0.05$; **, significant at $P < 0.01$; ns, not significant.
[b]Only 38 samples for 100-egg infestation rate.

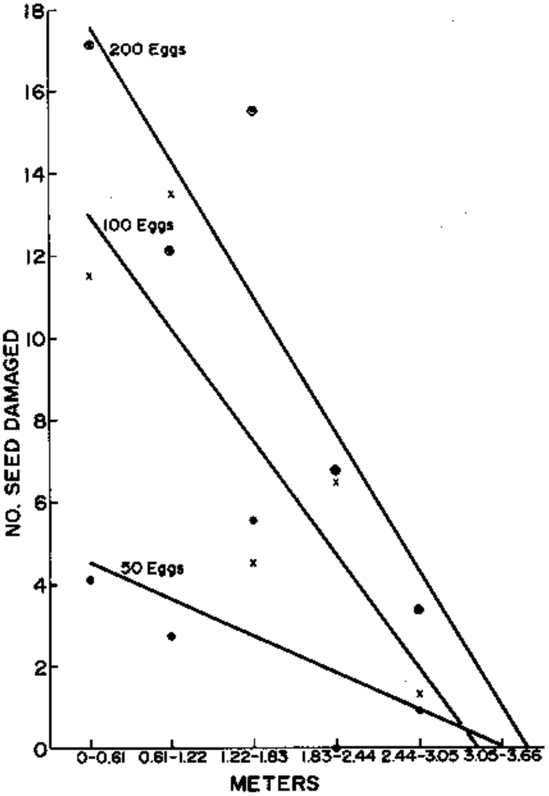

FIG. 1. Number of bean seeds damaged per 0.61 m of row by western bean cutworm larvae at various distances in the row from the release point of eggs at three levels.

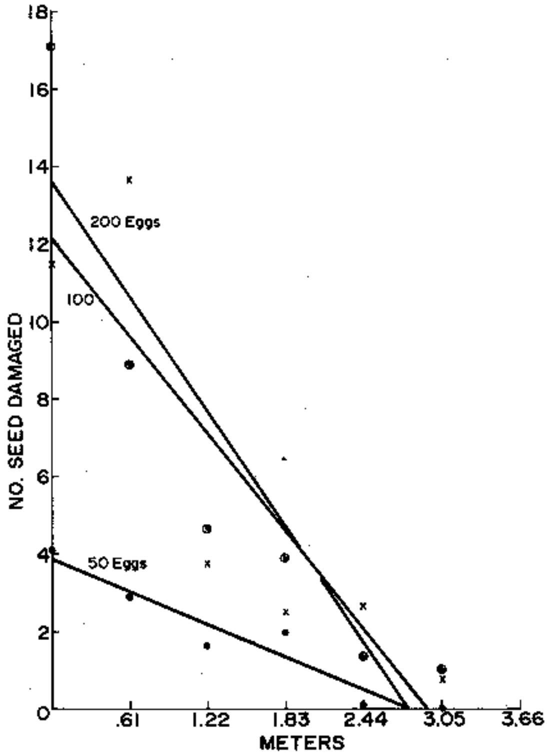

FIG. 2. Number of bean seeds damaged per 0.61 m of row by western bean cutworm larvae at various distances across rows from the release point of eggs at three levels.

Materials and Methods

Egg masses were collected from corn in the field and placed on 'Pink Viva' beans on 16 July. Plots were 8.53 m long and 13 rows (7.92 m) wide, with 0.61-m row spacing. The center of each plot was infested at rates of 50, 100, or 200 eggs. Treatments were randomized in four replicates. At harvest, five successive samples, each consisting of 0.61 m of row, were taken in the release row north and south and across rows east and west from the infestation point. Thus, in each plot there was a total of 10 samples in the release row and 10 samples across rows, to a maximum distance of 3.05 m from the release point. The number of seeds eaten or damaged was determined for each sample. Natural infestation in the plots was assumed to be zero. A blacklight trap nearby showed a very low moth population in the area, and an adjacent bean planting showed no damage. Of the 240 samples, two successive samples in a row furthest from a release point showed a sudden increase in damage and these were discarded. The data were subjected to correlation and regression analyses.

Results and Discussion

Direction N and S from the release point in the release row had no effect on damage distribution. This was also true for E-W damage distribution across rows, but E-W distribution differed from N-S distribution. There were, therefore, two samples for each distance within the release row and two samples for each distance across rows in each plot. The data are summarized in Table 1 and plotted in Fig. 1 and 2.

Although most correlations between damage and distance from egg release site were significant or highly significant ($r = P < 0.05$ or 0.01), sample variation was large as shown in Table 1 by SEMs and low r values based on individual samples. Linear regressions indicate damage from all three egg infestation levels extending to 3.05 to 3.66 m in the release row (Fig. 1) and extending across rows (Fig. 2) 2.45 to 3.05 m. However, based on the last four sample distances at the two higher egg levels in Fig. 2, damage across rows would also be expected to extend to 3.66 m.

The distribution of damage based on means averaged over egg levels shows rather uniform damage of 8.58 to 10.91 per sample within the release row extending to the third sample (1.23 to 1.83 m), and 8.46 per sample only to the next row (0.61 m). Thus, the majority of the damage (72.3%) was contained in an area three rows (1.83 m) wide by 3.66 m long. Beyond these distances, damage was abruptly reduced but continued to decline with distance from the release point. This seems compatable with the habit of newly hatched larvae on corn to migrate quickly and some distance from upper leaves to the tassel to begin feeding. In beans they should be able to disperse more rapidly and successfully within the row where leaves are intermingled than across rows. Later dispersal of larger larvae could occur at a different rate and more readily across rows with the development of a closed canopy.

In this test, the dispersal of larvae from single egg mass infestations as measured by damage to beans was approximately double the distance reported in corn (Douglass et al. 1957, Hagen 1962), but my data tend to confirm Hagen's observation that larvae migrate more readily in the row than across rows.

These data confirm general observations of spotty damage in the field under low levels of infestation and help explain the difficulty in obtaining significant differences among treatments in insecticide tests (Blickenstaff and Peckenpaugh 1981). Obviously, increasing the number of small samples and scattering them as widely as possible would provide more reliable damage estimates than fewer and larger samples.

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