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Comparison of Leafhopper Species Complexes in the Ground Cover of Sprayed and Unsprayed Peach Orchards in Michigan (Homoptera: Cicadellldae)

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COMPARISON OF LEAFHOPPER SPECIES COMPLEXES IN THE GROUND COVER OF SPRAYED AND UNSPRAYED PEACH ORCHARDS IN MICHIGAN (HOMOPTERA: CICADELLIDAE)[1]

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ABSTRACT

Two Michigan peach orchards were sampled for leafhoppers using a fixed-area ground sampling device attached to a D-vac®. Absolute abundance estimates indicated that routine tree insecticide applications greatly depressed leafhopper populations. This, and the fact that no resident, known vectors of the X-disease pathogen were detected, suggests that increasing insecticide applications to check the spread of the disease through vector control would be ineffective.

X-disease, a stone fruit malady of probable mycoplasma etiology (Nasu et al. 1970, Jones et al. 1974), is a major problem in the peach and cherry growing areas of southern Michigan (Rosenberger and Jones 1977). This is true for many of the major stone fruit producing areas in the United States (Gilmer and Blodgett 1976, Purcell and Elkington 1980).

Leafhoppers are the only known vectors of the X-disease pathogen (Gilmer and Blodgett 1976, Nielson 1968). There is much grower interest in checking the spread of X-disease through insecticidal control of the leafhopper vectors. To investigate this potential, it is necessary to sample leafhopper populations in such a manner as to allow for comparison between treated and untreated sample sites. The major means of sampling leafhoppers in stone fruit orchards has been yellow sticky-board traps (McClure 1980, Purcell and Elkington 1980, Rosenberger and Jones 1978, Taboada et al. 1975). The relative abundance estimates obtained through this method preclude interspecific or intersite comparisons because the units of measurement are unknown, making only comparisons in space and time possible (Southwood 1978). This paper reports the comparison of the leafhopper species complexes between a sprayed and unsprayed peach orchard using absolute abundance estimates.

METHODS AND MATERIALS

Sample Sites. The sprayed sample site was a commercial peach orchard maintained on a regular pesticide spray schedule until harvest (Howitt et al. 1981). Approximately 1165 trees of several varieties were planted on 12-ft (3.7 m) centers in rows spaced 20 ft (6.1 m) apart. The ground cover consisted primarily of orchard grass (*Dactylis glomerata* L.) and red clover (*Trifolium pratense* L.) with many herbaceous weeds scattered throughout the orchard. The trees were marked with spray paint for X-disesase symptoms in 1978, 1979, 1980 and 1981 with 4.1%, 15.9%, 22.9% and 25.0%, respectively, showing symptoms.

The unsprayed sample site was a three-row peach block on the campus of Michigan State University (MSU). Originally, 123 trees were planted on 6-ft (1.8 m) centers in rows spaced 12 ft. (3.7 m) apart. Currently, X-disease has reduced the orchard to 45 trees and,

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of these, 11.1% showed symptoms of the disease. The ground cover was mainly orchard and other grasses which remained unmowed throughout the season.

Sampling Method. Both sites were sampled every 3–4 days from 9 June to 10 October 1980, using a D-vac® suction sampler (D-vac Corp., Riverside, CA). A cone 34 cm high with upper and lower diameters of 19 and 40 cm, respectively, was constructed from 1-mm thick, semi-transparent fiberglass. A 5-cm vertical flange of fiberglass was attached to the upper edge of the cone to accommodate a 20-cm ID suction hose. Two 15-cm diameter holes were cut, opposite one another, into the side of the cone. These were covered with two layers of 1.5-mm thick black rubber and a slit was cut into each perpendicular to one another to allow for hand entry into the interior of the cone. The bottom of the cone encompassed an area of 0.125 m^2.

The trap was used by inserting a nylon net into the upper hole of the cone, carefully approaching the sample area, and quickly setting the cone into the ground cover before any insects could escape. The D-vac® hose was then attached and the vacuum motor started. By inserting the hand into the cone, all plant material was uprooted and vacuumed into the sample net. The bare ground was raked over with the hands to insure that all trapped insects were taken up into the sample (Fig. 1). To prevent any insects from escaping, the vacuum hose was disengaged from the cone and the nylon net removed before shutting off the motor. The sample was transferred to a plastic bag, returned to the lab and frozen for future leafhopper identification and counting.

Random sample locations in each orchard were generated based upon a grid size delineated by the tree spacings. The grid sizes were 12 by 10 ft (3.7 by 3.0 m) and 6 by 6 ft (1.8 by 1.8 m) for the sprayed and unsprayed sites, respectively. Each grid (= sample unit) was sampled at its center with 20 grids at the sprayed site and four grids at the unsprayed site sampled each sampling day for a seasonal total of 508 and 112 samples, respectively.

RESULTS AND DISCUSSION

Leafhopper Complexes. The leafhopper species complexes and relative number captured at both sample sites were similar (Table 1). Only one specimen of a known vector of

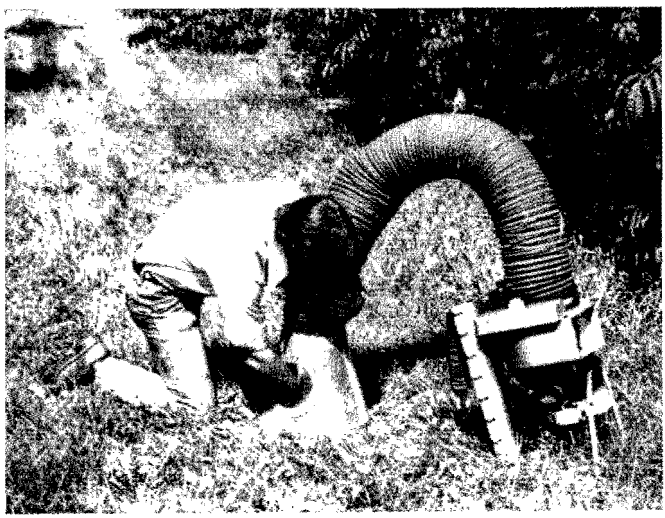

Fig. 1. Ground sampling device with attached D-vac® showing method of operation.

Table 1. Leafhopper species and their total numbers captured throughout 1980 in ground cover samples at the commercial (COMM) and Michigan State University (MSU) sample sites. The total number of samples at the COMM and MSU sites were 508 and 112, respectively.

Species	Sample Site		Total
	COMM	MSU	
Streptanus confinis (Reuter)	187	726	913
Aphrodes flavostrigata (Donovan)	35	249	284
Athysanus argentarius Metcalf	13	54	67
Draeculacephala antica (Walker)	6	42	48
Psammotettix ferratus (DeLong & Davidson)	1	29	30
Doratura stylata (Boheman)	1	26	27
Aphrodes fuscofaciata (Goeze)	4	18	22
Dicraneura mali (Provancher)	8	13	21
Endria inimica (Say)	10	5	15
Latalus sayi (Fitch)	1	9	10
Commellus comma (Van Duzee)	2	5	7
Macrosteles fascifrons (Stal)	6	0	6
Aphrodes bicincta (Schrank)	1	5	6
Parabolocratus viridis (Uhler)	1	5	6
Tylozygus bifidus (Say)	1	1	2
Xestocephalus pulicarius Van Duzee	2	0	2
Paraphlepsius irroratus (Say)	0	1	1
Amblysellus curtisii (Fitch)	0	1	1
Psammotettix lividellus (Zetterstedt)	0	1	1
Graminella nigrifrons (Forbes)	1	0	1

the X-disease pathogen (*Paraphlepsius irroratus* (Say)) was captured. This was unexpected because the most important known vectors in Michigan (*P. irroratus* and *Scaphytopius acutus* (Say)) use herbaceous plants predominantly as hosts for feeding and oviposition (Rosenberger and Jones 1978, McClure 1980). The lack of this, and any other, vector species suggests that the increase in X-disease at the commercial site for 1980 and 1981 might be attributed to non-resident vector species moving into and out of the orchard within a matter of hours or to resident leafhopper species not yet known to vector the X-disease pathogen. The most numerous leafhopper captured at both sites, *Streptanus confinis* (Reuter), has been observed on yellow sticky board traps along with *P. irroratus* at a height of ca. 1.8 m in cherry trees, which may warrant further investigation into its potential vector status.

Insecticide Influence. Comparing seasonal population trends for the two most common leafhopper species found in both sites (*S. confinis* and *Aphrodes flavostrigata* (Donovan)) indicates that tree foliar insecticide applications appears to greatly reduce their abundance in the ground cover (Figs. 2 and 3). While azinphosmethyl apparently reduces leafhopper numbers, endosulfan, and possibly phosmet, seem to have an even greater effect. Following termination of insecticide applications toward the end of July, leafhopper populations at the commercial site did tend to increase, but they never approached the densities recorded during the same period at the MSU site.

This indicates that while the ground cover may offer some protection from insecticides, tree foliar applications are likely to reduce leafhopper abundance. This calls into question the advisability of ground cover applications for vector control as it is unlikely that further reduction will be obtained (note the period around 1 August, Fig. 3). Late season, i.e., after harvest, insecticide applications may not aid in checking disease spread through

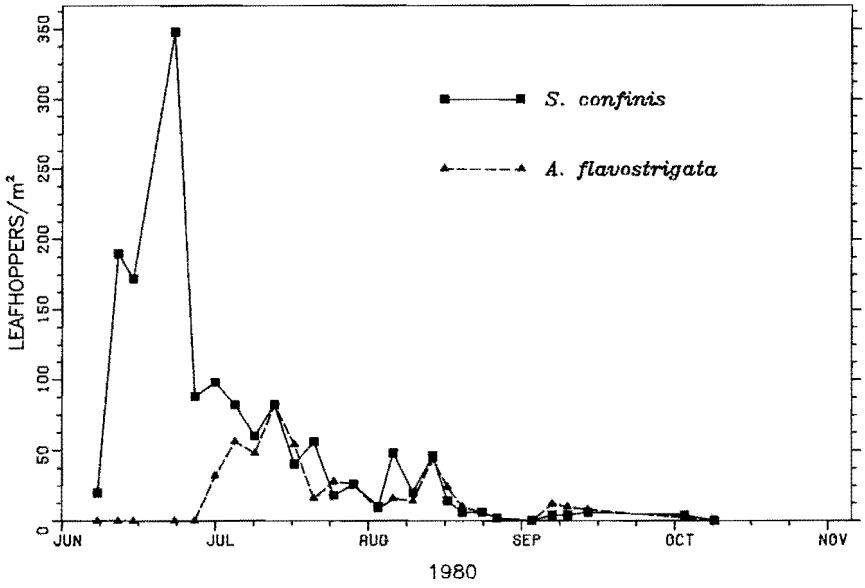

Fig. 2. Seasonal population trends for *Streptanus confinis* and *Aphrodes flavostrigata* at the unsprayed Michigan State University sample site.

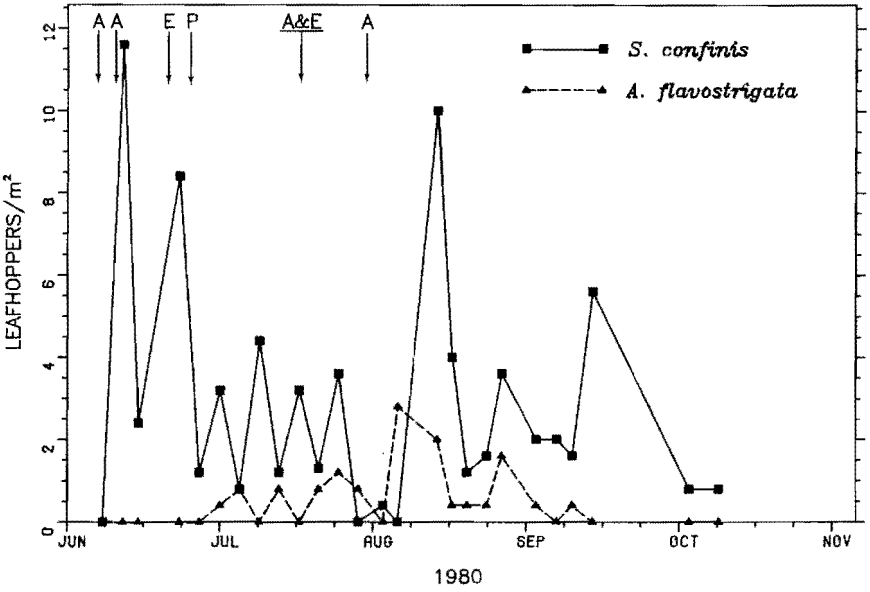

Fig. 3. Seasonal population trends for *Streptanus confinis* and *Aphrodes flavostrigata* at the sprayed commercial sample site showing dates of insecticide applications (A = azinphosmethyl, E = endosulfan, P = phosmet).

vector control as the leafhopper populations did not seem to reach high levels following the pre-harvest treatments.

CONCLUSIONS

Fixed-area ground cover sampling for absolute abundance estimates is an effective means of interspecific or intersite comparison but does not reveal leafhopper activity. Insects moving into and out of the orchard within short periods of time can only be detected with relative sampling methods, e.g., yellow sticky board traps. The sampling method used here may be used to assess the effectiveness of insecticidal control of leafhoppers. The incidence of X-disease increased in both 1980 and 1981 in the commercial orchard. This increase occurred in the absence of a resident known vector population and with greatly reduced leafhopper abundance in general. It would seem unreasonable, therefore, to increase insecticide applications in the orchard to check the spread of X-disease through vector control.

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