LITERATURE CITED

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BORDER EFFECTS OF SERPENTINE LEAF MINER ABUNDANCE IN POTATO FIELDS

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The manner in which insects infest plants and distribute themselves in a field is of interest and may be of value in determining control measures. Insects may be in a field prior to seedbed preparation and planting and infest plants as they begin growth. They may infest plants in the seedbed and be dispersed by man during transplanting. They may enter a field from the outside during the growth of the crop and become dispersed evenly over a field. They may, on the contrary, be unequally distributed because more insects stopped along the field border near the point of entry. Equalization of population or small and insignificant differences in distributions of a species over fields are attributable to two factors operating singly or in combination. These are (1) dispersability of an insect species, and (2) small fields or short distances under observation. These factors are considered to be operating where it appears that insects are evenly dispersed.

Interest is directed in this presentation to unequal distribution of insects, particularly to those cases in which more insects were observed nearest the insect sources outside of a field. It is recognized that unequal distribution of insects over a field, or border effects, may result from (1) unequal disper-
sion from an outside source, (2) a converging or massing of individuals of a species in areas with more favorable local conditions, or (3) other factors. In this presentation the border effects of the serpentine leaf miner, *Liriomyza pusilla* (Meig.), in potato fields are attributed to unequal dispersion from outside sources.

Larvae of the serpentine leaf miner, restricted as they are to feeding between leaf surfaces, disperse very short distances, in terms of inches, from the point of egg deposition. Pupae of the leaf miner may be distributed by dispersion agents such as man, wind, water, or by other agents. The distance might be considerable but is usually negligible. The adult fly is the active disperser of the species. It was reported by Webster and Parks (1913) that the adult serpentine leaf miners emerging from hibernation “do not travel far before oviposition takes place.” Information on definitive distances to which the serpentine leaf miner disperses are as woefully lacking as are those of most other insect species.

Marginal influences of fly activities were reported by Wolfenbarger (1947) for the severe leaf miner infestations recently encountered. As they became more abundant border effects were distinctly observed in several fields of tomatoes and potatoes, in large commercial fields. The tomato plants, first started in the fields in the area, attained large size and were heavily infested before the potatoes were attacked, so the tomato plants might have appeared to be a primary host plant of the insect.

Near the time of tomato maturity, the potato plants had grown so that they were attractive to the leaf miner adults. Definite fly dispersions were observed at this time. There were gradual and continuous movements of flies occupying days or even weeks of time. Flies were collected in nets, they were observed on the leaves, and a few days later plant symptoms of infestations were in evidence. These observations demonstrated that more flies were present where potatoes were planted to the west of tomatoes. Dispersion effects were less evident in potato fields to the south and to the north, and least to the east of tomato fields, showing decidedly directional effects.

Insects are generally considered to have their dispersion activities altered but little by winds. During the preparation of a summary on the dispersion of small organisms, Wolfenbarger (1946), references were encountered in which authors reported
or alluded to winds which actively dispersed insects. Part of
these references were devoid of numerical evidence. Most re-
ferences which gave data showed little or no directional in-
fluence of insect dispersion attributable to winds. Insects, in
general, are believed to seek shelter from winds which blow
them about; they tend to control their dispersion activities. It
is expected, however, that exceptions to this generality must
occur.

During the observations on the dense leaf miner infestations
the prevailing winds, although gentle, were from easterly direc-
tions. They were damp winds from the ocean but had passed
over some 3 to 6 miles of land. It seems likely that the winds
may have been instrumental in aiding dispersions toward the
west. It might be questioned, however, whether the wind was
an agent of propulsion toward the west or whether there was a
repulsion affecting the easterly direction of fly dispersion.

OBSERVATIONS

Leaf Mines: In one large 80 acre field of potatoes, bordered
on the east end by tomatoes, leaf miner infestation evidence was
very marked. Counts of leaf mines per potato leaf were made
at different distances from the end of the field. The average
number of leaf mines decreased with distance increase from the
margin of the potato field, as shown by the data in Table 1.

| TABLE 1.—NUMBER OF SERPENTINE LEAF MINER MINES PER POTATO LEAF
<table>
<thead>
<tr>
<th>AT DISTANCE FROM FIELD BORDER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distances classes, feet</td>
</tr>
<tr>
<td>Avg. No. of mines per leaf</td>
</tr>
</tbody>
</table>

A regression curve was drawn from these data, according to
the regular method of least squares, except that distances were
transformed to logarithms as discussed by Wadley and Wolfen-
barger (1944). The curve is expressed by the formula:

Expected number of leaf mines = 152.3708 - 50.6919 (log of distance).
The curve is illustrated in Fig. 1. The coefficient was found
to be highly significant. At distances greater than about 300
feet the border effects were reduced to low levels. Beyond this
distance infestations appeared to be more or less uniform in the
remainder of the field.

The rates of border effects observed in other fields ap-
peared similar to the one illustrated above. More marked dif-
ferences were observed in fields during the earlier stages of in-
Figure 1.—Serpentine leaf miner injuries and potato yields as related to field border.

Infestation than in the later ones. These differences were due to primary invasions since insufficient time had passed for the flies to have developed on potatoes. In later stages of infestations a greater equalization of leaf mines over the fields was evident. The equalization of units at later times or in later stages of infestation was a factor discussed by the author, Wolfenbarger (1946), in a summary on dispersion, under the subhead of, "Dispersion Equalization in Time Sequences." This factor is undoubtedly a matter of slight importance in some cases and of considerable importance in others.

TABLE 2.—Potato Yields at Distances from the Eastern Edges.

<table>
<thead>
<tr>
<th>Field designation</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ft. from margin 18 200 300 350 400 450 500 550 600</td>
</tr>
<tr>
<td></td>
<td>Ft. from margin 9 34 56 78 119 150 193 228 268 303 349</td>
</tr>
<tr>
<td></td>
<td>Ft. from margin 25 127 229 331 433 535</td>
</tr>
</tbody>
</table>
YIELD RESULT: Sections of potato rows were measured, dug, and the yield data were converted to bushels per acre, as taken from each of three potato fields at different distances from the eastern edges. These data are summarized in Table 2.

Border effects of leaf miner dispersions were observed repeatedly in each of these fields. Two curves were drawn for these yield data. The field designated “A” in Table 2 was the field in which the data on leaf mines (Table 1) were collected. A curve was drawn to smooth these data, Fig. 1, “Field A.” Another curve was drawn from the combination of data from the three fields, Fig. 1, “Fields combined.” These indicate the magnitude of yield increases with distant increases. The generalized regression formula obtained from the data in Table 2 is:

\[
\text{Expected yield} = 131.2942 + 28.5678 \times (\log \text{of distance})
\]

The results of computations from the use of the formula for selected distances showing the theoretical or expected yield at each are given as follows:

<table>
<thead>
<tr>
<th>Distance, ft. from field border</th>
<th>9</th>
<th>100</th>
<th>300</th>
<th>400</th>
<th>600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield, bu. per acre</td>
<td>171</td>
<td>188</td>
<td>202</td>
<td>206</td>
<td>211</td>
</tr>
</tbody>
</table>

A comparison of the curves illustrating yields, Fig. 1, shows similar curvilinearity, indicating how the data from the one field tended to agree with those of the combined fields.

In a consideration of the curves, Fig. 1, the leaf mines’ curve bends more sharply than those of the yields. This is attributed to the equalization of fly population, as discussed above. The data on leaf mines per leaf were taken at a time when the border effects were more marked. The yield data on the other hand, include effects of accumulated attacks of the miner over the growth period of the plants.

SUMMARY — Dense populations of the serpentine leaf miner developed in tomato fields and dispersed in westerly directions into adjoining potato fields. Data taken on the rate of decrease as related to distance increase from the field border showed that at about 300 feet leaf mines reached low levels that were general for the entire fields. Potato yields in three fields were found to increase with distance increase from the border where, based on the regression formula, 171 bushels per acre at 9 feet from the border increased to 202 bushels per acre at 300 feet.
A NOTE ON THE PREDACIOUS HABIT
OF THE MIRID

Cyrtopeltis varians (Dist)

By J. W. Wilson, Entomologist

Florida Agricultural Experiment Station

During the course of investigations, at the North Florida Experiment Station, Quincy, Florida in July, August and September, 1947, of means of controlling the green peach aphid, Myzus persicae (Sulz.), a small brown mirid was observed in large numbers on numerous occasions feeding on this aphid. During September, in a two acre field of shade tobacco that had been harvested and allowed to produce suckers, this mirid became so abundant that the previously heavy infestation of Myzus persicae was practically destroyed. In a tobacco seed bed planted for experimental purposes the mirids reduced the aphid population to such a point that investigation of chemicals for aphid control could not be continued. Specimens were sent to Dr. C. F. W. Muesebeck, Division of Insect Identification, Bureau of Entomology and Plant Quarantine, for identification. These specimens were identified by Dr. R. I. Sailer as Cyrtopeltis varians (Dist.). In his letter, Dr. Muesebeck stated that this insect had been reported as a predator on the suckfly Dicyphus minimus Uhl. and as injurious to tomatoes. From these reports it seems that C. varians may be both predacious and phytophagous. On one occasion during August several specimens (6 to 10) of C. varians were observed in the field feeding on about a third instar larva of Protoparce sexta (Jo- han.). Since this insect was observed only once in the act of feeding on a small tobacco hornworm larva it is not known that it will attack larger hornworm larvae.