A METHOD OF DETERMINING THE NUMBER OF POTENTIAL CONIDIA-FORMING CADAVERS OF ANTICARSIA GEMMATALIS INFECTED WITH NOMUREA RILEYI IN A SOYBEAN FIELD\textsuperscript{1,2}

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ABSTRACT

A method was developed for determining the number of cadavers of the velvetbean caterpillar, Anticarsia gemmatalis (Hubner), infected with the fungal pathogen Nomurea rileyi (Farlow) Samson in the developmental stage just prior to conidia formation (white stage) in a soybean field. One-third of the total number of cadavers in this developmental stage were observed to fall on the shake cloth during population sampling; (approximately two-thirds remained on the plant). Estimates of white cadaver counts from laboratory-held lots of field-collected larvae did not correlate with actual field counts.

Nomurea rileyi (Farlow) Samson is a fungal pathogen responsible each year for epizootics of various degrees of severity on soybean pests in Florida. Infections become evident in mid-August and, under certain conditions, by the end of the month will infect almost 100\% of the larvae of the velvetbean caterpillar, Anticarsia gemmatalis (Hubner). The fungus, once established, usually remains an active control agent until the end of September, when the caterpillars are no longer abundant. The pathogen becomes an effective control agent only after the pest population has seriously defoliated plants.

This naturally-occurring phenomenon has been observed in Florida (Watson 1915, Allen et al. 1971), and its occurrence and dynamics have been reported and investigated elsewhere by many workers (Petch 1924-1926, Hinds and Oosterburger 1931, Getzin 1961, Gudauskas 1966, Behnke et al. 1966, Burleigh 1972, Ignoffo et al. 1975).

A systematic approach to the application of this pathogen into an integrated biological control program has been underway in Florida for 3 years.

A standard method of determining fungal activity in the field has been to note the appearance of white cadavers, the first conspicuous sign that infection has occurred. It takes approximately 7 days from the time of infection to larval death. Conidiophores developing through the integument give the larva its cottony-white appearance. Depending on meteorological conditions, the fungus will then produce conidia, imparting a green color to the cadaver in 3 to 5 days.

The present method for determining the percentage of fungal infection in

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the host population is by retaining a sample of larvae collected by the shake cloth method in the field, for observation in the laboratory. The larvae are retained for 5 days to insure that infection occurred naturally in the field, and not as a consequence of the collection method or laboratory contamination. This procedure gives an accurate indication of trends in percent infection in the field.

The subsequent formation of conidia from the white stage is dependent on prevailing meteorological conditions. It is possible to find a large number of potential conidia-bearing cadavers in the field which have died over a period of several days to more than 1 week, when conditions have been unfavorable for conidia formation. However, since infected larvae in the laboratory are maintained in holding cups, with conditions favorable for conidiospore formation, the fungus usually develops conidia in approximately 48 hr, giving the insect its characteristic green appearance.

The inconsistency between conidia formation under laboratory and field conditions must be overcome in order to determine conidial densities in the field.

Conidial production in relation to larval size is known (Kish and Allen 1975), and host population counts are sized during sampling. As the effect of daily weather fluctuation on conidial production is determined, the fungal inoculum entering the system daily may be estimated and correlated with infection data. An accurate method of determining the number of potential conidia-producing cadavers in the field on a given day must be developed.

Since white cadavers are routinely observed on the shake cloth during population sampling, the purpose of this investigation was to determine the relationship between numbers collected on the shake cloth with the total number present on the plants.

METHODS AND MATERIALS

Populations were sampled by the shake cloth method in 2 plots of soybeans, each approximately 1 acre, at the University of Florida Agricultural Research and Education Center, Quincy, Florida.

Sampling was as follows: 50 ft of row for test A on 9 September 1974, 100 ft of row for test B on 10 September, and 100 ft of row for tests C and D on 11 September 1974. White cadavers were collected and counted for each plot from randomly selected 10 ft sections of the fields.

On the day white cadavers were counted by the shake cloth method, 1 row ft increments of soybean plants were cut and put in large plastic bags for transport to the laboratory. Each plant was carefully examined and the white cadavers removed and counted. Eight row-ft were examined for replication A; 24 row-ft for replication B; and 2 repetitions of 8 row-ft for replications C and D.

RESULTS AND DISCUSSION

The shake cloth method recovered 29-34% of the cadavers that were determined present by inspecting the entire plant (Table 1). The mean was 32.35% with deviations from the mean of 5.4, 5.4, 0.7, and 10.0 for the individual tests. The narrow range of determinations of the test suggests that the 32% figure for white cadavers counted by the shake method is valid for estimating the potential conidia-bearing cadavers in a soybean field.

The number of white cadavers per row-ft present in the field did not agree
TABLE 1.—WHITE CADAVERS INFECTED WITH *Nomuraea rileyi* FOUND ON 'Brago' soybean AT QUINCY, FLORIDA, DURING 1974. ENtIRE PLANT INSPECTION, SHAKE SAMPLING, AND LABORATORY REARING OF FIELD-COLLECTED VELVETBEAN CATERPILLAR LARVAE ARE COMPARED.

<table>
<thead>
<tr>
<th>Source of Cadavers</th>
<th>Number/row ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>White cadavers, lab-reared field sample</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>2.05</td>
</tr>
<tr>
<td>Recovered entire plant inspection</td>
<td></td>
</tr>
<tr>
<td>Recovered by shake sample method</td>
<td>.42</td>
</tr>
<tr>
<td>% relative efficiency of shake sample</td>
<td>34</td>
</tr>
</tbody>
</table>

with the percentage estimated from white cadaver counts in the laboratory-held lots. Loss of cadavers from field plants as a consequence of environmental factors, especially rain and predation, apparently reduces the number present and results in the difference between laboratory-based estimates and field counts.

The disease severity for the various sample dates differed from 38-68% based on laboratory rearing records. Within this range, the shake cloth and entire plant inspection methods for white cadaver counts show a consistent relationship of 1 to 3.

**LITERATURE CITED**


