INSECT ENEMIES OF THE EUROPEAN CORN BORER

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Introduction

Many species of beneficial insects play an important role in the natural biological control of harmful insects. For example, several species of predaceous insects influence corn borer populations.

Baker, et al. (1949) reported that predators were responsible for destroying 17.8 per cent of all corn borer eggs laid near Toledo, Ohio, during 1948. Eleven per cent were destroyed by predators during 1939. The lady beetle, **Ceratomegilla fuscilabris** (Muls.), was responsible for 50 per cent of the eggs destroyed. The lady beetles **Hippodamia convergens** (Guer.) and H. **tredecimpunctata tibialis** (Say), appeared later during the oviposition period. McCoy and Brindley (1961) attributed a loss of eight per cent of the initial borer population in Iowa to predation by the four-spotted fungus beetle, **Glischrochilus quadrisignatus** (Say). Jarvis (1960) found that insect predators were more abundant during the period of second-brood activity.

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Froeschner (1950) observed that larvae of a green lacewing, **Chrysopa plorabunda** (Fitch), a flower bug, **Orius insidious** (Say), and **C. fuscilabris** and **H. tredecimpunctata tibialis** (as **H. tibialis),** were important predators of borer eggs in Iowa. Jarvis (1960) and Dicke and Jarvis (1962) reported that **O. insidiosus** was generally most important late in the season. Chiang and Holdaway (1955) obtained evidence that there was some reduction in larval numbers as a result of predation in Minnesota. Sparks, et al. (1966) concluded that insect predators played an important part in fluctuations of corn borer populations in some locations during some years in the North Central states, but cannot be depended upon to play an important part in population regulation year after year or in a given year. The influence of predaceous insects on corn borer populations was investigated from 1964 through 1967 at Fargo.

Procedure

The sampling procedure was similar to that described by Chiang and Holdaway (1955), and used by Sparks, et al. (1966). A plot 10 hills long and 10 hills wide (Figure 1) was planted with Morning Sun sweet corn. The hills were thinned to three plants each. Twelve hills within the plot were randomly selected for the two treatments (six caged hills and six uncaged hills). About the time of natural oviposition, approximately 20 blackhead eggs

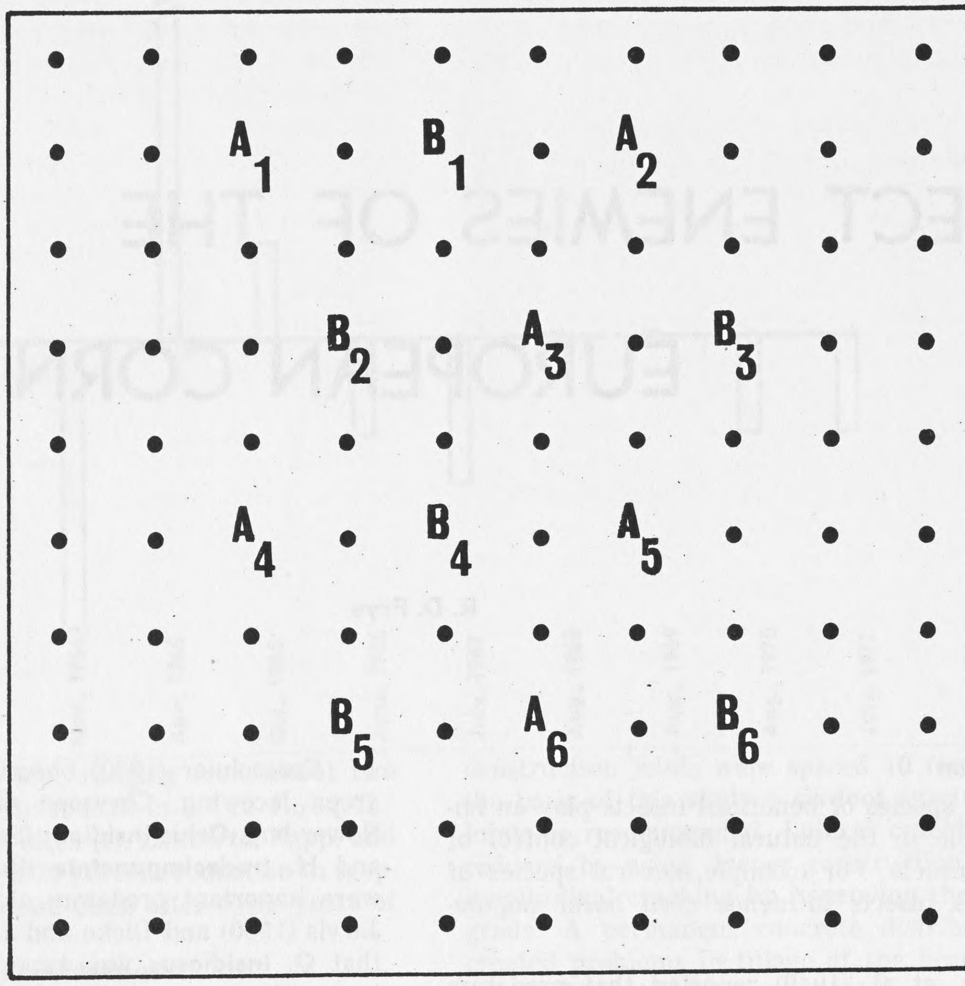

Figure 1. Diagram of the plot-setup for predation study.
A denotes caged hills of corn
B denotes uncaged hills of corn
• denotes a hill of corn, three plants

were placed in the whorl of each plant in the 12 selected hills (60 eggs per hill). Cages made from a 3½x3½x6-foot wooden frame covered on the sides and top with 18 mesh Lumite^{R} screen were placed over six of the hills to exclude predaceous insects. The cages were installed at the time the plants were artificially infested. Eggs of natural origin were removed from the test plants throughout the test. Predators found on the hills prior to caging were also removed. The caged and uncaged plants were dissected in the fall, and the intensity of predation was determined by using the following computation:

$$\text{Index of Intensity of Predation} = \frac{\text{Borers/caged plant} - \text{Borers/uncaged plant} \times 100}{\text{Borers/caged plant}}$$

Results and Discussion

Results are presented in Table 1, and summarized the entire growing season. Consequently, they give an indication of total predation over a season. Since a second-brood of the borer was non-existent or inconsequential during the study years, no attempt was made to separate second-brood predation from first-brood predation.

The indices of predation varied considerably from year to year. However, if the procedure is assumed to be valid, invertebrate predation was highly effective in reducing borer populations during all of the years. The "t" tests are also evidence that predation was a factor in reducing borer populations, and that under similar conditions it would be expected that 95 per cent (.05 confidence level) of the time there would be a significant difference between borer counts from plants inaccessible to predators (caged) and those accessible to predators (uncaged). It is interesting to note that reductions of borers from first-brood eggs per 100 plants to larvae per 100 plants in the fall at Fargo were 85.5 per cent and 96 per cent for 1966 and 1967, respectively. The intensity of predation index (Table 1) was 83 during 1966 and 72 during 1967. This is also evidence that predation accounted for a considerable amount of the population reduction during those seasons.

Table 1. Invertebrate predation on the corn borer, Fargo, North Dakota, 1964-1967.

Year	Intensity index	t value[1]
1964	78.9	2.935
1965	64.0	3.250
1966	83.0	3.767
1967	72.0	2.804

[1]Significant at the .05 level.

Lady beetles were the most numerous predators throughout the season, and were most abundant during the early part of the season when vulnerable stages of the borer were present. The most common lady beetles were **H. tredecimpunctata tibialis** (Say), **H. convergens** (Geur.) and **Adalia bipunctata** (L.). The species of lacewing observed were **C. plorabunda** and **C. oculata.** The former was more common. The lady beetles were most abundant during the period of first-brood development. Populations of **O. insidiosus** were low during the time of first-brood development and increased during the latter part of the season. Numbers of the various groups of predators varied considerably from year to year.

The results of this study are evidence that predators accounted for considerable mortality of the corn borer during the years 1964 through 1967 at Fargo. LeRoux, et al. (1963) reported that invertebrate predators were an important mortality factor during the egg stage of one-generation populations in Quebec. Again, these results and those of other workers have shown that considerable variation in the effect of entomophagous insects on borer populations may occur from year to year.

Small predators (**Orius**) and burrowing predators (ground beetles) were not entirely excluded by the cages. Therefore, their total influence on borer populations was not included in the results. **Orius** may not have had much of an impact on borer populations in the area because of a lack of synchronization between appearances of the predator and the vulnerable stages of the host. During most years of the study, **Orius** appeared later in the season, or after vulnerable stages of the borer were available and when second-brood borer development would be expected. In most years, there were few or no second-brood borer forms; consequently, the borer did not provide an important source of food for the predators present later in the season. Lady beetles and lacewings were more abundant early in the season when the borer was vulnerable and thus were likely the most important predators. The numbers of predaceous insects found on corn in Cass county during 1966 and 1967 are shown in Table 2.

Table 2. Average number of predaceous insects per 100 plants, functional stages; Cass county, North Dakota, 1966-1967.

Year	Observed during	Lady beetles	Lacewings	Flower bugs
1966	Early summer	429	71	6
	Late summer	237	21	108
1967	Early summer	155	38	18
	Late summer	94	11	63

Sparks, et al. (1966) found that the procedure was adequate for measuring predation. They concluded that lower borer survival on exposed plants than on caged plants was caused by predation, rather than by altered physical conditions under the cages which would have increased survival among borers on caged plants.

Summary

The study indicated that predaceous insects significantly reduced corn borer populations at Fargo. However, intensity of predation varied from year to year. Lady beetles and lacewings were the most important predators in the area.

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