Some Factors Associated with Earworm Resistance in Sweet Corn

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Plant resistance to insect injury has been demonstrated several times in the past few years. Most of the records of resistance refer to an insect having a limited number of similar host plants. As a contrast, the corn earworm has been recorded as feeding on nearly 100 species of food plants in the United States alone. These species include grains and forages, vegetables and flowers, and even the citrus fruits. The earworm always develops best on the fruiting parts of the plant but usually has little difficulty living on other parts if necessary. Resistance in a favored host-plant species to an insect of such omnivorous feeding habits would seem quite unlikely. Yet, that corn has been able to develop into a grain of such importance may be due to the development of protective factors within the plant, as well as to the natural enemies of the earworm. Certainly the 50 or more eggs often found would entirely destroy the ear if all developing larvae were able to feed on it.

For the most part, factors responsible for the observed resistance are not understood. Some of the factors are considered to be mechanical, such as a hairy or a hard stem that the insect cannot easily penetrate.

Husk covering was the most obvious reason for the differences Kyle (U.S.D.A. Bull. 708, 1910) observed in the amount of earworm injury on different varieties of corn. He considered that long, tight husks reduced the damage. Several workers since then have argued the point but have confused the issue by failing to differentiate between infestation and actual damage. Tight husks and closely placed rows do tend to reduce the total injury by compelling the larva to feed at the tip instead of penetrating deep into the ear. Thus, we have a mechanical form of resistance.

Tightness of husks does not have any effect on the percentage of the ears that may be infested. This lack of effect is easily understood when it is realized that a larva usually follows a single silk strand or a few adjacent strands in its feeding during the first, second, and sometimes third instar on its way to the kernels. Thus, it is not unusual to find a rather large number of small larvae in the silk channel during the early stages of development. By the time the larvae have reached the late third- or fourth-instar stage, they will have eaten off most of the silks and reached the tip of the ear. If the husks are tight the larva will be compelled to feed as it penetrates the ear. Thus, feeding will be confined to a small area at the tip where cannibalism occurs and often only one or two larvae survive. Although the ear is infested, less damage is done than if more larvae had wandered over the ear.

Early in our work with the earworm we noted that the larvae grew faster and larger on some varieties of corn than on others. In our hand-infestation work, we observed one case where larvae from the same batch of eggs had reached full size and left the ears of one inbred in 16 days whereas on an adjacent row of another inbred they were still feeding 10 days later. Also, in one case, when larvae from the same mother were kept in individual tin boxes under the same conditions in an incubator but fed different inbred lines of corn, those of one group reached full growth but those of another were very much smaller. Larvae fed on one very highly susceptible inbred were very much larger than normal and seldom completed development to the pupal stage. They remained as larvae or pre-pupae until death. The differences in growth pattern seemed to be due to some nutritional factor and should be studied further. This nutritional factor may affect the value of corn as food for livestock.

An inbred sent to us for testing by C. F. Poole of the Regional Vegetable Breeding Laboratory at Charleston, S. C., proved to be quite resistant. The progeny of a mutant selection found in 1941 have been highly resistant, and this character appears to be dominant since crosses of this selection also are resistant. This same resistance can be reselected from the crosses. Thus, it appears that the plants can produce some material perhaps distasteful to the larvae, and this character can be transferred from one plant to another through breeding. Likewise, we have observed a recessive character in one inbred that was highly resistant but the character was not expressed in the crosses.

We have also noted another form of resistance. Two inbreds, Ohio 55 and Connecticut 53, each of which are susceptible to earworm attack and injury, seem to have complementary factors for resistance. The cross of these inbreds gives us the resistant hybrid known as Brookhaven. A few other such results have been observed.

Perhaps the most spectacular form of resistance so far observed in corn was first found by R. A. Blanchard in 1941 in a line of flour corn with which he was working. He observed dead larvae in the silks of about 14 percent of the ears he had hand-infested with newly hatched larvae. This particular line of flour corn was lost but not until after it had been crossed with sweet corn.

Selections from these sweet x flour corn crosses have been found which carry the factor, sometimes much stronger than that of the original flour corn. What appears to be the same lethal character has been found in selections from a corn x teosinte x sweet corn cross, and from another line involving a cross between sweet corn and a semiflint variety known as Mexican June. The lethal character in these three lines appears to be dominant in breeding. The crosses are highly resistant and often a rather high percentage of the ears will have dead larvae in the silks. This lethal character that results in resistance is rather easily isolated again in inbreds.

We have found still a fourth line coming from a cross between sweet corn and Cuban Yellow Flint in which frequently from 50 to 75 percent of the inbred ears will have dead larvae in the silks. This character may be the same as that in the other three, but it appears to differ in being recessive in crosses and less easy to recover.

Thus, we have observed several resistant factors in the favored host of one of our most omnivorous insects. These factors each appear to be independent of any other plant character and can be used in breeding to combine two or more resistance factors in a single cross that is very highly resistant to earworm damage.