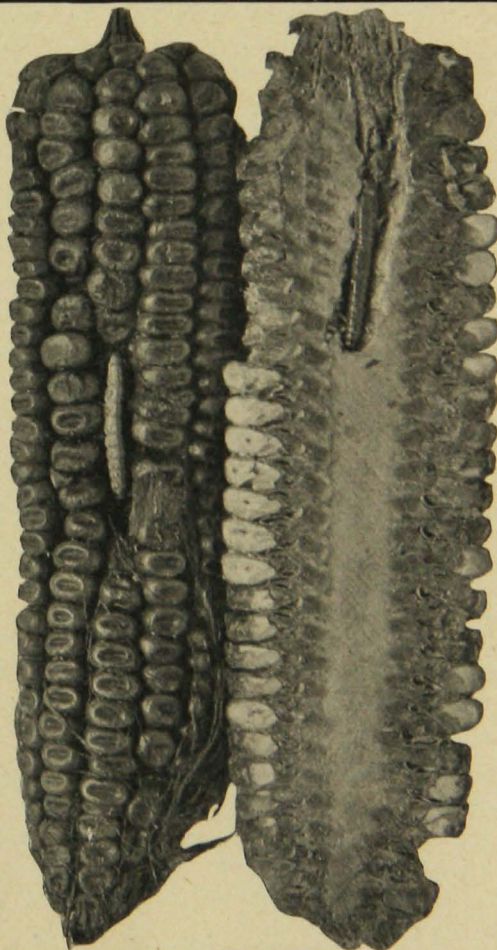


EUROPEAN CORN BORER

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CORN, one of the important farm crops in the United States, is menaced by the European Corn Borer. Congress has recently appropriated ten million dollars, in addition to large sums previously appropriated, to fight the borer and to save a crop and an industry that are indispensable.

The borer has reached Illinois on its march westward and is headed toward Minnesota. Just what it will mean to the corn growers of the state if the corn borer reaches Minnesota, it is impossible to predict.

In several counties in Ontario, where the insect is established, it has been impossible to raise corn profitably for the last two or three years. The same is true in two counties in Ohio and possibly one in Michigan; also in parts of New York State, particularly in sweet-corn areas. It is possible that in the Corn Belt certain areas will need to be devoted to other crops than corn if the pest once becomes established. Still other areas will continue to grow corn profitably.

The borer is probably the worst corn pest that the American farmer has ever had to contend with. The problem before us, therefore, is to learn "how to live with" the borer when it reaches us. In Minnesota the growing corn is often attacked by such insect pests as corn earworms, while grubs, grasshoppers, army worms, and wire worms, but only occasionally is an injurious insect generally distributed over the state.

FIRST BORERS HERE ABOUT 1909

The borer probably entered this country from Europe about 1909 or 1910. It was first found near Boston in 1917, where it was doing damage to sweet corn. There were three or four infested regions, one in Massachusetts, one in eastern New York, another in western New York in the Lake Erie region, and another, possibly still earlier, in upper Canada or Ontario. The last three are now practically one and the borers are rapidly approaching the larger corn belts of the middle west. In December, 1926, borers were found in Illinois, but to date, none have been found in 1927. If they continue to spread at the same rate they will be found in Minnesota before many years. The map (Fig. 1) shows the known spread (black area) for 1926. Flint and others have well said:

"There has never been a case in which an insect that has become established over so great an area has not spread over all adjoining territory in which conditions were favorable for its existence. The adult moth is capable of flying at least twenty miles, and with a good wind to carry it, can probably go several times that distance. Other moths similar to the corn borer are known to travel for hundreds of miles when carried along by the wind. The strict quarantines, both state and federal, that have been in force, preventing the shipment of

material which it is thought might carry the corn borer, have apparently prevented any commercial spread of the insect, but the moth cannot be stopped by quarantines."

The insect most likely to be confused with the European corn borer in Minnesota is the native corn earworm. The corn earworm feeds on the silk and kernels. The silk is often eaten off before fertilization, "nubbin" ears being the result. Sometimes the caterpillars are not mature at corn picking time and the worms may be seen on the cob among the kernels. If harvested with the corn, they usually die. Where these larvae have been, mold and bacteria develop and the ear has a musty appearance. The larvae of the European corn borer, on the other hand, burrow among the kernels as well as inside the cob, in the tassels, and in the stalks, twenty or more sometimes being found on a single stalk. (See Figs. 3 and 4.)

Another insect often mistaken for the European corn borer is the common stalk borer. Ordinarily, in Minnesota, the insect is confined to flower or vegetable gardens, where it bores in the stalks of

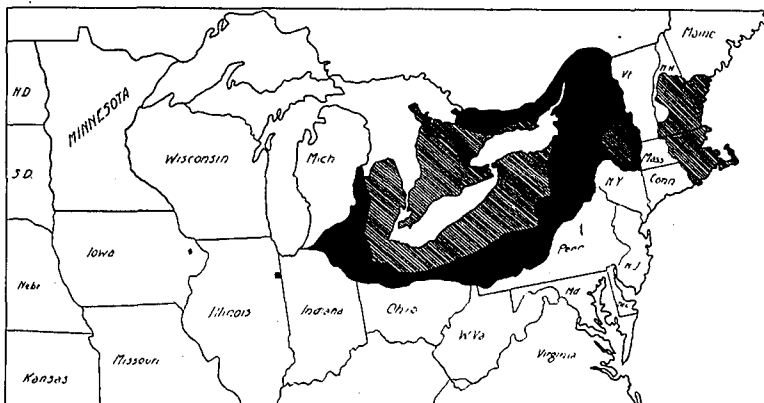


Fig. 1. Distribution of European Corn Borer in the United States, 1926

Shaded area shows region where the corn borer was found in 1925; black area, the spread of 1926.

hollyhocks, dahlias, tomatoes, and potatoes. This year (1927) the insect was very abundant in corn at the beginning of the season, the damage in some fields reaching 10 per cent. The caterpillar of the insect is striped with a dark band around the middle of the body. Later in the life of the caterpillar these stripes disappear. This species is never found in burrows in cornstalks or other hosts in the winter.

Still another insect received in large numbers this year, being mistaken for the European corn borer, was the lined stalk borer. The

larvae of this insect worked on young corn in nearly every case where the land was in sod the previous year. These caterpillars, also, are striped, which easily distinguishes them from the European species.



Fig. 2. Common Stalk Borer

SPEND WINTER IN COBS OR STALKS

The insect hibernates as a larva inside any part of the corn plant or other plants. It often spends the winter in the cob, but more often in the lower part of the stalk. It is about an inch long and an eighth of an inch across; has a dark brown head and a pinkish gray body, with two dark brown spots on the back of each body segment. Indistinct stripes run down the middle of the back. The under side of the body is clear and flesh colored.

In the spring the larva changes to a pupa in the burrow, and does not feed. During the last of June and the first of July the adult moth emerges. It measures about an inch across the wings. It is rather light in color, varying from pale to dark brown, often with irregular lines or streaks of yellow. The moths are strong fliers. They mate soon after emerging and the eggs are laid immediately. They are usually deposited on the under side of the leaves of corn and other food plants, and hatch in about two weeks. The young larvae begin feeding on the surface of the leaf, but soon hunt around for places into which they can tunnel such as the stem and larger veins of the leaf. They tunnel through the different tissues of the plant, often leaving one part and boring in at some other point. In five or six weeks after hatching the worm is full grown.

Caffrey and Worshley, in United States Farmers' Bulletin 1294, say that the larger borers can live for at least a month without food, even during their period of growth. This habit is especially significant, as the insects can be easily carried in infested material which may be transported considerable distances or may be kept in storage for a long time.

THEY ARE HARD TO KILL

"Experiments have shown that many of the full grown borers are able to survive total or partial submergence in either fresh or salt water for a period of at least 40 days during their inactive period in the late autumn, winter, or early spring."

If the borers are left undisturbed, they will remain in the old infested plant, particularly the lower 18 inches of the stalk, during the fall and winter months. If disturbed by collecting cornstalks in the field or when stalks are left in shock in the field, they crawl under rubbish, stones, and fences, and there construct a little silken covering for themselves, in which they remain over winter.

In the New England states the insect has two generations each year: in the area nearest to Minnesota it has only one generation. In either case the insects pass the winter as borers in the stalks.

EAT OUT HEARTS OF STALKS

The damage is done entirely by the larvae while boring into all parts of the stalk and ears of the corn plants. The central portion of the stalk is eaten out, the plant is not properly nourished, and the ears can not fill out and mature. The weakened stalks fall over and decay where the worms have worked. Ears thus injured do not keep well in storage. In certain parts of the older infested areas the crop is often completely destroyed.



Fig. 3. European Corn Borer in Cornstalk
(Courtesy of L. H. Worthley, U. S.
Bureau of Entomology)

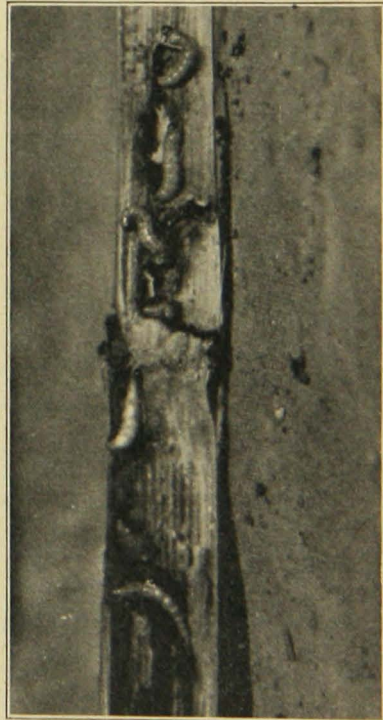


Fig. 4. European Corn Borers at Work
(Courtesy of L. H. Worthley, U. S.
Bureau of Entomology)

FEED ON MANY FORMS OF PLANTS

Another unfortunate thing is that this insect feeds on many plants.

It seems to be particularly fond of sweet corn but any kind of corn will do. It will burrow into millet, sunflowers, soybeans, dahlias, cosmos, celery, beans, rhubarb, spinach, potatoes, tomatoes, asters, and zinnias. In fact, many more plants, including several weeds, are attacked by the pest.

EVENTUALLY PARASITES MAY GIVE AID

No native insect enemies of importance have appeared to attack the pest. Government entomologists are searching in Europe for natural parasites and several have been obtained and set free in this country. But it undoubtedly will be several years before the parasites become effective. In their native country the parasites already found do not reduce the insect more than 30 per cent. We cannot rely upon parasitic control.

CONTROL METHODS MUST BE APPLIED NOW

The most important thing to consider is how this pest can be controlled. As the European corn borer will reach Minnesota sooner or later, we must be prepared to meet it by improving our agricultural practices. Methods known to be effective must be put into practice **immediately** by all corn growers. Crop rotations which include a cultivated crop have been found to be effective if rightly followed.

In Minnesota the type of farming which on the average has proved most profitable has been that in which the crops that make up good rotations are grown and disposed of in part directly for cash but largely indirectly through feeding to good livestock.

The leguminous crops grown in this type of farming provide high protein roughages so necessary for profitable livestock feeding and aid in maintaining or increasing the supply of organic matter and nitrogen in the soil, particularly when the manure is put on the fields before the valuable constituents are leached out.

The cultivated crops in the rotations, when properly cared for, aid very materially in reducing the amount of weed damage. The yields of grain crops, grown frequently on the same fields without intervening cultivated crops, are lowered materially by weeds.

Investigations have shown clearly that the growing of a leguminous crop and a cultivated crop once in from three to five years usually increases the yields of the grains and corn 20 to 30 per cent on farms where 6 to 8 tons of barnyard manure are applied preceding the corn.

The growing of corn in rotations not only aids in raising the yields of other crops by keeping down weeds, but also provides large yields of both grain and roughage for livestock feeding.

Keeping the soil in a productive state results in vigorous growth of plants. This makes them less subject to injury by the borer than weak plants growing on soil of low productivity.

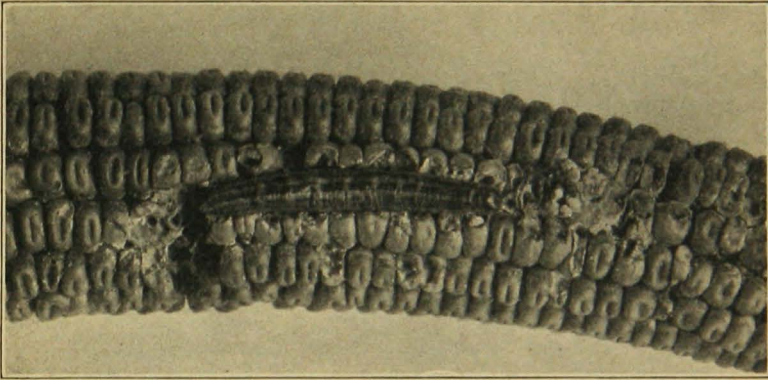


Fig. 5. Corn Ear Worm (Natural size)

A native pest often mistaken for the European corn borer

TYPES OF ROTATIONS OUTLINED

The kind of rotation followed must suit conditions on each farm, Therefore only general outlines of rotations can be given :

1. Three-year rotation : grain, clover, cultivated crop.
2. Four-year rotations :
 - (a) grain, clover and timothy, timothy, cultivated crop.
 - (b) grain, clover and timothy, cultivated crop, grain.
3. Five-year rotation : grain, hay, pasture, corn, oats.

Any of these rotations may be so modified that the amount of roughage and pasture produced is ample for the livestock carried.

The corn borer does very little damage to wheat and oats and the damage to barley and soybeans is ordinarily not serious. Clovers and alfalfa are not attacked by the borer. Therefore, the proportion of these crops in the rotations may be maintained or increased. The chief concern is to continue to produce the required acreage of corn.

CONCERTED ACTION IS NECESSARY

After the borer has appeared concerted action by farmers over a considerable area on the program of work outlined below may keep the borer down to such an extent that the usual acreage of corn can be grown, except where the infestation is very heavy.

1. The borer does most damage to early planted corn. Therefore, disk and harrow the land to keep down weeds until the ground is well warmed up. The corn will then germinate and

grow rapidly. This may be a week to ten days beyond the usual planting date. In many instances it will mean growing an earlier maturing corn that can be relied on to mature under average conditions even tho planted later than usual.

2. Many borers live in the lower part of the stalks of the corn plant. Cutting the corn as low as possible leaves fewer borers in the stubble.

3. Put as much corn as possible in silos. The worms are killed in the silage.

4. Shred the bundle corn whenever practical. This kills the worms in the stalks.

5. Burn scattered stalks and all cobs in the fall or early spring. According to the best advice stover should not be fed.

6. Plow corn fields 6 inches deep or deeper, preferably in the fall, using care to turn all stubble and stalks under deep.

7. When corn is husked from standing stalks, break down the stalks as soon as the ground freezes hard in the fall and burn them. Make a clean job of it. A thoro clean-up of all cornstalks each fall or spring is necessary, no matter how the corn is handled. Plow early in spring.

The rotations mentioned and the good farming methods outlined are already being followed by many growers in the state. Organized community effort will bring many others to adopt them. Then it may be possible to live with the borer without undue losses to the corn crop.

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