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## Protect Roasting Ears From Worms

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Fig. 1.—Ear worm working in tip of roasting ear.

Sweet corn is one of the choicest garden vegetables, especially when harvested for the table at the proper stage of maturity. The yellow sweet corn varieties are important sources of vitamins

and they also include large amounts of energy-containing substances. In Missouri, the most serious drawback to the successful growing of this crop is the ear worm. Judging by recent developments, not even the European corn borer is likely to prove so serious a pest of sweet corn. Every year considerable injury is caused by ear worms, and in some years practically every ear may be damaged. While only a portion of the grain at the tip of the ear is usually destroyed, wormy roasting ears are most unsightly and their market value is greatly reduced. This is especially true of plantings which mature after August 1. As a war measure, damage by this and other garden pests should be reduced. This brief report will give sweet corn growers and other gardeners the latest known facts about this pest and the best methods of reducing losses from it.

### **Crops Attacked**

The corn ear worm is a very general feeder. While most destructive to corn, first working in the curl early and then later in the ears, it also bores into and feeds on green and ripening tomatoes, beans, soybeans, cotton bolls, tobacco seed pods, peppers, flower buds, and the stems and foliage of various other crops. It is almost world-wide in its distribution, but in this country it survives the winter successfully only in the southern states. The moth is a strong flier, which enables it to migrate on its own power from the warm subtropical regions to the distant temperate zone farming areas. In the United States it is most destructive in the Corn Belt.

### **Life History and Description**

The pest is a close relative of the cutworms and army worms. It may develop from the egg through the caterpillar and pupa or resting stage to the adult moth in from 35 to 45 days. This means that we may have three or four broods of moths and worms each summer. It spends the winter in the resting stage in an earthen chamber two to four inches below the surface of the ground. From central Missouri north few of them survive severe winters. However, early summer flights of moths from the south bring the pest back to us just about the time field corn is ready to tassel. From that time on each succeeding brood of worms becomes more destructive until they are checked by the cold weather in the fall.

The moth has a wing spread of about  $1\frac{1}{2}$  inches. The color of the front wings varies from an olive-green to dark-brown, with

lighter and darker blotches. It flies mostly at night, but may be seen on wing in late afternoon visiting the blossoms of zinnias, four o'clocks, and other flowers, feeding on the nectar. From early dusk on into the night it may be seen darting about the cornfield, depositing its small eggs on the silks and shucks of corn. Frequently, a dozen or more eggs may be found cemented to the silks of a single ear of corn. However, the caterpillars feed on each other so that usually not more than one or two become full-fed in the same ear. The moth lives for several days and deposits from five hundred to a thousand or more eggs.

In warm weather the eggs will hatch usually in three or four days, and the small caterpillar immediately looks for a place to hide and feed among the silks in the tip of the ear. By feeding ravenously the caterpillar may grow from the newly hatched worm, scarcely large enough to be seen, to the full-fed tightly stuffed worm, measuring an inch and a half and the thickness of a pencil in about three weeks. The worm in corn ears is familiar to everyone. It may vary in color from green to yellowish-brown or almost black with lighter and darker body stripes. While developing in an ear of corn it may remain near the tip, or tunnel down several inches from the tip, feeding usually on two rows of grains. In fact, it frequently leaves the ear in which it starts to develop and enters another ear at the tip, or by cutting through the green shucks near the base. In case of tomatoes, one worm may injure several before it becomes full-fed.

As soon as the caterpillar has eaten its fill it leaves the ear and goes into the ground. As a rule, it makes a vertical tunnel 2 to 4 inches deep, after which it reverses its direction, digging a sloping escape tunnel back almost to the surface. At the bottom of this escape tunnel it makes its pupal chamber, where the caterpillar changes to the pupa stage. The pupa or resting stage is brown to black in color, about one inch long and as thick as a pencil. The fall brood spends the winter in the pupa stage, but the pupae of the summer broods change to moths in 10 to 14 days and escape to the surface through the open escape tunnel made by the caterpillars before pupating.

#### **Nature and Extent of Damage**

Ear worms do most of their damage to corn ears in the tip two or three inches, though some may work down to the middle

of the ear or farther. Most of the damage is done when the ears are "in the milk", or during the first two weeks following silking. However, in the late fall, ear worms may continue to eat the dry grains until cold weather kills them. Generally, sweet corn is more severely damaged than field corn though there is a great difference in the relative susceptibility to damage of the various strains and hybrids of both sweet and field corns.

The amount of grain on infested ears that is actually eaten varies from a few grains to 10 percent or more in severe infestations. Besides the grain actually eaten, however, usually much more is made worthless by small beetles and their white grubs which attack wormy ears, and by molds and other fungi introduced by the worms while feeding on the soft milky grain. In fact, some molds found in wormy corn may actually prove poisonous to livestock.

In case of tomatoes, as a rule, every green or ripening fruit entered by a worm is made worthless for human consumption. In seasons of severe infestations, as much as half of the late tomato crop may be destroyed. Some years, also, the pest seriously damages beans, and often in the South it is a major pest in the bolls of cotton.

### Control

The corn ear worm is a very difficult pest to control. No cultural or thoroughly effective and practical insecticide control has been perfected. However, there are a number of control practices which will help materially in reducing its damage to sweet corn. These control practices include a number of cultural and cropping practices, the planting of the less susceptible strains of corn, and the use of insecticides.

**Cultural Practices.**—Since the pest in considerable numbers may survive milder Missouri winters in the soil, late fall or winter plowing or heavy disking of infested cornfields, truck gardens, and home gardens, where danger from winter erosion is not serious, will help to reduce possible local carryover of the pest. Where land erodes badly, spring cultivation before the moths emerge will help to reduce carryover of the pest.

Late-maturing corn usually suffers most from ear worms. Early planting, therefore, combined with the use of fertilizers and proper cultivation to insure rapid growth and early maturing of the crop, is one effective means of reducing ear worm damage. The seeding of an early maturing strain of corn will also help in the same way.

Corn breeding experiments indicate the possibility of developing hybrids of both sweet and field corn which suffer much less damage from ear worms than do most standard varieties. While present widely planted strains of hybrid sweet corn may not show such resistance, indications are that forthcoming new strains of sweet corn will have resistance or tolerance to ear worms.

Emmert and Price, in Kentucky Agricultural Experiment Station Bulletin 436, report effective control of the corn ear worm by simply clipping and destroying the tips of the ears with enclosed worms after pollination is completed. Others have not found clipping so effective. Many growers delay clipping until the roasting ears are ready for marketing and then use a hatchet to clip off the injured tips of the ears with enclosed worms.

**Insecticide Control.**—Efforts during the last 20 years to develop an economical means of control for ear worms through the use of insecticides have largely failed in case of field corn, due largely to the high cost of the treatments as compared with the value of the corn actually saved. Garden and commercial plantings of sweet corn, however, and even field plantings of high priced hybrid seed corn can be profitably treated with insecticides.

Poison sprays and dusts formerly applied to the silks and shucks generally did not prove effective. Better results, in recent years, have been secured by introducing insecticides inside the husk at the tips of the ears, soon after pollination has been effected. Any insecticide, to be used in this way effectively, must protect the ear from worms without injury to the normal development of the ear and without leaving any poisonous or disagreeable residue on the ear when prepared for canning or for table use. Of the various insecticides used, two different types have proven especially valuable in protecting the ears. One is a mixture of refined white mineral oil and either pyrethrum extract or dichloroethyl ether, and the second is hexachloroethane in the form of a conveniently shaped tablet.\*

To use one of these insecticides successfully, the grower must first allow the silks to begin to dry, which indicates that the grains have been fertilized. If the insecticide is applied before silks start wilting, proper pollination will not take place, resulting in the formation of a nubbin. Also, in applying the chemical, care must be taken to avoid overdosing or injuring the tip of the ear or in opening up the husk too much. Also, for best results, a second application should be made in about a week to

\*To Geo. W. Barber, Bailey B. Pepper, and others of the Bureau of Entomology and Plant Quarantine most of the credit for the effective development of these ear worm insecticides is due.

treat those ears which were not ready for the first treatment. Only one application of the insecticide is required for each ear.

**Oil-Pyrethrum Treatment.**—During the past four years the authors have used white mineral oil (medicinal oil) alone and in combination with pyrethrum extract and a number of other chemicals to determine the effectiveness of the different materials. When the oil alone is used it should have a Saybolt viscosity of 150 to 250, but when pyrethrum or other insecticide is combined with it experience has shown that it should have a viscosity of 100 to 150 in order to disseminate the pyrethrum better in among the silks. Drug stores can supply such oils.

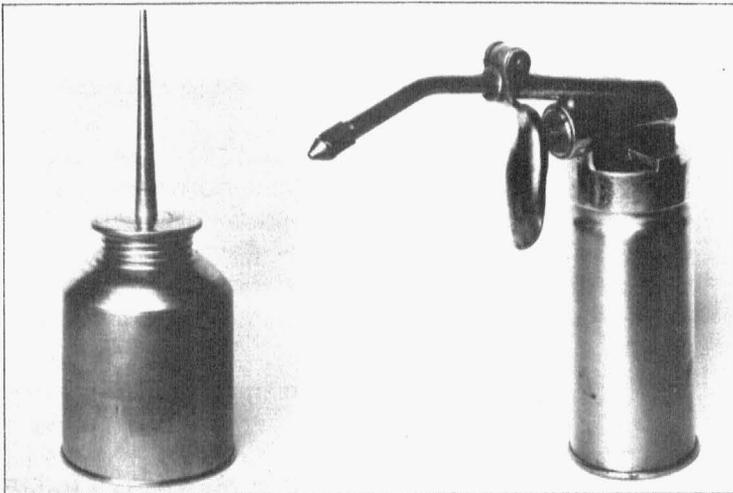


Fig. 2.—Oil can and oil gun used for injecting oil-pyrethrum into tips of ears.

About 20 drops, or one-fourth teaspoonful, of the oil-pyrethrum is used per ear and it is introduced from one-half to one inch down in the tip of the ear. For applying it on a small garden planting, a medicine dropper will work, but for larger plantings an oil can or special oil gun should be used. (See Fig. 2.) When applied after pollination was completed and when the ears were not overdosed, no harm whatever was done to the ears. This treatment gave from 50 to 80 per cent of the ears free of worms in 1941 when untreated plantings had only 2 per cent of the ears worm-free. In 1942, equally good results were secured in large field tests. There are on the market a number of commercial

brands of white mineral oil with 0.2% pyrethrins included. When the oil alone was used in 1942, control was less satisfactory. When Lethane was used with the oil in one test equally as good results were secured as when pyrethrum was added to the oil. Dichloroethyl ether with the oil has not been used by the authors, but Pepper and Barber, in 1940, reported even better control where 2% of it was used in the oil than where pyrethrum was used with the oil.

**Hexachloroethane Tablet Treatment.**—Tablets the size and shape of a bean and containing one-half gram of hexachloroethane, introduced in the tips of the ears, have been used experimentally for the past four years. This treatment has given from 46 to 85 per cent of the ears free of worms, when only 2 per cent of the ears on untreated plantings were free of worms.

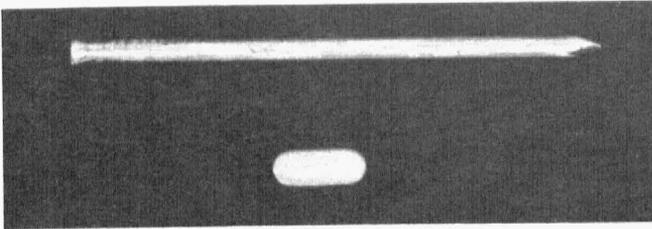


Fig. 3.—Hexachloroethane tablet and 16-penny casing nail used to push tablet into tip of ear.

The tablet is carefully pushed in at the tip of the husk after the silks have begun to dry, signifying that pollination has been completed. To insert the tablet, use the head of a 16-penny casing nail and push the tablet in until it touches the tip of the ear. In doing this, be careful to avoid tearing the husk apart at the tip of the ear. Then preferably close the tip of the husk, and for this purpose wire paper clips, hairpins, and rubber bands have been used. On the other hand, very good results have been secured by simply pinching the tip of the husk together by hand after inserting the tablet.

This treatment kills the worms by virtue of the gas slowly given off by the hexachloroethane. In the experience here reported, this treatment neither injures the ear nor leaves any disagreeable odor to the corn when prepared for canning or for table use. The tablets used in this work can be purchased from regular dealers in insecticides.

The use of insecticides in the tips of corn ears, as here described, for protecting the ears against worm injury is effective and not too expensive for garden, as well as commercial, plantings of sweet corn. It may also prove practical on hybrid seed corn plantings.