Cereal Leaf Beetle Control
Michigan State University
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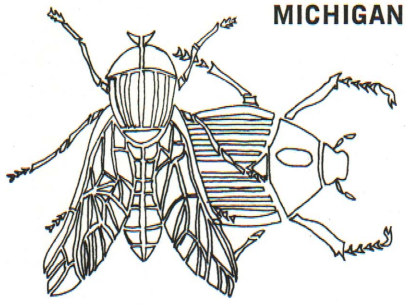

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Integrated Cereal Leaf Beetle Control

By Robert F. Ruppel and Frederick W. Stehr, Entomology Department

Insecticides have been used to protect small grain crops from the cereal leaf beetle since this pest was first found in Michigan in 1962. The latest report shows that 35% (about 155,000 acres) of Michigan's oats was treated. It still continues to spread and increase in spite of the intensive use of insecticides. The increase in total numbers of cereal leaf beetles has been measured at 3-fold per year in southern Michigan, and as much as 18-fold per year in northern Michigan. A pair of beetles could have over 100,000 progeny in ten years at the 3-fold rate of increase! Insecticides have been effective in protecting individual fields from the beetle and are recommended for this use. However, insecticides have not suppressed the upward population trend and beetle numbers can be expected to increase.

Integrated Control

The cereal leaf beetle is a European insect that was accidentally introduced into this country. It is only occasionally a pest of small grains in Europe, just as our native insects (the armyworm, for example) are only occasional pests here. Yet, the cereal leaf beetle is a continuous pest in Michigan. Natural enemies (parasites, predators, and diseases) are a major reason why the beetle is only a scattered pest in Europe. These natural enemies, unfortunately, did not come over with the beetle so that it has constantly increased in this country.

As soon as the cereal leaf beetle was found in Michigan, a study was started of the natural enemies of the cereal leaf beetle in Europe. Some promising natural enemies were selected and introduced into Michigan. One, *Tetrastichus julis*, is a small, wasp-like, parasitic insect that lays its eggs in the bodies of cereal leaf beetle larvae (Figure 1). The grubs that hatch from the parasite eggs feed within the body and eventually kill the larva. This parasite is now being introduced in special plots in each county in the Lower Peninsula by County Agricultural Extension Agents. There is a good chance that the parasite will increase in numbers, spread, and contribute greatly to the reduction of the cereal leaf beetle problem in the next few years. Studies are continuing on other natural enemies, small grain varieties resistant to the beetle, hormones and habits of the beetle, and better ways to use insecticides. They will be added to our arsenal of control tools, as soon as they prove to be effective and desirable. In time, they should help make the cereal leaf beetle a minor factor in our production of small grains.

These practices are not yet proven, however, and several years are expected to elapse before *Tetrastichus julis* exerts an effect on the cereal leaf beetle. Insecticides, then, are the only reliable means for protecting against the beetle. But, *Tetrastichus julis* is an insect and could be killed by the same insecticides which are applied to kill the beetle. The problem is now complex: crop protection requires insecticides, but there

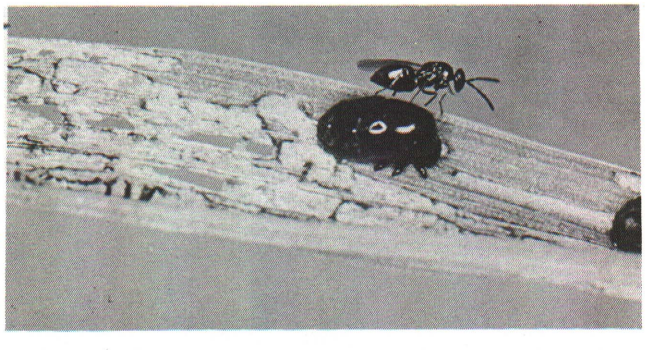

Figure 1. The parasite TETRASTICHUS JULIS inserting its eggs into the larva of a cereal leaf beetle. Note the black, slimy coating on the larva.

must be a minimum hindrance to the increase and effectiveness of the parasites. The solution to this problem is called integrated control—the simultaneous use of different, complementary means to keep insects from damaging crops. Integrated control requires more knowledge and takes more time than does simple control with insecticides. It should immediately reduce costs somewhat, and more importantly, provide fully satisfactory control of the cereal leaf beetle in the future.

The integrated control program recommended for the cereal leaf beetle is simple:

1. Learn to recognize the different stages of the cereal leaf beetle.
2. Check periodically for all stages of the pest.
3. Decide which fields *really need to be protected* from the beetle.
4. Time the application properly.
5. Carefully select and apply an insecticide.

Details on how to conduct an integrated control program are presented in this bulletin.

The parasite spreads from field to field and farm to farm, increasing most rapidly in areas where they are exposed to the least insecticide. The full effectiveness of integrated control depends on all growers following the recommendations—using insecticides *only when needed* and *with the greatest care possible.*

Recognizing The Cereal Leaf Beetle

Adult cereal leaf beetles (Figure 2) overwinter in cracks and crevices near ground level where they are protected from extreme cold. They are hard-shelled, about ¼ inch long, with metallic blue wing covers, a red pronotum (neck), yellow legs, and black head and antennae (feelers). They become active with the first warm days (50°F, or more) of early spring. They feed at first on available grasses, then move into winter grains, and flock into spring grains when these become available. They feed by eating elongate holes completely through the leaf. Adults are very active on warmer (60°F or more), sunny days and begin to mate and lay eggs shortly after they become active in the spring.

Eggs are laid singly or in short chains on the upper surfaces of the leaves of grain crops (Figure 3). They are pinhead size, elongate, and bright yellow to dull brown in color. The female covers her eggs with a sticky substance that glues the side of the egg to the leaf.

Larvae that hatch from the eggs are oval and range in size from very small when first hatched to about 3/8 inches long when fully grown. Larvae of the cereal leaf beetle have a black head and six small legs just behind the head. They are actually yellowish in color, but cover themselves with a black, sticky mixture of mucus and feces (Figure 1). This coating gives them a slimy, blackened appearance and protects them from drying out and possibly from some natural enemies. The parasite *Tetrastichus julis* does not find this coating offensive and is actually attracted to it. Cereal leaf beetle larvae look and move as slowly as slugs on the leaves. The larvae feed on the upper surfaces of the tender upper leaves of the grains, chewing elongate strips from the upper layers of the leaves. The whitish lower surface is usually left intact by the larvae so that a heavily damaged field appears to be "frosted."

The fully grown larvae cast off their black coatings (Figure 4) and move down into the upper layer of the soil. They hollow out a small cell in the soil, coat the cell with a tough silk, and transform into a quiet, pupal stage. The pupae transform into adults within this cell. Adults emerge from the pupal case in late June and early July. They feed actively on available green grains and even on young corn, but most of their feeding is on grasses that are succulent at this time. The feeding on corn appears as fine, whitish scratches on the upper surface of the leaves. These scratches run together and give the corn leaves a whitened, ragged appearance when adults are abundant, but the damage is usually not of any importance. These new adults feed actively

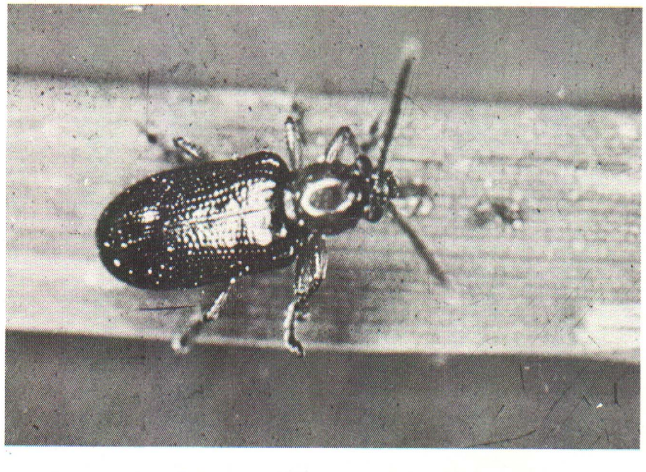

Figure 2. An adult cereal leaf beetle.

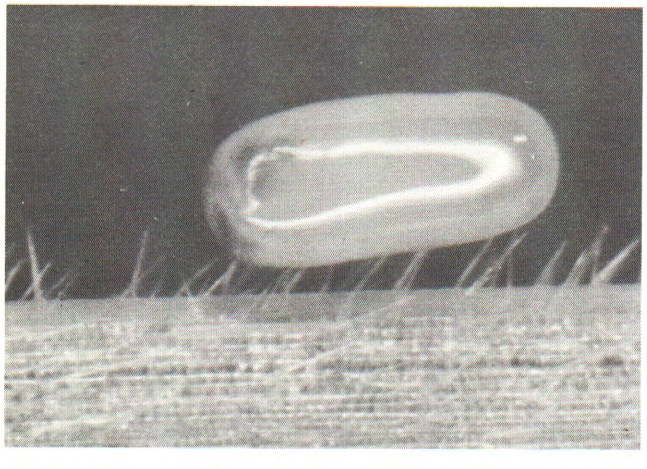

Figure 3. Egg of the cereal leaf beetle.

for ten days to three weeks, then seek protection from the heat of the summer and cold of the winter. They spend the rest of the summer, the fall and winter in an inactive condition (diapause) in these protected places, and do not become active again until the following spring.

Checking The Field

Your County Agricultural Extension Agent will send out general warnings on when to expect the cereal leaf beetle in the spring. You can help him, and your neighbors, by informing him of the results of your examinations. Since the beetles do not appear at the same time in all fields, you should periodically check each of your own fields of small grains. There is a wide variation between infestations of beetles in different fields. Checking can be done by examining several areas in each field for:

a. stage of growth of the crop.
b. relative abundance of adult beetles and their feeding holes.
c. approximate number of eggs and larvae of beetles per stem.

The boot stage of crop growth is a critical point in the control of cereal leaf beetles. Certain insecticides cannot be applied after the boot stage, because residues might remain on the grain at harvest time. Also certain insecticides are not recommended for heading grains because of the possibility of creating later difficulties with aphids that infest the heading grains. The effects of the cereal leaf beetle feeding on the plants also change after the boot stage is reached. Before the boot stage, they cause a general loss of plant vigor. After the boot stage, they feed largely on the flag leaf, which affects seed set and grain test weight. The plant can better tolerate larvae at the tillering stage than heading. Carefully note plant stage each time you examine the fields.

Feeding holes made by adult beetles are easily seen and are a good indication of the relative numbers of adults in the field. Start checking for the holes in plants when temperatures first reach 50°F in the early spring. The adults stay hidden near the base of the plants during cold weather. They are active on sunny days, especially when temperatures reach 60°F. If adult beetles or their feeding is very evident, check frequently for the appearance of eggs and larvae.

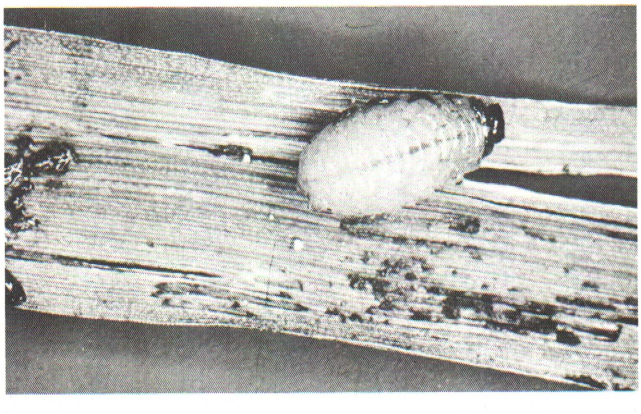

Figure 4. A fully-grown larva of the cereal leaf beetle ready to enter the soil to pupate.

The first eggs of the cereal leaf beetle appear very early in the spring. Adults are not very active and do not lay many eggs, however, until temperatures reach 60°F. Start looking for eggs after the first warm spell. The first larvae are also found early in the season. Larvae do not become "common," however, until it warms up enough to permit the adults to lay an abundance of eggs and the eggs to hatch. Fields should be carefully examined for larvae during periods of warm weather. Check especially carefully for larvae in fields that have abundant eggs. The day the larvae become common in a field is a critical point in control. To determine the seriousness of infestation, count the number of eggs and larvae on the leaves of about twenty stems from several areas of each field. Start such counts as soon as the small larvae become common in the field.

Deciding On The Need To Spray

The decision to spray should be based on the stage of plant growth and the number and stage of development of the cereal leaf beetle. An application of insecticides IS RECOMMENDED in most fields under the following conditions:

a. Grain has not reached boot stage and there is a total of three or more eggs and larvae per stem, *or*
b. Grain is heading and there is one or more larvae per flag leaf, *or*
c. In the case of corn attacked by new adults, the corn is small and nearly every leaf has adult beetles on it.

An application is NOT RECOMMENDED in most fields under the following conditions:

d. There is *less* than the numbers of cereal leaf beetles noted in "a" and "b" above, *or*
e. Plants that have not yet headed appear "frosted" and most of the larvae are large, *or*
f. Flag leaves of heading plants have been mostly destroyed.

By periodically checking the fields, you can avoid "e" and "f" above; there is little justification (except revenge) for killing insects after they have damaged your crop. The eggs hatch and the larvae develop very rapidly during hot weather. The only way to properly protect your fields from the beetle is to check them regularly.

The value you place on your fields, of course, is extremely important in your decision. The cost of the insecticide and its application will run about $3 to $3.50 per acre. A moderately high infestation of cereal leaf beetle will destroy about 30% of spring grains and 12%

to 15% of winter grains. This is a loss of about $9.92/acre for spring grain, and about $6.43/acre for winter grain. The loss will increase as the infestation increases to a maximum of 75% loss in spring, and 25% loss in winter grains. Your final decision to spray or not to spray will rest on your assessment of the probable return to you for investment in the insecticide. You may be asked not to spray in future years – to accept some loss or to spray only part of your crop – to facilitate increase of parasites that will, in turn, continue to save you money year after year.

Timing The Spray

Proper timing of insecticide application is extremely critical for complete control of the cereal leaf beetle and to reduce the danger of killing parasites of the pest. If the spray is applied too early, there is a good chance the field will be re-infested and another spray will be necessary. If applied too late, the field will already have some damage and the parasites may be seriously affected by the insecticide.

The best time to apply an insecticide is as soon as possible after the small larvae have become common (easily seen without searching) in the field. Little damage has been done to the plants, hatching larvae will be killed, the number of adults that could re-infest the field is rapidly diminishing, and relatively fewer parasites are active in the field at this time. A single application now will eliminate at least 80% of the damage with little chance of re-infestation.

Growers frequently wait until the damage is evident in the field before spraying for the beetle. This is wasteful – the plants have already been damaged and the parasite has been exposed to the insecticide. This latter point will become even more important as the parasite increases in numbers and effectiveness. The only way to know when larvae are common is to frequently check your own fields. This will enable you to time your spray for the greatest effectiveness and least hazard.

Selecting And Applying The Insecticide

Insecticides can be effectively applied with ground or aerial equipment for cereal leaf beetle control. Either a weed-killer or row-crop type of ground sprayer can be used. Carefully adjust and calibrate the sprayer to assure a uniform coverage of the upper leaves of the plants. About 12 to 15 gallons of spray per acre is sufficient. The amount of spray applied by air will depend on the type of equipment used. About one gallon of spray per acre is adequate with the usual aerial spray equipment. The effectiveness of an aerial application depends on the skill and thoroughness of the pilot. Take care to select a reliable air contractor.

The insecticides recommended for cereal leaf beetle control in 1972 are given in Table 1. A systemic insecticide (an insecticide which is absorbed and transported within the plant and kills the beetle when it feeds on the plant) applied to the seed prior to planting may be recommended in place of sprays in the near future. Check with your County Agricultural Extension Agent for changes in recommended insecticides in future years. Note that only malathion in water sprays applied by ground or air or in ULV (ultra-low-volume) aerial sprays is recommended for use after the boot stage (after the plants have started to head or have headed). Do not use the other sprays after the boot stage. They might leave an unacceptable residue on the grain or create a problem with aphids following late applications. Malathion will not leave a residue on the grain and will control aphids as well as the cereal leaf beetle in heading plants. Malathion has a short residual effectiveness. This is not important in heading grains since there is no danger of cereal leaf beetles re-infesting grains that are headed. Use only malathion in plants which have started to head.

Remember that insecticides are poisonous; handle, store, and apply them with great care. The label on the insecticide container has full instructions for the safe, effective use of that specific insecticide. *Read the label* before buying any insecticide. Be sure you apply no more insecticide than recommended. The insecticides used for cereal leaf beetle control and the common small grain weed killers are compatible, and can be mixed and applied together.

- Learn to recognize the different stages of the cereal leaf beetle.
- Check your fields periodically for all stages of the pest.
- Carefully decide *which fields really need to be protected* from the beetle.
- Time the insecticide application very carefully.
- Select and apply your insecticide with care.

Table 1. Insecticides Recommended for Control of the Cereal Leaf Beetle; 1972[a]

Insecticide	Lbs. Active Insecticide/A	Notes
PLANTS BEFORE BOOT STAGE (Do not apply after heads begin to form)		
carbaryl (Sevin)	1	0 days[b]. Kill eggs, adults and larvae
endosulfan (Thiodan)	1/4	Do not feed treated forage to dairy animals nor animals being finished for slaughter
azinphosmethyl (Guthion)	1/2	30 days[b]; 1 application per season; hazardous, use with care
GRAINS AFTER BOOT STAGE, AND CORN		
malathion	1	7 days[b]
malathion	6/10	7 days[b]; ULV aerial spray

[a] Consult your County Agricultural Extension Agent in future years.
[b] Minimum number of days between application and harvest or grazing.

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