

Cereal Leaf Beetle

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Cereal leaf beetle poses an economic threat, mainly to spring-seeded small grain crops such as wheat, barley and oats. Hot, dry, drought conditions are unfavorable for this pest. Monitoring for adult activity, eggs and the damaging larval stage are important for making management decisions.

The cereal leaf beetle, *Oulema melanopus* (L.), was first detected in North America in the early 1960's, in Utah in 1984 and has been present in Montana since 1989. Since these introductions CLB has spread, adding new counties to its distribution each year. As CLB has spread and become established throughout the state, acreage treated with insecticides for this pest also increased until 1998. Unfavorable drought conditions at that time greatly reduced populations. The current Montana distribution for cereal leaf beetle is shown on the map at right.

Although the cereal leaf beetle is found throughout the state, treated acreage varies, as unfavorable drought conditions were replaced by cool wet springs more favorable for cereal leaf beetle. Parasitism by *T. julis* has also increased and become established in much of the state, contributing to lower CLB populations. As higher moisture cycles recur, the balance may once again favor greater and more widespread cereal leaf beetle populations.

Life history

Adult cereal leaf beetles are about 1/4 inch in length with a brightly colored orange-red

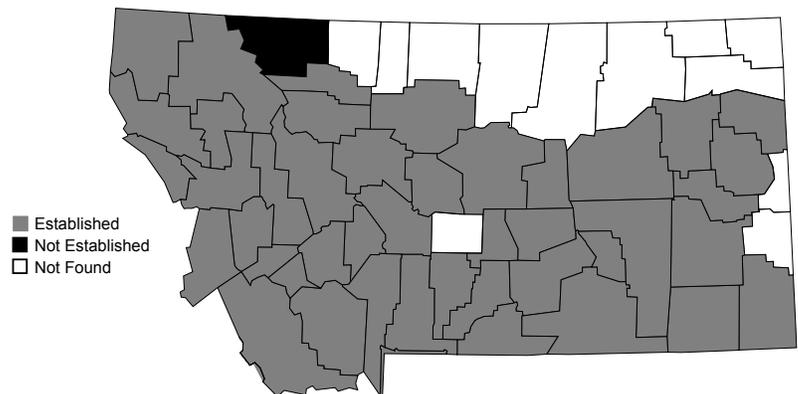


Figure 1. CLB distribution map

thorax, yellow/orange legs and metallic blue head and wing covers (Figure 2). The adult stage overwinters and becomes active in the spring, moving into its preferred hosts, spring planted grains, including spring wheat, barley and oats. Adults may also be found in winter wheat, but typically, more activity occurs in spring small grain crops. Adults feed for about 10 days before beginning egg lay.

Eggs are deposited end to end singly or in groups of two or three on the upper leaf surface near the base of the leaf. Newly laid eggs are bright yellow, darkening to orange-brown and finally to black before they hatch (Figure 3). Egg hatch may take from four to 23 days, depending on temperatures.

Larvae have a yellow body, brown head and legs, and three pairs of legs (Figures 2 and 4).

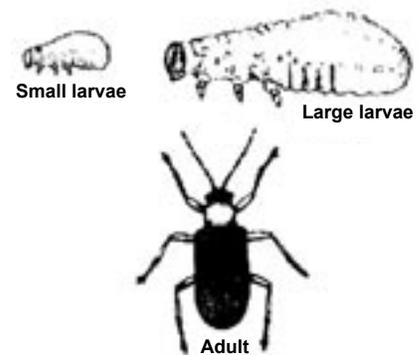


Figure 2. Cereal Leaf Beetle

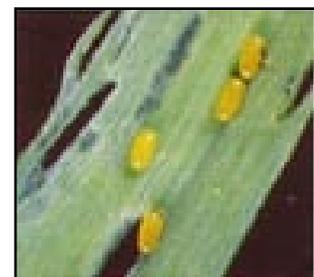


Figure 3. CLB eggs on a wheat leaf

Although the body is yellow, it appears as a black oily droplet in the field because the body is protected by a layer of slimy mixture of fecal material and mucous. If you are working in or walking in a CLB-infested field, the slime will rub off on your clothing or sweep net.

Larvae feed for approximately 10 to 14 days before they complete development, shed their slimy coverings and drop to the ground. They then hollow out an earthen cell for pupation.

The pupal stage takes from 10 to 14 days before new adults emerge. These next generation adults prefer succulent grasses, later-planted grain and corn, feeding for about two weeks before entering a summer dormant stage. As temperatures drop in the fall, the adult beetles search out suitable overwintering sites.

Plant Damage

Although both adults and larvae feed on plant tissues, the larvae are the primary damaging stage. They feed on the leaf surface, removing all the green material down to the lower cuticle and leaving an elongated feeding scar described as a 'windowpane' parallel to the leaf veins (Figures 5 and 6). Severe feeding damage can look like frost damage. CLB prefers more tender spring small grains such as barley, spring wheat and oats to winter wheat crops.

Crop damage by CLB may result in significant yield and quality reduction such as lowered grade and reduced economic returns to producers. In addition, this pest has posed marketing limitations because of quarantine restrictions that require fumigation to ship grain and hay to markets in areas not yet infested. Canadian and California quarantines are of special concern to Montana producers.

Figure 4.
CLB larvae.



Monitoring

Monitoring is extremely important for determining the magnitude of adult activity and for early detection of egg and larval populations. Examine plants for eggs and/or larvae, which can be found on the upper leaf surface.

Examine 10 consecutive plants per location, and select one location for every 10 acres of field. Count the number of eggs and larvae per plant (before tillering) or per stem (after tillering). Then, calculate an average number of eggs and larvae per plant.

Degree Day Predictions

Because the growth and development of cereal leaf beetle is dependent on temperature, a degree day calculation based on daily maximum and minimum temperatures can help gauge when to initiate sampling this pest.

To assess degree days, start collecting minimum and maximum daily temperatures from Jan. 1. Compute degree days daily and accumulate them each day (Table 1). The base temperature for CLB is 44.6° F, the lowest temperature at which biological activity of this insect occurs. If you obtain negative numbers from the calculations, then no degree days are accumulated and 0 is recorded for that day, since no insect growth occurred.

Based on temperature calculations in Montana and careful observation of adult cereal leaf beetle, activity typically begins when 176 degree days have been accumulated (Table 2). The first cereal leaf beetle eggs have been found when 253 degree days have accumulated. The calendar date will vary with temperatures and locations around state (Table 3).



Figure 5. Damage to oats.



Figure 6. Damage to wheat.

Time your first field visits to coincide with early egg lay and continue them on a weekly basis until the larval stage is largely completed and the risk of damage has passed.

Obtain the needed temperatures for the site you are monitoring by using a min-max thermometer on site or by using local weather station data located on the web or from the newspaper.

Economic Thresholds

Consider market price and the costs of controls when making treatment decisions.

Before the flag leaf emerges, treatment is warranted when plant samples average three or more eggs and/or larvae per plant (tillering stages). Once a flag leaf is present the threshold drops to one or more larva per flag leaf.

However, even if a field has reached the economic threshold, experience under Montana field conditions suggests that you should delay treatment decisions until at least 25 percent of the eggs have hatched and larvae have emerged before making a spray application. This delay ensures that conditions are favorable for egg hatch and a larval population is likely to develop. Larvae are the target population for treatment with insecticide.

Treatment Options

Current treatment options for cereal leaf beetle include chemical control, quarantines, biological control and resistant varieties. These vary in their cost and effectiveness, as well as environmental impacts.

Pesticide applications to control

Table 1. Degree day formula.

<p>Degree Day Formula</p> <p>[(daily minimum temp + daily maximum temp)/2]-44.6=degree day</p>
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Table 2. Degree day guide.

Degree Day based monitoring guidelines		
Degree days since Jan. 1 (44.6°F base)	CLB Stage	Monitoring comments
176	Early Adult Activity	Monitor for adult activity
253	First Egg Lay	Monitor for eggs and larvae

the cereal leaf beetle have increased each year in Montana, from 1990 to a peak of approximately 15,000 acres treated in 1997. Since that time, cereal leaf beetle populations have only reached economic levels in localized regions. Monitoring will help you decide whether cereal leaf beetle treatment is warranted.

Chemical Control

Many chemicals are registered for use on cereal leaf beetle. However, consider label restrictions when making treatment decisions, especially pre-harvest intervals.

Consult the high plains IPM guide on the web at <<http://highplainsipm.org>> or for more information on chemical control, or contact your local MSU Extension agent.

When using a pesticide always read carefully and follow the label directions. The pesticide label is a legal document.

Updates on CLB occurrence, timing of degree day accumulation

and chemical efficacy are included in the MSU-IPM Crop Health Report <<http://scarab.msu.montana.edu/mchr/index.html>>.

Quarantines

Quarantines are used at both state and national levels as a management tool to control the spread of pests from infested to uninfested regions. State Department of Agriculture personnel must inspect, treat and approve the movement of agricultural commodities under quarantine before they can be exported from CLB-infested states to uninfested states or countries.

California

Regulated commodities include small grains, straw and hay, grass and forage seed, used harvesting equipment, ear corn, grass sod, fodder and plant litter, and Christmas trees.

All regulated commodities can be admitted into California from infested counties only if certified by

Table 3. Dates when egg/larvae sampling should begin

Range of recommended sampling dates based on cumulative degree days (DD) from historical temperature averages for some Montana locations						
DD since Jan 1	Sidney	Billings	Great Falls	Bozeman	Missoula	Kalispell
First Adults (176DD)	4/17 – 4/30	4/12 – 5/3	4/13 – 5/9	4/14 – 5/10	4/24 – 5/3	5/4 – 5/10
First Eggs (253DD)	4/24 – 5/8	4/26 – 5/12	4/24 – 5/18	5/2 – 5/19	5/14 – 5/20	5/19 – 5/28

Montana Department of Agriculture as treated prior to shipment.

Canada

Regulated commodities include small grains, small grain hay and straw, and alfalfa hay.

Canadian quarantines may require import permits, chemical treatments and phyto-sanitary certificates from the Montana Department of Agriculture prior to shipping these commodities into Canada.

Biological Control

Five species of exotic parasites have been used as biological control agents, including an egg parasite, *Anaphes flavipes* (Forester) (Fig. 7), and a larval parasite, *Tetrastichus julis* (Walker) (Fig. 7). These organisms are very small parasitic wasps that lay their eggs within the cereal leaf beetle egg or larva, respectively. In the Midwestern states, where cereal leaf beetle and parasites have been present for several decades, these parasites have greatly reduced the economic impact of cereal leaf beetles.

The USDA-APHIS-PPQ has established *T. julis* in Montana through a successful release program. *T. julis* is now no

longer massively released and is considered to be established within the CLB distribution. However, a rearing effort of *A. flavipes* is still ongoing with the cooperative effort between USDA, APHIS-PPQ and local cooperators around the state.

Locales where *A. flavipes* has become established in Montana have become a source for subsequent release efforts in other regions of Montana.

Parasitoids that have become adapted to Montana's unique dryland crop environment are useful for release programs in similar environments.

People are becoming more interested in controlling CLB with biocontrol agents. This approach can help to maintain populations of CLB below economic thresholds without widespread use of insecticides. However, some locations may experience the need for sampling to identify fields that have insect densities that exceed threshold levels.

Resistant Varieties

Some resistance has been found in certain varieties of wheat and barley, with wheat showing greater tolerance to CLB damage than barley. Resistance in wheat is due

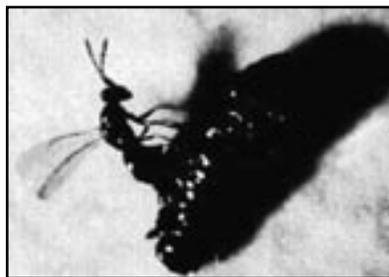


Figure 7. *T. julis* and larvae (above); *A. flavipes* and egg (below).

to leaf pubescence which results in fewer eggs being laid and deters feeding by young grubs. However, leaf pubescence can vary among varieties, and/or environmental conditions. However, resistant varieties are not currently available in wheat and barley cultivars recommended for Montana.



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