B-978

June 1993

Cooperative Extension Service
Department of Plant, Soil, and Insect Sciences
College of Agriculture

Sugar Beet Curly Top Virus and the Beet Leafhopper

Eric J. Morrison, Area Integrated Pest Management Coordinator
David E. Legg, State Integrated Pest Management Coordinator
Gary D. Franc, Research and Extension Plant Pathologist

Introduction

Curly top virus (CTV) is found throughout the western United States. The virus has an extensive host range of crop and weed plants with at least 300 species in 44 families identified. In the past in Wyoming, CTV caused severe economic loss when sugar beets were infected in epidemic proportions.

The initial source of CTV has not been identified. However, because CTV is only spread during the feeding activity of the beet leafhopper vector (*Cirulifer tenellus*), the disease outbreaks are associated with conditions that favor vector migration to crop plants. The number of beet leafhoppers, the proportion of the population carrying the virus (viruliferous), and the stage of plant development when beet leafhoppers feed are factors that contribute to a CTV outbreak. Research shows that even when resistant beet cultivars are planted, the crop is at risk if plants have less than 12 fully emerged leaves. There will be more than one beet leafhopper per ten sweeps in adjacent weedy areas, and more than 8 percent of the leafhoppers are viruliferous. Susceptible cultivars are always at a greater risk to curly top outbreaks.

Therefore, as part of an overall disease-control strategy, it is important to monitor beet leafhopper populations to determine if control measures are justified. Also, because sensitive tests have been developed for CTV detection, it is now possible to attempt the identification of CTV sources in Wyoming production areas. Results from tests can be used to determine the potential role of CTV sources in disease development and crop loss.

Standardized collection methods must be used to accurately monitor beet leafhopper populations and to determine the sources of CTV. This bulletin outlines procedures and equipment needed for monitoring beet leafhoppers as well as collecting leaves and leafhoppers for disease detection.

Beet Leafhopper Collection and Monitoring

The beet leafhopper overwinters primarily on winter annuals of the mustard family. These weed species can be found along roadways, stockyards, equipment yards, drilling sites, and other disturbed areas.

In the spring as winter annuals mature, the beet leafhopper will move to host plants in other habitats, primarily other mustards, kochia, hoary cress, halogeton, and Russian thistle. Beet leafhoppers prefer sparse vegetation that allows maximum sunlight and heat to penetrate through the plant canopy.

Collecting leafhoppers can be accomplished by rapidly passing a net over the top of host plants. Beet leafhoppers become startled by the moving net, jump, and are captured. Because beet leafhopper activity is greatly influenced by temperature, it is critical to make collections only when air temperatures are 60 degrees Fahrenheit or greater. Collections made at lower temperatures may underestimate actual populations because of leafhopper inactivity.

Materials

- Fifteen-inch-diameter sweep net
- Plexiglas sweep net cover
- Aspirator
- Collection vials with lids or stoppers
- Pencils or waterproof pens
- Forms for recording the collecting location
- Latitude/longitude maps and templates
- Identification material for beet leafhoppers
- Cooler with blue ice
- 10x hand lens
- Thermometer

Figure 1. 180 degree sweep technique

Figure 2. Pendulum sweep technique

Beet Leafhopper Monitoring

1. Locate an area with mustards, kochia, Russian thistle, or other weeds known to support beet leafhoppers. Keep in mind that beet leafhoppers prefer sparse vegetation that allows maximum sunlight penetration and heat buildup.

2. Sweep the selected area using the 180-degree arc method (Figure 1) or the pendulum method (Figure 2). Make certain the net hits the top of the plants. If the area to be sampled is small (less than 600 square feet), sample the entire area with at least 20 sweeps. Generally, most sites can be sampled with 50 to 100 sweeps.

3. Place the plastic cover in the top of the sweep net to prevent beet leafhopper escape (Figure 3).

4. Record the numbers of sweeps made and mark the latitude and longitude of the sampling site on a map.

5. Refer to the identification procedure listed below. Count the number of beet leafhoppers in the net (Figure 4). Leafhoppers for which identification is uncertain should be aspirated (Figure 5) and examined with a hand lens (Figure 6). If identification is still not possible, transfer the specimen to a labeled vial and take it to a Cooperative Extension Service office for identification with a microscope.

6. Record survey information on a survey form (Figure 7). Be certain to enter the number of beet leafhoppers found on a 10-sweep basis. For example, if 11 beet leafhoppers were captured in 90 sweeps, the resulting 10-sweep sample would be 11/9 = 1.22.

7. Discard the contents of the sweep net and proceed to the next sampling site.

Figure 3. Cover sweep net

Figure 4. Count leafhoppers

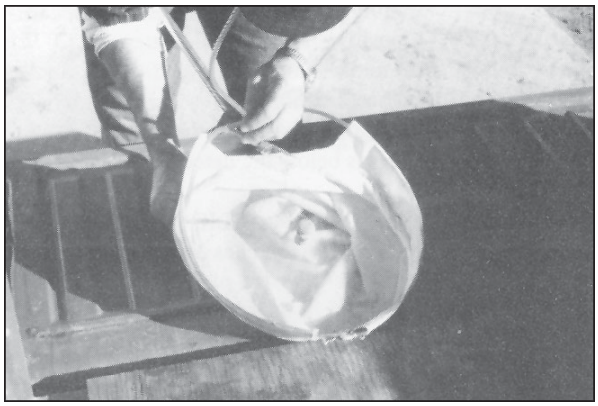

Figure 5. Aspiration

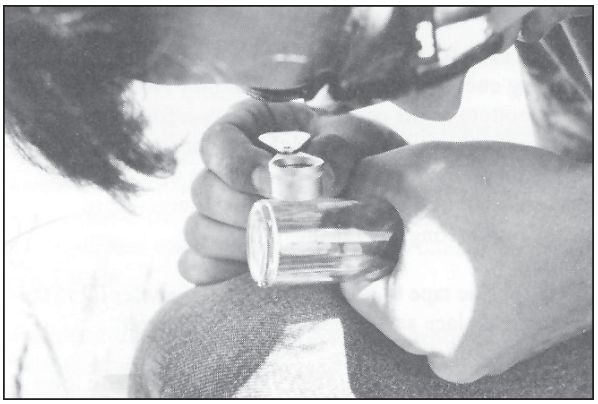

Figure 6. Examining BLH in the field with a hand lens

Figure 7. Recording all information in the sample area

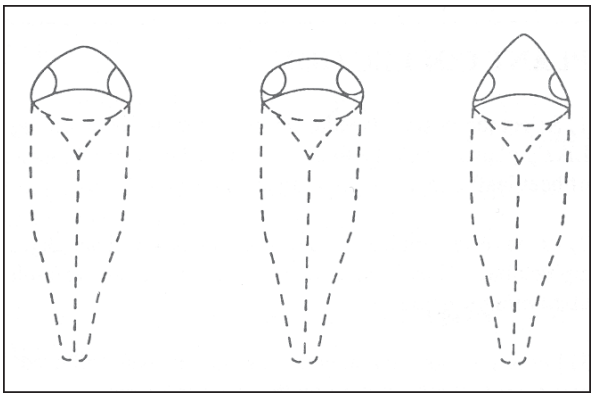

Figure 8. a b c

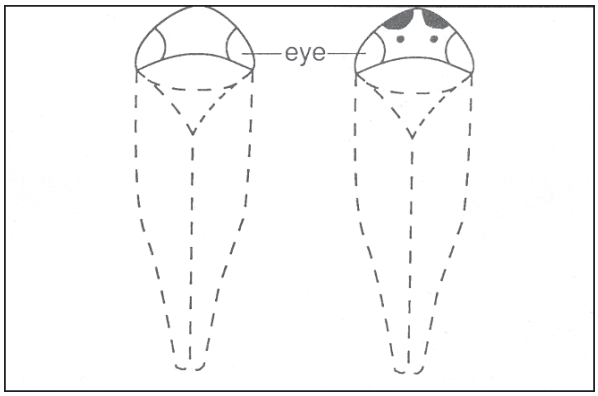

Figure 9.

Beet Leafhopper Identification

Proper identification of the beet leafhopper is essential to correctly estimate population densities.

The beet leafhopper is a small insect that is very active at high temperatures. Adults range from 3.1 to 3.5 millimeters long and are slightly less than 1 millimeter wide. They vary in color from one insect to the next and from specimens found in the spring, summer, fall, and winter. The spring brood is generally light brown to lemon green, summer and fall broods are tan to variably mottled, and overwintering forms are tan and mottled.

The beet leafhopper can be tentatively identified by the presence of a slightly roof-shaped face (Figure 8a) as opposed to a well-rounded (Figure 8b) or sharply pointed (Figure 8c) one that is absent of clearly defined spots (Figure 9). In addition, the terminal abdominal segments of the male are square shaped (as opposed to round or triangular), and the females have a semi-circular appearance on their terminal abdominal segment (a microscope will be necessary to view the terminal abdominal segment). On reasonably warm days (60 degrees Fahrenheit or warmer), the beet leafhopper is more active than other leafhoppers commonly found in Wyoming. Care should be taken, however, to make sure that quickly moving leafhoppers are actually sugar beet leafhoppers and not some other plant hopper.

Plant Material Collection and CTV Detection

Beet leafhoppers can be tested singly or in groups for the presence of CTV. Beet leafhoppers submitted for testing should be placed in vials labeled with a simple numbering scheme. Keep the beet leafhoppers refrigerated before mailing and use the shipping instructions listed below.

Required Equipment

- Ziploc® bag
- Felt tip indelible ink pen
- Latitude/longitude maps and template
- Forms for recording the collecting locations
- Cooler with blue ice

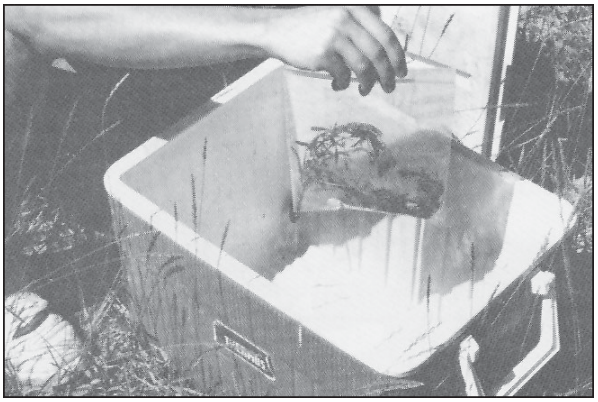

Figure 10. Placing plant sample into cooler

Plant Collection

1. Select the desired weed or crop host plant for sampling. Likely plants would be those harboring large populations of beet leafhoppers or showing symptoms of CTV.
2. Remove several leaves and place them in a clean, dry Ziploc® bag. Clearly label and date the bag using a simple numbering scheme.
3. Record the location at which the sample was collected and record all information on the reporting form.
4. Place the bags in a cooler (Figure 10) and refrigerate them as soon as possible. Keep samples cool and dry until they are shipped to a diagnostic laboratory for virus testing.

Shipping Plant Material or Beet Leafhoppers for CTV Detection

It is possible to detect CTV by testing leaves collected from infested plants or by the direct testing of beet leafhoppers.

Detection is done using an ELISA test developed specifically for CTV. A positive test result indicates that CTV is likely to be present in the sample and verifies that the plant was infected or that the beet leafhopper was carrying the virus. Negative test results indicate that samples were not infected or that the amount of virus was below the detectable levels.

The Washington State University ELISA Lab currently provides a CTV testing service. Fees are assessed on a per-sample basis. To successfully ship plant or insect material for CTV testing, use the following procedure:

1. Place the sample to be tested in labeled vials or Ziploc® bags and immediately cool. Remove any accumulated moisture prior to shipping. Moisture accumulation often occurs when warm samples taken from the field are placed in a cooler or refrigerator.
2. Pack samples (vials and Ziploc® bags) in a stryofoam shipping cooler and arrange them so they are not crushed in the bottom of the cooler. Next place a frozen blue ice pack over the samples and fill the remainder of the cooler with crumpled newspaper to immobilize the contents. Enclose a list of samples with the shipment to facilitate the reporting of test results.
3. Use plastic tape to secure the shipping cooler lid to the cooler and place an address label on the cooler.
4. Call the ELISA lab at (509) 786-2226 to inform lab officials that samples will be shipped and to determine the cost for processing the samples.

Time the date of shipping so that samples do not spend the weekend in transit. The best results from Wyoming have been achieved by shipping via priority mail on Mondays or Tuesdays.

Mail samples to:

ELISA Lab
WSU-IAREC
Route 2, Box 2953A
Prosser, WA 99350

UNIVERSITY
OF WYOMING
Cooperative Extension Service

Issued in furtherance of cooperative extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Jim DeBree, director, Cooperative Extension Service, University of Wyoming, Laramie, Wyoming 82071.