

Standardized European Corn Borer Protocol for All Host Crops

Objectives:

To collect data on the presence, stage(s) and damage of European corn borer (ECB) on various host plants to:

- a. Identify host plants/crops that are most attractive or that are at greater risk of injury by ECB, and
- b. Gain a better understanding of ECB presence across the Canadian agricultural landscape.

The best time to scout for ECB depends on your location in Canada. Thus, there are two scouting protocols available here, one for early season scouting and the other for mid-season scouting (July to harvest). The mid-season protocol is probably best for use in western Canada.

Both the early and late season scouting protocols were developed so that responses could be recorded in hard copy or using Survey 123 (links provided below). Scouting results recorded using Survey 123 will be used by the Surveillance Working Group of the Canadian Plant Health Council to improve the scouting protocols and to create resources to assist agriculture stakeholders in understanding and managing ECB.

Early to Mid-Season ECB Assessment (Before July)

Scouting Method:

1. Select the earliest planted fields in the area. In corn – V6 stage or later – DIMBOA in earlier stage corn deters ECB.
2. Assess 10 (minimum) to 30 plants (preferred). For 30 plants, select 10 adjacent plants from 3 areas of the field; If only able to assess the minimum 10 plants, select 3 adjacent plants in 3 areas of the field, with one additional plant used in one of these three areas. Distance these 3 areas equally apart, relative to the size of field/plot; a minimum of 20 m apart. Avoid assessing plants within 10 m of fields' edge.
3. Look for pin-holes, shot-gun holes or window-paning on the leaves of the 30 plants. Pull the whorls with feeding injury. In corn, unfurl the whorls to look for larvae.
4. Count the number of larvae per plant and determine the larval instars present.
5. Document where the feeding damage is on the plant, rate the leaf feeding injury on the leaves as well as the type of injury on the fruit, pods or ears of the plant.
6. Enter data in the table provided or directly online through the ECB Early Assessment Survey123:
<https://arcq.is/0qCCHH>

Expected Possible Responses to Include in Attached Table and on Survey123

1. Plant Stage Options:

- i. Vegetative stages,
- ii. Fluorescent stages,
- iii. Pod/Fruit/Seed Stages, or

- iv. enter BBCH Scale Code (<https://www.julius-kuehn.de/en/jki-publication-series/bbch-scale/>)

2. Feeding Location on Plant Options:

- a. top 1/3,
- b. middle 1/3,
- c. bottom 1/3,
- d. evenly distributed throughout the plant,
- e. on the florescence,
- f. in or on the fruit/pod/ear,
- g. other and explain

3. Leaf Feeding Injury Rating (If ECB is causing leaf damage)

- 0 = No feeding damage
- 1 = **Pinhole size holes** only
- 2 = **Shotgun holes (no elongated lesions) on 2 or fewer leaves**
- 3 = **Shotgun holes (no elongated lesions) on 3 or more leaves**
- 4 = **Elongated lesions of 2.5 cm or smaller on 2 or fewer leaves**
- 5 = **Elongated lesions of 2.5 cm or smaller on 3 or more leaves**
- 6 = **Lesions longer than 2.5 cm on up to 1/3 of the plant**
- 7 = **Lesions longer than 2.5 cm on up to 1/2 of the plant**
- 8 = **Lesions longer than 2.5 cm on 2/3 of the plant**
- 9 = **Lesions longer than 2.5 cm on most of the plant**

4. Instar stages of larvae. See Figure 1 below to determine instars:

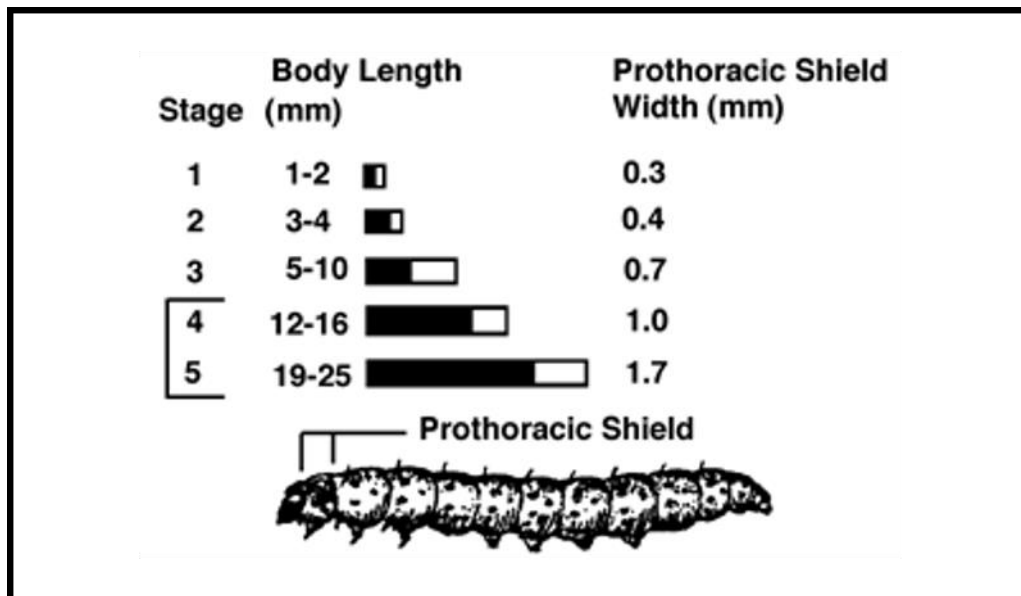


Figure 1: Body lengths and prothoracic shield widths for larval instars of the European corn borer. University of Illinois.

5. Fruit/Ear/Pod Damage Type:

- Surface grazing and wounds or
- Entry hole into the fruit

Early to Mid-Season ECB Assessment Worksheet (Before July)

Date of Assessment: _____

Name: _____ **Email:** _____ **Province:** _____ **Host Crop:** _____

Field Location GPS Coordinates: Lat (e.g. 41.44231): _____ **Long** (e.g. 78.92311): _____

Enter all data below into the Survey123 Online Form: <https://arcg.is/0qCCHH>

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Plant #	Plant Stage ¹	Feeding Location on Plant ²	Leaf Feeding Injury Rating ³	# of Larvae Found	List all instars found ⁴ (e.g. 1 st , 2 nd)	Fruit/Pod/Ear Damage Type ⁵	Other Feeding Patterns (describe and take photos)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Early to Mid-Season ECB Assessment Worksheet (Before July)

Plants 16 – 30

Date of Assessment: _____

Plant #	Plant Stage¹	Feeding Location on Plant²	Leaf Feeding Injury Rating³	# of Larvae Found	List all instars found⁴ (eg, 1st, 2nd)	Fruit/Pod/Ear Damage Type⁵	Other Feeding Patterns (describe and take photos)
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							

Mid-Season to Pre-Harvest ECB Assessment (July until Harvest)

Scouting Methods:

1. Select later planted fields relative to others in the area. These will be more attractive to later season moths.
2. Assess 10 (minimum) to 30 plants (preferred). For 30 plants, select 10 adjacent plants from 3 areas of the field; If only able to assess the minimum 10 plants, select 3 adjacent plants in 3 areas of the field, with one additional plant used in one of these three areas). Distance these 3 areas equally apart, relative to the size of field/plot; a minimum of 20 m apart). Avoid assessing plants within 10 m of fields' edge.
3. Turn over every leaf on the plant and look for egg masses on the underside of the leaf. Document the number of egg masses found.
4. Look for the presence of larvae outside of the plant. Document the number of larvae outside of the plant and their location on the plant.
5. Rate the level of leaf feeding found on the plant using the leaf injury rating below and indicate where the feeding is on the plant.
6. Search for larval tunneling along the mid-rib of leaves, or on the stem where the leaf axil connects. Frass on the stem or stalk is a good indicator of larval tunneling.
7. Destructively sample plants with frass and tunneling into stems/stalks by slicing the plant lengthwise from tip to base with a sharp knife. Document the number of larvae found inside the plant, the number of tunnels and average size of tunnels found in centimeters.
8. If fruit, seed, pods or ears are present on the plant, indicate whether the feeding is superficial or if there are entry holes into the fruit, pods, or ears.
9. Enter data in the table provided or directly online through the ECB Mid-Season to Pre-Harvest Survey123: <https://arcg.is/fSODf>

Expected Possible Responses to Include in Attached Table and on Survey123

1. **Plant Stage Options:**
 - i. Vegetative stages,
 - ii. Fluorescent stages,
 - iii. Pod/Fruit/Seed Stages, or
 - iv. enter BBCH Scale Code (<https://www.julius-kuehn.de/en/jki-publication-series/bbch-scale/>)
2. **Instar stages of larvae.** See Figure 1 below to determine instars

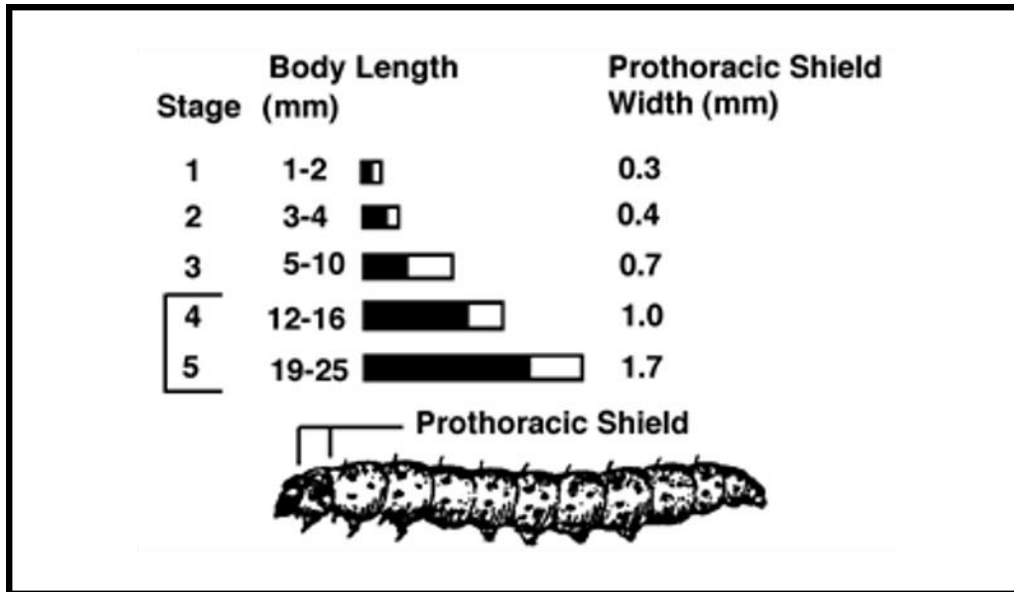


Figure 2: Body lengths and prothoracic shield widths for larval instars of the European corn borer. University of Illinois.

3. **Location on plant** where most of the larvae found:
 - a. top 1/3,
 - b. middle 1/3,
 - c. bottom 1/3,
 - d. evenly distributed throughout the plant,
 - e. on the florescence,
 - f. inside the stem or stalk of the plant;
 - g. in or on the fruit/pod/ear,
 - h. other and explain

4. **Location of damage** by ECB (record any that apply)
 - a. Leaves
 - b. Stem or stalk
 - c. Tassel or fluorescence
 - d. Fruit/pod/ear

5. **Leaf Feeding Injury Rating** (If ECB is causing leaf damage)
 - 0 = No feeding damage
 - 1 = **Pinhole size holes** only
 - 2 = **Shotgun holes (no elongated lesions)** on **2 or fewer** leaves
 - 3 = **Shotgun holes (no elongated lesions)** on **3 or more** leaves
 - 4 = **Elongated lesions of 2.5 cm or smaller** on **2 or fewer** leaves
 - 5 = **Elongated lesions of 2.5 cm or smaller** on **3 or more** leaves
 - 6 = **Lesions longer than 2.5 cm** on up to **1/3 of the plant**
 - 7 = **Lesions longer than 2.5 cm** on up to **1/2 of the plant**
 - 8 = **Lesions longer than 2.5 cm** on **2/3 of the plant**
 - 9 = **Lesions longer than 2.5 cm** on **most of the plant**

6. **Damage to the Fruit/Pod/Ear:**
 - a. Surface feeding/wounds or
 - b. Entry hole into the fruit

Mid to Late Season ECB Assessment Worksheet (July- Harvest) Date of Assessment: _____

Name: _____ Email: _____ Province: _____ Host Crop: _____

Field Location GPS Coordinates: Lat (eg. 41.44231): _____ Long (eg. 78.92311): _____

Enter all data below into the Survey123 Online Form: <https://arcg.is/fSODf>

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Plant #	Plant Stage ¹	# of Egg Masses	# of Larvae		Instars found ²	Location of Larvae on Plant ³	Location of Feeding on the Plant ⁴	Leaf Injury Rating ⁵	# of Tunnels Found	Avg Tunnel Length (cm)	Fruit/Pod/Ear Damage Type ⁶
			Inside	Outside							
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											

Mid to Late Season ECB Assessment Worksheet (July- Harvest)

Plants 16 – 30

Date of Assessment: _____

Plant #	Plant Stage ¹	# of Egg Masses	# of Larvae		Instars found ²	Location of Larvae on Plant ³	Location of Feeding on the Plant ⁴	Leaf Injury Rating ⁵	# of Tunnels Found	Avg Tunnel Length (cm)	Fruit/Pod/Ear Damage Type ⁶
			Inside	Outside							
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											
30											

Assessments can be done on any potential hosts of ECB:

Causes Economic Damage on:

Apples
Beans, dry
Beans, snap or green
Cannabis/hemp
Corn, grain (non-Bt)
Corn, seed (non-Bt)
Corn, silage (non-Bt)
Corn, sweet (non-Bt)
Corn, speciality (e.g., popcorn, white corn)
Hops
Millet
Miscanthus spp
Peppers (bell) field, greenhouse
Potato
Quinoa
Sorghum/broomcorn
Tomato
Wheat, spring
Wheat, winter

Potentially Feeds on:

Amaranthus spp
Aster
Barley
beet
Buckwheat
Canna
Cauliflower
Celery
Chard
Cocklebur
Common burdock
Cowpea
Dahlia
Eggplant
Gladiolus
Globe artichoke
Jimsonweed
Marigold
Mugwort
Oats
Okra
Onions
Pansy
Peach
Poplar
Rhubarb
Sage
Salvia
Soybean
Spinach
Sunflower
White sweet clover
Zinnia