Diagnostic Challenges for Insects in Field Crops

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### 10 Diagnostic Challenges Farmers and Agronomists of Field Crops should know

<table>
<thead>
<tr>
<th>Potential Pest Insect</th>
<th>Things that Eat It</th>
<th>Take home message</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early-season general defoliator</td>
<td>Generalist predator</td>
<td><em>Feeding patterns as a clue</em></td>
</tr>
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<td>Soil inhabiting seed and root feeder</td>
<td>Soil inhabiting predator</td>
<td><em>Good vs. bad “Wormy” things</em></td>
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<tr>
<td>Small green insects in canopy</td>
<td>Lions in your crops?</td>
<td><em>When to sweat the small stuff</em></td>
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<td>Colour conundrum</td>
<td>What’s inside that caterpillar</td>
<td><em>Don’t kill your free farm workers</em></td>
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<tr>
<td>Using behaviour as a clue</td>
<td>These damsels are vicious</td>
<td><em>The answer may be blowing in the wind</em></td>
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Diversity of Insects

- Insects comprise slightly over 50% of all living species of plants and animals worldwide.
- About 80% of all species of animals are insects.
- There are about as many species of beetles as the entire plant kingdom.
### Diversity of Animals, Plants and Fungi in Canada

<table>
<thead>
<tr>
<th>Group</th>
<th>Known</th>
<th>Still Unrecorded (Estimated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insects</td>
<td>18,530</td>
<td>11,800</td>
</tr>
<tr>
<td>Fungi</td>
<td>11,800</td>
<td>3,800</td>
</tr>
<tr>
<td>Flowering Plants</td>
<td>3,800</td>
<td>75</td>
</tr>
<tr>
<td>Coniferous Plants</td>
<td>34</td>
<td>0</td>
</tr>
<tr>
<td>Other Plants</td>
<td>1,100</td>
<td>60</td>
</tr>
<tr>
<td>Arachnids</td>
<td>3,275</td>
<td>7,730</td>
</tr>
<tr>
<td>Crustaceans</td>
<td>3,139</td>
<td>1,400</td>
</tr>
<tr>
<td>Molluscs</td>
<td>1,500</td>
<td>135</td>
</tr>
<tr>
<td>Fish</td>
<td>1,100</td>
<td>513</td>
</tr>
<tr>
<td>Birds</td>
<td>426</td>
<td>0</td>
</tr>
<tr>
<td>Mammals</td>
<td>194</td>
<td>0</td>
</tr>
</tbody>
</table>

What are Insects Doing on your Farm?

- Pollinating crops
- Eating other insects
- Eating weeds, and weed seeds
- Decomposing stubble, dung, animals
- Improving the soil
- Feeding on crops, livestock, and stored products
The Value of Diversity

• “Diversity can be expected, on average, to give rise to ecosystem stability.”

• “Invasions most frequently occur on cultivated land where human influence has produced greatly simplified ecological communities.”

What type of cutworms are these?

**General notes on cutworms:**

- In soil during the day, come out to feed at night.
- Cutworms may occur in patches.
What are these predatory beetles?

- Most nocturnal.
- Prey: Any invertebrate they can overpower.
- About 861 species in Canada, and 40,000 species worldwide.

Ground beetles (Carabidae)
Ground beetles (Carabidae)

• “Seven species of Carabidae were demonstrated to have fed in the field on cutworms or pupae of *E. Ochrogaster*.”

• “Carabidae are important as predators of *E. Ochrogaster*.”

Ground beetles (Carabidae)

- Carabid beetles prey upon *Delia eggs*, maggots, and puparia.
These were found in the soil where there was some poor plant emergence. What are they?

Wireworms
Wireworms

- About 30 species potentially pests in Canada.
- Larvae feed underground on plants.

- Most damage in early spring.
  - Move deeper in soil during the summer
This insect was found while digging in the soil. What is it?

Larva of a stiletto fly (Therevidae)
Stiletto flies (Therevidae)

- About 1,600 species worldwide.
- Larvae are predators of insect larvae in soil.
Exhibit A

Aphid

Exhibit B

Lygus bug nymph
Lygus Bugs

- Many host plants
- Many crops can compensate for feeding to buds and flowers, but not feeding directly on seeds.
General Notes On Aphids

• About 670 species of aphids in Canada.

• Complex life cycles
  • Parthenogenic (all female) generations.
  • Winged and Wingless individuals or generations.
  • Often a regular alternation of food plants.

• Produce honeydew
Aphids

Pea aphids on peas.

Potato aphids - Overwinter in MB on roses, raspberries, and strawberries.

Many predators like to feed on aphids

A fungal disease may reduce aphids in warm, moist weather

Heavy rains may dislodge and kill aphids
Natural Enemies of Aphids: Q1
What are these?

Aphid Mummies
Biological Control of Aphids

Aphidius ervi

Mummies from Aphidius ervi

Photos from University of California
Natural Enemies of Aphids: Q2
What is this aphid predator?

Lady beetle larva
Lady Beetles

66 species of lady beetles in Manitoba
Lady Beetles have Big Appetites

• Sevenspotted lady beetle females ate on average 115 soybean aphids in 24 hours, males ate 78, and third instars ate 105.

• Multicolored Asian lady beetles females ate on average 95 soybean aphids in 24 hours, males ate 54, and third instars ate 112.

Green Lacewings (Chrysopidae)

• About 1,300 to 2,000 species.
• Larvae eat aphids, insect eggs, caterpillars, etc.
• Larvae inject digestive secretions into their prey.
Green Lacewings

• Green lacewings have been observed feeding on diamondback moth larvae and cocoons.

• “Several instances of predation by lacewing larvae on adults of the flea beetle Phyllotreta cruciferae (Goeze) have been observed in Saskatchewan.”
What is this green caterpillar on canola?

Diamondback moth (*Plutella xylostella*) pupa and larva
Monitoring Diamondback Moth Adults
Diadegma insulare

- Lay eggs into diamondback moth larvae.
- *Diadegma insulare* is not known to overwinter in Canada, and is believed to migrate northwards along with diamondback moth.

Photo by Lloyd Dosdall
Diadegma insulare: Effectiveness

- Native populations of *D. insulare* have parasitized up to 70% of diamondback larvae in field trials in New York and from 50% to almost 90% in Wisconsin.
Diadegma insulare and nectar

• A nectar source can increase *D. insulare* female longevity from 2-5 days to more than 20 days.

• Numbers of diamondback moth larvae parasitized increases from zero per *D. insulare* female, with a poor nectar source, to more than 150 per female with an optimal nectar source.
The answer may be blowing in the wind

- Even if trap counts for diamondback moth are high, we don’t know what the levels of *Diadegma* may be.
What is this predacious bug?

• Generalist predators, catching almost any insect smaller than themselves.
• 12 species in Canada. About 500 species worldwide.

Damsel bug (Nabidae)
Damsel bugs (Nabidae)

- Damsel bugs can be important predators of diamondback moth.

- An average of 131 eggs or 95 larvae of diamondback moth were killed by a single female adult of *Nabis kinbergii* in 24 hours at 24 °C.
Damsel bugs (Nabidae)

• “several incidental observations of attack by the western damsel bug, Nabis alternatus, on adults of the flea beetle *Phyllotreta cruciferae* were made.”
  

• The damsel bug *Nabis alternatus* could be a potentially significant field predator of *Lygus hesperus*.
  
All these larvae were found in the same canola field. What are they?

A = Bertha armyworm

B = Bertha armyworm

C = Bertha armyworm
Agronomy Challenge

• If a canola field has high levels of bertha armyworm, should not neighbouring fields have high levels as well?

A) Always
B) Sometimes
C) Never
Agronomy Challenge - Answer

• Bertha armyworm levels can vary substantially between fields.
Agronomy Challenge – The Science

- The full-flower plants were significantly more preferred for oviposition than plants in preflower or pod stages. Bertha armyworm laid most eggs in the upper portion of the crop canopy on the underside of leaves.
Banchus flavescens

– Parasitism of bertha armyworm by *B. flavescens* may exceeds 40%

– Females attack 1\textsuperscript{st}, 2\textsuperscript{nd}, and 3\textsuperscript{rd} instar larvae.
Athrycia cinerea

- *A. cinerea* may kill over 20% of bertha armyworm.  

- Females attack third, fourth, fifth, and sixth instars of bertha armyworm.

Photo from Lloyd Dosdall
Conserving Natural Enemies

• Only use insecticides when economic thresholds have been exceeded.
• Use selective insecticides when possible.
• Crop rotation.
• Maintain good habitat for natural enemies.
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