FIELD HEROES

THINK BENEFICIALS BEFORE YOU SPRAY

PESTS & PREDATORS

FIELD GUIDE

A guide to insect pests that rob yield and the Field Heroes who lend a hand keeping pest populations down.




POWERED BY: WGRF

KNOW YOUR

PESTS & PREDATORS

Getting to know common pests in your fields and the beneficial insects that help to control them is vital. This Field Guide helps you do just that.

Armed with the information on the pages ahead, you'll be able to distinguish between the insect pests that can damage your crop and the beneficial insects that can protect it.

Allowing these Field Heroes to help control yield-robbing pests is an important part of integrated pest management. Beneficial insects can reduce spraying which lowers the cost of production and protects the environment. Be sure to consider them in your cropping decisions.

For more information, visit **FieldHeroes.ca** and follow **@FieldHeroes** on Twitter.

Acknowledgments

The *Pests & Predators Field Guide* was initiated and funded by the Western Grains Research Foundation (WGRF) as part of the Field Heroes campaign and its ongoing work to raise awareness of beneficial insects.

It was produced with the collaboration and cooperation of field extension and research entomologists from the public and private sectors who are part of the Prairie Pest Monitoring Network.

The information presented in this field guide is from both individual research and the collected work included in the Agriculture & Agri-Food Canada publication *Field crop and forage pests and their natural enemies in Western Canada*. It includes research or field experiences of the contributors as well as that of others who have made their research available for educational purposes.

Thank you to all of the image contributors; your photos provide immeasurable value.

How to use this Field Guide

Here are some tips to help you get the most out of this Field Guide.

The 'Quick Guide' at the start of this book is organized by crop and helps you quickly identify the most common pests in your cereals, pulses and oilseeds. Each of these insect pests have natural predators – otherwise known as beneficial insects. They are also listed in the Quick Guide so that you can quickly identify which pests they help to control.

The next section of the Guide includes detailed information for each Predator and Parasitoid, organized by insect order. This includes their life cycle, diet, identification, where they can be found and tips to protect them.

On page 67, you can find the Pest listing, organized alphabetically. Look to these pages for pest life cycle, identification, feeding damage, scouting tips, economic threshold and management options.

Best of luck with scouting this season. We hope you find that this Guide is a valuable tool to have with you while you're out in the fields.

And a special thanks to the following volunteers who shared their valuable time to submit information and to review and provide feedback on the draft versions. Field Heroes everywhere are grateful for your dedication to their cause.

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CEREALS
INSECT QUICK GUIDE

PEST

Cereal leaf beetle
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of English grain aphid and oat-birdcherry aphid

Aphid parasitoids

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Hover flies

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Minute pirate bugs
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PEST

Army cutworm, Pale western and Redbacked cutworm
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PREDATORS & PARASITOIDS

of Army cutworm, Pale western and Redbacked cutworm

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Chalcididae
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***Cotesia* spp.**
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Rove beetles
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Tachinid flies
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PEST

Grasshoppers
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PREDATORS & PARASITOIDS of Grasshoppers

Bee flies
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Predators & Parasitoids of Grasshoppers continued

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Lygus bugs

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Peristenus mellipes **and** ***P. digoneutis***

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INSECT QUICK GUIDE

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***Cotesia* spp.**
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PEST

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PREDATORS & PARASITOIDS of Grasshoppers

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Peristenus mellipes **and** ***P. digoneutis***

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PEST

Pale western cutworm and Redbacked cutworm

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PREDATORS & PARASITOIDS

of Pale western cutworm and Redbacked cutworm

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***Cotesia* spp.**

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Ground beetles

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Predators & Parasitoids of Pale western cutworm and Redbacked cutworm continued

Rove beetles
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Stiletto flies
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PREDATORS & PARASITOIDS

Orders of beneficial insects

Hemiptera (true bugs)

Characteristics of insects in this order are:

- Wings at rest are held flat (and overlapping) over the body or in some groups, may be held rooflike over the body
- Mouthparts are piercing/sucking
- Young nymphs somewhat resemble adults

Damsel bugs
P24

Minute pirate bugs
P26

Neuroptera (lacewing)

Characteristics of insects in this order are:

- Adults - four membraneous, many veined wings
- Larvae - elongated mandibles adapted for piercing and sucking

Green lacewing
P28

Coleoptera (beetles)

Characteristics of insects in this order are:

- Hard forewings known as elytra that are not used for flying
- Hindwings membranous, folded under the elytra when at rest

Ground beetles
P30

Lady beetles
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Rove beetles
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Diptera (flies)

Characteristics of insects in this order are:

- One pair of membranous wings
- Larvae usually legless and lacking well-developed head

Bee flies
P36

Flesh flies
P38

Hymenoptera
(wasps, ants and bees)

Characteristics of insects in this order are:

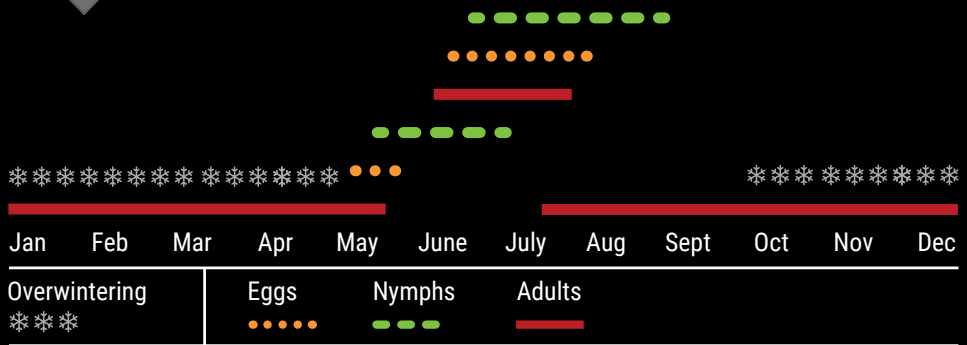
- Two pairs of membranous wings
- Females usually have a hardened ovipositor, that can be used for sawing, piercing or stinging
- Most hymenopterans have a constriction between the first two segments of the abdomen
- Compound eyes, usually large

DAMSEL BUGS

NABIDAE

This section applies to multiple damsel bugs: there are 22 species in Canada.*

FIELD HEROES



Diet

Prey on:

- Aphids
- Caterpillars
- Insect eggs
- Lygus bugs
- Leafhoppers
- Soft-bodied insects, including other predators

Identification

ADULTS

- 7-12mm long bugs
- Tan or grey
- Body tapers toward the head
- Long legs, enlarged front legs used to grab prey
- Well-developed wings

MATURE NYMPHS

- Resemble adults but smaller, paler colour, wing buds

Where to Find

- Visually inspect plants
- Use sweep net to detect adults and nymphs

Conservation Options

- Use economic thresholds for all pests and do not spray unless they reach threshold levels
- When adults are seen, avoid using broad-spectrum insecticides
- Preserve unsprayed vegetation near fields where adults can feed, reproduce and spread to nearby crops

Damsel bug — adult

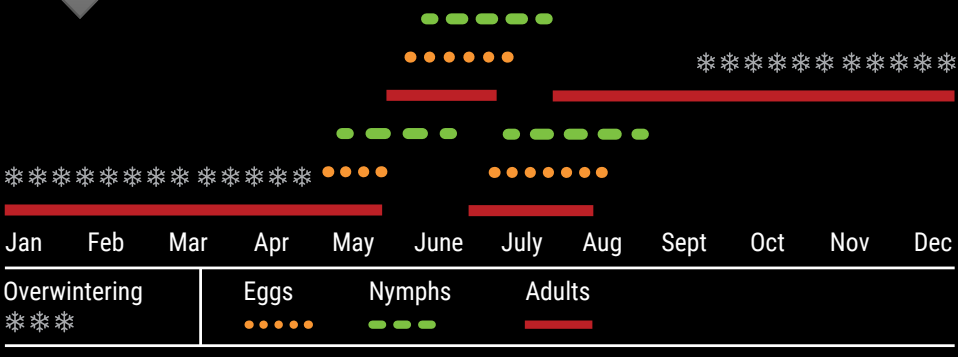
Photo credit: John Gavloski, Manitoba Agriculture and Resource Development

MINUTE PIRATE BUGS

ANTHOCORIDAE

This section applies to many minute pirate bugs: there are 39 species in Canada.*

FIELD HEROES



Diet

Prey on:

- Aphids
- Mites
- Scales
- Thrips
- Small caterpillars
- Nectar and pollen when prey is scarce

Identification

ADULTS

- 2-5mm long bugs
- Oval
- Shiny with black and white X-pattern on their back
- Pointed head

MATURE LARVAE

- 2-4mm
- Shiny
- Wingless
- Yellowish-pink to reddish-brown

Where to Find

- Use a sweep net to sample in crops throughout the growing season
- Use a beating tray to sample shrubs and trees

Conservation Options

- Use economic thresholds for all pests and do not spray unless they reach threshold levels
- Avoid using insecticides toxic to adults and larvae
- Preserve unsprayed vegetation near fields where adults can feed, reproduce and spread to nearby crops

Photo credit: "Minute pirate bug eating thrips ..." by gcchang is licensed under CC BY-SA 2.0

Photo credit: Dan Johnson

GREEN LACEWING

CHRYSOPIDAE

This section applies to multiple green lacewing: there are 26 species in Canada.*

FIELD HEROES

Overwintering	Eggs	Larvae	Pupae	Adults
❄❄❄	•••••	— — —	— —	———

Diet

ADULTS

Feed on:

- Nectar
- Aphid honeydew
- A few species are predaceous

LARVAE

Prey on:

- Aphids
- Spider mites
- Small caterpillars
- Insect eggs
- Thrips
- Leafhoppers
- Mealybugs

Identification

ADULTS

- 14-20mm long
- Pale yellow to bright green
- Two large pairs of clear, lace-like wings with green or brown veins that fold like a tent over the body
- Narrow body
- Long, slender antennae

LARVAE

- ≤15mm long
- Alligator-shaped
- Yellowish to mottled grey with red, brown, or black markings
- Clumps of short bristles on body
- Large, sickle-shaped mandibles (mouthparts)

Where to Find

ADULTS

- Sweep net or light trap

LARVAE

- Inspect or beat prey-infested plants over trays
- Sweep net sampling

Conservation Options

- Use economic thresholds for all pests and do not spray unless they reach threshold levels
- When adults or larvae are seen, avoid using broad-spectrum insecticides
- Preserve unsprayed vegetation near fields where adults can feed, reproduce and spread to nearby crops

Photo credit: Dan Johnson

Photo credit: H. Goulet

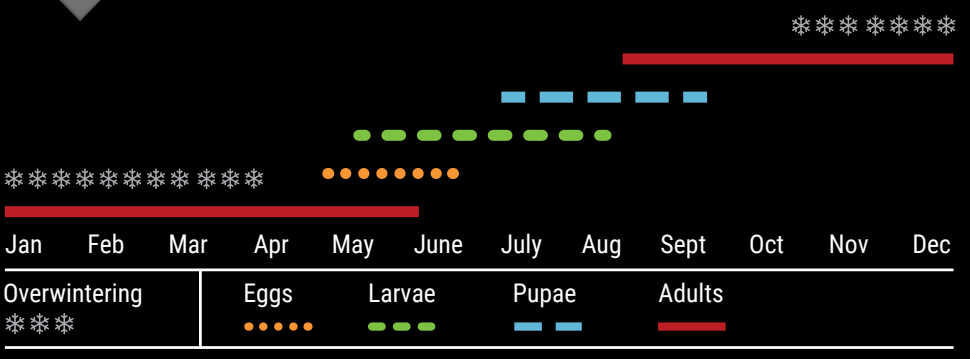
GROUND BEETLES

CARABIDAE

This section applies to most ground beetle species: there are 398 species in the Prairies. Ground beetles are generalist predators and may prey on many agricultural pests.*

Photo credit: John Gavloski, Manitoba Agriculture and Resource Development

FIELD HEROES



Diet

ADULTS

Prey on:

- Caterpillars (e.g. cutworms and armyworms)
- Beetle larvae
- Root maggot eggs and larvae
- Slugs
- Weed seeds (e.g. lamb's-quarters, wild oats) (some species only)

LARVAE

Prey on:

- Soft-bodied insect stages
- Earthworms, slugs, snails

Identification

ADULTS

- Tiny (2mm) to large (38mm) long beetles, depending on species
- Dark brown or shiny black, some are metallic blue or green
- Pincher-like mandibles projecting forward from the head
- Slender legs

MATURE LARVAE

- Tiny (2mm) to large (40mm) legged larvae, depending on species
- Often dark-coloured
- End is either tapered or has two small projections
- Large head with prominent pincher-like mouthparts

Where to Find

ADULTS

- Pitfall traps
- Look under soil clods, rocks, mulch and hand collect
- Observe ground following rain or irrigation

LARVAE

- Sift soil; larvae live below soil surface

Conservation Options

- Use economic thresholds for all pests and do not spray unless they reach threshold levels
- Minimize tillage
- When adults are seen, avoid using broad-spectrum insecticides

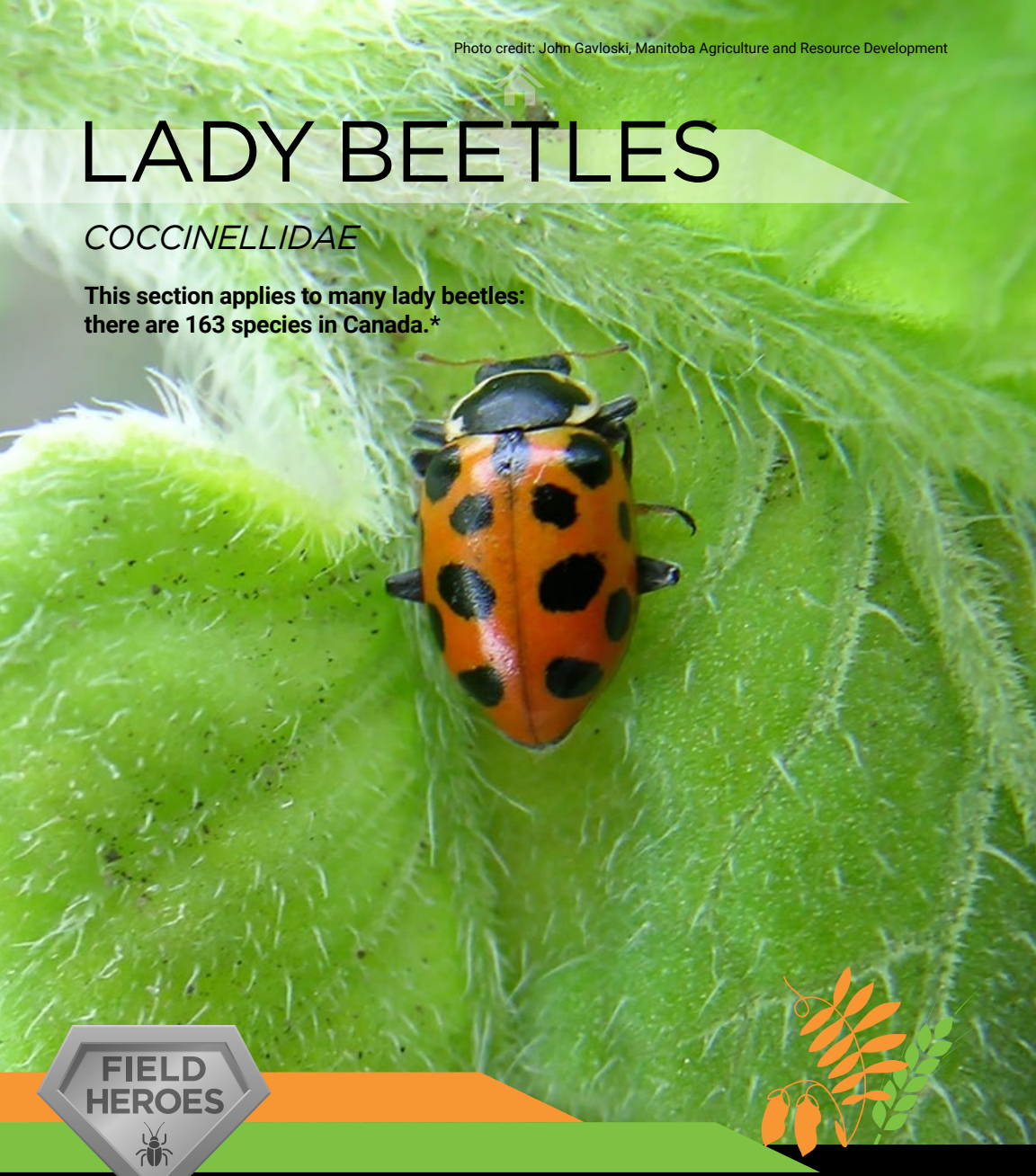
Photo credit: John Gavloski, Manitoba Agriculture and Resource Development

Photo credit: John Gavloski, Manitoba Agriculture and Resource Development

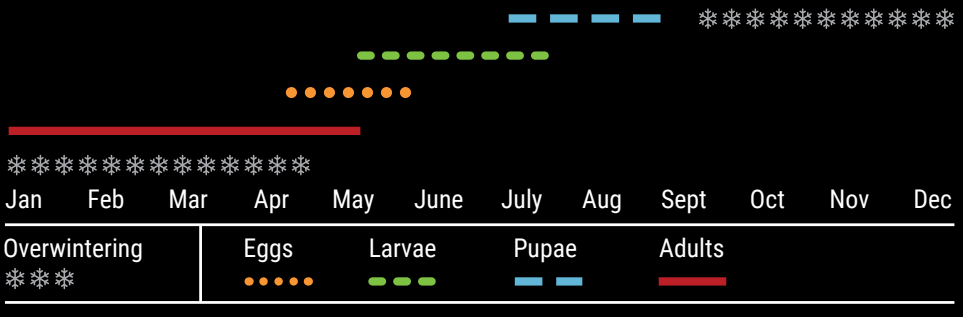
LADY BEETLES

COCCINELLIDAE

This section applies to many lady beetles: there are 163 species in Canada.*



FIELD HEROES



Diet

ADULTS AND LARVAE

Prey on:

- Aphids
- Mites
- Scale insects
- Mealybugs
- Thrips
- Cereal leaf beetle
- Smaller soft bodies larva
- Insect eggs when preferred food is scarce

Identification

ADULTS

- 1-7mm long beetle
- Wing shells are red, orange, or black, with or without red or black spots

MATURE LARVAE

- ≤11mm long
- Six strong legs
- Alligator-shaped
- Dark blue/black body with various patterns

EGGS

- Yellow to orange
- 0.5-1.5mm long
- Found upright in clusters of 3-300 on prey-infested plants

Where to Find

ADULTS AND LARVAE

- Visually examine plants, especially those with many prey insects like aphids
- Use a sweep net

EGGS

- Examine leaves of plants where prey (e.g. aphids) are found

Conservation Options

- Use economic thresholds for all pests and do not spray unless they reach threshold levels
- When adults are seen, avoid using broad-spectrum insecticides
- Preserve unsprayed vegetation near fields where adults can feed, reproduce and spread to nearby crops

Lady beetle – pupa
Photo credit: John Gavloski, Manitoba Agriculture and Resource Development

Lady Beetle – Larva
Photo credit: John Gavloski, Manitoba Agriculture and Resource Development

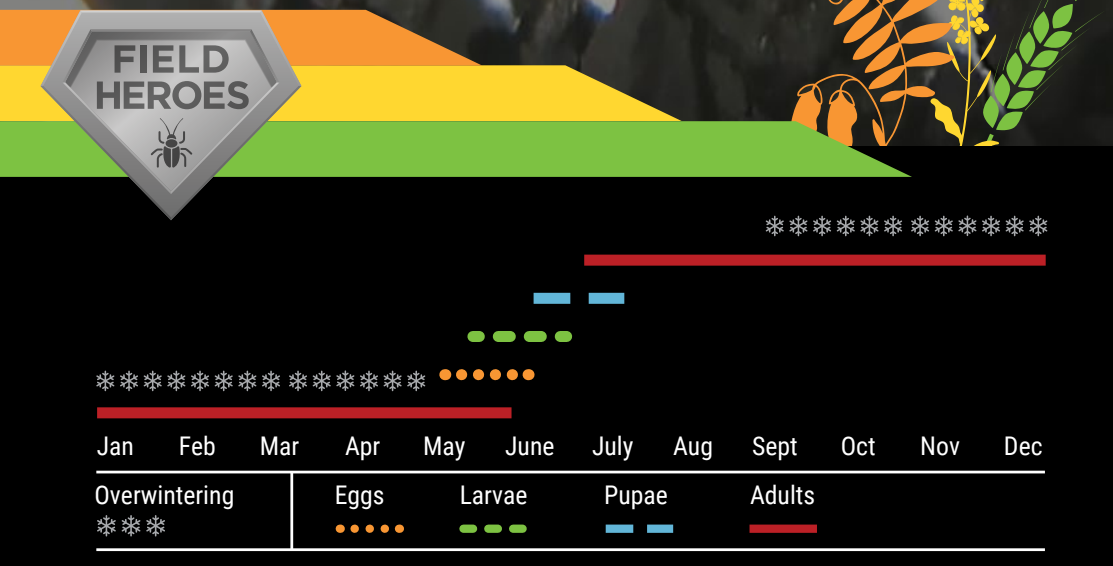
Photo credit: John Gavloski, Manitoba Agriculture and Resource Development

ROVE BEETLES

STAPHYLINIDAE

This section applies to many rove beetles: there are 1,774 species in Canada.*

FIELD HEROES



Diet

- Root maggots (eggs, larvae and pupae)
- Small soil insects

Identification

ADULTS

- 4-25mm long beetle
- Long, black or brown body
- Short, shell-like wing cases that don't cover the abdomen like they would in most other beetles
- Raise abdomen when disturbed

MATURE LARVAE

- Elongated, cylindrical but slightly flattened
- Off-white with brownish head and prominent legs
- Two slender projections on the tip of the abdomen

Where to Find

- Found in various crop and non-crop habitats
- Use pitfall traps
- Look under plants and other soil debris

Conservation Options

- Use economic thresholds for all pests and do not spray unless they reach threshold levels
- Minimize tillage
- Include shelterbelts and hedgerows that may shelter adults
- When adults are seen, avoid using broad-spectrum insecticides

Photo credit: Rove beetle – adult
Tyler Wist, AAFC

Photo credit: "Rove Beetle Larva" by treegrow is licensed under CC BY 2.0

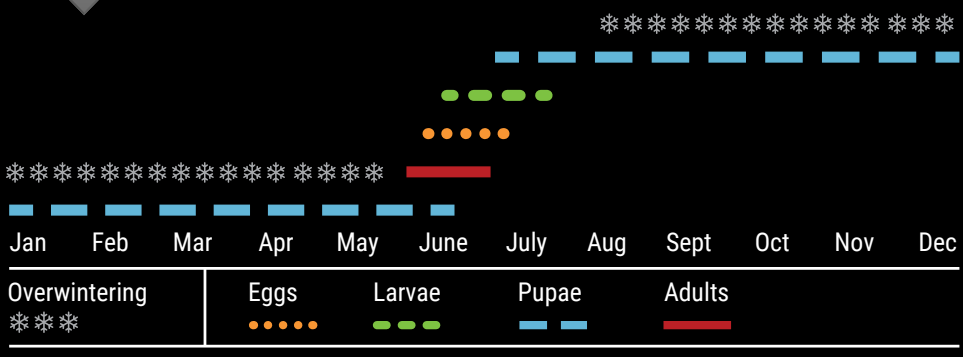
Photo credit: Mike Dolinski, MikeDolinski@hotmail.com

BEE FLIES

BOMBYLIIDAE

This section applies to most bee flies: there are 105 species in Canada.*

FIELD HEROES



Diet

LARVAE

Prey on:

- Grasshopper eggs (some species only)

Parasitoid of:

- Moths (including cutworms)
- Flies
- Beetles
- Wasps
- Ground-nesting bees

ADULTS

Feed on:

- Nectar and pollen

Identification

ADULTS

- 2-28mm long flies, some resemble bees
- Stout body, very hairy
- Thin and prominent “beak”
- Brown, red or yellow with bright markings
- Two wings
- Wings transparent with dark bands or marks (in many species)
- Wings held straight out from the body
- May hover in flight

Where to Find

- Larvae are found in the soil, where they feed on grasshopper eggs (some species only)
- Look for hovering adults near flowering plants
- Collect with sweep net

Conservation Options

- Use economic thresholds for all pests and do not spray unless they reach threshold levels
- When adults are seen, avoid using broad-spectrum insecticides
- Preserve unsprayed vegetation near fields where adults can feed, reproduce and spread to nearby crops

Bee fly — larva
Photo credit: AAFC

Photo credit: Tyler Wist, AAFC

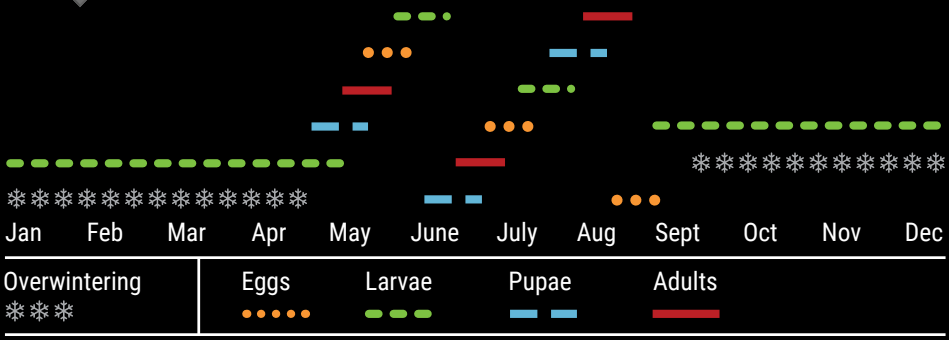
Photo credit: "Red-Tailed Flesh Fly" by Lisa Zins is licensed under CC BY 2.0

FLESH FLIES

SARCOPHAGIDAE

This section applies to a small number of flesh flies: there are 135 total flesh fly species in Canada.*

FIELD HEROES



Diet

Parasitoids of:

- Grasshoppers (some species of flesh flies)

Photo credit: "Flesh Flies" by loarie is licensed under CC BY-NC-SA 2.0

Identification

ADULTS

- 10-22mm long flies
- Three black "racing stripes" on grey back
- Resemble house flies at first glance

Where to Find

- Emerge in June

Conservation Options

- Use economic thresholds for all pests and do not spray unless they reach threshold levels
- When adults are seen, avoid using broad-spectrum insecticides
- Preserve unsprayed vegetation near fields where adults can feed, reproduce and spread to nearby crops

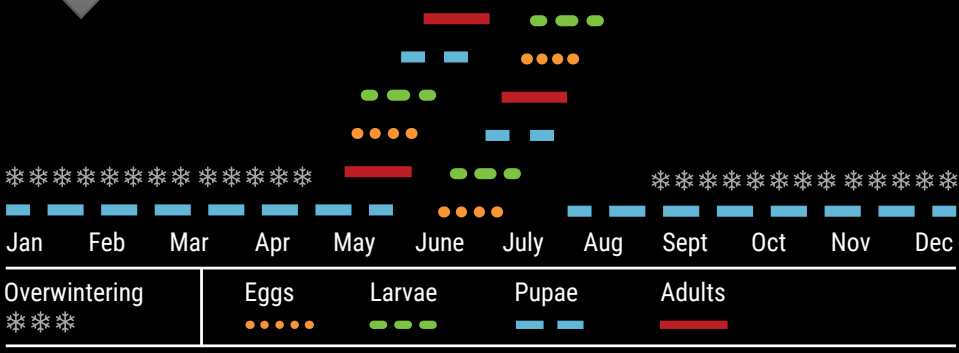
Photo credit: John Gavloski, Manitoba Agriculture and Resource Development

HOVER FLIES

SYRPHIDAE

This section applies to many hover flies: there are 593 species in Canada.*

FIELD HEROES



Diet

ADULTS

Feed on:

- Nectar and pollen
- Aphid honeydew

LARVAE

Prey on:

- Aphids
- Soft-bodied insects, including immature stages

Identification

ADULTS

- 8-15mm long fly, many resemble bees or wasps
- Brightly coloured with yellow, brown and black stripes OR entirely black/brown
- Smooth hairless bodies
- One pair of transparent wings

MATURE LARVAE

- 10-15mm long maggot, without legs
- Yellowish-green to pale brown with pale stripes
- Body narrows towards the head

Where to Find

- Visually inspect plants
- Use a sweep net on flowering plants

Conservation Options

- Use economic thresholds for all pests and do not spray unless they reach threshold levels
- When adults are present, avoid using broad-spectrum insecticides
- Preserve unsprayed vegetation near fields where adults can feed, reproduce and spread to nearby crops

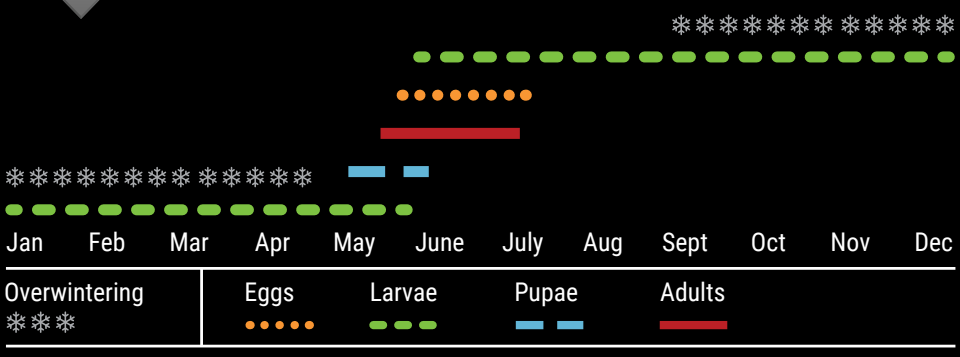
Photo credit: John Gavloski, Manitoba Agriculture and Resource Development

STILETTO FLIES

THEREVIDAE

This section applies to most stiletto flies: there are 50 species in Canada.*

FIELD HEROES



Diet

ADULT

Feed on:

- Nectar and plant exudates

LARVAE

Prey on:

- Larvae and pupae of flies, beetles and moths that are in the soil
- Grasshopper eggs
- Wireworms

Identification

ADULTS

- 4-14mm long fly
- Usually grey
- Large dark eyes
- Abdomen usually greyish, hairy, slender and pointed

MATURE LARVAE

- 6-18mm long, worm-like
- Legless
- White or pinkish
- Very long, cylindrical, thin body with tapered ends
- Thrashes when disturbed
- Don't confuse with wireworm

Where to Find

ADULTS

- Are uncommon
- Prefer open areas near sand dunes and sandy soils

MATURE LARVAE

- Found in soil or decaying material

Conservation Options

Unknown, but will likely benefit from the common conservation options listed below:

- Use economic thresholds for all pests and do not spray unless they reach threshold levels
- When adults are seen, avoid using broad-spectrum insecticides
- Preserve unsprayed vegetation near fields where adults can feed, reproduce and spread to nearby crops

Photo credit: Stiletto fly – adult (Spiriverpa senex)
Paul Bedell, Flickr

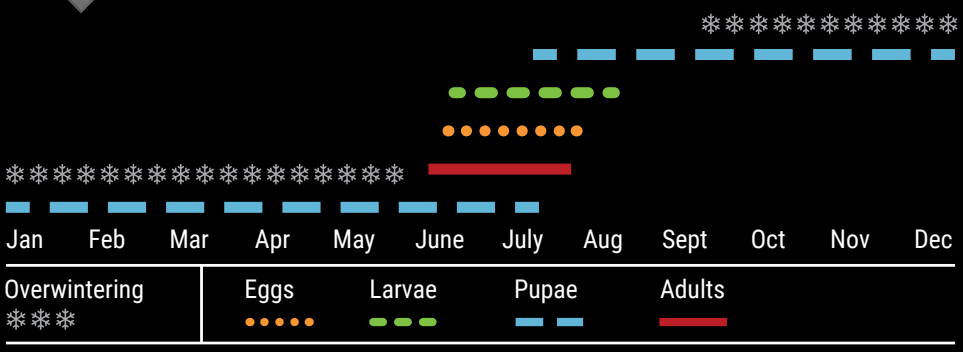
Stiletto fly – larva
Photo credit: John Gavloski, Manitoba Agriculture and Resource Development

TACHINID FLIES

TACHINIDAE

This section applies to many tachinid flies: there are 736 species in Canada.*

FIELD HEROES



Diet

ADULT

- Honeydew from aphids, scales and mealybugs
- Nectar

LARVAE

Parasitoids of:

- Moths and caterpillars (including armyworms)
- Bertha armyworm (*Athrycia cineria*)
- Beetles
- Sawfly larvae
- Grasshoppers
- Wasps
- Flies
- Plant bugs

Identification

ADULTS

- 5-15mm long fly
- Pale/dark brown/red/metallic green
- Bristly body
- One pair of transparent wings

MATURE LARVAE

- Inside hosts
- 6-16mm long maggot
- Whitish

Where to Find

- Examine slow/lethargic caterpillars or other hosts
  - Small, long white egg may be attached to body
  - Open up the host and look for Tachinid fly larvae

Conservation Options

- Use economic thresholds for all pests and do not spray unless they reach threshold levels
- Preserve unsprayed vegetation near fields where adults can feed, reproduce and spread to nearby crops

APHID PARASITOIDS

This section applies to multiple species of Braconid wasps in the *Aphidius* and *Praon* genera.

FIELD HEROES

Diet

ADULTS

- Nectar and honeydew

LARVAE

Parasitoid of:

- Over 40 species of aphids

Identification

ADULTS

- 2-3mm long wasps
- Black or brown

Where to Find

- Aphid colonies – search for tan-coloured, globe-like mummified aphids (*Aphidius* spp.), or white hollowed-out aphids over white cocoons (*Praon* spp.)
- Flowering vegetation

Conservation Options

- Use economic thresholds and do not spray aphids unless they reach threshold levels
- Preserve unsprayed vegetation near fields where adults can feed, reproduce and spread to nearby crops

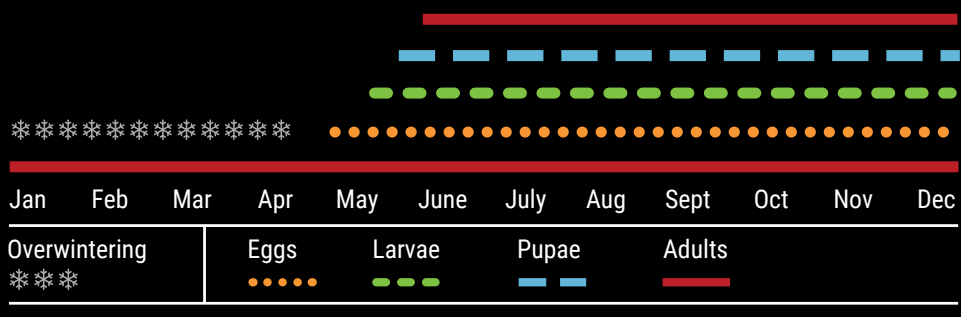
Photo credit: "Aphidius ervi victim....." by The Manic Macrographer is licensed under CC BY 2.0

ANTS

FORMICIDAE

This section applies to most ants: there are 212 species in Canada.
Ants are generalist predators and may prey on many agricultural pests.*

FIELD HEROES



Diet

Prey on:

- Soft-bodied pests like larvae of the diamondback moth
- Honeydew from aphids (some ants 'farm' aphids for honeydew)
- Leaves, insect eggs, plant sap
- Dead insects

Identification

ADULTS

- 1.5-13mm
- Usually brown or black
- Body divided clearly into three segments, with six distinct legs
- Usually wingless
- Antennae strongly elbowed (bent)

Where to Find

- Most ant colonies are built underground in the soil
- Found near plentiful food sources

Conservation Options

- Reduce tillage

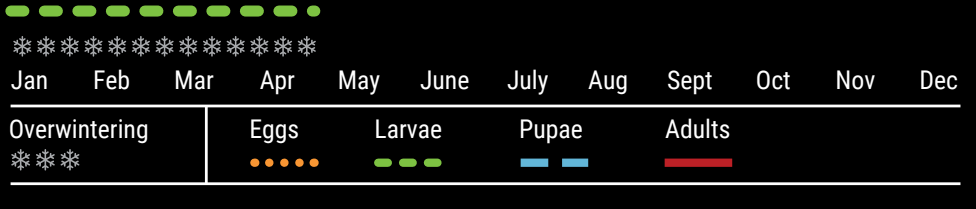
Photo credit: John Gavloski, Manitoba Agriculture and Resource Development

BANCHUS FLAVESCENS

ICHNEUMONIDAE

This species is a specialist parasitoid and only attacks bertha armyworm. Banchus flavescens also parasitizes clover cutworm and spotted cutworm.

FIELD HEROES



Diet

ADULTS

Feed on:

- Nectar
- Aphid honeydew

LARVAE

Parasitoid of:

- Bertha armyworm

Identification

ADULTS

- Relatively large orange wasps
- Long antennae
- In females, the ovipositor (egg-laying tube) is longer than the body

Where to Find

- Collect adults using sweep nets or light traps
- Adults found near flowering vegetation

Conservation Options

- Use economic thresholds for all pests and do not spray unless they reach threshold levels
- Preserve unsprayed vegetation near fields where adults can feed, reproduce and spread to nearby crops

Photo credit: John Gavloski, Manitoba Agriculture and Resource Development

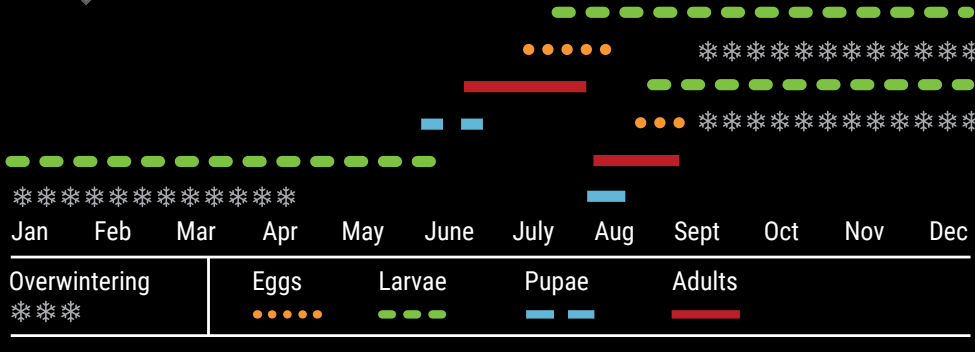
Photo credit: H. Goulet

BRACON CEPHI

BRACONIDAE

This species is a specialist parasitoid and only attacks Wheat stem sawfly.

FIELD HEROES



Diet

ADULTS

Feed on:

- Nectar
- Aphid honeydew

LARVAE

Parasitoids of:

- Wheat stem sawfly

Identification

ADULTS

- 3-4mm long wasps
- Yellowish-orange or darker
- Long antennae
- Females have a noticeable ovipositor (egg-laying tube)

Where to Find

- Catch adults by using a sweep net on plants with small flowers or in wheat fields
- Look for small “exit holes” in plant stems
- Examine wheat stems for overwintering parasitoid larvae by dissecting

Conservation Options

- Use economic thresholds. While there is no chemical control available for wheat stem sawfly, consider these beneficials when deciding to spray for other pests like aphids
- At harvest, leave stubble as tall as possible to preserve parasitoid overwintering habitat (at least 1/3 of stem height)
- Avoid tilling wheat fields so larvae are not destroyed

Photo credit: C. Barlow (AAFC Swift Current, retired)

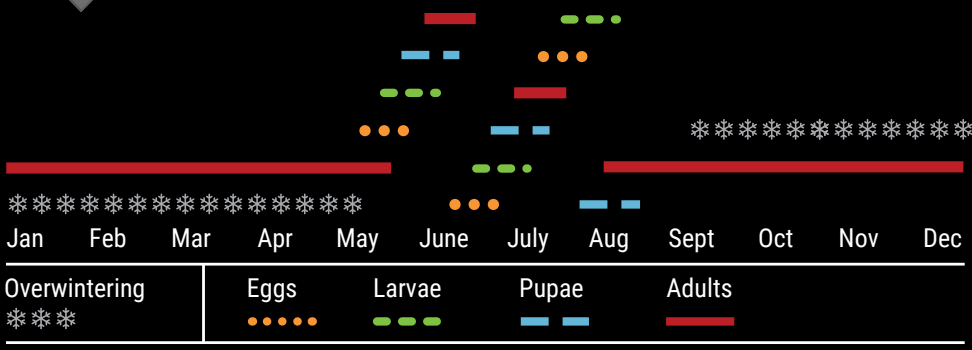
Conserve *B. cephi* in grass margins near wheat fields; avoid spraying insecticides on these grass margins.

Photo by H. Carcamo of Andy Provost who was sweeping large numbers of *B. cephi* in early September circa 2006 near Nobleford AB.

CHALCIDIDAE

This section applies to multiple species in the family Chalcididae: there are 37 species in Canada.*

FIELD HEROES



Diet

ADULTS

Feed on:

- Flower nectar
- Aphid honeydew

LARVAE

Parasitoids of:

- Larvae and/or eggs of 12 different insect orders (e.g. beetles, true bugs and moths like cutworms)

Identification

ADULTS

- <6mm long wasps
- Black, blue-black, green

Where to Find

- Sweep plants with small flowers for adults

Conservation Options

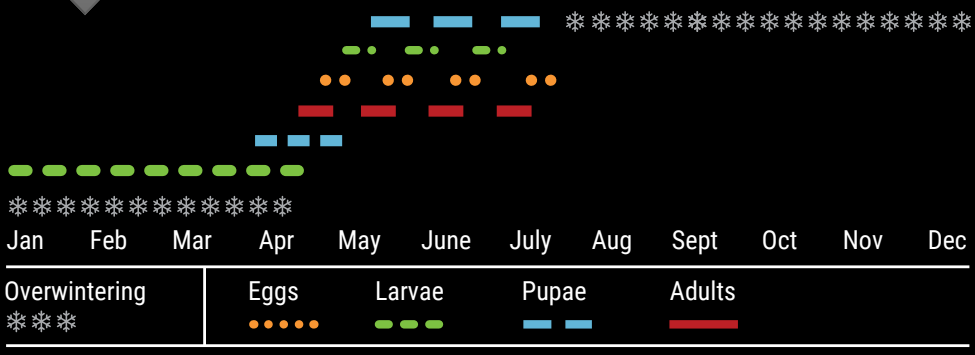
- Use economic thresholds for all pests and do not spray unless they reach threshold levels
- When adults are seen, avoid using broad-spectrum insecticides
- Preserve unsprayed vegetation near fields where adults can feed, reproduce and spread to nearby crops

COTESIA SPP.

BRACONIDAE

This section applies to multiple wasps in the *Cotesia* genus.

FIELD HEROES



Diet

Parasitoids of:

- Imported cabbageworm
- Cabbage looper
- Black cutworm
- Corn earworm
- Variegated cutworm
- Armyworm
- Fall armyworm
- Diamondback moth

Identification

ADULTS

- 2-3mm long wasps
- Black-brown
- Two pairs of transparent wings
- Long antennae
- Females have a noticeable ovipositor (egg-laying tube)
- Deposit multiple eggs inside a single host

Where to Find

- Catch adults by using a sweep net on plants with small flowers
- Clusters of pupae can be found on plants

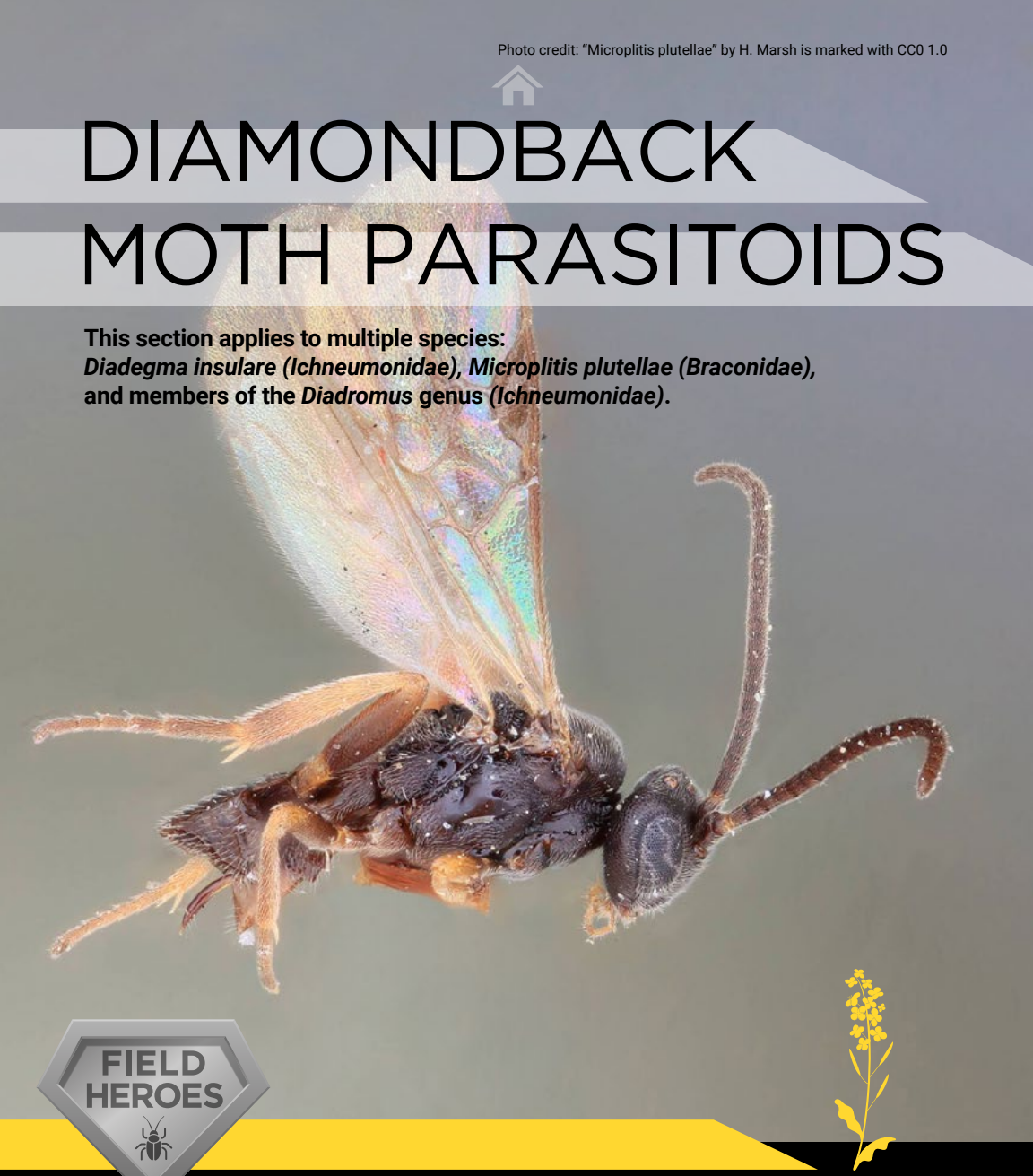
Conservation Options

- Use economic thresholds for all pests and do not spray unless they reach threshold levels
- Preserve unsprayed vegetation near fields where the adults can reproduce and spread to nearby crops

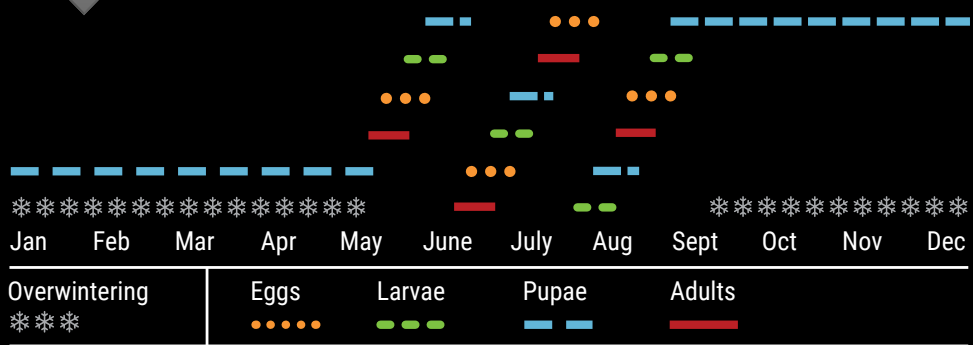
Photo credit: John Gavloski, Manitoba Agriculture and Resource Development

DIAMONDBACK MOTH PARASITOIDS

This section applies to multiple species:
Diadegma insulare (Ichneumonidae), Microplitis plutellae (Braconidae),
and members of the *Diadromus* genus *(Ichneumonidae)*.



FIELD HEROES



Diet

LARVAE

Parasitoids of:

- Diamondback moth

Identification

***Diadegma insulare and Diadromus* spp.:**

ADULTS

- 6mm long wasp
- Brown, red or black body
- Narrow waist
- In females, ovipositor (egg-laying tube) is longer than the body

***Microplitis plutellae*:**

ADULTS

- 2-3mm long wasp
- Black-brown
- Two pairs of transparent wings
- Long antennae
- Females have a noticeable ovipositor (egg-laying tube)

Where to Find

- Use a sweep net on plants with small flowers
- Light traps
- Found near flowering vegetation

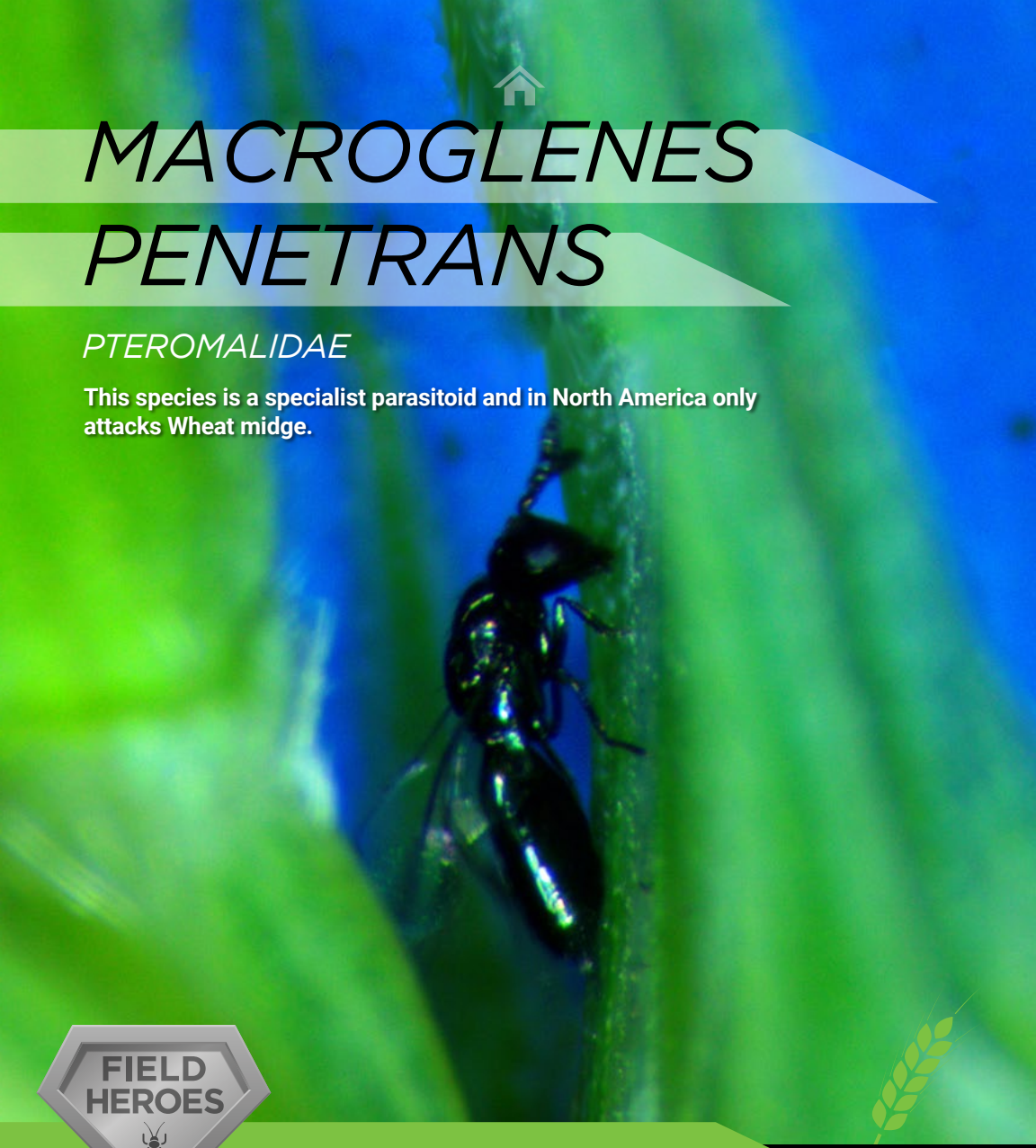
Conservation Options

- Use economic thresholds for all pests and do not spray unless they reach threshold levels
- Preserve unsprayed vegetation near fields where adults can feed, reproduce and spread to nearby crops

MACROGLENES PENETRANS

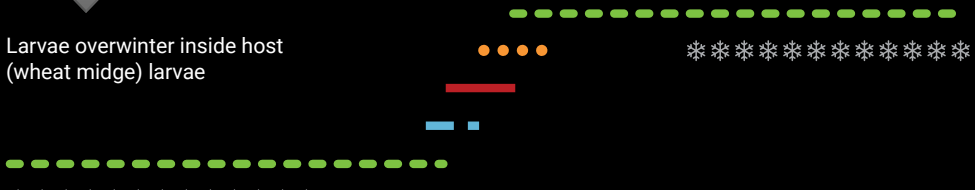
PTEROMALIDAE

This species is a specialist parasitoid and in North America only attacks Wheat midge.



FIELD HEROES

Larvae overwinter inside host (wheat midge) larvae



Diet

Parasitoid of:

- Wheat midge

Identification

ADULTS

- 1-2mm long wasp
- Shiny black body
- Two pairs of transparent wings

MATURE LARVAE

- 1-4mm
- Maggot-like
- Cream to yellow
- Legless

Where to Find

- Larvae overwinter in the soil, inside of wheat midge cocoons

Conservation Options

M. penetrans is a critical parasitoid to conserve: it can reduce wheat midge below economic threshold, and produced over $300M in value in Saskatchewan in the 90s.

- Use economic thresholds for all pests and do not spray unless they reach threshold levels
- Avoid using insecticides toxic to adults and larvae

Photo credit: Henri Goulet *Peristenus mellipes*

PERISTENUS MELLIPES AND P. DIGONEUTIS

BRACONIDAE

These species are specialist parasitoids and only attack Lygus and related plant bugs.

FIELD HEROES

Diet

ADULTS AND LARVAE

Parasitoid of:

- Lygus bugs

Identification

ADULTS

- 2-4mm long wasps
- Light to dark brown

Where to Find

- Found near flowering plants, but may be difficult to see

Conservation Options

- Use economic thresholds for all pests and do not spray unless they reach threshold levels
- Avoid using broad-spectrum insecticides toxic to adults and larvae

A quarter-inch-long parasitic wasp (Peristenus digoneutis) prepares to lay an egg in a tarnished plant bug nymph. Photo credit: "k7861-1" by USDAgov is licensed under CC BY 2.0

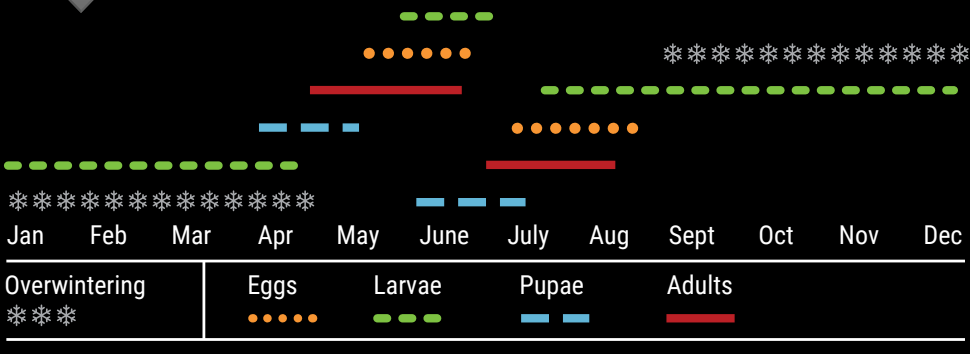
Photo credit: Swaroop Kher, University of Alberta

TETRASTICHUS JULIS

EULOPHIDAE

This species is an introduced specialist parasitoid and only attacks Cereal leaf beetle.

FIELD HEROES



Diet

ADULT

Feed on:

- Nectar
- Aphid honeydew

LARVAE

Parasitoid of:

- Cereal leaf beetle

Identification

ADULTS

- <4mm long wasp
- Shiny black or blue-black
- Narrow waist
- Two pairs of transparent wings

MATURE LARVAE

- Inside hosts
- 2-3mm long
- Maggot-like
- Yellow

Where to Find

ADULTS

- Use a sweep net on plants with small flowers during crop flowering period

LARVAE

- Break open mature cereal leaf beetle larvae, and yellow *T. julis* larvae may be visible

Conservation Options

- Use economic thresholds for all pests and do not spray unless they reach threshold levels
- Preserve unsprayed vegetation near fields where adults can feed, reproduce and spread to nearby crops
- Provide unsprayed corner/ border of cereal leaf beetle-infested crops to allow *T. julis* to establish
- Avoid using broad-spectrum insecticides toxic to adults and larvae

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ENDNOTES

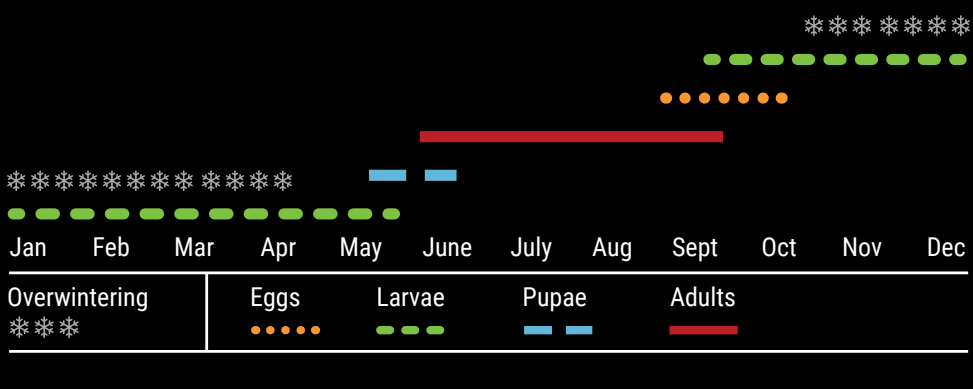
*Langor, DW and Sheffield, CS (Eds). The Biota of Canada – A Biodiversity Assessment. Part 1: The Terrestrial Arthropods. ZooKeys 819: 57-65. https://doi.org/10.3897/zookeys.819.24327

Photo credit: John Gavloski, Manitoba Agriculture and Resource Development

PESTS

ARMY CUTWORM

EUXOA AUXILIARIS



Identification

ADULTS

- Larger moths with 40-45mm wingspan
- Grey-brown
- Two prominent pale spots on each wing: one round, one kidney-bean shaped

MATURE LARVAE

- 37-40mm long fleshy caterpillars
- Mottled pale, greenish-grey to brown
- Whitish stripe down middle of back

Feeding Damage

ADULTS

- Flower nectar

LARVAE

- All damage done in mid-late spring
- Holes and notched margins until leaves are totally consumed
- Larvae move up to 5km to continue feeding

Scouting Tips

- Scout forage crops and pastures closely in April and early May
- An unusually dry July and wet autumn could indicate outbreak in the following year

Economic Threshold Calculation

- Identify a 50cm x 50cm area of crop
- Record the number of larvae within each 50cm of row in the sample area
- Multiple the number by four to give the number of larvae per m^2
- Repeat process in different areas of the field

Economic Threshold

- 5-6 larvae/m^2 in cereal crops

Management Options

BIOLOGICAL

Parasitoids such as:

- Tachinid flies
- Bee flies
- *Trichogramma minitum* wasp
- *Copidosoma bakeri*
- *Chalcididae* wasps
- *Cotesia* spp. wasps

Predators such as:

- Ground beetles
- Rove beetles
- Stiletto flies
- Birds

CULTURAL

- Seed spring crops later to avoid larvae

CHEMICAL

- Apply treatments based on provincial recommendations
- Select products least harmful to beneficial insects

Photo credit: John Gavloski, Manitoba Agriculture and Resource Development

BERTHA ARMYWORM

MAMESTRA CONFIGURATA

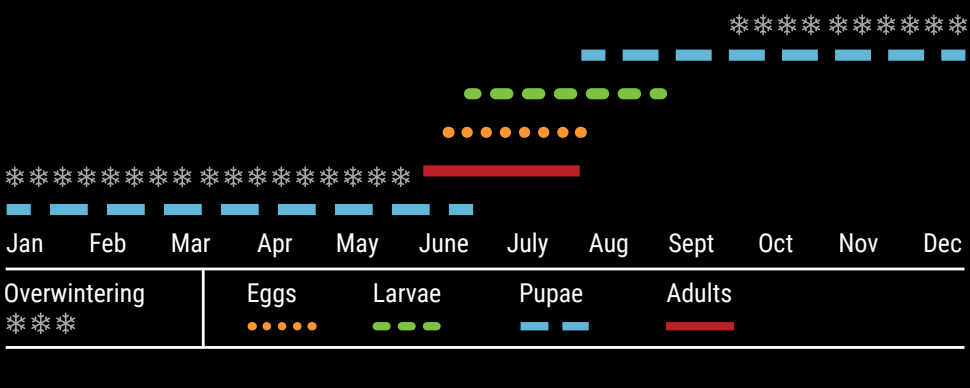
Information in this section pertains to this species only.

Photo credit: John Gavloski, Manitoba Agriculture and Resource Development

Economic Threshold

CANOLA:

- Varies with canola price, crop stage, and chemical costs
  - Tables are available on provincial government websites, found by inputting "bertha armyworm economic threshold [your province name]" into a search engine



Identification

ADULTS

- 20mm long moth, 40mm wingspan
- Greyish
- Forewing includes characteristic whitish kidney-shaped marking, and an irregular whitish border along wing borders

MATURE LARVAE

- 40mm long caterpillar
- Velvety black, sometimes light green/light brown
- Broad, yellow-orange stripe along each side
- Three narrow, broken white lines down back
- Light brown head

Feeding Damage

MATURE LARVAE

In canola:

- Will feed on leaves and pods
- "Debark" pods
- Chew into pods to eat seeds
- Completely consume pods

In flax:

- Eat flowers, developing bolls, and area below boll

Will also feed on quinoa, hemp and some other crops

ADULTS

- Feed on flower nectar

Scouting Tips

In canola:

Economic Threshold Calculation

- When canola is in early pod stage, count the number of larvae in a 0.25m^2 area, at 10-15 locations in the field spaced 50m+ apart in a zigzag pattern
- Shake plants to dislodge larvae, then count
- Calculate the average number of larvae/m^2

Management Options

BIOLOGICAL

Parasitoids including:

- *Microplitis mediator*
- *Banchus flavescens*
- *Athrycia cinerea* (Tachinid fly)
- *Trichogramma inoyoense, T. minitum* (egg parasitoids)
- Chalcididae wasps

Predators including:

- Gulls and other birds feed on the larvae

Diseases that attack larvae, including:

- Nuclear polyhedrosis virus (NPV)
- *Entomophthora* sp. fungus

CULTURAL

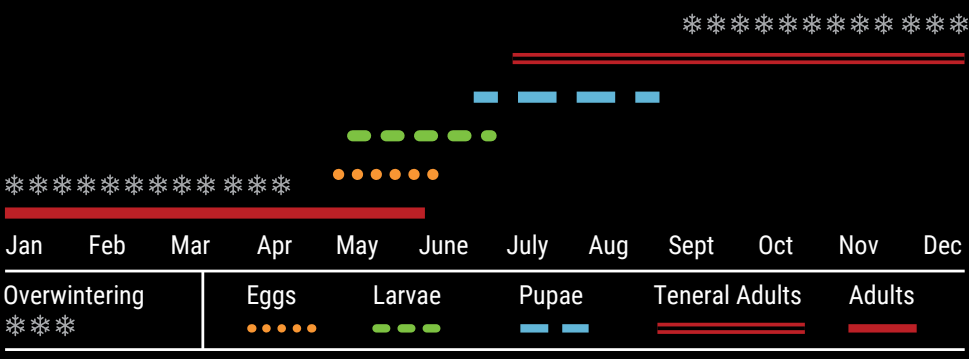
- Crop rotation with crops that are NOT: canola, mustard, alfalfa, peas, flax, potatoes
- Control of weed hosts
- Early swathing
- Fall cultivation
- Do not kill nearby infested weed hosts while the crop is vulnerable to feeding, as larvae will move to crop

CHEMICAL

- Several available products
- Apply in early evening when larvae begin moving to the top of crop canopy

CEREAL LEAF BEETLE

OULEMA MELANOPUS



Identification

ADULTS

- 6-8mm long beetle
- Metallic dark blue wings and head
- Reddish legs and thorax (insect bodies have three segments; the thorax is the middle section and in the cereal leaf beetle may be mistaken for the head)

MATURE LARVAE

- 4-5mm long
- Hump-backed yellow body covered in slimy faecal material

Feeding Damage

ADULTS

- Feed on cereal leaf tissue between cereal leaf veins, causing a striped effect
- Rarely causes economic injury

LARVAE

- Feed on upper tissue of leaves, causing long, windowpane-like patches of damage
- Yield quality and quantity are decreased if flag leaf is stripped

Scouting Tips

Economic Threshold Calculation

Small grains:

- Just before boot stage, examine 10-20 plants at five sites following a "W" pattern
  - Begin from field margin
    - Calculate average number of larvae and eggs/plant for the crop

Economic Threshold

- **Pre-boot stage:** three or more eggs and larvae per plant
  - Includes all tillers present before flag leaf emergence
- **Boot stage:** one or more larvae per flag leaf

Management Options

BIOLOGICAL

Parasitoids such as:

Tetrastichus julis

- Check for this parasitoid's presence by dissecting mature cereal leaf beetle larvae and looking for the small yellowish parasite larvae

Predators such as:

- Lady beetles
- Damsel bugs
- Ground beetles

CULTURAL

- Optimize crop development (i.e. nutrition management) to reduce impact of larval feeding

CHEMICAL

- Apply registered products if necessary
- If *T. julis* is found, leave up to one unsprayed acre in one or two corners next to a shelterbelt and/or water body to let the parasitoid multiply

Photo credit: John Gavloski, Manitoba Agriculture and Resource Development

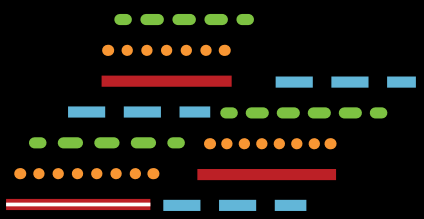
DIAMONDBACK MOTH

PLUTELLA XYLOSTELLA

Photo credit: John Gavloski, Manitoba Agriculture and Resource Development

Economic Threshold

- **Immature and flowering canola:** 100-150 larvae/m^2
- **Podded canola:** 200-300 larvae/m^2



Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Overwintering ❄❄❄			Eggs		Larvae		Pupae		Adults		Migrating Adults

Identification

ADULTS

- 12mm long moths, 18-20mm wingspan
- Slim body when wings are folded
- Forewings create diamond-shaped patterns along the back when the moth is at rest

MATURE LARVAE

- 8mm long caterpillars
- Green
- Narrow
- Wriggle backwards and drop on a silken thread when disturbed
- Two fork-like prongs on caterpillar's rear end

Feeding Damage

LARVAE

- Completely consume leaves except for veins
- "Shot holes" in leaves
- Frosted appearance on flowers, developing pods, and stems
- Feeding damage can reduce seed quality and yield

Scouting Tips

- Use pheromone traps to detect adult moths
- Consult provincial agricultural pest survey websites for early warnings
- Scout fields for larvae and crop damage in June through August

Economic Threshold Calculation

- In a vulnerable or infested crop, carefully pull up plants in a 0.1m^2, (about one foot square) and beat them against a smooth surface to dislodge larvae onto a beating tray or drop cloth
  - Count the larvae
  - Estimate the number of plants/m^2
  - Calculate the number of larvae/m^2
  - Repeat in 5-10 places

Management Options

BIOLOGICAL

Parasitoids such as:

- *Diadegma insulare*
- *Diadromus subtilicornis*
- *Microplitis plutellae*
- *Cotesia* spp.
- *Trichogramma praetiosum*

Predators include:

- Damsel bugs
- Green lacewing

CULTURAL

- Control weed hosts and volunteer canola

CHEMICAL

- Apply registered products if necessary; consult provincial recommendations for products and timing
- Diamondback moth does not overwinter in Canada; it blows up from the US annually, so there is no value in controlling pest populations this year to reduce next year's pressure

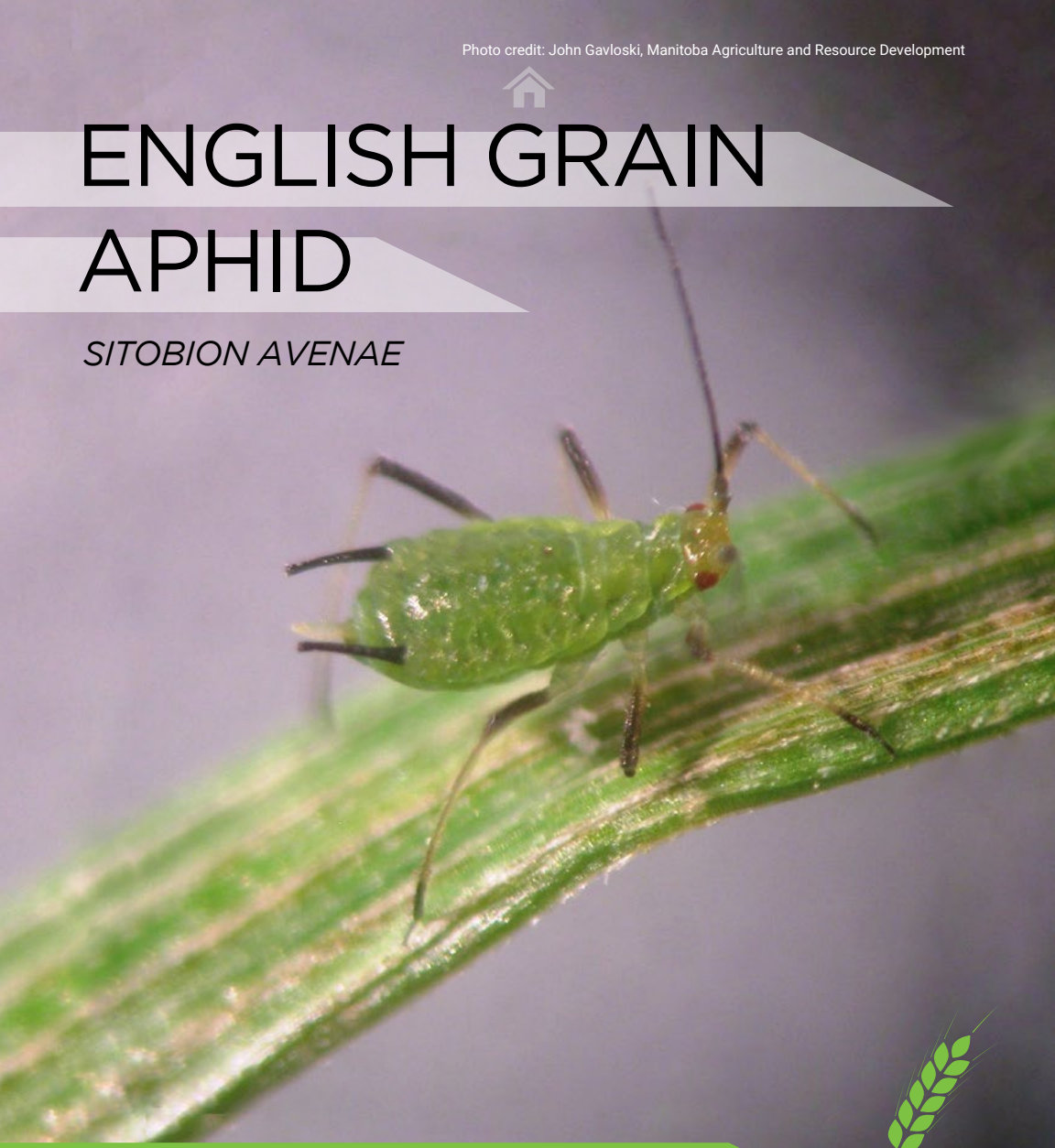


Photo credit: John Gavloski, Manitoba Agriculture and Resource Development

ENGLISH GRAIN APHID

SITOBION AVENAE

Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Overwintering ❄❄❄			Nymphs		Adults		Migrating Adults				

Identification

ADULTS

- 1.5-2mm long
- Bright green to yellow-green to reddish-brown
- Black bands on legs
- Two black tubes (called cornicles) protrude from the back of the abdomen
- Antennae are at least as long as the aphid's body

IMMATURES

- Similar to adults, but smaller

Feeding Damage

- Feed on heads of wheat, oats, barley, rye, timothy and canaryseed
- Can cause kernels to shrivel
- Aphid populations decrease quickly as heads mature

Scouting Tips

Economic Threshold Calculation

Small grains:

- Before soft dough stage, count number of aphids on 20 random tillers at five different sites located in a zig-zag pattern
- Calculate average number of aphids/tiller

Canaryseed:

- Bend the head and look closely for aphids hiding inside along the stem

Economic Threshold

SMALL GRAINS:

- **12-15 aphids/tiller before soft dough stage**

CANARYSEED:

- **10-20 aphids on 50% of stems before soft dough stage**

Management Options

BIOLOGICAL

Parasitoids such as:

- *Aphidius avenaphis*
- *Aphidius ervi*
- *Aphidius smithi*

Predators include:

- Lady beetles
- Green lacewing
- Hover fly larvae

CHEMICAL

- Chemical control for cereal aphids is **not economically justifiable after the soft (medium) dough stage**
- Apply products least toxic to natural enemies, if required

Photo credit: John Gavloski, Manitoba Agriculture and Resource Development

FLEA BEETLES

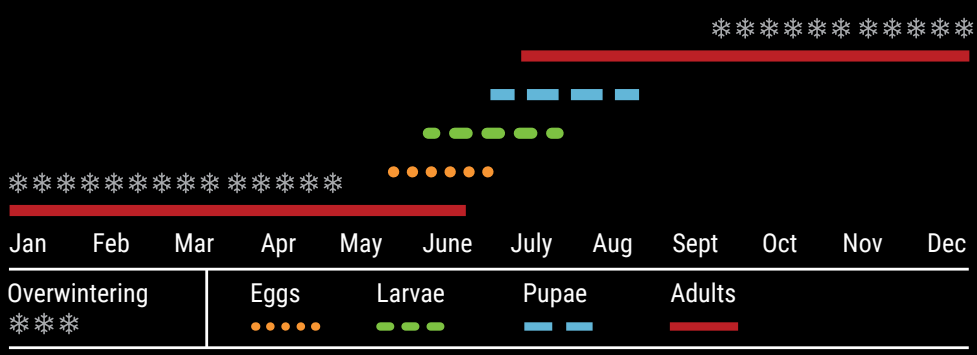
This section applies to two species of flea beetle:

- **Crucifer flea beetle (*Phyllotreta cruciferae*)**
- **Striped flea beetle (*Phyllotreta striolata*)**

Photo credit: Justin Pahara

Action Threshold

- 25% of the surface area of the cotyledons damaged, with adults present and continuing to feed
  - Use a lower threshold under hot, dry conditions. Slow seedling development will prolong the vulnerable stage of plants



Identification

ADULTS

- 2-3mm long beetle
- Oval
- (Crucifer flea beetle) shiny bluish black
- (Striped flea beetle) black with two wavy yellow lines along back
- Jumps like a flea when disturbed

MATURE LARVAE

- Found in soil
- <6mm long
- Whitish
- Slender body, brown head
- Three pairs of legs

Feeding Damage

ADULTS

- Shot-hole appearance in cotyledons and first true leaves
- Seedlings breaking or wilting
- Feed on bark of maturing pods in late summer, which causes premature ripening under high populations

LARVAE

- Feed on roots of host plants, but have minimal impact

Scouting Tips

Economic Threshold Calculation

- Start from field margins and estimate the area (%) of the cotyledons and first true leaves with shot-hole feeding damage
    - Look at several plants in each location
    - Repeat until 10-20 locations in the field have been visited
    - Estimate average amount of damage in the whole field
- Stop monitoring after third or fourth true leaves appear OR adult activity ceases
- Visual guides for estimating flea beetle damage in canola can be found online

Management Options

CULTURAL

- An upgraded seed treatment insecticide might be considered with your seed purchase if high flea beetle pressure is expected
- Optimize germination and vigorous growth
- Adjust seeding rates to reduce risk of damage
    - Target 5-8 established plants per square foot, using 1000KWT. Increase seeding rate under challenging establishment conditions
- Less damage is seen in zero-till vs. conventional tillage systems

CHEMICAL

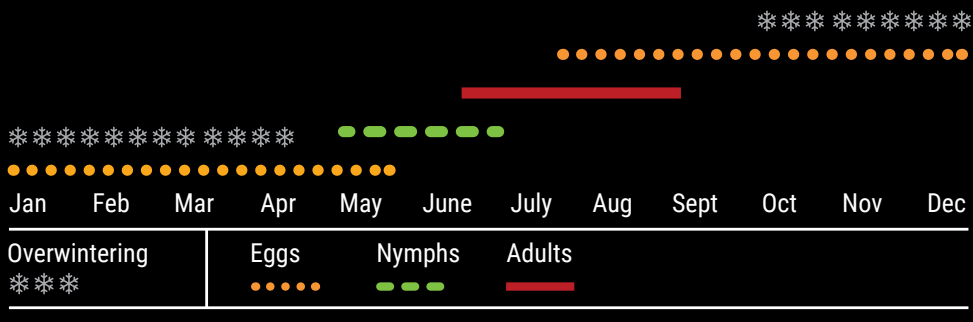
- Insecticide seed treatments
- Apply foliar treatments if seed treatments fail to protect young plants, especially if plant development is delayed

Photo credit: John Gavloski, Manitoba Agriculture and Resource Development

GRASSHOPPERS

This section applies to four grasshoppers species:

- **Clearwinged (*Camnula pellucida*)**
- **Migratory (*Melanoplus sanguinipes*)**
- **Packard (*Melanoplus packardii*)**
- **Twostriped (*Melanoplus bivittatus*)**



Identification

Clearwinged grasshopper:

ADULTS

- 21-32mm long
- Yellowish to brownish
- Forewings mottled with dark patches
- Two stripes beginning at the thorax and converging at wingtips

NYMPHS

- Newly hatched young are black with white band circling the thorax

Migratory grasshopper:

ADULTS

- 23-28mm long
- Brownish-greyish
- Small black stripe just behind the eye
- Hind legs have a series of black bands

NYMPHS

- Mottled greyish body
- Stripe across head

Packard grasshopper:

ADULTS

- 27-32mm long
- Grey-dark yellow
- Two light-coloured stripes extend from head to thorax
- Forewings uniformly grey, with no stripes
- Lower hind legs are blue-green

NYMPHS

- Young individuals are pale green to yellow-brown
- Speckled with small dark spots

IMPORTANT

Grasshopper control is more economical and effective before they become adults. However, there are many other grasshopper species that are not pests, but whose immature forms look very similar to those of pest species. **It is not necessary to control any grasshopper:**

- **Seen flying before June**
- **Where hindwings, seen when flying, have colour (red, yellow, orange or black)**
- **That make sounds either on the ground or in flight (e.g. singing, calls, clacks)**

See AAFC and Saskatchewan Pulse Growers' *Grasshopper Identification and Control Methods* publication for more information.

Twostriped grasshopper:

ADULTS

- 26-40mm long
- Brownish or greenish with black/brown markings
- Two pale stripes extending from behind the eyes to the tip of the wings
- Each hind leg has a solid black lengthwise stripe

NYMPHS

- Tan when newly hatched
- Brown/light green as they mature
- Two blurry stripes down the thorax

Feeding Damage

Migratory grasshopper:

- Feed on a wide range of cereal and broadleaf crops, including lentils
- Clip pods and heads to feed on green tissue as crops mature
- Prefer weedy grain fields, cultivated pastures, and hay fields

Clearwinged grasshopper:

- Prefer cereal grains and more succulent cultivated grasses
- Rarely feed on broadleaf plants

Packard grasshopper:

- Feed on broadleaf and grassy crops including pulses, cereals, alfalfa and grass
- Clip pods and heads to feed on green tissue as crops mature
- Prefer weedy grain fields, cultivated pastures, and hay fields

Twostriped grasshopper:

- Wide host range including broadleaf crops, cereals and grasses
- Prefers moist areas of lush vegetation

Scouting Tips

- Check field margins for grasshoppers moving in from roadsides and headlands
- Check around wet areas in dry seasons

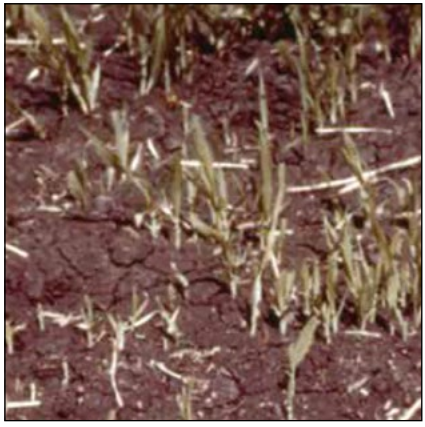
Economic Threshold

- **Thresholds are posted by crop on the Western Committee on Crop Pests website:**

westernforum.org/WCCP%20Guidelines.html

Economic Threshold Calculation

- Start from a corner of the field and work your way along a line to the field centre, then to one side
- Sample at least 20 sites along this transect
- Count the number of nymphs that jump in a $1m^2$ area as you approach each site (e.g. every 100 steps)
- Divide the total number of grasshoppers counted by the number of sites sampled to obtain the number/m^2



Insect damage
Photo credit: AAFC

Management Options

BIOLOGICAL

Predators include:

- Ground beetles
- Bee flies (some species)
- Tachinid flies
- Robber flies
- Spiders
- Blister beetles (some species)

Parasitoids include:

- Flesh flies
- Muscoid flies

CULTURAL

- Earlier seeding
- Tillage
- Trap strips
- Consult provincial agriculture websites for more specific information

CHEMICAL

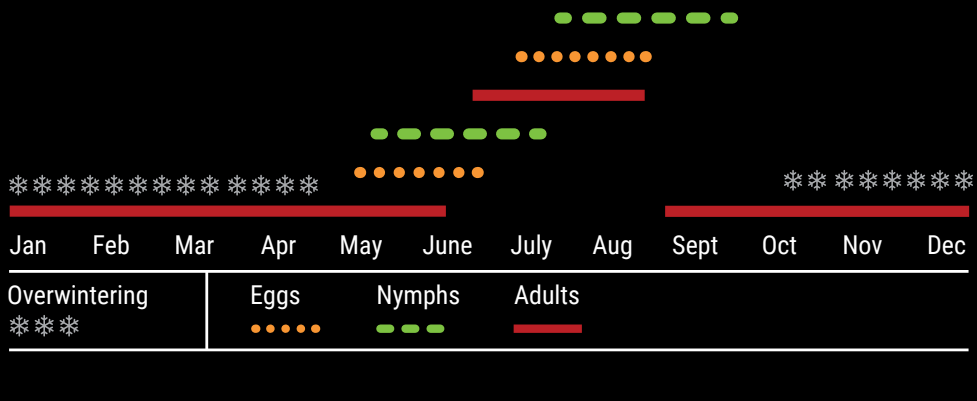
- Sprays and baits available
- Treat only if warranted by damage and numbers
- Target nymphs to use the lowest recommended rates
- Grasshoppers present as adults before June are not a threat to field crops
- Insecticides are much less effective when grasshoppers reach adult stage

Clearwinged grasshopper – egg, nymph, adult
Photo credit: AAFC

Packard grasshopper – egg, nymph, adult
Photo credit: AAFC

LYGUS BUGS

This section applies to many lygus bugs.



Identification

ADULTS

- 6mm long bugs
- Pale green to reddish brown to black
- Uniform to mottled colour
- Distinctive V-shaped marking in upper centre of their backs

MATURE NYMPHS

- Green, and wings not fully developed
- Five black dots in a pentagon on back

Feeding Damage

- Canola buds turn white or fail to develop
- Flowers fall without forming pods
- Pods fall without maturing
- Seeds will collapse, shrink and darken
  - Lose their quality and viability
- Additional loss may occur if flowering delayed by heavy feeding pressure or drought

Scouting Tips

- Use standard 38cm diameter sweep net in canola, alfalfa, lentils and faba beans. Examine buds and heads in sunflowers
- Sample crops in a consistent way to compare to economic thresholds

Economic Threshold

CANOLA

- Consult economic threshold charts on provincial government websites
  - Threshold varies with canola price, crop stage, and chemical costs
- Sprays are not recommended once seeds have ripened to yellow or brown

SEED ALFALFA

When alfalfa in is bud or bloom:

- 8 lygus bugs/sweep (40 in 5 sweeps) OR
- 4 alfalfa plant bugs/sweep (20 in 5 sweeps) OR
- 5 nymphs of any species/sweep (25 in 5 sweeps)

Lygus bug – damage
Photo Credit: Mike Dolinski, MikeDolinski@hotmail.com

Canola:

- Sample at the end of flowering and at early pod ripening when temperature is 15°C+
- Consult the sequential sampling chart from the Alberta, Saskatchewan and Manitoba government and the Canola Council of Canada websites

Scouting technique:

Take ten 180° sweeps at four or more sample locations

- Four sets of 10 sweeps in two paired locations can give a reasonable population estimate
- One sweep set of 10 at the field border, another 50m or more within the field
- The 3rd and 4th set is repeated 500m from the first paired sample location
- Count the number of lygus at 3rd nymphal stage or older
- Additional sampling locations may be necessary if counts are highly variable within the field
- Calculate the average number of lygus bugs per sweep

Seed alfalfa:

- Sample crops beginning at the bud stage

Scouting technique:

Take five 180° sweeps at each sampling site

- Count the total number of lygus bugs caught at each site
- Also count the total number of alfalfa plant bugs caught

Lygus lineolaris, first instar nymph
Photo credit: Tharshi Nagalingam, University of Manitoba.

Lygus lineolaris, second instar nymph
Photo credit: Tharshi Nagalingam, University of Manitoba.

Lygus lineolaris, fifth instar nymph
Photo credit: Tharshi Nagalingam, University of Manitoba.

- Calculate the average number of both lygus bugs and alfalfa plant bugs per sweep
- Repeat until you have sampled in 15 locations

Management Options

BIOLOGICAL

Parasitoids including:

- *Peristinus pallipes*
- *Peristinus digoneutis*

Predators including:

- Green lacewing
- Damsel bugs
- Spiders

CHEMICAL

- Apply insecticide one time at the end of flowering (90%+ bloom complete) or at early pod stage
- Insecticides applied against lygus bugs should also control alfalfa plant bugs

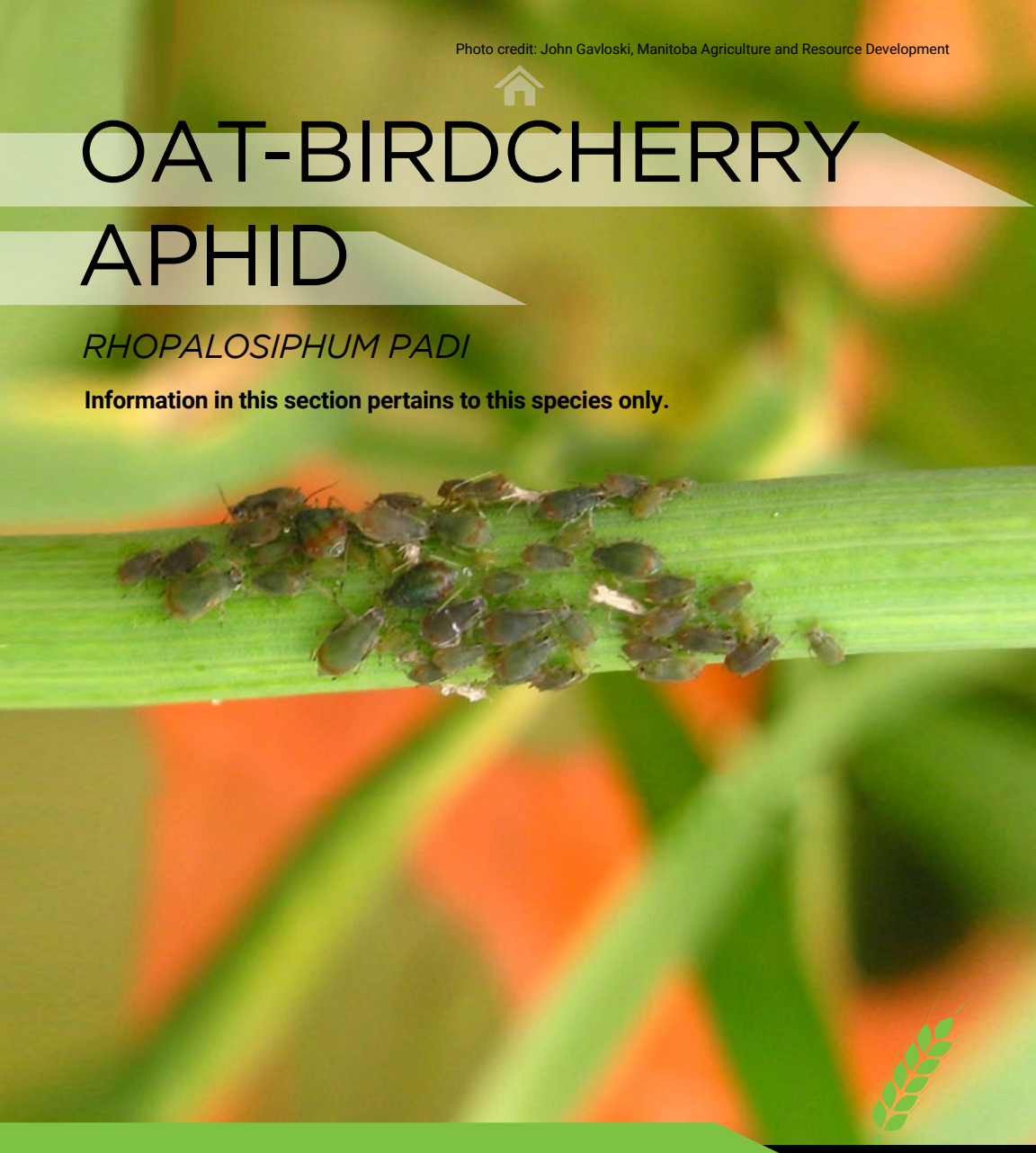
Lygus bug – adult
Photo credit: Whitney Cranshaw, Colorado State University, Bugwood.org

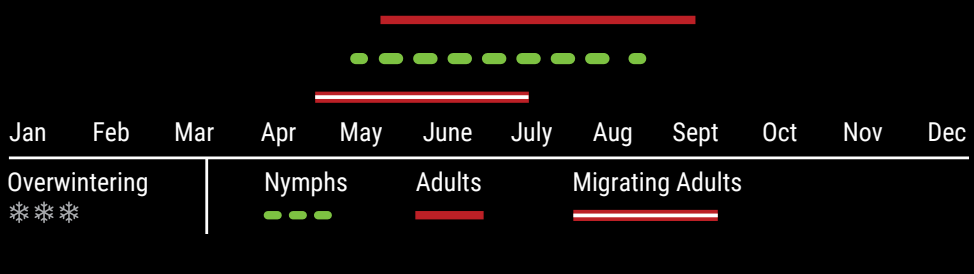
Photo credit: John Gavloski, Manitoba Agriculture and Resource Development

OAT-BIRDCHERRY APHID

RHOPALOSIPHUM PADI

Information in this section pertains to this species only.





Identification

ADULTS

- 2mm long
- Olive-green with small orange patch on rear
- Two black tubes (called cornicles) protrude from the back of the abdomen

IMMATURES

- Similar to adults, but smaller and pale yellow-green

Feeding Damage

- Heavy infestations reduce grain quality, affect protein content and test weight
- Twist the flag leaf into a corkscrew shape that traps awns, resulting in "fish-hooked" heads
- Vector of barley yellow dwarf virus, which can stunt barley and oat growth
- Spring wheat more susceptible than winter wheat

Scouting Tips

Economic Threshold Calculation

Small grains:

- Before soft dough stage, count number of aphids on 20 random tillers at five different sites located in a zig-zag pattern
- Calculate average number of aphids/tiller

Canaryseed:

- Bend the head and look closely for aphids hiding inside along the stem

Economic Threshold

SMALL GRAINS:

- 12-15 aphids/tiller before soft dough stage

CANARYSEED:

- 10-20 aphids on 50% of stems before soft dough stage

Management Options

BIOLOGICAL

Parasitoids such as:

- *Aphidius colemani*
- *Aphidius smithi*

Predators such as:

- Green lacewing
- Lady beetles
- Hover flies
- Minute pirate bugs

CHEMICAL

- Apply products least toxic to natural enemies, if required

Photo credit: Frank Peairs, Colorado State University, Bugwood.org

PALE WESTERN CUTWORM

AGROTIS ORTHOGONIA

For more information about cutworms, see AAFC's publication *Cutworm Pests of Crops on the Canadian Prairies*. The PDF is freely accessible on the AAFC website.

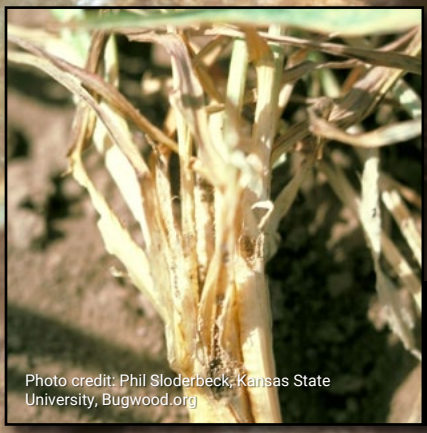
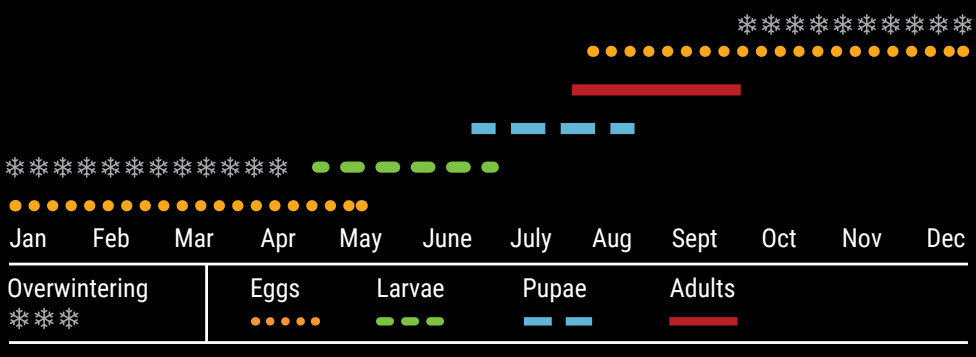


Photo credit: Phil Sloderbeck, Kansas State University, Bugwood.org

Economic Threshold

- 3-4 larvae/m^2



Identification

ADULTS

- 19mm long moth, 38mm wingspan
- Light grey forewings with vague markings

MATURE LARVAE

- <40mm long caterpillar
- Pale grey-greenish grey without distinguishable markings
- Fleshy
- Yellow-brown head

Feeding Damage

LARVAE

- Young larvae feed on leaves, creating holes
- Mature larvae cut off leaves and sever plants just below soil level

Scouting Tips

Monitoring

In areas where cutworm damage to crops is noticed, use a trowel or shovel to carefully search through top two to three centimeters of soil for cutworm larvae

- In dry soil larvae may be as deep as 8 to 10cm

Economic Threshold Calculation

Check germinating cereal crops for thinned or bare areas, especially sandy ridges and knolls

- At 10+ sites along edges of the affected area, mark off a 0.1m^2 area and look for larvae in:
  - The top 2-3cm of soil
  - Calculate the average number of larvae per m^2

Management Options

BIOLOGICAL

Parasitoids such as:

- Tachinid flies
- Bee flies
- Chalcididae (parasitic wasps)

Predators such as:

- Ground beetles
- Rove beetles
- Stiletto flies
- Ants

CULTURAL

- Egg-laying females are less attracted to weed-free, uncultivated fields from August to mid-September
- If volunteer cereals show signs of feeding damage, cultivate the soil and keep it black for 10 days before seeding to starve young cutworm larvae
  - Remember to always consider tillage with other agronomic factors such as soil moisture depletion and soil erosion

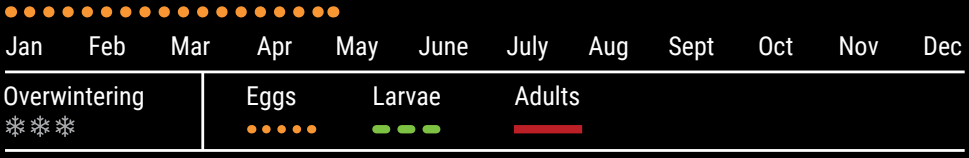
CHEMICAL

- Apply in late evening when larvae begin feeding, and only in infested areas
- Spray infested fields before reseeding

Photo credit: Tyler Wist, AAFC

PEA APHID

ACYRTHOSIPHON PISUM



Identification

- 3-4 mm long insect
- Light to dark green, sometimes red
- Pear-shaped with long legs
- May have transparent wings
- Usually found in clusters

Feeding Damage

- Yellow leaves and wilting
- Stunted overall plant growth
- On peas – feeding in the flowering and early pod stage can result in:
  - Reduced seed formation
  - Smaller seed size
  - Lower yields
- On alfalfa – feeding on stem and newly expanding leaves can result in:
  - Lower hay production
  - Higher likelihood of winter kill and lower hay quality

Scouting Tips

- Beginning when 50-75% of the pea plants are in flower, take five 180° sweeps in five locations
- Calculate the average number of aphids per sweep

or

- Check five 8-inch (20cm) long segments of plant tips along four well-spaced (50m/150 feet) stops in the field
- Calculate the average number of aphids/plant tip

Economic Threshold

PEAS:

- **Consult provincial government website for recommended thresholds, found by inputting "pea aphid economic threshold [your province name]" into a search engine**
  - **Varies with crop value and cost of treatment**

SEED ALFALFA:

- **Alberta:** 100 to 200 aphids/90° sweep
- **Saskatchewan and Manitoba:** 100 to 200 aphids/180° sweep when dryland crop is moisture-stressed, or until mid-August

Management Options

BIOLOGICAL

- Aphid parasitoids (*Aphidius* spp.)

Predators including:

- Damsel bugs
- Green lacewing
- Hover flies
- Lady beetles
- Minute pirate bugs

CULTURAL

- Seeding early in the spring

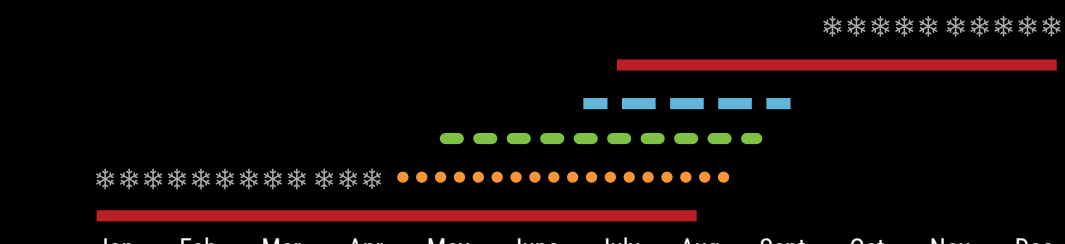
CHEMICAL

- **Peas:** a single application of insecticide when 50% of plants have produced some young pods **(if the economic threshold is exceeded)**

Photo credit: Jonathon Williams, AAFC-Saskatoon

PEA LEAF WEEVIL

SITONA LINEATUS



Identification

ADULTS

- 5mm long beetle with blunt, short snout
- Greyish brown
- Slender
- 3 light-coloured stripes running the length of the body

MATURE LARVAE

- In the soil
- 3.5-5.5mm long grub
- C-shaped
- Legless
- Brown head capsule

Feeding Damage

ADULTS

- Notched leaf margins and growing points
- Non-economic damage, not an issue after 5th node stage

LARVAE

- Feed on the nitrogen-fixing nodules on the roots
- Cause poor plant growth and low seed yields

Scouting Tips

- Up to 5th node stage

Economic Threshold Calculation

- Examine clam leaf of 10 plants for notches at five sites along the field edge and five sites at least 100m into the field

Economic Threshold

- 30% of seedlings with leaf notching on the clam leaf during 2nd to 5th node stage
  - Crop is not as susceptible after 5th node stage, or it is too late to attempt control

Management Options

BIOLOGICAL

Predators such as:

- Ground beetles
- Rove beetles

CULTURAL

- Trap crops of winter peas around field margins attract dispersing adults, that can be sprayed if necessary
- Seed crops as early as possible
- Inoculate and fertilize: mature and vigorous plants withstand weevil attacks better
  - Crops grown with sufficient nitrogen are at less risk of yield loss

CHEMICAL

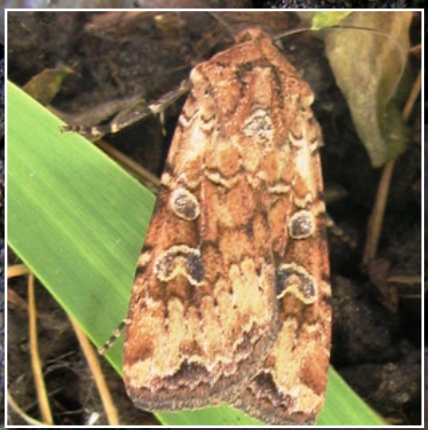
- Use seed treatments where pea leaf weevils are a constant threat
- Apply recommended foliar sprays against adults as required
- Keep monitoring when the crop is young, as weevils may re-invade fields after foliar insecticides are applied and gradually disperse into host crops

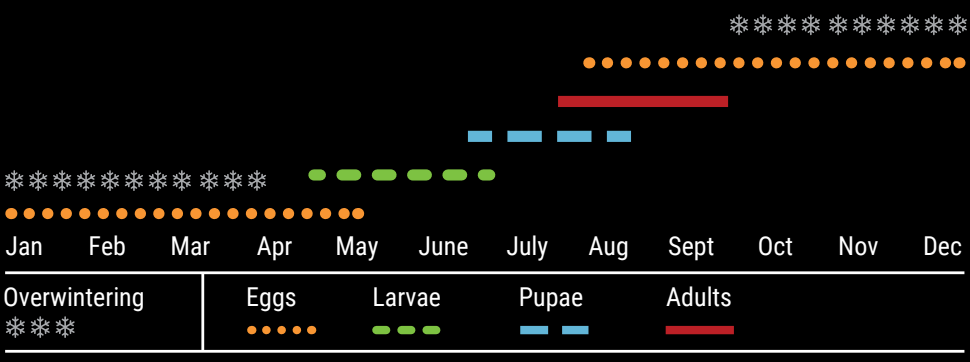
Photo credit: John Gavloski, Manitoba Agriculture and Resource Development

REDBACKED CUTWORM

EUXOA OCHROGASTER

For more information about cutworms, see AAFC's publication *Cutworm Pests of Crops on the Canadian Prairies*. The PDF is freely accessible on the AAFC website.





Identification

ADULTS

- Moth with 40mm wingspan
- Forewing colour is fawn to brick-red

MATURE LARVAE

- 38mm long caterpillars
- Fleshy
- Two broad reddish-brown stripes divided by a dark line

Feeding Damage

LARVAE

- Young larvae feed on leaves, creating holes
- Mature larvae cut off leaves and sever plants just below soil level

Scouting Tips

Monitoring

In areas where cutworm damage to crops is noticed, use a trowel or shovel to carefully search through top two to three centimeters of soil for cutworm larvae

- In dry soil larvae may be as deep as 8 to 10cm

Economic Threshold Calculation

Check germinating cereal crops for thinned or bare areas, especially sandy ridges and knolls

- At 10+ sites along edges of the affected area, mark off a 0.1m^2 area and look for larvae in:
  - The top 5-7cm of soil
- Calculate the average number of larvae per m^2

Economic Threshold

- 5-6 larvae/m^2

Management Options

BIOLOGICAL

Parasitoids such as:

- Tachinid flies
- Bee flies
- Chalcididae (parasitic wasps)

Predators such as:

- Ground beetles
- Rove beetles
- Stiletto flies
- Ants

CULTURAL

- Egg-laying females are less attracted to weed-free, uncultivated fields from late July to the end of September

CHEMICAL

- Apply in late evening when larvae begin feeding, and only in infested areas
- Spray infested fields before reseeding

Redback cutworm pupae
Photo credit: John Gavloski, Manitoba Agriculture and Resource Development

WHEAT MIDGE

SITODIPLOSIS MOSELLANA

Identification

ADULTS

- 2-3mm long fly
- Orange body with large black eyes
- Relatively long legs and antennae

MATURE LARVAE

- In wheat heads or soil
- 2-3mm long maggots
- Young larvae translucent white, turning bright orange when mature

Wheat midge – larva
Mike Dolinski, MikeDolinski@hotmail.com

Feeding Damage

LARVAE

- Aborted, shriveled, misshapen, cracked or scarred kernels that lower grain yield, quality and grade
  - Larvae feed on surface of developing wheat kernels
  - Symptoms depend on factors such as number of larvae and stage of kernel development

Wheat midge – larva
Mike Dolinski, MikeDolinski@hotmail.com

Scouting Tips

PHEROMONE TRAPS/ STICKY TRAPS

- Per 64ha (160ac): set out three pheromone traps OR 10 yellow sticky traps
- Deploy 4-5 days before crop heading
- Count the total number of midge per 10 traps

Economic Threshold Calculation

HEAD COUNTS

- Inspect fields daily at dusk (wind <10kph, 15°C+) from the time wheat heads emerge from boot leaf until anthers are visible on the heads
  - Count wheat midge adults on 4-5 wheat heads
  - Repeat until 4-5 sites have been sampled
  - Consider also sampling 4-5 sites along crop margins where infestations can be higher due to migration from other fields
  - Calculate the average number of midge per sampled site

OTHER

- Degree day development model is available to help time field inspections
- Consult your provincial agriculture website or local offices for current midge forecast reports

Economic Threshold

HEAD COUNTS

- **For yield loss prevention: 1+ adults/4-5 heads**
- **For grade loss (No.1) prevention: 1+ adults/ 8-10 heads**

STICKY TRAPS

- **As low as 4 midge on 10 cards for high-value varieties**

Photo credit: AAFC-Beaverlodge-S. Dufton & A. Jorgensen

Management Options

BIOLOGICAL

Parasitoids such as:

- *Macroglenes penetrans*
- *Platygaster tuberosula*
- *Euxestonotus error* (southern BC only)

Predators such as:

- Ground beetles

CULTURAL

- Avoid continuous wheat cropping in the same fields
- Severely infested fields should be cropped with non-susceptible crops
- Higher seeding rates
- Earlier planting
- Wheat midge resistant variety blends are available
  - Visit **www.midgetolerantwheat.ca** for more information

CHEMICAL

- Consult product labels for correct dosage and timing
- Spraying after the crop has flowered is not recommended
  - Crop is no longer at risk, and important parasitoids are exposed to harmful residues

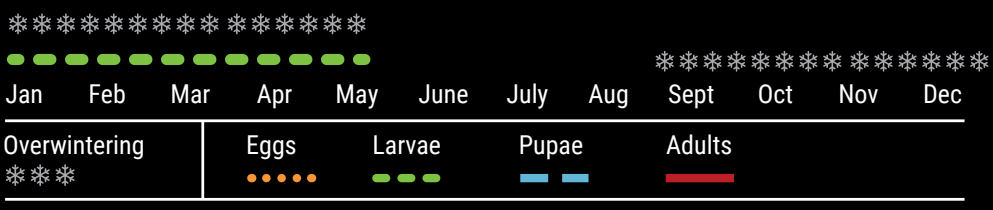
Photo credit: Alberta Agriculture and Rural Development

WHEAT STEM SAWFLY

CEPHUS CINCTUS

Economic Threshold

- 10-15% of crop in previous year cut by sawfly



Identification

ADULTS

- 8-13mm long, wasp-like
- Shiny black with three yellow bands around the abdomen
- Yellow legs

MATURE LARVAE

- Inside wheat and barley stems: curl into S-shape when removed
- 13mm long, worm-like
- Slender, whitish with brown head

Feeding Damage

MATURE LARVAE

- Feed on pith inside host plant stems
  - Can reduce crop yield and quality
- Cut "v" notch in stem just above ground level
  - Cut plants may break and fall, becoming unharvestable

Scouting Tips

- Infestation usually greater around crop margins
- In late June/early July: use a sweep net to sample for adults
- Early swathing can prevent cutting but shortens the growing season. To determine swathing need: Estimate proportion of stems containing larvae
  - Split 50-100 stems at each of 10 locations in the field and along the edge, look for larvae in stems
  - Search for parasitoid presence (another larva attached to sawfly larva)
  - More parasitoids reduces the need to swath
  - No economic threshold available for swathing, up to farmer judgement

Economic Threshold Calculation

- To determine if management is needed next year, count proportion of stems cut by sawfly in 1m row of crop
  - Repeat in 5-10 spots along crop margin

Management Options

BIOLOGICAL

Nine parasitic wasps, including:

- *Bracon cephi*
- *Bracon lissogaster*

CULTURAL

- Do not plant successive wheat or other host crops (e.g. barley)
- Rotate with solid-stemmed wheat varieties
- Earlier swathing can reduce losses
- Shallow tillage in fall can increase larval mortality (in situations where there is little risk of soil erosion)
- Do not seed at rates greater than 300 seeds/m^2
- Apply 30-60kg N/ha
- Use harvest cutting heights of at least 15cm to preserve overwintering beneficial insect parasitoids in the stem

CHEMICAL

- None

FIELD HEROES

THINK BENEFICIALS BEFORE YOU SPRAY

POWERED BY: WGRF