

Maximizing the Value of Beneficial Insects on the Farm: Predators and Parasitoids

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If we look hard, we can find many different insects in most fields or habitats, but this is not necessarily a bad thing. The majority of insects that are observed in most fields are either beneficial or benign. Insects can be beneficial on farms as pollinators, eating other insects, eating weeds and weed seeds, assisting in decomposition, and improving the soil. It is a relatively small proportion of insects that can cause damage to crops. Many insects prey on crop feeding insects, while others are parasitic and feed on other insects from within. At times it may be necessary to manage crop damaging insects, but ideally it is best to do this using methods that do as little harm as possible to all the beneficial insects that are performing valuable roles on your farm. This is the basis behind the concept of integrated pest management. In this factsheet we will look at some of the most common insects that prey on or parasitize crop feeding insects, and ways we can preserve them when pest management is needed.

Predaceous Beetles

There are many species of beetles in Manitoba that prey on other insects. Some of the most important of these in regulating populations of insects that feed on crops are lady beetles, ground beetles, and rove beetles.

Lady beetles (Family: Coccinellidae)

There are 66 species of lady beetles in Manitoba.

This group of insects is sometimes known as ladybugs, although entomologists prefer the term lady beetles, as these insects are not classified as true bugs.



Larva (a), pupa (b) and adult (c) of the seven-spotted lady beetle (*Coccinella septempunctata*).

Identification. Although most can recognize adult lady beetles, many do not recognize the larvae. Larvae are alligator-like in general shape and black with white, yellow, red or orange markings.

What they eat: Aphids. If aphids are scarce they may feed on the eggs of moths and beetles.

They may also feed on thrips, mites and other small insects, and some species may additionally feed on pollen and nectar.

How much they eat: A study in Manitoba on lady beetles feeding on different species of aphids on cereal crops found that the number of aphids consumed depended on the species of lady beetle and the species of

aphid being consumed. Adults of the thirteenspotted lady beetle, one of the more common species in Manitoba, each consumed between 110 and 160 aphids on average in 24 hours, depending on the species of aphid they were feeding on.¹ Studies from Ontario measuring soybean aphid consumption by lady beetles found that at high soybean aphid densities adult females of the sevenspotted lady beetle ate about 115 aphids in 24 hours, adult males ate about 80 in 24 hours, and third instar larvae ate about 105 in 24 hours.²

How they find their prey: Research in Iowa found that soybean plants containing soybean aphids released methyl salicylate, which was highly attractive to the sevenspotted lady beetle.³

Ground Beetles (Family: Carabidae)

861 species in Canada. About 40,000 species worldwide.



Ground beetle adults



Larva of ground beetle

Identification tips. Head at eyes narrower than section behind head. Elytra (front wings) may have striations or pits. Run rapidly when disturbed.

What they eat: Larvae of cutworms and diamondback moth; Colorado potato beetle and root maggot eggs, larvae, and pupae; aphids. A species called *Lebia atriventris* has been observed feeding on larvae of sunflower beetles in Manitoba. A study in Saskatchewan found 14 species of ground beetles fed on larvae of wheat midge.⁴

How much: Larvae and adults of several species of ground beetles have been shown to eat many times their own weight in prey if given the opportunity. Most are nocturnal (active at night).

Other potential Benefits: Some species of ground beetles feed on weed seeds and could have some potential for biological weed control, particularly certain species of *Harpalus* and *Amara*.

Rove Beetles (Family: Staphylinidae)

875 species in Canada.



Identification tips: Adult rove beetles are slender. They have short wings; 3-6 segments of the abdomen may not be covered by the wings. They often run fast, sometimes with the tip of their abdomen bent upward.

What they eat: Most adults and larvae are predaceous on insects, and a few are parasitic. Some species eat root maggot eggs and larvae.

How much: *Aleochara* adults may consume up to 5 root maggot larvae per day – a pair may destroy 1200 eggs and 130 larvae, and parasitize several hundred pupae during their lifetime.

Predaceous Flies

There are many groups of flies that are predators of other insects. For some groups it is the larvae that are predaceous, while in other groups the adults may be predaceous.

Here we feature 2 groups of predaceous flies: hover flies and stiletto flies. Other predaceous species of flies include bee flies (Bombyliidae), robber flies (Asilidae) and long-legged flies (Dolichopodidae).

Hover Flies (Family: Syrphidae)

About 500 species in Canada.



Hover fly larva



Hover fly adult

Identification tips: As adults, many species of hover flies resemble bees, but only have 1 pair of wings. Abdomen usually has black and yellow stripes. Adults often hover over flowers.

Larvae are often green or brown and tapered towards the head.

What they eat: Larvae eat aphids and small caterpillars.

How much: A single larva may consume up to 400 aphids during development, depending on species of hover fly and aphid. Adults feed on pollen and nectar and can be very effective as pollinators.

Larvae of stiletto flies (Family: Therevidae)

Larvae of this family of flies live in the soil or decaying materials and are voracious predators of earthworms and many insects, including wireworms. Do not confuse these with wireworms. Therevid larvae will thrash around a lot when disturbed, something wireworms will not do. Also notice the lack of legs on the larva of the stiletto fly; wireworms have 3 sets of small legs near the front.



Larva of stiletto fly



Adult of stiletto fly

True bugs (Suborder: Heteroptera)

There is a suborder of insects referred to as true bugs, where the basal part of the forewings are leathery, and the tips are membranous. Some types of true bugs prey only on other insects, some will feed on both other insects and plant sap, and some only on plant sap. Families of true bugs that feed primarily on other insects include minute pirate bugs, damsel bugs, assassin bugs, and ambush bugs. Although many species of stink bugs feed on plant sap, there are some species that are predaceous.

Minute Pirate Bugs (Family: Anthocoridae)

41 species in Canada.



Minute pirate bug adult

Identification tips: Adults are oval, black with white markings; 3-5mm. Nymphs orange to brown.

What they eat: Insect eggs, small caterpillars, thrips, mites, and aphids. Some species may be important predators of soybean aphids. May also feed on pollen and plant juices, enabling them to survive in the absence of prey.

Damsel Bugs (Family: Nabidae)

12 species in Canada.



Damsel bug

Identification tips: Long and slender. Enlarged front legs.

What they eat: Aphids, moth eggs, small caterpillars (including European corn borer and corn earworm), leafhoppers, mites, lygus bug nymphs. Damsel bugs can be important predators of diamondback moth. In a laboratory study an average of 131 eggs or 95 larvae of diamondback moth were killed by a single of female adult in 24 hours at 24 °C.⁵

Note- the toxin used by damsel bugs to subdue their prey will kill, even if the prey is not eaten.

Predatory Stink Bugs

(Pentatomidae: subfamily Asopinae)

Although many species of stink bugs feed on plant sap, there is a subfamily of stink bugs called Asopinae that are predaceous. Prey is primarily slow-moving soft-bodied insects, especially larvae. Some of these predatory stink bugs can be of importance agriculturally. For example, a species known as the spined soldier bug (*Podisus maculiventris*) is known to prey on larvae of diamondback moth, European corn borer, imported cabbageworm, and Colorado potato beetle. The twospotted stink bug (*Perillus bioculatus*) feeds on all stages of the Colorado potato beetle, and larvae of sunflower beetles.



Predacious stink bug (*Apateticus* sp.)



Predacious stink bug (*Perillus* sp.)

Green Lacewings

(Order Neuroptera, Family Chrysopidae)

About 25 species in Canada.



Adult of green lacewing



Lacewing larva eating Lygus bug

Identification: Adults are green, with wing veins that look like netting, and have gold eyes. Larvae are alligator-like in general shape (similar to lady beetle larvae), cream coloured with brown markings and sickle-shaped mandibles. Larvae have long bristles coming out from the sides. These bristles will collect debris and food remains, including the skins of aphids, that may provide camouflage.

What they eat: Aphids, thrips, and mites. They also eat eggs of many insects (including leafhoppers and Colorado potato beetle), small caterpillars and beetle larvae (including larvae of Colorado potato beetles). They will eat diamondback moth eggs, larvae and cocoons.

How Much: Developing lacewing larvae eat from 100 to 600 aphids.

Spiders

(Class: Arachnida; Order: Araneida)

Generalist predators. Prey ranges from mites and aphids to moths, flies, and beetles. There are at least 483 species of spiders in Manitoba. There are 767 recorded species of spiders in the Prairie Provinces. Forty-seven species of spiders were caught in a study of the diversity and abundance of spiders in a wheat field and its grassy borders in Saskatchewan.



Crab Spider (light yellow on flower) eating fly

Parasitoids of potential pest insects

Insects that parasitize and kill other insects are called parasitoids. In their immature stages these parasitoids live in or on the body of another insect (the host), but they are free-living as adults. Many of the parasitoids of insects in Manitoba are either wasps or flies. Parasitic wasps do have what looks like a stinger, but they use this to lay eggs in the insects that they are parasitizing, and not to sting people.

Parasitic wasps

Some of the more common groups of parasitic wasps include:

Ichneumonids (about 2,000 species in Canada),
Braconids (about 830 species in Canada), and
Pteromalidae (about 110 species in Canada).



Banchus flavescens



Tetrastichus julis (top and left)



Cotesia emerging from armyworm



Pupal cases of *Cotesia*



Adult *Cotesia* from armyworm

Wasp Parasitoids Important in Managing Potential Crop Pests in Manitoba

Parasitoids	Major crop feeding Insect host or prey
<i>Banchus flavescens</i> (Ichneumonidae)	Bertha armyworm
<i>Diadegma insulare</i> (Ichneumonidae)	Diamondback moth
<i>Glypta prognatha</i> (Ichneumonidae)	Banded sunflower moth
<i>Microplitis plutellae</i> (Braconidae)	Diamondback moth
<i>Cotesia</i> sp. (Braconidae)	Cutworms, armyworms
<i>Macroglenes penetrans</i> (Pteromalidae)	Wheat midge
<i>Tetrastichus julis</i> (Eulophidae)	Cereal leaf beetle
<i>Pediobius eubius</i> (Eulophidae)	Hessian fly
<i>Platygaster hiemalis</i> (Platygasteridae)	Hessian fly
<i>Aphidius ervi</i> (Aphidiidae)	Aphids
<i>Aphidius smithi</i> (Aphidiidae)	Aphids

Effectiveness:

- Parasitism of bertha armyworm by *Banchus flavescens* may exceed 40% in some years.⁶
- Over a 10 year period (1961-70) in Saskatchewan, 35 to 81% of first generation larvae of the diamondback moth were parasitized by *Diadegma insularis* and *Microplitis plutellae*, averaging 68%.⁷
- A study in Saskatchewan found that on average 33% of wheat midge populations were parasitized by *Macroglanes penetrans*.

Recent releases of *Tetrastichus julis* have been made in the Canadian prairies for the management of cereal leaf beetles.

Over 104,000 adult *Aphidius smithi* were released in Manitoba between 1983 and 1987 to help manage aphids.⁸

Parasitic flies**Fly Parasitoids Important in Managing Potential Crop Pests in Manitoba**

Parasitoid	Major crop feeding Insect host or prey
<i>Athrycia cinerea</i> (Tachinidae – Tachinid flies)	Bertha armyworm, etc.
<i>Villa</i> spp. (Bombyliidae – Bee flies)	Cutworms
<i>Blaesoxipha atlanis</i> (Sarcophagidae – Flesh flies)	Grasshoppers



Athrycia cinerea

Effectiveness: *Athrycia cineria* may kill over 20% of bertha armyworm.⁶

Conserving Predators and Parasites

There is economic value for farmers to having high populations of predators, parasitoids and pollinators in or near their fields. So if crop feeding insects do get to levels that may be economical, decisions and management strategies which preserve as many of these beneficial insects as possible may ultimately be the most economical strategy. While killing all insects in the field may solve a current problem, it can make the field quite vulnerable to crop feeding insects that may reenter the field, particularly those that can be moved in large numbers or can produce multiple generations in a year. It may also make crops in the area more susceptible in future years. The aim of the following tips is to help you maximize the value from beneficial insects in and around your fields, while still managing insects that get to levels where they are a potential threat to the crop.

- 1) Use **economic thresholds** when these are available. Applying insecticides when crop feeding insects are not at high levels can cause more harm than good. If beneficial insect populations are

- keeping crop feeding insects below economic levels, destroying the beneficial insects can potentially result in conditions allowing some crop feeding insects to reach pest levels.
- 2) **Selective insecticides:** If insect levels surpass the economic threshold and use of an insecticide is desired, use a selective insecticide if practical, which targets a specific group of insects and has little or no harm to natural enemies.
 - 3) **Selective application patterns:** Spray only patches, field edges or in strips where practical. Some insects, such as cutworms, may occur at high levels only in distinct patches, and whole fields may not need to be treated. Other insects may be more abundant at field edges.
 - 4) **Insect-resistant crops.** Crops that have some resistance or tolerance to crop feeding insects, such as midge tolerant wheat or *Bt* corn, can be used when populations of crop feeding insects are a high risk. These crops target specific crop feeding insects, and will have little or no harm to natural enemies of insects.
 - 5) **Crop rotation** can prevent some insects that potentially can reach pest levels from achieving levels that cause economic damage.
 - 6) **Providing favorable habitat** for beneficial insects can help maintain consistent populations. Adult hover flies and parasitic wasps need pollen and nectar for longevity and reproductive success. A diversity of flowering plants, both in species diversity and when they flower, is good. For example, adults of some parasitic wasps will visit flowering plants in many families to obtain nectar and pollen. However, a considerable number of species with short mouth parts may be restricted to plants of a few or one family, such as unbelliferous plant that have exposed nectaries. Minimum or zero tillage may increase populations of some predaceous insects.

Summary

We have seen that there are many insects that can help regulate levels of crop feeding insects. Healthy populations of insects like lady beetles, ground beetles, lacewings, damsel bugs, and many parasitoids can often keep crop feeding insects at insignificant levels. There are things we can do to preserve and enhance the abundance of these beneficial insects. And with good management decisions and the proper environment, this free biocontrol can help maximize the value of your crop.

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