



A FIELD
GUIDE TO

Pests of the Acadian Forest

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The position of Provincial Entomologist in Nova Scotia was created in 1915. In recognition of the 100th anniversary, we dedicate this guide to the professional and amateur entomologists who have devoted lifetimes to the study of insects.



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Gratitude is extended to those who generously allowed the use of their photographs. A detailed list of photographic contributors can be found on page 146.

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Introduction



Each year Nova Scotia's forests are damaged by numerous pests (insects and diseases) and abiotic agents (e.g. wind, flooding, and fire). Forest pests can slow down tree growth and vigour. Some can eventually kill trees. Others can reduce the fibre quality and appearance. However, it should be noted that insects and diseases also play an essential role in forest ecology. They are a food source for wildlife and provide various ecological services including pollination (enabling the creation of new seeds) and decomposition and nutrient recycling (aiding in forest renewal).

This guide and the companion module 15 *Pests of the Acadian Forest* were designed to be practical reference tools, providing woodland owners, homeowners, forest workers, and naturalists with information

concerning some of the most common and widespread forest pests in the province including native, non-native, and invasive alien species. Alien species are any species of plant, animal or micro-organism that spread beyond their native range into new locations as a result of natural spread or human assisted activity. They include species that are native to one part of Canada that move to another region of the country, as well as those that come from outside the country. A species is invasive when it is both non-native to the ecosystem in which it is found and capable of causing harm to the environment, economy, or human health. This harm can be costly and sometimes irreversible. Under the federal Plant Protection Act, the Canadian Food Inspection Agency (CFIA) is responsible for preventing the introduction into Canada, spread within Canada, and spread from Canada, of non-native pests. Any pests in this guide that are currently under regulation by the CFIA are noted and questions regarding them should be directed toward the CFIA. For further information related to non-regulated forest pests, contact any regional office

of the Nova Scotia Department of Natural Resources (NSDNR) novascotia.ca/natr/staffdir/offices.asp or the NSDNR Forest Protection Division novascotia.ca/natr/forestprotection. For further information on the *Woodlot Management Home Study Program*, go to woodlot.novascotia.ca.

How to Use this Field Guide

This guide provides information about some of the more common forest pests that may be found in the woodlands of Nova Scotia. It by no means covers all pests that may be encountered.

The guide is divided into six main sections. The first five are based primarily on the feeding habits of the pest insects and where the damage occurs on the tree:

Bark and wood-boring insects

The first evidence that a tree may be infested with a wood-boring insect is the appearance of exit holes or traces of pitch and sawdust. This damage results during both the larval and adult stages of numerous wood wasp and beetle species. These insects feed beneath the bark and into the heartwood of the tree. The majority of wood-boring insects found in Nova Scotia are attracted to a tree with a weakened condition; they therefore contribute to the natural decomposition process of dead and dying trees. Other species attack healthy trees, often resulting in the death of the tree, or in some instances the introduction of pathogens or fungi.

Foliage feeding insects

Numerous insect groups feed on the needles and leaves of trees, including sawflies, beetles, and moths. While most pests consume portions or all of the foliage, others, called miners, feed within the thin layers of the needles or leaves. In the case of sawflies and moth pests, feeding damage is done while in the immature, larval stage. With some families of beetles, both larvae and adults are known to cause damage.

Gall making insects

Galls are the result of the chemical reaction within the tree when feeding occurs or eggs are laid by adult insects into growing tissues of the plant. This chemical reaction generally results in swellings on stems, needles or leaves, and shoots, providing a safe place for the larvae to develop. The resulting damage doesn't kill the tree but reduces vigour. Of particular concern with respect to Christmas trees and ornamentals, galls can greatly affect the tree's appearance.

Sap feeding insects

These insects, which include aphids and adelgids, cause damage in both their immature and adult stages of life. Feeding damage may be evident on the foliage, shoots, and trunks of trees. Damage may result in deformed foliage, swellings in stems and shoots, and the browning of leaves or

needles. In some instances, this feeding behaviour can result in the introduction of disease or fungi.

Terminal shoot, twig, and root feeding insects

Damage may result when the larvae of beetles, moths, or sawflies bore within twigs, roots, or new shoots. This type of feeding can kill current leaders and newly developed shoots of trees, resulting in a reduction in growth and damage to the general health of the tree. But it rarely results in tree mortality. However, damage to root collars and the roots themselves is generally more serious. It more often results in the death of the affected tree.

Invasive alien species (IAS) not currently in Nova Scotia

The sixth section of this guide describes invasive alien species that have not yet been detected in Nova Scotia but that have the potential to cause great damage to our forests if they were to arrive here. Forest stakeholders, whether landowners, home owners, or forest workers, should be aware and keep an eye out for these pests.

Insect Identification and Description

A short **identification key** is provided for both the hardwood and the softwood tree sections (see pages 8–12). Begin by determining the **type** of tree affected, either **hardwood** or **softwood**. Next, for the insect, find the general **feeding type** that best describes what damage is occurring. Within each feeding type, you will find short descriptions of more specific **damage** patterns, to help you narrow the search for the target pest. Within each of these descriptions, you will find a list of the **species** that are covered in the guide. To identify the pest, carefully read the information provided on each insect species.

In this field guide, you will find information on each of the more common pest species found in Nova Scotia. Each entry provides descriptions of both **LARVA** and **ADULT** insect stages, and in a few cases also of the **EGG**, **PUPA**, or, where applicable, **NYMPH** stages. Each entry provides a brief explanation of the **LIFE CYCLE** of the pest and the **DAMAGE** it causes; sometimes symptoms of infestation and control measures that may be available are included. In addition, a **GLOSSARY** and a **REFERENCE** section may be found at the end of the guide.

It is hoped that the field guide will enable you to identify the pest insect or the damage you have observed. However, if you are still unsure or wish to confirm the identification, you can take a sample to your local NSDNR office.



Softwood

SYMPTOM

GUIDE SECTION

PEST AND PAGE NUMBER

- ▶ Exit holes with evidence of pitch or sawdust

Bark and wood-boring insects

Brown Spruce Longhorn Beetle - **16**, Carpenter Ants - **18**, Metallic Wood-Boring Beetles - **20**, Spruce Beetle - **24**, Whitespotted Sawyer - **28**, Wood Wasps (Horntails) - **30**

- ▶ Mined needles
- ▶ Defoliated (chewed) needles
- ▶ Clusters of chewed needles and webbing

Foliage feeding insects

Larch Casebearer - **62**

Balsam Fir Sawfly - **38**, Eastern Blackheaded Budworm - **46**, Gypsy Moth - **56**, Hemlock Looper - **58**, Jack Pine Budworm - **60**, Larch Sawfly - **64**, Pale Winged Grey - **76**, Rusty Tussock Moth - **78**, Spruce Budworm - **82**, White Pine Sawfly - **86**, Whitemarked Tussock Moth - **88**

Spruce Webspinning Sawfly - **84**

- ▶ Twig and bud deformity
- ▶ Needle deformity

Gall making insects

Balsam Gall Midge - **94**

Spruce Gall Adelgids - **96**

- ▶ Twig deformity
- ▶ Needles yellowing and/or wilt of new shoots
- ▶ Needle deformity

Sap feeding insects

Balsam Woolly Adelgid - **104**

Aphids - **100**, Hemlock Woolly Adelgid - **108**

Balsam Twig Aphid - **102**

- ▶ Terminal shoot kill
- ▶ Chew marks around collar of seedlings
- ▶ Mining of bud

Terminal shoot, twig and root insects

Balsam Shootboring Sawfly - **114**

Seedling Debarking Weevil - **116**

White Pine Weevil - **118**



Hardwood

SYMPTOM

GUIDE SECTION

PEST AND PAGE NUMBER

- ▶ Exit holes with evidence of pitch or sawdust

Bark and wood-boring insects

Asian Longhorned Beetle - **122**, Carpenter Ants - **18**, Metallic Wood-Boring Beetles - **20**, Bronze Birch Borer - **14**, Native Elm Bark Beetle - **22**, Emerald Ash Borer - **124**, Sugar Maple Borer - **26**, Wood Wasps (Horntails) - **30**

- ▶ Skeletonized leaves
 - ▶ Leaves rolled or folded with silk
- ▶ Defoliated (chewed) leaves
- ▶ Leaves enclosed in tent-like structure
 - ▶ Mined leaves

Foliage feeding insects

Alder Flea Beetle - **34**, Willow Flea Weevil - **90**

Leafrollers and Leaf tiers - **66**, Maple Trumpet Skeletonizer - **68**, Oak Leafshredder - **74**

Alder Woolly Sawfly - **36**, Dusky Birch Sawfly - **44**, Emerald Ash Borer - **124**, Fall Cankerworm - **50**, Forest Tent Caterpillar - **54**, Mountain Ash Sawfly - **70**, Northern Pinkstriped Oakworm - **72**, Satin Moth - **80**, Gypsy Moth - **56**, Rusty Tussock Moth - **78**, Whitemarked Tussock Moth - **88**

Eastern Tent Caterpillar - **48**, Fall Webworm - **52**

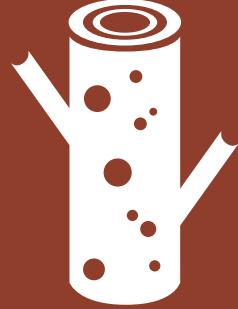
Beech Leaf Mining Weevil - **40**, Birch Leaf Mining Sawfly - **42**

- ▶ Leaves yellowing and/or wilt of new shoots
- ▶ Severe bark deformity

Sap feeding insects

Aphids - **100**, Woolly Alder Aphid - **110**

Beech Scale - **106**



bark and wood- boring INSECTS



Bronze Birch Borer

Bronze birch borer adult



Agrilus anxius Gory

HOST

- Birches

DESCRIPTION

Mature larva

- 35 mm; whitish yellow with a broad flattened head and tiny dark mouthparts

Adult beetle

- 6–13 mm; slender, flattened body, olive to copper-brown in colour

Bronze birch borer larva and galleries



Bronze birch borer pupa



DAMAGE

- Larval feeding under the bark results in stem die-back and eventual tree mortality, depending on infestation severity
- Symptoms include D-shaped exit holes, increased wood-pecker activity, and die back of stems and branches

Dieback associated with bronze birch borer damage



CONTROL

- Naturally occurring parasites, predators and diseases
- No chemical control available; cut down and remove infested and suspect trees

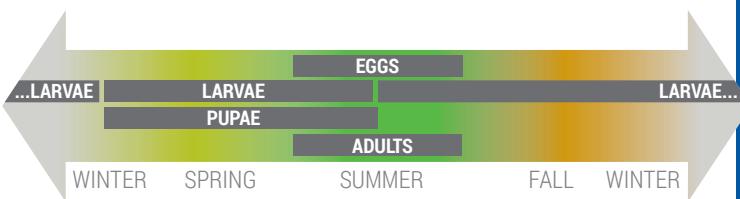
LIFE CYCLE: 2-year

Eggs: early summer to late summer

Larvae: midsummer to fall (feeds); fall to early spring (overwinters); resumes feeding in spring to fall; overwinters for a second season

Pupae: early spring to midsummer

Adults: early summer to late summer





Brown Spruce Longhorn Beetle

Brown spruce longhorn beetle adult



Tetropium fuscum (Fabricius)

⚠ INVASIVE ALIEN SPECIES

BACKGROUND

- First discovered in Halifax in 1999 but considered established since at least 1990
- Native to northern and central Europe
- Believed to have arrived in wood packaging aboard a container ship

HOST

- Spruces

DESCRIPTION

Mature larva

- 14–28 mm, yellow-white, with a widened reddish-brown head; body slightly flattened

Brown spruce longhorn beetle larva



Resinosis resulting from brown spruce longhorn beetle attack



Adult beetle

- 8–17 mm; head and neck are dark brown to black; wing covers tan, brown, or reddish brown, with 2 or 3 faint longitudinal stripes

Brown spruce longhorn beetle damage



DAMAGE

- Larvae feed under the bark and into sapwood, eventually girdling the tree; this weakens the tree, leading to tree mortality
- Symptoms include excessive resin down the length of the stem (sap weeping), 4 mm oval exit holes

CONTROL

- Naturally occurring parasites, predators and diseases
- Cut down and remove infested or suspect trees to slow the spread of this pest

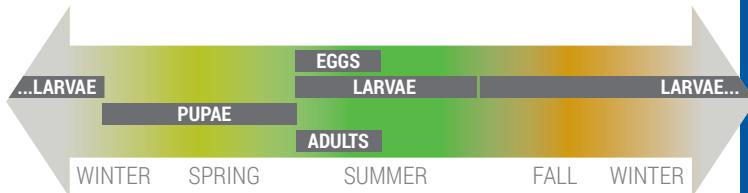
LIFE CYCLE

Eggs: early summer to midsummer

Larvae: early summer to fall (feeds), fall to early spring (overwinters)

Pupae: early spring to early summer

Adults: early to mid summer



NOTE

- This forest pest is regulated by the Canadian Food Inspection Agency (CFIA) under the federal Plant Protection Act, in order to prevent introduction and spread

For more information on the regulations, please contact a local CFIA office or visit the CFIA website.



Carpenter Ants

Carpenter ant adult



Camponotus spp.

HOST

- Weakened, dying, or dead trees and timbers in structures; these ants prefer decayed wood for nesting sites

DESCRIPTION

Adult ant

- 6–12 mm; queens up to 20 mm; size and colour can vary among species; from uniform dark brown and black to reddish brown

Winged carpenter ant



Carpenter ant larvae



DAMAGE

- Carpenter ants do not eat wood, but workers excavate wood for colony space, causing extensive damage to trunks and stems of trees, as well as to lumber within structures
- Symptoms include large round exit holes, increased woodpecker activity, excess sawdust around base of standing tree

Carpenter ant damage



CONTROL

- Apply registered insecticide according to label instructions to eliminate the ants once the colony is located

LIFE CYCLE

- They live in groups or colonies consisting of hundreds of worker ants, a few reproductive males and females, and at least 1 queen
- Winged males and females swarm from the colony and mate in spring. Soon after mating, females shed their wings and the males die
- Fertilized queens find a suitable nesting site and begin new colonies by laying eggs which will become adult workers
- It takes 3–6 years to establish a large and stable colony. After 2 or more years, the queen begins to produce winged males and females who will leave to begin new colonies



Metallic Wood-Boring Beetles

Metallic
wood-
boring
beetle
adult



FAMILY: Buprestidae

Many Species

HOST

- Various trees and shrubs

DESCRIPTION

Mature larva

- 7–30 mm; whitish yellow with a broad flattened head and tiny dark mouthparts

Adult beetle

- 10–30 mm; oval or “bullet shaped” body, iridescent or metallic looking underneath and sometimes on top

Metallic wood-boring beetle
mature larva



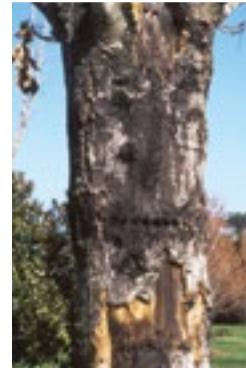
Metallic wood-boring beetle adult



DAMAGE

- Adult beetle feeds on leaves
- Larva feeding under the bark results in stem die-back and eventual tree mortality if infestation severe enough
- Boring holes can become entrance points of harmful and often lethal fungi
- Symptoms include D-shaped exit holes, increased wood-pecker activity

Metallic wood-boring beetle and sap sucker damage on sugar maple



CONTROL

- Naturally occurring parasites, predators and diseases
- Cut down and remove infested and suspect trees

TYPICAL LIFE CYCLE

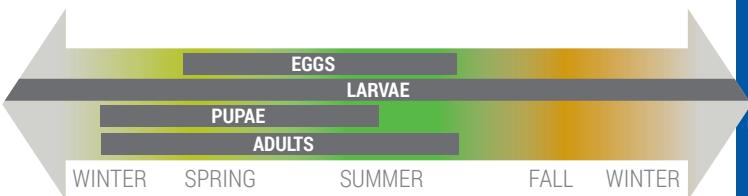
1–2 year cycle depending on species

Eggs: mid-spring to midsummer

Larvae: spring to fall (feeds), fall to spring (overwinters); can grow for 1–2 years before pupating

Pupae: early spring to midsummer

Adults: early spring to late summer





Native Elm Bark Beetle

Native elm bark beetle side view of the adult (length: 2.5 mm)



Hylurgopinus rufipes (Eichhoff)

HOST

- Elms

DESCRIPTION

Mature larva

- 3–5 mm; C-shaped, legless grubs, white with a brown head

Adult beetle

- 2–3.5 mm; dark brown to black; rough body surface with short, stiff, yellow hairs

Native elm bark beetle maternal tunnels and larval tunnels on an elm trunk



Native elm bark beetle adult in its v-shaped tunnel



DAMAGE

- Both adults and larvae feed under the bark of weakened branches
- Adults carry the fungal spores of Dutch elm disease on their bodies

Brown vascular staining caused by a fungus carried by the native elm bark beetle



CONTROL

- To reduce populations, remove and destroy infested trees and weakened branches before the adults emerge

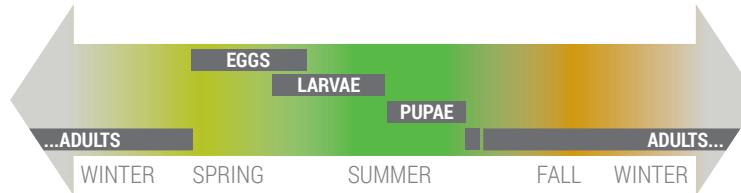
LIFE CYCLE

Eggs: mid-spring to early summer

Larvae: late spring to midsummer

Pupae: midsummer to late summer

Adults: late summer to fall (feeds); fall to mid-spring (overwinters)





Spruce Beetle

Spruce beetle adult



Dendroctonus rufipennis (Kirby)

HOST

- Spruces; prefers white spruce

DESCRIPTION

Mature larva

- 4–7 mm; white grub with a small black head

Adult beetle

- 4–6 mm; black or dark brown head with reddish wing coverings

Pitch tubes on spruce, a result of spruce beetle attack



Spruce beetle larvae



DAMAGE

- Adults and larvae feed under the bark, girdling the tree; a heavily infested tree can die within 2–3 years of attack
- Symptoms include numerous exit holes, yellowing and reddening of foliage, increased woodpecker activity, and blobs of dried sap or pitch (pitch tubes) on trunk of the tree

Spruce beetle damage - severely affected spruce



CONTROL

- Naturally occurring parasites, predators and diseases
- Cut down and remove dead or infested trees

LIFE CYCLE

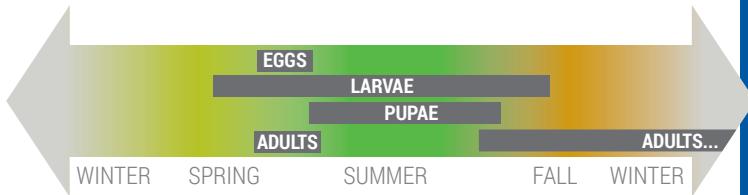
Adults: emerge late spring to early summer

Eggs: late spring to early summer

Larvae: early summer to mid-fall (feeds), overwinter under bark, resume feeding late spring/early summer of following year

Pupae: early summer to early fall

Adults: second generation adults emerge in the fall and overwinter at the base of trees





Sugar Maple Borer

Sugar maple borer adult



Glycobius speciosus (Say)

HOST

- Maples

DESCRIPTION

Mature larva

- 50 mm; robust, beige with brownish mouthparts

Adult beetle

- 20–25 mm; black body marked with bright yellow bands on the back, of varying widths and shaped somewhat like a "W"

Sugar maple borer adults



Appearance of a sugar maple crown, five years after attack by sugar maple borer



DAMAGE

- Holes chewed through the bark by beetle; usually on the lower 6 metres of the trunk
- Dead branches; if many galleries, tree may die
- Dead, cracked or swollen bark; bark may break off and expose the larva feeding galleries

Sugar maple borer damage on live standing tree



CONTROL

- Remove overmature, low-vigour, and heavily infested sugar maples; burn infested trees
- Promote stand vigour through sound sugar maple management
- Maintain well-stocked stands

LIFE CYCLE

Eggs: mid to late summer

Larvae: midsummer to fall (feeds), fall to spring (overwinters), summer to fall (feeds), fall to spring (overwinters)

Pupae: mid- to late spring

Adults: early to late summer





Whitespotted Sawyer

Adult white spotted sawyer



Monochamus s. scutellatus (Say)

HOST

- Dead and dying softwood trees; prefers white pine

DESCRIPTION

Mature larva

- 35–50 mm; whitish, with a dark reddish-brown head and sharp mouthparts; somewhat flattened

Adult beetle

- 13–27 mm; black, with small white dots on wing covers

Whitespotted sawyer adult seeking tender bark on a young stem of eastern white pine



Whitespotted sawyer larva—longitudinal cut through a larval tunnel



DAMAGE

- Adults feed on bark on the underside of twigs, causing the tips to die and turn red
- Otherwise, the beetle is usually considered a secondary pest, attacking the trunks of weakened, dying or dead trees
- Symptoms include large exit holes, small piles of sawdust may be present near the base of trees where larvae have been tunneling, as well as actual chewing noises coming from the wood

Dead foliage of balsam fir after whitespotted sawyer adult attack on the twig



CONTROL

- Naturally occurring parasites, predators and diseases
- Cut down and remove dead and dying trees

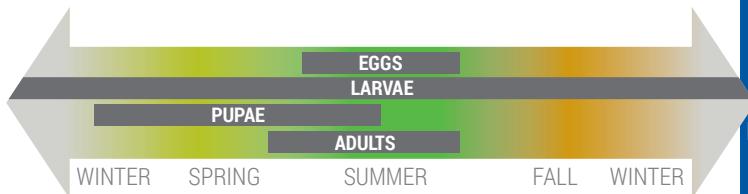
LIFE CYCLE: 2-year

Eggs: early summer to late summer

Larvae: early summer to fall (feeds), fall to spring (overwinters), spring to fall (feeds), fall to spring (overwinters for second season)

Pupae: spring to midsummer

Adults: late spring to late summer





Wood Wasps (Horntails)

Sirex
wood
wasp
(*Sirex
noctilio*)
adult



FAMILY: Siricidae

Many Species

HOST

- Various hardwood and softwood trees and shrubs; these insects prefer unhealthy or dying trees

DESCRIPTION

Mature larva

- Up to 40 mm; large white grub with sharp spine at tail end

Adult

- Up to 50 mm, with large sharp spine (a.k.a ovipositor) at the tip of female abdomen; variable colours depending on species-black, metallic blue, to yellow and black

Adult wood wasp



Wood wasp pupa



DAMAGE

- Larval feeding under bark and into sapwood may result in stem die-back and tree mortality
- Boring holes can become entrance points of harmful and often lethal fungi
- Symptoms include large round exit holes, increased woodpecker activity

Wood wasp damage
– exit holes



CONTROL

- Naturally occurring parasites, predators and diseases
- No chemical control available; cut down and remove infested and suspect trees

TYPICAL LIFE CYCLE

Eggs: throughout summer

Larvae: early summer to fall (feeds) fall to spring (overwinters); can remain in larval stage for 1–3 years before developing into pupae

Pupae: mid-spring to midsummer

Adults: late spring to late summer





foliage feeding

INSECTS



Alder Flea Beetle

Alder flea beetle adult



Macrohaltica ambiens (LeConte)

HOST

- Primarily alder; rarely willow and poplar

DESCRIPTION

Mature larva

- 8 mm; back is brown to black, underside is yellow

Adult beetle

- 5 mm; metallic greenish blue

Alder flea beetle larvae



Alder flea beetle adult



DAMAGE

- Adults chew holes in the leaves
- Larvae feed in groups and skeletonize the leaves
- Their feeding is most evident in mid- to late summer
- Trees may experience reduced growth but mortality is rare

Alder flea beetle damage – skeletonized leaf due to feeding



CONTROL

- Damage caused by this insect does not require insecticide use

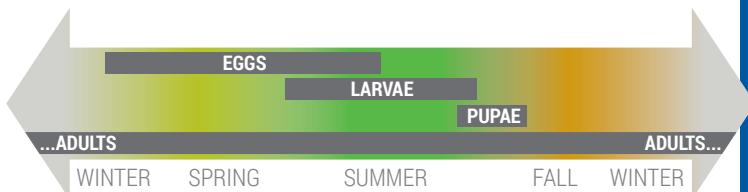
LIFE CYCLE

Eggs: early spring to midsummer

Larvae: summer

Pupae: late summer to fall

Adults: overwinter in duff at the base of plants late summer to mid-spring; emerge following mid-spring to early summer (feeds)



Alder Woolly Sawfly

Alder
woolly
sawfly
larva



Eriocampa ovata (Linnaeus)

⚠ NON-NATIVE SPECIES

HOST

- Alders

DESCRIPTION

Mature larva

- 13–16 mm; pale green body with a white, waxy, hair-like covering

Adult sawfly

- 6–7 mm in length; black body with a red pronotum

Alder woolly sawfly larva



Alder woolly sawfly larva



DAMAGE

- Numerous small holes appear in the leaves as the small larvae feed, giving the leaf a "shotgun" appearance
- Older larvae consume the whole leaf except the main veins
- Damage may result in growth loss and possibly branch dieback

Alder woolly sawfly damage



CONTROL

- Damage caused by this insect does not require insecticide use
- Hand-pick larvae from the leaves or spray with a strong jet of water; repeat as necessary

LIFE CYCLE

Eggs: early summer to midsummer

Larvae: summer

Pupae: midsummer to late spring (overwinters)

Adults: late spring to midsummer





Balsam Fir Sawfly



Balsam
fir sawfly
larva

Neodiprion abietis (Harris)

HOST

- Prefers balsam fir and occasionally on white and black spruce

DESCRIPTION

Mature larva

- 20 mm; green body with dark stripes down the back; head black

Cocoon

- Encloses pupa; 6–9 mm; oval-shaped, dark-tan coloured

Adult sawfly

- Resembles a small wasp; females are brown, males are black; 6–8 mm and 4–5 mm, respectively

Balsam fir sawfly female (left) and male (right) adults near their respective cocoons



Balsam fir sawfly egg niches



DAMAGE

- Larvae feed on needles; causes reduced vigour and growth and occasionally tree mortality

Balsam fir sawfly defoliated balsam fir twig: 1) current year's foliage is intact; 2) 1-year-old needles are chewed and reddened; and 3) 2-year-old needles have disappeared



CONTROL

- Naturally occurring parasites, predators and diseases
- Apply registered insecticides according to label instructions

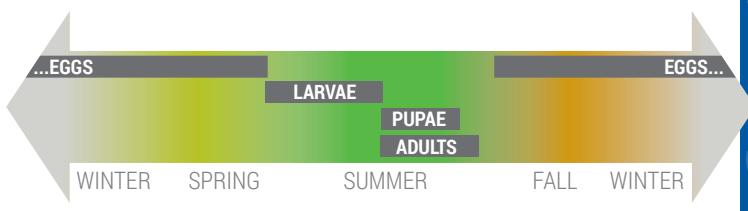
LIFE CYCLE

Eggs: early fall to late spring (overwinters)

Larvae: late spring to midsummer

Pupae: mid to late summer

Adults: midsummer to fall





Beech Leaf Mining Weevil

Beech leaf mining weevil adult



Orchestes fagi (Linnaeus)

⚠ INVASIVE ALIEN SPECIES

BACKGROUND

- In 2011, reports of diseased or distressed-looking beech trees near Halifax and on Cape Breton Island
- Believed to have been here since 2006
- Native to Europe

HOST

- Beech

DESCRIPTION

Mature larva

- 5 mm; shiny white with a black head

Beech leaf mining weevil larva



Beech leaf mining weevil damage



Adult weevil

- 2–3 mm; black beetle with short golden hair; large back legs; jumps like a flea when foliage is disturbed

Beech leaf mining weevil damage



DAMAGE

- Adults feed on newly expanding beech leaves in spring, peppering them with small holes, sometimes damaging the midrib
- Larvae feed within the leaf, creating a narrow mine from the midrib to the edge of the leaf, ending in a small brown blotch

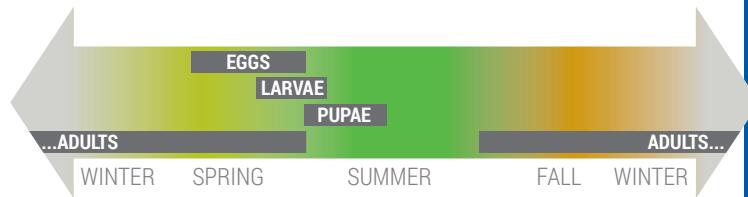
LIFE CYCLE

Eggs: mid-spring to early summer (oviposit within beech leaf tissue in May-June)

Larvae: late spring to early summer

Pupae: early to midsummer

Adults: fall to early spring (overwinters); early spring to early summer (feeds)



NOTE

- This forest pest is regulated by the Canadian Food Inspection Agency (CFIA) under the federal Plant Protection Act, in order to prevent introduction and spread.

For more information on the regulations, please contact a local CFIA office or visit the CFIA website.



Birch Leaf Mining Sawfly

Birch leaf mining sawfly (*Heterarthrus nemoratus*) adult



Heterarthrus nemoratus (Fallén)
or *Fenusia pusilla* (Lepeletier)

⚠ NON-NATIVE SPECIES

HOST

- Birches

DESCRIPTION

Mature larva

- 6–8 mm; somewhat flattened, whitish

Adult sawfly

- Resembles a small wasp; 3–5 mm long; black or black and yellow body

Birch leaf mining sawfly (*Heterarthrus nemoratus*) adult



Birch leaf mining sawfly (*Heterarthrus nemoratus*) larva



DAMAGE

- Larvae mine throughout the leaf
- Mined areas first appear as small brown patches on the edge of the leaf; patches increase in size and merge together

Birch leaf mining sawfly (*Heterarthrus nemoratus*) damage by larva



CONTROL

- Control measures usually unwarranted; a healthy tree can withstand many years of light to moderate attack

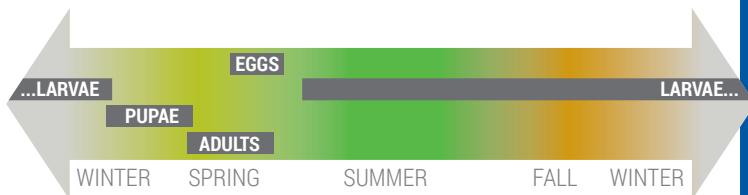
LIFE CYCLE

Eggs: late spring

Larvae: early summer to midsummer (feeds), midsummer to early spring (overwinters)

Pupae: early spring to mid-spring

Adults: mid-spring to late spring (late May and early June)



Dusky Birch Sawfly

Dusky birch sawfly adult



Croesus latitarsus Norton

HOST

- Birches

DESCRIPTION

Mature larva

- 24 mm; yellow-green, with black blotches on their sides and a black head

Adult sawfly

- Resembles a small wasp; 12 mm long; body dark in colour

Dusky birch sawfly cocoon



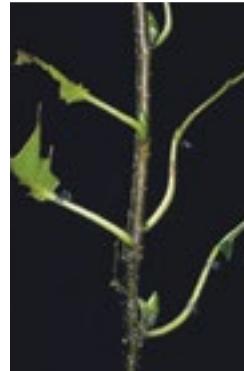
Dusky birch sawfly larvae



DAMAGE

- Larvae feed in groups on the edges of leaves until the entire leaf is consumed
- Small trees may be defoliated, but heavy defoliation is rare

Dusky birch sawfly damage



CONTROL

- Control of this pest is rarely necessary, except on young trees, which can be completely defoliated when heavily infested
- Remove and destroy small populations by hand
- Apply registered insecticides according to label instructions

LIFE CYCLE

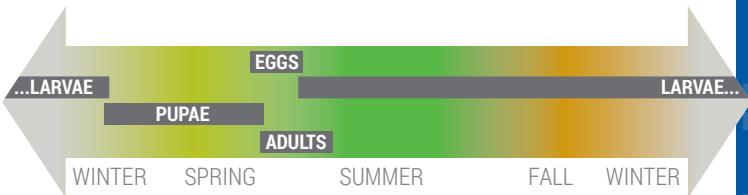
Eggs: late spring to early summer

Larvae: early summer to fall (feeds), fall to early spring (overwinters).

Note: the overwinter as larvae but within a cocoon

Pupae: early spring to late spring

Adults: late spring to early summer





Eastern Black-headed Budworm

Eastern black-headed budworm mature larva, on white spruce



Acleris variana (Fernald)

HOST

- Balsam fir, white and black spruce

DESCRIPTION

Mature larva

- 16 mm; green to yellowish green, with no distinct markings but a black head

Adult moth

- 15 mm; mottled grey and brown patterns on wings

Eastern blackheaded budworm adult



Eastern blackheaded budworm forewing patterns



DAMAGE

- Larvae feed on needles; cause reduced vigour and growth, and tree mortality

Eastern blackheaded budworm damage on balsam fir



CONTROL

- Naturally occurring parasites, predators and diseases
- Apply registered insecticides according to label instructions

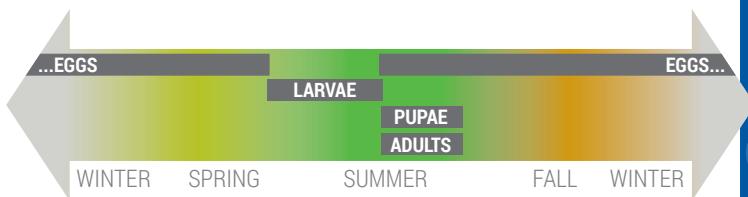
LIFE CYCLE

Eggs: midsummer to spring (overwinters)

Larvae: late spring to midsummer

Pupae: midsummer to late summer

Adults: midsummer to late summer



Eastern Tent Caterpillar

Eastern tent caterpillar larva



Malacosoma americanum (Fabricius)

HOST

- Numerous hardwood tree species

DESCRIPTION

Mature larva

- 40–50mm; hairy and black, with blue spots and brown and yellow lines down its back and sides

Adult moth

- 23–37 mm; reddish brown with 2 pale stripes running diagonally across each forewing

Egg mass

- covered with a shiny, black, varnish-like material; encircles branches that are about pencil-size or smaller in diameter; 150–400 eggs

Eastern tent caterpillar eggs



Eastern tent caterpillar adult



DAMAGE

- Caterpillars feed on deciduous trees, causing defoliation. They construct silken "tents" on 1 or more branches of a tree. Tents are often located in forks or crotches of branches and do not enclose leaves
- Healthy trees can generally tolerate occasional feeding by this insect. However, repeated infestation can weaken the tree making it more susceptible to damage from other insects and diseases

Eastern tent caterpillar tent



CONTROL

- Prune out and destroy the tents
- On larger branches or where pruning is impractical, cut the tent open and handpick the caterpillars
- Eggs can also be removed by scraping the egg mass with a knife
- Birds, rodents and beneficial garden insects such as ground beetles and predaceous wasps also help to keep caterpillar populations in check
- Apply registered insecticides according to label instructions, with enough force to penetrate the web nest

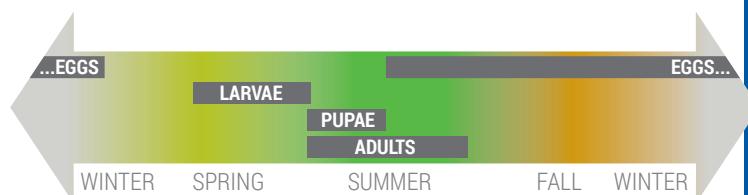
LIFE CYCLE

Eggs: midsummer to spring (overwinters)

Larvae: mid-spring to early summer

Pupae: early summer to midsummer

Adults: early to late summer





Fall Cankerworm

Fall
canker-
worm
larva



Alsophila pometaria (Harris)

HOST

- Numerous hardwood trees

DESCRIPTION

Mature larva

- 25 mm; vary between light green and dark brownish-green

Adult moth

- Males: 25–35 mm; brown glossy forewings crossed with irregular white bands Females: wingless 10–12 mm; brownish-grey

Fall cankerworm adult



Fall cankerworm larvae (dark form) on maple



DAMAGE

- Once larvae are mature, they consume the leaf entirely leaving only the midrib and major veins
- If heavy defoliation occurs several years in a row, the tree can die

Fall cankerworm damage



CONTROL

- Naturally occurring parasites, predators and diseases
- In the fall, apply sticky bands to trunks of host trees to capture females as they climb
- Apply registered insecticides according to label instructions, after bud break

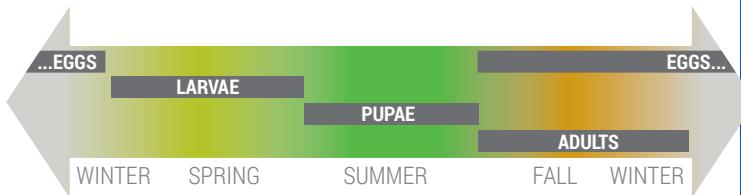
LIFE CYCLE

Eggs: fall to spring

Larvae: early spring to early summer

Pupae: early summer to fall

Adults: fall to early winter





Fall Webworm

Fall
webworm
larva



Hyphantria cunea (Drury)

HOST

- Numerous hardwood trees and shrubs; prefers alders

DESCRIPTION

Mature larva

- 25 mm; covered with long grey hairs and many black and orange spots

Adult moth

- 30–40 mm; white wings, often with black spots

Colony of fall webworm larvae in web



Fall webworm adult



DAMAGE

- Larvae skeletonize and consume leaves inside the protection of a tent-like web
- Damage generally has little effect on the vitality of the tree, because the loss of foliage occurs at the end of the season, when annual growth has ceased

Fall webworm damage



CONTROL

- Prune out and destroy the tents
- On larger branches or where pruning is impractical, cut the tent open and handpick the caterpillars
- Birds, rodents, and beneficial garden insects such as ground beetles and predaceous wasps also help to keep caterpillar populations in check
- Apply registered insecticides according to label instructions, with enough force to penetrate the web nest

LIFE CYCLE

Eggs: early summer to late summer

Larvae: midsummer to early fall

Pupae: fall to spring (overwinters)

Adults: early summer to late summer





Forest Tent Caterpillar

Forest tent caterpillar larva



Malacosoma disstria Hübner

HOST

- Numerous hardwood trees, prefers aspen

DESCRIPTION

Egg mass

- Covered with a shiny, black, varnish-like material; encircles branches that are about pencil-size or smaller in diameter; 150–400 eggs

Mature larva

- 20–30 mm; dark greenish-brown body with 2 rows of paired white dots on back

Adult moth

- 20 mm; grey-brown wings with silvery white patches

Forest tent caterpillar egg mass



Forest tent caterpillar adult



DAMAGE

- Larvae feed on leaves
- Masses of migrating mature larvae can cause widespread heavy defoliation

Forest tent caterpillar damage



CONTROL

- For ornamental trees, remove egg bands in the fall

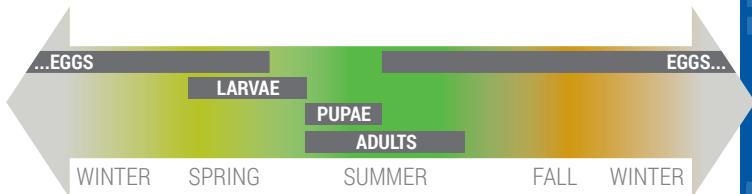
LIFE CYCLE

Eggs: midsummer to spring (overwinters)

Larvae: mid-spring to early summer

Pupae: early summer to midsummer

Adults: early to late summer





Gypsy Moth

Gypsy
moth
adult
female



Lymantria dispar (Linnaeus)

⚠ INVASIVE ALIEN SPECIES

HOST

- Numerous hardwood trees, occasionally softwoods

DESCRIPTION

Mature larva

- Up to 65 mm long, body is dark-coloured and hairy, with red and blue spots on the back

Adult moth

- Female: 55–70 mm; off-white colour with dark markings; fully formed wings but does not fly
- Male: 30–40 mm; brown in colour with black markings

Gypsy moth larva



Gypsy moth adult male



Egg mass

- Up to 30 mm; covered with tan-coloured hairs; found at the base of trees, underside of branches, under loose bark, crevices, under rocks or other debris on the ground

Gypsy moth damage on oak



DAMAGE

- Larvae feed on foliage; during severe outbreaks, trees and shrubs are completely defoliated over large areas

CONTROL

- Naturally occurring parasites, predators and diseases
- Remove egg masses in the fall to limit the population in the spring
- Apply registered insecticides according to label instructions

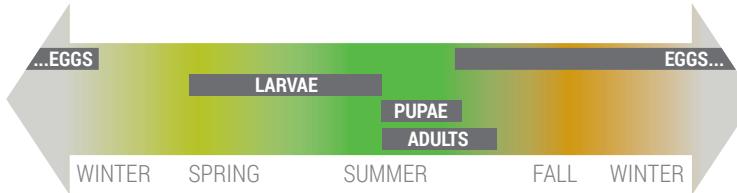
LIFE CYCLE

Eggs: late summer to spring (overwinters)

Larvae: mid-spring to midsummer

Pupae: mid to late summer

Adults: midsummer to early fall



NOTE

- This forest pest is regulated by the Canadian Food Inspection Agency (CFIA) under the federal Plant Protection Act, in order to prevent introduction and spread.

For more information on the regulations, please contact a local CFIA office or visit the CFIA website.



Hemlock Looper

Hemlock looper larva



Lambdina f. fiscellaria (Guenée)

HOST

- Balsam fir, Eastern hemlock, white and black spruce

DESCRIPTION

Mature larva

- 32 mm; cylindrical, shape, no bristles or hairs; grey to brown with dark markings

Adult moth

- 30–45 mm; beige to brownish grey moths; forewings crossed by 2 darker brown broken lines, hindwings by single line

Hemlock looper adult at rest



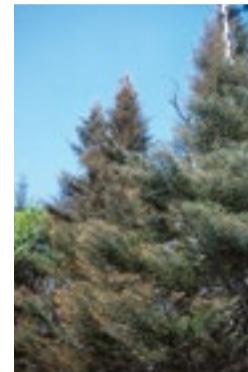
Hemlock looper dorsal and ventral views of pupa



DAMAGE

- Larvae feed on needles; during severe outbreaks, trees are completely defoliated over large areas

Hemlock looper damage - severely defoliated balsam firs



CONTROL

- Naturally occurring parasites, predators and diseases
- Harvest overmature trees
- Apply registered insecticides according to label instructions

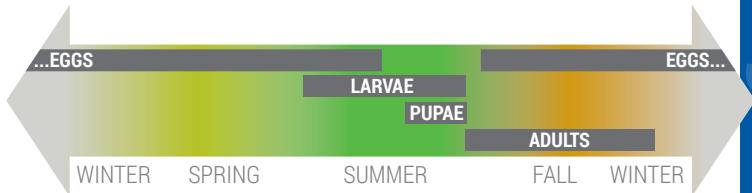
LIFE CYCLE

Eggs: fall to midsummer.
Overwinters in egg stage

Larvae: early to late summer

Pupae: late summer

Adults: late summer to late fall





Jack Pine Budworm

Jack pine budworm larva on male flower bearing jack pine shoot



Choristoneura p. pinus Freeman

HOST

- Pines; prefers white pine in Nova Scotia

DESCRIPTION

Mature larva

- 20–22 mm; shiny light brown to black head; reddish-brown body with yellow sides and white dots along back

Adult moth

- 15–24 mm; reddish-brown with silvery white patches

Jack pine budworm pupa in its natural position near its last larval molt



Jack pine budworm adult



DAMAGE

- Larva feeds on needles, causing defoliation, growth loss, top kill, and tree mortality

Jack pine budworm severe defoliation on jack pine tree

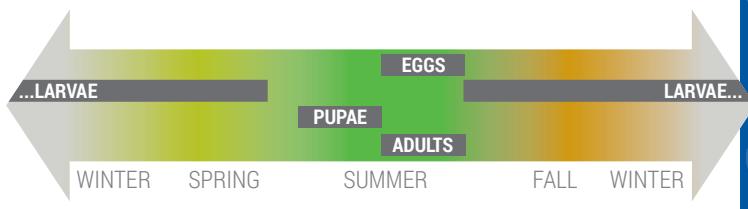


CONTROL

- Naturally occurring parasites, predators and diseases
- Apply registered insecticides according to label instructions

LIFE CYCLE

- Eggs:** midsummer to late summer
Larvae: late summer to mid-spring (overwinters); mid- to late spring (feeds)
Pupae: early summer
Adults: midsummer to late summer





Larch Casebearer

Larch
casebearer
larva
inside
of case



Coleophora laricella (Hübner)

⚠ NON-NATIVE SPECIES

HOST

- Larches
- Other common names: tamarack, hackmatack, juniper (not a true juniper)

DESCRIPTION

Mature larva

- 6 mm; light grey, remain inside their straw-coloured rectangular casings

Adult moth

- 9 mm; silvery-grey, narrow wings with fringe of long hairs

Larch casebearer cases fastened to twig after needle drop in fall



Larch casebearer first case as it appears in June



DAMAGE

- Larvae feed within their cases on the needles; most damage is caused in spring
- After severe defoliation, growth may be seriously reduced; tree mortality rare

Larch casebearer damage

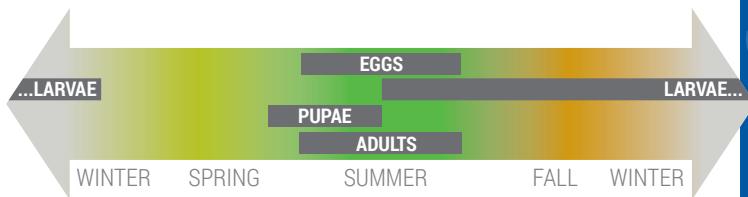


CONTROL

- Naturally occurring parasites, predators and diseases
- Apply registered insecticides according to label instructions

LIFE CYCLE

- Eggs:** early summer to late summer
Larvae: midsummer to fall (feeds), fall to spring (overwinters), spring (feeds)
Pupae: late spring to midsummer
Adults: early summer to late summer





Larch Sawfly

Larch
sawfly
mature
larvae



Pristiphora erichsonii (Hartig)

⚠ NON-NATIVE SPECIES

HOST

- Larches
- Other common names: tamarack, hackmatack, juniper (not a true juniper)

DESCRIPTION

Mature larva

- 16 mm; black heads, grey to green with white undersides

Adult sawfly

- Resembles a small wasp; 7–10 mm long; black body with an orange band around the abdomen

Larch sawfly damage – new larch shoot curled into a question mark following wounds inflicted by adult during egg laying



Larch sawfly adult female



DAMAGE

- Larvae feed on needles
- Repeated severe infestation over many years may result in growth reduction, tip dieback, branch mortality, and tree mortality

Larch sawfly damage - partially defoliated larch stand

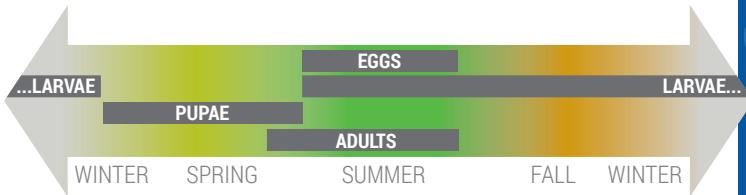


CONTROL

- Naturally occurring parasites, predators and diseases
- Apply registered insecticides according to label instructions

LIFE CYCLE

- Eggs:** early summer to midsummer
Larvae: early summer to early fall (feeds), early fall to spring (overwinters)
Pupae: early spring to early summer
Adults: late spring to late summer





Leafrollers and Leaftiers

Birch
leafroller
(*Epinotia solandriana*)
adult at rest



FAMILY: Tortricidae

Many Species

HOST

- Various hardwood trees

DESCRIPTION

- There are a variety of leafrollers and leaftiers, including the green aspen leafroller, dusky leafroller, fruittree leafroller, oak leaf tier, willow leaf tier, etc.

Mature larva

- 12–16 mm; exact sizes and colours vary with species; rolls, folds, or ties leaves together with silk to make a feeding shelter

Adult moth

- 16–21 mm; exact sizes and colours vary with species

Birch leafroller
(*Epinotia solandriana*) damage



Birch leafroller
(*Epinotia solandriana*) larva



DAMAGE

- Larvae feed on leaves; usually do not feed in groups
- Some larvae skeletonize; others consume large parts of the leaf

Leafroller damage –
larva wrapped up in leaf



CONTROL

- Local epidemics are usually of short duration and control measures are unwarranted
- Ornamental trees: larvae can be handpicked and destroyed

LIFE CYCLE

For examples of specific life cycles see the maple trumpet skeletonizer and the oak leafshredder



Maple Trumpet Skeletonizer

Maple trumpet skeletonizer damage



Epinotia aceriella (Clemens)

HOST

- Maples

DESCRIPTION

Mature larva

- 14 mm; light green with a yellowish head

Adult moth

- 15 mm; grey moth

Maple trumpet skeletonizer larva



Maple trumpet skeletonizer adult



DAMAGE

- Larva feeds inside a folded leaf within a trumpet-like tube of silk and frass

Maple trumpet skeletonizer damage trumpetlike tubes of frass and silk



CONTROL

- To lessen the overwintering population, rake and destroy the leaves in the fall
- Apply registered insecticides according to label instructions, during growth of new leaves

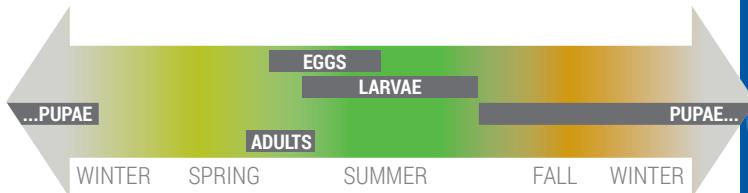
LIFE CYCLE

Eggs: late spring to midsummer

Larvae: early summer to fall

Pupae: fall to spring (overwinters)

Adults: late spring to midsummer





Mountain Ash Sawfly

Mountain
ash sawfly
larvae



Pristiphora geniculata (Hartig)

⚠ NON-NATIVE SPECIES

HOST

- Mountain ash

DESCRIPTION

Mature larva

- 16–20 mm; pale greenish yellow with black spots; head black or orange

Adult sawfly

- Resembles a small wasp; 9 mm long; black body

Mountain ash sawfly eggs



Mountain ash sawfly adult



DAMAGE

- Larvae eat the entire leaf except for the veins and stem
- Complete defoliation can occur

Mountain ash sawfly
damage and larvae



CONTROL

- Inspect trees regularly, especially trees that have been attacked in the previous season
- Prune out groups of larvae and destroy
- Apply registered insecticides according to label instructions

LIFE CYCLE

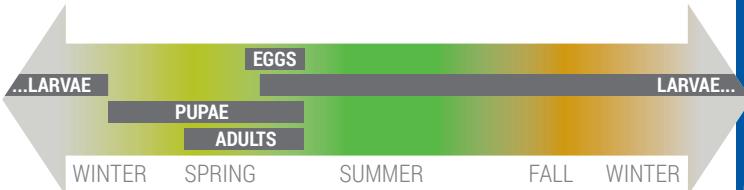
There may be 2 generations per year

Eggs: late spring to early summer

Larvae: late spring to midsummer (feeds), midsummer to early spring (overwinters)

Pupae: early spring to early summer

Adults: mid-spring to early summer





Northern Pink-striped Oakworm



Northern pinkstriped oakworm larva

Anisota v. virginiensis (Drury)

HOST

- Hardwoods; prefers red oak

DESCRIPTION

Mature larva

- 50 mm; dull reddish and dark grey bands down the back, covered with fine white granules and sparse, short black spines; head reddish brown with short horns

Adult moth

- 40–65 mm; females orange with pale purple at wing edges; males dark brown with some red on the hindwing and a large translucent patch on the forewing; both sexes have a small white spot on the forewing

Northern pinkstriped oakworm larva



Northern pinkstriped oakworm adult



DAMAGE

- Young larvae skeletonize leaves
- Loss of growth, dieback, or thinning of tree crowns

Northern pinkstriped oakworm larvae



CONTROL

- Naturally occurring parasites, predators and diseases
- Handpick and destroy larvae if infestation is small
- Apply registered insecticides according to label instructions

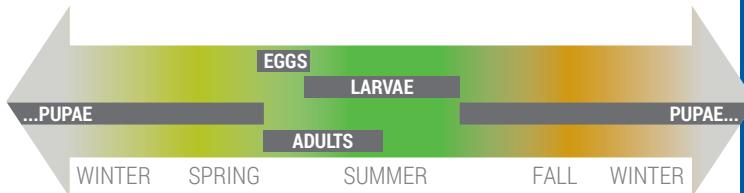
LIFE CYCLE

Eggs: late spring to midsummer

Larvae: early summer to late summer

Pupae: late summer to late spring (overwinters)

Adults: late spring to midsummer





Oak Leafshredder

Oak leafshredder larvae



Croesia semipurpurana (Kearfott)

HOST

- Red oak

DESCRIPTION

Mature larva

- 12 mm; pale yellowish brown with shiny black head

Adult moth

- 15 mm; sulphur yellow with brown markings

Oak leafshredder adult



Oak leafshredder pupa out of its silk cocoon.



DAMAGE

- Larvae feed within folded leaves tied with silk
- Leaves are mined and riddled with small holes
- Leaves turn brown, resulting in thin tree crowns; severe infestations cause significant growth loss; several years of defoliation may result in tree mortality

Oak leafshredder damage



CONTROL

- Large-scale control is difficult
- Apply registered insecticides according to label instructions, at bud break when larvae are young

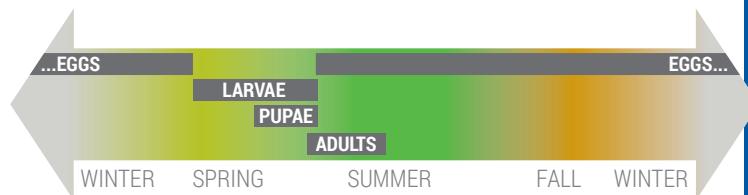
LIFE CYCLE

Eggs: early summer to mid-spring (overwinters)

Larvae: mid-spring to early summer

Pupae: late spring to early summer

Adults: early summer to midsummer





Pale Winged Grey

Pale winged grey larva



Iridopsis ephyraria (Walker)

HOST

- Eastern hemlock in Nova Scotia

DESCRIPTION

Mature larva

- 22–26 mm; mottled grey-brown to light-brown

Adult moth

- 23–28 mm; whitish grey with variable overlaying of light brown, dark grey, silver, and black

Pale winged grey egg



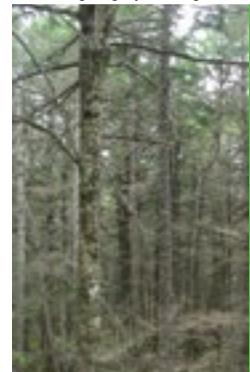
Pale winged grey adult



DAMAGE

- Larva feed on new shoots during the early part of the season; later stages feed on older needles
- Symptoms: missing or red needles, especially on the understory trees or lower branches of larger trees

Pale winged grey damage



CONTROL

- There are no registered control products for this pest at this time

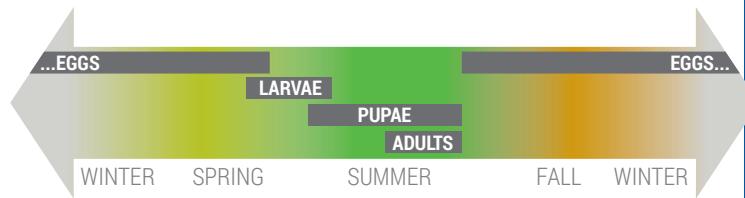
LIFE CYCLE

Eggs: late summer to late spring (overwinters)

Larvae: late spring to early summer

Pupae: early summer to midsummer

Adults: midsummer to late summer





Rusty Tussock Moth

Rusty
tussock
moth
larva



Orgyia antiqua (Linnaeus)

HOST

- Hardwood and softwood trees; prefers fir, spruces, larches, birches

DESCRIPTION

Mature larva

- 30 mm; very hairy, with black heads, dark grey backs, and yellow bellies; bodies have 4–7 tufts of dense, short, yellowish-white hair coming from orange bumps on the back, 2 long black pencil tufts behind head and 1 on the tail

Adult moth

- 22–30 mm; male orange-brown; female flightless, sedentary, with light tan hairs covering the body.

Rusty tussock moth larva



Rusty tussock moth adult male



DAMAGE

- Larvae first attack current-year foliage, which quickly turns brown
- Later in the season, larvae feed on foliage of any age

Rusty tussock moth damage



CONTROL

- Outbreaks are usually small-scale and short-lived
- Damage usually insignificant; no control measures to report

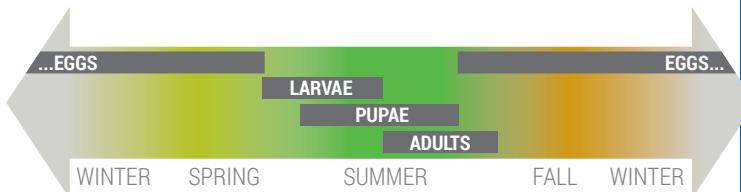
LIFE CYCLE

Eggs: late summer to late spring (overwinters)

Larvae: late spring to midsummer

Pupae: early summer to late summer

Adults: midsummer to early fall





Satin Moth

Satin
moth
side view
of adult
at rest



Leucoma salicis (Linnaeus)

⚠ NON-NATIVE SPECIES

HOST

- Aspens, poplars and willows; prefers ornamental poplars

DESCRIPTION

Mature larva

- 35–45 mm; greyish-brown body, dark head and back, 1 row of white or pale-yellow patches down the middle of the back, and 2 yellowish lines on the sides; 4 rows of orange bumps have tufts of long brownish hairs attached to them

Adult moth

- 24–47 mm; satiny white wings with no markings; stout, black bodies show through the dense covering of white hairs

Satin moth adult and open chrysalis



Satin moth larva



DAMAGE

- Young larvae skeletonize the leaves in late summer
- Consume whole leaves except major veins when feeding resumes in spring

Satin moth damaged leaves



CONTROL

- Naturally occurring parasites, predators and diseases
- Apply registered insecticides according to label instructions, when larvae are in early instars

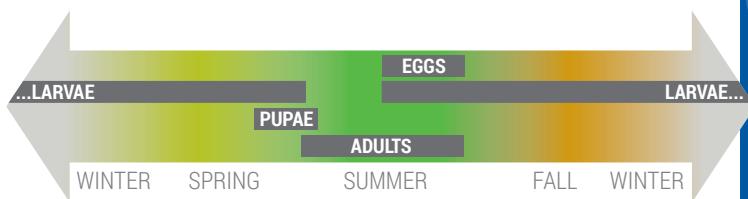
LIFE CYCLE

Eggs: midsummer to late summer

Larvae: midsummer to early fall (feeds), early fall to mid-spring (overwinters), mid-spring to early summer (finishes feeding)

Pupae: late spring to early summer

Adults: early to late summer





Spruce Budworm

Spruce
budworm
larva



Choristoneura fumiferana (Clemens)

HOST

- Fir and spruces

DESCRIPTION

Mature larva

- 20–30 mm; dark greenish-brown body with 2 rows of paired white dots on back

Adult moth

- 20 mm; grey-brown with silvery white patches

Spruce budworm adults



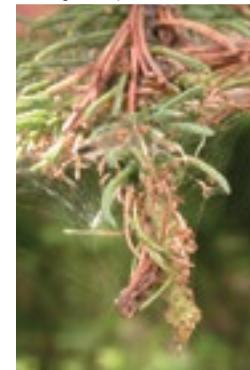
Spruce budworm damage



DAMAGE

- Partly chewed needles and dead buds seen on tree tops and branch tips

Spruce budworm
damage on spruce



CONTROL

- Naturally occurring parasites, predators and diseases
- Apply registered insecticides according to label instructions, after bud break

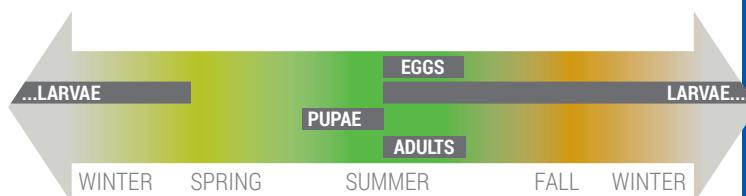
LIFE CYCLE

Eggs: mid- to late summer

Larvae: midsummer to mid-spring (overwinter), mid-spring to early summer (feeds)

Pupae: early to mid summer

Adults: mid to late summer





Spruce Web-spinning Sawfly

Spruce web-spinning sawfly larva



Cephalcia fascipennis (Cresson)

HOST

- Spruces; sometimes balsam fir, red pine, larch

DESCRIPTION

Mature larva

- 20 mm; light-tan head, body yellowish brown with reddish stripes on back and sides; constructs shelters from silk and frass

Adult sawfly

- Resembles a small wasp; small; black body

Spruce web-spinning sawfly larva



Spruce web-spinning sawfly larva



DAMAGE

- Feeds on the needles

Spruce web-spinning sawfly damage

CONTROL

- On ornamentals, shelters containing larvae may be manually removed by hand and destroyed
- Apply registered insecticides according to label instructions, with enough force to penetrate the nest



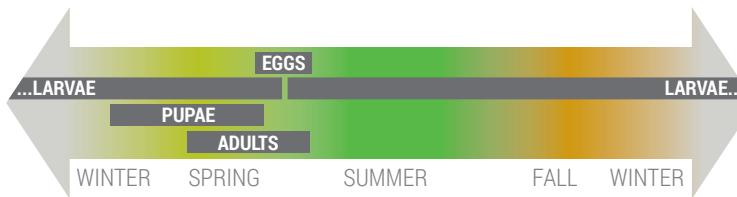
LIFE CYCLE

Eggs: late spring to early summer

Larvae: summer to fall (feeds), fall to spring (overwinters)

Pupae: early to late spring

Adults: mid spring to early summer





White Pine Sawfly

White pine sawfly larva



Neodiprion pinetum (Norton)

HOST

- White and red pine

DESCRIPTION

Mature larva

- 25 mm; pale yellow with black head and 4 rows of black spots from head to tail

Adult sawfly

- Resembles a small wasp; 8–10 mm long

White pine sawfly adult



White pine sawfly larvae



DAMAGE

- Larvae feed on needles, generally feeding on one branch before moving on to the next
- Larvae feeding may kill the tree

White pine sawfly larva



CONTROL

- Remove or dislodge larvae that are accessible with a power water spray
- Apply registered insecticides according to label instructions

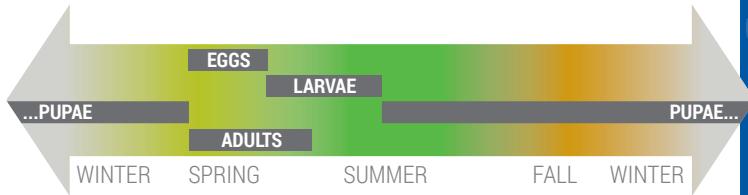
LIFE CYCLE

Eggs: mid to late spring

Larvae: late spring to midsummer

Pupae: midsummer to mid-spring (overwinters)

Adults: mid spring to early summer





Whitemarked Tussock Moth

White-marked tussock moth adult male



Orgyia leucostigma (J. E. Smith)

HOST

- Primarily hardwood trees; also softwoods (fir, spruces, larch)

DESCRIPTION

Mature larva

- 38 mm; red head; 2 long black tufts of hair on each side of head and 1 near its hind end; 4 greyish brush-like tufts and 2 bright red spots on its back

Adult moth

- Male 26–30 mm, ash grey;
- female 13 mm, off white, hairy, wingless

Whitemarked tussock moth cocoon



Whitemarked tussock moth adult female with egg mass



DAMAGE

- Young larvae skeletonize leaves; older larvae consume entire leaf except for the main veins and stem; on softwoods, whole needles consumed

Whitemarked tussock moth larva



CONTROL

- Naturally occurring parasites, predators and diseases
- Apply registered insecticides according to label instructions

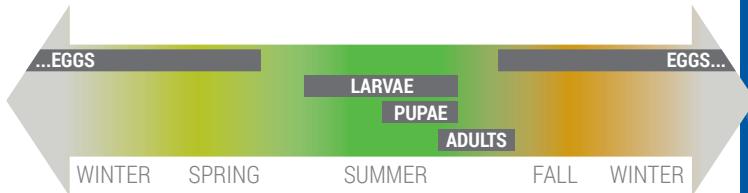
LIFE CYCLE

Eggs: early fall to late spring (overwinters)

Larvae: early to late summer

Pupae: midsummer to late summer

Adults: late summer to early fall





Willow Flea Weevil

Willow
flea
weevil
adult



Isochnus rufipes (LeConte)

HOST

- Willows and poplars

DESCRIPTION

Mature larva

- 3 mm; dirty, off-white; legless, flattened, head and spots on body dark brown

Adult beetle

- 2 mm; black, orange legs, oval-shaped

Willow flea weevil larva and damage



DAMAGE

- Larvae feeding causes small irregular blotch mines in leaves; beetles create circular holes in leaves
- Brown leaves; in early August, hedges and trees have a scorched appearance

Willow flea weevil damage



CONTROL

- Apply registered insecticides according to label instructions, in early June when the adults begin to feed

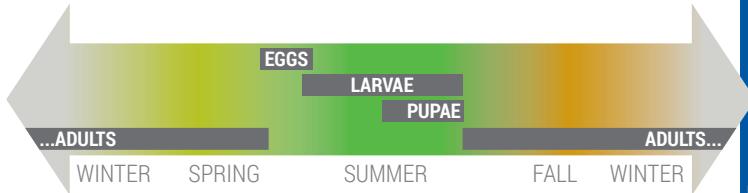
LIFE CYCLE

Eggs: late spring to early summer

Larvae: early summer to late summer

Pupae: mid to late summer

Adults: late summer to late spring (overwinters), late spring to early summer (feeds)





gall making INSECTS



Balsam Gall Midge

Balsam gall midge adults



Paradiplosis tumifex Gagné

HOST

- Balsam fir

DESCRIPTION

Mature larva

- 1–3 mm; tiny yellowish-orange maggot inside needle galls

Adult midge

- 1–3 mm; tiny, delicate, orange-coloured fly

Balsam gall midge galled balsam fir needles summer above and fall below



Balsam gall midge adult laying eggs on newly-emerging needles



DAMAGE

- Swollen growth(s), or galls, at the base of current-year needles
- Galled needles turn yellow and dry out, dropping to the ground in fall
- Repeated severe infestations can cause tree growth loss but does not result in mortality

Balsam gall midge damage



CONTROL

- Key control agent is a predator midge
- Apply registered insecticides according to label instructions, when buds are at least 20 per cent flushed

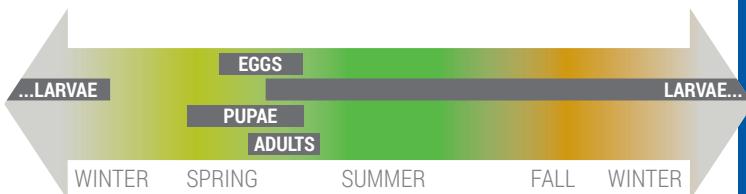
LIFE CYCLE

Eggs: late spring to early summer

Larvae: late spring to fall (feeds); fall to early spring (overwinters)

Pupae: mid spring to early summer

Adults: late spring to early summer





Spruce Gall Adelgids

Eastern spruce gall adelgid (*Adelges abietis*) winged adults



Adelges spp. and *Pineus* spp.

HOST

- All spruces

DESCRIPTION

Adult adelgid

- 2–3mm, tiny aphid-like insect, bluish-grey

Eastern spruce gall adelgid (*Adelges abietis*) old gall in its natural state



Pine leaf adelgid (*Pineus pinifoliae*) old gall on a spruce host, after adelgid emergence



DAMAGE

- Feeding causes characteristic pineapple shaped growths or galls to form at or near branch tips. These galls can stunt or kill twigs, and in severe infestations, can disfigure valuable ornamental trees
- Continuous infestations can increase the tree's susceptibility to attack by other diseases and pests
- Galls form in spring or early summer and turn brown and dry out

Ragged spruce gall adelgid (*Pineus similis*) damage on red spruce



CONTROL

- Cut off galls and destroy them while they are still green, before they dry out and adults emerge

LIFE CYCLE

- The life cycle of these insects is complex, involves many generations, and can include more than 1 type of host tree
- The galled stems can remain on the host tree throughout the year even after the adults have emerged



sap
feeding
INSECTS



Aphids

Aphids
on a
conifer
tree



FAMILY: Aphididae
Many Species

HOST

- Attack nearly all species of plants, including both softwood and hardwood trees

DESCRIPTION

Nymph

- Resemble adults but are smaller and wingless

Adult aphid

- Small (2–10 mm long), soft bodied pear-shaped insect with long antennae. Two tubular structures, called cornicles, emerge from the back of its body. Most are wingless and colours are widely variable – ranging from very pale yellow to dark, nearly black.

Aphids on a conifer tree



Female winged adult



DAMAGE

- Leaves turn yellow, dry out, and wilt
- Some aphids cause galls or distorted, curled, or deformed leaves
- Aphids on stems or twigs may cause stunted growth, early leaf fall, or twig mortality
- Aphid damage very rarely kills the plant
- During feeding, aphids secret a clear, sticky, sweet substance called honeydew; other insects such as ants are attracted to the honeydew and a fungus called sooty mold often grows in the secretion

Aphids on False Sunflower
(*Heliopsis helianthoides*)



CONTROL

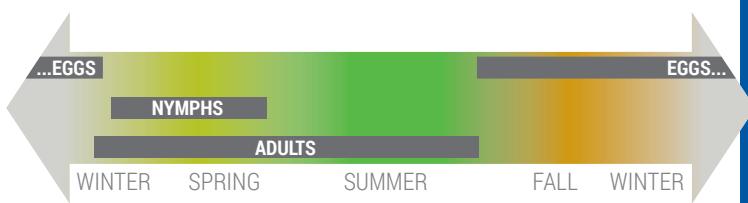
- Various parasitic and predatory insects that occur naturally
- Physical control by rubbing or handpicking aphids from plant, or knocking off aphids with steady stream of water
- Apply registered insecticides according to label instructions

LIFE CYCLE

Eggs: fall to spring (overwinters)

Nymphs: early to late spring

Adults: spring to fall (multiple generations)





Balsam Twig Aphid

Balsam
twig
aphid
adult



Mindarus abietinus Koch

HOST

- Balsam fir

DESCRIPTION

Nymph

- 1–3 mm; soft-bodied; woolly wax and droplets of sticky honeydew may be visible on surface of a pale yellowish-green body

Adult aphid

- 3 mm; pale bluish green; winged or wingless

Balsam twig aphid damage



Balsam twig aphid characteristic damage of annual shoot attack



DAMAGE

- Twisted, short, and deformed needles from the current year's growth
- Twig aphids produce considerable honeydew which can support the growth of black sooty mold. Ants and bees may also be present

Balsam twig aphid shoot infested by a colony of aphids and honeydew secretion



CONTROL

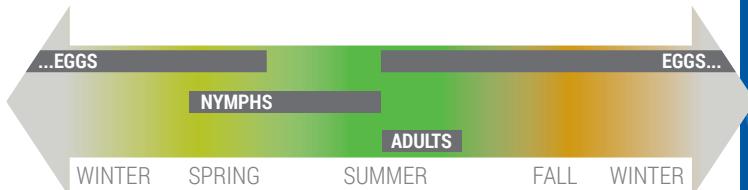
- Apply registered insecticides according to label instructions

LIFE CYCLE

Eggs: midsummer to late spring (overwinters)

Nymphs: mid spring to mid summer

Adults: mid- to late summer





Balsam Woolly Adelgid

Balsam
woolly
adelgid
adults
(insert)
Balsam
woolly
adelgid
damage



Adelges piceae (Ratz.)

⚠ INVASIVE ALIEN SPECIES

HOST

- Balsam fir

DESCRIPTION

Nymph

- Less than 1 mm; black

Adult adelgid

- 1 mm; dark purple to black; appears white when covered in wool in late winter to early spring

DAMAGE

- Injury to stems and twigs
- Gouting (swelling) along buds and branch nodes, causing needles to drop and branches to die
- May cause dead tops or drooping branch tips of current year's growth
- Feeding on the main stem may result in reduction in growth and eventual mortality

CONTROL

- In forest situations, silvicultural and management techniques can be used to reduce adelgid populations and damage

- In Christmas tree plantations, if only a few trees are infested cut and destroy infested trees. If the infestation is more wide spread, chemical treatment may be necessary
- Apply registered insecticides according to label instructions

LIFE CYCLE

Nymphs: midsummer to mid-spring (overwinters)

Adults: mid-spring

Eggs: mid-spring

Nymphs: late spring to early summer

Adults: early summer

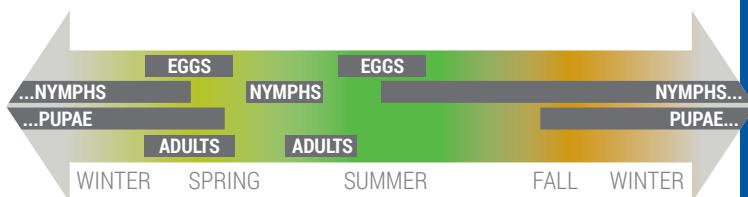
Eggs: midsummer

Nymphs: midsummer to mid-spring (overwinters)

Immature nymphs overwinter on the trunk, larger branches, and around buds. In early spring, they mature and the female adelgids are present.

Females cover themselves with waxy, wool-like covering. Each female produces a cluster of eggs under the woolly mass surrounding her body. Eggs hatch in about a month, around the time of bud break. Crawlers emerge, and search for a place to settle. These nymphs insert their mouthparts into the bark to feed, but once inserted, the nymph is not able to move. These stationary crawlers will moult several times before becoming adults. In midsummer, these adults lay eggs, which again hatch into crawlers. The crawlers overwinter and start the cycle again the following spring

Balsam woolly adelgid nymph





Beech Scale

Beech scales in bark crevice



Cryptococcus fagisuga Lindinger

⚠ INVASIVE ALIEN SPECIES

HOST

- Beech

DESCRIPTION

Nymph

- Less than 0.5 mm; soft-bodied, yellow, oval in shape, covered with a protective white, waxy "wool"

Adult scale

- 0.5–1 mm; yellow, spherical body covered with a protective white, waxy "wool"

Fruiting bodies of the fungus that causes beech bark disease.



Beech scales in bark crevice



DAMAGE

- Feeding causes bark to crack, allowing *Nectria* fungus to infect these wounds
- Fungus spreads beneath the bark, girdling the tree, causing mortality

Beech bark disease damage. Feeding by the beech scale creates wounds in the bark through which the fungus can enter the tree causing cankers to form.



CONTROL

- Thin and remove infected trees
- Physical removal of scale insects by scrubbing trees, by using high-pressure water, or by applying horticultural oil, which covers and suffocates scale insects, may be used on individual high-value ornamental or yard trees

LIFE CYCLE: 2-year

Eggs: late spring to midsummer

Nymphs: first stage (a.k.a. crawlers; wingless with well-developed legs and antennae); midsummer to fall

Nymphs: second stage (without legs and covered with woollike wax); fall to early spring (overwinters)

Adults: early spring to midsummer





Hemlock Woolly Adelgid

Hemlock
woolly
adelgid
adults with
eggs on
hemlock



Adelges tsugae (Annand)

⚠ INVASIVE ALIEN SPECIES

BACKGROUND

- First discovered in Nova Scotia in 2017
- Native to Asia (China, India, Japan, Taiwan)
- Causing extensive damage to hemlock in Eastern North America since 1950s
- Spread by birds, animals and wind
- Spread assisted by movement of firewood, nursery stock and wood products

HOST

- Eastern hemlock

DESCRIPTION

Nymph

- Less than 1.5 mm in length; brownish orange
- Nymph stage is the only mobile stage

Adult adelgid

- 1.5 mm; dark reddish brown to purplish black; appears white when covered in wool in fall to spring

DAMAGE

- Feeding causes needles to die and fall off
- Impedes new growth and creates dieback potential; complete defoliation and death can occur within four years

Hemlock
woolly adelgid adults



WHAT TO LOOK FOR

- Adult adelgid:** white wool at the base of needles, particularly on the younger growth, fall to spring

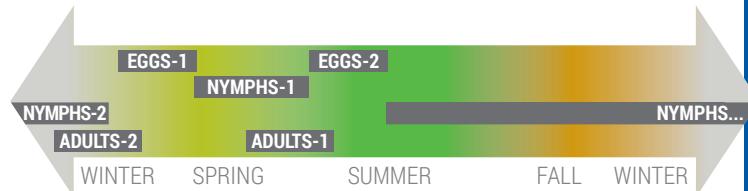
LIFE CYCLE: 2 Generations per year

1st GENERATION:

- Eggs:** early to mid spring
Nymphs: mid spring to early summer(feeds)
Adults: late spring to early summer

2nd GENERATION:

- Eggs:** early to mid summer
Nymphs: mid summer to late winter(overwinters)
Adults: late winter to early spring



NOTE

- This forest pest is regulated by the Canadian Food Inspection Agency (CFIA) under the federal Plant Protection Act, in order to prevent introduction and spread

For more information on the regulations, please contact a local CFIA office or visit the CFIA website.



Woolly Alder Aphid

Woolly alder aphids



Prociphilus tessellatus (Fitch)

HOST

- Alders and maples

DESCRIPTION

Nymph

- Less than 2 mm; grey

Adult aphid

- 2 mm; grey, usually covered by dense, white, waxy strands; winged or wingless

Woolly alder aphids



Woolly alder aphids



DAMAGE

- Minimal; partially curled leaves with lots of white woolly material
- Honeydew secreted by aphid is colonized by sooty mold fungi

Woolly alder aphids



CONTROL

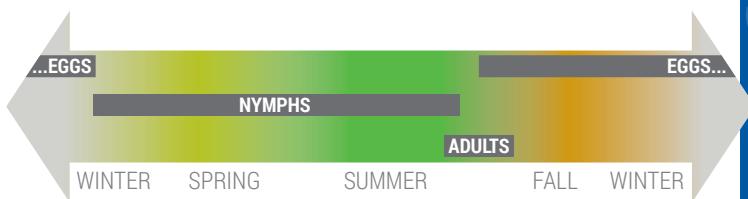
- Naturally occurring parasites, predators and diseases
- Apply registered insecticides according to label instructions

LIFE CYCLE

Eggs: fall to spring (overwinter on the bark off maples)

Nymphs: spring to late summer (feed on maples, have multiple generations)

Adults: late summer (fly to branches of alder); to fall (fly back to maple trees to mate)





terminal, shoot, twig, and root INSECTS



Balsam Shoot-boring Sawfly

Balsam shoot-boring sawfly adult on balsam fir



Pleroneura brunneicornis Rohwer

HOST

- Balsam fir

DESCRIPTION

Mature larva

- 6 mm, yellowish-white

Adult sawfly

- Resembles a small wasp; 5–6 mm long; black and white stripes on the abdomen

Balsam shootboring sawfly view from above of the larva on damaged annual shoot



Balsam shootboring sawfly mature larva



DAMAGE

- New shoot tips appear flattened, with the centre turning red and dying
- Mostly aesthetic damage, no lasting effect on tree health

Balsam shootboring sawfly damage



CONTROL

- Apply registered insecticides according to label instructions pertaining to flying adults

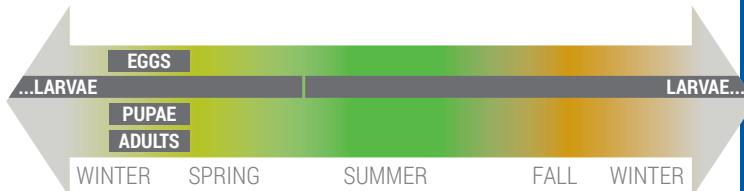
LIFE CYCLE

Eggs: early to mid-spring

Larvae: mid-spring to early summer (feeds); early summer to early spring (overwinters)

Pupae: early to mid spring

Adults: early to mid spring





Seedling Debarking Weevil

Seedling debarking weevil adult



Hylobius congener
DallaTorre, Schenkling, Marshall

HOST

- Softwood seedlings

DESCRIPTION

Mature larva

- 5–9 mm; whitish grub with light to dark brown head

Adult beetle

- 6–8 mm; dark reddish brown to black, with tiny white spots on wing coverings

Seedling debarking weevil adult and damage



DAMAGE

- Beetles feed on the bark, creating irregular shaped scars along the stem, killing the seedling if 50 per cent or more of the bark is removed
- Feeding creates a wound, allowing disease to enter the tree

Seedling debarking weevil damage



CONTROL

- Delay planting for 2 years after harvesting trees
- If planting on recently cut site, scrape back the duff-layer or plant the seedlings in scarified sites to reduce weevil feeding by 50 per cent

LIFE CYCLE: 2-year

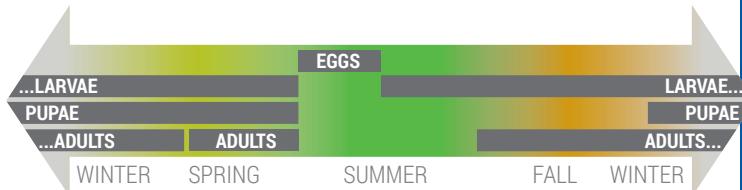
Adults: mid spring to early summer (emerge from overwintering sites, feed, mate, and lay eggs)

Eggs: early to midsummer

Larvae: midsummer to fall (feeds), late fall to early summer (overwinters),

Pupae: late fall to early summer

Adults second generation: fall to mid spring (overwinters)





White Pine Weevil

White pine weevil adult



Pissodes strobi (Peck)

HOST(S):

- Pines and spruces; mainly white pine

DESCRIPTION:

Mature larva

- 7 mm; white with a brown head; legless, and slightly C-shaped

Adult beetle

- 4–7 mm; rust-coloured with white and brown patches; long hooked snout with small antennae

White pine weevil eggs in their natural position into a terminal shoot



White pine weevil adult near the exit hole of its chamber



DAMAGE:

- Where feeding, larvae causes the shoot to wilt, droop and eventually die; takes shape of a shepherd's crook; permanently crooked
- Infested trees are seldom killed; tree may become forked

White pine weevil damage



CONTROL:

- Watch for pitch flow from small holes on leaders during spring; hand prune infested leader and destroy it early-mid July
- Apply registered insecticides according to label instructions at 3–4 year intervals until trees exceed 10 m in height
- Open grown trees are more susceptible, trees under canopy are less vulnerable

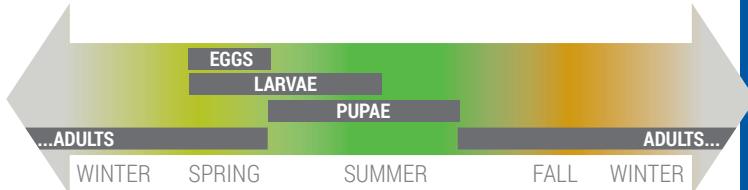
LIFE CYCLE

Eggs: mid spring to late spring

Larvae: mid spring to mid-summer

Pupae: late spring to late summer

Adults: late summer to late spring (overwinter)





invasive alien
species (IAS)

**not
currently
in Nova
Scotia**



Asian Longhorned Beetle

Asian longhorned beetle adult

(insert) Asian longhorned beetle larva



Anoplophora glabripennis
(Motschulsky)

⚠ INVASIVE ALIEN SPECIES

BACKGROUND

- Native to China and other parts of Asia
- First discovered in Canada in 2003 near the border of Toronto and Vaughan, Ontario
- Likely transported in wood pallets or wood packing material

HOST

- Numerous hardwood trees; prefers maples

DESCRIPTION

Mature larva

- 50mm; legless grub; cream coloured with dark brown mouthparts

Adult beetle

- 25–35 mm; shiny, black body with up to 20 white spots on its wing covers; long, segmented antennae

DAMAGE

- Adult females chew egg-laying pits in the bark on branches and trunk
- As the larva matures it bores into the sapwood and heartwood; chewing tunnels that structurally weaken the tree and girdle stems and branches

Asian longhorned beetle damage – exit hole



WHAT TO WATCH FOR

- Adult beetle:** Active from summer to fall
- Exit holes:** Adults emerge through large, round exit holes, mid- to late summer

LIFE CYCLE

Eggs: mid summer to early fall

Larvae: late summer to fall (feeds); fall to spring (overwinters); spring to fall (feeds for second season); fall to spring overwinters for second winter as a prepupae

Pupae: late spring to mid summer

Adults: early summer to early fall



NOTE

- This forest pest is regulated by the Canadian Food Inspection Agency (CFIA) under the federal Plant Protection Act, in order to prevent introduction and spread

For more information on the regulations, please contact a local CFIA office or visit the CFIA website.



Emerald Ash Borer

Emerald ash borer adult



Agrilus planipennis Fairmaire

⚠ INVASIVE ALIEN SPECIES

BACKGROUND

- First detected in 2002 in Windsor, Ontario
- Native to China, Japan, North Korea, South Korea, Mongolia, Russia, and Taiwan

HOST

- Ash

DESCRIPTION

Mature larva

- 26–32 mm; body flat, broad, creamy-white

Adult beetle

- 7–14 mm; body narrow, elongate, metallic green

Emerald ash borer larva



Emerald ash borer adult



DAMAGE

- Larvae make long S-shaped galleries into the sapwood
- Feeding damage causes general yellowing and thinning of the foliage, dying of branches, crown dieback, and eventually death of the tree after 2–3 years of infestation

Epicormic shoots, or suckers, are a typical sign that a tree is under stress. Ash trees will send out these epicormic shoots when under stress from an emerald ash borer infestation.

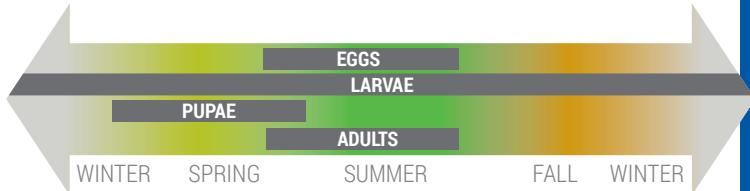


WHAT TO LOOK FOR

- Adult beetle:** flying, active late spring to late summer
- Exit holes:** 3–4 mm, D-shaped

LIFE CYCLE

- Eggs:** late spring to late summer
Larvae: early summer to fall (feeds); fall to spring (overwinters); spring to fall (feeds for second season); fall to spring overwinters for second winter as a prepupae
Pupae: early spring to early summer
Adults: late spring to late summer



NOTE

- This forest pest is regulated by the Canadian Food Inspection Agency (CFIA) under the federal Plant Protection Act, in order to prevent introduction and spread

For more information on the regulations, please contact a local CFIA office or visit the CFIA website.

APPENDIX A

GLOSSARY

Abdomen: in insects, the posterior or hind part of the body

Abiotic: nonliving features of an ecosystem such as climate, light, soil chemistry, and water availability

Aesthetic injury: visually displeasing damage to plants or structures that does not necessarily adversely affect plant health

Alien species: plants, animals and microorganisms from one part of the world that are transported beyond their natural range and become established in a new area; they are sometimes also called “exotic,” “introduced,” “non-native,” “non-indigenous,” or “invasive” species

Bark: protective covering of trees and shrubs

Borer: general term describing insects that excavate wood for food and shelter

Bud: a “condensed” shoot; stem very short and leaves are so close that they overlap, each one wrapping round the next above it

Bud break: the opening of bud scales in spring, followed by elongation of new shoots

Bud scales: the outermost leaves of a bud are often thicker and tougher, and sometimes black or brown. These are the bud scales and they protect the more delicate, inner foliage leaves from drying up, from damage by birds, insects, fungi, etc., and, to some extent, from extremes of temperature

Canopy: the leafy parts of vines or trees

Cocoon: silken case spun by an insect larva, inside which the pupa is formed

Conifer: cone-bearing trees having needles or scale-like leaves, usually evergreen, and producing wood known commercially as “softwoods”

Crown: the live branches and foliage at the top of a tree

Deciduous: commonly known as broadleaved or hardwood trees; generally lose their leaves during the fall

Defoliation: loss of leaves, as occurs in natural shedding or from the feeding activities of insects and other plant feeders

Duff-layer: organic matter in various stages of decomposition on the floor of the forest

Ecosystem: a group/community of organisms interacting with their environment

Elytra: the hard, thickened forewings of beetles that act as wing covers for the hindwings

Epidemic: a widespread and unusually high level of incidence of a disease or insect pest; generally preceded by a rapid increase in population size

Exit hole: a hole through the bark or wood that is created by an emerging insect

Forewing: the first pair of insect wings

Frass: solid excrement of insects, particularly larvae

Fungus (plural fungi): a group of lower organisms that usually reproduce by spores and are composed of cellular filaments (hyphae). Fungi obtain their nutrients from other organisms. Most conifer diseases are caused by fungi

Gall: an abnormal swelling of plant tissue caused by insects, microorganisms, or external injury

Galleries: excavated spaces in wood, soil, etc., made by organisms such as beetles and ants in which to live and reproduce

Girdle: damage that completely encircles a stem or root, often resulting in death of plant parts above or below the girdle

Gouting: excessive swelling of a branch or shoot; often accompanied by misshapen needles and buds

Grub: typically, the larva of a beetle, or of some flies

Hardwood: trees that are generally deciduous, broad-leaved species such as oak, birch, alder or maple

Heartwood: the inner core of a woody stem composed of nonliving cells and usually differentiated from the outer wood layer (sapwood) by its darker colour

Hindwings: the second pair of wings of an insect

Honeydew: the sugary liquid discharge from certain insects such as aphids and scales; provides a growing media for sooty mold

Horticultural oils: highly refined petroleum (or seed-derived) oils that are manufactured specifically to control pests on plants

Host: a plant or animal that provides nourishment for another organism

Hypha (plural hyphae): a fine, usually branched, threadlike filament of the vegetative body of a fungus that grows on or within the host; a bundle of hyphae is termed a mycelium

Instar: a stage in the development of an insect larva between periods when the larva sheds its skin in order to grow

Invasive species: an alien (or non-native) species whose introduction does, or is likely to cause economic or environmental harm or harm to human health; only a small portion of non-native species are invasive

Larva (plural larvae): the immature form of insects that develop through the process of complete metamorphosis, which includes eggs, several larval stages, pupa, and adult

Leader: the main shoot that develops from the terminal bud at the top of a tree each year

Maggot: a fly larva

Major veins: the major, large veins of a leaf, which are attached to the midrib or the petiole

Metamorphosis: the change in form that takes place as insects grow from immatures to adults

Midrib: the large, central vein of a leaf

Mines: tunnels or blotches excavated by a larva as it feeds on the tissue between the upper and lower surfaces of a leaf

Mycelium (plural: mycelia): the vegetative feeding structure of a fungus; composed of interwoven hyphae and considered distinct from the fruiting body

Non-quarantine pest: pest that is not a quarantine pest for an area

Nymph: the immature form of certain insects, usually resembling the adult form but smaller and lacking fully developed wings

Open grown trees: trees or shrubs with crowns receiving full light from above and from all sides

Outbreak: a large-scale temporary increase in a population causing severe damage over a large geographic area

Overmature: a quality exhibited by trees that have declined in growth rate because of old age and loss of vigour

Overwinter: a period of rest or hibernation by which insects survive the winter

Ovipositor: a tube that is used for laying eggs

Parasite: an organism that derives its food from the body of another organism, the host, without killing the host directly; also, an insect that spends its immature stages in the body of a host that dies just before the parasite emerges (this type is also called a parasitoid)

Pest: any organism considered detrimental to effective forest management

Phloem: the food-conducting tissue of a plant

Phytosanitary measure: any legislation, regulation or official procedure having the purpose to prevent the introduction and/or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests

Pitch: tree resin or sap

Pitch tube: Small blobs of pitch secreted by the host tree in its efforts to trap and prevent an insect from entering the stem

Plants for planting: plants intended to remain planted, to be planted or replanted

Predator: any animal that kills other animals (prey) and feeds on them

Pronotum: a plate-like cover of the first segment of the thorax

Pupa (plural pupae): the non-feeding, inactive stage between larva and adult in insects, during which the larva typically undergoes complete transformation within a protective cocoon or hardened case

Quarantine: official confinement of regulated articles for observation and research or for further inspection, testing and/or treatment

Quarantine pest: a pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being official control

Queen: the reproductive female within a colony of social insects such as ants

Regulated article: any plant, plant product, storage place, packaging, conveyance, container, soil and any other organism, object or material capable of harbouring or spreading pests, deemed to require phytosanitary measures, particularly where international transportation is involved

Regulated non-quarantine pest: a non-quarantine pest whose presence in plants for planting affects the intended use of those plants with an economically unacceptable impact and which is therefore regulated within the territory of the importing contracting party

Resinosis: an abnormal flow of resin or pitch from a conifer usually in response to infection, insect activity, or wounding

Sapwood: the wood found closest to the bark and usually distinguished from heartwood by being lighter in colour; consists of xylem (provides structural support, transports water, etc.)

Scarification: the removal of the top litter layer of an area (usually in strips) for site preparation

Shepherd's crook: a leader or branch with a down-curved tip in the shape of a shepherd's crook, characteristic of attack by certain insects or diseases

Skeletonize: to remove soft tissue leaving harder structures such as leaf veins in place

Sign: parts of the pest itself or other evidence of their presence e.g. frass

Softwood: cone-bearing trees with needle or scale-like leaves, such as balsam fir, eastern white cedar, and jack pine

Sooty Mold: a dark fungal growth that develops on foliage covered with honeydew secretions from insects

Species: a genetic subdivision whose numbers are capable of mating and producing fertile offspring

Spore: a reproductive body produced by certain fungi and other organisms, capable of growing into a new individual under proper conditions

Stand: a group of forest trees of sufficiently uniform species composition, age, and condition to be considered a homogeneous unit for management purposes

Susceptible: the likelihood of an infestation as based on key stand characteristics (species composition, tree density, etc.)

Symptom: visible reaction of a host to abiotic injuries or pest attack including insect feeding indicators, or discoloration from diseases

Terminal: the growing tip of a stem, especially the main stem

Thorax: that middle portion of an insect's body that bears the legs and wings

Vascular system: the system of plant tissues that conducts water, mineral nutrients, and products of photosynthesis through the plant, consisting of the xylem and phloem

Vascular tissue: plant tissue that carries water and nutrients throughout the plant

Vigour: the health and vitality of a tree; most accurately assessed by observing foliage (density, width, and colour) and per cent of live crown

Vulnerable: the likelihood of tree or stand damage resulting from an infestation or infection

Wood: the hard fibrous substance beneath the bark in the stems and branches of trees and shrubs; xylem

Worker: females within social insect colonies (e.g., ants) that are not able to reproduce

Xylem: the principal strengthening and water conducting tissue in most plants

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Native Elm Bark Beetle

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Northern Pinkstriped Oakworm

– *Anisota virginiensis virginiensis* (Drury)

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Oak Leafshredder

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Satin Moth – *Leucoma salicis* (Linnaeus)
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Spruce Budworm

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Spruce Webspinning Sawfly

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Sugar Maple Borer – *Glycobius speciosus* (Say)

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Whitemarked Tussock Moth

- *Orygia leucostigma* (J. E. Smith)

Natural Resources Canada. (2012, January 25).

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Whitespotted Sawyer

- *Monochamus s. scutellatus* (Say)

Yanega, D. 1996. Field Guide to the Northeastern Longhorned Beetles (Coleóptera: Cerambycidae). Illinois Natural History Survey Manual 6. Illinois Natural History Survey, Urbana-Champaign, IL. 184 p.

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Wooly Alder Aphid – *Prociphilus tessellatus* (Fitch)

Anonymous. Woolly alder aphid *Prociphilus tessellatus*, p 223 in: Krischik, V., and Davidson, J. (eds.). 2004. Integrated Pest Management of Midwest Landscapes. Cooperative Project of NCR-193, North Central Committee on Landscape IPM, Minnesota Agricultural Experiment Station SB-07645. Retrieved from <http://cues.cfans.umn.edu/old/Web/223WoolyAlderAphid.pdf>

APPENDIX C PHOTO CREDITS

Bronze Birch Borer

- *Agrilus anxius*

Bronze birch borer (*Agrilus anxius*) adult. Whitney Cranshaw, Colorado State University, Bugwood.org

Dieback associated with bronze birch borer (*Agrilus anxius*) damage. Whitney Cranshaw, Colorado State University, Bugwood.org

Bronze birch borer (*Agrilus anxius*) larva and galleries. David G. Nielsen, The Ohio State University, Bugwood.org

Bronze birch borer (*Agrilus anxius*) pupa. David G. Nielsen, The Ohio State University, Bugwood.org

Brown Spruce Longhorn Beetle

- *Tetropium fuscum*

Brown spruce longhorn beetle (*Tetropium fuscum*) adult. Jon Sweeney, Natural Resources Canada, Bugwood.org

Brown spruce longhorn beetle (*Tetropium fuscum*) damage. Nova Scotia Department of Natural Resources Forest Protection

Brown spruce longhorn beetle (*Tetropium fuscum*) larva. Stephanie Sopow, Natural Resources Canada, Bugwood.org

Resinosis resulting from brown spruce longhorn beetle (*Tetropium fuscum*) attack. Nova Scotia Department of Natural Resources Forest Protection.

Carpenter Ants

- *Camponotus* spp.

Carpenter ant (*Camponotus* spp.) adult. David Cappaert, Michigan State University, Bugwood.org

Carpenter ant (*Camponotus* spp.) damage. Natural Resources Canada, Canadian Forest Service

Winged carpenter ant (*Camponotus* spp.). Mardon Erbland, Logy Bay, Newfoundland, Canada. <http://creativecommons.org/licenses/by-nc-sa/2.5/ca/>

Carpenter ant (*Camponotus* spp.) larvae. Whitney Cranshaw, Colorado State University, Bugwood.org

Metallic Wood-Boring Beetles

- *Buprestidae*

Metallic wood-boring beetle adult.

Bob Oakes, United States Department of Agriculture Forest Service, Bugwood.org

Metallic wood-boring beetle and sap sucker damage on sugar maple. Randy Cyr, Greentree, Bugwood.org

Metallic wood-boring beetle mature larva. William M. Ciesla, Forest Health Management International, Bugwood.org

Metallic wood-boring beetle adult. Nova Scotia Department of Natural Resources Forest Protection

Native Elm Bark Beetle**- *Hylurgopinus rufipes***

Native elm bark beetle (*Hylurgopinus rufipes*) side view of the adult (length: 2.5 mm).

Natural Resources Canada, Canadian Forest Service

Brown vascular staining caused by a fungus carried by the native elm bark beetle (*Hylurgopinus rufipes*). Andrew Williams, Town of Truro, Nova Scotia

Native elm bark beetle (*Hylurgopinus rufipes*) maternal tunnels and larval tunnels on an elm trunk. Natural Resources Canada, Canadian Forest Service

Native elm bark beetle (*Hylurgopinus rufipes*) adult in its v-shaped tunnel. Natural Resources Canada, Canadian Forest Service

Spruce Beetle**- *Dendroctonus rufipennis***

Spruce beetle (*Dendroctonus rufipennis*) adult. Steven Valley, Oregon Department of Agriculture, [Bugwood.org](#)

Spruce beetle (*Dendroctonus rufipennis*) damage - severely affected spruce. Natural Resources Canada, Canadian Forest Service

Pitch tubes on spruce, a result of spruce beetle (*Dendroctonus rufipennis*) attack. Nova Scotia Department of Natural Resources Forest Protection

Spruce beetle (*Dendroctonus rufipennis*) larvae. Nova Scotia Department of Natural Resources Forest Protection

Sugar Maple Borer**- *Glycobius speciosus***

Sugar maple borer (*Glycobius speciosus*) adult. Ronald S. Kelley, Vermont Department of Forests, Parks and Recreation, [Bugwood.org](#)

Sugar maple borer (*Glycobius speciosus*) damage on live standing tree. Steven Katovich, United States Department of Agriculture Forest Service, [Bugwood.org](#)

Sugar maple borer (*Glycobius speciosus*) adults. Natural Resources Canada, Canadian Forest Service

Appearance of a sugar maple crown, five years after attack by sugar maple borer (*Glycobius speciosus*). Natural Resources Canada, Canadian Forest Service

Whitespotted Sawyer**- *Monochamus s. scutellatus***

Whitespotted sawyer (*Monochamus s. scutellatus*) adult. Natural Resources Canada, Canadian Forest Service

Dead foliage of balsam fir after whitespotted sawyer (*Monochamus s. scutellatus*) adult attack on the twig. Natural Resources Canada, Canadian Forest Service

Whitespotted sawyer (*Monochamus s. scutellatus*) adult seeking for tender bark on a young stem of eastern white pine. Natural Resources Canada, Canadian Forest Service

Whitespotted sawyer (*Monochamus s. scutellatus*) larva - longitudinal cut through a larval tunnel. Natural Resources Canada, Canadian Forest Service

Woodwasps (Horntails)**- Siricidae**

Sirex woodwasp (*Sirex noctilio*) adult. Gyorgy Csoka, Hungary Forest Research Institute, [Bugwood.org](#)

Wood wasp damage - exit holes.

Louis-Michel Nageleisen, Département de la Santé des Forêts, [Bugwood.org](#)

Adult wood wasp. Edward H. Holsten, United States Department of Agriculture Forest Service, [Bugwood.org](#)

Wood wasp pupa. Nova Scotia Department of Natural Resources Forest Protection

Alder Flea Beetle**- *Macrohaltica ambiens***

Alder flea beetle (*Macrohaltica ambiens*) adult. Whitney Cranshaw, Colorado State University, [Bugwood.org](#)

Alder flea beetle (*Macrohaltica ambiens*) damage – skeletonized leaf due to feeding. Scott Tunnock, United States Department of Agriculture Forest Service, [Bugwood.org](#)

Alder flea beetle (*Macrohaltica ambiens*) larvae. Nova Scotia Department of Natural Resources Forest Protection

Alder flea beetle (*Macrohaltica ambiens*) adult. Nova Scotia Department of Natural Resources Forest Protection

Alder Woolly Sawfly**- *Eriocampa ovata***

Alder woolly sawfly (*Eriocampa ovata*) larva. Nova Scotia Department of Natural Resources Forest Protection

Alder woolly sawfly (*Eriocampa ovata*) damage. Natural Resources Canadian Forest Service Pacific Forestry Centre, Forest Health Network

Alder woolly sawfly (*Eriocampa ovata*) larva. Natural Resources Canadian Forest Service Pacific Forestry Centre, Forest Health Network

Alder woolly sawfly (*Eriocampa ovata*) larvae. Nova Scotia Department of Natural Resources Forest Protection

Balsam Fir Sawfly**- *Neodiprion abietis***

Balsam fir sawfly (*Neodiprion abietis*) larva. Nova Scotia Department of Natural Resources Forest Protection

Balsam fir sawfly (*Neodiprion abietis*) defoliated balsam fir twig: 1) current year's foliage is intact; 2) 1-year-old needles are chewed and reddened; and 3) 2-year-old needles have disappeared. Natural Resources Canada, Canadian Forest Service

Balsam fir sawfly (*Neodiprion abietis*) female (left) and male (right) adults near their respective cocoons. Natural Resources Canada, Canadian Forest Service

Balsam fir sawfly (*Neodiprion abietis*) egg niches. Nova Scotia Department of Natural Resources Forest Protection

Beech Leaf Mining Weevil**- *Orchestes fagi***

Beech leaf mining weevil (*Orchestes fagi*) adult. Nova Scotia Department of Natural Resources Forest Protection

Beech leaf mining weevil (*Orchestes fagi*) damage. Milan Zubrik, Forest Research Institute - Slovakia, [Bugwood.org](#)

Beech leaf mining weevil (*Orchestes fagi*) larva. Gyorgy Csoka, Hungary Forest Research Institute, [Bugwood.org](#)

Beech leaf mining weevil (*Orchestes fagi*) damage. Gyorgy Csoka, Hungary Forest Research Institute, [Bugwood.org](#)

Birch Leaf Mining Sawflies

- *Heterarthrus nemoratus* (Fallén) or *Fenusia pusilla*

Birch Leaf Mining Sawfly (*Heterarthrus nemoratus*) adult.
Natural Resources Canada, Canadian Forest Service

Birch Leaf Mining Sawfly (*Heterarthrus nemoratus*) damage by larva.
Natural Resources Canada, Canadian Forest Service

Birch Leaf Mining Sawfly (*Heterarthrus nemoratus*) adult.
Natural Resources Canada, Canadian Forest Service

Birch Leaf Mining Sawfly (*Heterarthrus nemoratus*) larva.
Natural Resources Canada, Canadian Forest Service

Dusky Birch Sawfly

- *Croesus latitarsus*

Dusky birch sawfly (*Croesus latitarsus*) adult. Lacy L. Hyche, Auburn University, [Bugwood.org](#)

Dusky birch sawfly (*Croesus latitarsus*) damage. Lacy L. Hyche, Auburn University, [Bugwood.org](#)

Dusky birch sawfly (*Croesus latitarsus*) cocoon. Lacy L. Hyche, Auburn University, [Bugwood.org](#)

Dusky birch sawfly (*Croesus latitarsus*) larvae. Lacy L. Hyche, Auburn University, [Bugwood.org](#)

Eastern Blackheaded Budworm - *Acleris variana*

Eastern blackheaded budworm (*Acleris variana*) mature larva, on white spruce. Natural Resources Canada, Canadian Forest Service

Eastern blackheaded budworm (*Acleris variana*) damage on balsam fir.
Rick West, Canadian Forest Service, [Bugwood.org](#)

Eastern blackheaded budworm (*Acleris variana*) adult. Todd M. Gilligan and Marc E. Epstein, TortAI: Tortricids of Agricultural Importance, United States Department of Agriculture Animal and Plant Health Inspection Service Identification Technology Program, [Bugwood.org](#)

Eastern blackheaded budworm (*Acleris variana*) forewing patterns.
Todd M. Gilligan and Marc E. Epstein, TortAI: Tortricids of Agricultural Importance, United States Department of Agriculture Animal and Plant Health Inspection Service Identification Technology Program, [Bugwood.org](#)

Eastern Tent Caterpillar

- *Malacosoma americanum*

Eastern tent caterpillar (*Malacosoma americanum*) larva.
William M. Ciesla, Forest Health Management International, [Bugwood.org](#)

Eastern tent caterpillar (*Malacosoma americanum*) tent.
William M. Ciesla, Forest Health Management International, [Bugwood.org](#)

Eastern tent caterpillar (*Malacosoma americanum*) eggs.
Whitney Cranshaw, Colorado State University, [Bugwood.org](#)

Eastern tent caterpillar (*Malacosoma americanum*) adult.
Pennsylvania Department of Conservation and Natural Resources - Forestry Archive, [Bugwood.org](#)

Fall Cankerworm

- *Alsophila pometaria*

Fall cankerworm (*Alsophila pometaria*) larva. Joseph Berger, [Bugwood.org](#)

Fall cankerworm (*Alsophila pometaria*) damage. United States Department of Agriculture Forest Service - Ogden Archive, United States Department of Agriculture Forest Service, [Bugwood.org](#)

Fall cankerworm (*Alsophila pometaria*) adult. William M. Ciesla, Forest Health Management International, [Bugwood.org](#)

Fall cankerworm (*Alsophila pometaria*) larvae (dark form) on maple. E. Bradford Walker, Vermont Department of Forests, Parks and Recreation, [Bugwood.org](#)

Fall Webworm

- *Hyphantria cunea*

Fall webworm (*Hyphantria cunea*) larva. Natural Resources Canada, Canadian Forest Service

Fall webworm (*Hyphantria cunea*) damage. Lacy L. Hyche, Auburn University, [Bugwood.org](#)

Colony of fall webworm (*Hyphantria cunea*) larvae in web. Natural Resources Canada, Canadian Forest Service.

Fall webworm (*Hyphantria cunea*) adult. Gyorgy Csoka, Hungary Forest Research Institute, [Bugwood.org](#)

Forest Tent Caterpillar

- *Malacosoma disstria*

Forest tent caterpillar (*Malacosoma disstria*) larva. William M. Ciesla, Forest Health Management International, [Bugwood.org](#)

Forest tent caterpillar (*Malacosoma disstria*) damage. Minnesota Department of Natural Resources Archive, Minnesota Department of Natural Resources, [Bugwood.org](#)

Forest tent caterpillar (*Malacosoma disstria*) egg mass.
Steven Katovich, United States Department of Agriculture Forest Service Forest Service, [Bugwood.org](#)

Forest tent caterpillar (*Malacosoma disstria*) adult. Mark Dreiling, Retired, [Bugwood.org](#)

Gypsy Moth

- *Lymantria dispar*

Gypsy moth (*Lymantria dispar*) adult female. Natural Resources Canada, Canadian Forest Service

Gypsy moth (*Lymantria dispar*) damage on oak. Louis-Michel Nageleisen, Département de la Santé des Forêts, [Bugwood.org](#)

Gypsy moth (*Lymantria dispar*) larva. Natural Resources Canada, Canadian Forest Service

Gypsy moth (*Lymantria dispar*) adult male. Nova Scotia Department of Natural Resources Forest Protection

Hemlock Looper

- *Lambdina f. fiscellaria*

Hemlock looper (*Lambdina f. fiscellaria*) larva. Pennsylvania Department of Conservation and Natural Resources - Forestry Archive, [Bugwood.org](#)

Hemlock looper (*Lambdina f. fiscellaria*) damage - severely defoliated balsam firs. Natural Resources Canada, Canadian Forest Service

Hemlock looper (*Lambdina f. fiscellaria*) adult at rest.
Natural Resources Canada, Canadian Forest Service

Hemlock looper (*Lambdina f. fiscellaria*) dorsal and ventral views of pupa. Natural Resources Canada, Canadian Forest Service

Jack Pine Budworm

- *Choristoneura p. pinus*

Jack pine budworm (*Choristoneura p. pinus*) larva on male flower bearing jack pine shoot. Natural Resources Canada, Canadian Forest Service

Jack pine budworm (*Choristoneura p. pinus*) severe defoliation on jack pine tree.

Natural Resources Canada, Canadian Forest Service

Jack pine budworm (*Choristoneura p. pinus*) pupa in its natural position near its last larval molt. Natural Resources Canada, Canadian Forest Service

Jack pine budworm (*Choristoneura p. pinus*) adult. Nova Scotia Department of Natural Resources Forest Protection

Larch Casebearer

- *Coleophora laricella*

Larch casebearer (*Coleophora laricella*) larva inside of case. Natural Resources Canada, Canadian Forest Service

Larch casebearer (*Coleophora laricella*) damage. Nova Scotia Department of Natural Resources Forest Protection

Larch casebearer (*Coleophora laricella*) cases fastened to twig after needle drop in fall. Natural Resources Canada, Canadian Forest Service

Larch casebearer (*Coleophora laricella*) first case as it appears in June. Natural Resources Canada, Canadian Forest Service

Larch Sawfly

- *Pristiphora erichsonii*

Larch sawfly (*Pristiphora erichsonii*) mature larvae. Natural Resources Canada, Canadian Forest Service

Larch sawfly (*Pristiphora erichsonii*) damage - partially defoliated larch stand.

Natural Resources Canada, Canadian Forest Service

Larch sawfly (*Pristiphora erichsonii*) damage - new larch shoot curled into a question mark following wounds inflicted by adult during egg laying. Natural Resources Canada, Canadian Forest Service

Larch sawfly (*Pristiphora erichsonii*) adult female. Natural Resources Canada, Canadian Forest Service

Leafrollers and Leaftiers

- Tortricidae

Birch leafroller (*Epinotia solandriana*) adult. Natural Resources Canada, Canadian Forest Service

Leafroller damage – larva wrapped up in leaf. Nova Scotia Department of Natural Resources Forest Protection

Birch leafroller (*Epinotia solandriana*) damage. Nova Scotia Department of Natural Resources Forest Protection

Birch leafroller (*Epinotia solandriana*) larva. Natural Resources Canada, Canadian Forest Service

Maple Trumpet Skeletonizer

- *Epinotia aceriella*

Maple trumpet skeletonizer (*Epinotia aceriella*) damage.

Maple trumpet skeletonizer (*Epinotia aceriella*) damage trumpetlike tubes of frass and silk. E. Bradford Walker, Vermont Department of Forests, Parks and Recreation, [Bugwood.org](#)

Maple trumpet skeletonizer (*Epinotia aceriella*) larva. Agriculture and Agri-Food Canada

Maple trumpet skeletonizer (*Epinotia aceriella*) adult. John Lee, Scarborough, Ontario, Canada

Mountain Ash Sawfly

- *Pristiphora geniculata*

Mountain ash sawfly (*Pristiphora geniculata*) larvae. E. Bradford Walker, Vermont Department of Forests, Parks and Recreation, [Bugwood.org](#)

Mountain ash sawfly (*Pristiphora geniculata*) damage and larvae. Joseph O'Brien, United States Department of Agriculture Forest Service, [Bugwood.org](#)

Mountain ash sawfly (*Pristiphora geniculata*) eggs.

L.J. Lipovsky, Maine Forest Service, [Bugwood.org](#)

Mountain ash sawfly (*Pristiphora geniculata*) adult. James Lindsey, [Bugwood.org](#)

Northern Pinkstriped Oakworm

- *Anisota v. virginiensis*

Northern pinkstriped oakworm (*Anisota v. virginiensis*) larva. Aaron Goodwin, Bartlesville, Oklahoma.

<http://creativecommons.org/licenses/by-nd-nc/1.0/>

Northern pinkstriped oakworm (*Anisota v. virginiensis*) larvae. Jo Ann Poe-McGavin, Jim Thorpe, Pennsylvania

Northern pinkstriped oakworm (*Anisota v. virginiensis*) larva. Lynette Schimming, Thompson Falls, Montana. <http://creativecommons.org/licenses/by-nd-nc/1.0/>

Northern pinkstriped oakworm (*Anisota v. virginiensis*) adult. Siobhan Basile, Epping, New Hampshire

Oak Leafshredder

- *Croesia semipurpurana*

Oak leafshredder (*Croesia semipurpurana*) larvae. Natural Resources Canada, Canadian Forest Service

Oak leafshredder (*Croesia semipurpurana*) damage. Natural Resources Canada, Canadian Forest Service

Oak leafshredder (*Croesia semipurpurana*) adult. James B. Hanson, United States Department of Agriculture Forest Service, [Bugwood.org](#)

Oak leafshredder (*Croesia semipurpurana*) pupa out of its silk cocoon. Natural Resources Canada, Canadian Forest Service

Pale Winged Grey

- *Iridopsis ephyraria*

Pale winged grey (*Iridopsis ephyraria*) larva. Agriculture and Agri-Food Canada

Pale winged grey (*Iridopsis ephyraria*) damage. Nova Scotia Department of Natural Resources Forest Protection

Pale winged grey (*Iridopsis ephyraria*) egg. Nova Scotia Department of Natural Resources Forest Protection

Pale winged grey (*Iridopsis ephyraria*) adult. Nova Scotia Department of Natural Resources Forest Protection

Rusty Tussock Moth*- Orygia antiqua*

Rusty tussock moth (*Orygia antiqua*) larva. Jerald E. Dewey, United States Department of Agriculture Forest Service, [Bugwood.org](#)

Rusty tussock moth (*Orygia antiqua*) damage. Evgeny Akulov, Russian Research Institute of Plant Quarantine, [Bugwood.org](#)

Rusty tussock moth (*Orygia antiqua*) larva. Connecticut Agricultural Experiment Station Archive, Connecticut Agricultural Experiment Station, [Bugwood.org](#)

Rusty tussock moth (*Orygia antiqua*) adult male. United States Department of Agriculture Forest Service, Northern and Intermountain Region Archive, United States Department of Agriculture Forest Service, [Bugwood.org](#)

Satin Moth*- Leucoma salicis*

Satin moth (*Leucoma salicis*) side view of adult at rest. Natural Resources Canada, Canadian Forest Service

Satin moth (*Leucoma salicis*) damaged leaves. Jan Liska, Forestry and Game Management Research Institute, [Bugwood.org](#)

Satin moth (*Leucoma salicis*) adult and open chrysalis. Natural Resources Canada, Canadian Forest Service

Satin moth (*Leucoma salicis*) larva. Natural Resources Canada, Canadian Forest Service

Spruce Budworm*- Choristoneura fumiferana*

Spruce budworm (*Choristoneura fumiferana*) larva. Natural Resources Canada, Canadian Forest Service

Spruce budworm (*Choristoneura fumiferana*) damage on spruce. Joseph O'Brien, United States Department of Agriculture Forest Service, [Bugwood.org](#)

Spruce budworm (*Choristoneura fumiferana*) adults. K.B. Jamieson, Canadian Forest Service, [Bugwood.org](#)

Spruce budworm (*Choristoneura fumiferana*) damage. Nova Scotia Department of Natural Resources Forest Protection

Spruce Webspinning Sawfly*- Cephalcia fascipennis*

Spruce webspinning sawfly (*Cephalcia fascipennis*) larva. Natural Resources Canada, Canadian Forest Service

Spruce webspinning sawfly (*Cephalcia fascipennis*) damage. Nova Scotia Department of Natural Resources Forest Protection

Spruce webspinning sawfly (*Cephalcia fascipennis*) larva. Natural Resources Canada, Canadian Forest Service

Spruce webspinning sawfly (*Cephalcia fascipennis*) larva. Natural Resources Canada, Canadian Forest Service

White Pine Sawfly*- Neodiprion pinetum*

White pine sawfly (*Neodiprion pinetum*) larva. James B. Hanson, United States Department of Agriculture Forest Service, [Bugwood.org](#)

White pine sawfly (*Neodiprion pinetum*) larva. E. Bradford Walker, Vermont Department of Forests, Parks and Recreation, [Bugwood.org](#)

White pine sawfly (*Neodiprion pinetum*) adult. United States Department of Agriculture Forest Service - Region 8 - Southern Archive, United States Department of Agriculture Forest Service, [Bugwood.org](#)

White pine sawfly (*Neodiprion pinetum*) larvae. Allison Kanoti, Maine Forest Service, Forest Health and Monitoring, Augusta, Maine

Whitemarked Tussock Moth*- Orygia leucostigma*

Whitemarked tussock moth (*Orygia leucostigma*) adult male. James Solomon, United States Department of Agriculture Forest Service, [Bugwood.org](#)

Whitemarked tussock moth (*Orygia leucostigma*) larva. Daniel Herms, The Ohio State University, [Bugwood.org](#)

Whitemarked tussock moth (*Orygia leucostigma*) cocoon. Nova Scotia Department of Natural Resources Forest Protection

Whitemarked tussock moth (*Orygia leucostigma*) adult female with egg mass. John L. Foltz, University of Florida, [Bugwood.org](#)

Willow Flea Weevil*- Isochnus rufipes*

Willow flea weevil (*Isochnus rufipes*) adult. Nova Scotia Department of Natural Resources Forest Protection

Willow flea weevil (*Isochnus rufipes*) damage. Nova Scotia Department of Natural Resources Forest Protection

Willow flea weevil (*Isochnus rufipes*) larva and damage. Claude Gélinas, PHYTO Ressources Inc., Québec

Balsam Gall Midge*- Paradiplosis tumifex*

Balsam gall midge (*Paradiplosis tumifex*) adults. Scott McEwan, Nova Scotia Department of Natural Resources

Balsam gall midge (*Paradiplosis tumifex*) damage. Nova Scotia Department of Natural Resources Forest Protection

Balsam gall midge (*Paradiplosis tumifex*) galled balsam fir needles summer above and fall below. Natural Resources Canada, Canadian Forest Service

Balsam gall midge (*Paradiplosis tumifex*) adult laying eggs on newly-emerging needles. Ronald S. Kelley, Vermont Department of Forests, Parks and Recreation, [Bugwood.org](#)

Spruce Gall Adelgids*- Adelges spp. and Pinus spp.*

Eastern spruce gall adelgid (*Adelges abietis*) winged adults. Stanislaw Kinelski, [Bugwood.org](#)

Ragged spruce gall adelgid (*Pineus similis*) damage on red spruce. Ronald S. Kelley, Vermont Department of Forests, Parks and Recreation, [Bugwood.org](#)

Eastern spruce gall adelgid (*Adelges abietis*) old gall in its natural state. Natural Resources Canada, Canadian Forest Service

Pine leaf adelgid (*Pineus pinifoliae*) old gall on a spruce host, after adelgid emergence.

Whitney Cranshaw, Colorado State University, [Bugwood.org](#)

Aphids**- Aphididae**

Aphids on a conifer tree. Nova Scotia Department of Natural Resources Forest Protection

Aphids on False Sunflower (*Helianthopsis helianthoides*). Ilona Loser, Cross Plains, Wisconsin. <http://creativecommons.org/licenses/by-nd-nc/1.0/>

Aphids on a conifer tree. Nova Scotia Department of Natural Resources Forest Protection

Female winged adult. Natural Resources Canada, Canadian Forest Service

Balsam Twig Aphid**- *Mindarus abietinus***

Balsam twig aphid (*Mindarus abietinus*) adult. Natural Resources Canada, Canadian Forest Service

Balsam twig aphid (*Mindarus abietinus*) shoot infested by a colony of aphids and honeydew secretion. Natural Resources Canada, Canadian Forest Service

Balsam twig aphid (*Mindarus abietinus*) damage. Nova Scotia Department of Natural Resources Forest Protection

Balsam twig aphid (*Mindarus abietinus*) characteristic damage of annual shoot attack. Natural Resources Canada, Canadian Forest Service

Balsam Woolly Adelgid**- *Adelges piceae***

Balsam woolly adelgid (*Adelges piceae*) adults. North Carolina Forest Service Archive, [Bugwood.org](#)

Balsam woolly adelgid (*Adelges piceae*) damage. Nova Scotia Department of Natural Resources Forest Protection

Balsam woolly adelgid (*Adelges piceae*) nymph. United States Department of Agriculture Forest Service - Asheville Archive, United States Department of Agriculture Forest Service, [Bugwood.org](#)

Beech Scale**- *Cryptococcus fagisuga***

Beech scale (*Cryptococcus fagisuga*) adults. Chris Malumphy, The Food and Environment Research Agency, [Bugwood.org](#)

Beech bark disease damage. Feeding by the beech scale (*Cryptococcus fagisuga*) creates wounds in the bark through which the fungus can enter the tree causing cankers to form. Nova Scotia Department of Natural Resources Forest Protection

Fruiting bodies of the fungus that causes beech bark disease. Natural Resources Canada, Canadian Forest Service

Beech scale (*Cryptococcus fagisuga*) in bark crevice. Natural Resources Canada, Canadian Forest Service

Woolly Alder Aphid**- *Prociphilus tessellatus***

Woolly alder aphids (*Prociphilus tessellatus*). Nova Scotia Department of Natural Resources Forest Protection

Woolly alder aphids (*Prociphilus tessellatus*). Jim Baker, North Carolina State University, [Bugwood.org](#)

Woolly alder aphids (*Prociphilus tessellatus*). Jim Baker, North Carolina State University, [Bugwood.org](#)

Woolly alder aphids (*Prociphilus tessellatus*). William M. Ciesla, Forest Health Management International, [Bugwood.org](#)

Balsam Shootboring Sawfly**- *Pleroneura brunneicornis***

Balsam shootboring sawfly (*Pleroneura brunneicornis*) adult on balsam fir. Ronald S. Kelley, Vermont Department of Forests, Parks and Recreation, [Bugwood.org](#)

Balsam shootboring sawfly (*Pleroneura brunneicornis*) damage. Trish Hanson, Vermont Forestry Division, [Bugwood.org](#)

Balsam shootboring sawfly (*Pleroneura brunneicornis*) view from above of the larva on damaged annual shoot. Natural Resources Canada, Canadian Forest Service

Balsam shootboring sawfly (*Pleroneura brunneicornis*) mature larva. Natural Resources Canada, Canadian Forest Service

Seedling Debarking Weevil**- *Hylobius congener***

Seedling debarking weevil (*Hylobius congener*) adult. Christopher Adam, Fredericton, New Brunswick, Canada

Seedling debarking weevil (*Hylobius congener*) damage. Nova Scotia Department of Natural Resources Forest Protection

Seedling debarking weevil (*Hylobius congener*) adult and damage. Nova Scotia Department of Natural Resources Forest Protection

White Pine Weevil**- *Pissodes strobi***

White pine weevil (*Pissodes strobi*) adult. Natural Resources Canada, Canadian Forest Service

White pine weevil (*Pissodes strobi*) damage. Nova Scotia Department of Natural Resources Forest Protection

White pine weevil (*Pissodes strobi*) eggs in their natural position into a terminal shoot. Natural Resources Canada, Canadian Forest Service

White pine weevil (*Pissodes strobi*) adult near the exit hole of its chamber. Natural Resources Canada, Canadian Forest Service

Asian Longhorned Beetle**- *Anoplophora glabripennis***

Asian longhorned beetle (*Anoplophora glabripennis*) adult. Michael Bohne, [Bugwood.org](#)

Asian longhorned beetle (*Anoplophora glabripennis*) damage – exit hole. Dan Herms, The Ohio State University, [Bugwood.org](#)

Asian longhorned beetle (*Anoplophora glabripennis*) larva. Thomas B. Denholm, New Jersey Department of Agriculture, [Bugwood.org](#)

Emerald Ash Borer**- *Agrilus planipennis***

Emerald ash borer (*Agrilus planipennis*) adult. Natural Resources Canada, Canadian Forest Service

Epicormic shoots, or suckers, are a typical sign that a tree is under stress. Ash trees will send out these epicormic shoots when under stress from an emerald ash borer (*Agrilus planipennis*) infestation. Nova Scotia Department of Natural Resources Forest Protection

Emerald ash borer (*Agrilus planipennis*) larva. Natural Resources Canada, Canadian Forest Service

Emerald ash borer (*Agrilus planipennis*) adult. Natural Resources Canada, Canadian Forest Service

Hemlock Woolly Adelgid

- *Adelges tsugae*

Hemlock woolly adelgid (*Adelges tsugae*) egg sacs on hemlock.
United States Department of Agriculture Forest Service Southern
Research Station Archive, United States, Department of Agriculture
Forest Service, Southern Research Station, [Bugwood.org](#)

Hemlock woolly adelgid (*Adelges tsugae*) adults. Ashley Lamb, Virginia
Polytechnic Institute and State University, [Bugwood.org](#)



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