



Environment
Canada

COMMON FOREST INSECTS



Canadian Forestry Service
Great Lakes Forest Research Centre
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COMMON FOREST INSECTS
OF THIS AREA

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FOREWORD

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This booklet and the accompanying display of Common Forest Insects is a project of Environment Canada. They have been prepared and distributed by the Insect and Disease Survey Unit in cooperation with the Ontario Ministry of Natural Resources. It is hoped that provincial foresters will find the displays useful as an aid to identification and the booklets a ready source of biological information on each of the pests displayed.

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INTRODUCTION

The important or common insect species selected for the accompanying display are numbered and generally arranged in order of seasonal occurrence from left to right. The circled numbers relate to pages in the accompanying booklet wherein appear biological notes on life history, habits and importance.

Since only the more common members of the vast number of insects that feed on trees and shrubs can be displayed here, identification and information on less common insects may be obtained from the Forest Insect and Disease Survey Unit.

The authors of this booklet wish to acknowledge the assistance of Survey field and laboratory staff, who provided and prepared material for the displays, and of the Graphics Unit for photography.

LARCH CASEBEARER

The larch casebearer, Coleophora laricella (Hübner), an introduced pest, feeds on all species of larch and is found throughout Ontario except in the northwestern corner. Defoliation is sometimes severe in recently invaded stands but rarely so in other areas. There is little permanent damage to trees since outbreaks of the casebearer are usually of short duration and trees usually refoliate after the early spring defoliation.

This pest overwinters as a larva inside a tiny case fastened to a twig, usually near the base of a bud. In early spring the larvae mine new needles, causing them to take on a bleached appearance. Larvae later become pupae inside their cases and the tiny moths emerge during June. The eggs, which are laid singly on needles, hatch in about 2 weeks. Damage caused by the tiny larvae in summer and fall is inconspicuous.

If chemical control is required, an insecticide with some systemic action should be used because the insect is protected in its case.

CANKERWORMS

There are two kinds of cankerworms, designated as "spring" and "fall" because of the different seasons when moths emerge. The fall cankerworm, Alsophila pometaria Harris, the more common species, is found in southern and northwestern Ontario, whereas the spring cankerworm, Paleacrita vernata (Peck), is found only in the south. Both species feed on broad-leaves trees, particularly Manitoba maple, apple and elm. Although defoliation is often severe the trees usually replace their leaves and little injury results.

Both cankerworms feed in May and June, initially skeletonizing and later consuming entire leaves except for the major veins. The full-grown larvae drop to the ground. The fall cankerworm spins a cocoon and becomes a moth in the fall and the wingless female lays her eggs in clusters on twigs and branches. Winter is spent in the egg stage. On the other hand, the spring cankerworm overwinters as a larva in earthen cells and becomes a moth in early spring. The wingless female of this species lays her eggs in the rough bark of the trunk and branches.

Control measures have not been necessary in forest stands. Shade trees may be banded with sticky material to prevent the females from climbing the trees to lay eggs.

AMERICAN ASPEN BEETLE

The American aspen beetle, Gonioctena americana Schaeffer, is a common leaf feeder on trembling aspen in Ontario. It is usually found on young, open-growing trees or on the lower branches of larger ones.

Overwintered adults appear on the foliage in late May and deposit fully formed embryos that become young larvae in a matter of minutes. The larvae initially feed in groups on the lower surface of the leaf but later they disperse and become solitary feeders. When full grown they are 6-10 mm long and black in color. They change to pupae on the ground about the end of June. The variously spotted, orange-brown-to-black adult beetles emerge about mid-July and feed for a short period before returning to the ground to overwinter.

Although control measures are usually not required a contact or stomach insecticide should be effective.

BALSAM SHOOT BORING SAWFLY

Although the balsam shoot boring sawfly, Pleroneura borealis Felt, occurs commonly on balsam fir east and south of Lake Superior, it has not been recorded as a serious pest. Because shoots mined by the larvae wilt and turn rusty red, the damage resembles that caused by frost. Feeding injury tends to occur every other year in any one locality.

Adults lay their eggs in the expanding buds, usually in the latter part of May. The larva bores into the bud tip and tunnels toward the base of the expanding shoot. Having completed its feeding in late June or early July, it drops to the ground and spins a cocoon in an earthen cell where it apparently spends two winters before emerging as an adult.

Trees are usually not seriously damaged and control measures have not been necessary.

EUROPEAN PINE SHOOT MOTH

The European pine shoot moth, Rhyacionia buoliana Schifferrmüller, was introduced into Ontario in 1925 and is now common south of a line joining Manitoulin Island and Kingston. In this area trees are often deformed by continued bud and shoot killing. North of the line high populations do not persist because low winter temperatures kill the larvae above snow level. All species of pine are attacked but red and Scots pine are favored hosts.

The larvae overwinter mainly in excavated buds. In spring they move to feed in other buds or shoots and it is at this time that damage becomes most noticeable. The pupa is formed within the damaged bud or shoot during June, and the moths lay their eggs on current foliage or buds during June and July. A few needles are killed by the feeding of the tiny larvae before they bore into the buds to overwinter.

Despite the many parasites and predators which attack the shoot moth, some chemical control measures may be necessary to protect red pine. However, control is difficult, and specialists should be consulted. On the other hand, pruning Scots pine for Christmas trees keeps populations low on that species.

POPLAR-BIRCH LEAF ROLLER ✓

Although the poplar-birch leaf roller, Epinotia solandriana Linnaeus, is found throughout the Province, severe infestations have been sporadic and restricted to relatively small areas. The preferred host trees are white birch and trembling aspen. The moths fly from mid-July to mid-August; eggs are laid singly on the bark of twigs and small branches, where they overwinter and hatch in early spring. The young larvae feed in swollen buds and later construct leaf rolls. Feeding is completed during the latter half of June when the larvae drop and change to pupae in the soil, completing the life cycle. There are many species of leaf rollers, particularly on aspen, and identification is best left to the specialist.

Control measures are not usually required for this species. On ornamentals, however, leaf rolls can be picked and destroyed in early June when the larvae are still inside.

FOREST TENT CATERPILLAR

Outbreaks of the forest tent caterpillar, Malacosoma disstria Hübner, have occurred at roughly 10-year intervals. The larvae feed mainly on trembling aspen but also on sugar maple and other deciduous trees. Although defoliation rarely causes tree mortality, diameter growth in the tree is greatly reduced. When populations are high migrating larvae become a real nuisance.

Eggs are laid in bands on small twigs, where they overwinter. After hatching in early spring the young larvae feed first on the expanding buds. Later they feed openly on the foliage in large groups but, despite their name, do not form a tent. Towards the end of their feeding period they wander from their original host tree. Beginning about mid-June, the larvae spin loose, silken cocoons in the foliage of any convenient tree or shrub and there change to pupae. The moths emerge in about 10 days.

In the forest, outbreaks usually subside as a result of starvation, parasitism, disease, and/or unfavorable weather. For control on shade trees, the unhatched egg clusters should be removed, or a contact or stomach poison should be applied to the young larvae in early spring.

EASTERN TENT CATERPILLAR

The eastern tent caterpillar, Malacosoma americanum (Fabricius), is a common defoliator of pin and choke cherry, mainly south of a line drawn between Sault Ste. Marie and Mattawa.

The overwintered egg clusters hatch in early spring as the cherry leaves are unfolding. The gregarious larvae construct a silken tent in a branch fork from which they feed on nearby foliage. When feeding is completed they leave the tent and disperse to spin whitish silken cocoons on the bark of trees or ground cover, or on buildings and fences. The pupae are formed in the cocoons and the adults soon emerge to lay their eggs in masses partially encircling small stems or branches.

On ornamentals the tents with larvae should be pruned and destroyed as early as possible. If chemical control is required a contact or stomach insecticide would be appropriate.

EUROPEAN PINE SAWFLY

The European pine sawfly, Neodiprion sertifer (Geoffroy), since its discovery at Windsor in 1939, has spread across southern Ontario south of a line between Midland and Kingston. In recent years it has been found on Manitoulin Island and in the cities of Sault Ste. Marie and Ottawa. Its eventual spread throughout Ontario appears inevitable because of the movement of vast quantities of pine nursery stock. This insect is a serious pest in Scots pine Christmas tree plantations, but red pine may also be attacked.

The sawfly overwinters in the egg stage in needles and the larvae feed together on the older needles from early spring to about mid-July. When feeding is completed the larvae drop to the ground and spin tough, golden-brown cocoons in which they change to pupae. The adults emerge in September and October and lay their eggs in the needles of host trees.

A virus disease that often occurs naturally in populations of this sawfly has been successfully propagated and applied as a selective insecticide. Should chemical control be necessary, a contact or stomach poison should be applied against the larvae in early spring.

JACK PINE SAWFLIES

Two very closely related species of sawflies occur on jack pine in Ontario. Species A, Neodiprion pratti banksianae Rohwer, which is widespread in Ontario, has a history of sporadic local infestations, especially in open-grown stands. Where infestations persist, as on islands, tree mortality may occur. Species B, Neodiprion pratti paradoxicus Ross, is a serious pest of jack pine in southeastern Ontario and some tree mortality has occurred there in persistent infestations.

Both sawflies overwinter in the egg stage and the colonies of larvae feed on the previous year's needles from mid-May to early July in the south and to early August in the north. When feeding is completed the larvae drop to the ground and spin cocoons in the soil. Adults emerge in the fall and lay their eggs in the needles.

Chemical control measures have not been necessary in the forest; however, threatened high-value trees could be treated with a stomach or contact insecticide.

RED-PINE SAWFLY

The red-pine sawfly, Neodiprion nanulus nanulus Schedl, occurs commonly across Ontario except in the south. The larvae feed on the needles of red and jack pine, periodically causing severe defoliation in localized areas.

Winter is spent in the egg stage. Hatching occurs in the spring and the larvae feed gregariously on the older needles from late May to early August. The full-grown larvae drop to the ground and spin cocoons in the litter. The adults emerge in the fall and deposit their eggs in slits cut near the tips of the current year's needles.

Infestations of this sawfly have been of short duration because of natural control agents; consequently, no large-scale chemical control measures have been required. However, on shade or specimen trees colonies of larvae could be handpicked or killed with a stomach or contact insecticide.

CEDAR LEAF MINERS

The cedar leaf miners are common pests of cedar but damage is most prevalent in southern Ontario. The species involved are Argyresthia thuiella (Packard), A. aureoargentella Brower, A. canadensis Freeman and Pulicalvaria thujaella (Kearfott). It is not uncommon to find all four species at a single location.

The larvae overwinter in leaf mines. In spring A. aureoargentella and A. canadensis change to pupae in silken cocoons on the foliage, while the other two species change to pupae in the larval mines. Moths of the Argyresthia species emerge from late May to early July while the Pulicalvaria moths emerge from late June to early August.

Control of these pests is difficult since they are concealed feeders. However, a systemic insecticide applied in May or in mid-August should control all four species. On ornamental species, prune and destroy infested tips before June.

SPRUCE BUDWORM

The spruce budworm, Choristoneura fumiferana (Clemens), is the most important pest of spruce and balsam fir in Ontario. Severe, widespread outbreaks have occurred periodically in many parts of the Province. Defoliation of balsam fir over a 3-5-year period usually results in tree mortality but white spruce is less often killed and black spruce is rarely injured severely.

Moths deposit their eggs in masses on the undersides of needles in late June or July. The eggs hatch in about 10 days and the tiny larvae soon spin silken shelters in various niches on the tree where they overwinter. In early spring they mine into the old needles, unopened buds or flowers. As the new shoots expand the larvae spin loose webs about them and feed on the new foliage. They will also feed on old foliage if necessary. When mature in June or July, they change to pupae at the feeding site or on lower branches.

Information on large-scale control of the spruce budworm is available from the Canadian Forestry Service. On specimen trees a contact or stomach insecticide, recommended for defoliators, should be used.

LARGE ASPEN TORTRIX

Periodic outbreaks of the large aspen tortrix, Choristoneura conflictana (Walker), have caused severe defoliation of trembling aspen over vast areas. Outbreaks are usually of 2-3 years' duration and in-between damage is seldom seen.

The early-stage larvae overwinter at or near the base of host trees and in early spring they ascend the trees to mine the swelling buds. Later the dark-green-to-blackish larvae may be found in tied leaves or leaf rolls until about mid-July. The black pupae are usually found between two leaves tied loosely together. Moths are in flight from late June to early August and lay their eggs in flat clusters on the upper leaf surface. On hatching the young larvae feed for awhile and then move to hibernation sites at the base of trees sometime in August, overwintering there in bark crevices or under moss.

If control measures are necessary a spray recommended for defoliators should be applied in late May or early June.

WESTERN TENT CATERPILLAR ✓

The western tent caterpillar, Malacosoma californicum pluviale (Dyar), occurs across Ontario north of Lake Huron. Pin cherry foliage is its favorite food but the larval tents also occur on other cherries, willow, white birch, etc. However, no serious defoliation of forest trees has occurred.

The larvae and their silken tents are found from late May to mid-July. Silken cocoons that contain the pupae are spun on various types of vegetation, often some distance from the tent. The moths fly in late July and August and lay eggs in masses on the stems of host shrubs or trees. Winter is spent in the egg stage.

On ornamental shrubs the tents and larval inhabitants should be pruned and destroyed in early spring.

JACK-PINE TIP BEETLE

The jack-pine tip beetle, Conophthorus banksianae McPherson, feeds primarily on jack pine and occasionally on Scots and red pine, mainly in northern Ontario. Occasionally it becomes very abundant in localized areas but its damage is not a serious threat to pine.

In May the adults, which vary in color from red to black and are about 2.5 mm long, bore into tips of jack pine to feed; their entrance hole is characteristically pitch encrusted. In early June, egg tunnels constructed by the female cause the new growth to wilt and die. The tiny larvae, usually two or three per tip, extend the egg tunnels into the current year's growth. The parent beetles can produce two broods each summer if conditions are favorable. In the fall the adults bore into and girdle shoots near the base of the bud and later mine the bud. The mined shoot tips are very fragile and are soon broken off by the wind. The beetles overwinter on the ground inside the fallen tips.

No chemical control measures are known for this pest.

OAK LEAF SHREDDER

The oak leaf shredder, Croesia semipurpurana (Kearfott), appears in large numbers in Ontario every year in some part of the main range of red oak, its primary food plant. Although tree mortality resulting from repeated defoliation is reported elsewhere, such damage is unknown here.

The eggs overwinter on the trees and hatch about mid-May. The young larvae bore into the buds and later tunnel through the developing leaves, giving them a shredded, tattered appearance. When feeding is completed the larvae change to pupae among dead leaves on the ground or occasionally on lower foliage of oak or other species. The moths fly in late June and July. The eggs are laid in roughened portions of the branches where they overwinter.

No extensive control programs have been carried out to date. Infested specimen trees could probably be protected from severe defoliation by applying a stomach insecticide as the buds are opening.

PITCH NODULE MAKER

The pitch nodule maker, Petrova albicapitana (Busck), occurs throughout the range of its primary host, jack pine, and is occasionally found on other pine. It is sometimes abundant in local areas and its feeding in the cambial region can result in deformed trees.

Two years are required to complete its life cycle. The moths fly and lay their eggs on the new shoots from late May to July. First-year nodules are small and seldom noticed. In the spring of the second year the larvae move to the stem, form their final nodules at a crotch and spend the second winter there. The following spring, when full grown, they change to pupae in the pitch shelters and the moths emerge shortly afterward.

Since chemical control of the pitch nodule maker is difficult, no large-scale measures have been undertaken. On high-value trees the nodules can be handpicked and destroyed.

JACK PINE BUDWORM

The jack pine budworm, Choristoneura pinus pinus Freeman, is a major pest of jack pine which has caused widespread tree mortality in northwestern and central Ontario. Red and white pine may also be damaged and heavy feeding has been reported in Scots pine Christmas tree plantations where any loss of foliage is serious.

The tiny budworm overwinters mainly under bark scales and in the spring feed on male flowers or on developing foliage of the new shoot. Later the larvae feed under loose, silken webs spun around the flowers or needles where they change to pupae. The moths emerge in July or early August and, after mating, deposit eggs on the needles in clusters of about 40. Hatching occurs in about 2 weeks and the tiny larvae, without feeding, spin their silken overwintering shelters.

Information on large-scale control programs is available from the Canadian Forestry Service. In Scots pine plantations, a contact or stomach poison applied when the pollen is being shed would reduce foliage loss to a minimum.

UGLY-NEST CATERPILLAR

The ugly-nest caterpillar, Archips cerasivoranus Fitch, constructs the dense, silken webs that are frequently seen on cherry bushes along roadsides, in abandoned fields or in clearings throughout Ontario. It prefers to feed on chokecherry, but when populations are high it will feed on other plants as well.

This insect overwinters in the egg stage and the larvae begin to emerge in the second half of May. Because of their long emergence period larvae may be found throughout the summer but most are present in July. Pupae are formed in the nests and the adults are in flight beginning in midsummer. After mating, the female lays her eggs in poorly formed bands on small stems of chokecherry close to the ground.

No large-scale control measures have been used against this pest, and because outbreaks are of short duration few shrubs are killed. Destruction of the small tents with their larvae early in the season would be an effective means of control.

BALSAM-FIR SAWFLY

The balsam-fir sawfly, Neodiprion abietis complex, is a serious periodic defoliator of balsam fir and spruce throughout Ontario, and in conjunction with the spruce budworm has occasionally caused considerable tree mortality.

The larvae feed in colonies on the old foliage from June to August and when they are full grown they drop to the ground and spin cocoons in the soil. The adult sawflies emerge from July to September and the females cut slits in the edge of needles where they lay the overwintering eggs. Some cocooned larvae, however, do not develop into adults the same year but overwinter in the cocoons and emerge as adults the following year.

Any stomach or contact insecticide will control this pest.

SPINY ELM CATERPILLAR

The spiny elm caterpillar, Nymphalis antiopa Linnaeus, is found throughout Ontario. It feeds mainly on willow, poplar and elm and is often injurious to shade and ornamental trees.

The adult, also known as the mourning cloak butterfly, overwinters and in the spring lays eggs in clusters around small twigs. The dark, spiny caterpillars feed gregariously on the foliage from June to early September. Towards the end of their feeding they disperse and form chrysalids on fences, buildings or trees. Shortly thereafter the adults emerge from the chrysalids and the cycle is complete.

On small trees either the larvae can be handpicked or infested twigs can be pruned and destroyed. On larger trees a contact or stomach insecticide would be appropriate and should be applied when the larvae are small.

ASPEN LEAF TIER

The aspen leaf tier, Enargia decolor Walker, periodically defoliates trembling aspen over large areas of Ontario. However, infestations are usually of relatively short duration and no tree mortality is known. There is one generation each year.

The pale-green larvae may be found on the trees from May to late July, between two leaves tied together with silk. These larvae change to pupae in the ground litter under the trees. The moths fly from mid-July to mid-September and deposit the overwintering eggs in irregular masses on the ground.

A systemic or stomach insecticide should be effective against the young larvae.

PALES WEEVIL

In Ontario the pales weevil, Hylobius pales (Herbst), occurs mainly south and east of Lake Nipissing. Although this weevil breeds in pine stumps, the adult feeds on the bark of young pine branches causing discolored foliage and often branch mortality. This pest is particularly injurious in and around Christmas tree plantations where a continuous supply of new stump breeding material is usually available.

The pales weevil overwinters in both adult and larval stages. Eggs are laid in the roots or in the part of the stump below ground level. The larvae create tunnels under the bark as they feed down the root; having completed feeding they construct "chip cocoons" in which they change to pupae. There are two periods of heavy adult feeding: the first is by the overwintered adults from early spring to late June; the second is by the new adults after they emerge about mid-September.

To prevent injury to transplants, replanting of cutover lands should be delayed for 2 years after harvesting if breeding material cannot be destroyed or made unsuitable.

NORTHERN PINE WEEVIL

The northern pine weevil, Pissodes approximatus Hopkins, breeds throughout Ontario in recently dead or dying conifers, particularly pine, but appreciable damage has not been reported in natural stands. The annual crop of stumps in Christmas tree plantations forms ideal breeding sites and large populations develop. The resultant heavy feeding by the adults on the tender bark of living twigs and young trees may cause their death.

This weevil usually overwinters as an adult in the humus. On emerging in spring the adults feed on bark of young trees for a short while prior to egg laying. Larvae feed on the inner bark for about 5 weeks and change to pupae in shallow pits in the wood under a cover of fine wood chips. Adults emerge throughout the remainder of the summer and, after a short feeding period, enter the duff.

Removal and destruction of stumps and slash where annual cropping is occurring will prevent a population increase. After clear cutting, delaying replanting for 2 years will prevent damage to young trees.

MAPLE BLADDER-GALL MITE

The maple bladder-gall mite, Vasates quadripedes (Shimer), is a common persistent pest of soft maple, particularly silver and red maple. It seems to prefer fringe and ornamental trees. Damage appears to be more prevalent in the lower crown and although it may persist for a few years no permanent injury has been observed.

The mature mites overwinter in crevices in the bark along the stem and in the crown. As the buds open in spring the mites move to feed on the unfurling leaves, thereby stimulating the development of small, globular red galls on the upper leaf surface. Eggs are laid inside the galls where the young feed until they are mature. There may be several generations, with the peak population occurring in July. The mites leave the gall from July onward to seek overwintering sites.

Since no permanent injury appears to result from feeding by these mites and since populations fluctuate from year to year the need to apply insecticides is questionable. If control does become necessary application of a miticide would be appropriate.

PINE SPITTLEBUG

The pine spittlebug, Aphrophora parallela (Say) is a serious pest in Scots pine Christmas tree plantations in Ontario and is frequently abundant on other pines, balsam fir and spruce. Heavy feeding may cause twig, branch and tree mortality in the following year.

The eggs overwinter on the tips of twigs, and hatch in spring. The young pierce the bark to feed on the sap and soon cover themselves with a frothy mass of spittle made up of tiny air bubbles. From May to July the young move gradually inward on the branch, and when full grown in July they have usually reached the main stem, where many bugs may feed together under a large mass of spittle. When the young change to adults the spittle masses dry up but a black, sooty mould often develops at the feeding sites. The adults also feed on the tree's sap but do not form spittle.

In the forest, populations are often kept in check by a fungal disease. In plantations, however, control may be required and since the spittle masses give protection to the young, contact insecticide sprays must be applied with force.

SPRUCE GALLS

Six species of adelgids in the genera Adelges and Pineus commonly produce galls on spruce in Ontario. Galls are common on fringe trees in the forest but are of greatest concern on ornamental or shade trees because of the discolored, ragged appearance of twigs bearing the old, opened galls.

The adelgids that cause the galls are closely related to the aphids and have a complex life cycle that for most species includes pine or larch as an alternate host. The closed, early-season galls of three of the species are pineapple shaped; one other resembles a spruce cone, while the remaining two are compact but elongate. The young adelgids feed inside the galls in late spring and summer. When the galls open the adults move to new breeding sites on spruce, pine or larch depending on the species involved. Those that move to pine or larch do not form galls there but usually feed and develop for 1 year before moving back to spruce.

Control can be effected by hand pruning and destroying the galls in early summer before the adults emerge. If required, a systemic insecticide or one with some fumigant action should be used in early spring when the tiny insects are feeding at the base of buds.

EASTERN PINE SHOOT BORER

The eastern pine shoot borer, Eucosma gloriola Heinrich, feeds on all species of pine and appears to prefer shoots in the upper part of the tree. When the leader is killed and one of the lateral shoots becomes the new leader, a crooked stem results. This shoot borer has not been a problem in good natural stands but is often abundant in thinly stocked plantations or wherever a closed crown canopy does not occur.

Moths emerge from overwintering pupae in early spring. The egg site is not known but the young larvae bore into the pith and feed towards the base of the developing shoot. Towards the end of its feeding stage the larva reverses direction and widens the original tunnel. In July, when the larva is usually finished feeding, it cuts an exit hole, drops and changes to a pupa in the soil under the tree.

Chemical control measures against this pest have been relatively unsuccessful. Where feasible, hand pruning of damaged shoots while the larva is still present is perhaps the best means of control.

ASPEN BLOTCH MINER

The aspen blotch miner, Lithocolletis ontario Freeman, periodically damages trembling aspen throughout the Province. Leaf damage is most severe on trees less than 4 inches in diameter growing in partially shaded, open, or fringe situations.

Eggs are laid on the underside of the leaves in May or June. Upon hatching the larvae enter the leaf to feed singly in whitish, oval or round mines readily seen on the undersurface of the leaf. In heavy infestations the entire leaf may be mined. The larvae change to pupae in the mines in late July and August. It is believed that the adults, after emerging in August and early September, overwinter in bark crevices of large, nearby conifers.

Outbreaks are of short duration probably because parasites and competition for food by the larvae combine to reduce infestation numbers. Chemical control has not been attempted.

BALSAM POPLAR BLOTCH MINER

The balsam poplar blotch miner, Lithocolletis nipigon (Freeman), is widely distributed throughout the Province but severe leaf damage has occurred mainly in the Thunder Bay area. The insect apparently feeds only on balsam poplar.

The tiny larvae feed inside whitish blotch mines that become noticeable on the underside of the leaves about mid-July. They change to pupae in the mines in late July and August. The moths emerge in August and early September and probably overwinter in the rough bark of nearby conifers. They lay their eggs on the leaves in June of the following year.

To date chemical control has not been required for this leaf miner.

WHITE SPOTTED SAWYER

The white spotted sawyer, Monochamus scutellatus (Say), which usually breeds in spruce and fir is one of several sawyer beetles found in Ontario. The larvae tunnel through the wood and prevent the salvage of wind-thrown or fire-killed timber, or cause heavy losses in sawlogs left too long in the woods. When they are numerous the adults cause extensive injury by feeding on the bark of twigs and branches of living trees.

Eggs are laid in the bark in early summer in felled, dying or recently dead trees. The larvae tunnel through the bark and feed on the wood surface until cool weather arrives; then they cut oval-shaped tunnels deep into the wood. Feeding continues the following summer and the tunnel is extended almost to the wood surface, where a cell is constructed. The following spring the pupa is formed and a short while later the adult cuts a circular exit hole.

When borers are detected in shade trees it is usually too late for control measures. If the occurrence of large amounts of breeding material cannot be prevented the advice of control specialists should be sought.

WHITE PINE WEEVIL

Damage by the white pine weevil, Pissodes strobi (Peck), is widespread every year in Ontario and malformed trees in numerous white pine plantations are mute evidence of recurring attacks by this pest. Although all species of pine and most species of spruce are attacked, white pine appears to be preferred.

The overwintered adults emerge from the ground soon after the snow has melted and, after a period of feeding in the leading terminals, they mate and lay their eggs in the leaders of host trees. The larvae feed downward in a ring-like formation, soon girdling the stem. As a result the developing leading whorl withers and turns brown. The larvae change to pupae in the pith and the adults emerge in late summer.

This pest can be controlled by applying insecticides to the leaders in early spring during the adult feeding period, or removing and destroying currently infested leaders to prevent population buildup, or growing trees under a broadleaved canopy which will prevent most damage.

LARCH SAWFLY

The larch sawfly, Pristiphora erichsonii (Hartig), occurs throughout most of the range of tamarack, its primary host. It is also a pest of planted exotic species of larch. Since they are deciduous, the larches do not die readily from the effects of defoliation but growth is greatly reduced and mortality will occur if severe defoliation persists for a number of years.

Since the adults emerge from overwintering cocoons from May to August there is much overlapping of the developmental stages, particularly during June and July. Eggs are laid in slits cut lengthwise along the shoot, causing it to curl as it matures. The larvae feed in groups on the twigs and, when full grown, drop to the ground and spin cocoons in the humus where they overwinter.

Populations of the larch sawfly are regulated by many natural factors including parasites, predators, microorganisms, and flooding of cocoon sites. A newly introduced parasite to Manitoba holds much promise for the control of the pest. If insecticide applications become necessary a stomach or contact type, applied during the larval stage, would be appropriate.

MOUNTAIN ASH SAWFLY

The mountain ash sawfly, Pristiphora geniculata (Hartig), was first recorded on this continent in New York State in 1926. It has since spread westward across Ontario to Thunder Bay and will no doubt continue to spread over the entire range of its host plant, mountain ash. Since even severe defoliation has not been known to kill trees this insect is mainly a nuisance where mountain ash is used as a shade or ornamental tree.

Two generations annually are common, except in the north where there is only one. The insect overwinters as a larva in a cocoon in the ground and changes to a pupa in the spring. The adult sawflies emerge from late May to early July and lay their eggs in slits cut around the edges of leaflets. The larvae feed in colonies but disperse towards the end of feeding and may be found on the trees from June to September.

On ornamentals while the larvae are still small and feeding in clusters the infested leaflets can be handpicked and destroyed. If an insecticide is required a stomach or contact poison would be appropriate.

BIRCH LEAF MINER

The birch leaf miner, Fenusa pusilla (Lepeletier), an introduced pest, has spread rapidly across Ontario, probably on nursery stock. It has become a common pest of birch, particularly ornamentals.

There are two or more generations of this miner each year. The first adults emerge from the soil from late May to early June and the female sawfly lays her eggs singly in the newly developed leaf. When the tiny larvae hatch they feed between the upper and lower surfaces of the leaves, causing discolored brown blotches or blisters that often coalesce. When the larva is full grown it drops from the mine and changes to a pupa in the soil. The adult soon emerges, and a generation is thus completed in about 5 or 6 weeks. When the later generations appear, young, tender leaves are relatively scarce and new mines will be found only in leaves on vigorous growth.

A systemic insecticide applied early in the spring against the first generation offers the best control for the birch leaf miner. However, reinfestation from other areas is a constant threat even to isolated ornamental trees and a second application of insecticide may be required.

GREEN-STRIPED MAPLEWORM

The green-striped mapleworm, Anisota rubicunda Fabricius occurs throughout the range of maple but is found more commonly on red than on sugar maple. Periodically it has caused widespread severe defoliation in a wedge-shaped band extending from Sault Ste. Marie in the west to Lake Temiskaming and Pembroke in the east.

The moths are present throughout June and early July. Eggs are laid in clusters on the undersurface of the leaf and the larvae emerge in about 10 days. The larvae feed in groups from June to October, but are most abundant in late July and early August. On completion of feeding, they drop to the ground, change to pupae in the humus, and overwinter.

Outbreaks are brought under control by a number of natural control factors that differ from place to place. Fungus and bacterial diseases, a number of parasite species, and bird and small rodent predators all take their toll of larvae and/or pupae. Large-scale chemical control measures have not been used to date.

YELLOW-NECKED CATERPILLAR

The yellow-necked caterpillar, Datana ministra (Drury), occurs across Ontario, feeding on the foliage of white birch, white elm, and occasionally on many other tree species, sometimes causing severe defoliation in local areas.

The moths fly in June and July and lay their eggs in masses of 100 or more on the undersides of leaves. The larvae feed in dense colonies near the ends of twigs and branches from early July to late September. When full grown they drop and change to pupae in the soil at depths of 2-4 inches and spend the winter there.

Colonies of larvae can be removed by pruning or can be handpicked and destroyed. On large trees colonies can be dusted or sprayed with a contact or stomach insecticide.

WALNUT CATERPILLAR

The walnut caterpillar, Datana integerrima Grote & Robinson, is a pest of black walnut, hickory and butternut where these hosts occur in southern Ontario. Infestations have often persisted for a number of years with tree mortality reported in some localized areas.

The moths fly in June and July, depositing eggs in masses on the undersides of leaves. The larvae are present from mid-July to mid-September and feed in colonies until almost full grown. They are often found in masses on the trunk or branches where they congregate to moult. When full grown they drop to the ground and change to pupae in the soil where they overwinter.

When control is necessary colonies of larvae can be picked by hand and destroyed or large trees can be sprayed with a contact or stomach insecticide.

EUROPEAN SPRUCE SAWFLY

The European spruce sawfly, Diprion hercyniae Hartig, was introduced to North America in 1922, and soon afterward was responsible for serious losses in the spruce forests of Gaspé and northern New Brunswick. Since the collapse of that outbreak, however, population levels have remained low and, although it has spread across Ontario, this sawfly has never caused appreciable defoliation here. The larvae will feed on all species of spruce but favor white spruce.

There are probably two overlapping generations of this insect each year since adults have been collected from mid-May through September. Eggs are laid in slits cut in needles and on hatching the larvae are solitary feeders on the older foliage from June to late fall. The insect overwinters in a cocoon on the ground.

Populations of this sawfly are apparently kept in check by diseases and parasites; hence, chemical control measures have not been necessary.

RED-HEADED PINE SAWFLY

The red-headed pine sawfly, Neodiprion lecontei (Fitch), is probably the most serious pest of red pine plantations in southern and central Ontario. Sporadic outbreaks occur every year, causing serious damage. Complete defoliation kills small trees while less severe injury retards growth and often kills defoliated branches. Although they prefer red pine, larvae also feed on jack, Scots and other pines.

Adults emerge from overwintered cocoons and lay their eggs in the needles, mainly in June and July. Larvae feed in colonies from July to early October and show a preference for needles of the previous year's growth, but when populations are high they will consume all needles. The full-grown larvae drop to spin cocoons in the ground litter.

A polyhedral virus, along with parasites and predators, often causes the collapse of infestations. If necessary, however, a contact or stomach poison can be applied against the early larvae to prevent serious loss of foliage.

RED-HEADED JACK-PINE SAWFLY

Although the red-headed jack-pine sawfly, Neodiprion virginianus complex, occurs throughout the Province, severe feeding injury is usually restricted to single or small groups of open-grown jack pine, its preferred host. Red and Scots pine are infrequently attacked.

The adult sawflies emerge from overwintering cocoons in spring and lay their eggs in needles 1 or more years old. The larvae feed in colonies on the older foliage from early July to mid-September.

Large-scale control measures have not been necessary for this pest; however, a stomach or contact insecticide would provide control if such were required.

YELLOW-HEADED SPRUCE SAWFLY

The yellow-headed spruce sawfly, Pikonema alaskensis (Rohwer), is a common, widespread pest of spruce. Because it prefers to feed on young, open-grown trees, plantation and ornamental trees are often seriously damaged while those in natural or closed stands are seldom attacked.

The insect overwinters in the ground in dark brown cocoons encrusted with soil and the adult sawflies emerge mainly in June and July. Eggs are usually laid singly in a slit made near the base of needles. The larvae may be found from late June to mid-September feeding in colonies, primarily on the new growth. When populations are high they will consume all needles.

Frequent examination of ornamentals in the summer and removal and destruction of the larvae should reduce damage to a minimum. A contact or stomach insecticide will provide good control when larvae are abundant.

PINE NEEDLE SCALE

The pine needle scale, Phenacaspis pinifoliae (Fitch), occurs on all species of pine as well as on other conifers. Although it is sometimes abundant on open-growing trees it is not a serious pest in the forest. Ornamental pines, however, are often heavily infested; the foliage becomes discolored and is shed early.

The insect overwinters in the egg stage under the whitish scale. Eggs hatch in the spring just before the new needles break out of their sheaths. The tiny young, known as crawlers, move about on the foliage but soon settle on a needle and insert their feeding tubes into the sap stream. The males develop relatively quickly and emerge as tiny, winged adults to mate with the females in July and August. The females secrete the white scale covering, lay their eggs under it during the fall and die in late fall.

Although scale insects are often preyed upon by the larvae and adults of lady beetles, control measures may be required on ornamentals. A contact insecticide would be most effective if applied during the crawler stage in early spring.

OYSTERSHELL SCALE

The oystershell scale, Lepidosaphes ulmi (Linnaeus), is probably the most common and widespread scale on deciduous trees in Ontario. In the forest it is of little concern, but most deciduous ornamental and open-grown trees may be heavily attacked. Where low-vigor apple, cherry, plum, ash and lilac trees occur, this scale is often found on the bark of stem, branch or twig.

Winter is spent in the egg stage under the scale. The eggs, of which there may be 30 or more under each scale, hatch about the time flowers appear on the host. The tiny, pale-yellow crawlers move to new sites, and insert their long, sucking mouthparts into the sap stream. By the end of July the new scale is fully formed and a new crop of eggs is produced in August.

Unless susceptible ornamentals are examined once a year heavy attack by this scale may cause branch or tree mortality. A contact insecticide applied during the crawler stage will prevent damage.

LECANIUM SCALE

Lecanium scale, Lecanium corni Bouché, is a common scale on deciduous trees and shrubs, particularly open-grown or ornamental trees. After heavy infestations twig and branch mortality are common and, with prolonged infestations, whole trees may be of such low vigor that they are susceptible to attack by other organisms.

This pest overwinters as a partly grown scale on twigs and branches. In spring the young develop into large, dark brown, globular bodies filled with eggs. These eggs hatch in July. The crawlers move to the underside of leaves where they settle to feed until fall when they move back to the twigs.

Although the scales are frequently attacked by parasites that are probably effective control agents in the forest, artificial controls may be required for high-value trees. Contact insecticides applied during the crawler stage should prevent damage by this pest.

FALL WEBWORM

The fall webworm, Hyphantria cunea (Drury), feeds on a wide range of deciduous trees and shrubs throughout Ontario and although it is very abundant in some years it is not considered a serious forest pest since feeding injury occurs late in the year and usually on fringe trees. However, it is often of concern in orchards and on shade trees and roadside plantings.

The white moths fly in June and July and lay several hundred eggs in hair-covered masses, usually on the undersides of leaves. The larvae spin a silken web over the foliage on which they feed and, when numerous, may cover entire trees with webbing. Feeding occurs from late June to mid-September. When the larvae are full grown they drop to the ground, change to pupae and overwinter in that form in the duff or soil.

If the fall webworm cannot be controlled by destruction of the nests on orchard or ornamental trees, a contact or stomach insecticide would be an effective alternative.

SWAINE JACK-PINE SAWFLY

The Swaine jack-pine sawfly, Neodiprion swainei Middleton, occurs throughout most of Ontario but extensive infestations and tree mortality have been reported mainly from a large area north of Sudbury and North Bay and from the Lake of the Woods-Rainy Lake area in the west. Although this pest has been found primarily on open-growing jack pine on islands or along rocky shorelines, in recent years it has also occurred in large numbers in closed stands of pole-sized trees.

The adult sawflies emerge from overwintering cocoons in late June and early July and one egg is laid in each needle of the pair. The larvae feed in colonies from July to October. When they are full grown they drop and spin cocoons in the soil.

In the event of large infestations specialists should be consulted about the application of a polyhedral virus that has been tested in Quebec. When small numbers of trees are infested any stomach or contact insecticide should provide control.

NURSERY PINE SAWFLY

The nursery pine sawfly, Diprion frutetorum (Fabricius), is an introduced species first found in Canada at Niagara Falls in 1934. It has spread slowly and is currently found as far north as Cockburn Island, Lake Nipissing and Pembroke. Although it prefers Scots pine it feeds on other pines as well. This sawfly has caused serious injury in pine plantations in the United States but to date has not done so in Canada. It is often found in conjunction with the introduced pine sawfly and population numbers of both species usually fluctuate similarly.

There are two overlapping generations per year. The solitary feeding larvae, which prefer older needles, are present from early June to October, with the greatest number in September. Their greenish color makes them difficult to detect on the needles. The insect overwinters in cocoons on the ground or sometimes attached to twigs on the tree.

Chemical control measures have not been necessary for this sawfly.

INTRODUCED PINE SAWFLY

The introduced pine sawfly, Diprion similis (Hartig), was first recorded in Canada in 1931 near Oakville, and until recently had not been found outside of southern Ontario. In 1970, however, colonies of larvae were found on mature white pine near Fort Frances, and on white and Scots pine in Sault Ste. Marie. Although all pines are attacked, white and Scots pine appear to be preferred hosts.

There are two generations of this sawfly each year, with larvae being found from late June to mid-September. At first the larvae feed gregariously but they separate much sooner than other sawflies; consequently, feeding injury is more diffuse. Cocoons are spun among needles or elsewhere on the tree, or in the ground litter.

Populations of this sawfly appear to be maintained at relatively low levels by natural control factors. However, if chemical control becomes necessary a contact or stomach poison applied during the feeding stage should be effective.

AMBER-MARKED BIRCH LEAF MINER

Although the amber-marked birch leaf miner, Profenusa thomsoni (Konow), is found in most parts of the Province, it has been particularly abundant in the north where it has caused the browning of birch foliage over large areas from Lake Nipigon east to the Quebec border.

The small adult sawflies emerge from pupal cells in the soil from mid-July to early August and lay their eggs in leaf tissue. The larvae feed inside the leaf with their presence indicated by the discoloration of the feeding area. Some larvae may be present in the leaf mines as late as mid-October. When they are full grown they drop to overwinter in the soil.

Since this insect does not cause serious injury and is more often found in the forest than on open-grown ornamentals, control measures have not been necessary. If control is required a systemic insecticide should be used.

The amber-marked birch leaf miner should not be confused with the birch leaf miner, Fenusa pusilla, which mines the leaves of birch from early spring to late summer and is common on ornamental trees.

POPLAR BLACK-MINE BEETLE

There are at least three species of poplar black-mine beetles, Zeugophora spp., in Ontario. Although one or more species occur throughout the Province they have been most numerous in northeastern and north central areas. The black leaf mines produced by the larvae on all species of poplar are conspicuous, but they appear late in the growing season and cause no obvious injury to trees.

Little is known about the biology of these beetles. However, the tiny adults feed on the underside of poplar leaves and have been collected from late May to late September. Larvae have been found in the black blotch mines from early July to late September. They change to pupae in cells in the soil, where all species probably overwinter.

Chemical control has not been required against the poplar black-mine beetles.

BIRCH SKELETONIZER

The leaves of birch trees throughout Ontario are periodically skeletonized by larvae of the birch skeletonizer, Bucculatrix canadensisella Chambers. The injured leaves turn brown in late summer and drop prematurely. In the past, outbreaks of this skeletonizer involved vast areas of up to 80,000 square miles, but between outbreaks numbers of larvae are usually very low. All species of birch are attacked.

This tiny insect overwinters in ribbed cocoons on the ground, and the moths fly in July. Eggs are laid on the undersides of leaves and the larvae initially feed as miners inside the leaf. Soon, however, they leave the mines to feed externally on the lower surface, often completely skeletonizing the leaves. The larvae are found from July to September and spin their characteristic moulting pads of white silk on the underside of the leaf.

Since the main feeding by this skeletonizer is late in the season, no large-scale control measures have been initiated to date. Any contact insecticide would provide control on ornamental trees.

PINE ENGRAVER BEETLE

The pine engraver, Ips pini (Say), breeds in recently cut, large slash or in trees recently killed by fire, insects, disease, etc. Its feeding between the bark and the wood might be considered beneficial since it hastens the return of dead material to the humus. Living trees suffering from drought, however, may be attacked by beetles in numbers sufficient to kill them.

This bark beetle probably has two generations a year in Ontario with adults overwintering in the litter. The male selects suitable material and constructs a small cell under the bark on the wood surface, where it is soon joined by a number of females. Each female constructs an egg gallery along which the eggs are deposited. On hatching, the tiny white larvae feed out from the egg gallery and construct mines, mostly on the inside surface of the bark. About 5 weeks after the eggs are laid the first generation has developed. The parent beetles leave the original galleries, select new material and start a second brood. First-generation adults also move to new material where a second generation develops.

Removal or destruction of breeding material will prevent population buildup and damage to living trees.

AMBROSIA BEETLES

Ambrosia beetles resemble bark beetles in most respects but differ from them in their habit of cutting tunnels through the bark and deep into the wood, whereas bark beetles generally feed between the bark and the wood. Ambrosia beetles, of which there are numerous species, are usually found in dying or recently cut trees, although members of the genus Corthylus attack living trees. The tunnels are simple or branched and the wood surrounding them is stained brown or black by the action of the fungi which is associated with the insects and from which the name "ambrosia beetle" is derived. No wood is immune to attack.

Because of the number of species involved the seasonal occurrence of stages will differ. However, it is probable that the majority of species overwinter in the adult stage and that there is a peak flight period in spring and early summer.

Development of the insect can proceed only when the moisture content of the wood is high. Consequently, drying of the wood offers the most effective means of preventing losses caused by the tunneling of the beetles and the accompanying stain.

ROOT COLLAR WEEVIL



The root collar weevil, Hylobius radialis Buchanan, occurs primarily in southern Ontario and is most prevalent in young Scots pine plantations. Damage is also found on other pines when they are mixed with Scots pine. Because the weevil larvae feed under the bark and girdle the tree at the root collar, infestations are seldom discovered until numerous trees are dead or seriously injured.

Eggs are usually laid in adult feeding punctures at the root collar and as they hatch the larvae feed at the wood surface. The copious flow of resin resulting from feeding soaks into the soil, binding it into a mass around the base of the tree. Because eggs are laid from early spring to late summer, larvae or pupae can usually be found under these masses at any time of the year.

Control is difficult because there are few acceptable insecticides. Removing the lower branches from the trees to let light into the tree collar will make the tree an unsuitable host.

NATIVE ELM BARK BEETLE

The native elm bark beetle, Hylurgopinus rufipes (Eichhoff), probably occurs wherever elm grows in Ontario. It is important as a vector of Dutch elm disease, but in southwestern Ontario is considered less important in that regard than the smaller European elm bark beetle. In the absence of Dutch elm disease, feeding by the native species is not of economic importance, since the insect is found in small numbers and attacks only decadent or dying elm trees. All species of elm are attacked.

This insect has one and one-half generations each year and overwinters under the bark as a larva or adult. Galleries produced by this species in the wood and bark have the typical, deep egg tunnels across the grain with radiating larval tunnels. The galleries are formed on the trunk or on the larger branches.

Chemical control is difficult and should be attempted only on the advice of a forestry specialist.

SMALLER EUROPEAN ELM BARK BEETLE

The smaller European elm bark beetle, Scolytus multistriatus Marsh, occurs south of a line from Midland to Cornwall and has been found recently in Sault Ste. Marie. It is a principal vector of the Dutch elm disease that has ravaged the elm throughout much of its range. Dead and dying elms serve as breeding sites and all species of elm are attacked.

There is generally a single generation each year. The beetle spends the winter as a partially grown larva in the bark of dead elm. Larval development is completed in the spring and pupae and adults occur in June and July. Adults fly to living trees and feed in the crotch of twigs, often tunneling deep enough to cause the twigs to fall in the wind. Later the adults fly to dead or dying elm trees to construct their brood galleries, thereby completing the cycle.

Control of this bark beetle is most difficult and the assistance of control specialists should be sought.

COMMON NAMES

Ambermarked birch		Nursery pine sawfly	49
leafminer	51	Oak galls	74
Ambrosia beetle	55	Oak leaf shredder	17
American aspen beetle	3	Oystershell scale	45
Aspen blotchminer	30	Pales weevil	24
Aspen leafroller	61	Pine bark aphid	66
Aspen leaftier	23	Pine engraver beetle	54
Balsam fir sawfly	21	Pine needle scale	44
Balsam poplar		Pine spittlebug	27
blotchminer	31	Pitch nodule maker	18
Balsam shootboring		Poplar-and-birch	
sawfly	4	leafroller	6
Balsam twig aphid	59	Poplar-and-willow	
Birch leafminer	36	borer	73
Birch skeletonizer	53	Poplar blackmine	
Bruce spanworm	60	beetle	52
Cedar leaf miners	12	Redheaded jack pine	
Cottony maple scale	75	sawfly	42
Eastern pineshoot		Redheaded pine sawfly	41
borer	29	Red pine sawfly	11
Eastern tent		Root collar weevil	56
caterpillar	8	Saddled prominent	67
Eastern pine sawfly	9	Satin moth	70
European pine shoot		Smaller European	
moth	5	elm bark beetle	58
European spruce sawfly	40	Spiny elm caterpillar	22
Fall cankerworm	2	Spring cankerworm	2
Fall webworm	47	Spruce budworm	13
Forest tent caterpillar	7	Spruce galls	28
Greenstriped mapleworm	37	Spruce needle miners	68
Gypsy moth	69	Swaine jack pine	
Introduced pine sawfly	50	sawfly	48
Jack pine budworm	19	Tiger swallowtail	63
Jack pine sawflies	10	Uglynest caterpillar	20
Jack pine tip beetle	16	Walnut caterpillar	39
Juniper loopers	72	Western tent	
Larch casebearer	1	caterpillar	15
Large aspen tortrix	14	Whitemarked tussock	
Larch sawfly	34	moth	71
Lecanium scale	46	White pine weevil	33
Linden looper	64	Whitespotted sawyer	
Maple bladdergall mite	26	beetle	32
Maple pile mites	62	Woolly alder aphid	65
Mountain ash sawfly	35	Yellowheaded spruce	
Native elm bark beetle	57	sawfly	43
Northern pine weevil	25	Yellownecked	
Northern pitch twig		caterpillar	38
moth	18		

SCIENTIFIC NAMES

<i>Adelges</i> spp.	28	<i>Malacosoma disstria</i>	7
<i>Alsophila pometaria</i>	2	<i>Mindarus abietinus</i>	59
<i>Anisota rubicanda</i>	37	<i>Monochamus scutellatus</i>	32
<i>Aphrophora parallela</i>	27	<i>Neodiprion abietis</i>	21
<i>Archips cerasivoranus</i>	20	<i>Neodiprion lecontei</i>	41
<i>Argyresthia</i>		<i>Neodiprion nanulus</i>	
<i>aureoargentella</i>	12	<i>nanulus</i>	11
<i>Argyresthia canadensis</i>	12	<i>Neodiprion pratti</i>	
<i>Argyresthia thuiella</i>	12	<i>banksianae</i>	10
<i>Bucculatrix</i>		<i>Neodiprion pratti</i>	
<i>canadensisella</i>	53	<i>paradoxicus</i>	10
<i>Choristoneura</i>		<i>Neodiprion sertifer</i>	9
<i>conflictana</i>	14	<i>Neodiprion swainei</i>	48
<i>Choristoneura</i>		<i>Neodiprion virginianus</i>	42
<i>fumiferana</i>	13	<i>Nymphalis antiopa</i>	22
<i>Choristoneura pinus</i>		<i>Operophtera bruceata</i>	60
<i>pinus</i>	19	<i>Orgyia leucostigma</i>	71
<i>Coleophora laricella</i>	1	<i>Paleacrita vernata</i>	2
<i>Conophthorus</i>		<i>Papilio glaucus</i>	
<i>banksianae</i>	16	<i>canadensis</i>	63
<i>Croesia semipurpurana</i>	17	<i>Petrova albicapitana</i>	18
<i>Cynipidae</i>	74	<i>Phenacaspis pinifoliae</i>	44
<i>Datana integerrima</i>	39	<i>Pikonema alaskensis</i>	43
<i>Datana ministra</i>	38	<i>Pineus</i> spp.	28
<i>Diprion frutetorum</i>	49	<i>Pineus strobi</i>	66
<i>Diprion hercyniae</i>	40	<i>Pissodes approximatus</i>	25
<i>Diprion similis</i>	50	<i>Pissodes strobi</i>	33
<i>Enargia decolor</i>	23	<i>Pleroneura</i>	
<i>Epinotia nanana</i>	68	<i>brunneicornis</i>	
<i>Epinotia solandriana</i>	6	(= <i>borealis</i>)	4
<i>Erannis tiliaria</i>	64	<i>Porthetria dispar</i>	69
<i>Eriophyidae</i>	62	<i>Pristiphora erichsonii</i>	34
<i>Eucosma gloriola</i>	29	<i>Pristiphora geniculata</i>	35
<i>Eupithecia</i> spp.	72	<i>Prociophilus</i>	
<i>Fenusa pusilla</i>	36	<i>tessellatus</i>	65
<i>Gonioctena americana</i>	3	<i>Profenusa thomsoni</i>	51
<i>Heterocampa</i>		<i>Pseudeuxentera</i>	
<i>guttivitta</i>	67	<i>oregonana</i>	61
<i>Hylobius pales</i>	24	<i>Pulicalvaria thujaella</i>	12
<i>Hylobius radialis</i>	56	<i>Pulvinaria</i>	
<i>Hylurgopinus rufipes</i>	57	<i>innumerabilis</i>	75
<i>Hyphantria cunea</i>	47	<i>Rhyacionia buoliana</i>	5
<i>Ips pini</i>	54	<i>Scolytus multistriatus</i>	58
<i>Lecanium corni</i>	46	<i>Sternochetus lapathi</i>	73
<i>Lepidosaphes ulmi</i>	45	<i>Stilpnotia salicis</i>	70
<i>Lithocolletis nipigon</i>	31	<i>Taniva albolineana</i>	68
<i>Lithocolletis ontario</i>	30	<i>Thera</i> spp.	72
<i>Malacosoma americanum</i>	8	<i>Vasates quadripedes</i>	26
<i>Malacosoma</i>		<i>Zeugophora</i> spp.	52
<i>californicum pluviale</i>	15		