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EC86-1548 Common Insect Pests of Trees in the Great Plains

Mary Ellen Dix
USDA Forest Service

Judith E. Pasek
USDA Forest Service

Mark O. Harrell
University of Nebraska - Lincoln, mharrell2@unl.edu

Frederick P. Baxendale
University of Nebraska - Lincoln, fbaxendale1@unl.edu

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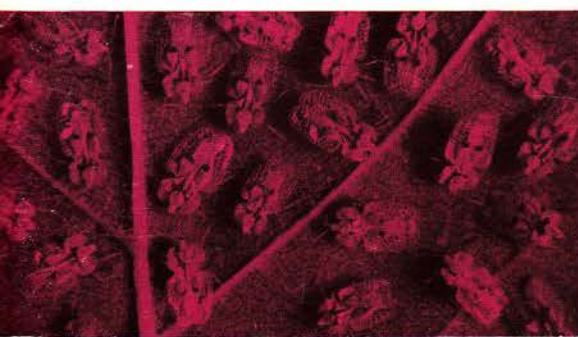


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COMMON INSECT PESTS OF TREES IN THE GREAT PLAINS

TECHNICAL COORDINATORS

Mary Ellen Dix, USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Lincoln, Nebraska, 68583.
Judith E. Pasek, USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Lincoln, Nebraska, 68583.
Mark O. Harrell, Department of Forestry, Fisheries and Wildlife, University of Nebraska, Lincoln, Nebraska, 68583.
Frederick P. Baxendale, Department of Entomology, University of Nebraska, Lincoln, Nebraska 68583.

CONTRIBUTORS

Entomologists on the Pest Management Task Force of the Great Plains Agricultural Council Forestry Committee contributed portions of the text for this publication. Contributors are listed in alphabetical order.

Whitney S. Cranshaw, Department of Zoology and Entomology, Colorado State University, Fort Collins, Colorado, 80523.

Mary Ellen Dix, USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Lincoln, Nebraska, 68583.

Richard D. Dorset, South Dakota Department of Game, Fish and Parks, Division of Forestry, Pierre, South Dakota, 57501.

Mark O. Harrell, Department of Forestry, Fisheries and Wildlife, University of Nebraska, Lincoln, Nebraska, 68583.

Bruce B. Hostetler, USDA Forest Service, Forest Pest Management, Portland, Oregon, 97208.

J. Ackland Jones, Department of Entomology, University of Nebraska, Lincoln, Nebraska, 68583.

Dennis D. Kopp, Cooperative Extension Service, North Dakota State University, Fargo, North Dakota, 58102.

David A. Leatherman, Colorado State Forest Service, Fort Collins, Colorado, 80523.

G. Bruce Neill, Agriculture Canada, Prairie Farm Rehabilitation Administration, Indianhead Tree Nursery, Indianhead, Saskatchewan, Canada, S06 2K0.

Herbert A. Pase III, Texas Forest Service, Lufkin, Texas, 75901.

Judith E. Pasek, USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Lincoln, Nebraska, 68583.

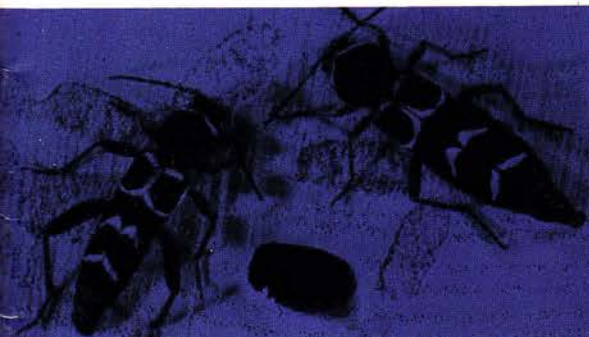
Everett W. Spackman, Agricultural Extension Service, University of Wyoming, Laramie, Wyoming, 82071.

Hugh E. Thompson, Department of Entomology, Kansas State University, Manhattan, Kansas, 66502.

Scott Tunnock, USDA Forest Service, Forest Pest Management, Missoula, Montana, 59801.

ACKNOWLEDGMENT

We wish to thank the following for their reviews of the manuscript or assistance in preparation of the manuscript: S. Kamble, Department of Entomology, University of Nebraska; G. Amman, A. Drooz, J. Peacock, G. Peterson, J. Schmid, J. Solomon, B. Weber and L. Wilson of the USDA Forest Service; and R. Stevens, retired, USDA Forest Service. We also wish to thank those who submitted photographs.



COMMON INSECT PESTS OF TREES IN THE GREAT PLAINS

This publication is a cooperative effort of the Rocky Mountain Forest and Range Experiment Station, USDA Forest Service, and the University of Nebraska Cooperative Extension Service.

TABLE OF CONTENTS

PREFACE..... vi



HARDWOOD DEFOLIATORS 1

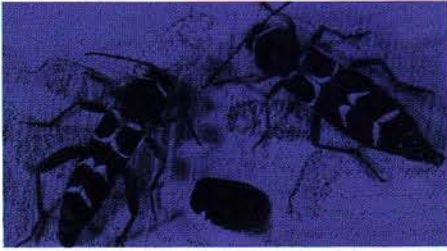
- FALL CANKERWORM—*Alsophila pometaria*; SPRING CANKERWORM—*Paleacrita vernata*
 MOURNINGCLOAK BUTTERFLY (Spiny-elm caterpillar)—*Nymphalis antiopa*
 NEVADA BUCK MOTH—*Hemileuca nevadensis*
 GREENSTRIPED MAPLEWORM—*Dryocampa rubicunda*
 VARIABLE OAKLEAF CATERPILLAR—*Heterocampa mantee*
 FRUITTREE LEAFROLLER—*Archips argyrospilus*
 FOREST TENT CATERPILLAR—*Malacosoma disstria*
 PRAIRIE TENT CATERPILLAR—*Malacosoma californicum lutescens*; EASTERN TENT CATERPILLAR—*M. americanum*
 FALL WEBWORM—*Hyphantria cunea*
 UGLYNEST CATERPILLAR—*Archips cerasivorana*
 MIMOSA WEBWORM—*Homadaula anisocentra*
 ELM SAWFLY—*Cimbex americana*
 SAWFLIES—*Nematus* spp.
 PEAR SAWFLY (PEAR SLUG)—*Caliroa cerasi*
 ELM LEAF BEETLE—*Pyrrhalta luteola*
 COTTONWOOD LEAF BEETLE—*Chrysomela scripta*
 CARAGANA BLISTER BEETLE—*Epicauta subglabra*;
 ASHGRAY BLISTER BEETLE—*E. fabricii*
 GRASSHOPPERS—*Melanoplus* spp.
 ASPEN BLOTCHMINER—*Phyllonorycter tremuloidiella*
 ASPEN LEAFMINER—*Phyllocnistis populiella*
 POPLAR BLACK MINE BEETLE—*Zengophora scutellaris*

CONIFER DEFOLIATORS 10

- SPRUCE NEEDLEMINER—*Endothenia albolineana*
 PINE NEEDLE SHEATHMINER—*Zelleria haimbachi*
 CEDAR WEBWORM—*Cudonigera houstonana*
 JACK PINE BUDWORM—*Choristoneura pinus*
 PINE TIGER MOTH—*Lophocampa ingens*
 BAGWORM—*Thyridopteryx ephemeraeformis*
 PINE SAWFLIES—*Neodiprion* spp.
 YELLOWHEADED SPRUCE SAWFLY—*Pikonema alaskensis*
 BLACK VINE WEEVIL—*Otiorhynchus sulcatus*
 CARAGANA BLISTER BEETLE—*Epicauta subglabra*;
 ASHGRAY BLISTER BEETLE—*E. fabricii*
 GRASSHOPPERS—*Malanoplus* spp.

HARDWOOD BORERS..... 15

- NATIVE ELM BARK BEETLE—*Hylurgopinus rufipes*;
 SMALLER EUROPEAN ELM BARK BEETLE—*Scolytus multistriatus*
 ASH BARK BEETLES—*Hylesinus* spp.
 BOXELDER TWIG BORER—*Proteoteras* spp.
 CARPENTERWORM—*Prionoxystus robiniae*
 LILAC (ASH) BORER—*Podosesia syringae*; BANDED ASH CLEARWING—*P. aureocincta*
 PEACHTREE BORER—*Synanthedon pictipes*; LESSER PEACHTREE BORER—*S. exitiosa*
 CLEARWING BORERS: VIBURNUM BORER—*Synanthedon viburni*; CURRANT BORER—*S. tipuliformis*



HARDWOOD BORERS..... 15

- COTTONWOOD BORER—*Plectrodera scalator*
- POPLAR BORER—*Saperda calcarata*
- LOCUST BORER—*Megacyllene robiniae*
- REDHEADED ASH BORER—*Neoclytus acuminatus*; **BANDED ASH BORER**—*N. caprea*
- ASPEN ROOT GIRDLER—*Agrilus horni*



CONIFER BORERS..... 22

- PINETIP MOTHS: NANTUCKET**—*Rhyacionia frustrana*, **SOUTHWESTERN**—*R. neomexicana*, **WESTERN**—*R. bushnelli* and other *Rhyacionia* spp.
- WESTERN PINE SHOOT BORER**—*Eucosma sonomana*
- METALLIC PINE PITCH NODULE MAKER**—*Retinia metallica*
- WHITE PINE WEEVIL**—*Pissodes strobi*
- ZIMMERMAN PINE MOTHS**—*Dioryctria ponderosae*, *D. tumicolella*, and *D. zimmermani*
- PINE ROOT COLLAR WEEVIL**—*Hylobius radialis*
- PINE BARK BEETLES**—*Ips grandicollis*, *I. calligraphus*, *I. pini*, *Ips* spp., *Dendroctonus ponderosae*, *D. valens*, and *Dendroctonus* spp.
- CEDAR BARK BEETLES**—*Phloeosinus* spp.
- CONIFER-INFESTING LONGHORNED BEETLES**—*Monochamus* spp., *Semanotus* spp., *Xylotrechus* spp., and other *Cerambycidae*



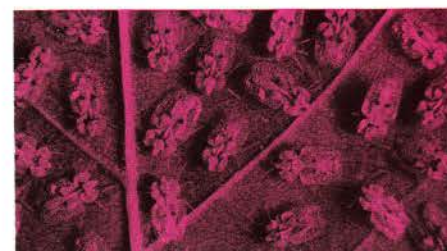
GALL INSECTS 28

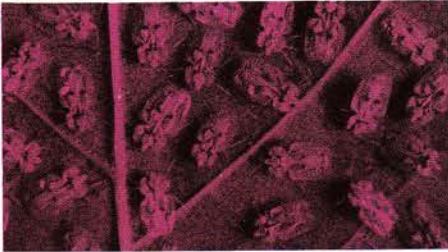
- ASH FLOWER GALL MITE**—*Eriophyes fraxiniflora*
- POPLAR BUD GALL MITE**—*Eriophyes parapopuli*
- HACKBERRY NIPPLEGALL MAKER**—*Pachypsylla celtidismamma*; **HACKBERRY BLISTERGALL MAKER**—*P. celtidisvesicula*
- HACKBERRY BUDGALL PSYLLID**—*Pachypsylla celtidisgemma*; **HACKBERRY PETIOLEGALL PSYLLID**—*P. venusta*
- POPLAR GALL APHIDS**—*Pemphigus* spp.
- POPLAR VAGABOND APHID**—*Mordvilkoja vagabunda*
- HONEYLOCUST POD GALL MIDGE**—*Dasineura gleditschiae*
- OAK GALLS**—**CECIDOMYIIDAE** and **CYNIPIDAE**; **OAK-APPLE GALL**—*Amphibolips confluenta*
- COOLEY SPRUCE GALL ADELGID**—*Adelges cooleyi*
- GOUTY PITCH MIDGE (BIRD'S-EYE PINE MIDGE OR PONDEROSA PINE RESIN MIDGE)**—*Cecidomyia piniinopis*



HARDWOOD SAPSUCKING INSECTS..... 33

- BOXELDER APHID**—*Periphyllus negundinis*
- BLACK WILLOW APHID**—*Pterocomma smithiae*
- CARAGANA APHID**—*Acyrtosiphon caraganae*
- WOOLLY ELM APHID**—*Eriosoma americanum*; **WOOLLY APPLE APHID**—*E. lanigerum*
- HONEYSUCKLE WITCHES'-BROOM AHPID**—*Hyadaphis tataricae*
- EUROPEAN ELM SCALE**—*Gossyparia spuria*
- LECANIUM SCALES**—*Parthenolecanium* spp.
- OYSTERSHELL SCALE**—*Lepidosaphes ulmi*
- BOXELDER BUG**—*Leptocoris trivittatus*
- ASH PLANT BUG**—*Tropidosteptes amoenus*;
- HONEYLOCUST PLANT BUG**—*Diaphnocoris chlorionis*
- LACE BUGS**—*Corythucha* spp., and *Gargaphia* spp.
- SPIDER MITES**—*Oligonychus* spp., *Tetranychus* spp., and *Eotetranychus* spp.





- SPIDER MITES—*Oligonychus* spp., *Tetranychus* spp., and *Eotetranychus* spp.
- PINE NEEDLE SCALE—*Chionaspis pinifoliae*
- PINE BARK ADELGID—*Pineus strobi*
- GIANT CONIFER APHIDS—*Cinara* spp.
- SPITTLEBUGS—*Aphrophora* spp., and *Clasoptera* spp.
- LECANIUM SCALES—*Parthenolecanium* spp.

COMMON AND SCIENTIFIC NAMES OF INSECT PESTS.....41
 HOST PLANTS WITH SCIENTIFIC EQUIVALENTS.....42
 SELECTED REFERENCES.....43
 PESTICIDE PRECAUTIONARY STATEMENT44
 LIST OF INSECTICIDES BY COMMON AND REGISTERED
 TRADE NAMES44
 FOOTNOTE.....44

Publication design by Reneé Lanik; layout by Kathy Guiducci for the Department of Agricultural Communications, Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln.

PREFACE

This publication was developed by entomologists on the Pest Management Task Force of the Great Plains Agricultural Council Forestry Committee to provide the public and professionals with information needed to identify and manage common insect pests of trees in the Great Plains. It is designed for those with no formal training in entomology and is not intended to summarize everything known about a particular insect.

Insect pests of hardwoods and conifers are arranged according to damage category. Hardwood trees annually shed their leaves in the fall; conifer trees annually shed only their oldest needles and retain the current year's needles. Defoliators feed on the leaves and needles. Borers mine buds, sapwood, and inner bark (between sapwood and the bark). Sapfeeding insects extract sap from leaves, needles, branches and trunks. Feeding by gall insects causes leaves, buds, and branches to grow abnormally.

Because pesticide registrations are rapidly changing, only pesticides that mention a specific pest and host were included in the control recommendations. Current information on when pesticides are needed, pesticide registration, local use pesticides, and pesticide application can be obtained from your local agricultural extension specialists.

HARDWOOD DEFOLIATORS

FALL CANKERWORM—*Alsophila pometaria*; SPRING CANKERWORM—*Paleacrita vernata*

HOSTS: Boxelder (Manitoba maple), ash, oak, elm, linden, and apple

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Cankerworm caterpillars, also called inchworms or loopers, have 2 to 4 pairs of false legs, vary from green to reddish-brown to black, and have one or more white, pale green, or black stripes. Mature caterpillars are about 19 mm long. Female moths are about 12 mm long, wingless, and dark gray. Males are similar but have tan wings.

Fall cankerworm moths emerge, mate, and lay eggs on twigs during the fall and winter; spring cankerworm moths emerge, mate, and lay eggs in early spring (March in Nebraska). Egg hatch for both species coincides with the appearance of new leaves on their host. If the caterpillars hatch earlier, they eat the leaf buds before they unfold.

Larvae initially eat small holes in the leaves and later skeletonize them. Eventually, only the midribs of leaves remain. Cankerworm defoliation decreases tree vigor and is unsightly.

CONTROL: Spray leaves of infested trees with carbaryl, *Bacillus thuringiensis* (B.t.), acephate, or methoxychlor as soon as small holes or other damage to leaves appear and prior to complete defolia-

tion. Except for B.t., these insecticides also will kill beneficial insect parasites and predators that feed on cankerworm eggs and larvae. The number of eggs laid on trees can be reduced by banding trees with a sticky substance such as Tanglefoot[®] or Stickem Special[®], at a height of 1.5 m above the ground. The sticky band should be approximately 10 cm wide and can be applied either to the bark or to a strip of foam rubber wrapped around the bark. When the wingless females crawl up the trunk they become trapped and die. In Nebraska, trees should be banded in early September to control fall cankerworms and in March for spring cankerworms.



Spring cankerworm larvae and damage

MOURNINGCLOAK BUTTERFLY (Spiny-elm caterpillar)—*Nymphalis antiopa*

HOSTS: Elm, willow, hackberry, and cottonwood and other poplars

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Mature larvae are about 70 mm long and are velvety black sprinkled with small white dots. The abdominal prolegs and a single row of spots on the back are red. Several rows of large branched spines run the length of the body. The butterfly has a black body, a wingspan of 60 to 80 mm, and dark reddish-brown wings with a creamy-yellow border and a row of blue spots.

Adult butterflies overwinter in sheltered places, and in early spring (April in Nebraska), females lay clusters of eggs around twigs. Two to three weeks later, eggs hatch and the young caterpillars feed gregariously, usually on leaves of terminal branches. However, leaves throughout the tree may be eaten. During July, larvae molt to the chrysalis (pupal) stage. In the Southern Plains, first generation adults appear in late July and lay eggs for a second generation. The second generation larvae pupate in September. There is only one generation per year in the Northern Plains.

CONTROL: Spray carbaryl, methoxychlor, malathion, diazinon, fluvalinate, or *Bacillus thuringiensis* (B.t.) on the leaves as soon as feeding is observed during the spring or summer. Except for B.t., these insecticides also will kill beneficial insect parasites and predators that feed on eggs and larvae of the spiny-elm caterpillar. Cut and burn branches with egg masses.



Spiny-elm caterpillar

HARDWOOD DEFOLIATORS

NEVADA BUCK MOTH—*Hemileuca nevadensis*

HOSTS: Willow and cottonwood and other poplars

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Larvae are black when young and mostly yellow when mature. They are armed with quill-like spines that irritate the skin. Moths have a black body and yellowish-white wings with dark outer and inner borders.

Young larvae emerge in the spring and feed gregariously on leaves. Older larvae disperse to feed, and in late summer spin dense cocoons in leaf litter, where they pupate. Moths appear in fall and lay eggs. Winter is passed in the egg stage.

CONTROL: Spray foliage with carbaryl, chlorpyrifos, or fluralinate as soon as feeding is observed in the spring.



Nevada buck moth larva

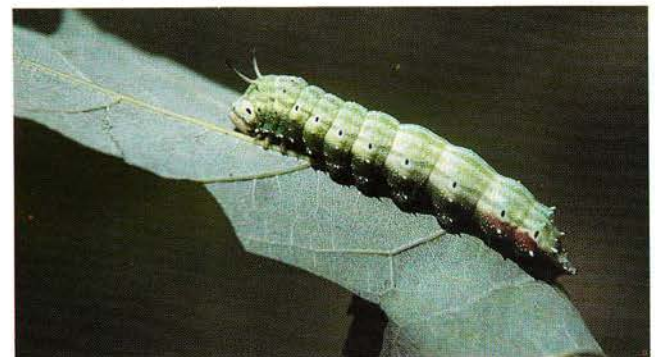
GREENSTRIPED MAPLEWORM—*Dryocampa rubicunda*

HOSTS: Maple, boxelder (Manitoba maple), and oak

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Larvae have two horns behind the head and are yellow-green with several green stripes and two posterior red marks. Moths are hairy, have a wingspread of 37 to 50 mm, and a yellow and rose-pink body. Forewings are rose-pink with a broad yellow band, while hind wings are yellow.

Larvae feed on leaves for about a month before migrating to the ground to pupate and overwinter in the soil at the base of host trees. Moths emerge during May and June and lay eggs on the underside of leaves. There are two generations in the south and one generation in the north.

CONTROL: Spray foliage with acephate in late May or early June.



Greenstriped mapleworm

VARIABLE OAKLEAF CATERPILLAR—*Heterocampa manteo*

HOSTS: Oak, elm, boxelder (Manitoba maple), apple, and other hardwood trees

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Mature larvae are about 37 mm long and yellowish-green, usually with a broad dark red dorsal stripe. The ash-gray moths have a wingspan of 37 to 47 mm.

Larvae overwinter in the top soil or duff. Moths emerge in spring (May in Nebraska) and lay eggs on leaves. Young larvae feed on the lower surfaces of leaves; older larvae consume entire leaves, leaving only veins. There are two generations per year in the southern Great Plains, one in the north.

Outbreaks may cover large areas. Young trees that are repeatedly defoliated may be killed.

CONTROL: Spray foliage with carbaryl or

acephate in mid to late June while caterpillars are still small and defoliation is limited. These insecticides also will kill beneficial insect parasites and predators that feed on the eggs and pupae of variable oakleaf caterpillars.



Variable oakleaf caterpillar

HARDWOOD DEFOLIATORS

FRUITTREE LEAFROLLER—*Archips argyrospilus*

HOSTS: Ash, elm, oak, maple, cherry, caragana, and other hardwoods

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Full grown larvae are 20 to 25 mm long, light green to dusty gray with light brown to black heads and legs. Moths are pale yellow to orange-red and have a wingspan of 18 to 25 mm.

Fruittree leafrollers overwinter in the egg stage. Eggs hatch in early spring and larvae build nests by weaving leaves together with silk, adding leaves as larvae mature. They pupate in cocoons located either inside or outside the nest. Adults emerge during July or August and mate. Females lay small round masses of 100 to 150 eggs on twigs and small branches.

Larvae leave nests to feed on the opening buds, blossoms, young fruit, and unfolding leaves, and later on mature leaves. Infested trees are unsightly but are seldom seriously damaged.

CONTROL: Spray the foliage with acephate, carbaryl, or *Bacillus thuringiensis* (B.t.) when buds begin to expand.



Fruittree leafroller larva



Fruittree leafroller damage

FOREST TENT CATERPILLAR—*Malacosoma disstria*

HOSTS: Boxelder (Manitoba maple), ash, oak, cottonwood and other poplars, and other hardwoods

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: The hairy larvae are pale blue with white key-hole shaped markings on their backs. Full-grown larvae are about 50 mm long. The stout-bodied moths are buff-brown with two dark diagonal bands on the wings and a wingspan of 20 to 45 mm.

Eggs hatch in spring, when leaves are expanding. Caterpillars feed in groups or clusters on leaves during early summer (June in North Dakota). Although larvae cluster around branches to rest or molt, they do not construct tents. In late summer female moths appear and lay eggs in shiny brown masses that encircle twigs.

Infested trees are usually completely defoliated and their growth and vigor is reduced. Outbreaks tend to be widespread.

CONTROL: Shortly after leaf expansion, spray the caterpillars and foliage with malathion, carbaryl, diazinon, acephate, methoxychlor, or *Bacillus thuringiensis* (B.t.). If infested trees are small, or the infestation is small, egg masses can be cut from trees during the fall and winter and destroyed. Larvae can also be collected and destroyed during summer. Populations of natural enemies, such as parasitic insects, birds, and viruses, usually build up after 3 to 4 years and cause caterpillar populations to collapse.



Forest tent caterpillar

PRAIRIE TENT CATERPILLAR—*Malacosoma californicum lutescens*; EASTERN TENT CATERPILLAR—*M. americanum*

HOSTS: Chokecherry, plum, willow, ash, poplar, and rose

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Mature larvae are 50 mm long and can be quite variable in pattern. In general, most prairie tent caterpillars are pale blue with an inter-

rupted white stripe bordered by two reddish-orange stripes down the center of the back. Eastern tent caterpillars are similar but have a continuous white stripe down the back and black heads. Moths of both species are reddish-brown, have two oblique whitish stripes on the forewings and have a wingspan of 37 to 50 mm.

Eggs hatch when the first new leaves appear.

HARDWOOD DEFOLIATORS

Prairie tent caterpillar, continued

Larvae live in colonies and construct large silk tents around a fork or branches of trees. These tents are enlarged as the larvae grow, enclosing the entire branch or even the entire tree. Adults of prairie tent caterpillars emerge in late summer (August in Nebraska) and lay flat egg masses on twigs and branches. Adults of eastern tent caterpillars emerge in June and early July. There is one generation per year.

Larvae skeletonize leaves outside tents. Infestations tend to be spotty and are often unrecognized un-

til entire trees have been defoliated. Severely infested trees are less vigorous and unsightly, but are rarely killed.

CONTROL: Spray leaves with carbaryl, acephate, diazinon, malathion, or *Bacillus thuringiensis* (B.t.) when tents first appear and caterpillars are small. Caterpillars and tents on small trees can be picked off and destroyed.



Prairie tent caterpillar nest



Prairie tent caterpillar larvae

FALL WEBWORM—*Hyphantria cunea*

HOSTS: Elm, plum, chokecherry, poplar, willow, and other hardwoods

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Larvae are about 25 mm long, and are either pale yellow with red heads and reddish-brown spots or yellow-green with black heads, a broad dark dorsal stripe and black spots. Moths are white, with reddish-orange front legs and a wingspan of 30 to 42 mm.

Pupae overwinter in cocoons in soil or duff. Moths emerge in late spring or early summer and lay eggs in hair-covered masses on the undersides of leaves. Larvae emerge about 10 to 14 days later and feed in groups in webbed nests constructed around leaves at branch ends. By late summer the unsightly nests may be 1 m across and contain excrement, dried leaf fragments, and cast skins of larvae. There are one to two generations per year.

Ornamental trees may become severely defoliated and unsightly.

CONTROL: When webs first appear spray foliage with *Bacillus thuringiensis* (B.t.), carbaryl, acephate, chlorpyrifos, methoxychlor, or diazinon. Except for B.t., these insecticides also will kill beneficial natural enemies of fall webworms. Remove and burn branches with webs.



Fall webworm nest



Dark phase fall webworm larva

UGLYNEST CATERPILLAR—*Archips cerasivorana*

HOSTS: Chokecherry, cherry, and other hardwoods

IDENTIFICATION, LIFE CYCLE,

AND DAMAGE: Larvae are 20 to 23 mm long and olive to greenish-yellow with black heads. Moths are bright orange with yellow hind wings and have a wingspan of 18 to 25 mm.

HARDWOOD DEFOLIATORS

Uglynest caterpillar, continued

Uglynest caterpillars overwinter as eggs on the bark of their host. Larvae emerge during May and June and construct extensive nests of webbing, leaves, and twigs. They feed on leaves within their nests during summer, and pupate in the nests in fall. Moths emerge and lay eggs in the fall.

Nests may envelop small trees and are unsightly.

CONTROL: Spray foliage with carbaryl, chlorpyrifos, or fluralinate when nests first appear.



Uglynest caterpillar

MIMOSA WEBWORM—*Homadaula anisocentra*

HOSTS: Honeylocust and mimosa

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Mature larvae are 12 mm long and pale green to dark brown with 5 longitudinal white stripes. Moths are silvery-gray with small black spots, and have a wingspan of 12 mm.

Pupae overwinter in whitish silken cocoons located in the soil or on vertical protected surfaces such as the trunks of trees. Moths emerge by May and lay eggs on flowers or foliage. Larvae weave a nest around the flowers and young leaves before feeding



Mimosa webworm nest with eggs, larva, and adult

within the nest. During July, larvae pupate within the nests, and by early August moths of the second generation appear. Larvae of the second generation may completely defoliate a tree. A third and even a fourth generation occur in the Southern Plains.

Mimosa webworms often severely defoliate ornamental trees, decreasing vigor and making them unsightly.

CONTROL: Spray foliage with carbaryl, acephate, diazinon, chlorpyrifos, or *Bacillus thuringiensis* (B.t.) when brown foliage first appears during early July and again in early August.



Mimosa webworm larva

ELM SAWFLY—*Cimbex americana*

HOSTS: Elm, willow, maple, cottonwood and other poplars, and other hardwoods

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Young caterpillars are slate-gray. Older caterpillars are yellowish-green with a black dorsal stripe and a wart-like skin texture. Adults are 25 mm long with smoky-gray wings. The body may be either reddish-brown to black or black with yellow spots.

Adult elm sawflies emerge during spring and summer, and females deposit eggs in leaves. They feed on sap by cutting transverse slits in the bark of twigs. Larvae feed on leaves during the summer and migrate to the ground to overwinter as pupae. Heavily infested trees can be completely defoliated. Caterpillars rear up in a characteristic “s”-shape when disturbed.

Although severe defoliation reduces tree vigor,

outbreaks of elm sawfly are rare.

CONTROL: Spray leaves with carbaryl when leaf damage is first noticed.



Elm sawfly larva

HARDWOOD DEFOLIATORS

SAWFLIES—*Nematus spp.*

HOSTS: Willow and cottonwood and other poplars

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Color of the larvae depends upon the species present, and may vary from black or greenish-black to light green with rows of yellow or dark colored spots along the sides of the body. Adults resemble small bees.

Adult sawflies emerge during spring and lay eggs in pockets cut in leaf tissue. Larvae feed gregariously on leaves during the summer and then drop to the ground to overwinter and/or pupate. There may be more than one generation per year. When disturbed, larvae curl in a characteristic "s"- or "c"-shape.

Large infestations can cause substantial defoliation.

CONTROL: Spray larvae and leaves with malathion or carbaryl.



Nematus sp. sawfly larvae on poplar

PEAR SAWFLY (PEAR SLUG)—*Caliroa cerasi*

HOSTS: Plum, cherry, cotoneaster, pear, and mountain ash

IDENTIFICATION, LIFE CYCLE AND DAMAGE: Larvae are slug-like, dark olive-green, and covered with slime. Adult sawflies are black and yellow, stout-bodied, and approximately 5 to 8 mm long.

Larvae overwinter in protected places in soil and pupate in the spring. Adult sawflies emerge in June and July, and females lay eggs in slits cut in leaves. Eggs hatch after a few days and larvae feed on foliage for 2 to 3 weeks. A second generation is common in late summer in the Central Great Plains with adults emerging during late July and August and peak larval feeding occurring in September.

Larvae feed almost entirely on the upper leaf surface, consuming tissue and avoiding main veins.

Heavily infested leaves appear scorched and may drop prematurely. Severe defoliation reduces plant vigor and is unsightly.

CONTROL: Spray leaves with carbaryl, malathion, diazinon, or other commonly available insecticides when damage first appears.



Pear sawfly larva and damage

ELM LEAF BEETLE—*Pyrrhalta luteola*

HOSTS: American and Siberian (Chinese) elms

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Small larvae are black and hairy; large larvae are yellow with two longitudinal dark stripes. Adults are 5 to 7 mm long, yellowish-green, and have a black stripe on the outer margin of each wing cover. Three black spots are present behind the head.

Elm leaf beetles overwinter as adults in sheltered dry areas, especially in and around buildings and in litter and bark crevices. They emerge when buds begin to expand in the spring and feed on leaves before laying clusters of yellow eggs on foliage in late spring.

Larvae skeletonize leaves for 2 to 3 weeks before pupating. There are two or three generations per year. Shade trees are often heavily defoliated, making them weak and unsightly.

CONTROL: Spray elm leaves with carbaryl or methoxychlor to kill larvae and adults. Do not spray when the weather is hot and dry. Inject systemics recommended by your extension service into the trunk or apply them to the soil. Spray and pupae larvae clustered at the base of the tree with carbaryl or methoxychlor, or pour boiling water or a light oil on them.



Elm leaf beetle eggs, larvae, and adult on damaged leaf

HARDWOOD DEFOLIATORS

COTTONWOOD LEAF BEETLE—*Chrysomela scripta*

HOSTS: Willow and cottonwood and other poplars

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Young larvae are black. Mature larvae are blackish with two white spots on each side and are about 12 mm long. Adult beetles are 6 mm long, and have black heads and yellowish wing covers with black stripes.

Beetles overwinter as adults under loose bark and debris, or in clumps of grass. In early spring, they emerge and feed on new leaves and tender bark. Females lay clusters of yellow eggs on the underside of leaves. Young larvae feed gregariously; older larvae feed alone.

Adults and larvae skeletonize leaves throughout the remainder of the spring and summer. There are two to four generations per year. Severely defoliated trees are weakened and unsightly.

CONTROL: Spray leaves with carbaryl or chlorpyrifos to kill adults and larvae. However, these insecticides also will kill beneficial lady beetle predators that feed on eggs and pupae of cottonwood leaf beetles.



Cottonwood leaf beetle larvae and damage



Cottonwood leaf beetle adults and damage

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CARAGANA BLISTER BEETLE—*Epicauta subglabra*; ASHGRAY BLISTER BEETLE—*E. fabricii*

HOSTS: Caragana (Siberian peashrub), honeylocust, pines, and other trees and shrubs

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Young larvae are long-legged and about 2 mm long. Older larvae are mummy-like and 7 mm long. Adult beetles are gray to black, soft-bodied, elongated, and 12 to 20 mm long. The segment directly behind the head is constricted giving the appearance of a neck.

Larvae live in the soil and eat grasshopper and other insect eggs. Mature larvae overwinter in the soil and pupate in early spring. Adults emerge in late May or early June and immediately begin feeding on the foliage. In the fall eggs are laid in the soil.

The beetles are voracious feeders that feed in groups or swarms; even moderate populations can cause extensive defoliation. The body fluids of most blister beetles contain cantharidin, a chemical

substance capable of producing large, watery blisters if allowed to come in contact with the skin. These beetles are toxic to mammals if eaten. Horses have died from eating beetles that were entrapped in bales of alfalfa hay.

CONTROL: Spray foliage and beetles with carbaryl or methoxychlor when large numbers are seen in late May, June, or July.



Epicauta sp. blister beetle

GRASSHOPPERS—*Melanoplus* spp.

HOSTS: Russian-olive, boxelder (Manitoba maple), caragana (Siberian peashrub), elm, cherry, plum, honeysuckle, lilac, oak, pine, and other conifer and hardwood trees and shrubs

IDENTIFICATION, LIFE CYCLE,

AND DAMAGE: Grasshoppers vary in size and coloration but all have short antennae, large eyes, large hind legs, leathery narrow forewings, and broad membranous hindwings.

Most grasshopper species overwinter as eggs in the ground. Nymphs emerge in the spring and mature

HARDWOOD DEFOLIATORS

Grasshoppers, continued

in 40 to 70 days. They feed throughout the remainder of the summer and early fall, and mate in the fall.

Grasshoppers usually feed on range grasses, small grains, soybeans, flax, corn, and grasses and weeds bordering fields. However, when populations become epidemic, they will feed on most plants, including trees and shrubs. Defoliation can be devastating to small trees.

CONTROL: For temporary control, spray leaves and branches with carbaryl or chlorpyrifos. Trees frequently are reinfested by grasshoppers moving in from untreated sites; therefore, trees should be

resprayed as needed.



Melanoplus sp. grasshopper nymph

ASPEN LEAFMINER—*Phyllocnistis populiella*

HOSTS: Aspen, cottonwood and other poplars

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Larvae and moths are similar in appearance to aspen blotchminers.

Aspen leafminers overwinter as adult moths. In spring eggs are laid near the tips of young leaves and larvae emerge a few days later. During summer larvae feed and construct winding tunnels within the leaves. There is one generation per year.

Severe infestation will reduce height growth and, if left unchecked for several years, can kill trees.

CONTROL: Spray leaves with chlorpyrifos

or oxydemeton-methyl at first sign of mining.



Aspen leafminer damage

ASPEN BLOTCHMINER—*Phyllonorycter tremuloidiella*

HOSTS: Cottonwood and other poplars

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Young larvae are white or cream-colored and very flat, while older larvae are more cylindrical and 4 to 5 mm long. Moths have a wingspread of 6 to 17 mm and have elongated yellowish forewings with white cross bars and diagonal markings. Larvae appear in spring and pupate within the mines during July and August; adults emerge during August.

During early summer, larvae of aspen blotchminers feed and construct irregularly shaped mines between the upper and lower surfaces of leaves. By mid-summer these mines appear as blotches on the leaves. Infested trees usually shed damaged leaves prematurely.

CONTROL: Spray leaves with chlorpyrifos or oxydemeton-methyl at first sign of mining.



Aspen blotchminer damage

POPLAR BLACK MINE BEETLE—*Zengophora scutellaris*

HOSTS: Cottonwood and other poplars

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Adult beetles are 4 to 4.5 mm

long and have a corn-yellow head and thorax with black wing covers.

In autumn larvae drop to the ground and spend winter in the upper layers of soil. Pupation and adult

HARDWOOD DEFOLIATORS

Poplar black mine beetle, continued

emergence occur during May and June. Beetles skeletonize small patches of leaf tissue in late June and during July. Eggs are laid on leaves and twigs. During July and August white, legless larvae mine large irregular areas between leaf surfaces that turn black.

Damage is unsightly and becomes conspicuous in late summer.

CONTROL: Spray leaves with carbaryl, malathion, or fluvalinate in late June when adults are feeding. Rake and dispose of leaves immediately after they drop and before larvae enter the soil.



Poplar black mine beetle

PHOTO CAPTIONS AND CREDITS

Spring cankerworm larvae and damage—(D. Keith, Univ. of Nebraska - Lincoln)

Spiny-elm caterpillar—(D. Leatherman, Colorado State Forest Service)

Nevada buck moth larva—(D. Leatherman, Colorado State Forest Service)

Greenstriped mapleworm—(D. Leatherman, Colorado State Forest Service)

Variable oakleaf caterpillar—(J. D. Solomon, USDA Forest Service)

Fruittree leafroller larva—(Kenneth Gray Slide Collection)

Fruittree leafroller damage—(D. Leatherman, Colorado State Forest Service)

Forest tent caterpillar—(B. Neill, Agriculture Canada, Prairie Farm Rehabilitation Administration)

Prairie tent caterpillar nest—(M. Harrell, Univ. of Nebraska - Lincoln)

Prairie tent caterpillar larvae—(B. Neill, Agriculture Canada, Prairie Farm Rehabilitation Administration)

Fall webworm nest—(R. G. Weber, Kansas State Univ.)

Dark phase fall webworm larva—(S. Krieg, Colorado State Forest Service)

Uglynest caterpillar—(S. Krieg, Colorado State Forest Service)

Mimosa webworm nest with eggs, larva, and adult—(J. Peacock, USDA Forest Service)

Mimosa webworm larva—(R. C. North, Iowa State Univ.)

Elm sawfly larva—(B. Neill, Agriculture Canada, Prairie Farm Rehabilitation Administration)

Nematus sp. sawfly larvae on poplar—(M. Harrell, Univ. of Nebraska - Lincoln)

Pear sawfly larva and damage—(Kenneth Gray Slide Collection)

Elm leaf beetle eggs, larvae, and adult on damaged leaf—(D. Leatherman, Colorado State Forest Service)

Cottonwood leaf beetle larvae and damage—(D. Leatherman, Colorado State Forest Service)

Cottonwood leaf beetle adults and damage—(D. Leatherman, Colorado State Forest Service)

Epicauta sp. blister beetle—(D. Leatherman, Colorado State Forest Service)

Melanoplus sp. grasshopper nymph—(D. Leatherman, Colorado State Forest Service)

Aspen blotchminer damage—(L. Wilson, USDA Forest Service)

Aspen leafminer damage—(E. Holsten, USDA Forest Service)

Poplar black mine beetle—(D. Leatherman, Colorado State Forest Service)

CONIFER DEFOLIATORS

SPRUCE NEEDLEMINER—*Endothenia albolineana*

HOST: Spruce

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Mature larvae are light green with brown heads and are about 8 mm long. Moths have dark brown wings with three wavy, transverse, grayish-white bands and a 12 mm wingspan.

Adults emerge in late May or June (in Nebraska) and lay 2 to 12 eggs in a row on the underside of needles. Groups of young larvae mine into the bases of older needles and construct funnel-shaped “nests” composed of dried needles, excrement, and silk around twigs on the lower branches of large trees. Older larvae feed singly on the needles and overwinter in the nest. In spring larvae feed and pupate within the nests.

Spruce needleminers will not kill trees but their damage is unsightly. Nests tend to be concentrated on lower branches of large trees.

CONTROL: No insecticide is currently registered for this insect. In spring before buds begin to swell or in fall hand remove nests or dislodge nests from the branches with a strong stream of water. Burn or destroy all dislodged nests. Contact your local extension service for more information.



Spruce needleminer nest



Spruce needleminer larva and damage

PINE NEEDLE SHEATHMINER—*Zelleria haimbachi*

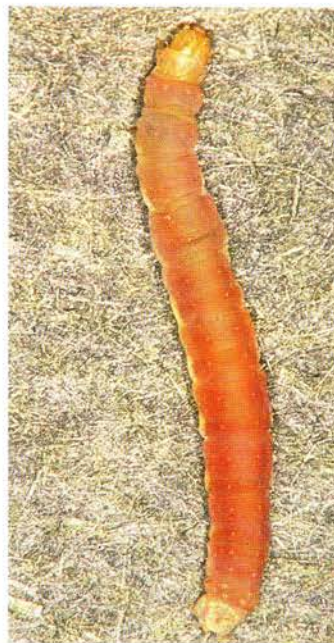
HOSTS: Ponderosa pine, and jack pine and other two needle pines

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Mature larvae are tan with two bright orange stripes and about 14 mm long. Moths are silvery-white with light yellow wings and have a wingspread of 12 mm.

Moths emerge during July and lay their eggs singly on needles. During late summer the newly hatched bright orange larvae mine current-year needles. Larvae overwinter in the needles and the following spring migrate to young needle clusters, where they feed within the needle fascicle sheaths and later form silk tubes around the bases of needles. In late June, larvae pupate within silk tubes.

Sheathminers sever needles within the needle fascicle sheath, causing them to droop and/or drop prematurely. Damage is unsightly but does not seriously affect tree vigor.

CONTROL: No insecticide is currently registered for this insect. Contact your local extension service for more information.



Pine needle sheathminer larva



Pine needle sheathminer damage

CONIFER DEFOLIATORS

CEDAR WEBWORM—*Cudonigera houstonana*

HOST: Juniper

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Larvae are green with black heads. The mottled yellowish-tan moths emerge during July and lay eggs singly on foliage.

Eggs hatch during July and August and the larvae mine needles. The following spring they leave the needles and weave branches together with silk. Then the larvae spin silken tunnels in the webbed foliage. Needles on branches within the web are consumed.

A branch that is repeatedly defoliated can be killed.

CONTROL: Spray foliage with carbaryl, acephate, or diazinon either: (1) in April when the partially grown caterpillars emerge from the needles to

weave branches together, or (2) in July when the females are laying eggs and the eggs are hatching.



Cedar webworm damage

JACK PINE BUDWORM—*Choristoneura pinus*

HOST: Jack pine

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Young larvae are pale orange or yellowish-brown and have yellowish-brown heads. Mature larvae are about 19 mm long and are dark brown with lateral brownish-yellow areas. Moths have reddish-brown wings with white markings and a wingspan of 19 mm. When at rest, moths hold their wings tent-like over their body.

Adults emerge in July and August, and females lay rows of overlapping eggs on needles. About 10 days later larvae emerge and immediately spin silken cocoons under bark scales on trees. Young larvae overwinter in cocoons and the following spring feed on needles. Larvae pupate during June and July.

Unsightly brown webs are formed when chewed-off needles are caught in silk webbing produced by the budworms. Foliage turns brown in July when larvae are reaching maturity. Feeding reduces tree growth and vigor and may kill trees that have been severely damaged for several years.

CONTROL: Spray foliage with *Bacillus thuringiensis* (B.t.) or carbaryl in late May or early June when larvae are about 13 mm in length.



Jack pine budworm larva on shoot



Jack pine budworm damage

PINE TIGER MOTH—*Lophocampa ingens*

HOST: Ponderosa pine

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Larvae are robust, hairy, and tannish-white with a dorsal hair tuft near the head and a series of black dorsal hair tufts down the back. Adult moths have dark brown forewings with large white

ovals, white hindwings, and a hairy buff-colored body.

Larvae construct large white webbed "nests" and feed gregariously on needles contained within the nests. Most nests are found on terminal branches, usually in tree tops.

CONIFER DEFOLIATORS

Pine tiger moth, continued

CONTROL: Spray foliage and webs with carbaryl, chlorpyrifos, or fluvalinate when webs are first noticed.



Pine tiger moth larva



Pine tiger moth nest

BAGWORM—*Thyridopteryx ephemeraeformis*

HOSTS: Juniper, pine, oak, poplar, willow, maple, spruce, and a variety of other conifer and hardwood trees and shrubs

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Caterpillars, pupae, and adult females live inside bags constructed of silk, twigs, and leaves which hang from trees. Full grown larvae are 18 to 25 mm long and dark brown. Bags of mature larvae are 30 to 50 mm long. Female bagworms are yellowish-white, wingless, maggot-like moths that do not have functional legs, eyes, or antennae. Male moths are sooty black and hairy, and have a wingspan of about 25 mm.

Eggs overwinter within the bags and hatch in spring. Larvae initially feed on the surfaces of leaves and later consume entire leaves. Larvae pupate in the bags in late summer. In the fall male moths emerge, fly to bags with females, and mate with the females.

Infested trees and shrubs are unsightly, weakened, and may be killed.

CONTROL: Spray foliage with carbaryl, malathion, diazinon, acephate, chlorpyrifos, or

Bacillus thuringiensis (B.t.) in late June when bagworms are less than 13 mm long. Large late-instar caterpillars are nearly impossible to control with insecticides. If only a few small trees or shrubs are infested, bags can be removed by hand and destroyed. A complex of several parasites frequently are effective in controlling outbreaks.



Bag of mature bagworm

PINE SAWFLIES—*Neodiprion* spp.

HOSTS: Ponderosa, Scotch, Austrian, and jack pines

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Sawfly larvae have eight pairs of prolegs and vary in color from grayish- to yellowish-green. Some species have one or more longitudinal stripes. Mature larvae may reach 18 to 25 mm in length. Adult sawflies resemble small bees.

The life cycle and number of generations varies with the sawfly species. Information on the life cycle of a specific species can be obtained from your county agent. Most species overwinter as pupae or pre-

pupae, a few as eggs. In spring larvae usually feed in groups on needles, starting at the needle tip. Older larvae feed singly or in pairs, but usually on the same branch as other larvae. The larvae of most species drop to the ground, spin cocoons, and pupate in the soil. All larvae rear up in a characteristic "s"-shape when disturbed.

Some species characteristically feed on young needles, others on old needles, and still others on both young and old needles. Species that feed only on old or young needles weaken trees and slow their growth, while species that feed on both young and old needles may kill severely damaged trees.

CONIFER DEFOLIATORS

Pine sawflies, continued

CONTROL: Spray needles with carbaryl when sawfly larvae first appear in May, June or July. Commercially formulated virus preparations can be used to kill some species. Natural enemies frequently are important in ending outbreaks.



Neodiprion sp. pine sawfly larvae



Pine sawfly feeding damage

YELLOWHEADED SPRUCE SAWFLY—*Pikonema alaskensis*

HOSTS: Spruce

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Young larvae are light yellowish-green with several grayish-green longitudinal stripes. Mature larvae are about 19 mm long, are olive-green with six longitudinal stripes down the body, and have a yellowish-brown head. The adult is tan and wasp-like, but the base of the abdomen is broadly joined to the thorax.

Adults emerge in early spring about the time spruce buds expand. Females lay eggs in current year's needles. Young larvae feed on new needles; older larvae feed on older needles. In July larvae drop to the ground and spin cocoons in the soil where they overwinter as mature larvae. When disturbed, larvae rear up in a characteristic "s"-shape.

Young trees less than 3 m tall and growing in the open are very susceptible to infestation. Three or four consecutive years of heavy defoliation can kill a tree.

CONTROL: Spray foliage in mid-June with carbaryl if trees are heavily infested or if trees are large. When trees and infestations are small, hand remove larvae from trees and kill them.



Yellowheaded spruce sawfly larvae

BLACK VINE WEEVIL—*Otiorhynchus sulcatus*

HOSTS: Yews, arborvitae, rhododendron, juniper euonymous, and other evergreen trees and shrubs

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Larvae are white, legless, and "c"-shaped. Adult weevils are 9 to 13 mm in length and are black with distinctive gold patches on the forewings.

Adults begin to emerge in mid-June and lay eggs in the soil during June and July. Newly hatched larvae migrate to roots where they feed until the following spring. Most black vine weevils overwinter as partially grown larvae that complete development the following spring. There is one generation per year.

Adult weevils are present throughout the year

but are usually most abundant in late June and July.



Black vine weevil

CONIFER DEFOLIATORS

Black vine weevil, continued

They feed at night on the buds, shoots, and foliage.

Damaged leaves have small notches along their edges. Larvae can extensively girdle the roots. Heavily infested plants fail to thrive, have discolored leaves, and may die. Container and field-grown nursery stock frequently are severely damaged.

CONTROL: Spray acephate or bendiocarb on the foliage and base of plants to kill adults and reduce the number of eggs laid. Control of larvae in the root zone is difficult. Drench soil around infested plants with bendiocarb or carbofuran. Contact your local extension agent for information on larval treatments.

CARAGANA BLISTER BEETLE—*Epicauta subglabra*; ASHGRAY BLISTER BEETLE—*E. fabricii*

HOSTS: Caragana (Siberian peashrub), honeylocust, pines, and other trees and shrubs

IDENTIFICATION, LIFE CYCLE, DAMAGE, AND CONTROL: See Hardwood defoliators.

GRASSHOPPERS—*Melanoplus spp.*

HOSTS: Russian-olive, boxelder (Manitoba maple), caragana (Siberian peashrub), elm, cherry, plum, honeysuckle, lilac, oak, pine, and other conifer and hardwood trees and shrubs

IDENTIFICATION, LIFE CYCLE, DAMAGE, AND CONTROL: See Hardwood defoliators.

PHOTO CAPTIONS AND CREDITS

Spruce needleminer nest—(L. Wilson, USDA Forest Service)

Spruce needleminer larva and damage—(R. Roselle, Univ. of Nebraska – Lincoln)

Pine needle sheathminer damage—(J. A. Jones, Univ. of Nebraska – Lincoln)

Pine needle sheathminer larva—(T. Miller, Univ. of Nebraska – Lincoln)

Cedar webworm damage—(H. Thompson, Kansas State Univ.)

Jack pine budworm larva on shoot—(A. Jones, Minnesota Dept. of Natural Resources)

Jack pine budworm damage—(A. Jones, Minnesota Dept. of Natural Resources)

Pine tiger moth larva—(D. Leatherman, Colorado State Forest Service)

Pine tiger moth nest—(D. Leatherman, Colorado State Forest Service)

Bag of mature bagworm—(J. A. Jones, Univ. of Nebraska – Lincoln)

Neodiprion sp. pine sawfly larvae—(D. Leatherman, Colorado State Forest Service)

Pine sawfly feeding damage—(D. Leatherman, Colorado State Forest Service)

Yellowheaded spruce sawfly larvae—(L. C. Thompson, Univ. of Arkansas – Monticello)

Black vine weevil—(Kenneth Gray Slide Collection)

Epicauta sp. blister beetle—(D. Leatherman, Colorado State Forest Service)

Melanoplus sp. grasshopper—(D. Leatherman, Colorado State Forest Service)

HARDWOOD BORERS

NATIVE ELM BARK BEETLE—*Hylurgopinus rufipes*; SMALLER EUROPEAN ELM BARK BEETLE—*Scolytus multistriatus*

HOSTS: Elm, especially American, Siberian, and Chinese elms

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Both species of beetles extend from the Southern United States to Canada. These beetles are vectors of the fungus that causes Dutch Elm Disease (DED); they carry fungal spores from diseased to healthy trees.

Larvae are grub-like and white. Adults are brownish-black, thinly covered with short yellow hairs, and about 3 mm long.

In early summer adult females lay eggs in tunnels mined between the sapwood and bark. During summer larvae extend these tunnels in the inner bark. There are two generations per year in the southern part of their ranges, but only one in the northern part.

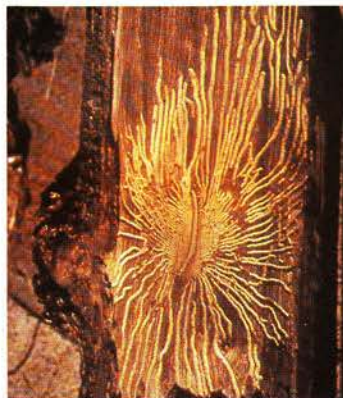
Leaves of diseased branches turn yellow to yellow-brown and die. After the beetles emerge, the bark of infested branches and trunks is marked by numerous pin-head-size exit holes. Sawdust-like frass accumulates below infested tree parts in cracks and crevices, or at the bases of trees.

CONTROL: There is no practical chemical control. In the spring, kill adult beetles before they mine into high value trees to feed and breed by spraying methoxychlor or chlorpyrifos on the bark. Thiabendazole injection will arrest the DED fungus. A community-wide sanitation program is advised. As

soon as an infestation has been diagnosed infested trees or portions of trees should be removed, debarked, and either buried beneath 0.5 m of soil or burned.



Native elm bark beetle



Smaller European elm bark beetle gallery

ASH BARK BEETLES—*Hylesinus* spp.

HOST: Ash

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Larvae are white, "c"-shaped, and legless. Adult beetles are robust, 2 to 4 mm long, and variegated gray and brown.

Adults overwinter in tunnels between the bark and wood of infested branches. In the spring, females construct egg galleries or tunnels perpendicular to the branch or trunk and between the bark and wood of dying or severely weakened trees. During summer, larvae tunnel in the inner bark of the trunk and branches. There are one to three generations per year, depending on location.

As larvae extend their tunnels, the bark becomes sunken and discolored and is marked by encircling rows of holes about 1 mm in diameter and about 4 mm apart. In July or August leaves on girdled branches turn yellow, then red-brown.

CONTROL: No insecticide is currently registered for these insects. Infested branches should be removed and burned. Contact your local extension service for more information.



Ash bark beetle



Ash bark beetle galleries

HARDWOOD BORERS

BOXELDER TWIG BORER—*Proteoteras* spp.

HOSTS: Boxelder (Manitoba maple) and maple

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Larvae are small yellowish-white caterpillars with dark heads. Moths are white to grayish-brown with olive-green with streaks and clusters of yellowish-tan to black scales on the wings and have a wingspan of about 17 mm.

Moths emerge in June or July and lay eggs on lower leaf surfaces. Young larvae initially feed on these areas and later mine into and overwinter in buds. In spring larvae mine into new shoots. There is one generation per year.

Damage stunts the growth of branches, and trees damaged for several years become bushy. A spindle-shaped gall is formed at the site of the mine, and new growth beyond the gall wilts.

CONTROL: No insecticide is currently registered for this insect. Prune and burn infested twigs in late June. Contact your local extension service for more information.



Boxelder twig borer damage

CARPENTERWORM—*Prionoxystus robiniae*

HOSTS: Ash, oak, black locust, elm, maple, willow, cottonwood and other poplars, and occasionally fruit trees and ornamental shrubs

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Mature larvae are about 75 mm long and pinkish-white with dark heads. The moths are stout-bodied with gray and brown mottled wings. Females are larger than males and have a wingspan of 75 mm.

Larvae mine the wood of the trunk leaving a maze of tunnels 20 to 25 mm in diameter. Sawdust may accumulate at entrance holes to the tunnels and at the bases of trees. Moth flight varies from May through mid-July in the Southern Plains and from mid-June through July in the Northern Plains. Eggs are laid in bark cracks, crevices, and wounds and hatch in 10–14 days. Two to three years are required to complete a generation.

Branches or entire trees may be killed. High winds or heavy snow may break off branches that have been weakened by larval tunnels.

CONTROL: Spray the trunk below 3 m with methoxychlor or chlorpyrifos during the spring or summer to prevent initial attack by larvae. Repeat two to three times at 2- to 3-week intervals. A commercially available male attractant, (Z,E)-3,5 tetradecadienyl acetate, can be used to monitor moth flight and determine the optimum time for insecticide application. Kill older larvae by injecting lindane, endosulfan, chlorpyrifos, or diazinon directly into the tunnels and sealing the tunnel entrances. To prevent adult emergence, wrap the trunk of infested trees with burlap or paper. Remove and burn heavily infested trees before the adults emerge. Decrease the probability of a successful attack by maintaining high tree vigor through watering, fertilizing, or other silvicultural practices.



Carpenterworm damage



Carpenterworm larva

HARDWOOD BORERS

LILAC (ASH) BORER—*Podosesia syringae*; BANDED ASH CLEARWING—*P. aureocincta*

HOSTS: Ash and lilac

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Mature larvae are about 25 mm long and creamy white with shining brown heads. The wasp-like moths vary from black and yellow to orange and brown, have clear wings, and have a wingspan of 26 to 28 mm.

Mature lilac borer larvae overwinter and pupate in tunnels under the bark. Moths emerge and lay eggs on the bark during March, April, and May in the Southern Plains, and during May, June, and July at northern sites. Larvae of banded ash clearwings pupate in August, and moths fly in late August or early September. Banded ash clearwings overwinter as young larvae in tunnels.

During the summer, larvae of both species mine the sapwood of young trees, causing leaves to turn reddish-brown and branches to die back and break. Entire trees are often killed. Entrances to the tunnels are frequently associated with sunken and cankered areas on stems and branches. Dark moist sawdust clings to the tunnel entrances and to the bases of trees. Empty pupal skins often protrude from exit holes.

CONTROL: Spray trunks and all branches below 3 m with chlorpyrifos. Trees should be sprayed two to three times at 2-week intervals during moth flight. Traps baited with a male attractant, (Z,Z)-3,13-octadecadienyl acetate, can be used to monitor moth flight and determine the optimum times to spray. Trees should be sprayed 10 to 14 days after the first moth is captured. Cut and burn heavily infested trees and branches.



Lilac (ash) borer damage



Lilac (ash) borer larva



Lilac (ash) borer adult female

PEACHTREE BORER—*Synanthedon pictipes*; LESSER PEACHTREE BORER—*S. exitiosa*

HOSTS: Peach, plum, and cherry

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: The appearances, life cycles, and types of damage of these two insects are similar. Larvae are hairless, cream-colored, and 12 to 25 mm long. The moths closely resemble wasps or bees, have long narrow wings, a wingspan of 1 to 3 cm, and are metallic blue to black with bright orange or yellow bands. Adults are swift fliers and often are found around flowers.

There is one generation per year. Immature larvae overwinter in their burrows and emerge as adults in early summer. Females lay up to 800 eggs in bark cracks, crevices, and wounds. Eggs hatch within 2 weeks and larvae immediately begin boring into the sapwood. Entrances to galleries are marked by masses of gummy exudate and brown sawdust-like material.

Young trees may be girdled and killed. Older

trees are weakened and after repeated attacks may be killed.



Lesser peachtree borer damage

HARDWOOD BORERS

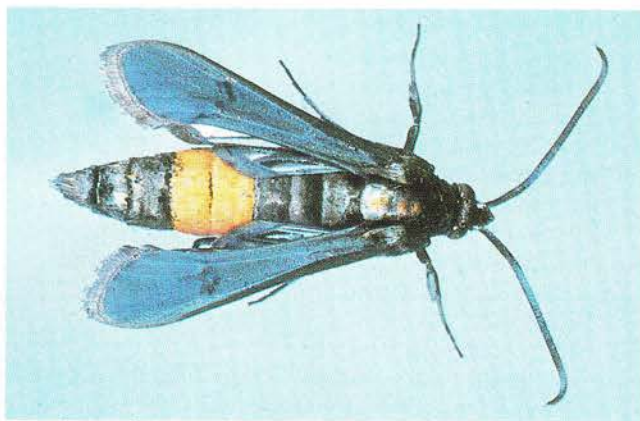
Peachtree borer, continued

CONTROL: Spray the root collar, trunk, and large branches with lindane, endosulfan, fluralinate, or chlorpyrifos two to three times during the spring and summer to prevent the newly hatched caterpillars from boring into the trunk. Do not allow sprays to touch the foliage. The timing and number of applica-

tions varies with the site and season. Your local extension service will have current information on the timing and number of applications for your area. A commercially available male attractant can be used to monitor moth flight and determine the optimum times to spray.



Lesser peachtree borer adult



Peachtree borer adult

CLEARWING BORERS: VIBURNUM BORER—*Synanthedon viburni*; CURRANT BORER—*S. tipuliformis*

HOSTS: Viburnum, currant, raspberry, and gooseberry

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Larvae are white with dark heads. Adult viburnum borers are blue-black clearwing moths with yellow markings on the thorax and a wingspan of 16 to 22 mm. Adult currant borers are black with a yellow band on the abdomen, large anal tufts, and a wingspan of 16 to 20 mm.

Adults appear in May or June. Female viburnum borers lay eggs in bark crevices near gall tissue or existing wounds, and larvae tunnel under the bark. Female currant borers lay eggs on the stems, and larvae tunnel within the stem. Larvae of both species overwinter in the tunnels.

Stems damaged by the viburnum borer may be girdled and die. Stems infested with currant borer wilt and die back.

CONTROL: During moth flight, spray stems with methoxychlor or chlorpyrifos two or three times at 2-week intervals. Commercially available traps baited with a male attractant can be used to monitor viburnum borer flight and to determine the optimum times to spray. Cut and burn heavily infested branches and plants before moth emergence.



Viburnum borer adult



Currant borer adult

COTTONWOOD BORER—*Plectrodera scalator*

HOSTS: Cottonwood and other poplars

IDENTIFICATION, LIFE CYCLE,

HARDWOOD BORERS

Cottonwood borer, continued

AND DAMAGE: Larvae are cream-colored and reach 32 to 38 mm in length. Beetles are black and white and 25 to 35 mm long with antennae nearly or as long as the body.

Beetles emerge during late spring and summer and feed on tender shoots of young trees. Females lay eggs in bark at the bases of trees. Larvae emerge in 10 to 14 days and mine tunnels in the lower trunk and large roots. Two years are required to complete the life cycle.

Shoots damaged by adult feeding turn black, shrivel up, and die. Sawdust may accumulate in entrance holes to the tunnels and in bark crevices at the bases of trees. Infestations frequently are not discovered until trees are severely damaged and weakened branches and tree portions have broken.

CONTROL: Spray trunks and lower limbs of high value trees with chlorpyrifos when adults begin to emerge in spring. Contact your local exten-

sion service for more information on proper treatment time.



Cottonwood borer adult

POPLAR BORER—*Saperda calcarata*

HOSTS: Cottonwood and other poplars

IDENTIFICATION, LIFE CYCLE,

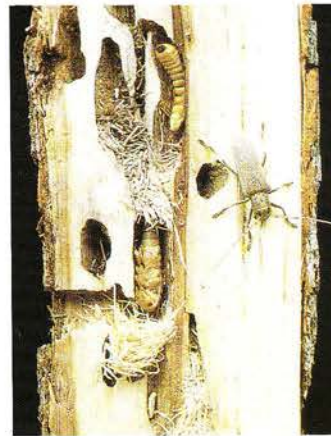
AND DAMAGE: Larvae are legless and creamy-white with brown heads. Adults are elongate, robust, grayish beetles about 20 to 30 mm long with yellowish markings on the wings and body.

Adults emerge during summer. They feed on the bark of young twigs and lay eggs in slits cut in the bark of the trunk and larger branches. Larvae tunnel inside the trunk and branches for 2 to 3 years.

Infested branches and trunks become swollen and scarred, and contain numerous holes marked by sawdust and sap. Wet areas around the holes eventually blacken and appear varnished. Large trees are often riddled with tunnels making them subject to wind breakage. Small trees may be girdled and killed.

CONTROL: Spray trunks and lower limbs of high value trees with chlorpyrifos when adult

beetles begin to emerge in summer. Contact your local extension service for more information on proper treatment time.



Poplar borer larva, pupa, adult, and damage

LOCUST BORER—*Megacyllene robiniae*

HOST: Black locust

IDENTIFICATION, LIFE CYCLE,

AND DAMAGE: Mature larvae are 25 mm long and white with dark heads. Adult beetles are about 18 mm long and black with bright yellow bands across the thorax and wing covers. The third band on the wings forms a "w" design.

Beetles emerge in late summer and early fall and are commonly seen on goldenrod flowers. In the fall they deposit eggs in cracks, crevices, and bark wounds. Newly hatched larvae immediately bore into

the tree and overwinter in the inner bark. Larvae tunnel in the sapwood and heartwood throughout the following spring and summer. There is one generation per year.

By spring, entrances to the larval tunnels are marked by sap oozing from the tree and granular exudate pushed out by the larvae. Larval mines can literally "honeycomb" both sapwood and heartwood, weakening the tree and making it subject to wind-throw. Borer damage also provides an opening for infection by heart rot fungus (*Fomes rimosus*). This fungus weakens and can kill black locust.

HARDWOOD BORERS

Locust borer, continued

CONTROL: Spray trees with lindane either in late summer or early fall or when the buds expand in spring to kill young larvae. Stressed trees and trees growing on poor sites are most susceptible to attack. Avoid planting this shallow rooted tree where soil conditions are unfavorable, or where the roots will be moisture stressed.



Locust borer adult

REDHEADED ASH BORER—*Neoclytus acuminatus*; BANDED ASH BORER—*N. caprea*

HOSTS: Ash, oak, and hackberry

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Larvae are cream-colored, fleshy, legless grubs. Beetles are typically elongate, cylindrical, and have antennae at least half as long as their bodies. Redheaded ash borer beetles have a reddish head and thorax, and a light brown wing covering marked with four yellow transverse bands. Banded ash borer beetles are dark brown to black with a whitish or yellowish thorax and four whitish or yellowish lines on the wing coverings.

Adults appear in March or April and deposit eggs on bark. Larvae initially bore in the inner bark and later into the sapwood and heartwood. There is one generation in the north and several in the south.

The elongate tunnels are usually filled with granular or fibrous frass. Borers usually are a problem in weakened or dying trees. Healthy trees are seldom attacked.

CONTROL: No insecticide is currently registered for these insects. Decrease the possibility of infestation by removing and destroying infested, diseased, and dead trees and limbs, and managing trees to increase tree vigor. Contact your local extension service for more information.



Banded ash borer adults and larval damage

ASPEN ROOT GIRDLER—*Agrilus horni*

HOSTS: Aspen, especially quaking aspen

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Mature larvae are flattened, about 25 mm long, and white with brown heads. Adults are blackish-green beetles about 7 to 12 mm long.

Two years are required to complete a generation. Beetles lay eggs at the bases of aspen trees. Larvae bore into the bases of aspen suckers, tunnel downward and out along large roots, then turn back and tunnel toward the main stem. Spiral galleries that encircle the roots may continue up the trunk for several centimeters.

Infested trees may be girdled and killed.



Aspen root girdler damage

HARDWOOD BORERS

Aspen root girdler, continued

CONTROL: No insecticide is currently registered for this insect. Contact your local extension service for more information.



Aspen root girdler larva

PHOTO CAPTIONS AND CREDITS

Native elm bark beetle—(B. Neill, Agriculture Canada, Prairie Farm Rehabilitation Administration)

Smaller European elm bark beetle gallery—(D. Leatherman, Colorado State Forest Service)

Ash bark beetle—(M. E. Dix, USDA Forest Service)

Ash bark beetle galleries—(D. Leatherman, Colorado State Forest Service)

Boxelder twig borer damage—(M. E. Dix, USDA Forest Service)

Carpenterworm damage—(D. Leatherman, Colorado State Forest Service)

Carpenterworm larva—(A. Tagestad, USDA Forest Service)

Lilac (ash) borer damage—(M. E. Dix, USDA Forest Service)

Lilac (ash) borer larva—(D. Nielsen, Ohio Agricultural Research and Development Center)

Lilac (ash) borer adult female—(D. Nielsen, Ohio Agricultural Research and Development Center)

Lesser peachtree borer damage—(K. Wid-

combe, Nebraska Department of Agriculture)

Lesser peachtree borer adult—(D. J. Shetlar, Chemlawn)

Peachtree borer adult—(D. Nielsen, Ohio Agricultural Research and Development Center)

Viburnum borer adult—(J. Capinera, Colorado State Univ.)

Currant borer adult—(F. Peairs, Colorado State Univ.)

Cottonwood borer adult—(M. Harrell, Univ. of Nebraska - Lincoln)

Poplar borer larva, pupa, adult, and damage—(J. D. Solomon, USDA Forest Service)

Locust borer adult—(USDA and Clemson Univ. Slide Collection)

Banded ash borer adults and larval damage—(J. Kalisch, Univ. of Nebraska - Lincoln)

Aspen root girdler damage—(L. Wilson, USDA Forest Service)

Aspen root girdler larva—(M. Ostry, USDA Forest Service)

CONIFER BORERS

PINE TIP MOTHS: NANTUCKET—*Rhyacionia frustrana*, **SOUTHWESTERN**—*R. neomexicana*, **WESTERN**—*R. bushnelli* and other *Rhyacionia* spp.

HOSTS: Ponderosa, Austrian, Scotch, and jack pines

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Larvae vary from yellowish-white to pink to reddish-orange, with dark heads. Mature Nantucket and western pine tip moth larvae are 9 to 12 mm long; mature southwestern pine tip moth larvae are 12 to 15 mm long. Coloration and wingspan of the moths varies with the species; however, most are a mottled reddish-brown and gray.

Nantucket pine tip moths overwinter as pupae in the buds, while the other tip moths overwinter as pupae in the ground. Moths appear during spring and females lay eggs on new growth. Nantucket pine tip moths have 2 to 4+ generations per year. Western pine tip moths have 1 to 2+ generations per year. Southwestern pine tip moths have one generation per year.

Larvae mine needles, buds, and new shoots, killing shoots and stunting tree growth. Old infested tips crumble when squeezed. Shoots infested with southwestern pine tip moths commonly turn brown and bend over in a shepherd's crook.

CONTROL: Spray acephate or dimethoate on foliage in spring when new shoots are elongating but before needles are more than 13 mm long. Repeat in late June or early July. Insecticide application should be timed to coincide with the appearance of young larvae. Synthetic attractants of male Nantucket and southwestern pine tip moths are available commercially and can be used to monitor adult flight periods. Trees should be sprayed 10 to 14 days after moth flight begins.



Southwestern pine tip moth damage



Western pine tip moth damage



Western pine tip moth larva

WESTERN PINE SHOOT BORER—*Eucosma sonomana*

HOSTS: Lodgepole and ponderosa pines, and Engelmann spruce

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Larvae are dirty white with dark heads and are 12 to 15 mm long. Moths have coppery-red forewings marked with two gray transverse bands and have a wingspan of 16 to 22 mm.

Pupae overwinter in the soil, and moths fly in early spring (April and May in Colorado). Adults lay eggs on the elongating shoots in the spring. During June, July, and August, larvae bore downward in the pith of elongating shoots. By August a few of the



Western pine shoot borer larva

CONIFER BORERS

Western pine shoot borer, continued

severely damaged shoots may die and turn red.

Infested trees are stunted and frequently have excessive branching. Unlike tips damaged by pine tip moths, western pine shoot borer infested tips do not crumble when squeezed.

CONTROL: No insecticide is currently registered for this insect. If the infestation is small, remove and destroy damaged shoots as they appear. Contact your local extension agent for more information.

METALLIC PINE PITCH NODULE MAKER—*Retinia metallica*

HOSTS: Ponderosa, jack, Austrian, and other pines

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Larvae are about 10 mm in length and are pink or cream with dark heads. Moths are mottled gray and white and have a wingspan of 7 to 10 mm.

Larvae overwinter inside the mined tip and pupate in their galleries during the spring. During May or early June moths emerge and lay eggs in the new growth. Larvae mine new shoot growth and buds throughout the summer. During July, a pitch nodule or round pinkish-maroon mass composed of pitch, sawdust, and insect excrement is formed at the point of attack.

Branch growth is stunted and tips are frequently killed. Heavily infested trees have excessive branching.

CONTROL: No insecticide is currently registered for this insect. Contact your local extension service for more information.



Nodule of metallic pine pitch nodule maker



Metallic pine pitch nodule maker larva

WHITE PINE WEEVIL—*Pissodes strobi*

HOST: Spruce

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Larvae are white and legless. Adult weevils are mottled brown and white, have a

long curved snout, and are 4 to 6 mm long.

Adults emerge in late summer or fall and overwinter in the ground. In the spring female weevils lay eggs in feeding punctures on previous year's growth. Larvae emerge in 7 to 10 days and tunnel downward



White pine weevil damage on spruce



White pine weevil adult

CONIFER BORERS

White pine weevil, continued

between the bark and wood of shoots. During August larvae pupate in fibrous wood chip cocoons under the bark.

Infested leaders are girdled and wilt, producing a characteristic “shepherd’s crook.” After several years of damage, trees become crooked, multiple-stemmed, and bushy. Trees less than 1 m tall may be killed.

CONTROL: In spring when adults first appear, spray leaders with oxydemeton-methyl. In mid-July cut and burn infested parts of the stem. Avoid planting host trees near infested areas.

ZIMMERMAN PINE MOTHS—*Dioryctria ponderosae*, *D. tumicolella*, and *D. zimmermani*

HOSTS: Austrian, ponderosa, and Scotch pines

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Mature *D. ponderosae* larvae are creamy-white with dark heads and are about 22 mm long. *D. tumicolella* and *D. zimmermani* larvae are pinkish-brown with several rows of dark spots, and, when mature, are about 25 mm long. Moths of these species are gray and black with wingspans of 25 mm to 30 mm.

The life cycle of *D. ponderosae* lasts 14 to 24 months. This species overwinters as a second, third, or fourth instar larva in its gallery. *D. tumicolella* and *D. zimmermani* have one-year life cycles and overwinter as young larvae under bark scales. *D. tumicolella* and *D. zimmermani* moths emerge in August (Nebraska), while *D. ponderosae* moths usually emerge in June and July. Adults of these species lay eggs singly under bark scales on the trunk and large branches, frequently at or near wounds or sites of previous attacks.

Larvae of these species mine under the bark, girdling branches and trunks. Masses of reddish pitch ooze from the entrances to larval galleries, especially where branches join the main stem. Infested branches may bend downward or break off at the main stem, especially following heavy snows. Trees may die after repeated infestations.

CONTROL: To kill *D. tumicolella* and *D. zimmermani*, drench stems and large branches with chlorpyrifos, dimethoate, or acephate during the second or third week of April, or inject (implant) acephate into the trunk in late April. To kill *D. ponderosae*, drench stems and branches as above, but during the first and last weeks of July. Remove and burn or debark heavily infested trees.



Zimmerman pine moth damage



Zimmerman pine moth pitch mass



Zimmerman pine moth larva

PINE ROOT COLLAR WEEVIL—*Hylobius radialis*

HOSTS: Austrian, jack, red, and Scotch pines

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Larvae are white and legless. Adult weevils are dark reddish-brown to black and about 10 to 12 mm long.

Larvae overwinter in soil or bark crevices and emerge in spring to feed on the bark of small branches. Throughout spring and summer females lay eggs in bark crevices at the bases of trees or in the soil within a few centimeters of tree trunks. Some adults survive through a second winter and continue to feed, mate,

CONIFER BORERS

Pine root collar weevil, continued

and lay eggs the following spring and summer.

Larvae tunnel downward between the bark and wood. Tunnels extend from the base of the tree into the root collar, and may extend into the soil around the base of the tree. Soil around the roots may become soaked with pitch. Bases of infested trees usually are weak because the root collar beneath the soil and duff is constricted. Frequently the tree is girdled and dies.

CONTROL: No insecticide is currently registered for this insect. Contact your local extension service for more information.



Pine root collar weevil larva

PINE BARK BEETLES—*Ips grandicollis*, *I. calligraphus*, *I. pini*, *Ips spp.*, *Dendroctonus ponderosae*, *D. valens*, and *Dendroctonus spp.*

HOSTS: Ponderosa, Scotch, eastern white, jack, and other pines

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Several species of bark beetles breed in pines in the Great Plains. Larvae are usually “c”-shaped, legless, and white with brown heads. Adults range from 3 to 10 mm long and are brown or black.

If winters are not severe, most bark beetle species can overwinter as adults, larvae, or eggs. Eggs are laid in galleries constructed between the bark and wood, and larval feeding galleries radiate from these egg galleries. The number of generations per year can vary from one to three or more depending upon the species involved and the severity of winter.

Gallery patterns, vigor of trees attacked, and site of attack vary with the species. Small holes in the bark, pitch masses on the bark, and boring dust in crevices and at the base of the tree are the first signs of attack. Infested trees have a characteristic blue-gray sapwood, caused by blue stain fungi, which the beetles introduce. Feeding by larvae and the accompanying spread of blue stain fungi eventually girdle infested trees. Needles on girdled trees turn a characteristic reddish-brown color. Group-killing of trees is characteristic of all species.

CONTROL: Avoid mechanical injuries to healthy trees. Prune only during dormant seasons. Cut and burn or debark infested materials. Thin overcrowded stands and remove weakened trees. Kill beetles in logging residue by burning slash or scatter-

ing slash so the sun can dry it quickly. High value trees can be protected from attack by late spring or early summer applications of carbaryl.



Ips sp. bark beetle galleries



Dendroctonus ponderosae adult and eggs in gallery

CEDAR BARK BEETLES—*Phloeosinus spp.*

HOSTS: Juniper and arborvitae

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Larvae are white and legless.

Beetles are 2 to 4 mm long, reddish-brown to black, and shiny or covered with short gray hairs.

Newly emerged adults initially tunnel and feed in twigs of healthy trees, often hollowing them out

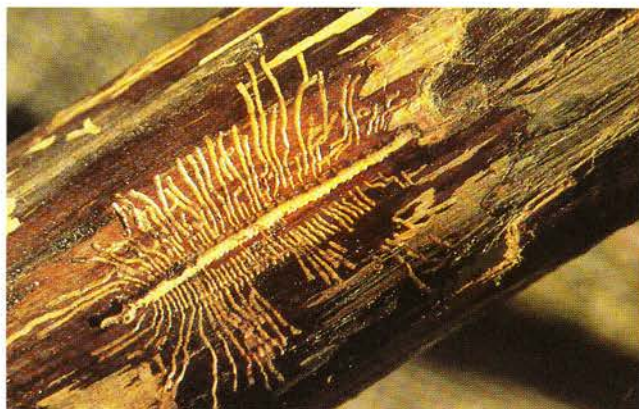
CONIFER BORERS

Cedar bark beetles, continued

about 15 to 30 cm from the tip. Infested twigs wilt, die, and break off. Beetles construct short vertical egg galleries beneath the bark of weakened, dying, and felled trees. Larvae initially construct tunnels horizontally from the egg gallery and then vertically in the phloem. Adults emerge through small exit holes in the bark in the spring and summer. There are from one to one and one-half generations per year.

Although these beetles kill twigs and may girdle branches or portions of a tree, they seldom kill entire trees.

CONTROL: No insecticide is currently registered for these insects. Remove and destroy infested twigs. Maintain tree vigor by watering. Contact your local extension service for more information.



Cedar bark beetle gallery

CONIFER-INFESTING LONGHORNED BEETLES— *Monochamus spp.*, *Semanotus spp.*, *Xylotrechus spp.*, and other Cerambycidae

HOSTS: Austrian, ponderosa, and Scotch pines, juniper, arborvitae, spruce, and other conifers

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: The grub-like larvae are white with brown heads and have a segmented and cylindrical body. Adult beetles have oblong or cylindrical bodies, 1 cm to over 2 cm in length, long legs, and antennae that are at least half the length of the body.

Length of the life cycle and the time of adult emergence varies with the species. Most life cycles last 1 or 2 years.

Adults feed on flowers or tender bark of twigs and cause only minor damage. Larvae of most species tunnel beneath the bark or in the sapwood of dead or dying trees. Large limbs and trunks are frequently girdled and killed. Sawdust-like material accumulates around the entrance to tunnels and at the bases of infested trees. Some species carry a tree-killing nematode for which there is no control. A chewing sound made by the larvae can often be heard in infested dead trees or in firewood.

CONTROL: Control is normally unnecessary because the host is already dead or dying before attack. Prevent larval entry into living high value trees by spraying the trunk and limbs during the egg-laying period with an insecticide recommended by your extension service. Store infested firewood outdoors to avoid the nuisance of noise, sawdust, or emerging adults. Infested structural lumber or logs may require professional fumigation.



Longhorned beetle larva



Longhorned beetle galleries



Monochamus sp. longhorned beetle adult

PHOTO CAPTIONS AND CREDITS

Southwestern pine tip moth damage-(D. Leatherman, Colorado State Forest Service)

Western pine tip moth damage-(M. E. Dix, USDA Forest Service)

Western pine tip moth larva-(J. Pasek, USDA Forest Service)

Western pine shoot borer larva-(K. Stoszek, Univ. of Idaho)

Nodule of metallic pine pitch nodule maker-(M. E. Dix, USDA Forest Service)

Metallic pine pitch nodule maker larva-(D. Leatherman, Colorado State Forest Service)

White pine weevil damage on spruce-(D. J. Shetlar, Chemlawn)

Adult white pine weevil-(D. J. Shetlar, Chemlawn)

Zimmerman pine moth damage-(D. Leatherman, Colorado State Forest Service)

Zimmerman pine moth pitch mass-(M. Harrell, Univ. of Nebraska - Lincoln)

Zimmerman pine moth larva-(M. Harrell, Univ. of Nebraska - Lincoln)

Pine root collar weevil larva-(L. Wilson, USDA Forest Service)

Ips sp. bark beetle galleries-(D. Leatherman, Colorado State Forest Service)

Dendroctonus ponderosae adult and eggs in gallery-(G. Amman, USDA Forest Service)

Cedar bark beetle gallery-(D. Leatherman, Colorado State Forest Service)

Longhorned beetle larva-(D. Keith, Univ. of Nebraska - Lincoln)

Longhorned beetle galleries-(D. Leatherman, Colorado State Forest Service)

Monochamus sp. long-horned beetle adult-(D. Leatherman, Colorado State Forest Service)

GALL INSECTS

ASH FLOWER GALL MITE—*Eriophyes fraxiniflora*

HOST: Ash

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Eriophyid mites are less than 1 mm long, have eight legs, and vary from yellowish to greenish to orangish to reddish to red. Each species causes a characteristic gall.

Under favorable conditions, these mites can develop from egg to adult in 10 to 14 days; therefore, many generations may occur throughout the growing season.

Ash flower gall mites feed in male flower clusters. Infested clusters become irregularly branched and fringed. They initially are green, and turn black as they dry. The clusters persist until the following spring. This damage is unsightly but does not affect tree vigor.

CONTROL: Control is not necessary unless

seed is desired. Spray branches, leaves, and flowers with carbaryl when blossoms first begin to form.



Galls of ash flower gall mite

POPLAR BUD GALL MITE—*Eriophyes parapopuli*

HOSTS: Cottonwood and other poplars

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Poplar bud gall mites are similar in appearance and life cycle to the ash flower gall mite. These mites feed on leaf buds, causing a cauliflower-like growth to develop.

Galls initially are dark green, hairy, and soft, but turn brick red by late summer. Old galls are grayish and hard. Although infested branches are often stunted and crooked, trees are seldom killed.

CONTROL: Spray expanding buds and leaves with carbaryl. Contact your local extension

service for more information on timing of applications.



Galls of poplar bud gall mite

HACKBERRY NIPPLEGALL MAKER—*Pachypsylla celtidismamma*; HACKBERRY BLISTERGALL MAKER—*P. celtidisvesicula*

HOST: Hackberry

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Adult psyllids are about 4–5 mm long, and look like miniature cicadas. The tiny, yellowish nymphs rapidly become enveloped by gall tissue and are rarely seen. Nipplegalls are light green, nipple-shaped, and about 4 mm in diameter. Blistergalls are 3–4 mm in diameter, green, and slightly raised.

Psyllids overwinter as adults in bark cracks and crevices. After mating in spring females lay eggs on new growth. Nymphs feed on new growth all summer, causing galls to form on the undersides of leaves. In September, large numbers of adults emerge from



Galls of hackberry nipplegall maker

GALL INSECTS

POPLAR VAGABOND APHID—*Mordvilkoja vagabunda*

HOSTS: Cottonwood and other poplars

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Nymphs and asexual adults range from 1 to 4 mm in length and have black heads, black thoraxes, and pale abdomens. Egg-laying females are golden-yellow.

Aphids overwinter as eggs that hatch in spring about the time new leaves expand. Young nymphs move to new shoots where they feed on sap. Initially infested leaves are reddish; later they become twisted and hollow. Two generations of aphids are produced within the galls. Winged adults leave the poplar galls during July and fly to secondary host plants where they feed and reproduce asexually for the rest of the summer. In fall winged adults migrate back to previously infested trees and deposit eggs in old galls or in bark crevices near the galls.

Galls persist on branches after leaves are shed. The same trees are often infested year after year while neighboring trees are not infested. Fully developed galls are 8 to 9.5 cm in diameter and initially are green. They dry out and turn dark brown after aphids

emerge. Although galls are unsightly, they do not affect tree vigor.

CONTROL: Spray trees immediately after leaves start to expand with oxydemeton-methyl, or a similar systemic insecticide labeled for use on poplars and cottonwoods. Contact your extension agent for more specific recommendations.



Gall of poplar vagabond aphid

HONEYLOCUST POD GALL MIDGE—*Dasineura gleditschiae*

HOST: Honeylocust

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Mature larvae are white or yellow and 6 mm long. Adult midges (flies) are 3 mm long. Males are generally black, and females are black with red abdomens.

In early spring adult midges emerge and lay tiny yellow eggs in young leaflets. One to two days later, larvae emerge and begin feeding on inner surfaces. Injured leaflets stop developing and form small hollow balls or pods around the larvae. Larvae feed within the galls for 2 to 3 weeks before pupating. There are four to seven generations per year. Larvae of the last fall generation leave galls and overwinter in the ground.

Pod-like leaflets eventually dry up, turn brown, and may drop prematurely. Twigs and small branches may be killed by repeated attacks. Trees are not killed but lose some of their ornamental value.

CONTROL: Spray growing tips and new foliage with carbaryl or trichlorfon as soon as they begin to develop in the spring. Repeat every 10 to 14 days especially during spring and early summer when the first two generations are developing.



Galls of honeylocust pod gall midge

OAK GALLS—CECIDOMYIIDAE and CYNIPIDAE; OAK-APPLE GALL—*Amphibolips confluenta*

HOST: Oak

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Information on the identity, life cycle, and control of most of these wasps is

sketchy. Numerous species of cecidomyiid and cynipid wasps cause the formation of galls on the leaves, leafstalks, and stems of oaks. Oak-apple galls, which are found on midribs and petioles of leaves, are typical. They are caused by several species of very

GALL INSECTS

Oak galls, continued

small wasps, the most common being *A. confluenta*.

Life cycles of these insects probably involve alternate generations on different parts of the oak. In spring, oak-apple galls are spherical, green, and vary from 12 to 50 mm in diameter. A single white, legless, wasp larva can be found in the center of the gall, surrounded by a hard capsule which in turn is surrounded by a spongy mass. As the gall matures the spongy mass dries into fibres and the shell becomes light brown, thin, and papery.

Although leaf, leafstalk, and stem galls are com-



Oak leaf galls

mon and sometimes unsightly, most do not seriously damage the host.

CONTROL: Natural controls are generally adequate. Galls in small trees should be pruned and destroyed while they are still green to reduce further infestation. Spraying of insecticides is not recommended because damage is aesthetic, galls do not seriously damage the tree, and application of insecticides is poorly defined.



Oak-apple gall

COOLEY SPRUCE GALL ADELGID—*Adelges cooleyi*

HOSTS: Spruce and Douglas-fir

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Nymphs are oval, reddish-to yellowish-brown, aphid-like insects which cover themselves with a white waxy or cottony substance. Adults are oval, reddish-brown, 1 mm long, and may be winged or wingless.

Cooley spruce gall adelgids normally alternate between spruce and Douglas-fir. Nymphs overwinter at the bases of spruce needles and buds, and mature in spring. Eggs are laid under masses of cottony material on the needles and hatch in about a week. Nymphs migrate to the new growth and begin to feed on sap at the bases of needles. On spruce, this feeding causes a cone-like gall to develop around the colony of nymphs. Up to 30 nymphs feed within chambers formed between the bases of needles and the stem. In July or August the chambers open and the mature nymphs crawl to the needles where they transform to winged adults. Females fly to Douglas-fir and deposit eggs on needles. Young nymphs emerge in late



Cooley spruce gall adelgids in cut gall

summer or fall and overwinter at the bases of needles. On Douglas-fir adelgids feed on needles beneath a white woolly material, but no galls are produced. In late summer winged adults develop and fly to spruce to lay eggs. The complete cycle from spruce to Douglas-fir and back to spruce takes two years. Adelgids also can develop asexually on one tree species in the absence of the alternate host.

The elongated cone-shaped galls on spruce are 25 to 75 mm long and 12 to 18 mm in diameter. Galls initially are light green to dark purple, then turn reddish-brown or brown, and become dry and hard after adelgids emerge. Old galls may persist on trees for several years. On Douglas-fir, needles are covered with tufts of white cottony material and become twisted and yellowish. Heavy shedding of foliage may result from severe infestations on poor sites.

CONTROL: Spray trees with carbaryl in early spring (late March in Colorado) and late September. When only a few small spruce trees are infested, remove galls by hand before they open in June. Avoid planting spruce and Douglas-fir near each other.



Gall of Cooley spruce gall adelgid

GALL INSECTS

GOUTY PITCH MIDGE (BIRD'S-EYE PINE MIDGE OR PONDEROSA PINE RESIN MIDGE)—*Cecidomyia piniinopis*

HOSTS: Ponderosa and other pines

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Larvae are bright red maggots less than 3 mm long. Adults resemble tiny gnats or mosquitoes.

Little is known of the life cycle of this insect. Larvae feed in small resinous pockets under the bark of current-year shoots. They apparently overwinter in the soil.

In early summer, infested shoots fade, droop, gradually turn yellow, and die. Severely infested trees have reduced growth and may be killed.

CONTROL: No insecticide is currently registered for this insect. Contact your local extension service for more information.



Gouty pitch midge larvae

PHOTO CAPTIONS AND CREDITS

Galls of ash flower gall mite—(D. Leatherman, Colorado State Forest Service)

Galls of poplar bud gall mite—(D. Leatherman, Colorado State Forest Service)

Galls of hackberry nipplegall maker—(D. Leatherman, Colorado State Forest Service)

Galls of hackberry budgall psyllid—(D. Leatherman, Colorado State Forest Service)

Gall of poplar gall aphid—(D. Leatherman, Colorado State Forest Service)

Poplar gall aphids in cut gall—(D. Leatherman, Colorado State Forest Service)

Gall of poplar vagabond aphid—(L. Wilson, USDA

Forest Service)

Galls of honeylocust pod gall midge—(D. Leatherman, Colorado State Forest Service)

Oak-apple gall—(L. Jenkins (retired), Columbia, Missouri)

Oak leaf galls—(H. White, Nebraska Department of Agriculture)

Gall of Cooley spruce gall adelgid—(D. Leatherman, Colorado State Forest Service)

Cooley spruce gall adelgids in cut gall—(R. G. Weber, Kansas State Univ.)

Gouty pitch midge larvae—(Kenneth Gray Slide Collection)

HARDWOOD SAPSUCKING INSECTS

BOXELDER APHID—*Periphyllus negundinis*

HOST: Boxelder

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Boxelder aphids are light to dark olive-green, and 2 to 2.5 mm long. Wings, if present, are held above the body.

Boxelder aphids overwinter as eggs on the host plant. Nymphs hatch in spring and develop into wingless adult females that reproduce without mating and give birth to living young. Several wingless generations are produced during the summer. The final generation in the fall develops into winged male and female adults which migrate to new host plants, mate, and produce eggs.

These sap-feeding aphids cluster under leaves and along stems, and often secrete a sticky sugary substance (honeydew) that covers leaves, branches, and objects below the tree. Molds grow on this substance giving it a sooty appearance. Feeding discolors leaves, may cause premature leaf drop, and can decrease tree vigor. Damaged leaves are yellowish with brown stippling.

Although damage usually is not severe, young trees in plantations or in ornamental plantings may be severely damaged.

CONTROL: Spray foliage on high value trees with malathion, acephate, or chlorpyrifos when aphid colonies first appear. Parasites and predators of the aphids, which frequently control outbreaks and maintain low populations, are also killed by these insecticides.



Boxelder aphids

BLACK WILLOW APHID—*Pterocomma smithiae*

HOSTS: Willow and cottonwood and other poplars

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Black willow aphids are relatively large aphids, 3 to 4 mm in length, that have black bodies and orange tube-like projections (cornicles) extending from the rear of the abdomen. They are found in groups on bark where they feed on sap.

The life cycle is similar to that of the boxelder aphid with several generations remaining on the same host plant. Adults can be found throughout the summer and fall, but they are most abundant during August and September.

Large aphid populations cause premature leaf drop and reduce tree growth.

CONTROL: Spray bark of high value trees

with malathion, diazinon, acephate, or chlorpyrifos when the colonies first appear. Parasites and predators of the aphids, which frequently control outbreaks and help maintain low populations, are also killed by these insecticides.



Wingless female adult and nymphs of black willow aphid

CARAGANA APHID—*Acyrtosiphon caraganae*

HOST: Caragana (Siberian peashrub)

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Caragana aphids are tiny, light green, pear-shaped insects. Adults may be wingless and slightly larger than the nymphs or may possess transparent wings.

Caragana aphids overwinter in the egg stage on branches. Nymphs emerge in the spring and form dense colonies on new shoots and leaves. Several

wingless, parthenogenic (females do not mate) generations may be produced. Later, winged adults are produced which move to newly formed seed pods to feed and reproduce additional wingless generations. A final winged generation migrates to branches to lay eggs.

During severe infestations, leaves wilt and drop prematurely.

CONTROL: Spray foliage of high value trees

HARDWOOD SAPSUCKING INSECTS

Caragana aphid, continued

with malathion, acephate, or chlorpyrifos when aphid colonies first appear. Parasites and predators of the aphids, which frequently control outbreaks and help maintain low populations, are also killed by these insecticides.



Caragana aphids

WOOLLY ELM APHID—*Eriosoma americanum*; WOOLLY APPLE APHID—*E. lanigerum*

HOSTS: Elm, apple, and a few other hardwoods.

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Woolly elm aphids are green to dusky gray; woolly apple aphids are yellowish to rusty brown. Mature aphids are 1.5 to 2.0 mm in length.

Woolly elm aphids overwinter as eggs that are laid in bark crevices in late fall. In spring, wingless females hatch from the eggs and migrate to newly expanding leaves, where they feed and give birth to live aphids. Up to 200 winged and wingless aphids may be produced by one female. The winged offspring migrate to new leaves, while the wingless offspring feed on the same leaf.

Feeding by nymph and adult aphids causes young elm leaves to swell, fold, and curl around the aphid colonies. Large populations are unsightly, adversely affect photosynthesis, and decrease tree vigor.

CONTROL: Spray acephate, diazinon, chlorpyrifos, or malathion on the expanding leaves of high value trees in the spring. Infested branches can be mechanically pruned from trees and destroyed. These insects are difficult to control, and most attempts are ineffective.



Woolly elm aphid damage



Woolly apple aphids

HONEYSUCKLE WITCHES'-BROOM APHID—*Hyadaphis tataricae*

HOST: Honeysuckle

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Honeysuckle witches'-broom aphids are pale green to cream and less than 2 mm long.

They overwinter as eggs or adults on infested shrubs. Eggs hatch in early spring when new leaves

appear, and aphids feed on the new growth throughout the summer. Many overlapping generations of wingless aphids may be produced asexually each year. Winged adults develop in the fall, mate, and lay eggs.

Damaged branches form unsightly witches'-brooms and have folded and dwarfed leaves.

HARDWOOD SAPSUCKING INSECTS

Honeysuckle witches'-broom aphid. *continued*

CONTROL: Spray new foliage with acephate, or dimethoate every 3 weeks throughout the growing season.



Honeysuckle witches'-broom aphids



Witches'-brooms caused by honeysuckle witches'-broom aphids

EUROPEAN ELM SCALE—*Gossyparia spuria*

HOST: Elm

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Mature female scales are oval, up to 10 mm long, and reddish-brown with a white fringe. Males are much smaller. Nymphs (crawlers) are brownish-gray, wingless, and resemble mealybugs.

Scales overwinter as nymphs on the bark of twigs and branches. During spring the nymphs feed on the sap of branches. Adults appear in May and June and continue to feed. In late June or July crawlers hatch from eggs laid on the branches and migrate to the underside of leaves. They molt to a nymphal stage which remains stationary while feeding on sap. In September or early October nymphs migrate to twigs and branches where they overwinter.

When feeding, nymphs and mature scales secrete honeydew, a sticky substance that coats the leaves, lower branches, and ground. Heavy infestations may kill small branches.

CONTROL: Spray trees with acephate, oxydemeton-methyl, carbaryl, or chlorpyrifos in late June to kill crawlers.



European elm scales

LECANIUM SCALES—*Parthenolecanium spp.*

HOSTS: Juniper, arborvitae, and hardwood trees

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Lecanium scales appear as hardened brown hemispherical shells that are 3 to 6 mm in diameter and tightly attached to the bark or leaves.

Immature scales overwinter on twigs and branches. In late spring, eggs are laid under the shells of adult females. Crawlers (nymphs) appear in early summer and move to twigs and leaves where they feed. In late summer or early fall they migrate to branches.

Leaves are discolored by nymphs and adults feeding on sap. Heavily infested twigs may be killed.

CONTROL: Spray twigs and branches with diazinon, acephate, oxydemeton-methyl, or chlorpyrifos when crawlers are present.



Lecanium scales

HARDWOOD SAPSUCKING INSECTS

OYSTERSHELL SCALE—*Lepidosaphes ulmi*

HOSTS: Ash, maple, lilac, and many other species of hardwood trees and shrubs

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Crawlers are very small, flattened and pale yellow or orange. Scales resemble tiny oyster shells, are gray to purplish-brown, and are about 3 mm long at maturity.

Scales overwinter as eggs beneath female shells. Crawlers emerge in May or June, migrate to a feeding site, and molt to the immobile scale form. Nymph and adult oystershell scales feed on the sap of twigs, branches, and thin-barked stems.

Branch and tree mortality may result from large scale infestations.

CONTROL: Spray twigs, branches, and

stems with superior oil in the spring before buds expand or with malathion or acephate when crawlers are present. During winter, scrape parent scales filled with overwintering eggs from infested tree parts by lightly rubbing with a plastic or Teflon[®] dish pad.



Oystershell scales

BOXELDER BUG—*Leptocoris trivittatus*

HOSTS: Boxelder (Manitoba maple), ash, apple, cherry, and plum

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: The flat, elongate adult is 10 to 14 mm long and has a grayish-brown to black body with conspicuous red lines on the back. Nymphs initially are bright red and gradually become marked with black as they mature.

Adults overwinter in protected sites. In spring they mate and females lay eggs on leaves. Nymphs are present throughout the summer and adults appear in late summer and early fall.

Both adults and nymphs feed on the sap of leaves, fruits, and seeds. Puncture spots are marked by brown stippling, and severely damaged leaves may curl or appear blistered. Puncture wounds may make fruits unmarketable. Boxelder bugs are a household

nuisance in the fall when adults congregate at overwintering sites in and around dwellings. These bugs do not feed on clothes or any household foods; however, they may stain curtains.

CONTROL: Spray trees with carbaryl in early summer. Common household insecticides can be used to control bugs that enter dwellings.



Boxelder bug adult

ASH PLANT BUG—*Tropidosteptes amoenus*; HONEYLOCUST PLANT BUG—*Diaphnocoris chlorionis*

HOSTS: Ash, honeylocust, and black locust

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Nymphs and adults vary from green to tan to dark brown and are 2 to 9 mm long.

They overwinter as eggs laid in bud scales, under bark scales, or in other protected places on the tree. Nymphs emerge in the spring and feed on the underside of leaves. Ash plant bugs feed throughout the summer and undergo at least two generations per year. Honeylocust plant bugs have one generation per year. Nymphs hatch when buds break, mature by June, and are gone by July.



Ash plant bug nymph and stippling damage

HARDWOOD SAPSUCKING INSECTS

Ash plant bug, continued

Feeding punctures cause stippled brown discolorations on leaves. Damage by ash plant bugs is cumulative throughout the year and can result in leaf deformity and stunting of growth. Honeylocust plant bugs can severely damage the buds and young foliage of 2- and 3-year-old twigs in early spring.

Young seedlings can be seriously damaged.

CONTROL: Spray leaves with carbaryl or chlorpyrifos when plant bugs or damage is first observed.

LACE BUGS—*Corythucha* spp., and *Gargaphia* spp.

HOSTS: Elm, hackberry, oak, sycamore, basswood, and other hardwoods

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Adults are flat, 5 to 6 mm long, and dark-colored with highly sculptured (lace-like) white wings.

There are usually two overlapping generations per year; thus all life stages can be found on the lower surface of leaves throughout the summer. Lace bugs overwinter as adults or eggs under bark scales or in other protected places on the tree.

Infested leaves have brown or yellow stippling from feeding punctures and tar-like defecation spots. Because severely damaged leaves turn brown and drop prematurely, heavily infested trees may be defoliated, especially during dry weather.

CONTROL: Spray leaves, especially the lower surfaces, with carbaryl, acephate, or malathion when lace bugs are first observed. Repeat treatment as needed.



Sycamore lace bug adults

SPIDER MITES—*Oligonychus* spp., *Tetranychus* spp., and *Eotetranychus* spp.

HOSTS: Spruce, pine, honeylocust, elm, linden, and other conifer and hardwood trees and shrubs

IDENTIFICATION, LIFE CYCLE, DAMAGE AND CONTROL: See Conifer sapsucking insects.

PHOTO CAPTIONS AND CREDITS

Boxelder aphids—(D. Leatherman, Colorado State Forest Service)

Wingless female adult and nymphs of black willow aphid—(Kenneth Gray Slide Collection)

Caragana aphids—(D. Leatherman, Colorado State Forest Service)

Woolly elm aphid damage—(B. Neill, Agriculture Canada, Prairie Farm Rehabilitation Administration)

Woolly apple aphids—(D. Leatherman, Colorado State Forest Service)

Honeysuckle witches'-broom aphids—(B. Neill, Agriculture Canada, Prairie Farm Rehabilitation Administration)

Witches'-brooms caused by honeysuckle witches'-broom aphids—(M. Harrell, Univ. of Nebraska - Lincoln)

European elm scales—(D. Leatherman, Colorado State Forest Service)

Lecanium scales—(H. Gunderson, Iowa State Univ.)

Oystershell scales—(M. Harrell, Univ. of Nebraska - Lincoln)

Boxelder bug adult—(D. Leatherman, Colorado State Forest Service)

Ash plant bug nymph and stippling damage—(Kenneth Gray Slide Collection)

Sycamore lace bug adults—(J. D. Solomon, USDA Forest Service)

Spruce spider mite—(B. Neill, Agriculture Canada, Prairie Farm Rehabilitation Administration)

Spruce spider mite damage—(M. Harrell, Univ. of Nebraska - Lincoln)

CONIFER SAPSUCKING INSECTS

SPIDER MITES—*Oligonychus* spp., *Tetranychus* spp., and *Eotetranychus* spp.

HOSTS: Spruce, pine, honeylocust, elm, linden, and other conifer and hardwood trees and shrubs

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: These tiny arthropods are less than 1 mm long and vary in color from yellow to red to green.

Mites overwinter as eggs on the tree. There are many generations per year. Mites feed on sap and spin a fine silk webbing among needles (leaves).

The damaged needles (leaves) become stippled, bleached, and brown, and may fall off. Severely in-

fested trees are less vigorous and occasionally may be killed.

CONTROL: Spray trees thoroughly with diazinon, cyhexatin, malathion, chlorpyrifos, or tetradifon as soon as mite damage appears during April or May. Repeat every 10 to 14 days as needed.



Spruce spider mite



Spruce spider mite damage

PINE NEEDLE SCALE—*Chionaspis pinifoliae*

HOSTS: Pine and spruce

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: Mature scales are tiny insects that are covered by a white, oblong, waxy protective covering that is 2.5 to 3 mm in length.

Scales overwinter as eggs beneath female scales on the needles. In mid-May (eastern Nebraska) crawlers hatch and migrate to new needles on the tree. The crawlers then molt to an immobile nymph stage that feeds on the sap and secretes the scale covering. In the Central Great Plains (central Nebraska), scales mature in July and lay eggs for a second generation. In the Northern Great Plains, scales mature and lay eggs in the fall.

By August needles become spotted with white elongated scales. Damaged needles are discolored and may fall prematurely. Severely infested trees are less vigorous and occasionally may be killed.

CONTROL: Thoroughly spray foliage, branches, and trunk with a dormant oil in March or with malathion, diazinon, acephate, or chlorpyrifos in early June. Control is not effective after the insects have formed their protective waxy scales.



Pine needle scales

PINE BARK ADELGID—*Pineus strobi*

HOSTS: Pine, spruce, and other evergreen trees

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: These aphids are less than

CONIFER SAPSUCKING INSECTS

Pine bark adelgid, continued

1 mm long, purplish to yellowish, and covered by a white cottony material.

The insects overwinter as immature female nymphs. In spring females mature and lay eggs that produce winged and wingless nymphs. Winged forms fly to new host trees; wingless nymphs remain on the original tree. Both forms feed on sap and produce a wingless generation of insects during July. There are three to five generations per year.

Infested trees are dotted with the white cottony material, and when heavily infested, trunks appear white-washed. Severely infested trees may be stunted and even killed.

CONTROL: Spray trunk and needles with chlorpyrifos in spring (mid-May in Nebraska) when adelgids are active, or wash insects from the tree with a fast stream of water.



Pine bark adelgids

GIANT CONIFER APHIDS—*Cinara spp.*

HOSTS: Junipers and most evergreens

IDENTIFICATION, LIFE CYCLE, AND DAMAGE: These aphids are 3 to 5 mm long, and are generally dark with a light covering of wax.

They overwinter as eggs on needles and bark. In spring the eggs hatch and aphids move to twigs and branches where they feed. Some species infest trunks and roots. Several generations are produced asexually each year. The final generation produces sexual forms that mate and lay overwintering eggs.

While feeding, aphids secrete large amounts of honeydew, a sticky substance that coats lower branches, trunks, and the ground. A sooty mold fungus grows in the honeydew. Large colonies reduce height growth and may kill infested twigs and branches.

CONTROL: Spray foliage with malathion,

diazinon, acephate, or oxydemeton-methyl when infestations are heavy. These materials are labelled for use on ornamentals or forest trees; however, some varieties of junipers may be injured by malathion.



Giant conifer aphids

SPITTLEBUGS—*Aphrophora spp.*, and *Clastoptera spp.*

HOSTS: Pines, other conifer trees, hardwood trees, and herbaceous plants

IDENTIFICATION, LIFE CYCLE AND DAMAGE: Nymphs cover themselves with a frothy mass of spittle and air bubbles. Adults resemble leafhoppers, are about 10 mm long, brown, and are not surrounded by spittle.

Spittlebugs overwinter as eggs on the branch tips. Eggs usually hatch in May and nymphs begin feeding on twigs and foliage. Nymphs change location several times as they develop, forming new spittle masses at each stop. Adults are present during July and August.

Both adults and nymphs feed on sap by insert-



Spittle mass of spittlebug nymph

CONIFER SAPSUCKING INSECTS

Spittlebugs, continued

ing their mouthparts into foliage, twigs, or small branches.

Most tree-feeding spittlebugs also feed on herbaceous plants in the immediate area. Damage caused by spittlebugs is unsightly. Occasionally, seedlings or trees in ornamental and Christmas tree plantings are severely infested and killed.

CONTROL: Spray severely infested branches and stems with carbaryl, diazinon, or malathion when nymphs first appear and spittle masses are evident. Wash nymphs and spittle off infested trees with a strong stream of water if trees are small or infestations are light.



Spittlebug adult

LEGANIUM SCALES—*Parthenolecanium spp.*

HOSTS: Juniper, arborvitae, and hardwood trees

IDENTIFICATION, LIFE CYCLE, DAMAGE AND CONTROL: See Hardwood sapsucking insects.

PHOTO CAPTIONS AND CREDITS

Spruce spider mite—(B. Neill, Agriculture Canada, Prairie Farm Rehabilitation Administration)

Spruce spider mite damage—(M. Harrell, Univ. of Nebraska - Lincoln)

Pine needle scales—(D. Leatherman, Colorado State Forest Service)

Pine bark adelgids—(L. Wilson, USDA Forest Service)

Giant conifer aphids—(D. J. Shetlar, Chemlawn)

Spittle mass of spittlebug nymph—(D. Leatherman, Colorado State Forest Service)

Spittlebug adult—(D. Leatherman, Colorado State Forest Service)

Lecanium scales — (H. Gunderson, Iowa State University)

COMMON AND SCIENTIFIC NAMES OF INSECT PESTS

HARDWOOD DEFOLIATORS

1. Fall cankerworm – *Alsophila pometaria* (Harris); Spring cankerworm – *Paleacrita vernata* (Peck)
2. Mourningcloak butterfly (spiny-elm caterpillar) – *Nymphalis antiopa* (Linnaeus)
3. Nevada buck moth – *Hemileuca nevadensis* Stretch
4. Greenstriped mapleworm – *Dryocampa rubicunda* (Fabricius)
5. Variable oakleaf caterpillar – *Heterocampa manteo* (Doubleday)
6. Fruittree leafroller – *Archips argyrosipilus* (Walker)
7. Forest tent caterpillar – *Malacosoma disstria* Hübner
8. Prairie tent caterpillar – *Malacosoma californicum lutescens* (Neumoegen and Dyar); Eastern tent caterpillar – *M. americanum* (Fabricius)
9. Fall webworm – *Hyphantria cunea* (Drury)
10. Uglynest caterpillar – *Archips cerasivorana* (Fitch)
11. Mimosa webworm – *Homadaula anisocentra* Meyrick
12. Elm sawfly – *Cimbex americana* Leach
13. Sawflies – *Nematus* spp.
14. Pear sawfly (Pear slug) – *Caliroa cerasi* (Linnaeus)
15. Elm leaf beetle – *Pyrrhalta luteola* (Müller)
16. Cottonwood leaf beetle – *Chrysomela scripta* Fabricius
17. Caragana blister beetle – *Epicauta subglabra* (Fall); Ashgray blister beetle – *E. fabricii* (LeConte)
18. Grasshoppers – *Melanoplus* spp.
19. Aspen blotchminer – *Phyllonorycter tremuloidiella* (Braun)
20. Aspen leafminer – *Phyllocnistis populiella* Chambers
21. Poplar black mine beetle – *Zengophora scutellaris* Suffrian

CONIFER DEFOLIATORS

1. Spruce needleminer – *Endothenia albolineana* (Kearfott)
2. Pine needle sheathminer – *Zelleria haimbachi* Busck
3. Cedar webworm – *Cudonigera houstonana* (Grote)
4. Jack pine budworm – *Choristoneura pinus* Freeman
5. Pine tiger moth – *Lophocampa ingens* Hy. Edwards
6. Bagworm – *Thyridopteryx ephemeraeformis* (Haworth)
7. Pine sawflies – *Neodiprion* spp.
8. Yellowheaded spruce sawfly – *Pikonema alaskensis* (Rohwer)
9. Black vine weevil – *Otiorhynchus sulcatus* (Fabricius)
10. Caragana blister beetle – *Epicauta subglabra* (Fall); Ashgray blister beetle – *E. fabricii* (LeConte)
11. Grasshoppers – *Melanoplus* spp.

HARDWOOD BORERS

1. Native elm bark beetle – *Hylurgopinus rufipes* (Eichhoff); Smaller European elm bark beetle – *Scolytus multistriatus* (Marsham)
2. Ash bark beetles – *Hylesinus* spp.
3. Boxelder twig borers – *Proteoteras* spp.
4. Carpenterworm – *Prionoxystus robiniae* (Peck)
5. Lilac (ash) borer – *Podosesia syringae* (Harris); Banded ash clearwing – *P. aureocincta* Purrington and Nielson
6. Peachtree borer – *Synanthedon pictipes* (Say); Lesser peachtree borer – *S. exitosa*
7. Clearwing borers: Viburnum borer – *Synanthedon viburni* Engelhardt; Currant borer – *S. tipuliformis* (Clerck)
8. Cottonwood borer – *Plectrodera scalator* (Fabricius)
9. Poplar borer – *Saperda calcarata* Say
10. Locust borer – *Megacyllene robiniae* (Forster)
11. Redheaded ash borer – *Neoclytus acuminatus* (Fabricius); Banded ash borer – *Neoclytus caprea* (Say)
12. Aspen root girdler – *Agrilus horni* Kerremans

CONIFER BORERS

1. Pine tip moths: Nantucket – *Rhyacionia frustrana*

- (Comstock), Southwestern – *R. neomexicana* (Dyar), Western – *R. bushnelli* (Busck), and other *Rhyacionia* spp.
2. Western pine shoot borer – *Eucosma sonomana* Kearfott
3. Metallic pine pitch nodule maker – *Retinia metallica* (Busck)
4. White pine weevil – *Pissodes strobi* (Peck)
5. Zimmerman pine moths – *Dioryctria ponderosae* Dyar, *D. tumicolella* Mutuura, Munroe and Ross, and *D. zimmermani* (Grote)
6. Pine root collar weevil – *Hylobius radialis* Buchanan
7. Pine bark beetles – *Ips grandicollis* (Eichhoff), *I. calligraphus* (Germar), *I. pini* (Say), *Ips* spp., *Dendroctonus ponderosae* Hopkins, *D. valens* LeConte, and *Dendroctonus* spp.
8. Cedar bark beetles – *Phloeosinus* spp.
9. Conifer-infesting longhorned beetles – *Monochamus* spp., *Semanotus* spp., *Xylotrechus* spp., and other *Cerambycidae*

GALL INSECTS

1. Ash flower gall mite – *Eriophyes fraxiniflora* Felt
2. Poplar bud gall mite – *Eriophyes parapopuli* (Keifer)
3. Hackberry nipplegall maker – *Pachypsylla celtidismamma* (Riley); Hackberry blistergall maker – *P. celtidisvesicula* Riley
4. Hackberry budgall psyllid – *Pachypsylla celtidisgemma* Riley; Hackberry petiolegall psyllid – *P. venusta* (Osten Sacken)
5. Poplar gall aphids – *Pemphigus* spp.
6. Poplar vagabond aphid – *Mordvilkoja vagabunda* (Walsh)
7. Honeylocust pod gall midge – *Dasineura gleditchiae* (Osten Sacken)
8. Oak galls – *Cecidomyiidae* and *Cynipidae*; Oak-apple gall – *Amphibolips confluenta* (Harris)
9. Cooley spruce gall adelgid – *Adelges cooleyi* (Gillette)
10. Gouty pitch midge (bird's-eye pine midge or ponderosa pine resin midge) – *Cecidomyia piniinopis* Osten Sacken

HARDWOOD SAPSUCKING INSECTS

1. Boxelder aphid – *Periphyllus negundinis* (Thomas)
2. Black willow aphid – *Pterocomma smithiae* (Monell)
3. Caragana aphid – *Acyrtosiphon caraganae* (Cholodkovsky)
4. Woolly elm aphid – *Eriosoma americanum* (Riley); Woolly apple aphid – *E. lanigerum* (Hausmann)
5. Honeysuckle witches'-broom aphid – *Hyadaphis tataricae* (Aizenberg)
6. European elm scale – *Gossyparia spuria* (Modeer)
7. Lecanium scales – *Parthenolecanium* spp.
8. Oyster shell scale – *Lepidosaphes ulmi* (Linnaeus)
9. Boxelder bug – *Leptocoris trivittatus* (Say)
10. Ash plant bug – *Tropidosteptes amoenus* Reuter; Honeylocust plant bug – *Diaphnocoris chlorionis* (Say)
11. Lace bugs – *Corythucha* spp., and *Gargaphia* spp.
12. Spider mites – *Oligonychus* spp., *Tetranychus* spp., and *Eotetranychus* spp.

CONIFER SAPSUCKING INSECTS

1. Spider mites – *Oligonychus* spp., *Tetranychus* spp., and *Eotetranychus* spp.
2. Pine needle scale – *Chionaspis pinifoliae* (Fitch)
3. Pine bark adelgid – *Pineus strobi* (Hartig)
4. Giant conifer aphids – *Cinara* spp.
5. Spittlebugs – *Aphrophora* spp., and *Clastoptera* spp.
6. Lecanium scales – *Parthenolecanium* spp.

HOST PLANTS WITH SCIENTIFIC EQUIVALENTS

American elm, *Ulmus americana* L.
American sycamore, *Platanus occidentalis* L.
Apple, *Malus* spp.
Arborvitae, *Thuja* spp.
Ash, *Fraxinus* spp.
Aspen, *Populus* spp.
Austrian pine, *Pinus nigra* Arnold
Basswood, *Tilia americana* L.
Black locust, *Robinia pseudoacacia* L.
Boxelder, *Acer negundo* L.
Caragana, *Caragana arborescens* Lam.
Cherry, *Prunus* spp.
Chinese elm, *Ulmus parvifolia* Jacq.
Chokecherry, *Prunus virginiana* L.
Cotoneaster, *Cotoneaster* spp.
Cottonwood, *Populus deltoides* Bartr.
Currant, *Ribes* spp.
Douglas-fir, *Pseudotsuga menziesii* (Mirb.) Franco
Eastern white pine, *Pinus strobus* L.
Elm, *Ulmus* spp.
Engelmann spruce, *Picea engelmannii* (Parry) Engelm.
Euonymus, *Euonymus* spp.
Fir, *Abies* spp.
Gooseberry, *Ribes* spp.
Hackberry, *Celtis occidentalis* L.
Honeylocust, *Gleditsia triacanthos* L.
Honeysuckle, *Lonicera* spp.
Jack pine, *Pinus banksiana* Lamb.
Japanese elm, *Ulmus japonica* (Rehd.) Sarg.
Juniper, *Juniperus* spp.
Lilac, *Syringia* spp.
Linden, *Tilia* spp.
Locust, *Robinia* spp.
Lodgepole pine, *Pinus contorta* Dougl.
Manitoba maple, *Acer negundo* L.
Maple, *Acer* spp.
Mimosa, *Albizia* spp.
Mountain-ash, *Sorbus* spp.
Oak, *Quercus* spp.
Peach, *Prunus persica* Batsch.
Pear, *Pyrus* spp.
Pine, *Pinus* spp.
Plum, *Prunus* spp.
Ponderosa pine, *Pinus ponderosa* Dougl. ex Laws.
Poplar, *Populus* spp.
Quaking poplar (aspen), *Populus tremuloides* Michx.
Raspberry, *Rubus* spp.
Red pine, *Pinus resinosa* Ait.
Rhododendron, *Rhododendron* spp.
Rose, *Rosa* spp.
Russian-olive, *Elaeagnus angustifolia* L.
Scotch pine, *Pinus sylvestris* L.
Siberian elm, *Ulmus pumila* L.
Siberian peashrub, *Caragana arborescens* Lam.
Spruce, *Picea* spp.
Sycamore, *Platanus* spp.
Viburnum, *Viburnum* spp.
Willow, *Salix* spp.
Yew, *Taxus* spp.

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PESTICIDE PRECAUTIONARY STATEMENT

Pesticides used improperly can injure people, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in original containers—out of reach of children and pets—and away from foodstuffs.

Apply pesticides selectively and carefully. Do not apply a pesticide when there is danger of drift to other areas. Avoid prolonged inhalation of a pesticide spray or dust. When applying a pesticide, it is advisable that you be fully clothed.

After handling a pesticide, do not eat, drink, or smoke until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first-aid treatment given on the label, and get prompt medical attention. If the pesticide is spilled on your skin or

clothing, remove clothing immediately and wash skin thoroughly.

Dispose of empty pesticide containers by wrapping them in several layers of newspaper and placing them in your trash can.

It is difficult to remove all traces of a herbicide (weed killer) from equipment. Therefore, to prevent injury to desirable plants, do not use the same equipment for insecticides and fungicides that you use for a herbicide.

NOTE: Registrations of pesticides are under constant review by the Federal Environmental Protection Agency. Use only pesticides that bear the EPA registration number and carry directions for home and garden use.

LIST OF INSECTICIDES BY COMMON AND REGISTERED TRADE NAMES

<u>Common Name</u>	<u>Trade Name(s)**</u>
acephate	Orthene
<i>Bacillus thuringiensis</i>	Dipel, Thuricide
bendiocarb	Ficam, Dycarb
carbaryl	Sevin
carbofuran	Furadan
chlorpyrifos	Dursban
cyhexatin	Plictran
diazinon	Diazinon
dimethoate	Cygon
endosulfan	Thiodan
fluvalinate	Mavrik, Spur
lindane	Lindane
malathion	Cythion
methoxychlor	Methoxychlor
oxydemeton - methyl	Metasystox-R
tetradifon	Tedion
thiabendazole*	Thiabendazole
trichlorfon	Dylox

**Some formulations of the pesticides listed above may be classified Restricted Use Pesticides. These products can be sold to and used only by Certified Applicators or by persons under their direct supervision.

FOOTNOTE

The use of trade, firm, or corporation names in this publication is for the information and convenience of the reader. No official endorsement or approval by the U.S. Department of Agriculture or the University of Nebraska Institute of Agriculture and Natural Resources of any product or service to the exclusion of others which may be suitable is intended.



This publication is produced cooperatively by the United States Department of Agriculture Forest Service and the Nebraska Cooperative Extension Service.

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Leo E. Lucas, Director of Cooperative Extension Service, University of Nebraska, Institute of Agriculture and Natural Resources.

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