INSECTS AND DISEASE IN NURSERIES

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ASH BORER - Podosesia syringae fraxini (Lug.)

Hosts - Green ash and mountain ash. A closely related form infests lilac.

Identification - The adults are wasp-like moths with clear or translucent wings. The males and females are alike. Their bodies are slender, dark brown or almost black with yellowish bands on the abdomen. The wings are narrow with a spread of approximately 11/4 inches. The legs are long and orange colored. At rest, the moths frequently hold the end of the abdomen in a raised position.

The eggs of the ash borer are elliptical in shape, gray or black and very small - 30 placed end to end would span only one inch.

Ash borer larvae are tiny, white caterpillars with dark heads when newly hatched. The full-grown caterpillars are creamy white, about one inch long, with reddish-brown heads.

The pupae are about 3/4 inch long and reddish-brown with small backward-projecting spines.

Life Cycle - The ash borer requires a minimum of two years in which to complete its life cycle. The moths begin to emerge from the host trees in late May and are present till late July. Eggs are laid in bark crevices on trunks and branches, and in bark wounds. Injuries to trees from cultivation, pruning, hail, frost or snow attract infestation. All sizes of trees may become infested but smaller, younger trees appear to be the most susceptible. The parts of the tree most frequently attacked are the lower portions of the trunk to ground level and the area where the lower branches arise.

The larval period extends from July of the year the eggs are laid to early May of the third year following oviposition. Most of the caterpillars start their burrows in cracks and crevices in the bark, with the entries marked by bits of fine frass and webbing. Some also enter old burrows. At the end of the first season, when activity is discontinued, some of the borers will have penetrated into the wood; others may still be in the bark. During the second season the burrows are lengthened and enlarged. In large trees the caterpillars bore into the sapwood at a slight incline for one or more inches, then turn upward and outward to terminate the burrows at the end of the season in or near the bark. In small trees and branches of larger ones the burrows penetrate to the centers and then rise for several inches before turning outward again, or they may pass through the trunk or branch to the bark on the opposite side. Masses of fresh moist frass ejected from the burrows can be seen

in June and early Jury. During May of the third season boring is resumed until only a thin layer of bark or wood remains. The caterpillars then pupate in the burrows behind this thin layer. Shortly before the moths are to appear, the pupae, with the aid of the backward-pointing spines on their bodies, wriggle forward, breaking the thin layer of bark or wood, and push themselves partly out of the burrows. The moths emerge and escape directly to the outside, leaving their pupal skins protruding from the burrow exits.

Control - The measures which may be employed involve prevention and applied control. A combination of both is usually desirable.

Prevention -

1. Avoid wounding trees. Where wounds occur at the base from cultural practices or on the upper trunk from pruning, etc., cover the wound areas with a commercial tree dressing or a suitable water-base paint to eliminate them as desirable egg-laying sites.

2. Remove and destroy "brood" trees before June. "Brood" trees are those damaged beyond recovery and still heavily infested. Trees which show severe damage to the trunks but which no longer appear to be infested may be saved to give many additional years of service. If the wound areas are cleaned out and treated to protect them, and good growth conditions are provided, new wood will gradually restore the vigor of the trees.

Applied Control -

1. Trapping the moths - where only one or two infested trees are involved and re-infestation from outside sources is small. Tightly wrap the areas on the trunk and branches where borer openings occur, with burlap or cotton cloth, in mid-May to prevent the moths emerging from the burrows and laying eggs; remove the wrapping about mid-August. Repeat the treatment for at least three years to ensure that all adults developing from the caterpillars in the trees have been destroyed.

2. Killing the caterpillars - for small trees, particularly green ash, lightly infested with borers as shown by the appearance of moist frass at burrow openings in May and June. Carefully dig out the insects with a pointed knife or kill the caterpillars by probing the burrows with a wire. Repeat the probing operation at frequent intervals as long as new frass is being ejected. Treat the wound areas with commercial tree dressing or water-base paint after the insects have been killed.

3. Injecting an effective poison into the larval burrows to destroy the caterpillars. A fumigant can be made by dissolving a spoonful of paradichlorobenzene (moth crystals) in a small amount of carbon disulfide. A commercial borer paste such as Borotox can be injected into burrows and the openings sealed.

CARPENTERWORM - Prionoxystus robiniae Peck

Hosts - 'Green ash, mountain ash, poplars, American and Siberian elms may UT— attack oaks, maple, willow, cottonwood, boxelder and fruit trees.

Identification - The adults of the carpenterworm are large moths; the females and males differ greatly in appearance. The female is grayish and stout-bodied with a wingspread of 3 inches. The front wings are mottled gray and black; the hind wings are smoky. The overall coloration of the female blends with the color of rough bark and makes it difficult to detect when at rest. The male is less stout then the female with a shorter body and a wing spread of 2 inches. The front wings are also mottled gray and black but the hind wings are yellowish-orange with black base and margins.

Carpenterworm eggs are oval-shaped, 1/16 inch long and light to dark brown in color. The shell is hard with a net-like pattern of ridges.

Newly-hatched caterpillars are dark brown, slightly hairy with a large black head. The full-grown caterpillars are two to three inches long, pinkish-white with brown heads.

The pupae are brown and 11/4 to 2 inches long, with circular bands of backward-pointing dark spines.

Life Cycle - The life cycle is three years or longer. Moths begin to emerge from infested trees in June and may be present till early August. The females are inactive and poor fliers and may lay 300 eggs or more. The eggs are stuck firmly to the surface, usually in small groups, in cracks, crevices and wounds in the bark, or in or near old burrow openings. The attraction of wounded or previously infested trees for egg-laying along with the poor ability of the female to fly results in the development of "brood" trees from which numerous moths emerge year after year. Eggs hatch in 10 to 16 days. The larval period extends from the July they are laid to May of the following fourth or fifth year. Young caterpillars crawl about freely on the host trees soon after hatching and often cover long distances on the trunks before beginning to burrow. Small shelters of frass particles and excrement held together by bits of webbing are constructed at burrow entrances. By August, frass ejected from the new burrows becomes noticeable.

In the second and following seasons the burrows are extended and enlarged, usually forming a maze of criss-cross tunnels in the wood. During this period a great deal of coarse frass is ejected from the burrows and may cling ribbon-like on the outside of the trunk or accumulate like sawdust around the tree base. Often, the caterpillars emerge from the burrows to crawl about on the bark, and then re-enter the burrows.

In May of the fourth or fifth year the caterpillars retreat to the upper parts of the burrows where they transform into pupae in specially prepared chambers.

Adults begin to appear in June. Before changing to the adult form, the pupae propell themselves downward by means of the backward-projecting

spines on their bodies to the burrow openings. When the moths emerge from their pupal skins they escape direculy to the outside.

Control - The same measures listed for ash borer apply to the carpenter-worm.

OYSTERSHELL SCALE - Lepidosaphes ulmi (L.)

Hosts - Apple, pear, occasionally other fruit trees, and many shade and ornamental plants. Lilac, poplar and ash are often seriously attacked.

Identification - The scale covering is brown, sometimes appearing gray, and shaped somewhat like oystershells. The covering of the female is nearly one-eighth inch long when completed, narrow at the anterior end and widened at the rounded posterior end. The covering of the males is smaller and more oval-shaped. The oystershell scale often occurs in such large numbers as to form a crust on the trunk or branches of its host.

Life Cycle - Winter is passed as minute white eggs beneath the female scale. Eggs hatch in late spring, and the tiny nymphs crawl out and migrate over the plant; in a few hours they settle down, insert their mouthparts, and begin sucking sap. At the first molt the legs and antennae are shed, and the molt skin is incorporated in the scale covering formed over the body. By mid-August nymphal development is completed; the two-winged males emerge and mate with the females, which spend their entire lives beneath the scale covering and deposit eggs in the fall before they die. There is one generation per year.

Control - Late dormant or delayed dormant spray - apply as winter buds swell just before opening or during early green tip stage. Wet the entire plant, being sure the cracks and crevices are hit and do not miss any terminal buds. Spray the ground and all debris around the base of the plants.

Dormant spray - amount of chemical per 100 gallons water

Oil spray, 2 gals. supreme or superior type oil, or
Oil spray, 4 gals. dormant oil emulsion, or
Ethion-oil premix combinations, 1.5 to 2 gals., or
Trithion, 1 lb. 25% W.P. plus 1.5 to 2 gals. supreme or superior type oil.

Lime sulfur, 3 gals. plus 2.5 gals. dormant oil emulsion, or
Lime sulfur, 3 gals. plus 1.5 gals. supreme or superior type oil, or
Polysulfide, 4.5 lbs. plus 2.5 gals. dormant oil emulsion, or
Polysulfide, 4.5 lbs. plus 1.5 gals. supreme or superior type oil.

Oil, 1.5 to 2 gals. supreme or superior type oil or
Oil emulsion 2.5 gals. plus 0.75 to 1 lb. of 50% Diazinon or
1 lb. 25% Parathion.

For ornamentals - amount per 1 gallon water

Lime sulfur 8T plus 0-.2T dormant oil emulsion, or

Lime sulfur 8T plus 4T supreme or superior type oil, cr
Supreme or superior type oil 2T, or
Polysulfide 1 oz. plus 10T superior or supreme type oil.

Summer application

Parathion - 1 lb. 25% W.P., or
Diazinon - 1 lb. 50% W.P., or
Malathion - 2 lbs. 25% W.P.

Should be applied in late May and June to control crawling stage. If dormant sprays are not applied or if infestations are particularly heavy, spray about mid-May and repeat twice at two-week intervals. This spray can be omitted if satisfactory control is obtained in dormant period.

OTHER ARMORED SCALES

SCURFY SCALE - Chionaspis furfura (Fitch)

Attacks a number of shade trees, apple, pear and other fruit trees, but is not considered a serious pest. Except for the brown anterior tip, the scale covering of the female is white or gray, pear shaped, and nearly 1/10 inch in length. Males are much smaller and parallel-sided with 3 dorsal ridges. Winter is passed as red puple eggs under the female scale coverings. There is one generation per year.

PINE NEEDLE SCALE - Phenacaspis pinifoliae (Fitch)

Attacks pines and some spruces. Pine needles may appear nearly white when heavily infested. Scales are elongated, 1/10 inch long, and white with a yellow spot at one end. Overwinters in the egg stage under old scales. The eggs hatch in May and June and the forms move up and down the branches and twigs during this period. When they choose a place to feed, they secrete a waxy substance and build a scale over themselves. Heavy infestation will cause the needles to become yellow and many of them wither and fall:

SOFT OR UNARMORED SCALES

EUROPEAN ELM SCALE - Gossyparia spuria

This scale attacks all kinds of elms. Young nymphs overwinter on the bark, hiding in cracks and crevices for protection. Males form conspicuous white cocoons in early spring and transform to minute winged or wingless, reddish forms in late April or May. Females are reddish-brown surrounded by a white cottony fringe, and lay eggs in June and July. When they hatch, the crawlers swarm over the twigs to the underside of the leaves where they settle and feed until fall. Migration to the limbs or trunk usually occurs before the leaves begin to drop.

COTTONY MAPLE SCALE - Pulvinaria innumerabilis

Attacks numerous trees, especially box elder and maples. The body of the female insect is oval or oblong, flat, pale or dark brown with a large white cottony egg sac two or three times as long as the body. Overall length is about 3/8 inch. This scale usually overwinters on the host plant in a half-grown state, becoming active during May.

EUROPEAN FRUIT LECANIUM - Lecanium corni Bouche'

Attacks numerous shade and forest trees, as well as many fruit trees. Adults are dark brown, sometimes with black banding and mottling, 1/8 inch in length, very convex, hemispherical, and fluted or crimped near the edges of the body. Overwinter as fertilized females which produce living young in the spring.

Control of the above scales is similar to that listed for the oystershell scale.

PEAR SLUG - Caliroa cerasi (L.)

Hosts - This chewing insect skeletonizes the leaves of pear, cherry, Plum, quince and occassionally apple.

Identification - In their early instars the larvae are green-black, elongate, slim, and slug-like, with very little evidence of legs. In the last instar they transform to typical sawfly larvae, nearly 1/2 inch in length, and resemble green-orange caterpillars. Their bodies are enlarged near the head and taper posteriorly. The adult is a glossy black, four-winged sawfly, about the size of a house fly.

Life Cycle - Winter is passed in the soil inside a cocoon. Adults emerge in the spring after the trees are fully leaved; they deposit their eggs in slits in the leaves by means of a saw-like ovipositor. Eggs hatch in about a week and larval development is completed in less than a month. Pupation takes place in cocoons in the soil. In late July adults of the second generation appear and lay eggs. On hatching the larvae develop to maturity, enter the soil, and spin cocoons in which they overwinter.

Control - Spray about 15 days after bloom with one of the following insecticides in 100 gallons of water:

Malathion - 2 lbs. 25% W.P., or
Parathion - 1 lb. 25% W.P., or
Diazinon - 0.5 lb. 50% W.P.

For ornamentals use the following amounts per gallon of water:

Malathion - 1 tablespoon 57% Emulsifiable concentrate, or
Diazinon - 1 tablespoon 25% Emulsifiable concentrate.

RASPBERRY OR ROSE CANE BORER - Oberea bimaculata (Oliver)

Hosts - Affects young shoots of raspberry, blackberry and roses.

Identification - The adult is a slender black beetle about half an inch long, with long antennae and usually two black dots on the yellow thorax. Larvae are whitish, legless grubs with light brownish heads.

Life Cycle - Adults appear in June and may be present until late August. After laying an egg, the female girdles the cane about 1-4 inch above and again 1/4 inch below the egg puncture, causing the tip of the shoot to wilt and die. On hatching, the larvae bore downward in the cane, passing the winter not far below the point of girdling. The next season they continue boring until the crown is reached; there the second winter is passed at or below ground level. The following spring full growth is attained when the larvae are nearly 3/L inch in length. Pupation follows, and new adults begin emerging in June. Two years are required to complete the life cycle.

Control - Prune away and destroy wilted tips well below the infested region. If pruning is done within a few days after the wilted tips appear, only an inch or so more than the wilted part need be removed.

FALL ARMYWORM - Spodoptera frugiperda (J.E. Smith)

Hosts - Feed on a wide range of plants but prefer grass crops, and are the most common armyworms found in turf.

Identification - The full-grown larvae are about 11/2 inches long, vary from light green to almost black, and have several stripes along the sides. Also there is a yellowish white inverted Y on the head.

Adults are ash-gray with mottled forcwings with irregular white or light gray spots near the tips. The expanded wings measure about 11/2 inches across.

Life Cycle - The moths are most active at night, and the females lay their egg masses on grass, leaves or other foliage. These masses may contain a hundred or more eggs and are covered with a light grayish fuzz from the females body. The larvae feed 2 to 3 weeks, mostly at night, then burrow 2 to 3 inches into the soil to pupate. In turf areas, larval feeding causes the grass to look ragged and bare. When heavy outbreaks occur, the larvae may devour the grass down to the ground. There is only 1 generation per year in the north. The fall armyworm does not overwinter except in the warmer parts of the southern U.S. Infestations in the northern Rockies and Plains Regions are the result of northward migrations of the moths each year.

ARMYWORM - Pseudaletia unipuncta (Haworth)

Larvae are similar in size and appearance to larvae of the fall army-worm. The adult moth has a wingspread of 11/2 inches and is brownish with a small white spot near the center of each front wing. The insect usually overwinters as a larvae but sometimes as a pupa. There are 2 or 3 gener-ations per year.

INSECTICIDES FOR CONTROL OF TURF PEST

INSECTICIDE AND FORMULATION	DOSAGE OF FORMULATION PER 1, 000 SQUARE FEET				
	White Grubs and Ants (See Note 1)	Sod Web-worms, Wireworms (See Note 2)	Chinch Bugs (See Note 3)	Armyworms, Cutworms, and Mole Crickets (See Note 4)	Leafhoppers
Granules					
Carbaryl, 10 percent.....	.....	2 pounds....	2 pounds....	.....	.....
Chlordane, 5 percent.....	5 pounds....	2½ pounds...	.....	2½ pounds...	.....
Diazinon, 10 percent.....	.....	2 pounds....	2 pounds....	.....	.....
Ethion, 5 percent.....	.....	.....	5 pounds....	.....	.....
Sprays					
Wettable Powders					
Carbaryl, 50 percent.....	.....	8 ounces....	8 ounces....	8 ounces....	8 ounces....
Chlordane, 40 percent.....	10 ounces...	5 ounces....	.....	5 ounces....	.....
Diazinon, 50 percent.....	.....	4 ounces....	6 ounces....	4 ounces....	.....
Ethion, 25 percent.....	.....	.....	12 ounces....	.....	.....
Emulsifiable Concentrates					
Chlordane, 75 percent (8 pounds per gallon).....	4 fluid ounces....	2 fluid ounces....	.....	2 fluid ounces....	.....
Diazinon, 4 pounds per gallon.....	.....	4 fluid ounces....	6 fluid ounces....	4 fluid ounces....	.....
Ethion, 4 pounds per gallon.....	.....	.....	8 fluid ounces....	.....	.....
Malathion, 5 pounds per gallon.....	.....	.....	.....	.....	1 fluid ounce.....
Nemacide, 8 pounds per gallon.....	.....	.....	12 fluid ounces....	.....	.....

INSECTICIDES FOR CONTROL OF TURF PESTS

Notes

Note 1. In hot dry areas, lower dosages may be necessary to prevent burning of the grass; consult your State agricultural experiment station. If only a few ant nests are present, treat them individually. Wash the insecticide into the nests or drench the mounds with it. Special treatment is required to control fire and harvester ants; consult your State agricultural experiment station for latest recommendations.

Note 2. To control sod webworms, apply the insecticide in late afternoon or evening and delay watering until the following morning. To control wireworms apply chlordane.

Note 3. A preventive spray program to control chinch bugs in the South requires treatment about every 6 weeks.

Note 4. To control cutworms, apply the insecticide in late afternoon.

CONTROL OF COOLEY SPRUCE GALL APHID

Spruce

Protection from gall formation on spruce can be obtained by spraying infested trees with malathion or nicotine sulfate insecticides. Careful timing of the spray application is necessary. Apply just as the buds break, or about the end of May. This should kill fundatrix nymphs and adults and some early gallicolae nymphs before they cause galls.

Mix the sprays as follows:

Materials	Large Amounts	Small Amounts
Malathion (25 percent wettable powder)	2 pounds	4 pound
Water	100 gallons	121/2 gallons
Nicotine sulfate* (40 percent mixture)	2 cups	2 tablespoonfuls
Water	100 gallons	6 gallons
Household detergent (powder)	2 cups	2 tablespoonfuls

*Black Leaf-40 is a commercial brand

Keep the malathion solution agitated while spraying so the powder will not settle to the bottom of the mixing container. The materials in thenicotine sulfate spray should be well mixed by stirring.

Both of these sprays give better kill when they are applied on dry or damp foliage (no water droplets present) and during a clear, warm day. Spray all the foliage and stems on an infested tree. Be sure to drench the upper and lower surfaces of the branches until the liquid runs off.

Caution should be used while handling and mixing concentrated malathion and nicotine sulfate. Nicotine is absorbed by the skin rapidly upon contact. It also should not be inhaled. Rubber gloves are recommended for mixing both of these insecticides. Remove outer clothing if it becomes wet with spray and wash skin if solutions are spilled on it.

The aphid population on small ornamental spruce trees can be reduced without spraying by cutting off current galls (green with purple tinge) before the nymphs emerge in August. The middle of July would be a good time to do this. Destroying the galls would also stop the aphids from flying to nearby Douglasfir trees.

Douglasfir

Malathion and nicotine sulfate can also be used for killing aphid generations on Douglasfir foliage. It can be mixed and used as previously described for control of the generations on spruce, Application in May will kill nymphal sistentes; and in June, adult sistentes and their progeny can be killed.

There is a possibility that nymphs on Douglasfir and spruce could be controlled during September. However, these two insecticides have more killing power when temperatures are higher.

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