FIELD BOOK
OF
DESTRUCTIVE FOREST INSECTS

By
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Kennebec Valley Protective Association
and
MAINE FOREST SERVICE
1932

FOREWORD

The Maine Forest Service protects the timber resources of the State from Fire, Insects, and Disease. Its fire protective force locates insect outbreaks so that control measures can be put in operation before they become widespread. Your help in this work is imperative.

Owners of infested timber are immediately notified, and advised as to methods which should be used to combat outbreaks.

Parasites that prey upon destructive insects are being reared and liberated. New methods of control are continually being worked out. Better and more economical methods of spraying are being found. An increased interest in Maine's invaluable shade and ornamental trees is being stimulated.

We sincerely hope that this second edition of the Field Book will aid you in identifying some of our more common forest insects. We are ready to assist you in every way possible to combat insect outbreaks.

HOW TO REPORT AN OUTBREAK

Every effort should be made to report the presence of insects or the dying of trees as soon as located. Specimens of the insect or injury should always be sent with reports. Specimens should be put in a small box or container so as not to be crushed in the mail.

In writing about an outbreak it is advisable to go into some detail. Whenever possible the Department will investigate outbreaks reported.

The following points should be covered in the report:

1. Exact location of outbreak and approximate size of area infested.

2. Kind of trees being attacked.

3. Type of insect as shown on the following page.

4. Type of injury, such as leaf feeders, sucking insects, borers, bark beetles, etc.

5. Type of surrounding forest.

6. How long have the insects been feeding in the area?

7. Date of observation.

Report blanks and mailing tubes will be furnished on request.

All reports and specimens should be addressed to the State Entomologist, State House, Augusta, Maine.

TYPES OF

CATERPILLARS These are for the most part leaf feeders and may or may not be covered with hairs. They include forms such as measuring worms, and hairy caterpillars such as the larvae of the gypsy and brown tail moths. The adult stage are either moths or butterflies.

SAWFLIES The larval stage is usually not hairy and includes many forms which feed on foliage. Sawfly larvae have a habit of elevating their heads and tails when disturbed. The adult stage is a four-winged fly.

LEAF FEEDING BEETLES The leaf feeding beetles are all relatively small and usually oval in shape. They chew holes in leaves and in their larval or grub stage skeletonize the leaves, chewing off the outer surface, leaving only the veins.

LEAF MINERS These include the larval stage of several types of insects. The larvae or grubs mine in leaves chewing out the inner portion of the leaf.

APHIDS Plant lice are small sucking insects. They are found on leaves, twigs, and trunks.

GALLS Abnormal growths on leaves, twigs and trunks, largely caused by insects.

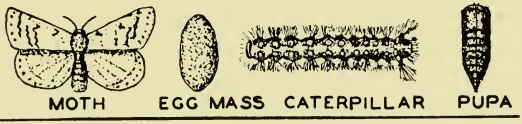
SCALES Small, waxy, scale-like insects found on leaves, twigs, and trunks.

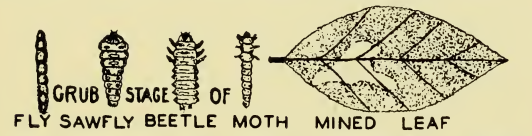
ROUND HEADED BORERS The larval or grub stage of the long-horned beetles are largely wood borers.

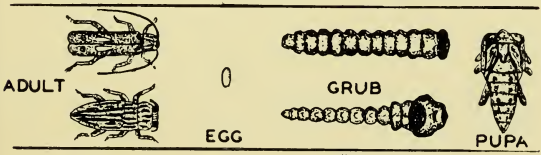
FLAT HEADED BORERS The flat or hammer-headed borers are the larval stage of rather flat beetles. The beetles are often of a metallic color.

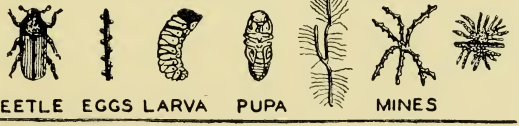
BARK BEETLES Both the grub and beetle tunnel beneath the bark leaving their engraved marks on the inner bark and outer wood. The grubs are white, curved, and rather stout. The beetles are amongst the smallest known, seldom over one-quarter of an inch in length.

FOREST INSECTS









FOREST CONDITIONS

LEAF FEEDING INSECTS (1) Airplane dusting, (2) Liberation of parasites, (3) Cutting or girdling infested softwoods, (4) Avoidance of pure forest types through management.

LEAF MINERS (1) Liberation of parasites. (2) Avoidance of pure forest types through management.

APHIDS Not as a rule forest pests.

GALLS No general control measures.

SCALES Cut and salvage heavily infested trees or stands.

BORERS (1) Keep stands well stocked, (2) Salvage burned or weakened trees immediately, (3) Float softwood logs during spring and summer, or dust with lime sulphur.

BARK BEETLES (1) Cut and salvage infested trees or stands, or (2) Cut infested timber, peel and burn bark during dormant season.

CONTROL MEASURES

SHADE TREE CONDITIONS

Spray when feeding is first noted with arsenate of lead. Usual dilution 5 lbs. arsenate of lead powder to 100 gals. water. Add 4 oz. by wt. of fish oil or linseed oil for each pound arsenate of lead. In the case of some insects it is necessary to spray the under surface of the leaves.

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(1) Spray as for Aphids just as eggs hatch. (2) Dormant miscible oil spray for case bearers.

Spray thoroughly with one part 40% nicotine sulphate, 800 parts water, 4 parts penetrol. One half oz. laundry soap for each gal. of spray may be used in place of the penetrol

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Each species requires specific measures.

Spray during dormant season with liquid commercial lime sulphur (1-9) or miscible oil (1-15).

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(1) Inject carbon bisulphide into burrows and plug holes, (2) Cut and burn infested limbs, (3) Keep trees well fed and watered.

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(1) Keep trees well fed and watered. For softwoods use hardwood litter or well rotted manure. For hardwoods use following formula: Bone meal 10 parts, ammonium sulphate 6 parts, muriate of potash 2 parts, nitrate of soda 2 parts.

SPRUCE BUDWORM

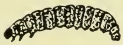
(Harmologa fumiferana Clem.)

Outbreaks of this insect usually start in areas where there is a predominance of fir, later spreading into the surrounding spruce. Infested trees show up for long distances due to the brown masses of needles clinging to the branches.

The moths appear from June 15 to July 20. Their predominating color is dull gray. The front wings are checkered with bands and spots of brown; in the middle of the upper margin is a white spot. Hind wings and body are uniform gray to brown.

MOTH

Late in July pale green eggs are laid on the underside of the needles. These hatch in about five days, the young larvae passing the winter in small cocoons in crevices on twigs near buds.



LARVA

PUPA

The body of the young caterpillar is light green, later changing to a dark or reddish brown. They feed first in the opening buds, then on the new growth needles, and later chewing off and webbing the needles in masses. They feed for about four weeks and when full grown are about one inch long. The pupae are formed on the twigs and this stage lasts about ten days.

See control for leaf feeding insects pages 4 and 5. Avoid growing pure stands of fir.

EASTERN SPRUCE BEETLE

(Dendroctonus piceaperda Hopk.)

Large quantities of spruce timber are killed by this small beetle which girdles beneath the bark of the trees, preventing the downward flow of sap. For the most part the beetles choose trees over nine inches in diameter, and attack the lower third of the trunk. The beetles are particularly destructive to spruce previously weakened by insects, windfalls, etc.

BEETLE GRUB

The beetles appear about three weeks after the balsam buds open and are about one-quarter inch in length, brown to black in color. They bore directly into the trunk, and egg tunnels of from four to ten inches long, usually running with the grain of the wood, scoring both wood and bark, are formed. Eggs are laid in alternate layers along the sides of the tunnel and upon hatching the curved, yellowish white, legless grubs tunnel in the inner bark at right angles to the egg tunnel. The winter is spent in either the grub or beetle stage.

MINES

The injury shows up first as small masses of gum or pitch and fine reddish borings on the trunks of the trees. As the trees die, the foliage turns brown and falls off. Woodpeckers usually attack the trees, flaking off the bark, in search for these beetles.

See pages 4 and 5 for control.

HEMLOCK SPANWORM

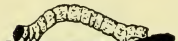
(Ellopia fiscellaria Guen.)

Outbreaks of this insect usually start in areas where there is a large percentage of balsam, or hemlock. The caterpillars also feed on spruce, pine, and hardwoods.

The moths appear in September and are of a light brown to yellowish gray color with a double wavy dark line across the wings. They have a wing spread of about one and one-half inches. Minute light green to brown eggs are laid on trunk, twigs, and needles.

MOTH

The time of hatching varies considerably, but in general the larvae start feeding in June. It takes them about six weeks to mature and as they are ravenous feeders they quickly defoliate large areas. When full grown the "loopers," or measuring worms, are about one inch in length, pale green in color, marked with numerous small black flecks and lines. Pupation takes place in crevices of the bark or in the ground.



LARVA

Airplane dusting using 15 lbs. calcium arsenate per acre has proved very effective. Individual trees may be sprayed in early July with arsenate of lead.

SATIN MOTH

(Stilpnotia salicis L.)

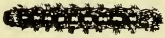
The Satin Moth is a European pest which is very destructive to willow and poplar. It is satiny-white in color with a wing expanse of about one and one-half inches. The body is usually black, covered with white, satiny hairs.

MOTH

The eggs are laid late in July in oval shaped, silvery-coated patches on the under side of the leaves, branches, trunks, or any material near the base of the trees.

EGGS

The caterpillars feed for about two weeks on the leaves and then spin small cocoons in the crevices of the bark, where the winter is spent. Feeding starts again in June. When full grown they are about one and one-half inches long. The head is bluish-black. The upper surface of the body is black with a series of large white spots along the back. The sides are gray. Tufts of reddish hairs occur between each segment.



LARVA

The pupal case is jet black, partially covered with white or yellowish hairs and enclosed in a loosely spun cocoon. The moths emerge in about ten days.

PUPA

Spray with 5 lbs. arsenate of lead to 100 gals. water plus fish oil May 26 to June 10, every other year.

BIRCH LEAF MINER

(Phyllotoma nemorata Fal.)

This insect is of European origin and has been destructive to birch in Maine since 1926.

ADULT

The adult sawflies appear from June 12 to July 10. These are three-sixteenths of an inch long, black, with a dark spot on the outer edge of each front wing. Eggs are laid in the margins of the birch leaves and hatch in about twenty days. The young larvae mine in the leaves during the months of July and August, causing them to turn brown. About the first of September, the larvae form round, flat, circular, blister-like cells in the leaves, and it is in these wax-lined cells that the winter is spent. By holding the infested fallen leaves to the light, the grubs can be seen within.

CELLS IN MINED LEAF

The latter part of June the larvae transform to flies in the round cells and cut their way out into the open. The mining of the leaves stops the growth of the trees just as if the leaves had been chewed off.

Trees should be sprayed with nicotine sulphate one part to 800 parts water during the last two weeks in July when the mines are smaller than a cross section of a lead pencil. Parasites are being liberated for control in the forest.

BIRCH CASE BEARER

(Coleophora salmani Hein.)

This new pest of birch appeared in Maine about 1926 and has begun to spread rapidly in the State.

The small, grayish-brown moths, having a wing expanse of about one-half inch, appear the first two weeks in July and lay their small, yellow eggs on the under side of the leaves. The egg stage lasts about three weeks. The larvae begin mining in the leaves, finally cutting out a portion of the leaf to form a curved tubular case. The larvae then move from place to place on the leaf using the case for protection and feeding on the leaf tissue. As the larva matures larger cases are formed. The winter is spent by the larva in a curved case, usually on the twigs.

Moth

Cases on Leaf

Feeding is resumed early in the spring. By early June leaves may show holes and small mined areas, and appear entirely brown. The larvae pupate in a cigar shaped case about one-quarter inch in length.

For control spray in early August with nicotine sulphate one part to 800 parts soapy water.

LARCH SAWFLY

(Lygaeonematus erichsonii Htg.)

Billions of feet of larch have been destroyed by this insect in the Northeast, and all areas in which there is an abundance of larch should be watched for a re-occurrence of this pest.

ADULT

The adult flies appear in June. These are about three-eighths of an inch long, body jet black except for a reddish brown band around the body and portions of the legs. The fly has four shiny transparent wings with a dark spot on the outer margin of the front wings. Eggs are laid in the new growth twigs, causing the twigs to curl. The eggs hatch in about one week. The young larvae feed on the foliage both day and night. When full grown they are about two-thirds of an inch long, with black head and six black feet just back of the head. The body proper is green. When disturbed, they curl in an "U" shape with head and tail up. The latter part of July they come down the trees and form their pupal cases in the ground beneath the trees. These are brown, oval, tough cases about one-half inch in length.

LARVA

PUPA

Spray with arsenate of lead four pounds per 100 gals. water plus soap, as soon as larvae appear, usually late in June.

LARCH CASE BEARER

(Coleophora laricella Hbn.)

This European insect at times defoliates large areas of larch in Maine. The minute ashy gray moths, having a wing expanse of about three-eighths of an inch, appear about the first of July. Small orange colored eggs are laid on the needles.

Moth

The young larvae tunnel in the needles until September when they cut off a portion of the hollowed leaf to act as a winter cocoon. They then migrate to the twigs, branches, and trunk of the tree with their cases. In the spring the larvae push the fore part of their body out of the case and crawl to the new needles, tunneling into them, and hollowing them out. By the first of July the trees appear as if scorched by fire. The foliage on the lower limbs is usually attacked first. The small cigar shaped cases are easily seen both on the needles and on the branches.

Cases on Needles

Considerable larch has been killed in Maine during the past few years by this insect.

Spray in mid July with nicotine sulphate 1 to 400 plus soap. A dormant miscible oil spray applied before buds open is very effective.

BRONZE BIRCH BORER

(Agrilus anxius Gory.)

Injury from this beetle shows up as dying tops of white and yellow birch. This injury in particularly abundant in stands that have been thinned. The bronze-colored beetles appear in June and lay their eggs in crevices of the bark of small branches. The grubs upon hatching burrow just beneath the bark, girdling limbs and trunk.

ADULT

SUGAR MAPLE BORER

(Glycobius speciosus Say.)

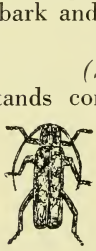
Trees infested with this beetle are easily spotted by the presence of dead limbs, ragged scars on the larger limbs and trunk and the presence of frass or sawdust. The black, yellow marked beetles appear in July or August, and lay their eggs on the larger limbs. The grubs tunnel beneath the bark and later in the wood.

ADULT

POPLAR BORER

(Saperda calcarata Say.)

Stands containing poplar which have been opened up are very subject to attack by this large gray beetle, which appears in July or August and lays its eggs in slits cut in the bark of the tree. The grubs bore beneath the bark. Presence of the beetle is indicated by dying of foliage and presence of "sawdust" around base of trunk.



ADULT

See pages 4 and 5 for control of borers.

INTRODUCED PINE SAWFLY

(Diprion simile Htg.)

This defoliator is a serious pest of white, Norway, and pitch pines. The adult fly appears early in the spring and lays its eggs in slits cut in the needles. The body of the larva is greenish yellow with a double brown stripe down the back, and on either side a broken yellow and brown stripe. The head is black. The larvae feed on the foliage. Winter is spent in cocoons made in the soil.

LARVA

RED-HEADED SAWFLY

(Neodiprion lecontei Fitch.)

Clusters of red-headed, dirty yellowish, black spotted caterpillars may be found feeding on pine in midsummer and again in the fall. They not only feed on the needles, stripping them from the trees, but may also feed on the tender bark.

LARVA

ABBOTT'S PINE SAWFLY

(Neodiprion pinetum Nort.)

The larvae of this sawfly are yellowish-white in color with black heads and four longitudinal rows of black spots. They feed in midsummer on the foliage of pitch and white pine.

LARVA

Spray as soon as larvae appear with four pounds arsenate of lead per 100 gals. water plus four ounces fish oil for each pound of arsenate of lead used.

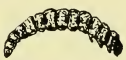
SPRUCE WEB WORM

(Epinotia nanana Tr.)

For several years this insect has become increasingly abundant on the spruce along the coast. The small brown worms cut off, mine and web the needles together. These soon turn brown, giving the trees the appearance of having been scorched by fire. Later the needles fall or are washed off and the trees take on a scraggly appearance. If the infestation is heavy the trees will die.

MOTH

The moths fly early in July and may be seen swarming around the foliage, particularly in sunny places. The moths are smoky brown in color with a wing spread of slightly less than three-eighths inch. Eggs are laid at this time.



LARVA

Upon hatching the larvae start mining the needles and cut off and web these together in a mass that clings to the twigs. The heaviest feeding is apparently done during May and June. The insect overwinters as young larvae inside mined out needles.

Spray trees thoroughly with six pounds arsenate of lead, plus fish oil, per 100 gals. water, the first week in April or first week in July.

SPRUCE SAWFLY

(Neodiprion abietis Harr.)

The larvae of this sawfly are at times very abundant on fir, spruce, pitch pine, and white pine, completely defoliating the trees. They are ravenous feeders and usually occur in clusters on the needles.

LARVA

The larvae, or false caterpillars, are about one-half inch in length when full grown. The head is black, the body dark green with darker green stripes down the back. The fore legs are black. Like other sawfly larvae, they have the habit of elevating both head and tail into an "U" shape when disturbed.

In some parts of Maine there are, apparently, two generations a year, the first appearing in June and the second the latter part of July.

ADULT

The adult flies are about one-fourth inch long with a wing spread of about one-half inch. The female is yellowish-brown above, with the under part of body and legs of a dirty yellow color.

The cocoon is slightly over one-quarter inch in length.

Spray when larvae first appear with four pounds arsenate of lead to 100 gals. water plus four ounces fish oil for each pound arsenate of lead used.

FOREST TENT CATERPILLAR

(Malacosoma disstria Hbn.)

The forest tent caterpillar is a general hardwood feeder, but is particularly injurious to white birch and poplar. In spite of its name this insect forms no tent or web.

MOTH

The light buff colored moths having two dark diagonal lines on the fore wings appear during July and August. They have a wing spread of slightly over one inch.

EGG MASS

Eggs are laid in ring-like bands which usually completely encircle the twigs. These masses of eggs are held together with a grayish, glue-like substance.

The caterpillars emerge early in the season and feed for about six weeks, largely at night. When full grown the caterpillars are about two inches in length. They are blue-black in color, slightly hairy, with two brownish yellow bands on the sides of the body and a series of cream colored dots along the middle.

LARVA

The larvae pupate in rather thick, yellowish white cocoons, which may be found almost anywhere.

Prune off and burn egg masses. Spray with arsenate of lead 4 to 100 in early spring or 6 to 100 when caterpillars are half grown.

ARBORVITAE LEAF MINERS

(Argyresthia thuiella Pack.)

(1) About the middle of June swarms of minute gray moths may be seen flying around cedar trees. The moths have a wing spread of about one-quarter inch, while lying at rest the wings are folded back over the body. The eggs are laid on the edges of the needles. The larvae are of a yellowish color with head slightly darker. These mine in the leaves, causing the foliage to turn brown.

MOTH

(Recurvaria thujaella Kear.)

(2) A second leaf miner occurs in some sections of the State causing similar damage. The small gray moths appear the latter part of July. They are very short-lived and lay their eggs on the needles. The egg stage lasts nearly a month. Upon hatching the larvae feed until late fall. When full grown they are about one-fourth inch long with black head and reddish body. The mines are lined with silk. The following July they pupate, and in about two weeks the moths appear.

MINED FOLIAGE

Cut and burn infested foliage. Spray early in July with a strong nicotine-soap solution.

SPRUCE GALL APHID

(Adelges abietis Linn.)

Ordinarily this insect is injurious only to ornamental spruce, but in some sections of the State it has now assumed epidemic proportions over large tracts. The injury shows up first as greatly enlarged buds which appear compact. Later these turn pink in color, and then finally brown, at the time they break open. The galls prevent further growth by the twigs they are on, and when in epidemic form may prevent all further growth on the tree.

GALL

The winter is spent as young aphids in crevices of stems or at the base of the buds. In the spring eggs are laid at the base of the buds and upon hatching the young crawl to the opening buds and establish themselves at the base of the new needles. Their feeding causes the gall to form. Later in the season the galls crack open and the winged aphids fly to the needles where eggs are laid. From these the over-wintering aphids hatch.

Trees should be sprayed with a dormant miscible oil before the buds open in the spring.

There are several other species of similar galls on spruce.

WHITE PINE WEEVIL

(Pissodes strobi Peck.)

This weevil is considered the most serious insect enemy of white pine. It also attacks red and Norway spruce. Red pine and white spruce are relatively immune. The small reddish-brown snout beetles pass the winter in the ground and at about the time growth starts in the spring they fly or crawl to the tops of the pine and lay their eggs in the leaders. Upon hatching the grubs feed beneath the bark killing the tops of the pine, and often destroying several years' growth.

WEEVIL

The injury is particularly abundant in plantations or in areas where pine is seeding in. The presence of the insect first shows up as pitch on the past year's leader. During July the top withers, and the foliage turns yellow and then brown. Neat round holes with "sawdust" sifting out show where the weevils have emerged.

DEAD LEADER

Cut and burn infested leaders in June and July. Spray in late April with lime sulphur 1-7. Mixed plantations in which weevil subject trees are over topped are advised.

BEECH SCALE

(Cryptococcus fagi Baer)

This insect, also known as the Felted Beech Scale, is a European pest. During the last few years it has killed large quantities of beech in Nova Scotia and New Brunswick. In 1931 it was found in Maine.

The presence of the insect is easily seen, for it appears as a white felt-like coating on the trunks and branches. When present in only small numbers, the white cottony masses appear streaked along crevices of the bark. As the infestation becomes severe, the bark turns brown and cracks open, allowing a brown slimy liquid to ooze out.

SCALE

The winter is spent by the wooly-covered lice in crevices of the bark, where, during the spring and fall, they feed by sucking the sap from the tree. Minute yellowish eggs are laid during the summer, which hatch in about a month. The extremely minute pale yellow crawlers move about the bark until a suitable feeding place is found. White waxy threads coat the body. The full grown louse which occurs in the spring is wingless, legless, yellow, round in shape and about 1/32 inch in diameter.

A fungus disease is closely connected with this insect, and its presence seems to be necessary for the killing of the trees. This fungus has small red fruiting bodies.

Control is obtained by a thorough dormant spring spraying with miscible oil diluted 1 to 15.

FIR BARK LOUSE

(Dreyfusia picea Ratz)

This European insect has just recently invaded Maine and is destroying large amounts of fir. The tops of infested trees become dead, swollen, distorted, and taper off rapidly. Buds become greatly swollen and smothered by the twig growth. The effect is often referred to as gout. The wood becomes brittle. The bark dies and becomes coated with white resin.

INJURY

The white wooly aphids often die and fall off before the injury is noticed. The winter is spent as small black larvae, with a fringe of white wax, in crevices of bark or at base of buds. In the spring these develop into hemispherical-shaped adults about 1/30 inch in length covered with a mass of white wool. An adult may lay 100 eggs. There are probably two or more generations a year. The insects are spread largely by wind, man, and birds. Affected trees are often attacked by mites and parasitic fungi. Infested trees should be cut and either salvaged or burned.

A dormant oil spray should prove effective.

SPRAY DILUTIONS

Arsenate of Lead

100 gals.	25 gals.	10 gals.	5 gals.	1 gal.
1 lb.	¼ lb.	1.6 oz.	4/5 oz.	1/6 oz.
2 lbs.	½ lb.	3.2 oz.	1.6 oz.	1/3 oz.
3 lbs.	¾ lb.	4.8 oz.	2.4 oz.	½ oz.
4 lbs.	1 lb.	6.4 oz.	3.2 oz.	2/3 oz.
5 lbs.	1¼ lbs.	8 oz.	4 oz.	4/5 oz.

The addition of 4 oz. by weight of fish oil (not fish oil soap), or linseed oil, for each lb. of arsenate of lead will help make the spray stick to foliage. Particularly necessary for glossy leaves.

40% Nicotine sulphate

Dilution	100 gals.	25 gals.	5 gals.	1 gal.
1-800	1 pt.	¼ pt.	6¼ T.	1¼ T.
1-1000	¾ pt.	3/16 pt.	5 T.	1 T.
1-1600	½ pt.	⅛ pt.	3¾ T.	¾ T.
1-2000	⅜ pt.	1 fl. oz.	2½ T.	½ T.

T=teaspoonful.

By adding ½ oz. laundry soap for each gal. of spray, or 1 part penetrol for each 200 parts spray, the amount of nicotine sulphate can be greatly reduced and more satisfactory results obtained.

Miscible oils.

Dormant spray 1 part oil to 30 parts water.
Summer spray 1 part oil to 100 parts water.

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FOREST INSECT FACTS

The average annual loss to the forests of Maine from insect attack amounts to over $2,500,000.

An additional heavy loss occurs in the destruction of forest seed, nursery stock, reproduction, fire-killed timber, and manufactured stock.

The spruce bud worm alone during the 1910-1919 series of outbreaks killed 27,500,000 cords of pulpwood in Maine.

There are about 600,000 known insects in the world, 200,000 of which attack trees.

The healthiest forest is a mixed rapid growing type.

The weakest forest is a pure, slow growing type, and it is in such types that insect outbreaks usually start and do their greatest damage.

By proper planning of cutting operations most insect outbreaks can either be prevented or stopped.

The secret of insect control lies in locating an outbreak before it becomes widespread.