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COMMON PEST PROBLEMS OF SUGAR MAPLE  
IN THE MARITIMES, WITH PARTICULAR  
REFERENCE TO SUGAR BUSHES

by

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## ABSTRACT

This report reviews the life stages and development of several sugar maple pest organisms. It describes the damage caused by each pest and gives presently accepted practical control recommendations.

## Résumé

Ce rapport donne un bref aperçu du cycle évolutif de plusieurs ravageurs de l'érable à sucre. Il explique les dégâts attribuables à chacun de ces organismes et tâche d'offrir des méthodes pratiques de répression.

### Introduction

Sugar maple, known in the lumber trade as hard maple, is one of the most valuable trees in North America: its wood is widely used in the manufacture of furniture, flooring, and many other wood products, and its sap is easily converted to maple syrup - a favorite sweetener for fritters and pancakes.

Sugar maple is a host for many insects, mites, and disease organisms. To date, none of these pests has caused serious damage on a large-scale in the Maritimes Region, but localized outbreaks have occurred. Many of the pests described in this report are potentially harmful, while others, though they have never caused serious damage in forest stands are included because they are common and have a potential for damage.

Repeated severe insect defoliation may not cause tree mortality but it reduces tree vigor, making the tree susceptible to attack from otherwise unimportant pests.

Disease fungi are common on maple but seldom kill the tree. A few fungi, especially those that attack the branches and stems, can significantly weaken trees, deform them, discolor the wood, inhibit growth, and decrease the usefulness of their by-products.

Chemical control of diseases under forest conditions is expensive, often impractical, and almost always unnecessary. Therefore the control measures given in this report are recommended only for the protection of valuable ornamental or shade trees, and application rates should not deviate from those listed on the container labels.

This report was prepared at the request of the Nova Scotia Department of Agriculture and Marketing for use in a training course in January 1976, for persons interested in the commercial production of maple syrup. A few of the organisms are pictured on hosts other than sugar maple, but the illustrations are for identification purposes only.

The damaging agents are described, and are classified according to the part of the tree affected. However, positive identification is not easy with only limited information. Additional information and diagnostic services are available on request from the Maritimes Forest Research Centre, P.O. Box 4000, Fredericton, N.B. or P.O. Box 667, Truro, N.S.

CLASSIFICATION OF DAMAGING AGENTS

BY PARTS OF TREE AFFECTED

Type of damage and description of agent	Name	Page
A. <u>Leaves</u> (Insects and Mites)		
Feeding results in numerous irregularly spaced holes and deep border indentations, with only larger veins remaining after heavy attacks; larva a light green to dark brown looper with many longitudinal light stripes; 6 pairs of legs, one pair very small.	Fall cankerworm	10
Feeding damage same as above; reddish to yellowish brown or yellowish green looper with whitish, mottled head; 5 pairs of legs	Spring cankerworm	12
Feeding damage same as above; looper green throughout with narrow yellowish white stripes on each side of the body; 5 pairs of legs	Bruce spanworm	13
Feeding damage and general appearance of the insect similar to the above, difficult to distinguish from the above.	Winter moth	14
Feeding same as above; slender green looper with narrow broken yellowish white lines on body; 5 pairs of legs	Lesser maple spanworm	17
Feeding same as above; bright yellow looper with wide dark stripe on back; 5 pairs of legs	Linden looper	18
Feeding same as above; yellowish green to grayish looper with small black spots on back; 5 pairs of legs	Hemlock looper	20
Feeding same as above; pale blue larva with a row of keyhole-shaped white spots down the middle of the back; 8 pairs of legs	Forest tent caterpillar	22
Feeding same as above; hairless larva with a contrasting saddle-shaped patch on the back; 8 pairs of legs	Saddled prominent	24
Feeding same as above; yellowish green larva with 2 horns near front of body; 8 pairs of legs	Greenstriped mapleworm	26
Feeding same as above; body smooth with yellowish orange-red swelling near posterior end; 8 pairs of legs	Red-humped oakworm	28

Type of damage and description of agent	Name	Page
Young larva a leaf skeletonizer, feeds only on under surface of leaf; older larva can consume entire leaves with only the main veins remaining intact; hairy caterpillar equipped with one pair of tufts of long black hairs near head and a single similar tuft near posterior end of body; 8 pairs of legs	White-marked tussock moth	30
Feeding as above; larva similar to above, but has an additional pair of black hair tufts behind the third pair of legs	Rusty tussock moth	33
Larva rolls leaf which eventually turns brown; larva green; 8 pairs of legs	Maple leaf roller	34
Larva feeds from inside a tube and eats only the under surface of leaves; 8 pairs of legs	Maple trumpet skeletonizer	36
Spindle-shaped swellings or reddish green felt-like patches on upper surface of leaf; causal organisms minute mites	Maple leaf galls	37

Type of damage and description of agent	Name	Page
<u>Leaves (Diseases)</u>		
Large brown areas anywhere on leaf	Anthracnose	40
Brown discoloration first appears on leaf margin	Leaf scorch	43
Brown spots, about 1/4 inch, with reddish-brown margin	Purple-eye leaf spot	44
Small, angular, brown spots with pinkish underside	Phleospora leaf spot	46
Blisters or charcoal-brittle black areas	Leaf blisters	48
Black tar-like blotches on leaves	Black tar spot	50
Small black specks in yellow-green areas	Speckled tar spot	52
Sudden wilting of leaves on one or more branches; greenish streak in sapwood	Verticillium wilt	55
Various discolorations of leaves; browning initially between veins	Fume damage	72
Sudden wilting of leaves; white fan-shaped growth and/or black shoestring-like streaks under bark close to base of tree	Shoestring root rot	56
<u>B. Twigs and Branches (Diseases)</u>		
Red flagging in crown; pinkish cushions on twigs	Coral spot Nectria	58
Red flagging in crown; black spots on twigs	Steganosporium	60
Red flagging in crown; white or black pinhead-size spots on twig	Cytospora canker	62
Small canker around wounds or branch stubs; white or black pinhead-size spots on twig	Cytospora canker	62
Small canker around wounds or branch stubs; red lemon-shaped fruiting bodies on twig	Nectria canker	64

Type of damage and description of agent	Name	Page
C. <u>Stems</u> (Diseases)		
Target-like canker with bark missing over ridges; red lemon-shaped fruiting bodies	Nectria canker	64
Target-like canker with bark left over ridges; black flask-shaped fruiting bodies	Eutypella canker	66
Dieback on one side of newly exposed tree, dying bark	Sunscald	70
Green streaking in outer wood, close to base; associated with wilting in crown	Verticillium wilt	55
White fan-like growth and/or "shoestrings" under bark, close to base; light brown mushrooms	Shoestring mushroom	56
Various conks, shelf fungi or flat growth on bark; wood rotten under bark	Decay fungi	68
Cracks on bark extending deep into wood, or line overgrown with callus formation	Frost crack	72
Canker around old tap-holes; yellowish to olive or dark-green "fingers" of discoloration in the sapwood	Tap-hole decay	71

DAMAGING AGENTS  
AND  
SUGGESTED CONTROL MEASURES

FALL CANKERWORM

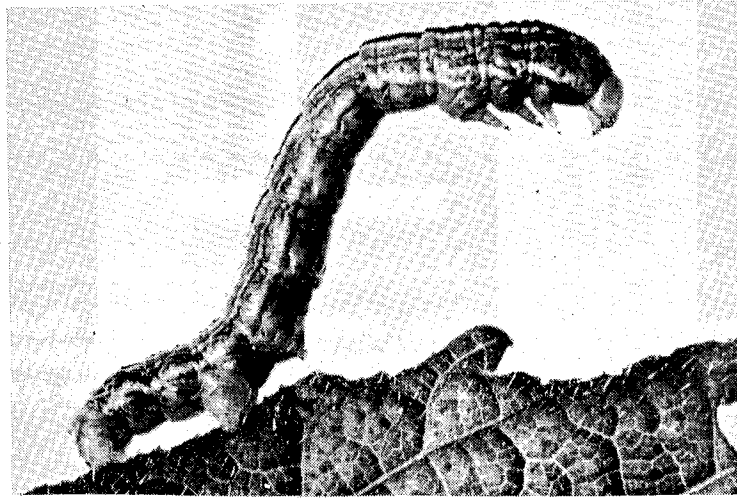
IMPORTANCE: This native insect, *Alsophila pometaria* (Harris), is one of the most widely distributed pests on deciduous forest and shade trees in North America. It attacks many species of trees particularly white elm, basswood, red maple, silver maple, red oak, and apple. It can completely defoliate forests over extensive areas, but because the epidemics usually last only a few years and trees seldom die from the defoliations, the fall cankerworm is not considered a major pest on sugar maple in forest stands. It can, however, be troublesome on shade trees. Under forest conditions the fall cankerworm is frequently found in association with other defoliators, such as the Bruce spanworm and winter moth.

INJURY: The caterpillars are heavy feeders and produce a characteristic feeding pattern by eating irregular holes through the leaves, but during heavy infestations, most of the leaf tissue is eaten leaving only the mid-rib and larger veins.

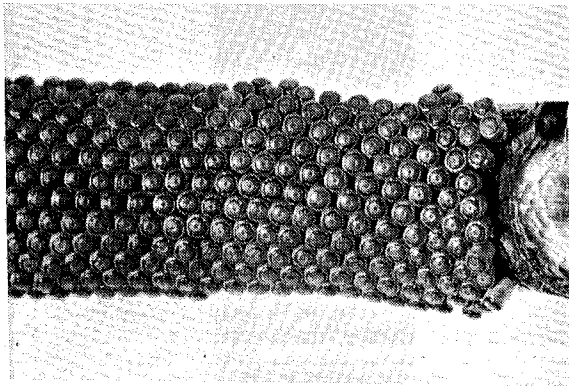
INSECT APPEARANCE: The caterpillars are known as loopers, inchworms, or measuring worms because they crawl with a characteristic looping motion. When fully grown they measure about 20 to 25 mm long. They vary from pale green with light stripes to dark brown with light stripes or markings (which may predominate over the green). They have six pairs of legs, although one pair (on 5th abdominal segment) is small. Male moths are greyish brown with darker spots and whitish bands on the wings. The females are ash-grey, about 12 mm long, and wingless. The eggs are also ash-grey.

LIFE CYCLE: The eggs are laid in mid-fall on the twigs and smaller branches, in masses averaging about 100. They overwinter and hatch in the spring shortly after buds burst (from 10 to 30 May). The larvae mature in late June. They then drop to the ground and form a brownish oval cocoon in the top 25 to 50 mm of soil. When foliage is depleted, large numbers of larvae drop prematurely from the trees and feed on shrubs and garden plants or crawl over houses, causing considerable annoyance. The moths emerge from mid-October to late November, usually after the first heavy frost. The adults are most active at dusk, when males can be seen fluttering about the bases of the trees. The moths mate as the females crawl up the tree trunks to the branches and twigs to lay their eggs.

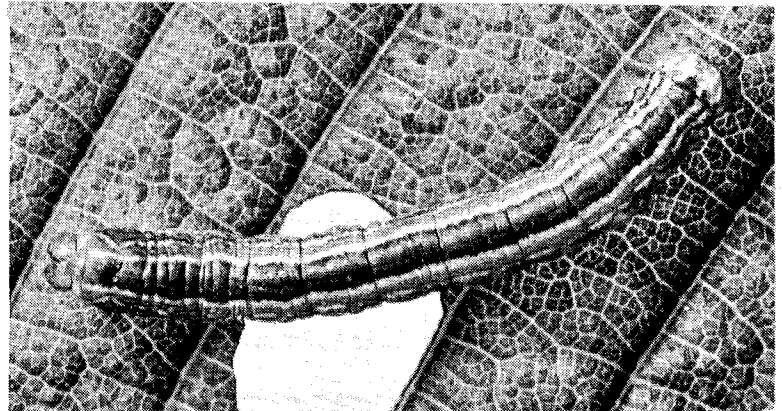
CONTROL: Spraying the foliage when the caterpillars are small, usually early in June is the most effective control (formulae 1, 3, 2, or 8). When only a few trees are involved, banding the trunks about October 1, with a 6- to 8-inch wide strip of paper coated with a sticky substance (tanglefoot) will prevent the wingless females from climbing the trees to lay their eggs. Crevices beneath the paper should be stoppered with cotton. The bands should be cleaned of debris (leaves and trapped cankerworm adults), at weekly intervals, to prevent the females bridging the tanglefoot.



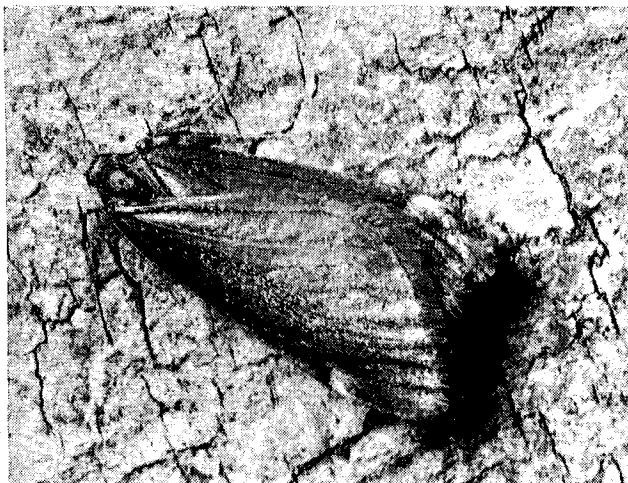
Mature larva in motion. Approx.  $\times 2\frac{1}{2}$



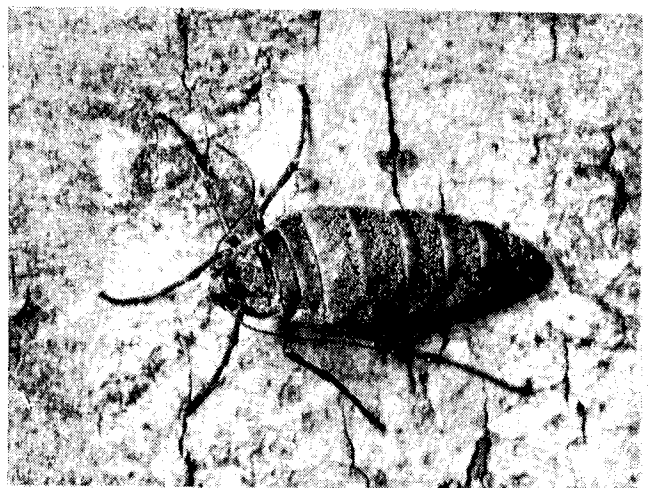
Egg mass



Mature larva



Adult male



Adult female

Figure 1. FALL CANKERWORM

SPRING CANKERWORM

IMPORTANCE: The spring cankerworm, *Paleacrita vernata* (Peck), is potentially as destructive as the fall cankerworm, but it seldom reaches population levels in the Maritimes, capable of causing economic problems on maple.

INJURY: Similar to the fall cankerworm.

INSECT APPEARANCE: Closely resembles the fall cankerworm in all stages, but the spring cankerworm caterpillar has a mottled white head capsule and only five pairs of legs; the female moth has a distinct black dorsal line or stripe; adults of both sexes have minute reddish spines arranged in dorsal rows on the abdomen.

LIFE CYCLE: Similar to that of fall cankerworm, except that the spring cankerworm moths do not emerge and lay their eggs until early spring.

CONTROL: Similar to fall cankerworm.

BRUCE SPANWORM

IMPORTANCE: This native insect, *Operophtera bruceata* (Hulst), is found from Newfoundland to British Columbia. It feeds on several species of deciduous trees, but in eastern Canada it feeds mostly on highland sugar maple and beech. It is an important pest of maple groves in Quebec where several stands in the eastern townships have been completely defoliated. In Nova Scotia, the spanworm occurred in low numbers for several years prior to the first recorded outbreak in a small area near Antigonish. Since this infestation, it has been found more frequently and often in damaging numbers on the high ground throughout the Cobequid Range in Cumberland and Antigonish counties.

INJURY: Similar to fall cankerworm.

INSECT APPEARANCE: The eggs are pale green when first laid but later turn bright orange. The full-grown larva is a looper about 20 mm long, bright green, with narrow, yellowish white stripes and has five pairs of legs. The adult male is light brown and has semi-transparent wings banded with brown or grey. The adult female is greyish brown, with wings reduced to nodules about 1 mm long.

LIFE CYCLE: Similar to the fall cankerworm except that the eggs are laid singly under lichens, loose bark, or in other protected places on the tree.

CONTROL: Data from recent studies on sugar maple stands in Quebec indicate that severe defoliation does not always reduce sap flow. Sometimes there is an abundant sap flow the year following severe spanworm attack. However, trees that are completely defoliated for 3 or 4 successive years will lose vigor and some will die. Applied control is similar to fall cankerworm.

WINTER MOTH

IMPORTANCE: The winter moth, *Operophtera brumata* (L.), is a European insect that feeds on several species of deciduous trees. Apple and oak are the most common hosts but basswood, white elm, and maple are also attacked. The insect was introduced into Nova Scotia several years ago, and now occurs throughout most of Nova Scotia, the southern part of Prince Edward Island, and southeastern New Brunswick. For several years, shade trees were sprayed to prevent them from being seriously defoliated. However, in many areas, introduced parasites and disease have reduced winter moth numbers and spraying is neither desirable nor necessary.

INJURY: Similar to fall cankerworm. The larvae usually feed between leaves tied or folded and held together with silk.

INSECT APPEARANCE: The eggs are pale green when first laid but after about 2 weeks they become reddish orange. The full-grown larva is a looper with five pairs of legs; about 25 mm long, yellowish to bright green with narrow, paler stripes along the side of the body. The adults are tawny-brown moths; the female is unable to fly, her wings are reduced to short stubs.

LIFE CYCLE: Similar to the Bruce spanworm except that the moths have been observed emerging late in December.

CONTROL: Timing same as for fall cankerworm. Formulae 1A, 1, 3, or 2. Banding with tanglefoot may be used on individual shade trees.



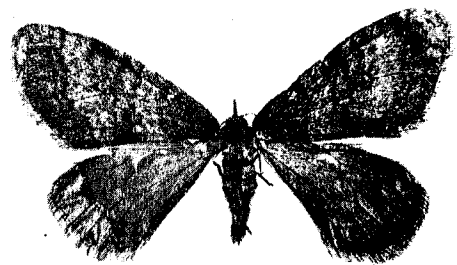
Eggs among lichens



Larva Approx.  $\times 4$



Female adults (Note vestigial wings)  
Approx.  $\times 3$



Male adult Approx.  $\times 2\frac{1}{4}$

Figure 2. WINTER MOTH

LESSER MAPLE SPANWORM

IMPORTANCE: The lesser maple spanworm, *Itame pustularia* (Gn.), is widely distributed in eastern Canada and extends west to central Saskatchewan. Over the past few years, populations of this native insect have increased considerably in central and southern New Brunswick and to a lesser extent in Prince Edward Island. Public interest has been aroused during July and August because numerous small white moths have been found in lawn grass, gardens, and on the foliage of most ornamental trees. Although it will feed on sugar maple, it feeds voraciously on red maple often stripping the crowns of trees over a large area. The current infestation of the lesser maple spanworm appears unprecedented and the insect could become of concern to owners of sugar maple stands. It usually feeds in association with other defoliators.

INJURY: Moderate feeding is characterized by numerous holes in the leaves and by large indentations on the edges. During heavy infestations, the larvae are capable of consuming all the green leaf portions, leaving only the main veins intact.

INSECT APPEARANCE: The larva is a green-headed looper with a green body and contrasting narrow white, cream, or yellowish lines; it grows to about 20 mm in length. The moth is white with a wing span of about 25 mm; the front edges of the forewings are marked with 3 or 4 golden brown spots and 2 or 3 very thin, often indistinct, transverse stripes of the same color. The eggs are grey to pink.

LIFE CYCLE: Adults emerge in mid- or late-July and lay their eggs, which overwinter and hatch in late May. Larvae feed until the latter part of June or the first week of July.

CONTROL: Trees should be inspected during the first ten days of June for the small green loopers. If more than one caterpillar per leaf is found, treatment should be initiated (formulae 1, 3, or 2).

LINDEN LOOPER

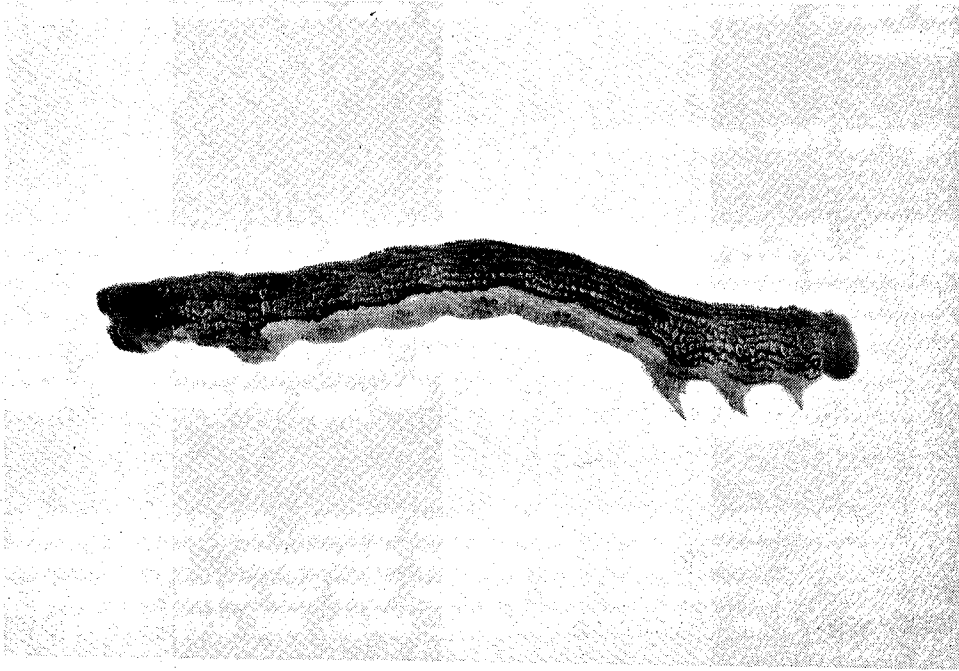
IMPORTANCE: The linden looper, *Erannis tiliaria* (Harr.), has been collected from Newfoundland to central Alberta. It periodically causes severe defoliation in local areas in the Maritimes. Other host trees of this insect are basswood, oak, birch, and elm.

INJURY: Similar to fall cankerworm.

INSECT APPEARANCE: The larva is a looper sometimes growing to 38 mm in length; it is characterized by a broad lemon-yellow stripe along each side of the body, with ten wavy narrow black lines on the back; it has 5 pairs of legs. The female moth is practically wingless and is yellowish-grey with two rows of black spots down the back; the male has tan-colored front wings displaying a conspicuous dark wavy line across the apical one-third, and a wider, fainter transverse band near the base. The eggs are light green.

LIFE CYCLE: Similar to fall cankerworm except that the eggs are laid on the bark, in small loose clusters of 4 or 5.

CONTROL: Similar to fall cankerworm.



Larva

Figure 3. LINDEN LOOPER

EASTERN HEMLOCK LOOPER

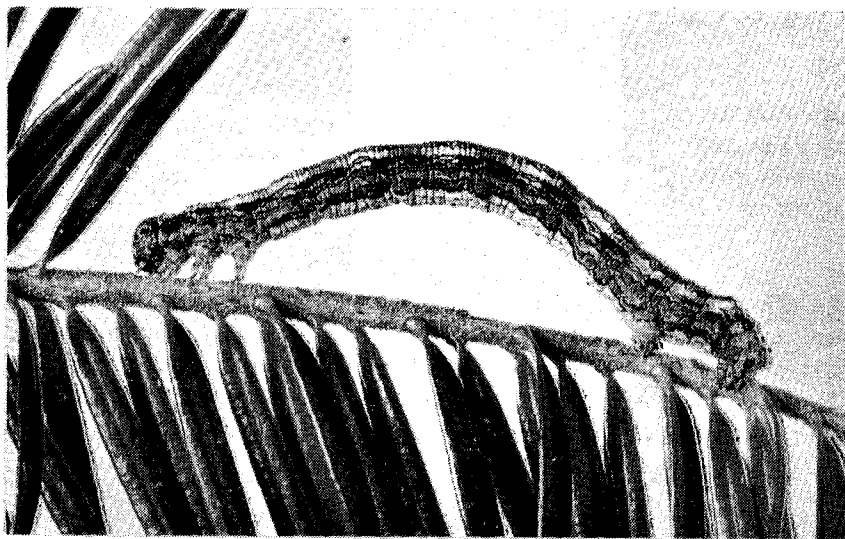
IMPORTANCE: This native insect, *Lambdina fiscellaria fiscellaria* (Guen.), is found throughout most of the range of balsam fir and hemlock in North America. During heavy infestations, the caterpillars will feed and defoliate deciduous trees, such as maple, poplar, oak, and birch, when the coniferous food supply has been depleted.

INJURY: Similar to fall cankerworm.

INSECT APPEARANCE: The young caterpillars are dark grey loopers with black transverse bands that give them a ringed appearance; older larvae are yellow to dark brown, both head and body are speckled with black; larvae measure about 32 mm long when full-grown; they have only five pairs of legs. The moths are creamy tan to grey; the front wings are marked with two transverse, wavy, narrow lines; the hind wings have one line. The eggs are green at first but later take on a copperish brown tinge.

LIFE CYCLE: Eggs overwinter on the coniferous hosts. The larvae hatch in mid-June and complete their development usually by mid-August. Adults start emerging early in September. They mate and the females then lay about 100 eggs singly or in small masses of 2 or 3 on the branches, twigs, and tree trunks.

CONTROL: Hemlock looper infestations seldom persist in the same area for long periods. The collapse is brought about by a combination of several factors, such as weather, disease, and predators. Chemical control can prevent damage if applied at the end of June or very early July (formulae 2, or 7).



Larva

FOREST TENT CATERPILLAR

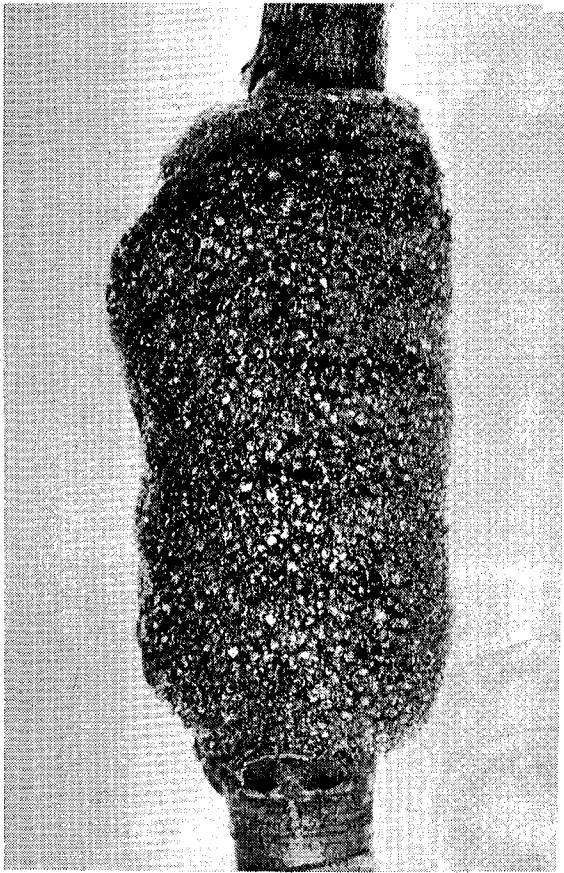
IMPORTANCE: This native insect, *Malacosoma disstria* Hbn., attacks many forest and shade trees, particularly sugar maple, aspen, oak, and elm. It is widely distributed throughout North America, wherever these hosts grow, and alternates between years with very high and very low populations. Trees are seldom killed even by many successive years of defoliation, but twig and branch dieback occurs.

INJURY: Early spring feeding results in the destruction of buds before they open. Severe defoliation in sugar bushes impedes growth, reduces the vigor of trees, and lowers sap production. Damage can be permanent if defoliation is followed by abnormally high temperatures, drought, or disease.

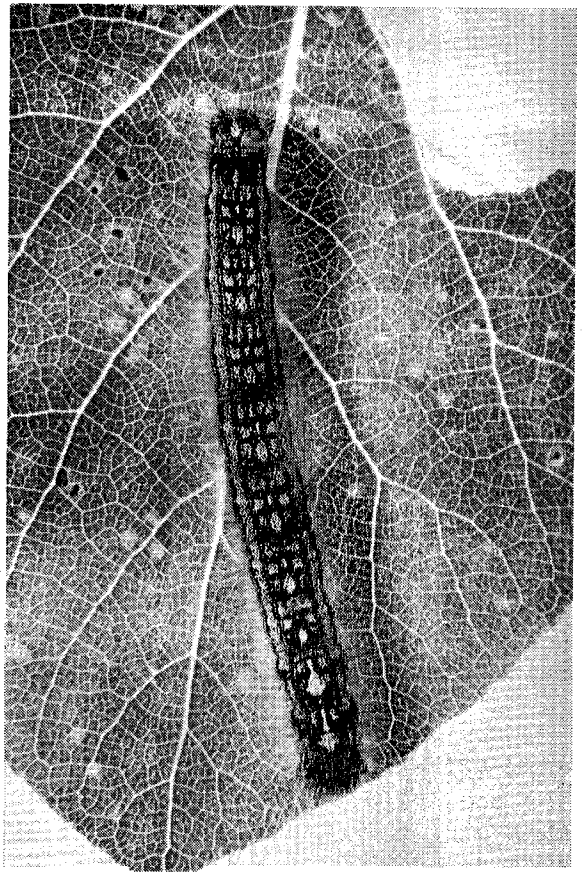
INSECT APPEARANCE: The egg masses are coated with a dark glue-like substance. The full-grown caterpillar is about 50 mm long and is black with a conspicuous row of irregular cream colored spots along the back and many bluish markings on the sides. The body is sparsely covered with light brown hairs. The moths are buff brown with two darker oblique lines near the middle of the forewings.

LIFE CYCLE: The eggs are laid in masses of 100 to 350, each mass encircling a twig. These hatch in late April or early May, about the time the buds begin to burst. The caterpillars feed in colonies and, when not feeding, congregate on the tree trunks or branches. Unlike the eastern tent caterpillar, a closely associated species, the forest tent caterpillar does not construct a tent. Large numbers of full-grown caterpillars are often seen migrating in late June in search of suitable places for spinning cocoons. Because of this migrating habit, they are often referred to as "armyworms". The cocoon is usually spun within a curled leaf and is composed of several layers of yellowish white silk. The adults emerge between early July and mid-August. After mating, the females lay their eggs, which overwinter on the trees.

CONTROL: In the past, large outbreaks have collapsed from natural causes, such as lack of food, unfavorable weather (freezing temperatures, cold rains), and parasites. Several outbreaks have been abruptly terminated by cold weather immediately before or after the eggs hatched. Cold weather causes death of the young caterpillars from starvation: they cannot eat the frozen leaves or they are too sluggish to feed. Localized infestations can be eliminated by thoroughly spraying the foliage with an insecticide when the caterpillars are small. Spraying should be done shortly after the leaves come out, before the caterpillars do much feeding (formulae 1, 2, and 8).



Egg mass



Larva Approx.  $\times 2\frac{1}{2}$



Larvae congregated on tree trunk

Figure 5. FOREST TENT CATERPILLAR

SADDLED PROMINENT

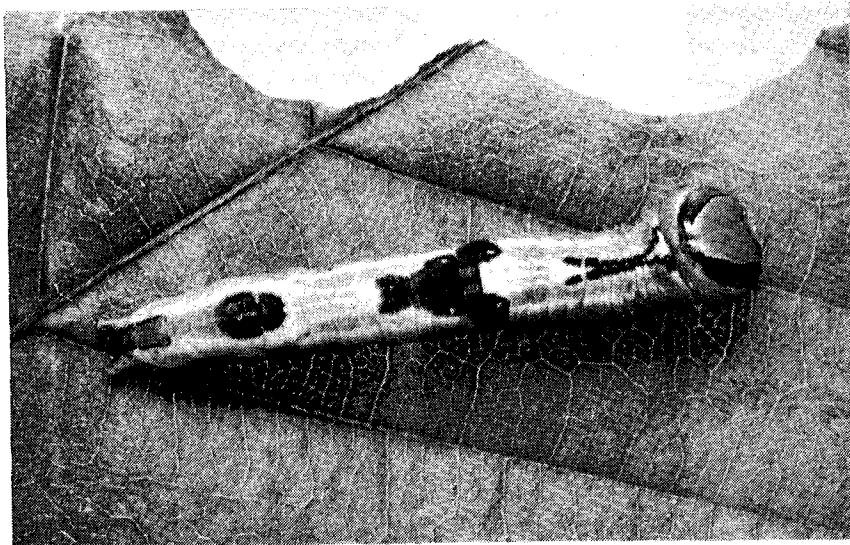
IMPORTANCE: This native insect, *Heterocampa guttivitta* (Wlk.), is widespread throughout the continent. It is found in Canada in the Maritime Provinces, southern Ontario, and southeastern Manitoba. The most common hosts are sugar maple, beech, and apple. In the Maritimes, sporadic outbreaks have been reported over large forest areas of Nova Scotia where it is considered to be one of the most serious defoliators of sugar maple. Because the larva feeds late in the season, defoliated trees do not usually refoliate and if they do, the new foliage often dies prematurely, resulting in reduced sugar production the following year.

INJURY: Top dieback often occurs on trees defoliated by this pest, and trees stripped of their foliage for two successive years may die. Prolonged drought associated with defoliation increases damage to infested trees and adversely affects the quantity and quality of sap sugar.

INSECT APPEARANCE: The full-grown larvae are about 38 mm long, variable in color and naked; colors range from yellowish to bluish green, or light green with a bluish cast; the back has a typical reddish brown or purplish saddle-shaped patch which in some larvae is obscure. The male moths are brownish grey, the females are pale olive brown on the inner half of the forewings and a lighter color on the outer half. The eggs are pale green.

LIFE CYCLE: The insect overwinters below the leafmold or in the soil, as a pupa. The moths begin to emerge in June. The female mates and lays as many as 500 individual eggs, usually on the underside of the leaves. Hatching occurs 8 to 10 days later, normally in early July. The young caterpillars feed only on the surface of the leaves, making small holes, but as they mature, they can consume the whole leaf, except the petiole. Pupation takes place late in August, after the mature larvae drop or crawl down the trunks to the litter.

CONTROL: Natural control factors seldom terminate outbreaks of this pest in less than three or more years of repeated defoliation. Therefore, chemical control may be required to prevent damage in valuable sugar bush stands (formulae 1 or 3). Best results are obtained when sprays are applied about July 20.



Larva

Figure 6. SADDLED PROMINENT

GREENSTRIPED MAPLEWORM

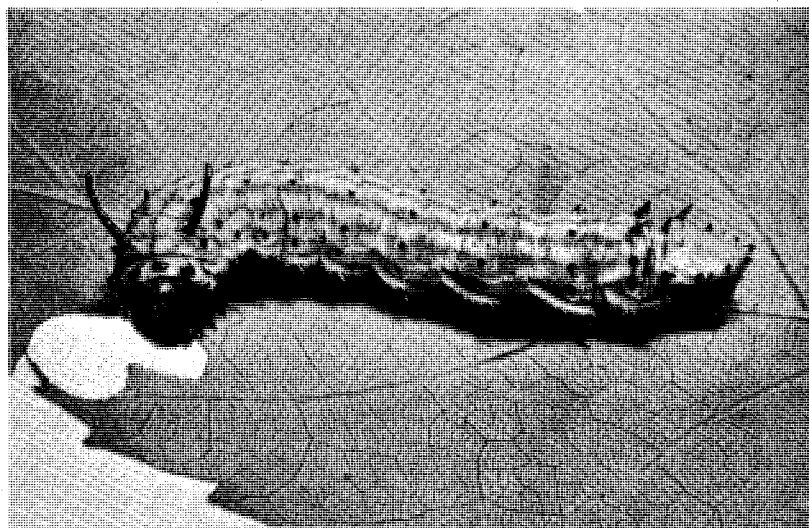
IMPORTANCE: This native insect, *Anisota rubicunda* (F.), occurs throughout the eastern United States and Atlantic Canada, and is known to extend to the western border of Manitoba. It has recently severely defoliated extensive stands of red maple in central Nova Scotia, but no appreciable damage has been observed on sugar maple. It is frequently associated with outbreaks of the saddled prominent.

INJURY: Can consume whole leaves.

INSECT APPEARANCE: The pale yellowish green caterpillar, nearly 50 mm long when full grown, is striped above with light yellowish green lines alternating with darker stripes; there are two "horns" behind the head capsule and two rows of spines on each side of the body; it has 8 pairs of legs. The moth is yellowish, the forewings are pink, each marked with a large central, yellow, transverse band. Eggs are pale green.

LIFE CYCLE: The insect overwinters as a pupa in the soil. The adults emerge in June and mate. The eggs are laid in large masses on the undersides of leaves, and hatch in early July. The larvae feed until late August or early September, when they drop to the ground to pupate.

CONTROL: Control measures (formula 1) should be instituted when the caterpillars are young and small, in mid- or late-July.



Larva

Figure 7. GREENSTRIPED MAPLEWORM

RED-HUMPED OAKWORM

IMPORTANCE: This native insect, *Symmerista albifrons* J.E. Smith, has been found from southern Manitoba to the Maritime Provinces. The most common hosts are maples, oak, and beech. Severe local infestations have been reported recently in sugar maple stands in Colchester and Cumberland counties, Nova Scotia. Little is known of the long-term damage that may result from these infestations, but it appears to be light because peak larval feeding does not occur until mid- or late-August.

INJURY: The caterpillars feed on the leaves, and can consume all the soft leaf tissue, leaving only the major veins.

INSECT APPEARANCE: The full-grown larva measures about 38 mm; has a large, orange-red, swollen head; the body is smooth with an orange-red swelling near the end of the abdomen and is marked with several yellow and black longitudinal lines. The moths are ash grey with a broad white, wavy band along the front margin of each forewing. The eggs are pale green.

LIFE CYCLE: The young caterpillars hatch from eggs laid in mid- or late-July in small masses on the undersides of the leaves. They feed in groups or colonies and may consume all the leaves. They eventually separate and feed individually until the latter part of August and sometimes even into October. The insect overwinters as a pupa in the ground. Adults emerge from June to July.

CONTROL: It is unlikely that applied controls will be required for this defoliator as most of the injury occurs late in the growing season. If spraying is necessary, it should be carried out when the larvae are small, during early August (formulae 1 or 3).

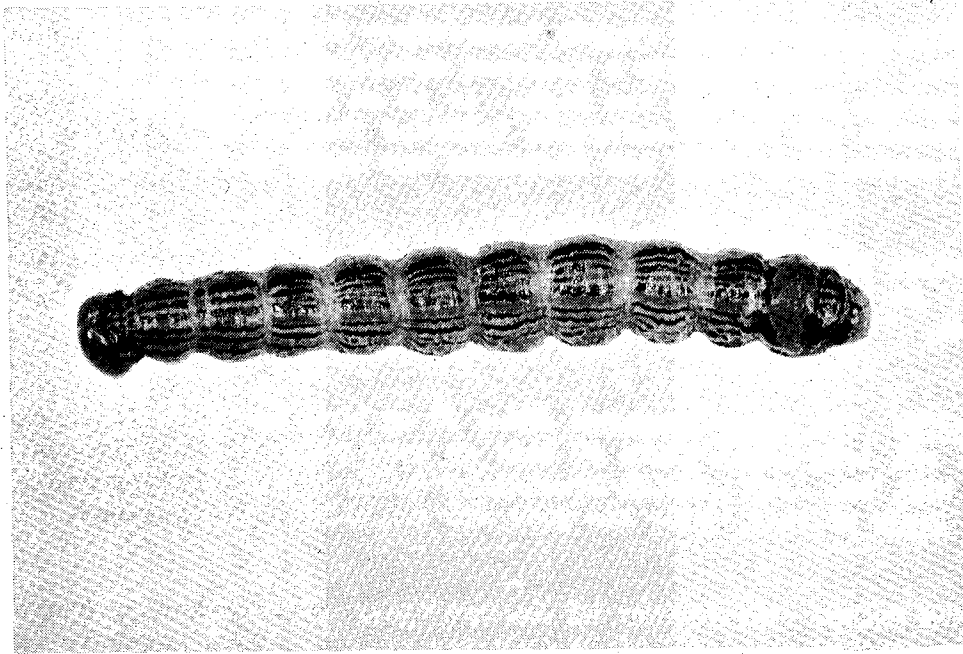


Figure 8. RED-HUMPED OAKWORM

WHITE-MARKED TUSSOCK MOTH

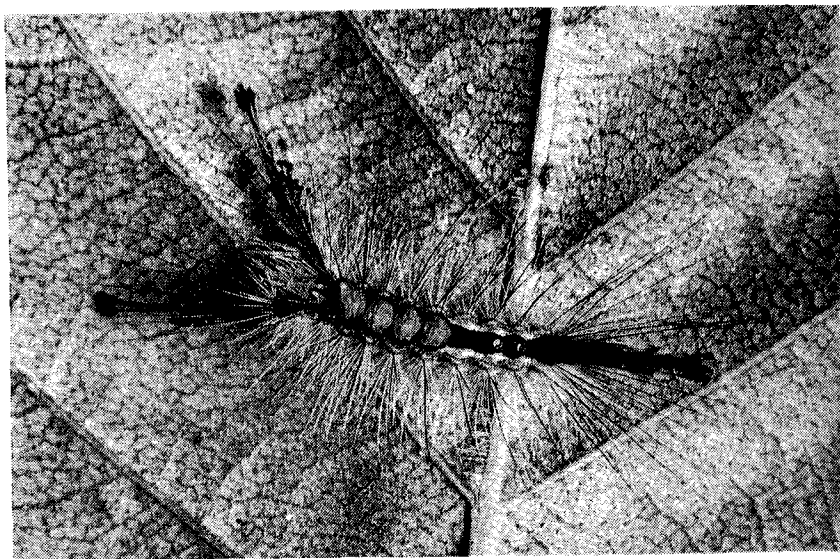
IMPORTANCE: This native insect, *Orgyia leucostigma* J. E. Smith, occurs periodically in large numbers. It is primarily a hardwood defoliator, but it also feeds on softwood when larval populations are high. It is an important pest of most ornamental hardwoods and recent outbreaks indicate that severe defoliation in forest stands reduces tree vigor and decreases sap sugar yield.

INJURY: The young larvae skeletonize leaves, feeding and consuming only the under surface. As they mature the entire leaf can be destroyed, except the principal veins.

INSECT APPEARANCE: The larva measures about 38 mm at maturity. It is characterized by a red head, two long black tufts of hair on each side of the head and one near its hind end, and four greyish brush-like tufts and two bright red spots on its back. Moths of both sexes are grey and the female is wingless.

LIFE CYCLE: The insect overwinters in the egg stage on branches or wherever the fully grown caterpillar crawled to spin its cocoon. Eggs hatch in late June or early July. The caterpillars feed for about 6 weeks and then spin loose grey cocoons within which they transform to pupae. Moths emerge about 2 weeks later and the female lays her eggs in a frothy mass on or near her empty cocoon.

CONTROL: If the insect becomes abundant, control measures should be undertaken before the caterpillars become large and before damage is serious (formulae 4 or 1B). The best control is obtained when the larvae are about 12 mm long, usually early in July. Later applications are not as effective because larger caterpillars are more difficult to kill. Caterpillars hit directly by the spray die within 24 hours, but others that feed on sprayed foliage take longer to die.



Larva

Figure 9. WHITE-MARKED TUSSOCK MOTH

RUSTY TUSOCK MOTH

IMPORTANCE: Although more widely distributed in Canada than the white-marked tussock moth, this native insect, *Orgyia antiqua* Linn., is of lesser importance in the Maritimes. It is frequently found with the white-marked tussock moth feeding on various deciduous and coniferous tree species.

INJURY: Similar to white-marked tussock moth.

INSECT APPEARANCE: This insect is similar to the white-marked tussock moth except that the caterpillar has an additional pair of long, black lateral hair tufts on the 2nd abdominal segment; the male moth is rust colored; the egg mass is not covered with a froth-like substance.

LIFE CYCLE: Similar to white-marked tussock moth.

CONTROL: Similar to white-marked tussock moth. The need for specific control against this defoliator is unlikely within maple stands in the Maritime Region.

MAPLE LEAF ROLLER

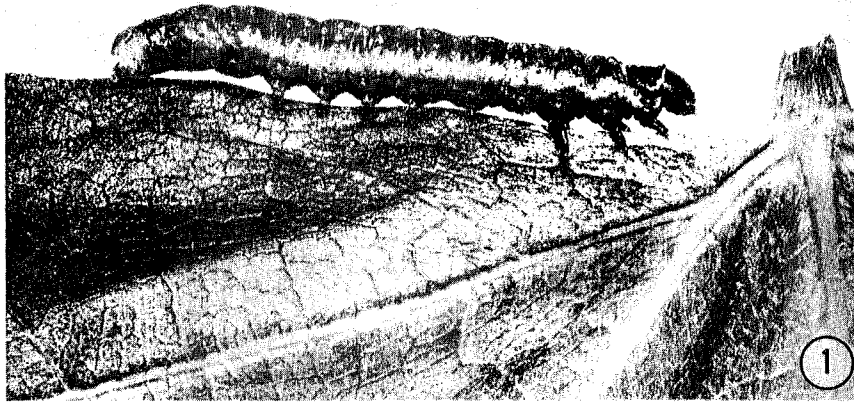
IMPORTANCE: This leaf roller, *Cenopsis pettitana* Rob., a perennial but seldom serious pest of maple trees in the Maritimes, is a native species known to occur throughout eastern Canada, the Atlantic States to Florida, and west to the Mississippi Valley. The most common host is red maple, but sugar and silver maples are also attacked. The larvae roll and tie the leaves together, causing the foliage to look unsightly. The damage is usually to the aesthetic appearance of trees, but in severe outbreaks the leaf roller causes twig and branch mortality and crown dieback.

INJURY: The larva typically rolls a newly formed leaf into a tube lined with silk within which it feeds and pupates. The larva cuts the mid-vein near the petiole after which the leaf dries out and turns brown.

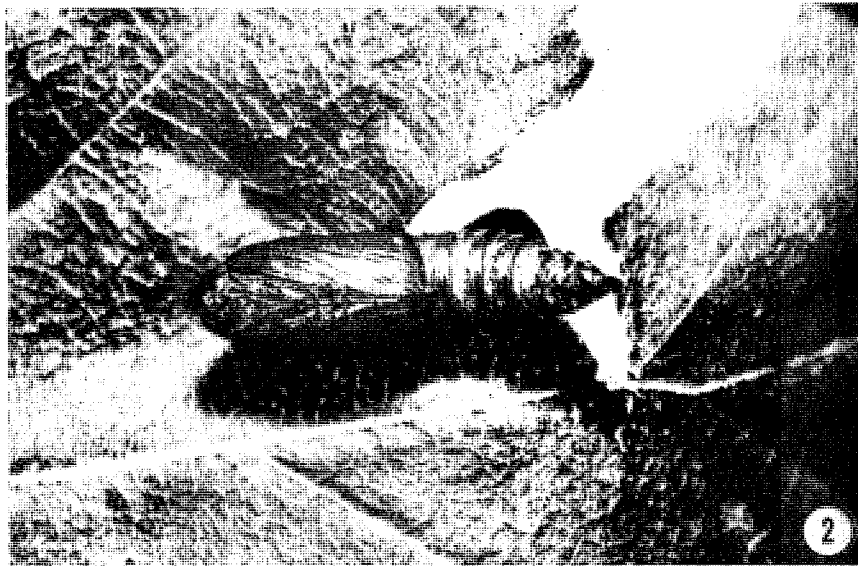
INSECT APPEARANCE: The adults are lemon yellow, the forewings are marked with light brown; hind wings are white. The full grown larvae, measuring about 20 mm, have a dull yellowish green body and a reddish brown head.

LIFE CYCLE: The moths emerge from about July 15 to August 15. The eggs are laid singly on twigs and smaller branches and hatch the next spring. The larvae are found from late May to late June or very early July, with peak occurrence during the first three weeks of June. Pupation takes place within the rolled leaf from mid-June to mid-July.

CONTROL: Artificial control of this species, though seldom necessary, is not easy because the larvae are protected within the rolled leaves. Satisfactory results should be expected with either formulae 1 or 2 if treatment is initiated in early June.



Larva Approx.  $\times 4$



Pupa Approx.  $\times 4\frac{1}{2}$

Figure 10. MAPLE LEAF ROLLER

MAPLE TRUMPET SKELETONIZER

IMPORTANCE: This native insect, *Epinotia aceriella* (Clem.) is one of the numerous leaf rollers that sometimes becomes abundant, but it is not classified as a major forest pest. It has been recorded in Nova Scotia, New Brunswick, and southern Ontario, mainly on sugar maple.

INJURY: The caterpillars are solitary leaf rollers that skeletonize the under side of leaves between the large veins. This is done from inside a long blackish trumpet-like tube which is made from leaf debris and body excrements. The tube increases in size with the development of the larva and may reach a length of 50 mm by the time the larva is fully grown.

INSECT APPEARANCE: The light green caterpillars have a yellowish head and measure about 12 mm at maturity. The moths are mottled grey.

LIFE CYCLE: The insect overwinters in the ground litter as a pupa. The moths emerge in late June, mate, and the females lay their minute eggs on the leaves. Hatching occurs within a few days. Larvae can be found from late July to late September with peak occurrence in August.

CONTROL: Damage can be prevented if larvae are sprayed with an insecticide in early August (formulae 1, 2, or 3).

### MAPLE LEAF GALLS

IMPORTANCE: Most leaf galls of maples are caused by mites barely visible to the naked eye or by minute insect maggots. Numerous galls may cover the upper surface of the leaves and seriously deform them. The injury is unsightly but the damage is usually light. However, in severe infestations, these galls cause twig and branch dieback, and reduce the sugar content of the sap.

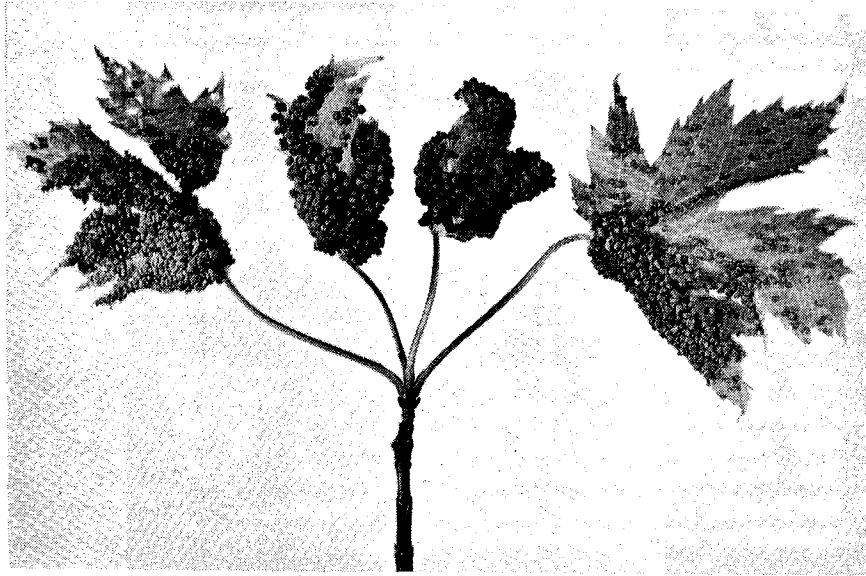
INJURY: The mites insert their slender mouth parts in the leaf tissue and suck the plant juices. When feeding they inject a growth-promoting substance into the tissues which results in the formation of swellings or galls on the surface of the leaf or flower. There are four main types of injury associated with these mites.

- 1) The maple spindle galls occur mostly on sugar maple but are also found on silver and red maple. They are caused by the mite *Vasates aceris-crumena* Riley and occur on the upper surface of the leaves. The gall is green, filiform or spindle-shaped, and about 5 mm high.
- 2) The maple bladder galls only occur on silver and red maples and are caused by the mite *Vasates quadripedes* (Shimer). The galls are globular, green when first formed, later turning red or black.
- 3) The maple leaf pile is found most commonly on sugar maple, but frequently occurs on red maple, beech, and yellow birch. Mites, *Eriophyes elongatus* Hodg. K. and other species of this genus, cause a "pile" or velvet-like green-red growth on the upper surface of the leaves. The deformations are caused by the excessive development of plant hairs.
- 4) The maple leaf blister galls are found on most maples. They are caused by mites (and occasionally midges and wasps), that burrow into the leaf tissue causing blister-like galls on the leaves. The individual galls are minute, yellowish or red, depending on the host species, but later turn black on some species. Several generations occur in a short time causing many blisters which ultimately deform the leaves.

Other galls, called maple leaf spots, found only on the leaves of red maple, are caused by a small fly, *Cecidomyia ocellaris* O.S. The swellings are circular, about 4 mm in diameter, and yellow with a red border. These eye-like blister galls do not appear to cause any significant damage to host trees.

MITE APPEARANCE: Gall mites measure less than one millimetre. The front of the body is wide, tapering gradually to the posterior end. Most gall mites overwinter as adults, hibernating in the crevices of the bark and beneath bud scales. When the buds begin to swell in early May, the mites crawl to the opening buds where they feed and lay eggs. The eggs hatch in 7 to 10 days and the nymphs settle on the young leaves. Galls begin to form around the nymphs shortly after they begin feeding, and within 2 weeks they are completely enclosed. By early August, when full grown, they emerge from the galls and go into hibernation.

CONTROL: Chemical control of leaf galls in sugar bushes has seldom been necessary. However, contact pesticides, or systemic pesticides (those which are absorbed into the plant and make it poisonous to the mites), are effective in maintaining the aesthetic appearance of individual shade trees. The time of spraying, late May, is important as the chemical should be applied before the young larvae become entombed in the galls (formulae 1, 5, 6, or 2).



Maple bladder galls on silver maple

Figure 11. MAPLE LEAF GALLS

ANTHRACNOSE

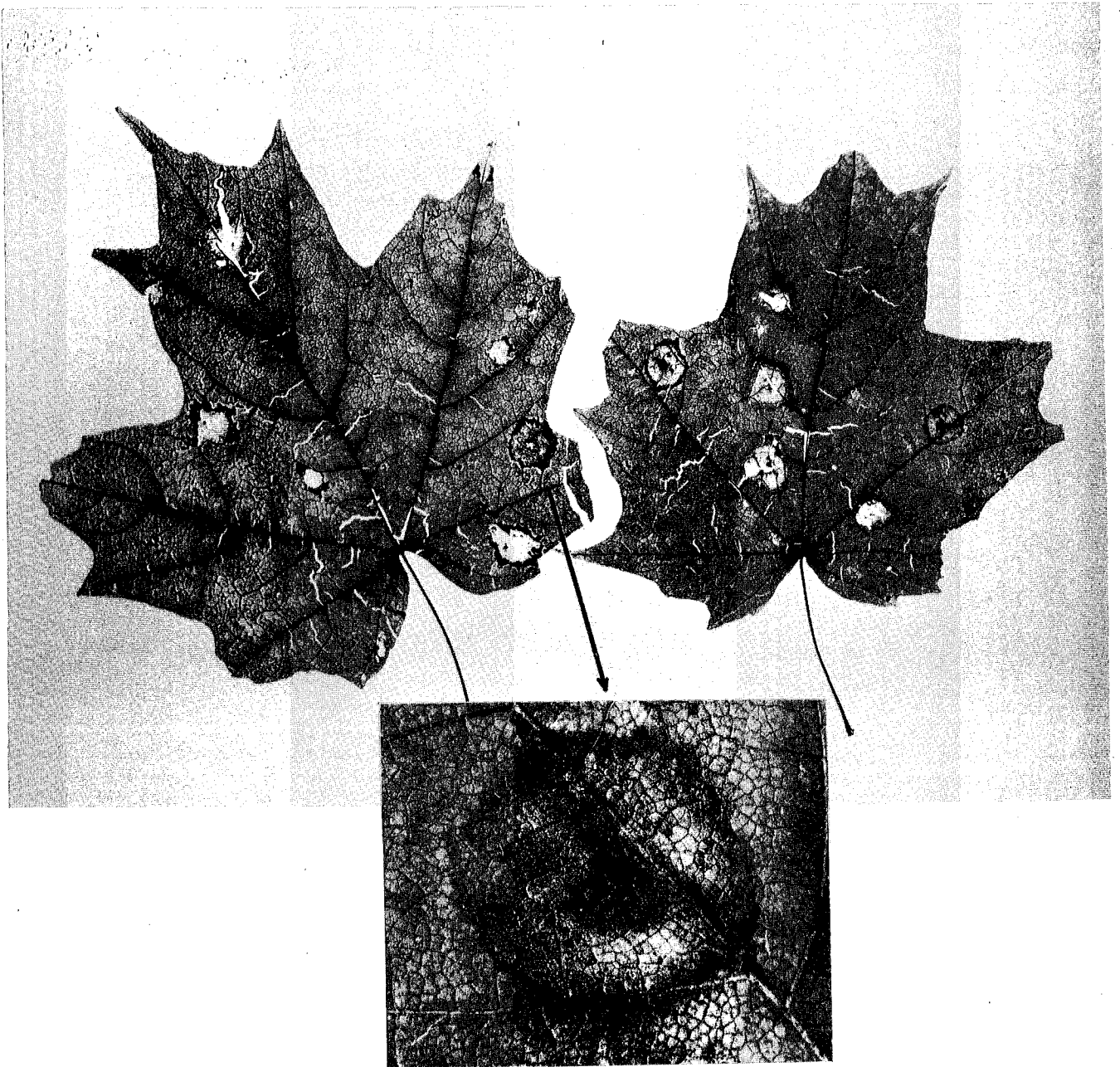
CAUSAL ORGANISM: *Kabatella apocrypta*

IMPORTANCE: In most years the fungus causes only limited leaf discoloration, but during wet springs anthracnose may become a serious problem, resulting in considerable leaf browning.

DAMAGE: Infection of leaves causes leaf discoloration, defoliation, and twig dieback. Browning of large areas of the leaf surface lowers the sugar producing capacity of trees which may result in lower quality syrup production the following year.

RECOGNITION: After several days of high humidity, circular or irregular discolored spots appear on the leaves, often along the veins. These reddish brown spots rapidly increase in size, merge, and the browning extends to the leaf margins, often killing entire leaves. Heavily infected trees appear scorched. Dead portions of leaves are often invaded by other secondary fungi and these may, depending on the species, change the color of the dead areas to grey or black.

CONTROL: Normally no control is necessary. If trees are severely affected for more than one season, feeding to stimulate vigorous growth may be considered. Spraying 3 times at 2-week intervals with zineb or a copper fungicide, starting when the leaves begin to unfurl in the spring, should provide control.



Anthracnose on sugar maple. Irregular spots on various parts of the leaves. Early symptoms before spots merge.

Figure 12. ANTHRACNOSE

LEAF SCORCH

CAUSAL AGENT: High temperature and bright sunshine.

IMPORTANCE: Occurs after hot, dry, periods in summer on exposed portions of crowns of forest and shade trees.

DAMAGE: Discoloration of foliage results in reduction of productive green leaf surface area. Complete browning and death of leaves results in early defoliation.

RECOGNITION: Leaf scorch is a physiological injury, almost invariably the result of a water deficiency. Margins of the leaves and the tissues between veins turn brown. Depending on the severity of the infection, the area of leaf discoloration varies, but in severe cases entire leaves may die.

CONTROL: No control for leaf scorch is known under forest conditions. For individual trees, this type of damage may be prevented if watering maintains tree vigor.

PURPLE EYE LEAF SPOT

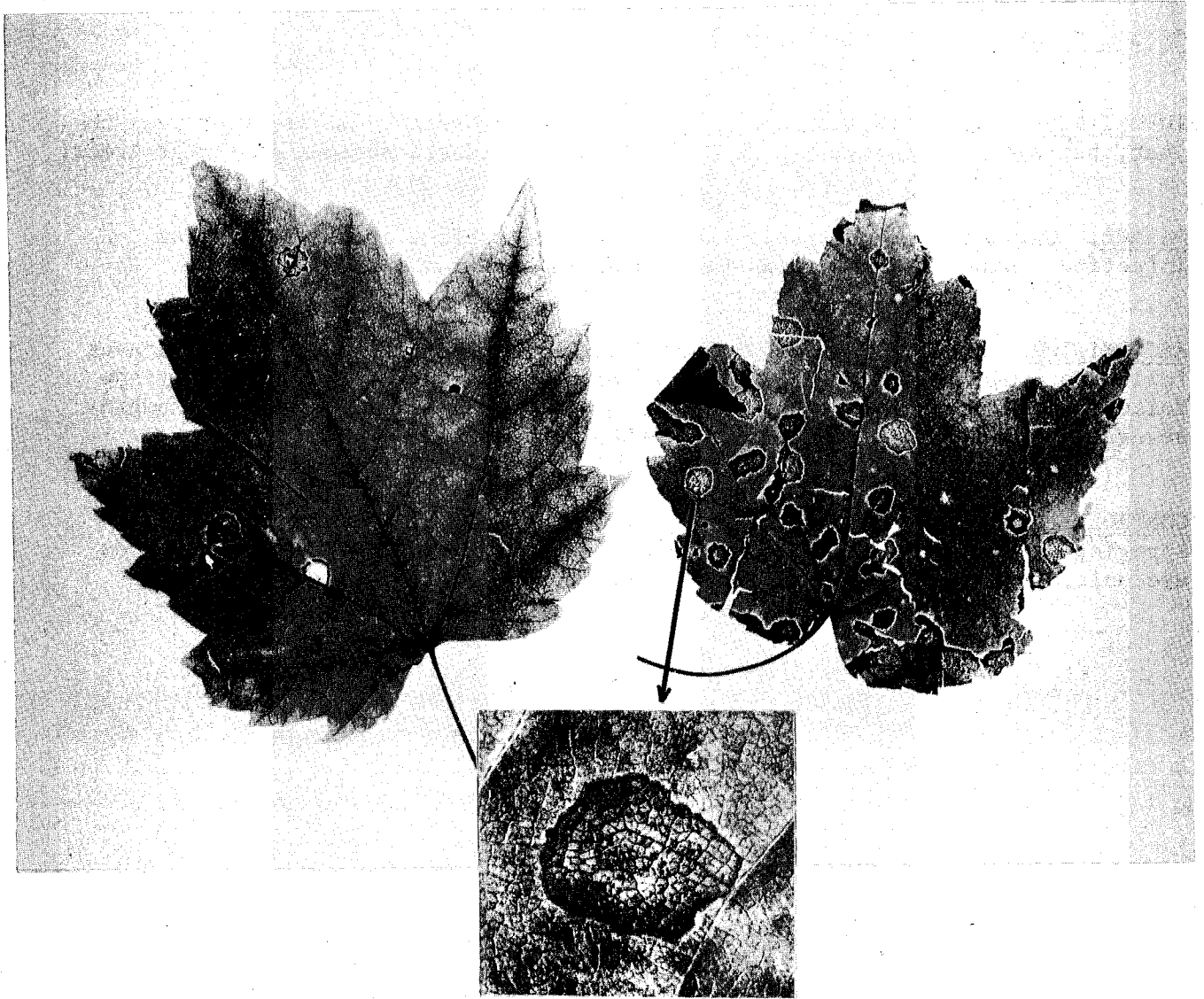
CAUSAL ORGANISM: *Phyllosticta minima*

IMPORTANCE: The incidence of infected leaves and the number of spots on the leaves vary from year to year, but even when heavy, the disease is not considered serious on forest trees.

DAMAGE: Only minor reduction in the green leaf-surface area results from infection. Discoloration ruins the aesthetic appearance of shade trees.

RECOGNITION: Circular or irregular spots of 6 mm or more in diameter develop on the leaves in early summer. The spots are brown with purple brown margins. Very small black fruiting structures (pycnidia) develop in the center of the spots.

CONTROL: Control is seldom necessary, except on valuable shade trees. Spraying with zineb three times at 2-week intervals, starting when the leaves are unfolding, should provide adequate protection.



Purple eye leaf spot on red maple. Note small black fruiting bodies in magnified leaf spot.

Figure 13. PURPLE EYE LEAF SPOT

PHLEOSPORA LEAF SPOT

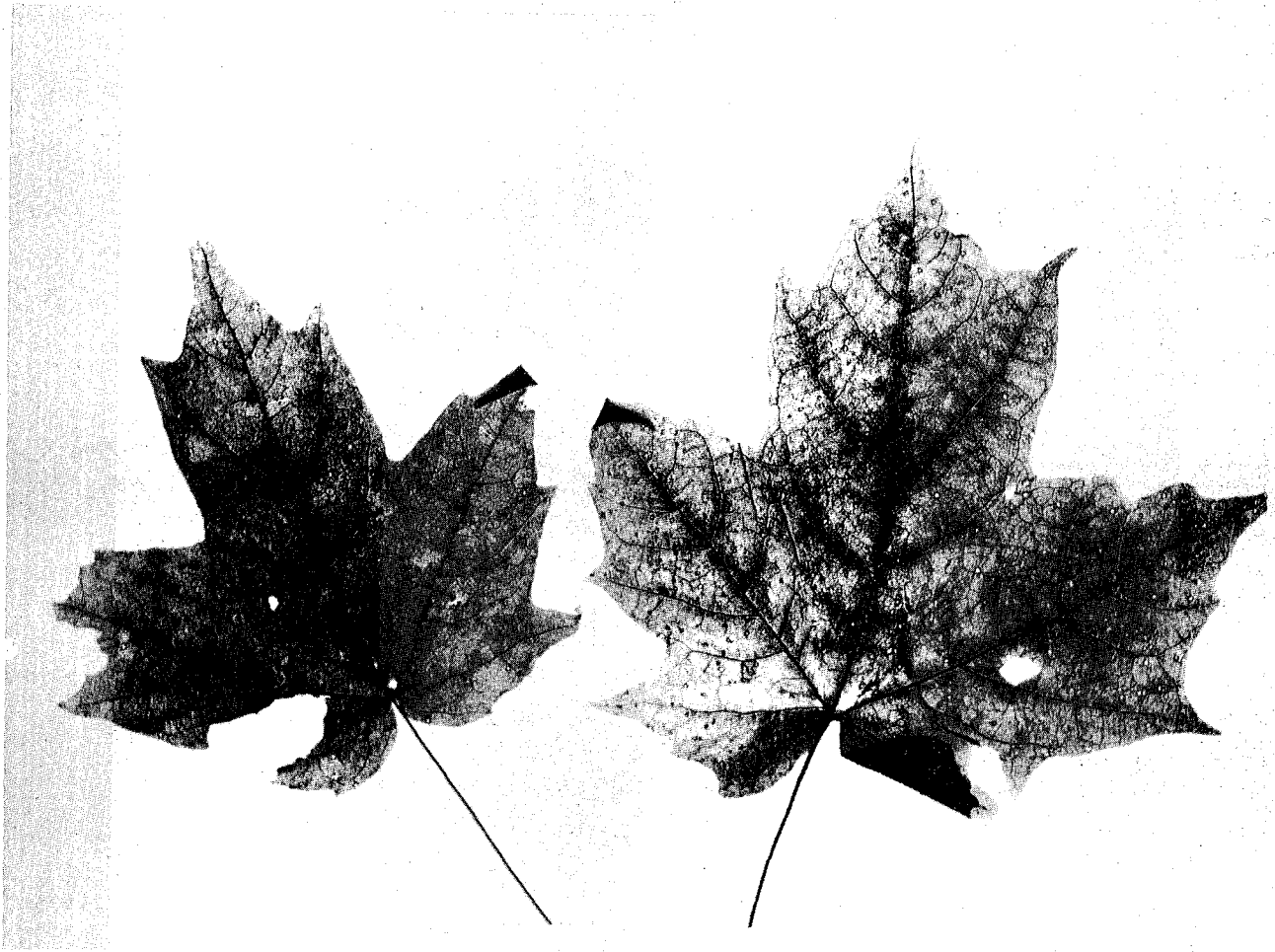
CAUSAL ORGANISM: *Phleospora aceris*

IMPORTANCE: This leaf spot occurs commonly, its intensity varies from year to year, but even when heavy the disease is not considered serious on forest trees.

DAMAGE: Only minor reduction in the green leaf-surface area results from infection. Discoloration ruins the aesthetic appearance of shade trees.

RECOGNITION: Small (3 mm) brown spots, angular in shape, appear on the leaves following humid periods. The underside of each spot acquires a pinkish tinge following the production of spores (microscopic seed-like bodies) which begin several weeks after the appearance of the first spots.

CONTROL: Control is seldom necessary except on valuable shade trees. Spraying with zineb three times at 2-week intervals, starting when the leaves are unfolding, should provide adequate protection.



Phleospora leaf spot on sugar maple. Note small angular spots on leaves.

Figure 14. PHLEOSPORA LEAF SPOT

LEAF BLISTERS

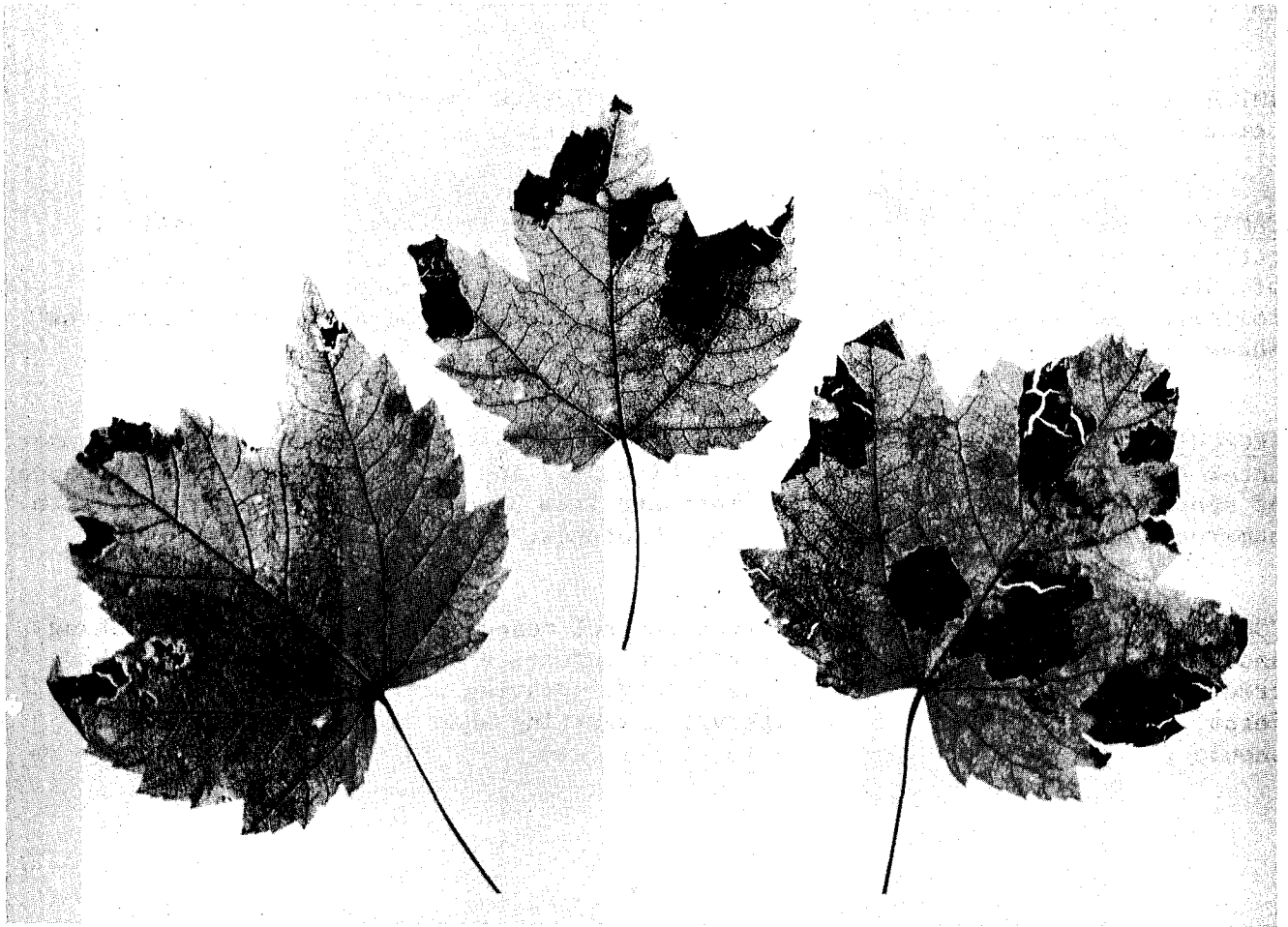
CAUSAL ORGANISMS: *Taphrina* spp.

IMPORTANCE: Leaf blisters are common, especially in shaded locations, and localized outbreaks of the disease have been reported in the literature; however they do not usually cause problems.

DAMAGE: Only minor reduction in the green leaf-surface area results from infection.

RECOGNITION: Irregular black areas on the leaf, often along the main vein, give the appearance of charcoal shortly after leaf expansion in the spring. Veins crossing these blackened, brittle areas break easily and this cuts off the transport of water and nutrients to and from other areas of the leaf. Another type of injury is characterized by lesions which are circular or irregular in shape, pinkish or buff on the underside and buff above.

CONTROL: Dormant application of lime sulfur, ferbam, maneb, captan, zineb or 8-8-100 bordeaux mixture could be effective, but should be considered only for valuable individual trees.



Leaf blisters on red maple. Note irregular black areas.

Figure 15. LEAF BLISTERS

BLACK TAR SPOT

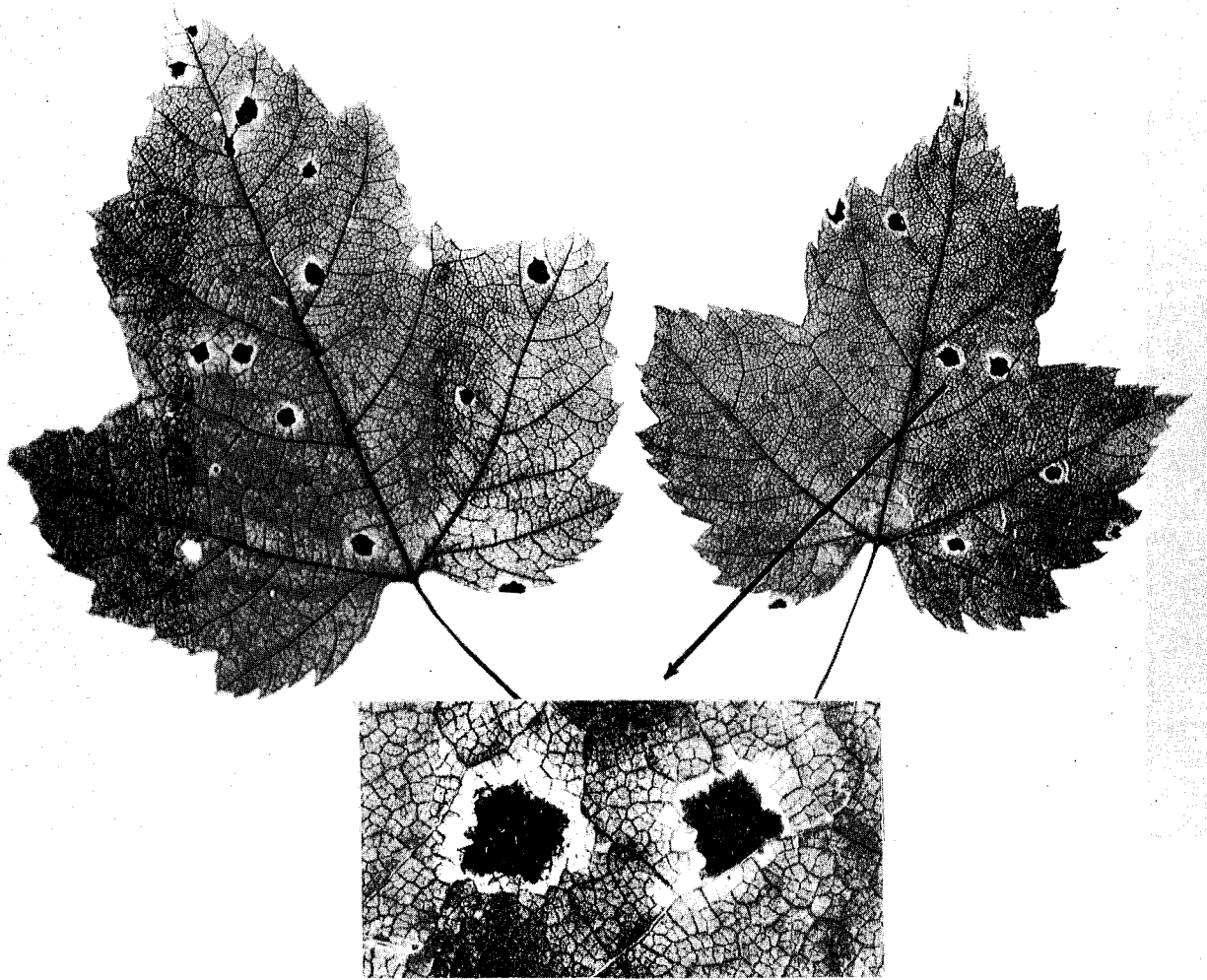
CAUSAL ORGANISM: *Rhytisma acerinum*

IMPORTANCE: Common but usually not numerous enough to cause concern. When severe, tar spot may cause premature defoliation.

DAMAGE: Usually only minor reduction of the green leaf-surface area results, but when severe the disease causes reduction in the sugar producing capacity of infected trees, which may result in lower quality syrup production the following year. The unsightly spots may ruin the appearance of heavily infected shade trees.

RECOGNITION: Light yellow-green areas appear on the leaves in early to mid-summer. Later these areas become shiny-black, thickened, and raised, giving the appearance of spots of tar on the leaf. The spots are from 3 to 13 mm in diameter and, when numerous, may merge to form large black blotches.

CONTROL: The disease does not warrant control measures on forest trees. Raking and burning the leaves in the fall reduces infection the following year on shade trees. If chemical protection is necessary, spraying with bordeaux mixture or ferbam several times at 2-week intervals, starting when the buds are opening, should provide some control.



Black tar spot on red maple. Note light border around black areas.

Figure 16. BLACK TAR SPOT

SPECKLED TAR SPOT

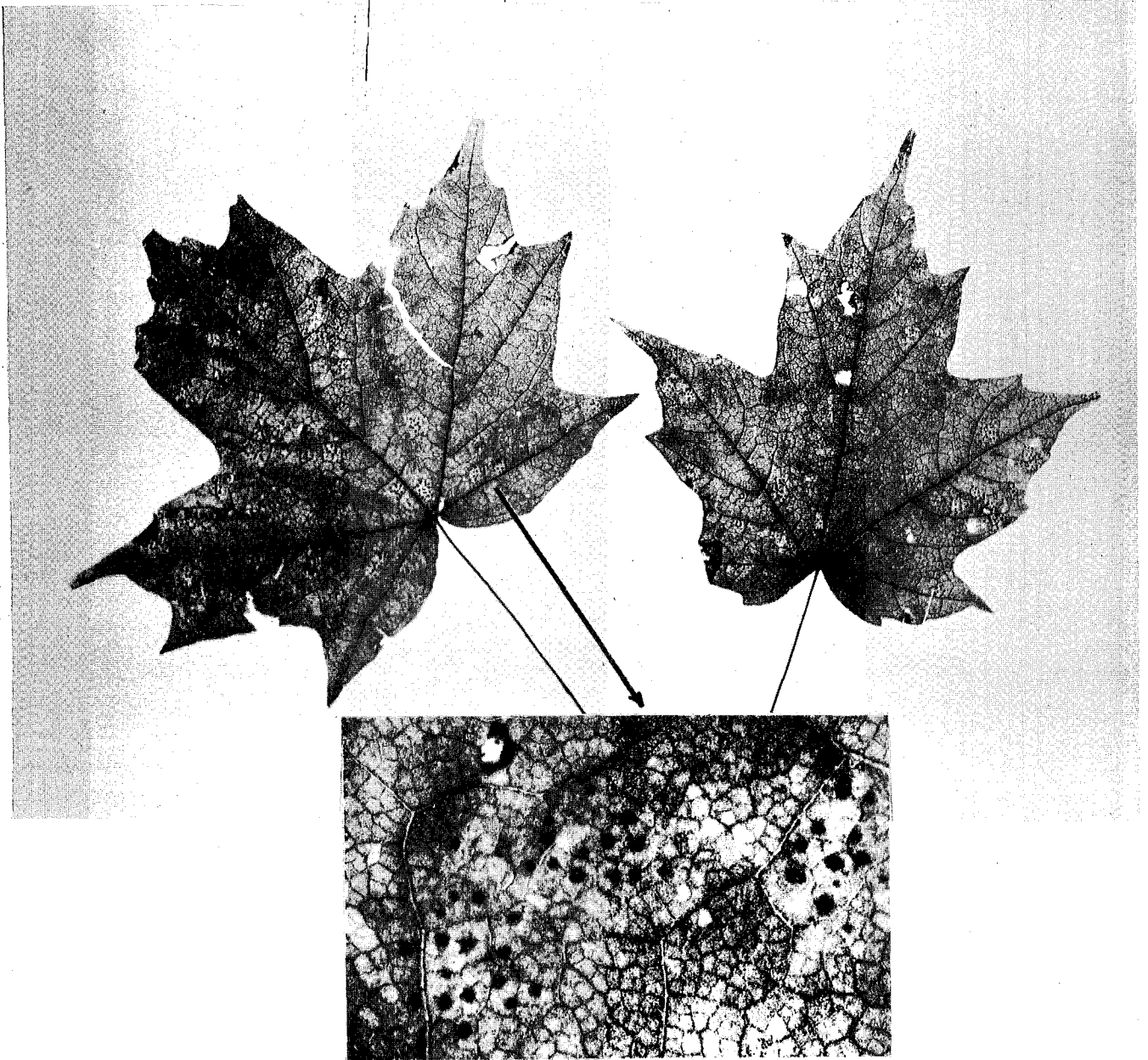
CAUSAL ORGANISM: *Rhytisma punctatum*

IMPORTANCE: Occasionally common on leaves but not considered serious on forest trees.

DAMAGE: Only minor reduction in the green leaf-surface area results from infection.

RECOGNITION: Light yellow-green areas appear on the leaf in the summer. Later, black raised specks, slightly larger in size than a pinhead, develop in groups over the discolored area which measures about 13 to 20 mm in diameter. These areas retain their yellow-green color, dotted with black specks, even after the rest of the leaf has faded in the fall.

CONTROL: The disease does not warrant control measures on forest trees and even on shade trees does not usually become severe enough to require more than raking and burning the leaves.



Speckled tar spot on sugar maple. Note groups of black spots on leaves.

Figure 17. SPECKLED TAR SPOT

VERTICILLIUM WILT

CAUSAL AGENT: *Verticillium albo-atrum*

IMPORTANCE: The disease is not yet known in the Maritimes but is present in Ontario, Quebec, and in the northeastern United States where it killed more maples planted along city streets than any other disease during the last 30 years. It is now believed that, on maple, it could rival the importance of Dutch elm disease on elm.

DAMAGE: Trees with trunk diameter of up to 2 inches may be killed by the disease. Larger trees may live for many years but will decline progressively; individual branches, one side of a tree, or the entire tree may die.

RECOGNITION: Sudden wilting of leaves on one or more branches in the middle of summer is the first symptom of infection. The wilted leaves may fall after they dry, or may hang on for the rest of the season. Periods of drought will accentuate wilting symptoms. There is often a greenish discoloration in the sapwood of affected branches and on the trunk, near the base of the tree, on the side where wilting occurred. Positive identification for *Verticillium* can be made only by laboratory isolation of the fungus from branches and, more reliably, from pieces of wood taken at the base of the tree (the fungus is a soil organism and most often infects trees through roots). Infected trees are predisposed to winter injury and often some branches and even the entire top of the tree will not leaf out the following spring.

CONTROL: Severely infected trees must be cut down and destroyed, and care taken to remove as many of the roots as possible; replanting at these locations should be done with a non-susceptible species. Pruning out infected branches and treating the cuts with wound dressing may save trees less seriously affected by this disease.

SHOESTRING ROOT ROT

CAUSAL ORGANISM: *Armillaria mellea*

IMPORTANCE: The fungus kills infected trees which have been weakened by other causes (insects, storm damage, drought, stand thinning, etc.).

DAMAGE: Entering the tree through the roots, the fungus decays the roots and progresses up the stem, kills the cambium, and, when the trunk is girdled, kills the tree. The fungus is not often the primary cause of tree death; it normally follows and completes the work of other weakening agents.

RECOGNITION: The fungus lives in the soil or in stumps and roots of dead trees. On infected trees, a layer of white, fan-like growth (mycelium) can be found under the bark close to ground level. Dark brown or black "shoestrings" (rhizomorphs) very often accompany the mycelial fan, or the rhizomorphs can be seen on and around the roots in the soil. In the early fall, or occasionally during wet periods in the summer, the fungus fruits and produces light brown mushrooms, often called the "honey mushroom", near the base of infected, dead or dying trees, or old stumps. The mushroom stage of the fungus produces the spores (microscopic seed-like bodies) which propagate the species.

CONTROL: No control is known, but the maintenance of tree vigor through proper silvicultural practices will lower the probability of infection.

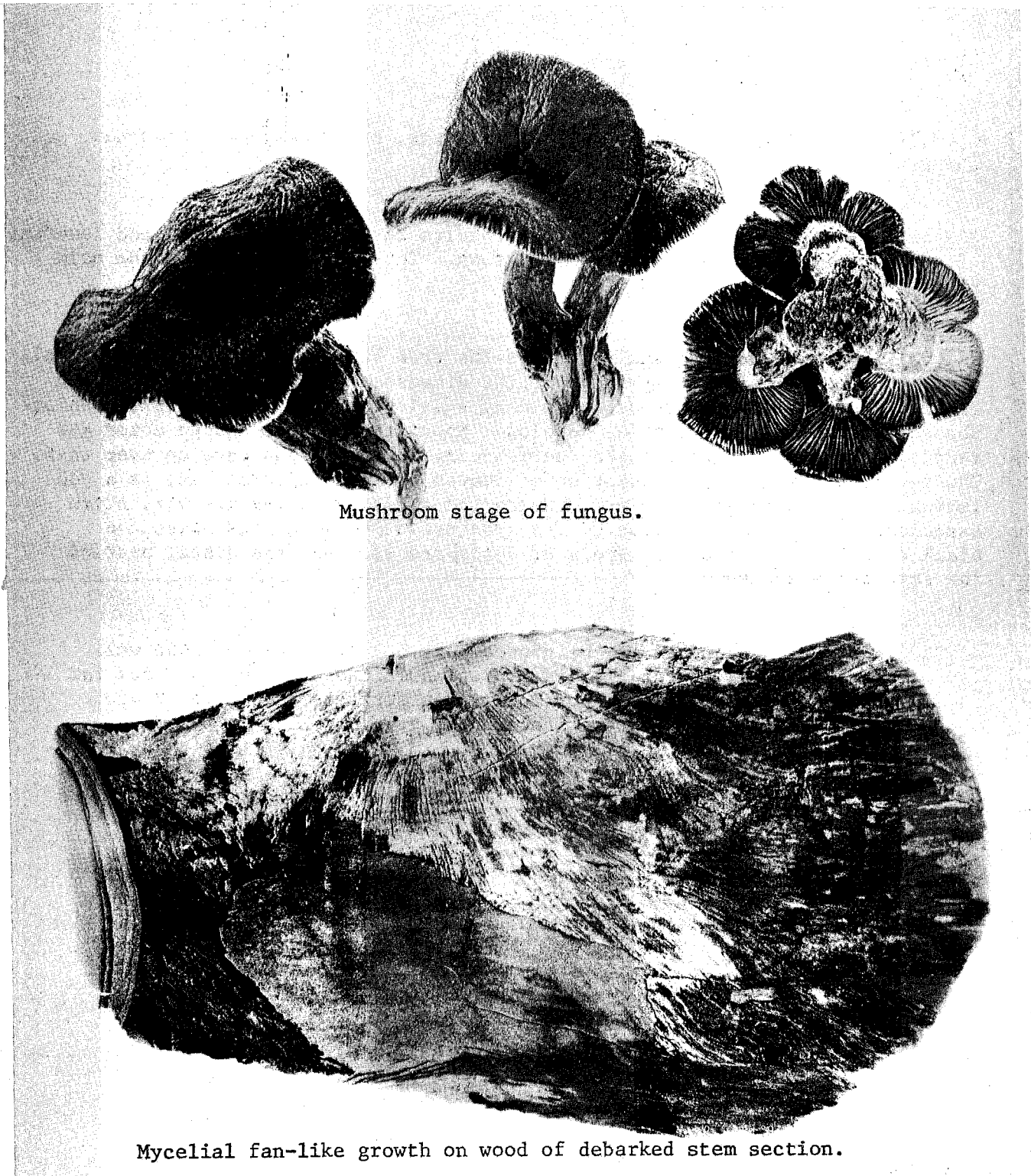


Figure 18. SHOESTRING ROOT ROT

CORAL SPOT NECTRIA

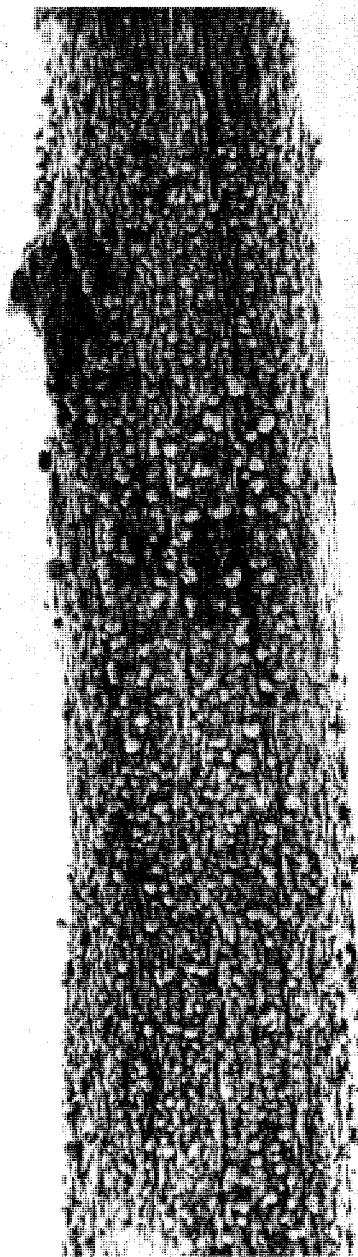
CAUSAL ORGANISM: *Nectria cinnabarina*

IMPORTANCE: The fungus girdles and kills twigs, small and large branches, and young trees.

DAMAGE: Dieback of twigs and branches results in decline of trees, and lowering of the green leaf-surface area of the crown. The fungus may girdle the main stem and kill the tree.

RECOGNITION: The fungus usually enters the tree through wounds or through small dead branches. The first symptoms of the disease are small, depressed, dead areas in the bark. Over these areas many small flesh-colored or pink, cushion-shaped structures (sporodothia) develop. Sporodothia later change color and reddish, lemon-shaped structures (perithecia) of the fungus develop over them. The red-flagging, the discoloration of leaves on infected branches, is a good indicator of a problem. *Nectria cinnabarina* fruiting bodies are very often associated with black pustules of *Steganothecium ovatum* at the base, and black or white, pinhead size spots of *Cytospora* sp. over the distal part of the infected branches.

CONTROL: Diseased branches may be pruned out, but cuts must be made well beyond affected area. Watch for discoloration in the wood and cut back far enough to remove all discolored portions. Cut surfaces should be treated with wound dressing to prevent reinfection of tree.



Coral spot Nectria. Note the round, cushion-shaped fruiting structures. (Photo of black locust twig.)

STEGANOSPORIUM

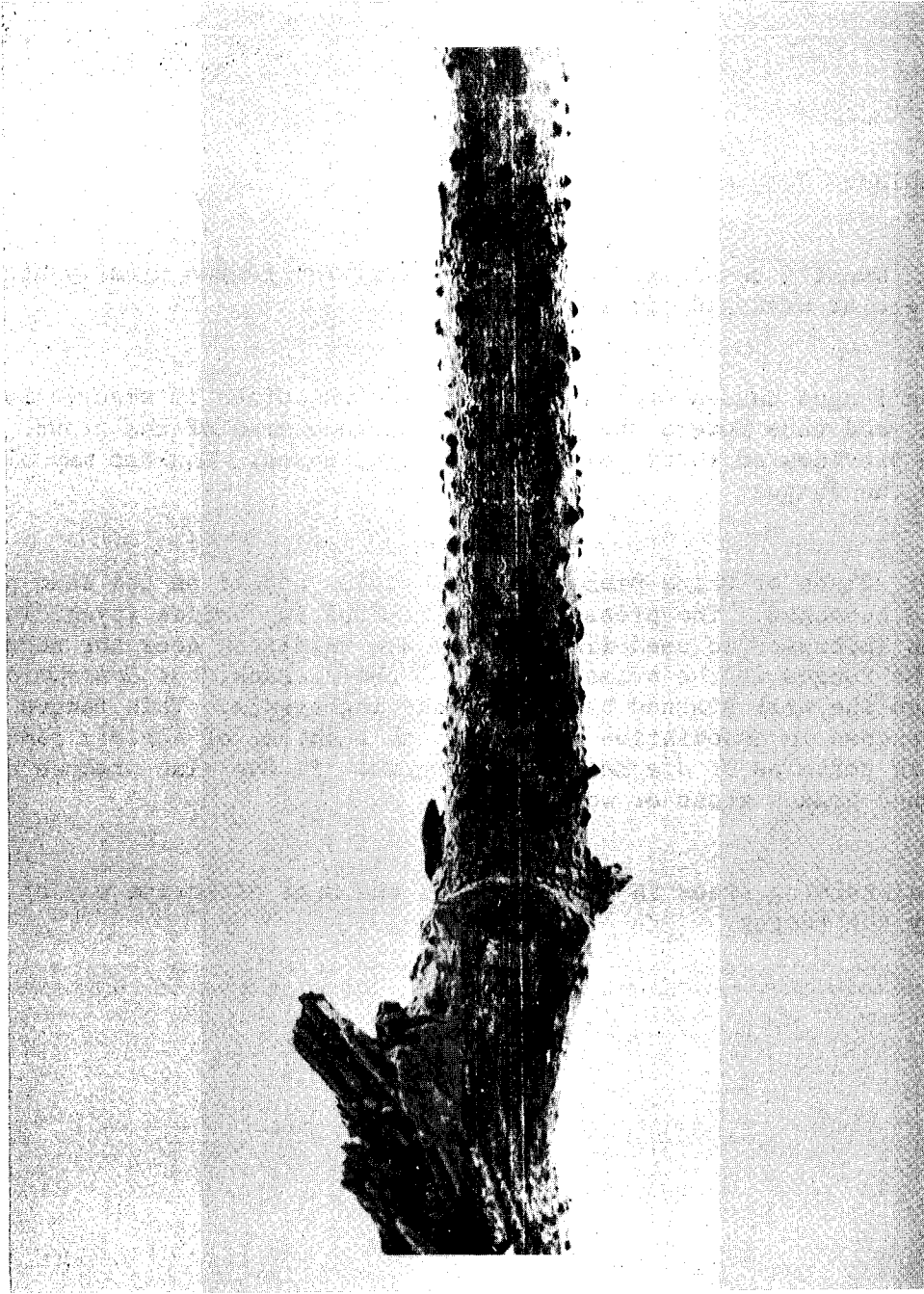
CAUSAL ORGANISM: *Steganosporium ovatum*

IMPORTANCE: The role of this fungus is not known, but because of its common association with twig dieback it is included in this report.

DAMAGE: Unknown.

RECOGNITION: The fungus appears at the base of small branches that show symptoms of red flagging. Small, black, sometimes shiny, pustules are often surrounded by greyish areas, as the rain washes some of the dark brown spores (microscopic seed-like bodies) from the pustules. The fungus is often found in association with pink pustules of *Nectria cinnabarina*, also at the base of branches, and with the black or white, pinhead size spots of *Cytospora* sp. over the affected portion of the branch.

CONTROL: Unknown, but pruning infected branches, as for *Nectria cinnabarina*, will improve the appearance of the tree.



Steganosporium ovatum on sugar maple. Note the black pustules of the fungus.

CYTOSPORA CANKER

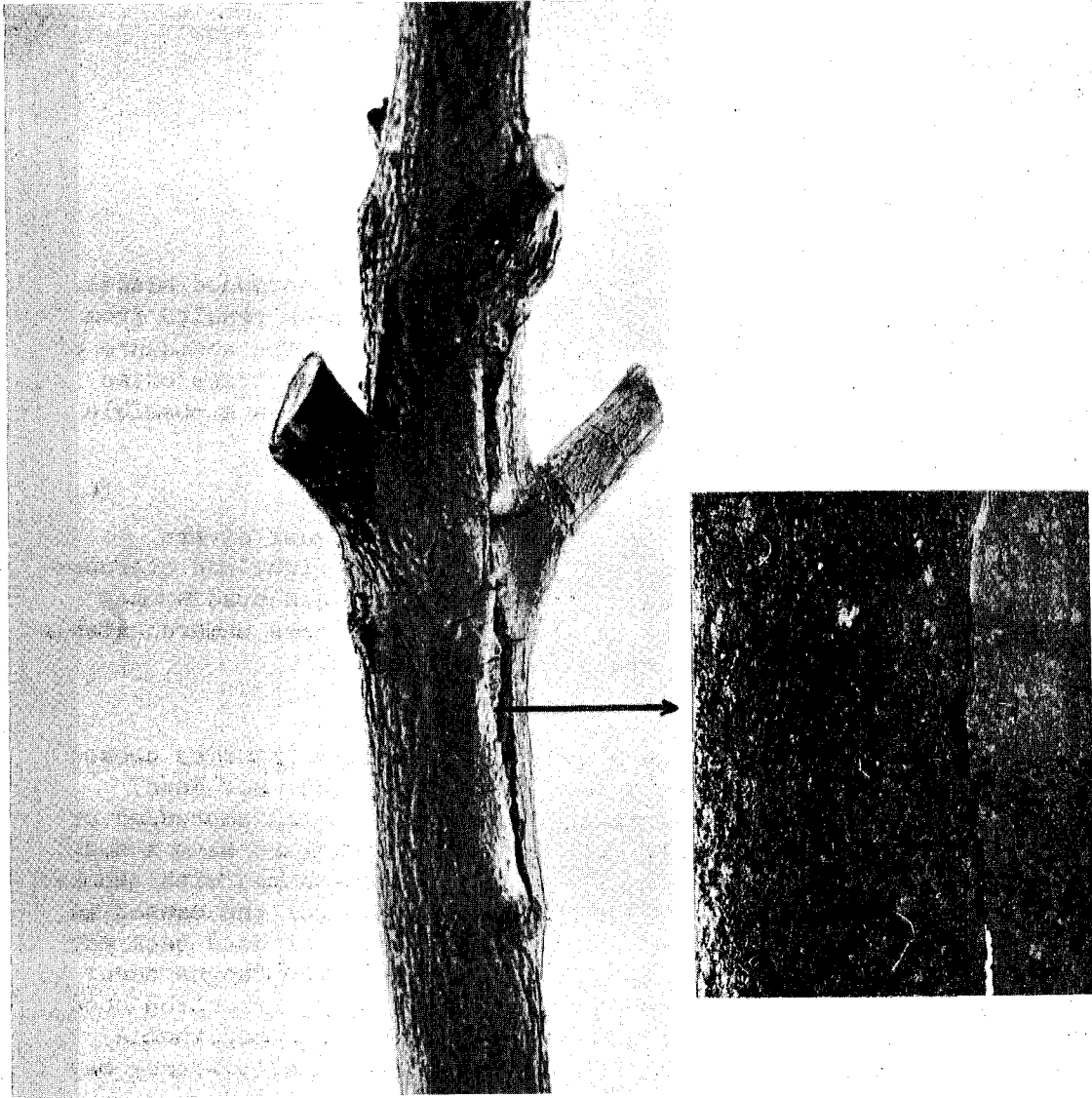
CAUSAL ORGANISM: *Cytospora* sp.

IMPORTANCE: Usually considered a weak parasite, the fungus usually attacks weakened trees or weakened parts of trees.

DAMAGE: The fungus causes branch and twig dieback, often in association with other fungi, and thus lowers the green leaf-surface area of the crown. The dead branch also provides an entry point for other diseases. Cankers may also be produced by the fungus.

RECOGNITION: Black or white pinhead size pustules appear on the dead portions of twigs and branches. The presence of these fruiting bodies (pycnidia), from which spores (microscopic seed-like bodies) are released, does not necessarily mean that the fungus is the primary cause of the dieback, but *Cytospora* might have finished the work started by other weakening agents. This fungus is often found on branches in association with the pink cushions of *Nectria cinnabarina* and the black pustules of *Steganosporium ovatum*. It may also produce cankers, usually around branch stubs or wound.

CONTROL: Maintaining trees in good vigor is the most effective way of preventing infection by the fungus.



Cytospora canker on sugar maple. Note the canker close to the branch stub, also the small black fruiting bodies on the magnified portion of the bark.

Figure 21. CYTOSPORA CANKER

NECTRIA CANKER

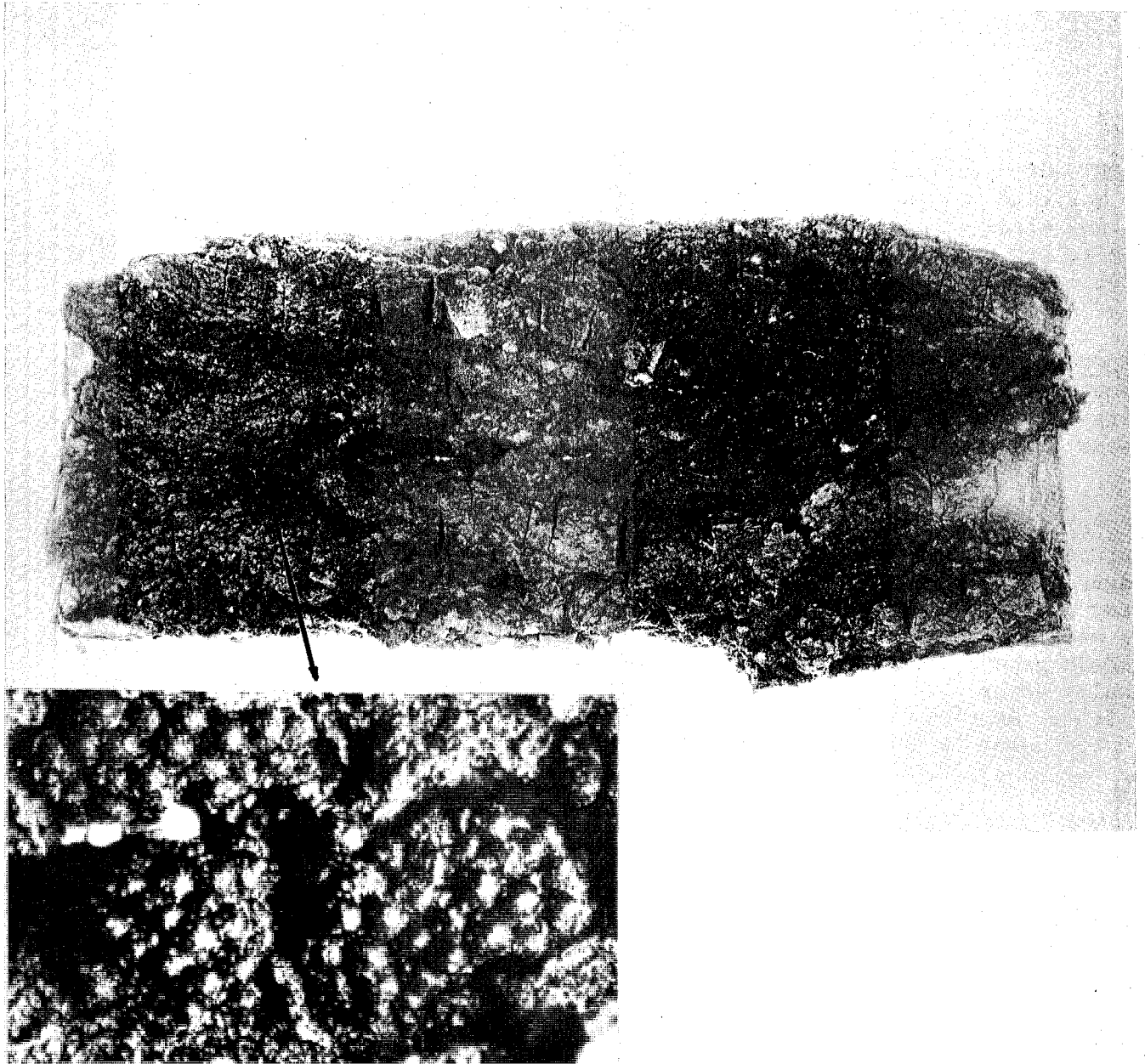
CAUSAL ORGANISM: *Nectria galligena*

IMPORTANCE: The most prevalent and serious canker disease of hardwood stands. Although the disease does not kill many trees, considerable loss results from reduction of merchantable wood and from breakage of branches. The abundance of the disease varies with locality, and groups of heavily cankered trees often occur in scattered areas. Any infected tree must be considered as a possible new source of infection in the spread of the disease.

DAMAGE: Trees subjected to severe attacks of Nectria canker must divert considerable amounts of energy from other vital functions to fight and overcome infection by this fungus; such a reaction lowers their vigor and predisposes them to other problems. Disfiguration of the trunk renders trees unmerchantable; killing of twigs and branches decreases green foliage surface.

RECOGNITION: Infection takes place through bark cracks, small injuries caused by snow and ice, or through other wounds in living or dying (but not dead) tissue. First indication of the disease is the presence of small depressed or flattened areas around small wounds or branch stubs. Most cankers have a small branch stub in the centre. Older cankers are usually target-shaped with exposed concentric rings of callous tissue. At other times the shape of the canker is irregular with indefinite callous ridges. A partial covering of dead bark may conceal the cankered area. Small red fruiting structures of the fungus occur singly or in clusters, on the bark at the margin of the canker, or on the wood. Easily detected when numerous, the lemon-shaped fruiting bodies (perithecia) can be seen only with a magnifying glass when sparse. Occasionally a tree may overcome the infection.

CONTROL: Remove infected trees, preferably while the cankers are young. If pruning is feasible, cankered branches should be cut and the cut ends treated with wound dressing. By their 30th year, trunks of trees are relatively safe from infection, although infection may occur higher in the trees.



Nectria canker on sugar maple. Note the areas on the bark where flask-shaped fruiting bodies are congregated.

Figure 22. NECTRIA CANKER

EUTYPELLA CANKER

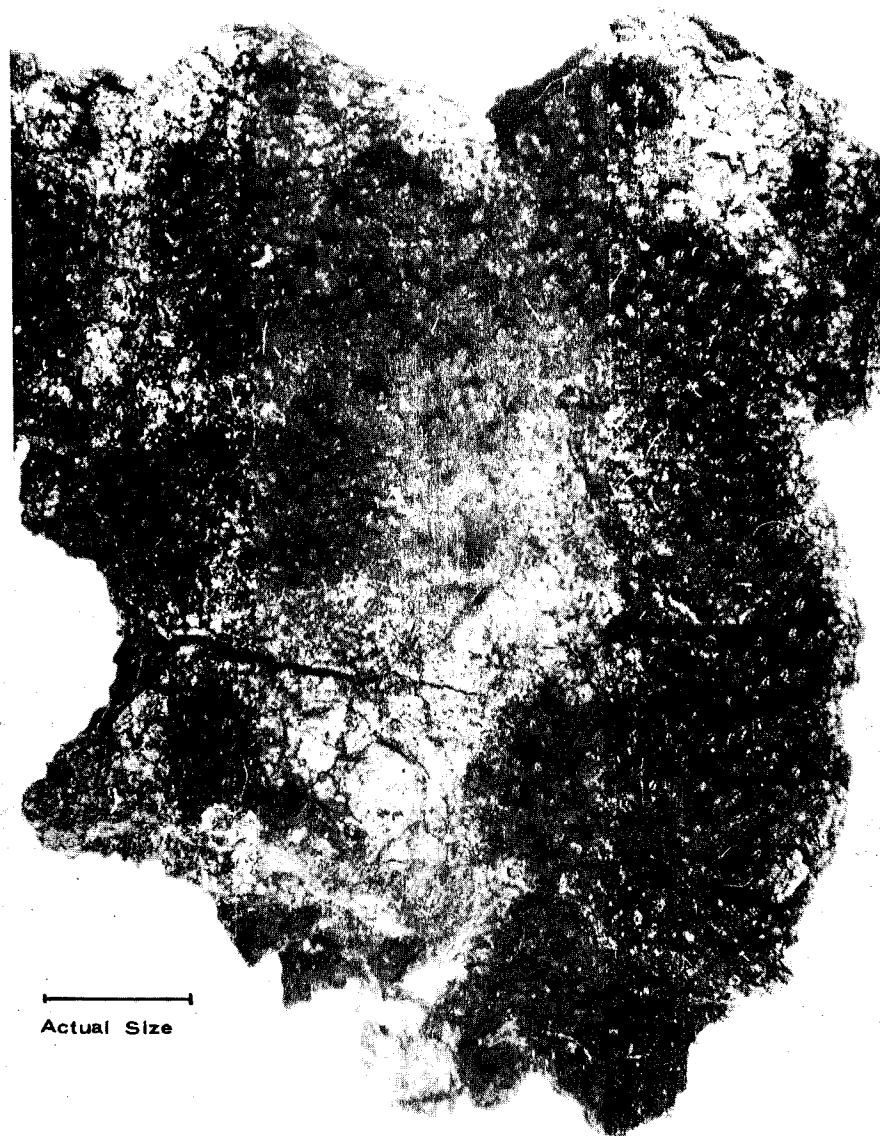
CAUSAL ORGANISM: *Eutypella parasitica*

IMPORTANCE: This disease is included, although it has not yet been reported in the Maritime Provinces, because it is known to occur on sugar maple, red maple and box elder in Quebec and in the northeastern United States. The cankers render tree trunks unmerchantable and become entry points for decay fungi which often lead to breakage.

DAMAGE: Cankers disfigure tree trunks and can kill young trees up to 3 inches in diameter. Heavy cankering also lowers the vigor of infected trees by diverting energy needed for normal growth processes to combatting the effects of the disease.

RECOGNITION: The fungus commonly infects branch stubs and then causes cankers, characterized by swelling and distortion of the trunk, formed by raised, concentric ridges of callous tissue with firmly attached bark. The fungus fruits in the older parts by producing black, long necked, flask-shaped structures (perithecia). The most characteristic feature of the disease is the heavy white or buff-colored growth (mycelium) under the bark at the margin of the canker. Cankers usually occur 2 to 8 feet from the ground but occasionally can be found up to 30 feet. At times the stem becomes flattened and bends back; because it resembles a cobra about to strike, it is sometimes called the "cobra canker".

CONTROL: No control for the disease is known but removal of infected trees will reduce the chances of its spread.



Eutypella canker on sugar maple. Note the long-necked, flask-shaped fruiting bodies on the bark. Also note the actual size of the specimen photographed.

Figure 23. EUTYPELLA CANKER

DECAY FUNGI

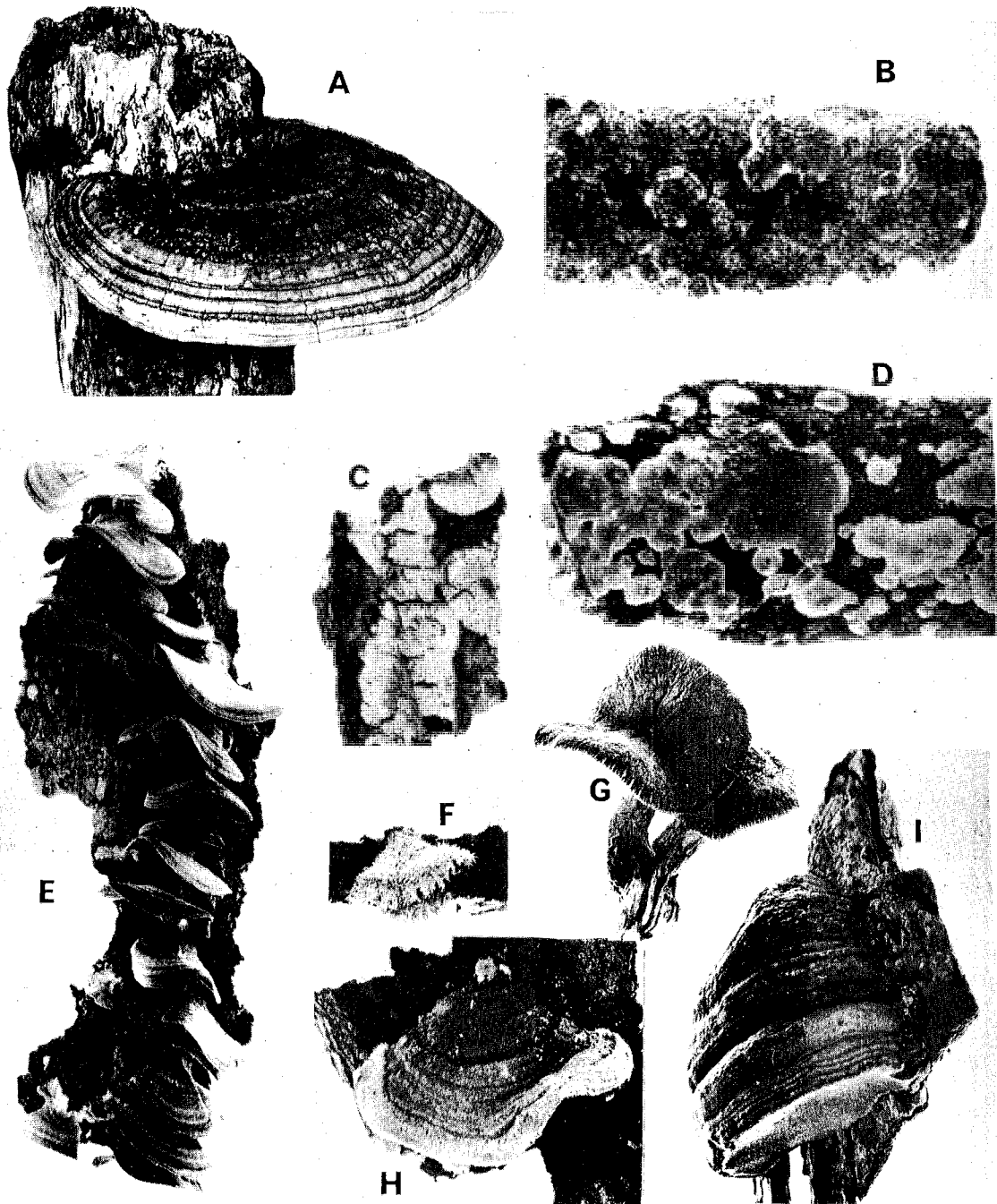
CAUSAL ORGANISMS: Many species of fungi belonging to Basidiomycetes.

IMPORTANCE: Many of these fungi decompose dead wood and are extremely important in returning nutrients to the soil by decaying slash in forest stands. Only a few cause extensive rot in the dead heartwood of living trees and still fewer can kill and decay living sapwood; nevertheless these particular fungi are responsible for extremely high wood losses in our forests.

DAMAGE: Fungi break down and destroy wood, making trees unmerchantable, weakening standing trees, and predisposing them to breakage.

RECOGNITION: Different species of fungi have different effects on the wood. Decay fungi can be classified in various ways—by location in the tree: root-, butt-, trunk-, or stem- and top-rot; by position in the trunk: sap- or heart-rot; by color changes: white- or brown-rot. The fungus damages inside the tree and by the time the fruiting bodies (conks) appear on the tree, much of the damage has been done. Different species cause different amounts of decay in the wood; the length of the decay column arising from the fruiting body varies from a few inches for some fungi to many feet for others; their upward and downward spread in the same tree may also differ. Fruiting bodies show great variations in shape, size, color, and duration: some appear only as a hue on the bark, others form a crust, a bracket or a mushroom; some are small, others range up to 2 feet wide; colors vary from white to black, from drab to brilliant orange or red; some disappear within a few days, some deteriorate after a year, others grow for decades, each year producing a new layer of growth. The fertile surface of conks also shows variation from smooth through porous (poroid), irregular (daedaloid), gill-like (lamellate), to teeth-like (hydroid). Only a small sample of decay fungi is shown on the opposite page.

CONTROL: No control is known but minimizing the number of wounds, through which infections enter, will lower the incidence of decay.



Decay fungi on sugar maple. A - Ganoderma sp.; B - Trametes sp.; C - Peniophora sp.; D - Poria sp.; E - Polyporus sp.; F - Schizophyllum sp.; G - Armillaria sp.; H - Daedalea sp.; I - Fomes sp. Note the variation in fruiting body formation.

SUNSCALD

CAUSAL AGENT: High temperature and bright sunshine.

IMPORTANCE: Occurs mostly on recently transplanted trees or on trees after heavy thinning in forest stands, followed by hot, dry periods in the summer.

DAMAGE: Killing of the cambium (the thin living layer of reproductive wood cells under the bark) particularly on the south or southwest side of tree trunk results in the death of the crown supported by that section of the trunk. Dieback, and invasion by fungi and insects may further weaken and eventually kill the entire tree.

RECOGNITION: Trees growing in stands are protected from direct radiation of the sun by other trees and develop thinner bark, consequently less insulation, than trees growing in the open. When thin-barked trees are exposed, such as after heavy thinning of the stand, the intense sunlight raises the temperature of the bark so high that it kills the cambium. General deterioration of the tree will usually follow.

CONTROL: Gradual thinning, spread out over several years, will lessen the shock by providing the trees with a period of adjustment to the changing conditions. Trunks of valuable, recently transplanted trees can be protected by first shading them and gradually increasing the exposure.

TAP-HOLE DECAY

CAUSAL ORGANISM: *Valsa leucostomoides* Peck

IMPORTANCE: Although very common in the New England States, the disease has not yet been reported in the Maritimes. This, however, may be indicative of limited observations rather than an absence of the fungus.

DAMAGE: The discoloration and decay, originating around untreated holes after removal of tap spouts, lower the quality of wood in the main stem and eventually reduce the value of the entire tree. Until now no adverse effect from this fungus has been reported on sap production.

RECOGNITION: Truncated cones of discoloration with light yellow center bordered by deep olive or greenish black streaks develop around tap holes. Fungi-like discolored areas often extend deep into the center of the wood, often merging and completely discoloring all sapwood. The decay associated with this discoloration is hard and dry, and occasionally punky within a short distance from the tap hole. It is claimed that the condition known as "mineral stain" is caused by this fungus.

CONTROL: Tap-holes should be treated immediately after the removal of spouts at the end of the syrup collecting season to prevent entry of the fungus.

### MISCELLANEOUS DISORDERS

FROST CRACKS: These are formed during the dormant period by a sudden and pronounced drop in temperature. The inner core of the wood remains relatively warm while the outer layers contract and split. Cracks which can go deep into the wood start at the base of the trunk and may extend upward many feet. Healing produces callous growth which results in "frost ribs". Open frost cracks often serve as entries (infection courts) for wood decay fungi.

HERBICIDE DAMAGE: Improper formulations of herbicides can cause leaf discoloration, and, in severe cases, defoliation. Herbicides may be absorbed directly by the leaves or transported to them through the roots.

SALT DAMAGE: Roadside trees may suffer from the injurious effects of salt applied to the roads during winter. Premature leaf coloration, marginal leaf scorch, defoliation, general decline and ultimately death of the tree may result.

FUME DAMAGE: Varying amounts of leaf discoloration, usually in the area between veins, result from exposure to various atmospheric impurities, such as SO<sub>2</sub> exhaust fumes from automobiles, motors, etc.

SPRAY MIXTURES<sup>a</sup> FOR MIST BLOWER OR AERIAL APPLICATION

Formula	Pesticide	Quantity <sup>b</sup> of pesticide required for -		
		2½ gallons	10 gallons	100 gallons
1	Sevin (carbaryl) 85 W or 80 S	2½ oz	10 oz	6¼ lb
1A	Sevin (carbaryl) 4 Fl.	5 fl.oz	1 pint	1¼ gal
1B	Sevin (carbaryl) 4 Fl.	6 fl.oz	24 fl.oz	1½ gal
2	Malathion <sup>c</sup> 50 EC	5 fl.oz	1 pint	1¼ gal
3	Methoxychlor 24 E or EC	6 fl.oz	24 fl.oz	1½ gal
4	Dylox 80 SP	½ lb	2 lb	20 lb
5	Kelthane 18.5 EC	4 fl.oz	16 fl.oz	1 gal
6	Genite 50 EC	4 fl.oz	16 fl.oz	1 gal
7	Fenitrothion EC or LI	4 fl.oz/acre. Apply as a low volume or ultra low volume spray or in sufficient water for good coverage; one application of 4 fl.oz/acre or two applications each 2-3 fl.oz/acre, 4 to 6 days apart.		
8	Dipel SU ( <i>Bacillus thuringiensis</i> Berliner var. <i>alesti</i> ) A biological insecticide	2.4-3.6 billion i.u./acre. For mist-blower apply in up to 10 gallons of water; for aerial application use 5 to 20 gallons/acre. Wet foliage thoroughly, but not to excessive runoff. To prevent rain washoff, formulate with a sticker additive.		

- a. Conforms to recommendations contained in the "Compendium on Pesticides Registered for Use in Canada Against Pests of Forests, Trees and Shrubs" (Environment Canada, Canadian Forestry Service, Chemical Control Research Institute, Ottawa. Information Report CC-X-19. Revised for 1975).
- b. Based on approximate spray rates of 25 gallons/acre (formulae 1-3) and 10 gallons/acre (formula 4).
- c. Malathion is not effective when air temperature is below 65°F (18.5°C).

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