

INSECT ENEMIES OF BIRCH

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NATIVE BIRCHES are subject to attack by insects at all stages of growth from the germinating seedling to the mature tree. All parts of the tree — roots, stem, branches, foliage, and even the developing seed — may be utilized as feeding sites by insects of one kind or another.

An enumeration of the many insects recorded in the literature as feeders on birch might be impressive in numbers but would contribute little to this symposium. Rather, it would seem more appropriate to consider a few representative kinds of insects that are responsible for particular types of injury, to indicate their relative importance and the need for control.

Much of the literature dealing with insect damage to tree seedlings emphasizes damage to conifers, and especially to seedlings in forest nurseries. Insect damage to seedling hardwoods appears to have attracted relatively little attention on the part of research workers up to the present.

Under natural conditions birch seedlings may be destroyed by such root-feeding insects as white grubs, weevil larvae, and wireworms, or by above-ground feeders such as cutworms or miscellaneous other stem or leaf feeders. At this early stage of growth a seedling may be killed by the activity of a single insect, but insect damage to birch seedlings is rarely reported. This may be accounted for by the fact that the suspect insects normally occur in relatively small numbers under forest conditions and have limited mobility during their larval feeding stages, or it may be that the loss of a small percentage of seedlings is more or less taken for granted.

Linteau (1948) found that insects were responsible for a mortality of about 9 percent of yellow birch seedlings. Nearly all of the injury was attributed to the spring cankerworm, *Paleacrita vernata* (Peck), and occurred under conditions of full canopy. No seedlings

were killed in plots in the open or under partial canopy. Godman and Krefting (1960) found that insects caused little damage to yellow birch in upper Michigan. Graham and Knight (1965) caution against too complacent an attitude toward insect pests of seedlings but indicate that applied control measures are rarely necessary except in forest nurseries.

Beyond the seedling stage, the birches— in common with other hardwoods—are fed upon by an almost endless variety of insects. By far the great majority occurring on yellow or paper birch are scarcely known outside the field of taxonomy. Some, because of their frequent occurrence in outbreak form or because of obviously destructive feeding habits, have long occupied the attention of workers in forest entomology and timber improvement.

Root-feeding insects ordinarily cause little damage to birch saplings or to the older trees. The extensive root system is able to tolerate without serious effect the feeding of the relatively limited population of underground insects.

The birch canopy provides a particularly attractive feeding ground for a large array of insects. Some, having a piercing beak or proboscis, suck the sap from the leaves. Others, having mandibulate mouth parts, mine within the leaf tissues, or devour the entire leaf structure.

The sap-sucking insects belong to two major groups, the Hemiptera and the Homoptera. The Hemiptera are represented especially by the lace bugs (Tingidae) and the plant bugs (Miridae). A number of species of lace bugs are known to feed on birch. They sometimes occur in great numbers, and because of their sedentary habits are readily observed. The young nymphs feed on the underside of the leaves, the adults on either surface. Although they will feed on trees of all sizes, they seem to prefer saplings and pole-sized

trees (Graham and Knight 1965). Drake (1922) studied the birch tingid *Corythuca pallipes* Parshley in the Cranberry Lake area in New York, and concluded that it was the most injurious leaf feeder on yellow birch in that vicinity.

Little information is available on the mirid plant bugs that feed on birch. So far as known they overwinter as adults and lay their eggs in the leaf veins or stems. Under forest conditions the plant bugs occur in relatively small numbers and are not considered to be important pests of trees.

The leafhoppers that occur on birches have attracted only a limited amount of research attention even though certain species are sometimes numerous over wide areas. Varty (1963, 1964) indicated that the species feeding on birch occur chiefly in the genera *Oncopsis* and *Erythroneura*. The biologies and host-relationships of the leafhoppers of forest trees warrant careful study since a number of species belonging to that family are known vectors of important plant diseases.

Foliage-infesting aphids often appear on birches over extensive areas and in great abundance. In variety of species as well as individuals they are the dominant group of sap-sucking insects. Birch aphids do not kill trees directly (Graham and Knight 1965) and their abundance in a given locality may fluctuate greatly from year to year. Under conditions of heavy aphid populations they interfere with the normal functioning of the foliage and thus weaken the trees.

Investigations of birch aphids, largely of a survey nature, have been carried on in the Maritime provinces of New Brunswick by Varty (1963, 1964) and in Quebec by Quedneau (1966).

Among the chewing insects of birch foliage the birch skeletonizer, *Bucculatrix canadensisella* Chambers, periodically appears over extensive areas in outbreak numbers, causing complete defoliation (Simpson 1932). The tiny moths are most numerous in July, and the young larvae start off as miners within the leaf. After 3 or 4 weeks they emerge from their mines and after molting feed for another 3 or 4 weeks on the underside of the leaves as skeletonizers, eating only the softer leaf tissues. Since defoliation by this species occurs late in the growing season, its effect on

growth is not likely to become evident until the following year.

At least three species of leaf-mining sawflies occur commonly on birch. Probably the most widely observed is *Fenusa pusilla* (Lep.). Year after year this species is likely to be abundant over wide areas. It prefers gray birch, although it does attack white birch also. The birch leaf miner appears within the first expanding leaves in the spring and may have two generations and, in some areas, three complete generations a year. The biology of this species was reported in detail by Friend (1927, 1933).

The birch leaf-mining sawfly *Heterarthrus memoratus* (Fallén) shows a preference for paper birch. In severely infested trees there may be noticeable killing of top branches, annual growth is reduced, and the quality of the wood may be inferior (Craighead 1950). The species has a single generation annually, but because it is parthenogenetic it is capable of rapidly developing very large populations.

A third species, *Profenusa thomsoni* (Konow), prefers paper and yellow birch. In the past it has been confused with other species found on birch. Recent studies by Martin (1960) show that the adults begin to appear about the middle of July, and larval feeding is most evident in August and September. Males are unknown, indicating that the species is parthenogenetic. Martin considered that this sawfly causes little or no noticeable injury to birch because of the lateness of the larval feeding period.

The typical defoliators are the insects that devour the entire leaf, or most of it. The more important kinds on birch are the larvae of Lepidoptera, such as the forest tent caterpillar, *Malacosoma disstria* Hbn., and the saddled prominent, *Heterocampa guttivitta* (Walk.). The larvae of certain sawflies, and certain Coleoptera, mostly chrysomelid leaf beetles and their larvae, are sometimes numerous enough to cause noticeable defoliation.

The forest tent caterpillar is perhaps the best known and most important of the defoliators attacking birch, even though its most spectacular outbreaks are ordinarily associated with other hardwoods (Anderson 1944, Craighead 1950, Graham and Knight 1965, Redmond 1957). Studies in Minnesota by Hodson (1941) and in Ontario by Sippell (1962) indicate that major outbreaks have

occurred in the past about every 10 years, but the interval is not consistent. The last major outbreak in New Hampshire occurred over 30 years ago.

Barter and Cameron (1955) studied the effects of forest tent caterpillar defoliation on aspen and paper birch. They found that radial growth in paper birch was reduced 22, 68, and 86 percent compared with 23, 87, and 52 percent defoliation in the 3 consecutive years of the outbreak. Growth retardation following defoliation was more pronounced on birch than on aspen even though defoliation of birch was less and occurred later in the season. They reported that 21 percent of the birch had died since the start of the outbreak, largely as a result of bronze birch borer attack on the defoliation-weakened trees.

It is generally known that vigorous hardwoods, unlike the conifers, may survive three or more consecutive years of practically complete defoliation. That is true largely because of the ability of hardwoods to refoliate immediately after defoliation occurs. The effect on growth and vigor of the tree is influenced not only by the amount of defoliation but also when it occurs.

Although the immediate effects of defoliation are measurable to some extent in terms of reduced growth increment, the indirect effects may be even more important but much more difficult to express. Defoliating insects appear to be incapable of direct killing of birch stands, but by weakening the trees they may induce heavy attack by secondary insects such as bark beetles and ambrosia beetles and various borers. When that happens the tree is usually doomed.

The bronze birch borer, *Agrilus anxius* Dru., is by far the most important of the borers affecting paper and yellow birch. Ordinarily it occurs in modest numbers, breeding in storm-damaged or otherwise injured, overmature, or decadent trees. Throughout much of its range it has a 2-year life cycle, although in some situations it may complete its development in 1 year.

The devastating birch dieback outbreak that began to develop in the late 1930's focused

attention on the bronze birch borer, which was then appearing in unprecedented numbers in the affected stands. The fact that many young birches were being attacked by the borer led to some speculation as to whether the insect was solely responsible for death of the trees.

Early studies of the dieback problem by Balch and Prebble (1940) indicated that in some areas previous defoliation of birch stands in 1927 and 1928 had weakened the trees, thus favoring an increase in borer activity. Hawbolt and Skolko (1948) noted that many yellow birches were already in advanced stages of decline without having been attacked by the borer. The findings of these and other investigators of the problem were reviewed by Redmond (1957). There is general agreement that the bronze birch borer played a secondary role in birch dieback, although as Barter (1957) had indicated, its activity may have been an important factor in determining whether a tree died or recovered from a serious decline.

In the management of birch stands to prevent bronze birch borer attack, the recommendations of Balch (1944) and Redmond (1957) appear to be equally applicable today. Major emphasis should be placed on the prompt elimination of weakened and mature trees. Operations should be planned so that vigorous trees are not injured or subjected to overexposure to sun and wind.

It would appear that, up to the present, the use of insecticides on birch stands has seldom been found necessary except during outbreaks of defoliators such as the forest tent caterpillar, the saddled prominent, or the gypsy moth. Even then, the treatment of birch has apparently been incidental to the need for treating other hardwoods, which are preferred hosts of these insects.

That is not to suggest that insecticides can be dispensed with in the management of birch stands in the future. On the contrary, the continued depletion of the older stands and the need to maintain vigorous growth in the younger trees may well require more frequent use of insecticides than has been true in the past.

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