

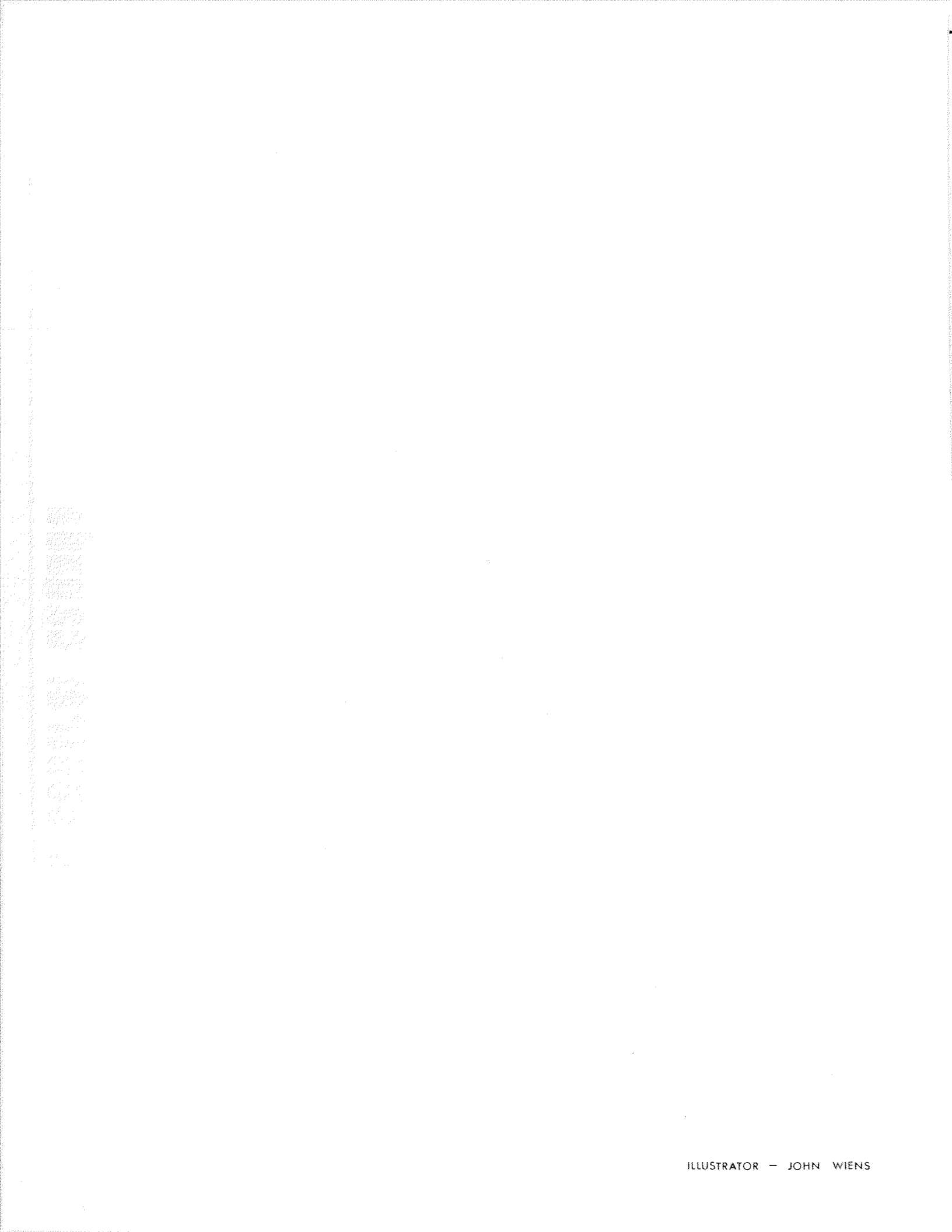
in central canada

# JACK PINE BUDWORM

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**Liaison & Services Note MS-L-4**

FORESTRY BRANCH, AUGUST 1968

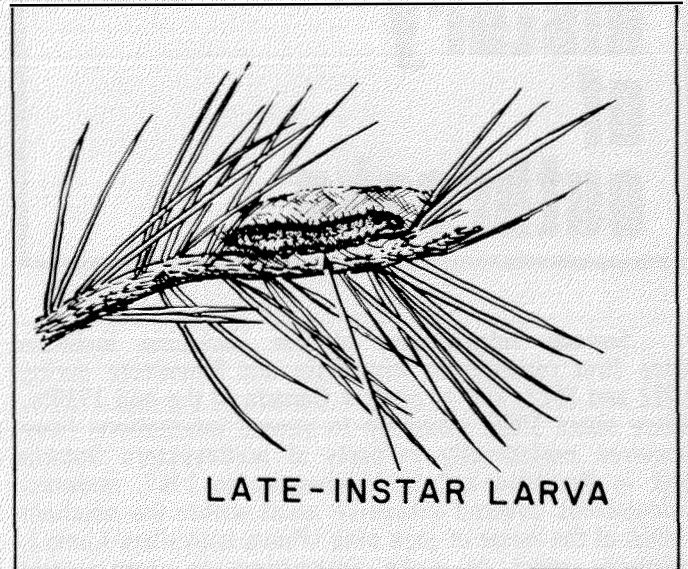




# introduction

The jack-pine budworm (*Choristoneura pinus pinus* Freeman, Lepidoptera: Tortricidae) is the most important insect pest of pines in the forested regions of western Ontario, Manitoba and Saskatchewan. Recent studies of biological and ecological characteristics have shown the jack-pine budworm to be a distinct and valid native North American species. Prior to 1953, this insect was considered to be a racial form of the well-known spruce budworm (*C. fumiferana* (Clem.)).

Although named "jack-pine budworm", the insect attacks many species of pines, and the major damage is to the foliage and staminate (male) flowers rather than to the buds. Most of the injury to host trees is caused by half- to full-grown larvae (4th to 7th instar), and approximately two-thirds of the foliage consumption takes place during the last two or three weeks of the larval feeding period. Severity of attack is closely related to the production of staminate flowers by host trees. Therefore, heavy flower production is favorable for budworm population increase, and trees with the most abundant flower crops usually support the largest populations.



LATE-INSTAR LARVA

*Mature budworm larva feeding on pine foliage.*

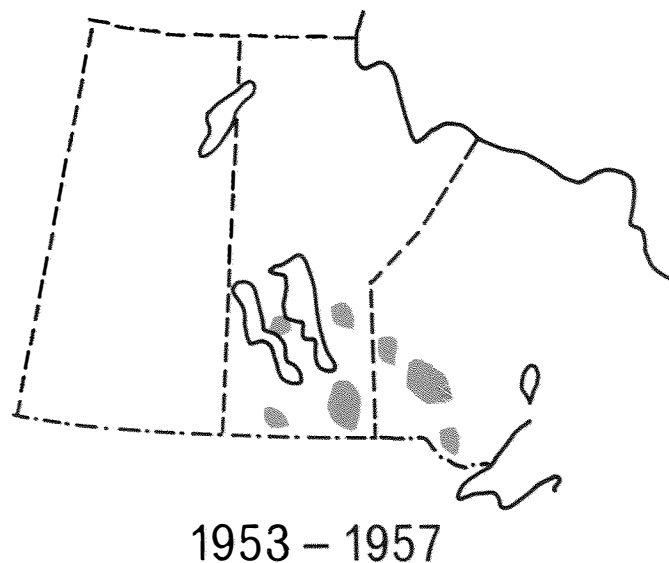
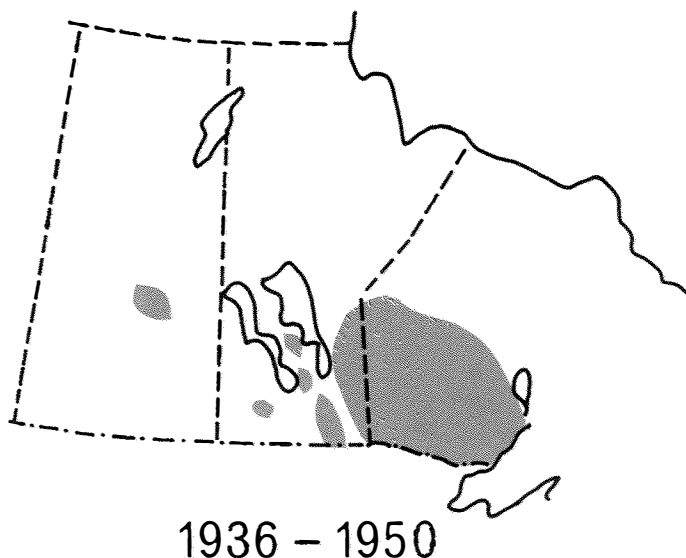
# history of outbreaks

Serious infestations of the jack-pine budworm were first reported in Wisconsin and Minnesota during 1922 and 1923, and in central Canada in the mid 1930's. Since about 1936, moderate to severe infestations have occurred periodically in parts of northwestern Ontario and in Manitoba and Saskatchewan. In 1967, budworm infestations covered extensive areas within the southern limits of the range of jack pine, (*Pinus banksiana* Lamb.), primarily west of Lake Superior to west-central Saskatchewan, and in the pine growing region extending through Michigan, Wisconsin and Minnesota in the United States.

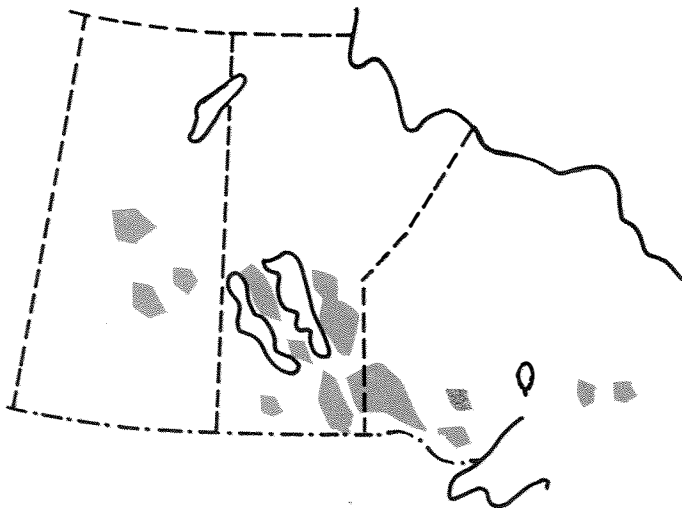
In Ontario, records indicate moderate to severe defoliation occurred almost continuously in one or another part of the Kenora-Fort Francis-Sioux Lookout Districts, and east as far as Port Arthur during the periods 1937-50 and 1953-56. A third outbreak developed in 1959 when five separate localized infestations were noted in the Fort Francis District. Sharp population increases were recorded annually in the ensuing years, and by 1967 the outbreak extended from Fort Francis and Dryden to Manitoba.

In Manitoba, outbreaks have generally coincided with the outbreaks in northwestern Ontario. Periodic infestations, ranging from one to four years duration in localized areas, occurred continuously in the south-eastern part of the province from 1936 to 1950. A second outbreak period was recorded between 1954 and 1957 when jack pine stands were moderately to severely defoliated over extensive areas of the Sandilands and Belair Provincial Forests. During this period, particularly severe infestations occurred on pine plantings in the Spruce Woods Provincial Forest. More recent outbreaks developed during 1963 and 1964 in the above-mentioned forests and in natural stands elsewhere in the province. In 1967, however, this outbreak subsided in many areas, and severe defoliation was confined to natural jack pine stands east of Lake Winnipeg and in the Whiteshell Provincial Park.

The history of jack-pine budworm infestations in Saskatchewan is very similar although damage has not been as widespread as in Manitoba or Ontario. The first recorded outbreak was observed in the Fort à la Corne Provincial Forest in 1939. Following several years of moderate to severe injury, the outbreak terminated in 1945. As in Manitoba and Ontario, the recent outbreaks experienced in central Saskatchewan commenced in 1963, and have since caused serious injury over extensive areas, particularly in the Nisbet, Pines, Canwood, and Fort à la Corne Provincial Forests. Relatively high budworm populations persisted to 1966, but by 1967 complete population collapse had occurred in most areas.

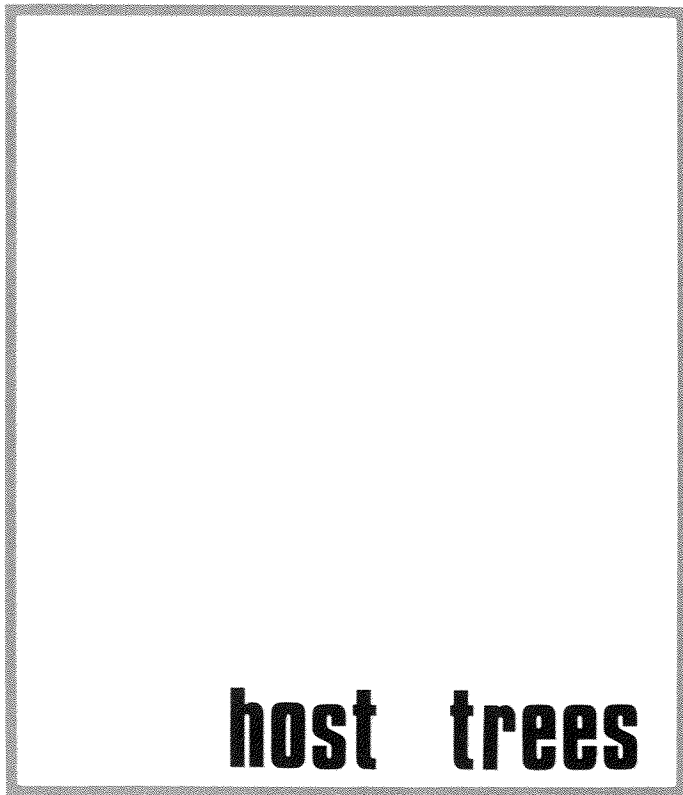






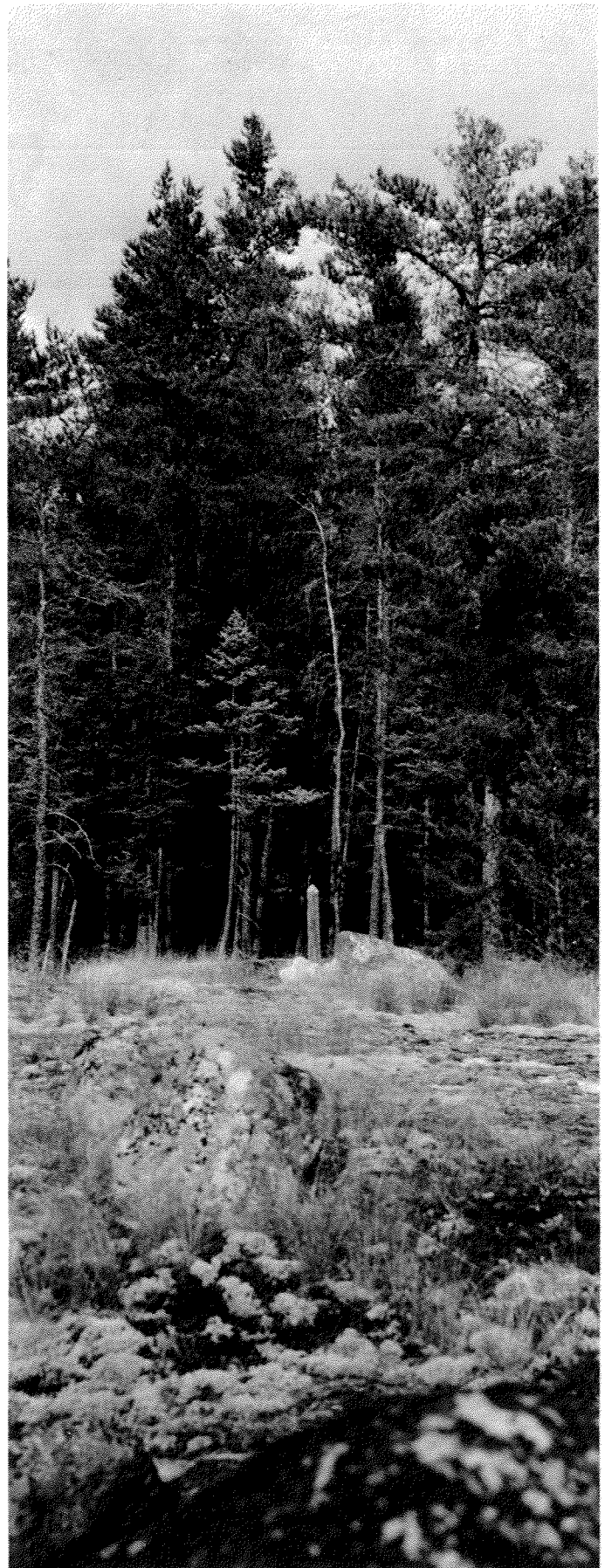
1959 – 1967

*Jack-pine budworm outbreaks in central Canada.*

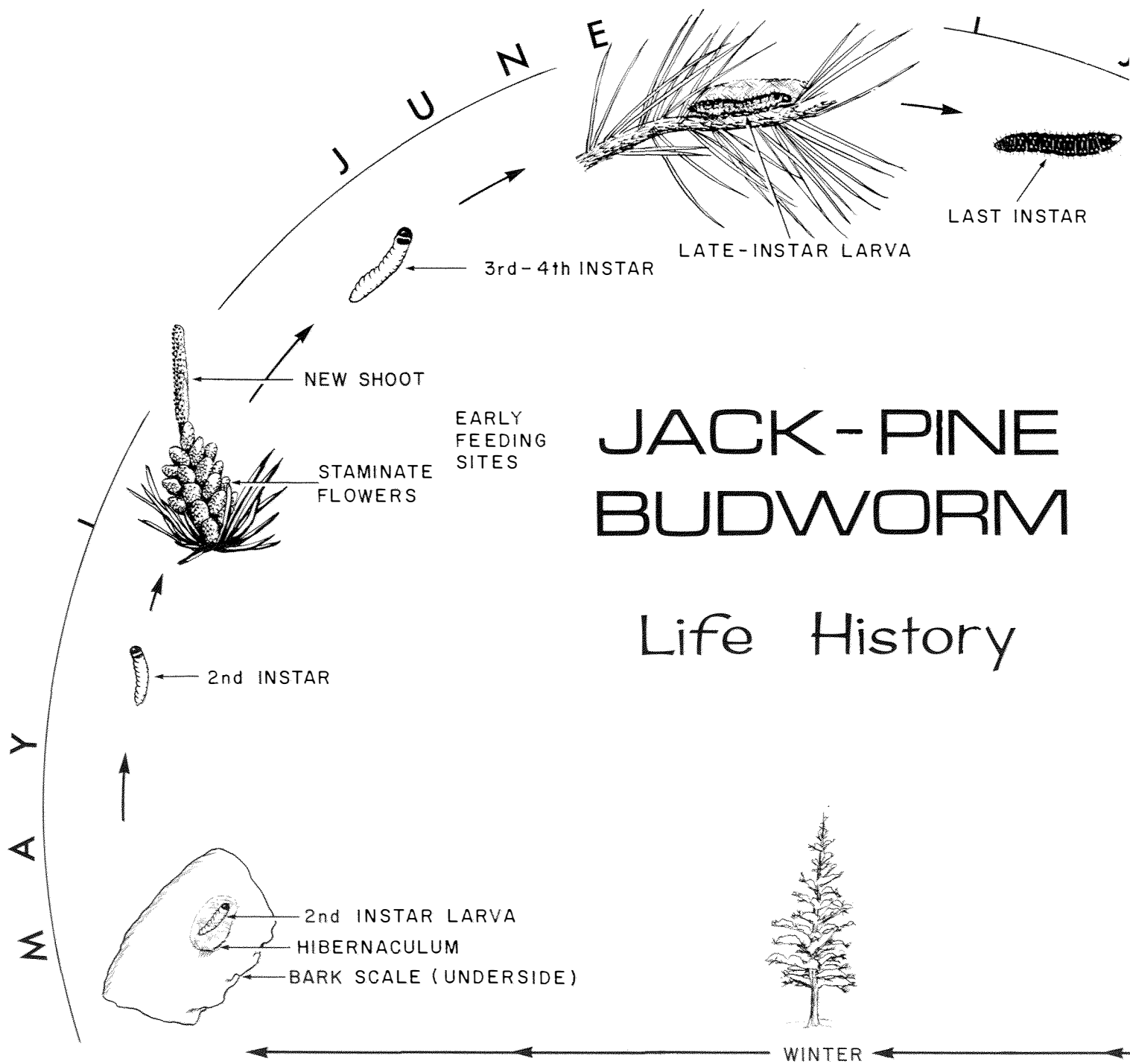


**host trees**

The principal host of the jack-pine budworm is jack pine, although red pine (*P. resinosa* Ait.), Scots pine (*P. sylvestris* L.), white pine (*P. strobus* L.), and lodgepole pine (*P. contorta* Dougl.) also are important host species, especially when near susceptible jack pine stands. Jack-pine budworm feeding also has been recorded on balsam fir (*Abies balsamea* (L.) Mill.), tamarack (*Larix laricina* (Du Roi) K. Koch), and spruces (*Picea* spp.). However, damage and sustained attack on hosts other than pines is rare.



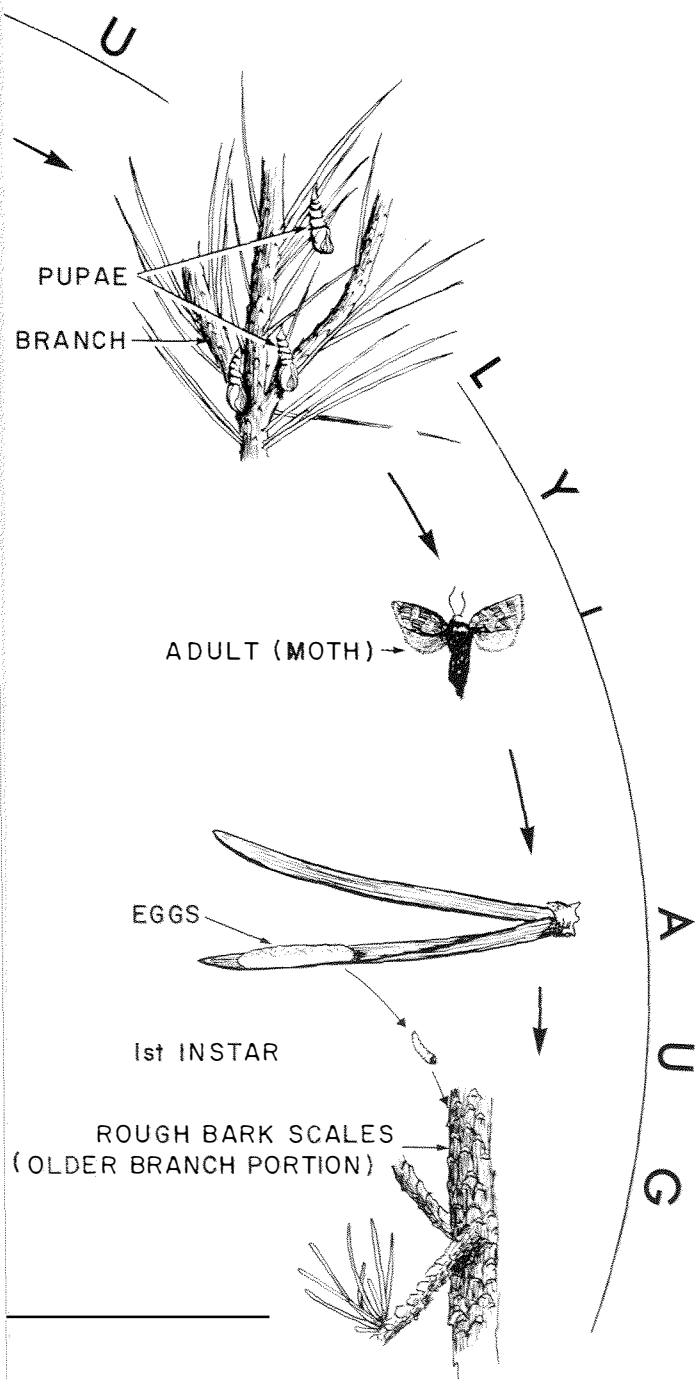
*Jack pine stand; the most frequent host of the budworm.*



# JACK-PINE BUDWORM

## Life History

# life history & habits



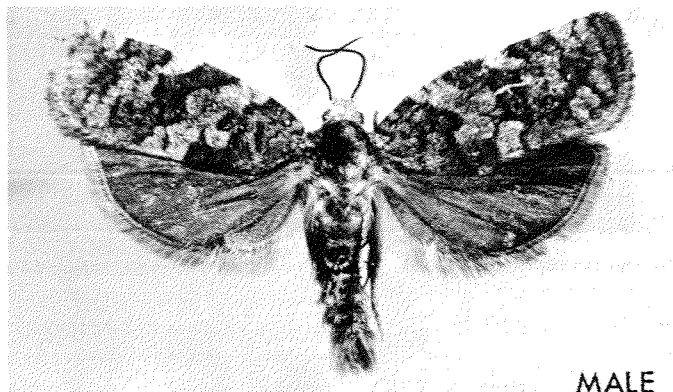
The generalized life history and habits of the jack-pine budworm in central Canada is schematically depicted on page 4. It overwinters as a second-instar larva within a silken hibernacula (tightly spun protective webbing) beneath bark scales, between needles, or in old staminate flower bracts. The cold hardiness of these small budworm larvae permits survival at winter temperatures as low as  $-50^{\circ}$  F. During late May to early June, the larvae leave the hibernacula and commence feeding on the male flowers and developing buds. Some larvae may spin out strands of silk and drop from the branches to be dispersed on air currents. Often previously uninfested trees may be reached in this manner. After becoming established at a suitable feeding site, the larvae feed for a period of six or more weeks depending upon weather conditions. Late-instar larvae feeding on new foliage are found under a loosely-spun silk webbing in which excrement and plant debris accumulates. Needles are seldom entirely eaten and, together with the frass of feeding larvae, remain caught in the webbing until removed by wind and rain. The accumulation of this material imparts a distinctive reddish color to attacked trees.

Pupae are formed at the completion of the feeding period on the branches of host trees. Often, larvae will congregate to pupate in clusters of three or more at branch nodes. Pupation occurs from early July to early August, depending upon geographical area and climatic factors. After emergence of the adults, the empty pupal cases adhere to the larval webbing by means of the cremaster.

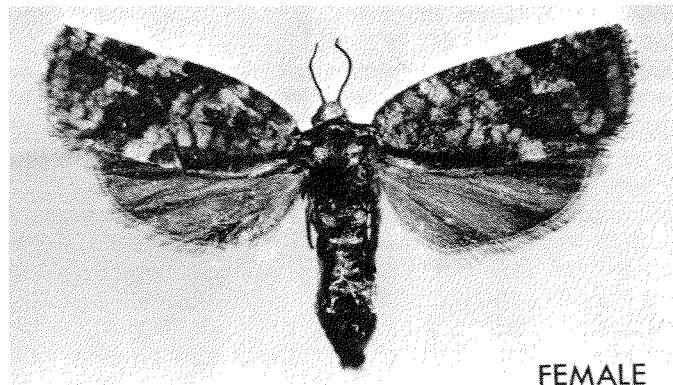
Moths emerge in July and early August and dispersal of the population to areas remote from their origin may occur at this time with the assistance of air currents. During 1967, large numbers of moths believed to have originated in the Sandilands Provincial Forest appeared in Steinbach and Winnipeg, Manitoba (distances of 20 and 60 miles, respectively).

Eggs deposited on foliage hatch in about 10 to 14 days. The first-instar larvae do not feed, but spin hibernacula in suitable sites and then molt to overwinter as second-instar larvae.

# description of life stages



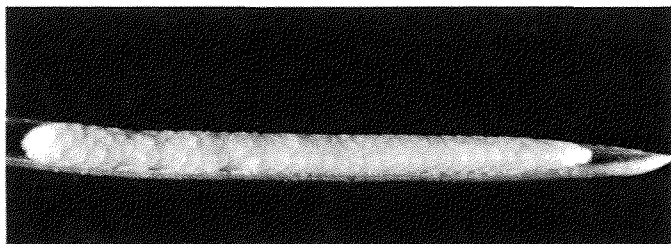
MALE



FEMALE

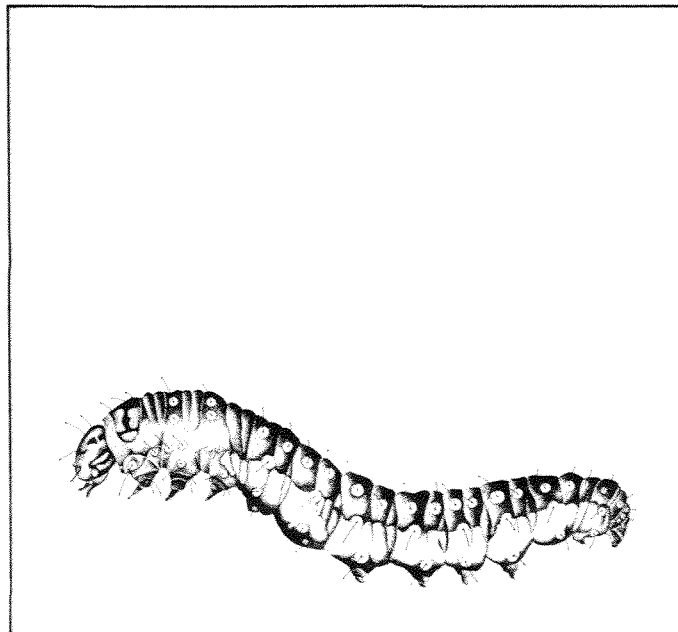
*Male and female moths of the jack-pine budworm.*

**Adult** — Color markings on the wings of the moths vary slightly between individuals. The forewings are reddish-brown with silvery white patches. Hind wings are uniformly gray. Wingspan measures approximately three-quarters of an inch. At rest, the wings are held roof-like over the abdomen.



*Jack-pine budworm eggs on pine needle.*

**Egg** — Eggs are light green in color and are deposited in two rows on the foliage of host trees in an overlapping, fish-scale pattern. Individual egg masses vary in size, but average about 40 eggs. Females deposit approximately 150 eggs each. Old egg masses are milky-white in color, and may persist on the foliage for one year.



*Mature jack-pine budworm larva.*

**Larva** — The overwintering second-instar larva, about one-eighth inch long, is yellow-orange with a dark brown to black head. As the larva grows, body and head pigmentation change. The last-instar larva has a dark brown body with lighter spots on the dorsal and lateral surfaces. The head is reddish-tan with darker markings on the lateral areas. Body length of the mature larva is about seven-eighths of an inch. There may be either six or seven larval instars.



*Jack-pine budworm pupa — showing cremaster (c).*

**Pupa** — The pupa is reddish-brown, and measures about three-quarters of an inch in length. Abdominal segments are armed with spines and a well-defined cremaster (terminal hooks) at the posterior end.

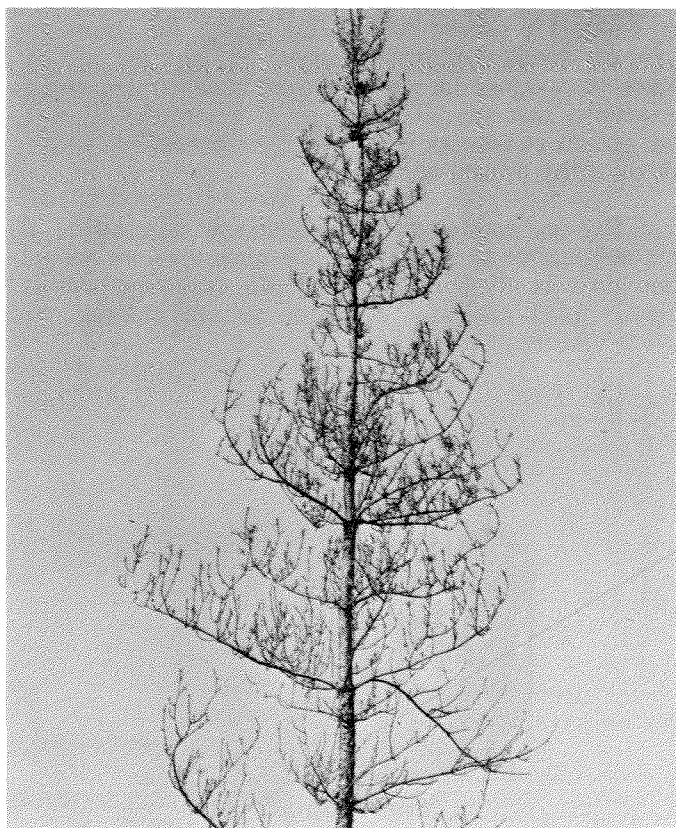


# injury

Severe budworm defoliation seriously affects the growth and quality of large tracts of natural stands and valuable plantations of susceptible host trees. Thus, yield at rotation age may be significantly reduced by the presence of large numbers of cull trees and marked reductions in annual increment.

Complete-tree mortality does not usually occur unless trees have been under sustained heavy attack for several years and are growing on poor sites. The more common damage is top-killing or reduced tree vigor. The localized severe infestation of 1956 and 1957 in pine plantations on the Spruce Woods Provincial Forest, which resulted in complete loss of the current foliage for the two consecutive years, killed approximately 22 per cent of 30-year-old Scots pine and caused serious top-killing of most of the remainder during the second year of attack.

Weakening and top-killing of trees may permit the entry of secondary insects and diseases which may ultimately cause mortality. Mortality or serious deformity also may occur in reproduction or regeneration when over-topped or near larger infested trees. Lack of food on the larger defoliated trees causes larvae to drop to the understory where they continue feeding.



*Jack pine tree severely defoliated by larvae of the jack-pine budworm.*

# control

Environmental factors such as climate, natural enemies (parasites and predators), and food quantity play a major part in regulating jack-pine budworm abundance and subsequent injury to hosts. However, the influences of these factors are not known well enough to be manipulated by the forest manager. Investigations have indicated that the effect of one or two years of sustained attack by budworm may not only reduce tree vigor but will inhibit flower production on attacked trees. This reduction in flower production in turn decreases the chances of successful establishment of larvae, thereby inducing decline or collapse of out-breaks.

There are two feasible approaches to the problem of reducing damage caused by the budworm: (1) Employing techniques designed to protect the trees from damage by increasing the number of years between successive outbreaks, thereby decreasing the cumulative severity of damage, and (2) the application of insecticides during outbreaks.

Sound forestry practices incorporating good site or ground preparation and subsequent plantation improvement programs maintaining maximum stocking are recommended for the establishment of vigorous, faster growing plantations which are less susceptible to budworm injury. In both plantations and natural stands, suppressed, non-vigorous and orchard-type wolf trees should be removed to limit the number of trees having large complements of staminate flowers and to improve stand quality.



*Improving stand by removing "wolf" or open-growing jack pines.*



*Aerial application of insecticide to control outbreaks of the jack-pine budworm.*

Chemical control by aerial application of insecticides may be utilized to prevent damage to valuable forest stands or large plantations. The decision to spray should be based on survey techniques which indicate the continuation of severe infestations following initial discovery of the outbreak. One-half pound of technical DDT per acre, applied in a fuel oil solution at the rate of one gallon of mixture per acre using conventional aerial spray equipment, will provide adequate control.

The timing of the applications is critical as early-instar larvae occupy protected feeding sites while late-instar larvae rapidly destroy new branch shoots. Therefore, spray applications should be made when larvae are first feeding openly, usually during the third or fourth instar (normally from June 15 to 25).

Preliminary research with the insecticides Matacil and Sumithion indicate that they may be used as substitutes for budworm control by aerial application, but more extensive testing is necessary to fully evaluate their effectiveness. However, these materials may be suitable for use in parks or in areas where watershed contamination by DDT is undesirable because of its toxicity to fish, birds and wildlife.

For small stands and ornamental trees effective control can be obtained by spraying with DDT (25% emulsifiable concentrate) at the rate of 4 fluid ounces or Malathion (50% emulsifiable concentrate) at the rate of 3 fluid ounces in 10 gallons of water using hydraulic sprayers. With such sprayers, the infested trees should be thoroughly wetted with a fine spray. An alternative type of ground-spraying equipment is the mist blower, which is designed for applying more concentrated sprays in smaller amounts. If this type of equipment is used, the amount of insecticide should be increased six times for the same amount of water.

Extreme caution should be exercised during handling and application of insecticides because they are considered toxic to all forms of animal life, including humans. Always read carefully pesticide package labels, and follow directions explicitly.



*Application of chemicals with ground equipment to control the jack-pine budworm.*



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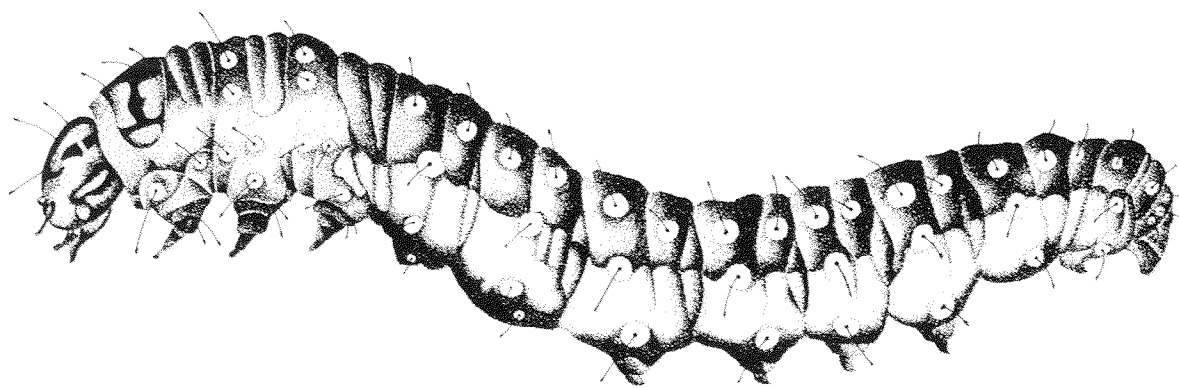
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