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Pests of Christmas Trees
in British Columbia.

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Douglas-fir *Pseudotsuga*
Pests of Christmas Trees
in British Columbia

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Forest Entomology Laboratory, Victoria, B.C.



Forest Entomology and Pathology Division

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DOUGLAS-FIR NEEDLE MIDGES--PESTS OF CHRISTMAS TREES IN BRITISH COLUMBIA

BY S. F. CONDRASHOFF

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INTRODUCTION

Damage to needles on the current year's growth of Douglas-fir caused by maggots of gall midges has been noted in British Columbia since 1935. Subsequently, with growth and development of the Christmas-tree industry, these midges have attracted increased attention as pests of economic significance. Periodically large areas, often portions of important Christmas-tree producing regions, have been severely infested, making the trees unsightly and unfit for market and resulting in considerable losses. Recent studies on the identity and life history of these insects have shown that three species of gall midge¹ are involved, each differing in the type of injury produced and in economic importance.

DESCRIPTION OF STAGES

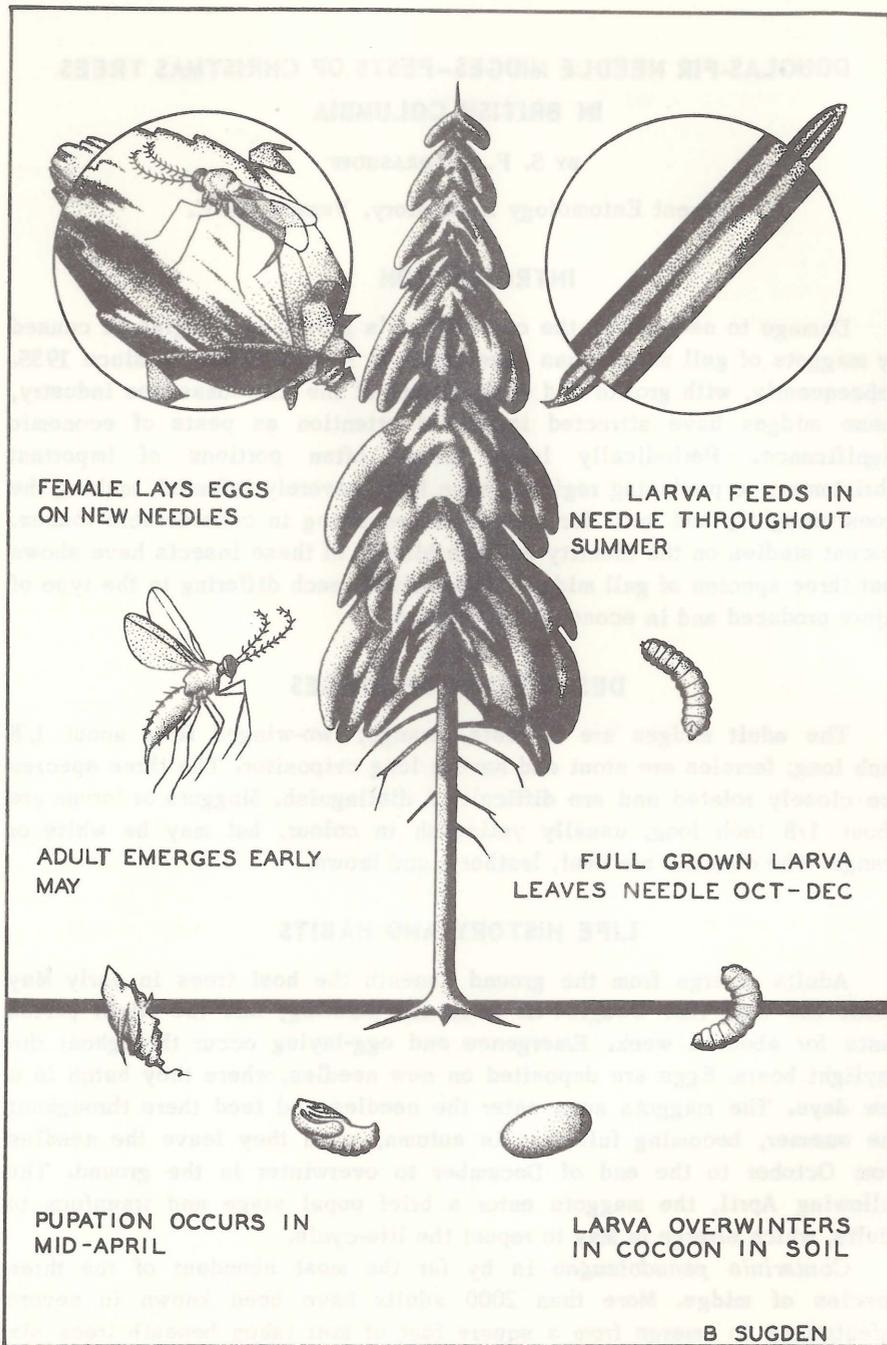
The adult midges are delicate, orange, two-winged flies about 1/8 inch long; females are stout and have a long ovipositor. The three species are closely related and are difficult to distinguish. Maggots or larvae are about 1/8 inch long, usually yellowish in colour, but may be white or orange. The cocoons are oval, leathery, and brown.

LIFE HISTORY AND HABITS

Adults emerge from the ground beneath the host trees in early May about the time that Douglas-fir buds are bursting, and the flight period lasts for about a week. Emergence and egg-laying occur throughout the daylight hours. Eggs are deposited on new needles, where they hatch in a few days. The maggots soon enter the needles and feed there throughout the summer, becoming full size in autumn, when they leave the needles from October to the end of December to overwinter in the ground. The following April, the maggots enter a brief pupal stage and transform to adults, which emerge in May to repeat the life-cycle.

Contarinia pseudotsugae is by far the most abundant of the three species of midge. More than 2000 adults have been known in severe infestations to emerge from a square foot of soil taken beneath trees six inches in diameter. Up to 40 eggs have been found on a single needle,

¹*Contarinia pseudotsugae* Condr., *C. constricta* Condr. and *C. cuniculator* Condr.



Life-cycle of the Douglas-fir Needle Midges

with 21 maggots entering the tissue. An average of four or five maggots may mature in each current year's needle. Heavy infestations may last for three to five years, often beginning with only a few insects, reaching a peak in several years, then subsiding to a low level.

Severe infestations have occurred around Laurier, Grand Forks, in the Okanagan Valley, and East Kootenay. Lighter infestations have been found around Prince George, Quesnel, Shuswap Lake, Lytton, portions of the Coast near Vancouver, and in the southern portions of Vancouver Island.

Severe infestations appear to build up and recur in dry-belt, open-grown, Interior forest types at lower elevations. This pest is not abundant above 3000 feet elevation.

NATURE OF DAMAGE²

The maggots cause the infested part of the needle to swell on the lower surface and to become discoloured on both surfaces with yellow, pink or purple. A small orange blotch marks the entrance hole made by the larva on the lower surface. Damage to the needle is evident by mid-July; at first the needle is soft and pliable but during summer it becomes drier, harder, and darker, and in late autumn it is brown and brittle. (Fig. 1).

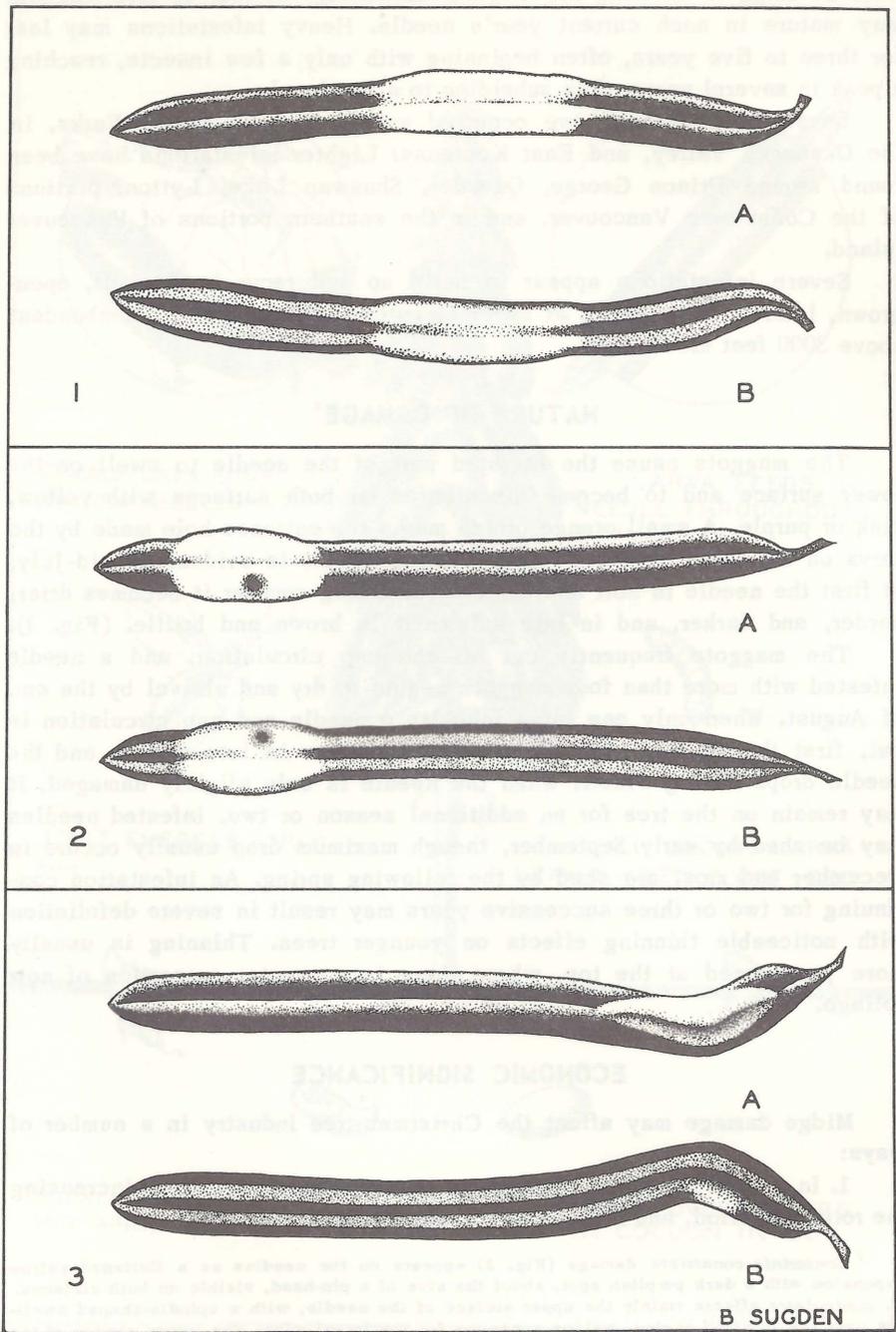
The maggots frequently cut off the sap circulation, and a needle infested with more than four maggots begins to dry and shrivel by the end of August. When only one larva inhabits a needle and sap circulation is cut, first the tip and then the base turns brown in late autumn and the needle drops during winter. When the needle is only slightly damaged, it may remain on the tree for an additional season or two. Infested needles may be shed by early September, though maximum drop usually occurs in December and most are shed by the following spring. An infestation continuing for two or three successive years may result in severe defoliation with noticeable thinning effects on younger trees. Thinning is usually more pronounced at the top, where there is a greater proportion of new foliage.

ECONOMIC SIGNIFICANCE

Midge damage may affect the Christmas-tree industry in a number of ways:

1. In natural stands or plantations it may reduce harvest by increasing the rotation period, and it may disrupt management practices.

² *Contarinia constricta* damage (Fig. 2) appears on the needles as a flattened yellow expansion with a dark purplish spot, about the size of a pin-head, visible on both surfaces. *C. cuniculator* affects mainly the upper surface of the needle, with a spindle-shaped swelling over the infested region, making a canopy for the larval mine. The upper portion of the damaged area is dirty yellow with a glossy, waxy appearance, while the lower surface appears normal. Frequently the needle is bent at the site of injury. (Fig. 3). Ordinarily neither of the latter two species damage needles severely.



Figures 1-3. Midge-damaged Douglas-fir needles.
 1, *Contarinia pseudotsugae*. 2, *C. constricta*.
 3, *C. cuniculator*. A, upper surface; B, lower surface.

2. Losses may be sustained through culls from private holdings and stumpage fees for culls from cutting permits.

3. Harvested trees may be downgraded and shipments rejected.

4. Difficulties may arise in fulfilling annual contracts and in supplying orders.

5. Over a long term it may be a threat to the status of Douglas-fir in the Christmas-tree market.

REMEDIAL MEASURES

To date very few Christmas-tree plantations have been established in British Columbia, and these apparently are in areas where the midges are not a problem. Satisfactory chemical control has not yet been developed, and in natural stands it is not likely to be economical on the basis of present average tree yield per acre. However, losses due to severe midge infestation may be avoided or reduced in several ways:

1. Natural stands of Douglas fir intended for Christmas-tree management should be selected outside the known areas of severe infestation.

2. Midge-damage surveys should be conducted from late July to September to anticipate in advance the volume of marketable trees that can be cut.

3. During years of heavy midge attack, Christmas trees should be harvested at elevations above 3000 feet.

4. Midge-damaged trees should be left uncut to allow affected trees to recover for possible future harvest, and to avoid stumpage losses on cutting permits.

5. Sites for Douglas-fir plantations should be carefully selected to avoid a severe midge problem. In some areas other species suitable for Christmas trees might be planted instead of Douglas-fir.

Additional information on the biology and control of the Douglas-fir needle midges may be obtained from the Forest Entomology and Pathology Laboratory, 409 Federal Building, Victoria, B. C., or the Forest Entomology Laboratory, Box 1030, Vernon, B. C.