species grew in the presence of 70% spruce extract. Several other *Bacillus* species, including crystal-forming strains of *B. thuringiensis,* were affected by the different extracts much as was *B. cereus* Mu-3055.

Next, a survey was made to determine how much, if any, antibacterial activity was to be found in the gut contents of spruce budworm feeding on balsam fir, larch, or spruce. The following method was used to detect antibacterial substances in an insect's gut contents: The intact gut was removed and slit open lengthwise. A strip of filter paper, 6 mm. wide, was pressed upon the moist gut contents, dried in air, and laid on a buffered nutrient agar plate that was first thinly spread with a bacterial suspension.

Following overnight incubation at room temperature, the presence of antibacterial substances was shown by a clear zone of inhibition of bacterial growth surrounding the part of the paper strip that had been in contact with the gut contents; when present, inhibiting substances appeared to be most concentrated in the mid-gut. Using *B. cereus* Mu-3055, an inhibition zone 1-2 mm. in diameter was formed around the gut-contents impression of balsam fir-fed spruce budworm, but not around those of larch- or spruce-fed spruce budworm. Similar results were obtained with the gut contents of balsam fir- or spruce-fed blackheaded budworm. If spruce budworm were fed on parafilm, so that their guts were full of parafilm particles but empty of foliage, the gut contents were not inhibitory to the growth of *B. cereus.*

No inhibitory zones were produced around the gut contents of spruce-, balsam fir-, or larch-fed spruce budworm when these were placed on plates inoculated with *P. aeruginosa* or *S. marcescens,* results that might be expected, considering the small inhibitory activities of foliage extracts on these organisms.

These results, and others to be reported in more detail elsewhere, suggest a direct incorporation of antibacterial substances from foliage into the feeding insect's gut contents. Although the matter must be investigated directly, it is possible that the presence or absence of antimicrobial substances in foliage eaten by insects may substantially determine the resistance of these insects to microbial attack and, thereby, determine their success on a particular host.—D. J. Kushner and G. T. Harvey.

TABLE I

Effect of balsam fir, spruce, and larch foliage extracts on bacterial growth

Bacteria	Tree species and per cent extract used						
	Balsam fir				Spruce	Larch	
	1	2	40	70	70	40	70
Bacillus cereus Mu–3055	+	–	–	–	+	+	–
Pseudomonas aeruginosa 251–4–3 R1 or 249–1A	+	+	+	–	+	+	+
Serratia marcescens 424–1A or 17–2B	+	+	+	+	+	+	+

\+ = Growth on plate after 24 hr.
– = No growth.
Growth medium contained 0.8% dried nutrient broth (Difco), 1% agar 0.1 *M* sodium phosphate, pH 7.4, and extracts in the amounts shown.

BRITISH COLUMBIA

Chemicals for Preventing Ambrosia Beetle Attacks.—For over ten years the gamma isomer of benzene hexachloride (lindane) has been recognized as the most effective material for preventing ambrosia beetle damage to logs and lumber. Experimental work in British Columbia and elsewhere has heretofore failed to reveal superior insecticides, but recently Allen and Rudinsky (Allen, D. G. and J. A. Rudinsky. J. Econ. Ent. 52 (482-4). 1959) showed that Thiodan was superior to lindane or Sevin for preventing attacks of the Douglas fir beetle, *Dendroctonus pseudotsugae* Hopk. Subsequently H. A. Richmond (Consulting Entomologist, Nanaimo, B.C.) obtained some evidence that Thiodan was more effective than BHC in preventing attacks by the ambrosia beetle *Trypodendron lineatum* (Oliv.). The following is the account of a small experiment conducted at Cowichan Lake in 1960 to compare the effectiveness of Thiodan and lindane.

Eight Douglas-fir logs, seven feet long and averaging ten inches in diameter were selected from trees felled in October, 1959. These were supported off the ground sufficiently so that cloth trays could be placed beneath them. Both ends of each log were left unsprayed as checks. In the centre portion of each log, two treatment zones 18 inches in length and separated by a six-inch buffer zone were marked. Lindane was applied to one treatment zone and Thiodan to the other. Concentration of both materials was 0.4 per cent by weight. Four per cent Socal #2, an aromatic solvent, was used to dissolve the active ingredient, and this solution was emulsified in water with 0.5 per cent of the non-ionic detergent Antarox A-400.

The materials were applied with a hand sprayer on April 4 while the bark was still damp. Spray was applied until the bark was thoroughly wetted. Plastic sheeting was used to protect portions of the logs not being sprayed.

It was anticipated that beetle attack would commence in the weeks following treatment. Instead, the weather turned cool and wet for most of April and May. Although a few *Trypodendron* were active during the last four days of April and sporadically throughout May, the first heavy attacks by this insect did not occur until the first two weeks of June. By then almost 12 inches of rain had fallen since the logs had been sprayed. From June 14 to 20 another inch of rain fell. Subsequently the weather cleared and *Trypodendron* attacks continued until at least July 19.

Dead and dying beetles taken in the cloth trays beneath the logs indicated that both treatments had a toxic effect on the beetles. Totals of 336 and 290 beetles were taken from the lindane and Thiodan trays, respectively.

After the attack period was over in mid-August, the bark was removed and numbers of successful attacks tallied. As shown in the accompanying table, both treatments successfully reduced beetle damage, but Thiodan was much superior to lindane in this respect. Compared with damage in the contiguous unsprayed wood, Thiodan reduced attack an average of 88 per cent, whereas lindane effected only a 63 per cent reduction.

A number of shallow holes were found which in many cases still contained the dead beetles. Most of these were less than one-eighth of an inch deep, and were not counted as successful attacks. They were much more numerous in the Thiodan- than lindane-treated zones.

The fact that either chemical had appreciable effect on the beetles after so much time and rain is remarkable. With less weathering it is possible that Thiodan would have given complete protection. It should be noted, however, that the logs were beneath a dense second growth forest where they were not subject to much direct sunlight or high temperature. The results indicate that rain alone may be relatively unimportant in deteriorating toxic deposits such as these.

Although this further evidence of the superiority of Thiodan over lindane for beetle control may prompt its widespread use, it should be recognized that it is slightly more toxic than lindane to warm blooded animals and fish. Before it is used to treat logs in water storage, an assessment of its effect on fish and other aquatic life should be undertaken.—J. M. Kinghorn.

The Relative Effect of Lindane and Thiodan in Preventing *Trypodendron lineatum* Attacks

Log No.	Lindane			Thiodan		
	Sprayed	Check	% Reduction	Sprayed	Check	% Reduction
	(Attacks/sq. ft.)			(Attacks/sq. ft.)		
1........	15.0	27.7	45.8	4.1	25.2	83.7
2........	12.9	30.4	57.6	2.8	31.5	91.1
3........	10.5	35.3	70.3	3.5	39.3	91.1
4........	12.4	55.0	77.5	6.1	43.8	86.1
5........	14.1	32.9	57.1	3.2	37.8	91.5
6........	11.0	32.5	66.2	5.3	29.0	81.7
7........	11.8	31.2	62.2	4.5	28.5	84.2
8........	18.3	39.6	53.8	1.5	32.9	95.4
Averages.	13.3	35.6	62.8	3.9	33.5	88.4

Willow Blight in British Columbia.—Crown mortality in a group of ornamental willows at the University of British Columbia Arboretum has been identified as willow blight caused by *Fusicladium saliciperdum* (All. & Tub.) Tub. The damage was originally observed in the summer of 1958 on *Salix* "June des Ardennes" and has since spread to *S. amygdalina* L. v. *fragilis, S. alba* L. v. *vitellina,* and *S.* x *fruticosa* Doell. The trees are approximately 30 feet high. Several native willows including *S. sitchensis,* standing within 200 feet of the outbreak, have not shown any symptoms to date.

The early symptoms of the blight are a blackening of the entire blade in the youngest leaves; subsequently a black lesion encircles and progresses down the shoot and eventually whole branches are killed. In some trees up to one-third of the crown has been destroyed so far. Suckers thrown from the base of *S. alba* v. *vitellina* have also been blighted.

The causal fungus has been found on the leaves and small twigs. Fruiting occurs on the undersurface of the leaves, chiefly along the course of the midrib and large lateral veins, and also on the lesions which have extended into the small twigs. The simple, brownish conidiophores are densely compacted, each bearing a single acrogenous conidium. The conidia, which are olive to brownish, are 2-celled (the basal cell larger and somewhat truncate, the apical cell rounded), and measure 13.8-24.0 x 6.2-9.0 μ.

The occurrence of *Physalospora miyabeana* Fuk., which frequently accompanies or follows *Fusicladium saliciperdum* in willow blight, has not been observed in this present outbreak in either of its spore states. However, the abundant occurrence of the submerged pycnidia of *Cytospora* sp. has been noted on killed, overwintered twigs. This secondary fungus is believed to be present in a strictly saprophytic capacity and not to contribute to the primary damage to the host.

The above record of willow blight in British Columbia is the first since 1941 (Conners, I. L., A. W. McCallum, and J. E. Bier. 1941. Willow blight in British Columbia. Phytopathology, 31: 1056-1058.) when the disease was reported on a willow at Abbotsford.—W. J. Bloomberg and A. Funk.

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ROGER DUHAMEL, F.R.S.C., Queen's Printer and Controller of Stationery, Ottawa, 1960

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