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ENTOMOLOGY

European Elm Bark Beetle in New Brunswick — A New Record.—Dutch elm disease was first found in the Maritime Provinces of Canada in 1957 at Woodstock, New Brunswick. The causal fungus, *Ceratocystis ulmi* (Buism.) C. Moreau, has since spread, until in 1975 the disease is known to occur in 12 of 15 counties in New Brunswick and in 7 of 18 counties in Nova Scotia. The disease has not yet been found in Prince Edward Island. The chief vector of this disease is *Hylurgopinus rufipes* (Eichh.), the native elm bark beetle. *Scolytus multistriatus* (Marsh.), the European elm bark beetle, considered a primary vector in most of the United States, has not previously been trapped in the Maritimes Region. (*S. multistristus* was found in bark of imported lumber at Halifax, Nova Scotia in February 1963, but there is no evidence that the beetle became established.) Recent development of an effective pheromone for *S. multistriatus* (Pearce *et al.*, J. Chem. Ecol. 1:115-124, 1975), provides a method to survey for its distribution.

In late May 1975, sticky paper traps, 45 x 65 cm, equipped with a pheromone pad (courtesy of Dr. J. W. Peacock, United States Forest Service, Delaware, Ohio), were set out at 34 locations in western New Brunswick. This area (Madawaska, Victoria, Carleton, York, and Charlotte counties) has a long history of infection, and has an abundance of beetle-breeding material. The traps were stapled about 3 m high on utility poles or trees other than elm. The original pheromone pad was used throughout the season but the sticky sheets on which miscellaneous insects, seeds, and leaves accumulated, were changed. Trapped beetles were removed periodically for laboratory examination. Trapping was terminated in early October.

A single specimen of *S. multistriatus* was trapped at Upper Mills, Charlotte County, between June 23 and July 23, and is the first record of the European elm bark beetle trapped in the Maritime Provinces. Examination in October of about 50 elms within a 1-km radius of the trap did not reveal any galleries typical of *S. multistriatus*, indicating that the population of the European elm bark beetle is extremely low in the area surveyed.

During the season 2,219 native elm bark beetles were collected from the 34 traps, even though the pheromone is reported not to be attractive to the native beetle (Peacock 1975. *In* Dutch elm disease, Proc. IUFRO Conf. 1973).—T. E. Sterner, W. R. Newell, and F. A. Titus, Maritimes Forest Research Centre, Fredericton, N.B.

Eriophyid Mite Associated with Damaged Yellow Cypress Cones.—In a study of yellow cypress [*Chamaecyparis nootkatensis* (D. Don) Spach] cone development, Owens and Molder (B.C. For. Serv. Res. Note No. 68) noted that a large number of cones bore callus-like growths (proliferations) and lacked mature embryos. This paper characterizes and identifies this damage.

In November 1974, 448 cones from four yellow cypress trees on southern Vancouver Island were examined and classified as follows:

Class 1 — lacking brown discolorations;
Class 2 — brown resin glands and small necrotic surface abrasions;
Class 3 — yellow or brown necrosis along scale margin, continuing internally;
Class 4 — opening prematurely with discolored and frequently proliferated scales, particularly at the margin;
Class 5 — brown and open.

Although isolations from necrotic lesions onto water agar and malt agar media were attempted, no pathogen was isolated. Class 1 and 2 cones appeared to be immature and mature, respectively. In the most severely damaged cones (Classes 3 and 4), an eriophyid mite identified as *Trisetacus* n. sp. (Smith, Biosystematics Research Institute, Ottawa) was readily observed. Mites, present in both 1- and 2-year-old cones, were restricted to the damaged parts (Fig. 1), but did not affect seed numbers or weight (Table 1). Class 5 cones could have been the remains of the previous year's crop or ones opened prematurely as a result of mite infestation. Some of these cones had proliferated scales and bore few seeds.

Figure 1. Yellow cypress cones. The cone on the left has opened prematurely, revealing an infestation of mites (arrow). This cone has proliferations of callus-like growths on the scale margin. The one on the right is an uninfested normal cone.

TABLE 1

Seed yield and seed weight among yellow cypress cone classes

Cone class	1	2	3	4	5	Sample size
dry weight of seeds (gm)	1.90	1.94	1.94	1.89	—	100/class
mean no. seeds/cone	9.2[a1]	9.5[a]	9.1	9.6	2.4[b]	10/class
	9.2	9.5	9.1[a]	9.6[a]	2.4[b]	10/class
% of cones	7.8	31.3	44.4	6.5	10.0	448/total

[1] Means followed by the same letter do not differ significantly (P = 0.05) by Duncan's multiple range test.

In November 1975, 20 cones from five trees were collected and examined. Most (82%) had matured to the brown stage, obscuring any brown necrosis on the margin of the scales which could have been caused by mites, although scale proliferation was apparent on 10%. Of the remaining green ones, 72% bore yellow and brown necrotic symptoms radiating out from the scale margins, in association with the mites.

The cones with proliferated scales observed by Owens and Molder (*loc. cit.*) were found only in association with an undescribed *Trisetacus* sp. This mite is similar to *T. quadrisetus* (Thomas), a species causing similar damage to juniper berries (Morgan and Hedlin, Can. Ent. 92: 608-610). The constant association of only *Trisetacus* n. sp., a member of a known plant damaging mite group with unique damage symptoms, suggests that *Trisetacus* n. sp. causes the damage to yellow cypress cones. True assessment of the damage is not easy because of the difficulty in distinguishing between current and next year's cone crop (Owens and Molder *loc. cit.*); the browning of mature cones may obscure damage symptoms; mites may damage only part of the cone, and open brown cones (class 5) may or may not have been mite infested. Nevertheless, over 50% of the 1974 sampled cones were mite damaged, indicating that mites may be a major problem for seed production in yellow cypress.—R. S. Hunt, Pacific Forest Research Centre, Victoria, B.C.

FIRE

A Divide-By Circuit for Cup Anemometers.—Although the cup anemometer, widely used in forest meteorology, has certain faults (Middleton and Spilhaus, 1953: *Meteorological Instruments*, Univ. of Toronto Press), its basic properties such as simplicity of design, ease of fabrication, ruggedness, good sensitivity and relatively low cost make it practical for many investigations of airflow.

Cup anemometers are usually designed to produce a fixed number of voltage pulses or switch closures for each revolution of the cup assembly, which occasionally presents difficulties for certain applications. For example, the pulses recorded on an event strip-chart recorder might be too close together for adequate resolution, or if an electromechanical counter was used, the total number of pulses might overflow the counter register. Under these circumstances, an anemometer system that produced fewer pulses for each revolution of the cup assembly would be desirable. This divide-by capability is usually provided by a worm gear arrangement. However, the worm gear has a frictional drag which results in decreased sensitivity of the anemometer. Also, the ratio of output pulses to cup assembly rotation remains a fixed figure so that flexibility in application is lost.

To perform this division, an electronic circuit could be incorporated into the anemometer system. Although the use of electronic divide-by circuitry seems to be a logical development, no mention of such an application appears in the literature. This note presents a simple divide-by circuit which has been successfully tested and used.

The circuit consists of three principle sections: a counter or divide-by unit, a buffer stage, and an output transistor switch. The counter employed is a 7-stage binary counter. Incoming positive voltage pulses were selectively divided by a factor of 2^N, where $N = 1$ to 7 according to the output terminal selected. As shown in Fig. 1, the incoming pulses were divided by a factor of 32 (i.e., 2^5). CMOS (complementary symmetry metallic oxide semiconductor) devices were

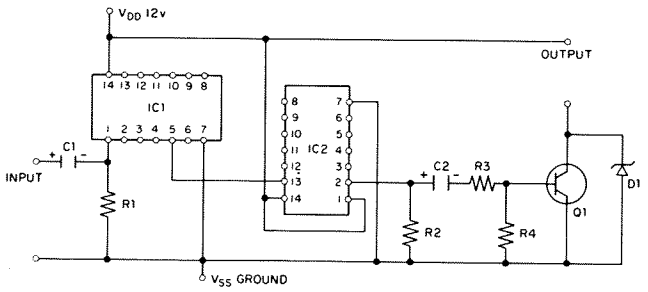


Figure 1. Anemometer divide-by circuit.

TABLE 1

Component list for divide-by circuit

ICI	RCA	CD4024AE	7-stage binary counter
IC2	RCA	CD4016AE	Quad bilateral switch
Q1	ELCOM	ECG103	Transistor or equivalent
D1	15 volt zener diode		
C1, C2	25 uf capacitor, electrolytic		
R1	100 K ohm resistor		
R3	3.3 K ohm resistor		
R2, R4	33 K ohm resistor		
VDD	device supply voltage		
VSS	ground voltage		

utilized to minimize supply power requirements. A quad-bilateral switch (CD 4016) was used as a buffer, but another type of buffer, such as a hex inverter (CD 4009), would have served equally well. Pin numbers (Fig. 1) of the integrated circuit devices are shown as an aid to interpretation. Technical details on CMOS devices may be obtained from the appropriate handbooks (e.g. Anon. 1975: *RCA Solid State Data Book Series SSD-203B COS/MOS Digital Integrated Circuits.* RCA Corporation.) The output transistor switch was selected for its suitability to actuate the solenoid of an event recorder or an electromechanical counter. The circuit was designed for 12 volts, although it will operate at a level not exceeding 15 volts. The input voltage pulse to the counter must not, however, exceed the supply voltage or the device may be damaged.

The divide-by circuit has been used with a sensitive anemometer (Cassella, Model 16108/2) and has been recorded on an event strip-chart recorder (Rustrak, Model 2146) as part of a study of experimental prescribed burns. From the chart record, it was possible to utilize the total number of pulses recorded as the measure of average windspeed, and the length between pulses as the measure of the variation in windspeed during the course of the fire.

The circuit herein described is only an example and not an optimum design. It was simple to construct and gave satisfactory results.—R. H. Silversides, Pacific Forest Research Centre, Victoria, B.C.

PATHOLOGY

A Summer of Vegetation Recovery Near a Phosphorus Plant, Long Harbour, Newfoundland.—The extent of fluoride damage to vegetation until late 1973 and levels of fluoride in foliage and soils in the vicinity of the phosphorus plant, Long Harbour, Nfld., were reported earlier by Sidhu and Roberts (Can. For. Ser. Bi-Monthly Res. Notes, 31(6): 41-42, 1975). Vegetation surveys were continued during 1974 and 1975. However, the 1975 survey was conducted under anomalous conditions because the phosphorus plant was not in operation and as a result there were no fluoride emissions reported during the period from 23 May to 6 October, 1975. This temporary shutdown of the plant provided an opportunity to seek answers to such questions as (a) what degree of vegetation recovery and what levels of fluoride should we expect in vegetation in the absence of emissions from the phosphorus plant during the growing period, and (b) will the present accumulated high levels of fluoride in foliage and soil have any undesirable effects on the new growth of different tree species?

Vegetation was sampled at five sites, one in each of the four Damage Zones and the other outside of Damage Zone IV (see Sidhu and Roberts 1975). At each of the sample locations, 1974 and 1975 foliage from balsam fir, black spruce, white spruce, and speckled alder were collected and fluoride concentrations were determined following the same procedures reported by Sidhu and Roberts (1975). Additionally for balsam fir the percent defoliation, percent foliage with fluoride symptoms and 1974 and 1975 growth of leader and branches were

TABLE 1

Foliar fluoride concentration, % folioage with fluoride symptoms, % defoliation and leader and branch growth in balsam fir in samples from selected sites from four damage zones and a pollution free site

Parameter	Species	ZONE-I '74[a]	ZONE-I '75[b]	ZONE-II '74	ZONE-II '75	ZONE-III '74	ZONE-III '75	ZONE-IV '74	ZONE-IV '75	OUTSDE ZONE-IV '74	OUTSDE ZONE-IV '75
% foliage with fluoride symptoms	Balsam fir	100	0	100	0	100	0	100	0	0	0
% defoliation	Balsam fir	100	0	40	0	10	0	10	0	0	0
Leader length (cm)	Balsam fir	5.2[c]	6.0	17.0	24.1	22.0	33.8	4.5	11.1	31.8	32.2
Branch length (cm)	Balsam fir		(+15.4)[d]		(+41.7)		(+34.9)		(+17.9)		(+1.2)
Foliar fluoride concentration ppm/dry wt)	Balsam fir	7.2	7.7[e]	9.1	9.6	11.1	12.7	7.1	7.9	14.4	14.7
	Black spruce		(+6.9)		(+5.5)		(+14.4)		(+11.1)		(+2.1)
	White spruce	251.0	24.7	54.1	7.6	19.3	7.4	10.4	3.7	7.2	5.2
	Speckled alder	370.0	8.1	34.3	8.7	14.3	6.5	7.1	3.9	5.2	3.7
		—	—	19.2	7.5	—	—	8.7	4.9	5.2	3.7
		—	9.2	—	8.3	—	6.3	—	5.1	—	3.9

[a] During 1974 growth phosphorus plant was in full operation.
[b] During 1975 growth the phosphorus plant was not in operation.
[c] Average of 6 values.
[d] Values in parentheses are % change in growth from 1974 (% change = (75-74).100/74).
[e] Average of 12 values.

recorded. Two branches from each of six trees at a site were sampled for these parameters.

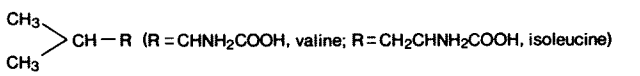
The results of the field measurements and the chemical analysis are given in Table 1. There was an absence of fluoride symptoms on the 1975 growth whereas all 1974 foliage exhibited fluoride damage, varying from chlorosis to strong tipburn. Correspondingly, the foliage samples of 1975 growth had fluoride concentrations of less than 10 ppm, with the exception of one sample taken near the plant's settling pond located in Zone I. Concentrations of fluoride in the 1975 growth were consistently lower (2 to 45 times) than those recorded from the 1974 foliage. This decrease in the foliage fluoride concentrations between 1974 and 1975 were most pronounced in samples from Zone I and less pronounced with greater distance from the phosphorus plant. Insignificant differences in the concentrations of fluoride in 1975 foliage from all damage zones are indicative of little translocation of fluorides from older to younger foliage, from soils to foliage via root absorption and absorption of fluorides by bud scales from fluoride rich atmosphere during the winter. However, these observations still need further clarification.

The 1975 leader and branch elongation in balsam fir showed a definite improvement over the 1974 growth. General observations of growth in black spruce, white birch, larch, alder, and raspberry indicate that in the absence of emissions from the plant we can expect resumption of near normal growth of all plant species except where all meristematic tissue had been destroyed. Although vegetation recovery will occur in all zones, in Zone I where the understory is dominated by hardwoods at present and over 90% of the softwood overstory is dead, the future tree stratum is expected to change from balsam fir-black spruce to white birch-pin cherry. In Zone II, the overstory is a mixed forest of black spruce, balsam fir and larch or scrub vegetation with black spruce as a dominant species. The hardwoods form only small portions of the understory in this zone. Therefore, if there were no emissions from the phosphorus plant, hardwoods may become dominant in localized areas. Also, areas of larch in both damage Zones I and II will continue to be dominated by larch. Larch, being deciduous, reacts to fluoride rich atmosphere in a manner quite similar to that of deciduous broadleaf species. In Zones III and IV the balsam fir, black spruce and white spruce will recover.

A detailed study of the changes in vegetation patterns, species compositions and relative sensitivity of the various species to fluoride is still in progress.—S. S. Sidhu, Newfoundland Forest Research Centre, St. John's, Nfld.

Branched-chain Fatty Acids in *Conidiobolus heteosporus*.— The occurrence of substantial amounts (up to 35% of the total) of branched-chain fatty acids in the lipids of *Conidiobolus denaesporus* was reported in 1968, (Tyrrell, Lipids 3:368-372, 1968) and branched-chain fatty acids have subsequently been found in several other *Conidiobolus* species (Tyrrell, Can. J. Microbiol. 17:1115-1118, 1971; Tyrrell and Weatherston, Can. J. Microbiol. in press). Only even carbon-number iso acids and odd carbon-number anteiso acids have been confirmed in these fungi: odd carbon-number iso acids have not been detected, although the gas chromatographic conditions employed for analysis of the fatty acid methyl esters would not preclude the presence of small amounts of these latter acids.

It has been clearly shown in bacteria (Kaneda, Can. J. Microbiol. 12:501-514, 1966) that the amino-acids valine, leucine and isoleucine are the precursors of the branched-chain moities of the even carbon-number iso, odd carbon-number iso and odd carbon-number anteiso fatty acids, respectively. The effect on fatty acid composition of *Conidiobolus heterosporus* of supplementing the basal medium (peptone 2%, glucose 2%, yeast extract 0.1%) with each of these three amino acids was therefore determined. The amino acids were added at the level of 2 mg/ml. Culture, extraction and analytical procedures were as previously described (Tyrrell, Can. J. Microbiol. 17:1115-1118, 1971). The results (Table 1) show that supplementation of the medium with valine leads to a doubling of the percentage of iso acids present compared with the control (basal medium) while there is a three fold drop in anteiso acids. With isoleucine, the proportion of anteiso acids shows a more than six fold increase, while iso acids are almost completely suppressed. With leucine, however, both iso and anteiso acids are reduced to only half the control level. These results indicate that valine is, as in bacteria, the precursor of the branched-chain moiety in even carbon-number iso acids and isoleucine similarly is precursor for the anteiso acids. The observation that leucine supplementation not only failed to stimulate branched-chain acid formation, but led instead to a two fold decrease in branched-chain acids supports the suggestion that odd carbon chain iso acids are not formed by this fungus. It would also seem that the biosynthetic pathway(s) leading to incorporation of branched-chain amino acids into branched-chain fatty acids are specific for the structure



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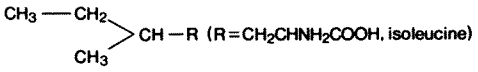

TABLE 1

The effect of valine, isoleucine and leucine supplements on the fatty acid composition of *Conidiobolus heterosporus*.

Acid*	Control**	Valine***	Isoleucine	Leucine
12:0	0.3	0.2	0.3	0.2
a13:0	—	—	0.6	—
13:0	0.2	0.2	0.3	0.1
i14:0	8.7	18.0	0.5	4.5
14:0	6.0	3.5	3.9	6.2
a15:0	5.8	2.1	37.6	2.3
15:0	0.8	0.5	0.6	0.9
i16:0	2.1	2.9	—	1.0
16:0	7.9	5.0	5.9	9.0
16:1	2.6	1.0	2.9	3.0
16:2	0.7	0.5	0.6	0.9
18:0	4.5	8.0	6.0	4.3
18:1	20.0	17.7	11.9	25.2
18:2	10.2	8.7	6.8	9.5
18:3	4.3	3.4	3.5	4.9
20:2	2.6	4.1	2.1	2.6
20:4	23.3	24.2	16.5	25.3
iso	10.8	20.9	0.5	5.5
anteiso	5.8	2.1	38.2	2.3

* Fatty acids are listed as the ratio of number of carbon atoms to number of double bonds in the molecule.
** Basal medium, no additions.
*** Added at 2 mg/ml medium.
i = iso. a = anteiso.

TABLE 2

The fatty acid composition of total, neutral and polar lipids of *Conidiobolus heterosporus* grown on basal medium

Acid*	Total	Neutral	Polar
12:0	0.3	1.1	—
13:0	0.2	0.6	—
i14:0	8.7	25.9	1.8
14:0	6.0	17.7	1.2
a15:0	5.8	12.4	3.2
15:0	0.8	0.9	0.7
i16:0	2.1	1.9	2.2
16:0	7.9	9.6	7.6
16:1	2.6	1.5	3.1
16:2	0.7	0.3	0.8
18:0	4.5	13.4	0.8
18:1	20.0	10.6	24.3
18:2	10.2	1.1	13.3
18:3	4.3	1.4	5.6
20.2	2.6	—	3.3
20:4	23.3	2.9	32.4
iso	10.8	27.8	4.0
anteiso	5.8	12.4	3.2

* Fatty acids are listed as the ratio of number of carbon atoms to number of double bonds in the molecule.
i = iso. a = anteiso.

The results also suggest an inverse relationship of branched-chain fatty acid content with octadecenoic acid. In order to investigate this relationship further, therefore, the lipid extract from mycelium grown on the basal medium was fractionated into neutral and polar lipid on a silicic acid column and the respective fatty acid compositions determined (Table 2). The branched-chain acids are located predominantly in the neutral lipid, while the unsaturated acids are predominantly in the polar lipid. These data therefore suggest that the branched-chain fatty acids in *Conidiobolus heteroporus* partially replace, and fulfill a function in the neutral lipid similar to that of octadecenoic acid.—David Tyrrell, Insect Pathology Research Institute, Sault Ste. Marie, Ont.

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