

The Effects of Fumidil B on Spruce Budworm and Its Microsporidial Parasites.—Wilson (Can. Entomol. 106:995-996, 1974) stated that Fumidil B could be used to suppress microsporidia in stock cultures of spruce budworm. This paper describes the effects of Fumidil B on stock cultures of budworm heavily infected with microsporidia.

Second-instar larvae from our laboratory stock, in which every adult was heavily infected with microsporidia, were reared on artificial diet to which the antibiotic, Fumidil B, had been added to give final concentrations of 0 (control), 453, 903, 2,709, and 4,505 ppm. Larvae were reared at 19.5 ± 0.5 C and 16-h photoperiod.

Survival of second-instar larvae to pupae was low at all treatment levels, being highest at the intermediate concentrations of the antibiotic (Table 1). Survival of pupae to adults was also low; male pupae suffered

TABLE 1
Effects of Fumidil B on spruce budworm infected with microsporidia

Observations	Treatment (ppm Fumidil B in diet)				
	0	453	903	2,709	4,505
No. second-instar larvae treated	500	500	500	500	500
No. pupated:					
male	70	106	108	86	68
female	100	95	84	67	54
% larval survival	34.0	40.2	38.4	30.6	24.4
No. adults emerged:					
male	17	29	27	17	12
female	52	35	36	34	18
% pupal survival:					
male	24.3	27.4	25.0	19.8	17.7
female	52.0	36.8	42.9	50.8	33.3
Overall survival, larval to adults*					
male	6.8	11.6	10.8	6.8	4.8
female	20.8	14.0	14.2	13.6	7.2
Days to 50% pupation:					
male	38	38	37	38	41
female	41	40	40	41	45

* Assuming a 1:1 ratio of males and females in the second-instar larvae.

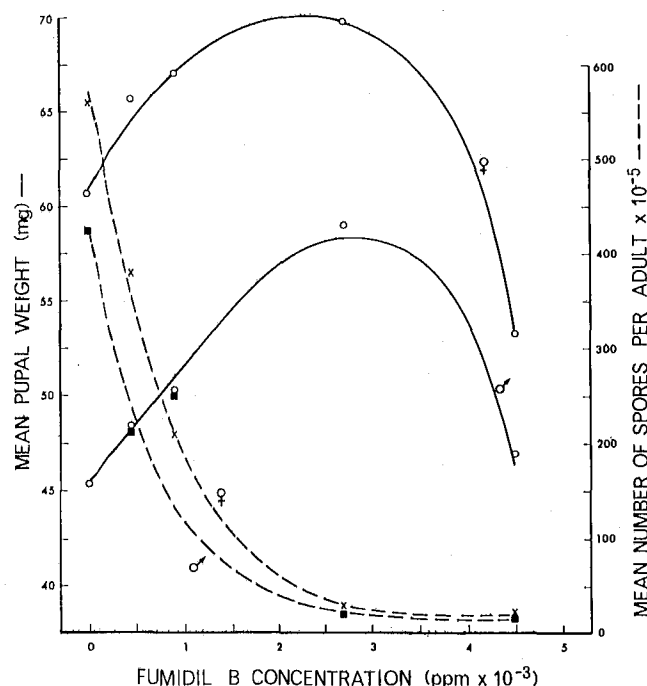


Figure 1. The effect of Fumidil B in larval diet on mean pupal weight and number of microsporidial spores in adult spruce budworm.

greater mortality than female pupae (76.7% vs. 56.2%). Overall survival of larvae to adults showed a difference between the sexes. The two lower concentrations of Fumidil B increased male survival, but at the higher concentrations any benefit to the males by the reduction in the number of microsporidia was apparently negated by toxicity of the antibiotic. The overall survival of females (Table 1) suggests that the antibiotic was more toxic than the microsporidia.

Pupal weights, and presumably fecundity of females, increased with increasing concentrations of Fumidil B up to 2,709 ppm, then decreased (Fig. 1). Spore counts decreased sharply with increasing concentrations of Fumidil B up to 2,709 ppm but showed very little decrease beyond this level (Fig. 1).

These data show results somewhat different from those obtained by Wilson (1974), the differences probably being due to the degree of infection. Wilson's stock was relatively lightly infected (208×10^5 spores/larva, male pupal weight 77 mg, female pupal weight 110 mg), whereas the Maritimes Forest Research Centre stock was heavily infected (525×10^5 spores/adult, male pupal weight 45 mg, female pupal weight 60 mg).

In budworm heavily infected with microsporidia, concentrations of Fumidil B up to 2,500 ppm have a relatively greater effect on the microsporidia than on the budworm, thus allowing increased fecundity of females; at higher concentrations this effect is negated by the increased toxicity of the antibiotic to the budworm.—A.W. Thomas, Maritimes Forest Research Centre, Fredericton, N.B.

Some Parasites and Insect Predators of the Blackheaded Budworm in Newfoundland.—The blackheaded budworm, *Acleris variana* (Fenn.), is native to North America. In Newfoundland it defoliates black spruce, *Picea mariana* (Mill.) B.S.P., balsam fir, *Abies balsamea* (L.) Mill., and white spruce, *P. glauca* (Moench) Voss. Two major outbreaks have been recorded on the Island since 1946 (Miller, Can. Entomol. 98:592-613, 1966). These outbreaks lasted for about 6 years and caused extensive defoliation and some top-killing and tree mortality in localized areas, particularly where stands had been weakened by other insects. The present outbreak started in 1971 and now covers about 163 000 ha (402,000 acres). Some of these stands are also infested by the spruce budworm, *Choristoneura fumiferana* (Clem.).

Studies were initiated in 1973 on the biology and population behavior of the blackheaded budworm and its parasites in Newfoundland. This note presents a list of parasites, reared from the blackheaded budworm in 1973 and 1974, and observations on some of the insect predators noted.

Totals of 1,487 blackheaded budworm larvae and 533 pupae were collected at several locations across the Island in 1973 and 1974 respectively. The larvae and pupae were reared in the laboratory at $21 \pm 2^\circ\text{C}$, 70% R.H. and 12-h photoperiod until the emergence of moths and parasite adults was completed. Parasite larvae that emerged from the host were permitted to pupate, and pupae that did not give rise to adults in the fall were allowed to overwinter, the technique used being that described by Otvos (Can. Entomol. 105:581-582, 1973).

The following parasites were reared from blackheaded budworm larvae and pupae (the parasites and predators being identified by specialists ¹W. R. M. Mason, ²J. R. Barrow, ³D. M. Wood, ⁴L. Masner, ⁵C. M. Yoshimoto, ⁶C. C. Loan and ⁷M. Ivanochko, Entomology Research Institute, Ottawa):

Hymenoptera

Braconidae

- Apanteles* sp. nr. *popularis* group¹
- Capidosoma deceptor* Miller⁵
- Meteorus argyrotaeniae* Johansen¹
- Meteorus trachynotus* Viereck¹
- Microgaster peroneae* Walley¹

Ichneumonidae

- Apechthis ontario* (Cresson)²
- Exochus decoratus scitulus* Provancher²
- Glypta fumiferana* (Viereck)²
- Itoplectis conquistator* (Say)²
- Itoplectis vesca* Townes²

Phaeogenes hariolus (Cresson)⁷
Phytodietus vulgaris (Cresson)²
Phytodietus n. sp.⁶
Prosilomma columbianum (Ashmead)⁴
Mesochorus sp. 1 (hyperparasite)²
Mesochorus sp. 2 (hyperparasite)²

Diptera

Tachinidae

Actia diffidens Curran³
Actia interrupta Curran³
Erynnia tortricis (Coquillett)³

Two of these parasites, *Itopectis conquisitor* and *Meteorus trachynotus*, were introduced into Newfoundland in 1950. However, *M. trachynotus* is probably native, because it was reared from the blackheaded budworm and spruce budworm before its introduction in 1950 (Clark, Otvos and Pardy, Inf. Rep. N-X-96, 1973).

Of the 17 species of primary parasites reared in this study, 10 have been reported from the blackheaded budworm either from Newfoundland (Forbes, Bi-mon. Prog. Rep. 8(2):2, 1952) or from the Maritime Provinces (Miller, Can. Entomol. 98:592-613, 1966). The blackheaded budworm is a new host record for the other seven species: three braconids, *Capidosoma deceptor*, *Meteorus argyrotaeniae*, *Apanteles* sp. nr. *popularis* group; and four ichneumonids, *Apechthis ontario*, *Glypta fumiferana*, *Phytodietus vulgaris* and *Prosilomma columbianum*. *P. columbianum* apparently represents also a first record of the genus *Prosilomma* from Newfoundland.

Total apparent parasitism by all species combined varied from 0.6% to 48% over the 2 years, depending on the location and the time of the collection. The overall percentage parasitism was about 16% in 1973 and 20% in 1974. These are probably an underestimation of the actual parasitism because some of the collections were made before oviposition by the parasites was completed. In 1973 more than half of the parasitism was caused by hymenopterous and the remainder by dipterous species, but in 1974 this ratio was reversed.

Percentage parasitism was not determined for each species because of high mortality of parasites especially in the overwintering pupal stage. The cause of this high mortality is unknown because the same rearing method was very successful when used to overwinter *Winthemia occidentis* Reinh., a parasite of the hemlock looper (Otvos, 1973). Most of the parasites reaching the adult stage in this study were *Actia diffidens* and *Meteorus argyrotaeniae*.

Among the invertebrate predators, two species of ants, *Camponotus herculeanus* L.⁷ and *Formica fusca* L.⁷, have been found regularly in the larval and pupal samples. Both species of ants were frequently observed on trunks of infested trees and carried early instar blackheaded budworm larvae as "booty."

The increasing trend in parasitism, 16% in 1973 and 20% in 1974, suggests that parasites are important in the control of the blackheaded budworm, but their control value cannot be fully assessed before the present outbreak terminates.— Imre S. Otvos, Newfoundland Forest Research Centre, St. John's, Nfld.

PATHOLOGY

Dothichiza Canker of Lombardy Poplar in Newfoundland.— Lombardy poplar, *populus nigra* var. *italica* Muenchh., is a common ornamental tree in Newfoundland. With increasing interest in urban forestry in recent years, this species has attracted considerable attention.

Dothichiza canker, also known as European poplar canker, caused by *Dothichiza populea* Sacc. & Briard [Perfect stage — *Cryptodiaporthe populea* (Fckl.) Butin], is an important disease of poplars, particularly Lombardy poplar. The disease is sporadic but causes serious damage in the United States and eastern Canada, particularly in Ontario, Quebec and New Brunswick (Hubbes, 1967. Pages 42-44 in Davidson and Prentice, eds. Important Forest Insects and Diseases of Mutual Concern to Canada, the United States and Mexico. Dep. For. Rural Dev., Can.). Although dieback and canker symptoms of the disease on ornamental Lombardy poplar have been observed in Newfoundland during the past few years, the first record of

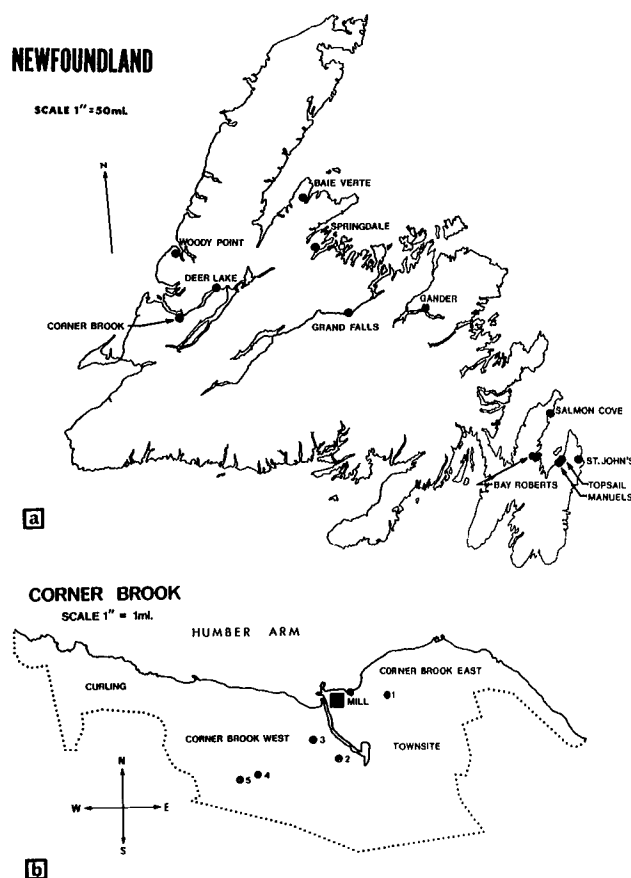


Figure 1. a. Map of Newfoundland showing distribution of *Dothichiza* canker of Lombardy poplar.
b. Map of Corner Brook with five study areas (nos. 1 to 5).

the disease from the Island was made only in 1975 (Forest Insect & Dis. Surv., Annu. Rep. 1975, Nfld. Reg., Dep. Fish. Environ., Can. For. Serv., in press). A preliminary survey was conducted in 1975 and 1976 to determine the status of the disease on the Island. This report describes the distribution, incidence and intensity of the disease and discusses the status of the disease problem.

Ornamental poplars (Lombardy, Carolina and balsam poplars and trembling aspen) in 12 communities throughout the Island were examined for the presence of the disease (Fig. 1a). Detailed investigation on the symptomatology, incidence and intensity of the disease was conducted in Corner Brook because of the greater abundance of Lombardy poplar in the town. Lombardy poplar trees, to a total of 213, in five different areas (42, 40, 41, 45, and 45 trees in areas nos. 1, 2, 3, 4, and 5 respectively) of the town (Fig. 1b, nos. 1 to 5) were examined and the following data were recorded: the number of infected and dead trees, the number of main stems infected and the proportion of the tree crown damaged (with dead leafless branches). Percent infection and percent tree mortality were calculated from the data.

Dothichiza canker was found only on Lombardy poplar and the disease is Island-wide in distribution (Fig. 1a). All stages of the symptoms and signs of the disease were evident except the perfect stage of the causal fungus. The cankers were almost invariably formed at nodes and spread either way. The cankers girdled young branches and stems rapidly and caused pronounced dieback. Rows of trees planted as windbreaks or fences seemed to be particularly susceptible. The data from Corner Brook showed that the incidence and severity of the disease was very high: about 97% of the trees were infected and mortality averaged 38%. Infection varied from 85% to 100% and tree mortality from 3% to 69% in the five areas of Corner Brook. Crown dieback averaged 62%, varying from 13% to 90%. Percentages of