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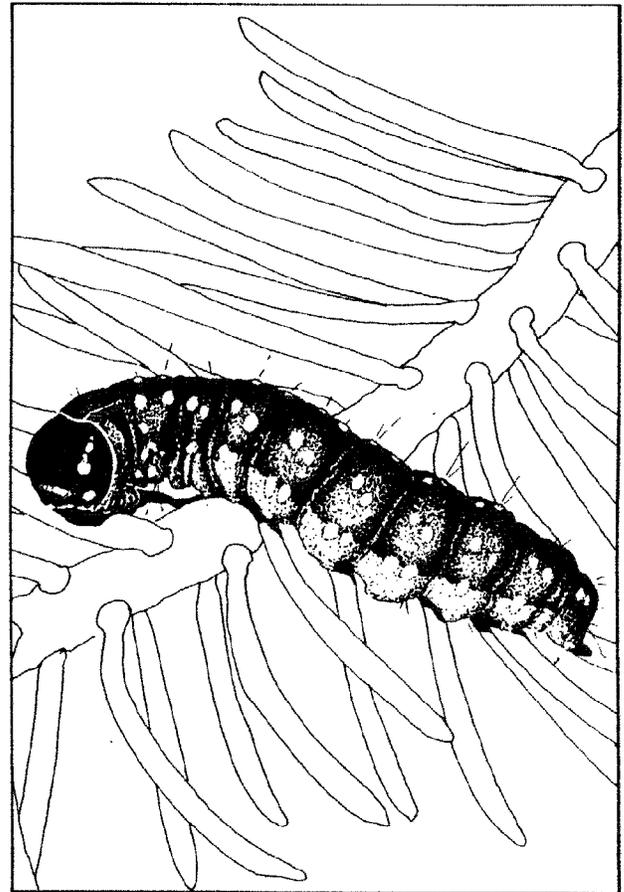
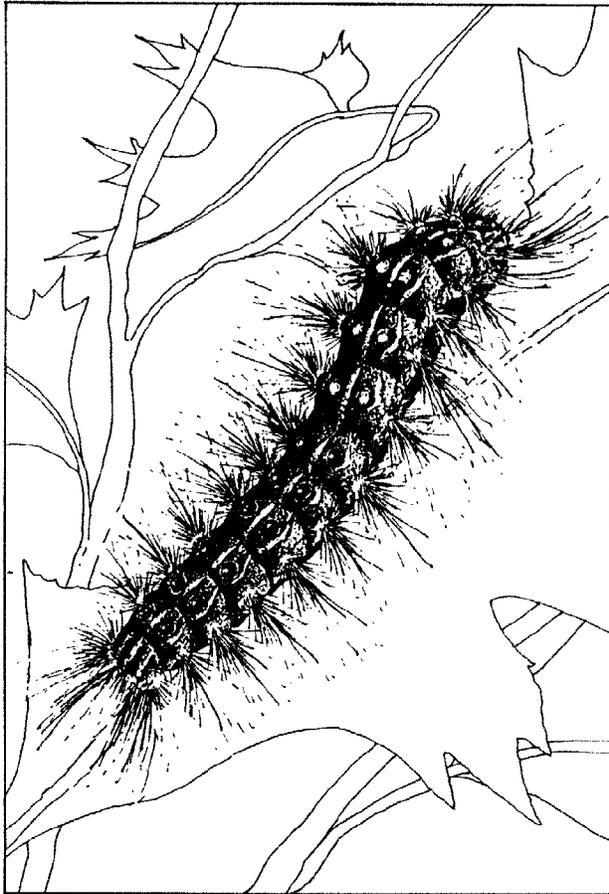
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# Proceedings

## Forest Defoliator - Host Interactions: A Comparison between Gypsy Moth and Spruce Budworms



## FOREWORD

The Canada/U.S. Spruce Budworms Program in cooperation with the Center for Biological Control of Northeastern Forest Insects and Diseases of the Northeastern Forest Experiment Station co-sponsored this Forest Defoliator-Host Interaction Workshop. This invitational workshop was limited to investigators of the spruce budworms and gypsy moth in the Forest Service, Canadian Forestry Service, and the University sector. The primary purpose of this workshop was to foster communication between researchers having a mutual interest and active research projects designed to understand the relationships between the host plant and forest defoliator feeding behavior, growth, and reproduction.

This Workshop was a follow-up to two previous meetings on host-insect interaction. In 1980, Dr. W. Mattson hosted a CANUSA-sponsored meeting at the North Central Forest Experiment Station, St. Paul, MN. This informal gathering brought together CANUSA Program investigators from the US and Canada for the purpose of sharing preliminary information and data on host-insect interactions. The second meeting took place in the fall of 1982. CANUSA(E) sponsored a Symposium on Spruce Budworm-Host Interaction at the Eastern Branch Meeting of the Entomological Society of America, Hartford, CT. The current Workshop developed from this Symposium. We found that participants were raising question concerning the similarity or differences between the spruce budworm and gypsy moth host interaction systems.

These Proceedings resulted from a three-day Workshop held in April 1983 at the Park Plaza Hotel, New Haven, CT. The structure of the Workshop allowed each participant a period for a presentation followed by lengthy discussion. These discussions were lively, friendly technical exchanges clarifying or elaborating on points raised by the speaker. Frequently, these exchanges were thought-provoking and often provided avenues for further detailed discussions and in some cases, future cooperative efforts.

The papers that make up these Proceedings were submitted at the Workshop as camera-ready copy. As a result, the participants did not have the benefit of reappraising their work in light of the discussions that followed their presentations or other ideas that developed at the Workshop.

Since the Workshop was planned late in the life of the CANUSA Program, we asked each investigator to be especially aware of the implications of these interactions on population dynamics of the insect in relation to forest management potential. When possible, we also asked that future research needs and direction be mentioned.

As technical coordinators for this Proceedings, it was our task to arrange and more effectively focus material so that papers provide a smooth transition of ideas and research

activities on insect-host interactions for the spruce budworms and gypsy moth.

Lastly, we would like to acknowledge the support and confidence expressed by the following:

Denver P. Burns, Director, Northeastern Forest Experiment Station

Melvin E. McKnight, Program Leader, CANUSA

William E. Wallner, Director's Representative, Hamden, CT

August 1983      Robert L. Talerico, Broomall, PA

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## COVER SKETCH

Left, gypsy moth larva; right, spruce budworm larva.

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PROCEEDINGS,

forest defoliator--host interactions:

A comparison between gypsy moth and spruce budworms

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New Haven, Connecticut, April 5-7, 1983

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Sponsored jointly by the  
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Northeastern Forest Experiment Station

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CONTENTS

Summary of Life History and Hosts of the Spruce Budworms . . . . .	1
R. L. Talerico	
Gypsy Moth Host Interactions: A Concept of Room and Board . . . . .	5
William E. Wallner	
Selection for Insect Resistance in Forest Trees . . . . .	9
Donald H. DeHayes	
Douglas-fir Progency Testing for Resistance to Western Spruce Budworm . . . . .	15
G. I. McDonald	
A Technique to Study Phenological Interactions between Douglas-Fir Buds and Emerging Second Instar Western Spruce Budworm . . . . .	17
Roy F. Shepherd	
Western Larch as a Host of the Western Spruce Budworm: A Comparison of Caged Larvae on Susceptible Conifers . . . . .	21
Roy C. Beckwith	
Spruce Budworm and Energy Metabolism . . . . .	25
Thakor R. Patel	
Comparisons of Elemental Profiles of the Western Spruce Budworm Reared on Three Host Foliages and Artificial Medium . . . . .	33
John A. McLean, P. Laks, and T. L. Shore	
Chemical Basis of Host Plant Selection by Eastern Spruce Budworm, <u>Choristoneura fumiferana</u> Clem. (Lepidoptera: Tortricidae) . . . . .	41
P. J. Albert and S. Parisella	
The Quest for Antifeedants for the Spruce Budworm ( <u>Choristoneura fumiferana</u> (Clem.)) . . . . .	45
M. D. Bentley, D. E. Leonard, and G. M. Strunz	
Foliage Consumption by 6th-Instar Spruce Budworm Larvae, <u>Choristoneura fumiferana</u> (Clem.), Feeding on Balsam Fir and White Spruce . . . . .	47
A. W. Thomas	
Western Spruce Budworm Consumption - Effects of Host Species and Foliage Chemistry . . . . .	49
Michael R. Wagner and Elizabeth A. Blake	
Spruce Budworm ( <u>Choristoneura fumiferana</u> ) Performance in Relation to Foliar Chemistry of its Host Plants . . . . .	55
William John Mattson, Scott S. Slocum, and C. Noah Koller	
Leaf Quality and the Host Preferences of Gypsy Moth in the Northern Deciduous Forest . . . . .	67
Martin J. Lechowicz	
Changes in Tree Quality in Response to Defoliation . . . . .	83
Jack C. Schultz and Ian T. Baldwin	
Effect of Fertilization on Western Spruce Budworm Feeding in Young Western Larch Stands . . . . .	87
Wyman C. Schmidt and David G. Fellin	
Spruce Budworm Fecundity and Foliar Chemistry: Influence of Site . . . . .	97
M. D. C. Schmitt, M. M. Czapowskyj, D. C. Allen, E. H. White, and M. E. Montgomery	
The Influence of Herbivory on the net rate of Increase of Gypsy Moth Abundance: A Modeling Analysis . . . . .	105
Harry T. Valentine	
Foliage Quality and its Effect on Budworm Populations: A Modeller's Viewpoint . . . . .	113
Richard A. Fleming	

Characteristics of Stands Susceptible and Resistant to Gypsy Moth Defoliation . . . . . 125  
David R. Houston

Management Implications of Interactions between the Spruce Budworm and Spruce-Fir Stands . . . . . 127  
John A. Witter, Ann M. Lynch, and Bruce A. Montgomery

Biomass and Nitrogen Budgets During Larval Development of Lymantria dispar and  
Choristoneura fumiferana: Allometric Relationships . . . . . 133  
Michael E. Montgomery

Summary Remarks . . . . . 141  
M. E. Montgomery

DOUGLAS-FIR PROGENY TESTING FOR RESISTANCE TO  
WESTERN SPRUCE BUDWORM

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Ample evidence exists that inland populations of Douglas-fir suffer varying amounts of defoliation by western spruce budworm (Johnson and Denton 1975; Williams 1967; McDonald 1981). Such variation in plant insect association can be the result of the plant escaping attack in time and place to actual confrontation between plant and insect (Harris 1980). Co-evolved genetic interaction between insect and plant is usually involved in initiation and preservation of plant polymorphisms, whether they be morphological or chemical responses (Gilbert 1982; Berenbaum 1983). Since western spruce budworm (*Choristoneura occidentalis* Freeman) is a native insect, there are three reasons for wanting to know more about the genetic nature of the Douglas-fir-budworm interaction. First, genetic interaction may hold the key to understanding budworm population release and crash (Lorimer 1982). Second, a co-evolved and dynamically balanced genetic interaction may be keeping damage to levels biologically tolerable to Douglas-fir, which, if preserved, will provide the foundation for additional silvicultural and chemical controls (Browning 1980). The third reason is the possibility of actively breeding for unnatural levels of resistance for use in reforestation (Lamb and Aldwinckle 1980).

All investigations of genetics must begin with some observable difference in the target populations. Budworm feeding differences are readily apparent in western conifer populations (Williams 1967; McDonald 1981). These differences could be caused by factors ranging from asynchronous phenology (Manley and Fowler 1969) to a complex interaction of pheromones, mating, egg oviposition, and larval feeding preference (McDonald 1981). The first step to unlocking these secrets is progeny testing (McDonald 1982). Such tests have shown the presence of independent genetic components for larval feeding (family heritability = 0.43) and oviposition levels (stand differences) on 2-year-old Douglas-fir (McDonald, in press). One must conclude that some level of genetic interaction for one or both of these traits is functioning. More importantly, these traits may be reciprocally related to geographic variation of budworm populations as delineated by Willhite and Stock (1983) and discussed by

McDonald (in press). Such geographic association could materially change seed and breeding zone requirements for inland Douglas-fir.

Since ecological adaptation has a genetic basis in Douglas-fir (Rehfeldt 1979), genotypes were expected to express consistent long-term growth patterns in response to their adapted environments. Patterns of radial stem growth were studied and found to be associated with a tree's ability to accommodate budworm outbreaks. The patterns of radial growth of dead or heavily defoliated Douglas-fir varied greatly, whereas paired, non-defoliated trees showed much more consistent growth patterns from year to year.

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DOUGLAS-FIR PROGENY TESTING FOR RESISTANCE TO  
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