Pteromalidae

Habrocytus sp.

One wasp of this genus was reared from a gall which also yielded *T. bedeguaris* and *Eurytoma* sp. Muesebeck *et al.* (1951) record species of *Habrocytus* as parasites of various galls of the genus *Diplolepis* and Judd (1954, 1959) reared two species of *Habrocytus* from willow and rose galls at London.

Tenthredinidae

Allantus cinctus (L.)

One sawfly emerged from a gall on February 24, 1960, almost two months after the gall was collected. The range of this species includes southern Canada and its host is rose (Muesebeck *et al.*, 1951).

Cleridae

Enoclerus rosmarus Say

One beetle emerged from a gall on February 24, 1960, almost two months after the gall was collected. Knull (1951) reports that clerid beetles usually overwinter in the larval stage, although some species overwinter as pupae or as adults. Knull also records five species of checker beetles that have been recorded from insect galls, including two from cynipid galls.

References

Felt, E. P. 1940. Plant galls and gall makers. Comstock Publishing Co., Ithaca, New York.

Fernald, M. L. 1950. Gray's Manual of Botany. 8th. edition. American Book Co., New York.

Judd, W. W. 1954. *Euura salicis-nodus* (Dalla Torre) (Hymenoptera: Tenthredinidae) and its hymenopterous parasites reared from spindlegalls of willow. *Can. Entomol.* 86: 542-546.

Judd, W. W. 1955. *Phytophaga tumidosae* (Felt) (Diptera : Itonididae) and its hymenopterous parasites reared from the scarred gall of willow. *Can. Entomol.* 87: 241-245.

Judd, W. W. 1959. Hymenoptera reared from the mossy rose gall caused by *Diplolepis rosae* (L.) (Hymenoptera : Cynipidae). *Can. Entomol.* 91: 727-730.

Judd, W. W. 1960. Studies of the Byron Bog in southwestern Ontario. XI. Seasonal distribution of adult insects in the *Chamaedaphnetum calyculatae* association. *Can. Entomol.* 92: 241-251.

Knull, J. N. 1951. The checkered beetles of Ohio (Coleoptera : Cleridae). *Ohio Biol. Surv. Bull., No.* 42.

Muesebeck, C. F. W., K. V. Krombein and H. K. Townes. 1951. Hymenoptera of America north of Mexico – synoptic catalog. *U.S. Dept. Agr. Agric. Monogr. No.* 2.

(Received January 24, 1962)

Dissemination of Viruses Against the Spruce Budworm *Choristoneura fumiferana* (Clemens)[1]

By G. R. Stairs and F. T. Bird

Introduction

The spruce budworm, *Choristoneura fumiferana* (Clemens), is susceptible to a nuclear polyhedrosis virus and to a granulosis virus which may occur as single infections (Bergold 1950, 1951) or as double infections (Bird, 1959). Laboratory studies have shown that relatively heavy concentrations of either virus must be injected or fed to budworm larvae to cause infection and death. In one quantitative study Bergold (1951) estimated that the intralymphal LD50 of the polyhedrosis virus for the budworm is about 5000 times that for the silkworm, *Bombyx mori* L., when each is administered to its natural host. Field tests of the

[1]Contribution No. 34 Insect Pathology Research Institute, Department of Forestry, Sault Ste. Marie, Ontario.

TABLE I
Mortality of Spruce Budworm on artificially infested trees after they were sprayed with polyhedrosis and granulosis viruses in 1959.

	Virus suspensions sprayed on trees*					Unsprayed	
	Polyhedrosis virus		Granulosis virus	Both viruses			
Tree number	1	2	3	4	5	6	7
Number of Budworm on each tree	232	170	149	103	143	280	113
Percentage mortality from:							
Polyhedrosis	1.7	2.9	0	19.4	4.2	0	0
Granulosis	0	0	2.0	3.9	0.7	0	0
Mixed infection	0	0	0	2.9	0	0	0
All diseases	1.7	2.9	2.0	26.2	4.9	0	0

*Trees 1, 2, sprayed with 2.5 litres containing 0.2 mg. of polyhedral protein per ml of water; Tree 3 received 2.5 litres containing 0.2 mg of granulosis protein per ml of water. Trees 4 and 5 received 3.0 litres containing 0.1 mg polyhedral protein per ml of water and an unknown but relatively heavy concentration of granulosis virus.

viruses were made in 1959 and 1960 to determine whether infection and mortality would result from spraying suspensions in infested forests.

Methods

In 1959, a hand sprayer was used to disseminate the viruses on artificially infested trees about ten feet high. The foliage was drenched with 2.5 litres of heavy suspensions of the viruses (Table I). In 1960, naturally infested trees from 10 to 40 feet high were sprayed with a hand sprayer or a mist blower (Micro Hart Model). Virus concentrations were similar to those used in 1959 but the volume of spray supplied was only about 300 ml per tree. The concentrations of

TABLE II
Infection of Spruce Budworm when naturally infested trees were sprayed with polyhedrosis and granulosis viruses in 1960.

Virus suspensions sprayed on trees	Days after spraying							
	14-20		21-30		31-38		39-45	
	Number examined	Percentage diseased	Number examined	Percentage diseased	Number examined	Percentage diseased	Number examined	Percentage diseased
Polyhedrosis (1)	14	28.5	29	17.2	19	31.6	35	5.7
(2)	26	26.9	23	4.7	19	31.6	–	–
Granulosis (1)	15	40.0	12	41.6	12	25.0	13	61.5
(2)	28	17.9	51	21.6	46	10.8	–	–
Mixed (1)	23	4.4	32	12.5	60	5.5	–	–
Controls	142	0.0	93	0.0	118	0.0	136	0.0

(1) Disseminated by hand sprayer
(2) Disseminated by mist blower

https://doi.org/10.4039/Ent94966-9 Published online by Cambridge University Press

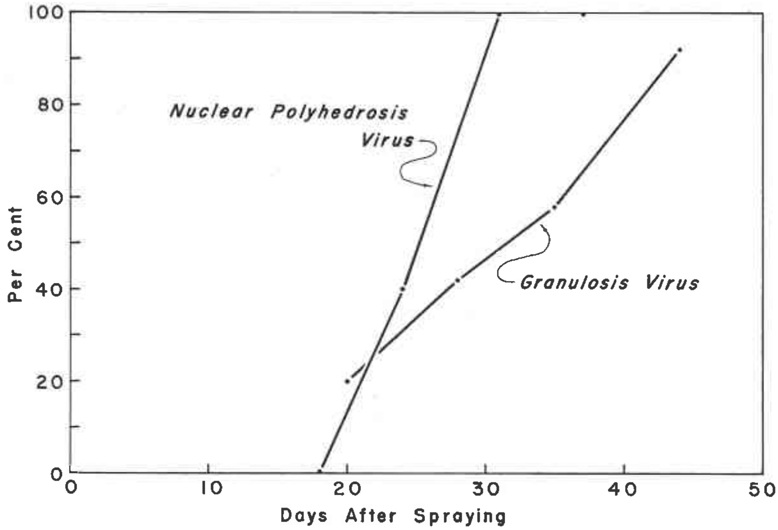

Fig. 1. Relation between infection and mortality of spruce budworm following the application of nuclear polyhedrosis virus and granulosis virus on infested trees in 1960.
Ordinate. Percentage of infected larvae that were dead.
Abscissa. Days after spraying.

the virus suspensions were determined (1) by counting the number of polyhedra per ml of water and (2) by estimating the weight of protein in the suspensions (0.2 mg of protein per ml of water represents about 10,000,000 polyhedra per ml of water).

The viruses were applied when larvae were in the third and fourth instars and the current year's foliage was just beginning to elongate.

The results of the 1959 experiments were determined from the diagnosis of all living and dead larvae. Trays were constructed beneath the trees to catch any larvae that fell and larvae found in the foliage were removed from the trees at the end of the experiment. In 1960, living and dead larvae, found in branch tips taken from the mid-crown of each tree at weekly intervals, were diagnosed.

Results

In 1959, all virus suspensions caused some mortality and there was no mortality from virus among larvae on unsprayed trees (Table I). The greatest mortality (26.2%) occurred on Tree No. 4 which was sprayed with a suspension containing both viruses. Mortality on Tree 5 which was sprayed with the same suspension was only 4.9%. This tree, however, was sprayed one week later than Tree 4.

In 1960, infected larvae were found on all sprayed trees 14 to 20 days after dissemination of the viruses and there was no evidence of disease on any of the unsprayed trees (Table II). The highest incidence of infection (61.5%) was obtained on a group of trees sprayed with the granulosis virus, but the rate of mortality was more rapid among those larvae infected with the polyhedrosis virus (Fig. 1).

More infection was obtained in 1960 on the naturally infested trees than in 1959 on the artificially infested trees although the volume of spray applied on similar sized trees in 1960 was much less (300 ml compared with 2500 ml). There are many factors that could be responsible for this result but the one that appears most probable is that larvae on the artificially infested trees did not settle down rapidly and consume food (and the virus) but wandered over the foliage in search of suitable sites.

Conclusions

It has been shown that granulosis and polyhedrosis viruses cause infection and mortality among budworm larvae when sprayed on infested trees. Their practical use in biological control will depend on (1) the development of efficient methods of virus propagation, (2) a knowledge of the most efficient concentrations of viruses to apply, (3) the determination of the stage in the life-cycle of the insect during which they are most vulnerable, and (4) whether, once established, the viruses persist from year to year. In addition, there exists the possibility that viruses in combination with other pathogens will produce an effective spray.

References

Bergold, G. H. 1950. The multiplication of insect viruses as organisms. *Can. J. Res. E.* 28: 5-11.

Bergold, G. H. 1951. The polyhedral disease of the spruce budworm, *Choristoneura fumiferana* (Clemens). *Can. J. Zool.* 29: 17-23.

Bird, F. T. 1959. Polyhedrosis and granulosis viruses causing single and double infections in the spruce budworm, *Choristoneura fumiferana* (Clemens). *J. Insect Path.* 1: 406-430.

(Received 29 January, 1962)

A New Species of *Rhopalosiphum* Koch

By W. R. Richards

Entomology Research Institute, Research Branch
Canada Department of Agriculture, Ottawa, Ontario

The species described herein brings the number of described North American species of *Rhopalosiphum* Koch to thirteen. Only the apterous alienicolae of this species are known and these can be distinguished from the apterous alienicolae of other North American species by means of the key offered below.

Key to Apterous Alienicolae of the North American Species of *Rhopalosiphum* Koch

1. Antenna five-segmented 2
   Antenna six-segmented 7
2. Setae on abdominal terga VI-VIII blunt or weakly capitate .... *fitchii* (Sanderson)
   Setae on abdominal terga VI-VIII normally pointed 3
3. Middle portion of protibia with dorsal setae that are distinctly shorter and more spine-like than those on ventral surface .... *nigrum* Richards
   Middle portion of protibia with setae that are all about the same length and shape 4
4. Abdominal tergum VIII normally with four setae .... *rufiabdominalis* (Sas.)
   Abdominal tergum VIII normally with two setae 5
5. Longest setae on hind tibia about equal to greatest diameter of hind tibia .. *viridis* Richards[1]
   Longest setae on hind tibia distinctly longer than greatest diameter of tibia 6
6. Setae on abdominal terga I-V pointed .... *parvae* (H. and F.)
   Setae on abdominal terga I-V weakly capitate or blunt .... *padiformis*, new species
7. Cornicle strongly swollen on apical half and usually about 0.3 mm. long or longer, not strongly spiculose .... *nymphaeae* (L.)
   Cornicle not strongly swollen on apical half, if 0.3 mm. or longer then strongly spiculose 8
8. Cornicle strongly spiculose, usually about 0.3 mm. or longer .... *enigmae* (H. and F.)
   Cornicle not strongly spiculose, normally less than 0.3 mm. long 9

[1]Apterous alienicolae of *Rhopalosiphum insertum* Walker available for study key out here.