

**PREDATOR STUDIES OF THE
BALSAM WOOLLY APHID IN
BRITISH COLUMBIA, 1968**

by

J. W. E. Harris and A. F. Dawson

**FOREST RESEARCH LABORATORY
VICTORIA, BRITISH COLUMBIA
INTERNAL REPORT BC-11**

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INTRODUCTION

Investigations into biological control of the balsam woolly aphid, begun in 1958, have been reported to 1967, giving information on the infestation and host species, together with details of predator releases and assessment (Harris et al. 1968). Eight species were released in two areas; one of these, Laricobius erichsonii Rosenhauer (Coleoptera: Derodontidae), successfully overwintered for several years on the mainland. Since the above report was published, collections made in 1967 at Thetis Lake Park, Vancouver Island, were identified as Aphidoletes thompsoni Moehn (Diptera: Cecidomyiidae), released there in 1966. Native predators were also investigated but they had not exerted a measurable impact on aphid populations.

In 1967, assessment was confined to Vancouver Island and no releases were made. In 1968, however, predator introductions were resumed on Vancouver Island and the adjacent mainland. Despite lack of success with most previous releases, we felt that further test introductions might be useful. This report describes the releases and the assessment for native and previously released predators during 1968.

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METHODS

Releases

Procedures

Releases were carried out, in general, as in previous years (Harris et al. 1968). Most predators were released free, but some were confined for a time in sleeve cages placed around areas of mass aphid attack on stems (Clark and Brown 1958; Elliott and Powell 1966) to give the newly released predators a better chance for initial establishment and facilitate later checks.

Over 9,000 specimens of five species, imported from Germany, were liberated (Table 1), including 3 beetle and 2 fly species. All but one fly, Leucopis n. sp. nr. melanopus Tanas., had previously been released in B. C. Releases are listed in Appendix I and located on the accompanying map.

On Vancouver Island, Laricobius erichsonii were released on infested grand fir (Abies grandis (Dougl.) Lindl.) at Thetis Lake Park and Francis Park, about 0.7 miles apart. Previously, 712 of this species had been released at Thetis Lake Park, but none were recovered in later years. At nearby Langford, 30 Aphidecta obliterated (Linnaeus) (Coleoptera: Coccinellidae) were caged.

On the mainland, A. obliterated and L. erichsonii were released on amabilis fir (Abies amabilis (Dougl.) Forb.) in the Rainy River Valley on the west side of Howe Sound near Port Mellon, the former at four sites (free-release plus 20-50 caged at each) and the latter only at the lowest elevation site. Laricobius were also released at Witherby Point, two miles south of Port Mellon near the mouth of the Rainy River. The remaining three species were liberated on amabilis fir in the Seymour River Valley near Vancouver. Pullus impexus Mulsant (Coleoptera: Coccinellidae) were released at five sites (about 45 caged). Cre semifania nigrocellulata Czerny (88 caged) and Leucopis n. sp. nr. melanopus (108 caged) (both Diptera: Chamaemyiidae) were released at a single point northeast of the dam.

To minimize problems with local climatic conditions in 1968 releases, we planned to hold shipments received during cold, wet periods until favorable weather occurred or until holding mortality made this undesirable. Since the scattering of small populations of predators was a suspected problem in establishment particularly with Aphidecta obliterated which habitually disperses before overwintering, this species was released at four points in the Rainy River Valley; also, Pullus impexus was released at five points in the Seymour River Valley.

Table 1. Balsam Woolly Aphid Predators Released in
British Columbia, 1968

Predator Species	Month Released	No. of Releases	No. of Insects	
			Mainland	Vancouver Island
<u>Aphidecta</u> <u>obliterata</u> (Linnaeus)	May	2	1,100	30
<u>Cremifania</u> <u>nigrocellulata</u> Czerny	June - July	4	706	0
<u>Laricobius</u> <u>erichsonii</u> Rosenhauer	May	4 ^{1/}	1,837	1,327
<u>Leucopis</u> n. sp. nr. <u>melanopus</u> Tanas.	August - September	3	2,273	0
<u>Pullus</u> <u>impexus</u> Mulsant	June	3	2,079	0
Totals		16	9,322	

^{1/} Two releases on Vancouver Island.

Characteristics of Test Insects

The four predator species previously released, Aphidecta oblitterata, Cremifania nigrocellulata, Laricobius erichsonii and Pullus impexus, have been described (Harris et al. 1968).

Leucopis n. sp. nr. melanopus is native to Europe and Turkey where it is an active predator in mass stem- and twig-attack populations of the aphid (Eichhorn 1968). There is one generation per year, overwintering as adults on the stem or as pupae in the litter. Adults fly early in the spring and oviposit in April. Larvae are well synchronized with the hiemosistenes generation of the host, feeding from May to June on all stages except the dormants.

Assessment

Methods of assessment have been described (Harris et al. 1968). Four grand fir on Vancouver Island at Thetis Lake Park and five amabilis fir in the Seymour River Valley were examined for the predator species released prior to 1968 (Table 2). Glass-pane flight traps were not used in 1968 as they had not caught many insects, but direct observations of infested bark were made, and funnel-traps, corrugated cardboard bands and sticky "Tanglefoot" coated cards were used at some or all of the sites. In addition to the above trees, others on which predators were released in 1968 (Appendix I) were examined by direct observations and by using cardboard bands.

Table 2. Examinations for Predators of the Balsam Woolly Aphid, British Columbia, 1968^{1/}

Locality	Dist. from Release Point (miles)	No. of Trees	Period Examined
Vancouver Island			
Thetis Lake Park	0.0 to 0.6	4	March - October
Mainland			
Seymour River Spur 4	2.5	2	June - September
Seymour Lake NE of dam	6.5	3	June - September
Totals		9	

^{1/} Examinations made approximately every 2 to 4 weeks.

RESULTS

Ocular examination of aphid-infested bark was the best method of determining the presence of predators and observing their activities. Traps, especially funnel-traps, aided in determining numbers of predators and in catching those less easily observed. Corrugated cardboard bands trapped predators which pupated on the bark, predominantly syrphids, hemerobiids and coccinellids. Tanglefoot cards were not useful as they trapped mostly Apterygota.

Native Predators

As in previous years native predators did not seem to be important in reducing aphid populations. Again the most common predator was the large, red mite, Allothrombium mitchelli Davis (Acarina: Trombidiidae), prevalent in spring and early summer on moss-covered trees. The most abundant insect predators were syrphids and hemerobiids, larvae being commonly observed and pupae often collected in the corrugated cardboard bands. Ichneumonid and chalcid parasites were occasionally collected from both insect groups. Table 3 lists the more important native predators collected or observed. Less important predators collected in 1968, and some collected in 1966 but identified since the previous report (Harris et al. 1968), are listed in Appendix II.

Released Predators

No sign of predators released before 1968 was detected this year. Assessment trees set up in the Seymour River Valley at Spur 4 and northeast of the dam failed to show Laricobius larvae and adults which had been found in these areas in 1966. The infestation had declined at the original release area on Mt. Seymour and no stem-attack trees were found for use in assessment. At Thetis Lake Park, where over 18,000 Pullus impexus had been released in 1966, a principal spring predator was a similar closely related, native species, Scymnus phelpsii Cresson, but Pullus were not found. Some collections made in 1968 appeared similar to Aphidoletes thompsoni, released in 1966, but these identifications have not been confirmed.

All trees on which predators were released in 1968 were checked for initial establishment and assessed for native predators (Table 4). All stages of Aphidecta obliterated were observed. Eggs of this species were noticed in mid-June at Langford and Rainy River. Larvae were seen during July and pupae in late July and early August. Adults were observed from the release date until mid-August.

Table 3. Native Predators and Suspected Predators of the Balsam Woolly
Aphid Found on Stem-attacked Trees, British Columbia, 1968

Name	Remarks	Locality	Relative Abundance
Acarina			
<u>Allothrombium mitchelli</u> Davis (Trombidiidae)	Larvae and adults predaceous	All areas	Very abundant on mainland, common on V.I.; several to several hundred per tree.
<u>Anystis</u> sp. (Anystidae)	Predaceous	All areas	Frequently from 1-20 adults per tree.
Bdellidae - species not identified	Possibly predaceous	All areas	Frequently from 1-20 adults per tree.
Neuroptera			
<u>Agulla adnixa</u> Hag. (Rhaphidiidae)	Larvae predaceous	Thetis Lake Park	Two adults and 20 larvae collected.
<u>Hemerobius</u> sp. (Hemerobiidae)	Larvae predaceous	All areas	Pupae commonly collected in cardboard bands and reared to adults. Larvae rarer.
Diptera			
Syrphidae - species not identified	Larvae predaceous	All areas	Larvae and pupae extremely common, 20 adults collected, many reared from pupae.
Coleoptera			
<u>Scymnus phelpsi</u> Cresson (Coccinellidae)	Predaceous	Thetis Lake Park	Several adults collected, 55+ larvae observed.

Table 4. Introduced Predators Observed or Recovered Following Release, British Columbia, 1968

Species	Location	Number Observed or Recovered			
		Egg	Larva	Pupa	Adult
<u>Aphidecta obliterata</u>	Langford	8	16+	4	5
	Rainy River	18	13	2	53
<u>Cremifania nigrocellulata</u>	Seymour Lake	-	-	1	1
<u>Laricobius erichsonii</u>	Thetis Lake Park	-	4	-	4
	Francis Park	-	6	-	-
	Witherby Point	-	4	-	10
	Rainy River	-	7	-	2
<u>Pullus impexus</u>	Seymour Lake	-	-	-	4
	Seymour River	-	-	-	35

Laricobius erichsonii larvae were observed at Thetis Lake Park, Francis Park, Rainy River and Witherby Point in mid-June. Adults were found until early August. Adults of Pullus impexus were observed from July to September, and one puparium of Cremifania nigrocellulata was collected in August.

DISCUSSION

Biological control is the ideal solution for a pest such as the balsam woolly aphid, which is difficult to control by other means. Successful establishment of candidate predators depends both on characteristics of the released species and on conditions at the release area. Introductions to date have been largely disappointing, but it is still possible that already tested species under different conditions, or new species, might be more successful.

The reason for establishment in previous years of only Laricobius erichsonii and Aphidoletes thompsoni is not known; better results were experienced in other areas of North America. There may have been adverse local conditions at the time of release, too few predators dispersing over too wide an area for re-establishment (particularly after overwintering) or subsequent too low aphid populations.

The only species tested for the first time in 1968, Leucopis sp., has not been tested thoroughly in other regions but was considered by observers in Europe to be worthy of trial.

Establishment of some 1968 releases may be accomplished. Most shipments this year were received when releases could be made immediately under favorable weather conditions. The fact that four of the five species were observed occasionally after release indicated that they were able to become established, at least temporarily. Releases were spread over a number of points to reduce dispersal problems during the overwintering period. On the negative side, however, aphid populations were low, with stem-attacked trees difficult to find, possibly hampering establishment and any increase in predator populations.

Small numbers of four species were caged for observation but only Aphidecta obliterated broods were observed in them. Since overwintering is difficult in small cages, an important point which requires more information, larger cages are advisable to provide overwintering sites.

Because overwintering is a critical period, establishment cannot be even tentatively acknowledged until at least one winter has passed. Observations in 1969 will determine if this summer's work has been at least initially successful.

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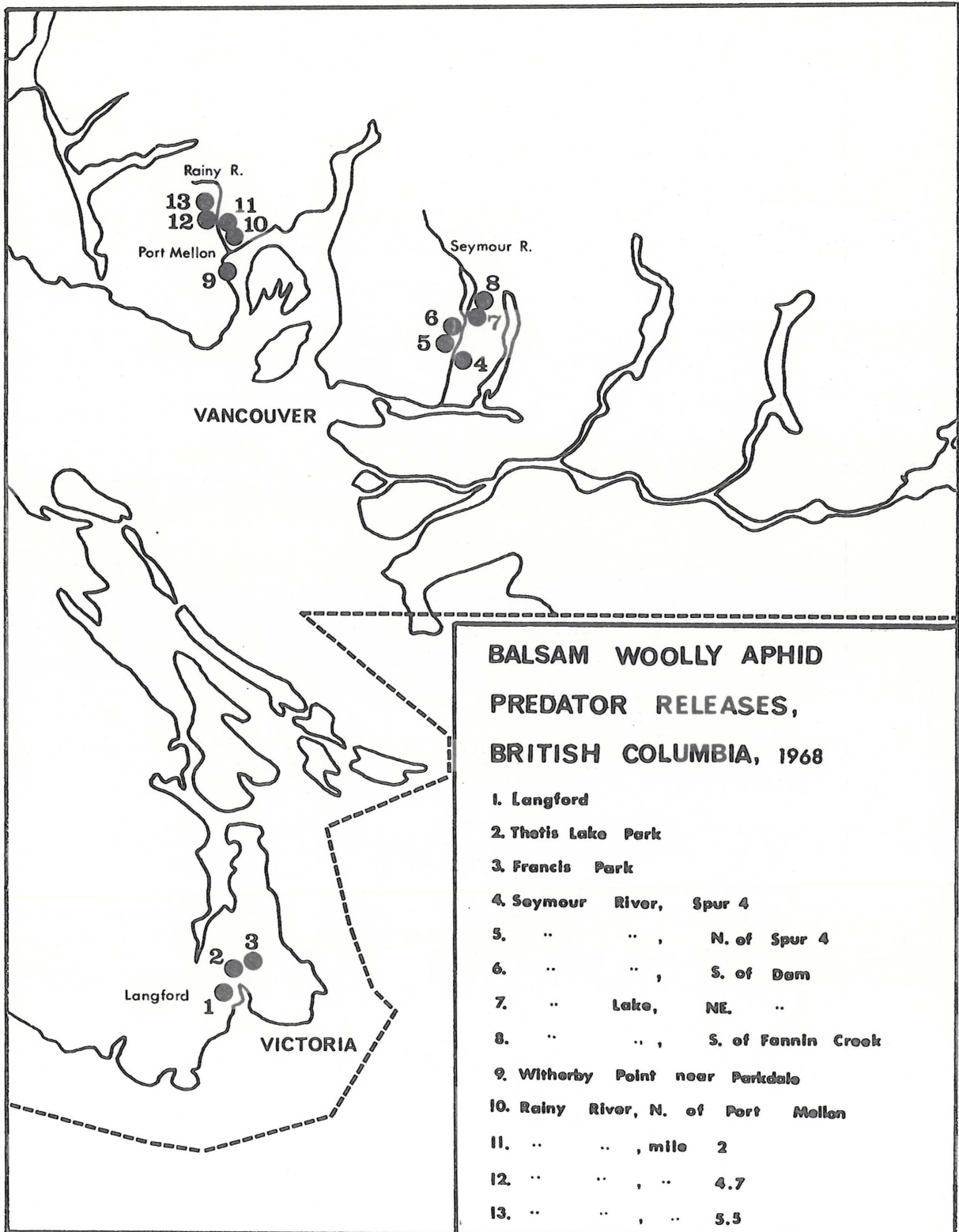
<u>L. erichsonii</u>	2	200 - 300	
<u>L. erichsonii</u>	2	200 - 300	
<u>L. erichsonii</u>	1	1,000	
<u>L. erichsonii</u>	2	400	
<u>L. erichsonii</u>	1	350	
<u>A. colligata</u>	1	900	
<u>A. colligata</u>	1	1,100	
<u>A. colligata</u>	1	1,600	
	29		Total

See map. All sites are on mainland except 1-3, which are on Vancouver Island (V.I.).

Appendix I. Balsam Woolly Aphid Predator Releases Sites,
British Columbia, 1968.

Release Site ^{1/}	Elev. (ft.)	No. of Trees	Species Released
1. Langford, V. I.	250	1	<u>A. obliterata</u>
2. Thetis Lake Park, V. I.	200	1	<u>L. erichsonii</u>
3. Francis Park, V. I.	250	3	<u>L. erichsonii</u>
4. Seymour River, Spur 4	400	1	<u>P. impexus</u>
5. Seymour River, N. of Spur 4	650	1	<u>P. impexus</u>
6. Seymour River, S. of dam	700	1	<u>P. impexus</u>
7. Seymour Lake, NE. of dam	850 - 900	4	<u>L. n. sp. nr. melanopus</u>
	850 - 900	5	<u>C. nigrocellulata</u>
	850 - 900	2	<u>P. impexus</u>
8. Seymour Lake S. of Fannin Creek	1,000	1	<u>P. impexus</u>
9. Witherby Point, nr. Parkdale	400	5	<u>L. erichsonii</u>
10. Rainy River, N. of Port Mellon	350	1	<u>L. erichsonii</u> <u>A. obliterata</u>
11. Rainy River, nr. mi. 2	900	1	<u>A. obliterata</u>
12. Rainy River, nr. mi. 4.7	1,100	1	<u>A. obliterata</u>
13. Rainy River, nr. mi. 5.5	1,600	1	<u>A. obliterata</u>
Total		29	

^{1/} See map. All sites are on mainland except 1-3, which are on Vancouver Island (V.I.).



Appendix II. Miscellaneous Predators and Suspected Predators of the Balsam Woolly Aphid found on Stem-attacked Trees, British Columbia, 1966 and 1968.

Name	Remarks	Locality	Relative abundance
Acarina - species not identified	Possibly predaceous	Thetis Lake Park	Six adults collected in 1968.
Neuroptera - species not identified	Larvae predaceous	All areas	Larvae common in 1968.
Chrysopidae - species not identified	Larvae predaceous	Thetis Lake Park, Witherby Point	One pupa and 1 adult collected in 1968.
Hemerobiidae			
<u>Hemerobius</u> sp.	Larvae predaceous	Mt. Seymour, Seymour Dam, Mt. Fromme	Four adults collected in 1966, larvae abundant.
Hemiptera			
Anthocoridae			
<u>Tetraphleps</u> <u>latipennis</u> Van Dyke	Predaceous	Mt. Seymour, Seymour Dam	Two adults collected in 1966.
Diptera			
Cecidomyiidae - species not identified	Larvae of some species probably predaceous	Mt. Seymour, Seymour River Mt. Fromme	Ten adults collected in 1966.

Appendix II. (Cont'd)

Name	Remarks	Locality	Relative abundance
Coleoptera			
Cantharidae - species not identified	Possibly predaceous	Seymour River	One larva collected in 1966.
<u>Podabrus confraternus</u> Fall	Probably predaceous	Seymour River	Two adults collected in 1966.
<u>Podabrus piniphilus</u> Eschscholtz	Probably predaceous	Mt. Seymour, Seymour River, Mt. Fromme	Seven adults collected in 1966.
<u>Podabrus</u> sp.	Probably predaceous	Mt. Seymour	Three adults collected in 1966.
<u>Silis difficilis</u> Leconte	Probably predaceous	Mt. Seymour	One adult collected in 1966.
<u>Silis</u> sp.	Probably predaceous	Seymour River	One adult collected in 1968.
Carabidae			
<u>Bembidion rusticum</u> Casey	Possibly predaceous	Mt. Seymour	One adult collected in 1966.

Appendix II. (Cont'd)

Name	Remarks	Locality	Relative abundance
<u>Leistus ferruginosus</u> Mannerhiem	Possibly predaceous	Mt. Seymour, Mt. Fromme	Four adults collected in 1966.
<u>Notiophilus sylvaticus</u> Eschscholtz	Possibly predaceous	Mt. Seymour, Seymour Dam	Two adults collected in 1966.
<u>Pterostichus amythystinus</u> Mannerhiem	Possibly predaceous	Mt. Seymour	Two adults collected in 1966.
<u>Scaphinotus angusticollis</u> Mannerhiem	Possibly predaceous	Mt. Seymour	Two adults collected in 1966.
Coccinellidae - species not identified	Probably predaceous	All areas	Several adults collected in 1968.
<u>Chilocorus stigma</u> Say	Probably predaceous	Seymour River	One adult collected in 1966.
<u>Mulsantina picta</u> minor Casey	Probably predaceous	Langford, Thetis Lake Park	Two adults collected in 1968.
Lampyridae			
<u>Ellychnia hatchi</u> Fender	Probably predaceous	Seymour Dam, Seymour River, Rainy River	Five adults collected in 1966, 3 in 1968.

Appendix II. (Cont'd)

Name	Remarks	Locality	Relative abundance
Lycidae			
<u>Dictyopterus hamatus</u> Mannerhiem	Probably predaceous	Mt. Seymour, Seymour Dam, Seymour River	Six adults collected in 1966.
<u>Dictyopterus laetus</u> Motschulsky	Probably predaceous	Mt. Seymour	Three adults collected in 1966.
<u>Dictyopterus</u> <u>simplipipes</u> Mannerhiem	Probably predaceous	Mt. Seymour, Mt. Fromme	Four adults collected in 1966. In 1968 many observed in spring on forest floor at Witherby Point, Rainy River.
Staphylinidae - species not identified	Possibly predaceous	All areas	Thirteen adults collected in 1968.
<u>Amphichroum maculatum</u> Horn	Possibly predaceous	Mt. Seymour, Seymour River, Seymour Dam	Five adults collected in 1966.
<u>Amphichroum maculatum</u> <u>immaculatum</u> Hatch	Possibly predaceous	Mt. Seymour, Seymour River, Seymour Dam, Mt. Fromme	Six adults collected in 1966.
<u>Anthobium subcostatum</u> Makl.	Possibly predaceous	Mt. Seymour	One adult collected in 1966.

Appendix II. (Cont'd)

Name	Remarks	Locality	Relative abundance
<u>Eusphaleum</u> <u>pothos</u> Mannerhiem	Possibly predaceous	Mt. Seymour, Seymour River, Mt. Fromme	Thirteen adults collected in 1966.
<u>Micropeplis</u> <u>brunneus</u> Makl.	Possibly predaceous	Mt. Seymour	One adult collected in 1966.
<u>Micropeplis</u> <u>oregonensis</u> Makl.	Possibly predaceous	Mt. Seymour	One adult collected in 1966.
<u>Quedius</u> sp.	Possibly predaceous	Mt. Seymour, Seymour Dam, Mt. Fromme	Seven adults collected in 1966.
<u>Stenus</u> sp.	Possibly predaceous	Mt. Seymour	Two adults collected in 1966.

