

**NATIVE PARASITES OF THE LARCH CASEBEARER,
COLEOPHORA LARICELLA
(LEPIDOPTERA: COLEOPHORIDAE), IN THE WEST
KOOTENAY AREA OF BRITISH COLUMBIA**

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ABSTRACT

Thirty-two species of parasites and hyperparasites were reared in 1973 from a total of almost 103,000 larch casebearers. *Coleophora laricella* (Hbn.), collected at eight locations in the West Kootenay area of British Columbia. The two highest casebearer populations were at Fruitvale and Shoreacres, with densities of 150 and 130 cases per 100 fascicles respectively. The highest incidence of parasitism was 17.7% at Rossland, where the host density was just under 100 cases per 100 fascicles. The *Dicladocerus* spp. complex comprised 40.7% of the total parasitism and was most abundant at Rossland, Arrow Creek, Christina Lake, Sheep's Creek, and Yahk; *Spilchalcis albifrons* (Walsh) comprised 23.6% of the total and was the most abundant parasite at Shoreacres, Christina Lake, and Fruitvale; and *Bracon pygmaeus* (Prov.) comprised 6.8% of the total and was the most abundant parasite at Anarchist Summit.

Introduction

The larch casebearer, *Coleophora laricella* (Hbn.) (Lepidoptera: Coleophoridae), was first discovered in western North America on western larch, *Larix occidentalis* Nutt. at St. Maries, Idaho, in 1957 (Denton 1958). It apparently entered southeastern British Columbia before 1966 and by 1973 extended along the international border from Anarchist Summit east to Roosville, and north to the Cranbrook, Lardeau, and Nelson areas. Its range seems to have been relatively stable in British Columbia since 1968.

Little is known of the native parasites of the larch casebearer in western North America. Bousfield and Lood (1973) listed 20 species of parasites and hyperparasites from Montana, Idaho and Washington; and Denton (1972) found 16 species at Ste. Maries, Idaho, with an aggregate parasitism of 17%. The only report on the impact of individual native parasite species on casebearer populations is by Bousfield and Lood (1970) for Washington, Idaho and Montana. In

British Columbia, Andrews and Geistlinger (1969) reared nine species of parasites and hyperparasites from small numbers of casebearers collected from 1966 to 1968. The total parasitism was 0.69% in 1966, 0.22% in 1967, and 4.0% in 1968.

The objectives of the work reported upon here were to determine the identities and impact of native parasites on the larch casebearer in the West Kootenay area of British Columbia in 1973.

Materials and Methods

Casebearers were collected on May 8-9 (Collection 1), mainly as fourth instar larvae, and on May 23-25 (Collection 2), mainly as pupae. Samples were collected at eight locations: Anarchist Summit, Cascade, Shoreacres, Rossland, Sheep's Creek cut-off (12 miles south of Salmo), Fruitvale, Arrow Creek, and Yahk (Fig 1).

In each collection, 10 to 15 trees were sampled at four to six feet (1.2 to 1.8 m) and at 10 to 12 feet (3.0 to 3.7 m). Five primary branches were taken from the full circumference of the tree at each height. Rearing was done mainly in 1 ft³ (0.283 m³) cages constructed from corrugated

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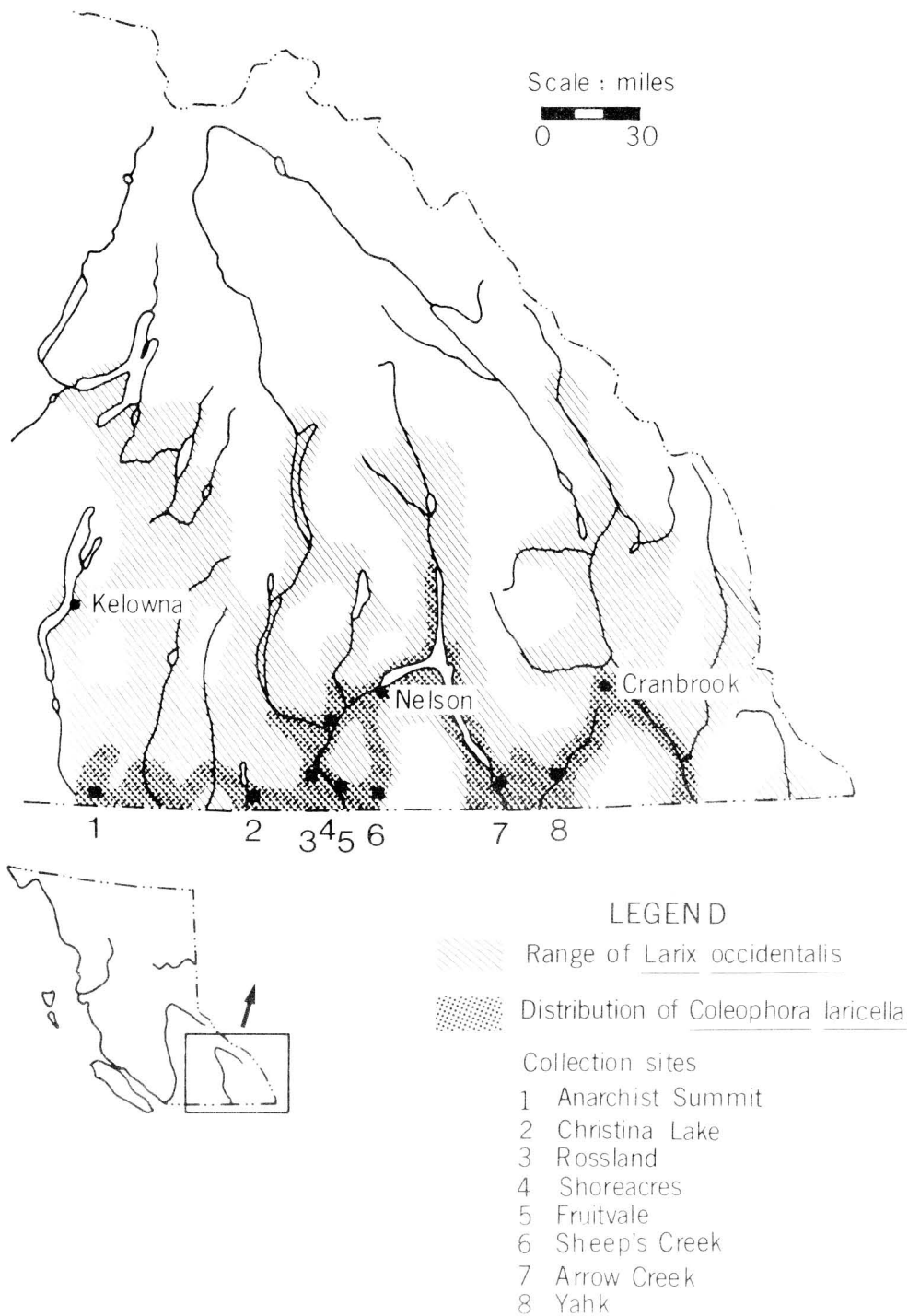


Fig. 1. Distribution of the larch casebearer in British Columbia and location of the eight collecting sites. (Adapted from R. F. Shepherd and D. A. Ross, "Problem analysis: larch casebearer in B.C." Unpublished Internal Report BC-37, Pac. For. Res. Cent., Victoria, B.C., 1973.)

cardboard, one side of which was replaced by fine Dacron mesh. Parasites were collected daily and preserved in 70% ethanol.

The number of fascicles per inch (2.5 cm) of branch was calculated by measuring the length and number of fascicles in 100 branches from each collection. When emergence of moths and parasites had ceased, all the branches were measured and the total numbers of fascicles estimated from the samples.

The number of casebearers in each collection was determined by removing the pupal cases by hand and counting them. Unemerged parasites were detected by immersing the cases in warm 10% KOH for 15 minutes and then examining them under the microscope. Unemerged parasites were not identified to species or genus.

Percentage parasitism was calculated by assuming that only one parasite emerged from each case. This may not be an entirely valid assumption, although Bousfield and Lood (1973) found a low incidence of more than one parasite emerging from a single case.

Results

A total of 102,947 cases were collected and reared, 40,695 in Collection 1, and 62,252 in Collection 2. A total of 4,459 specimens of 32 species of hymenopterous parasites and hyperparasites emerged, 543 from Collection 1 and 3,916 from Collection 2. Sixteen of the species could be named, and the remainder could be named to genus only. The 32 species were composed of 7 Ichneumonidae, 1 Braconidae, 1 Chalcididae, 14 Eulophidae, 4 Pteromalidae, 1 Mymaridae, and 4 Diapriidae. All the parasites from both collections emerged at the same time.

Five of the species have not been recorded previously from the larch

casebearer: *Acrolyta* sp., *Hyposoter* sp. (Ichneumonidae); *Melittobia* sp., *Diglyphus* sp. (Eulophidae); *Cyrtogaster vulgaris* Wlkr. (Pteromalidae); and *Anaphes* sp. (Mymaridae). As only one specimen of each of the first three of these and of *C. vulgaris* was reared, it is possible that these few came from hosts other than the larch casebearer which were accidentally included in the collections. This may also be true for the other two, *Diglyphus* sp. and *Anaphes* sp., although they were present in sufficiently large numbers, 107 and 24 specimens respectively, to suggest that they emerged from the larch casebearer.

The remaining parasite species reared in this work have been recorded on the larch casebearer from various areas in North America. Species that were previously recorded only from eastern North America (Webb 1953) are: *Itopectis vesca* Tow. (Ichneumonidae); *Eulophus* sp., *Euderus cushmani* (Cwfd.), *Elachertus proteoteratis* (How.), *Cirrospilus pictus* (Nees), *Chrysocharis (Kratochvili-ana) laricinellae* (Ratz.) (Eulophidae); *Telenomus* spp. and *Trissolcus* sp. (Diapriidae). Species taken previously in Washington, Idaho, and Montana (Bousfield and Lood 1973; Denton 1972) but representing new records for British Columbia are: *Gelis* sp., *Pristomerus* sp. (Ichneumonidae); *Bracon pygmaeus* Prov. (Braconidae); *Tetrastichus dolosus* Gah., *Achrysocharella* sp., *Zagrammosoma americanum* Gir. (Eulophidae); and *Habrocytus phycidis* Ashm., and *Catolaccus aeneoviridis* (Gir.) (Pteromalidae). Species found previously in both eastern and western North America, including British Columbia (Andrews and Geistlinger 1969; Bousfield and Lood 1973; Denton 1972; Webb 1953) are: *Gelis tenellus*

Parasite Species	Arrow Creek		Anarchist Summit		Christina Lake		Fruitvale		Rossland		Shoreacres		Sheep's Creek		Yahk	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Braconidae Bracon pygmaeus Prov.	8	0.1	5	0.7			2	*	1	*	16	0.2				
Eulophidae ** Diadoceris spp. (3)	1	*	1	0.1	128	2.3	25	0.3	93	4.3	54	0.6	21	0.3	2	3.7
Pteromalidae Mesopolobus sp.							3	*	4	0.2	11	0.1				
Additional species less than 0.1%							18	0.2	48	2.2	39	0.5	12	0.2	1	1.9
Unemerged Parasites	6	0.1	4	0.5	40	0.7										
Totals	15	0.2	10	1.3	168	3.0	48	0.5	146	6.7	120	1.4	33	0.5	3	5.6

*Less than 0.1% **Includes **Diadoceris westwoodii** Westw.

Table I. Numbers and percentages of parasites reared from larch casebearers collected on May 8-9 at eight locations in British Columbia.

(Say) (Ichneumonidae); *Spilochalcis albifrons* (Walsh) (Chalcididae); *Dicladocerus* spp. (including *D. westwoodii* Westw.), and *Tetrastichus ecus* Wlkr. [= *T. xanthops* (Ratz.)] (Eulophidae). *Mesopolobus* sp. [= *Amblymerus* sp.] (Pteromalidae) has been recorded only from the western United States and British Columbia (Andrews and Geistlinger 1969; Bousfield and Lood 1973; Denton 1972). *Scambus decorus* Wly. (Ichneumonidae) was previously recorded on the larch casebearer only in British Columbia (Andrews and Geistlinger).

Seven parasite species were reared from Collection 1 of May 8-9 (Table I). The highest aggregate parasitism was 6.7% at Rossland, followed by 5.6% at Yahk and 3.0% at Christina Lake. Three species of *Dicladocerus*, including *D. westwoodii*, were the most abundant parasites in this collection.

Thirty-two species of parasites, i.e. all the species found in the survey,

were reared from Collection 2 of May 23-25 (Table II). The highest aggregate parasitism of 17.7% occurred at Rossland, followed by Shoreacres with 6.8%, Arrow Creek with 4.0%, Anarchist Summit with 3.4% and Christina Lake with 2.9%. The most abundant species in this collection were the *Dicladocerus* spp. complex, *S. albifrons*, and *B. pygmaeus*.

Species that occurred in percentages less than 0.1% at any of the locations are not included in the tables. They are: *G. tenellus*, *I. vesca*, *Pristomerus* sp., *Hyposoter* sp., *T. dolosus*, *Eulophus* sp., *E. proteoteratis*, *C. pictus*, *C. laricinellae*, *Melittobia* sp., *H. phycidis*, *C. aeneoviridis*, *C. vulgaris*, and three species of *Telenomus*.

G. tenellus, *Acrolyta* sp., *E. cushmani*, *E. proteoteratis*, *C. pictus*, *C. aeneoviridis*, and *C. vulgaris* were reared only from casebearers collected at a height of four to six feet. *Eulophus* sp., *Melittobia* sp., *C. laricinellae*, and *Telenomus* spp. were reared only

Place	Collection Number	Number of Cases	Number of Parasites Reared	Percentage Parasitism	Number of Cases per 100 Fascicles	Number of Parasites per 100 Fascicles
Arrow Creek	1	6,874	15	0.2	72	0.2
	2	7,036	280	4.0	52	2.0
Anarchist Summit	1	767	10	1.3	13	0.2
	2	912	31	3.4	8	0.3
Christina Lake	1	5,596	168	3.0	68	2.1
	2	6,695	194	2.9	54	1.6
Fruitvale	1	9,899	48	0.5	150	0.7
	2	11,867	260	2.2	114	2.5
Rossland	1	2,165	146	6.7	81	5.5
	2	10,442	1,848	17.7	67	14.0
Shoreacres	1	8,546	120	1.4	130	0.1
	2	15,359	1,051	6.8	113	7.8
Sheep's Creek	1	6,794	33	0.5	93	0.5
	2	9,738	248	2.5	68	1.7
Yahk	1	54	3	5.6	1.5	0.08
	2	193	4	2.1	1.0	0.02

Table III. Summary of rearings of larch casebearers collected at eight locations in British Columbia showing the numbers of cases incubated, the numbers and percentages of parasites reared, and the numbers of cases and parasites per 100 fascicles.

Parasite species	Arrow Creek		Anarchist Summit		Christina Lake		Fruitvale		Rossland		Shore-acres		Sheep's Creek		Yahk		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Ichneumonidae																	
Scambus decorus Wly.																	
Gelis sp.	2	0.1					2	*			8	0.1					
Acrolyta sp.							4	*			1	*			2	*	1
Braconidae																	
Bracon pygmaeus Prov.	25	0.4	20	2.2	3	*	8	0.1	16	0.2	178	1.2	22	0.2	1	0.5	
Chalcididae																	
Spilochalcis albifrons (Walsh)	26	0.4			151	2.3	165	1.4	320	3.1	389	2.5	3	*	2	0.5	
Eulophidae																	
**Dicrocerus spp. (3)	121	1.7	1	0.1	13	0.2	9	0.1	1122	10.7	57	0.4	166	1.7	1	0.5	
Tetrastichus ecus Wlkr.	1	*			1	*	1	*	53	0.5	86	0.6					
Achrysocharella sp.									10	0.1	16	0.1	4	*	1	0.5	
Euderus cushmani (Cwfd.)			2	0.2													
Diglyphus sp.					2	*	3	*	56	0.5	43	0.3	3	*			
Zagrammosoma americanum Gir.									10	0.1							
Pteromalidae																	
Mesopolobus sp.	28	0.4			2	*	19	0.2	37	0.4	53	0.3	19	0.2			
Mymaridae																	
Anaphes sp.									24	0.2							
Diapriidae																	
Trissolcus sp.									1	*	9	0.1					
Additional species less than 0.1%	1	*					2	*	16	0.1	22	0.1					
Unemerged Parasites	76	1.1	8	0.9	22	0.3	47	0.4	183	1.8	189	1.2	29	0.3			
Totals	280	4.0	31	3.4	194	2.9	260	2.2	1848	17.7	1051	6.8	248	2.5	4	2.1	

* Less than 0.1% ** Includes **Dicrocerus westwoodii** Westw.

Table II. Numbers and percentages of parasites reared from larch casebearers collected on May 23-25 at eight locations in British Columbia.

from casebearers collected at a height of 10 to 12 feet. Not more than two individuals of any of these 11 species were obtained, except for *C. laricinellae* and *Telenomus* spp. where there were five and six respectively. Because there were not sufficient numbers of any of these species present at either height to have any significance, the collections taken at the two heights were pooled and are reported as single collections in the tables.

The *Di cladocerus* spp. complex comprised 40.7% of the total parasitism. This complex was the most abundant at Rossland, Arrow Creek, Christina Lake, Sheep's Creek, and Yahk. Next in importance was *S. albifrons* which comprised 23.6% of the total parasitism and was the most abundant species at Shoreacres, Christina Lake, and Fruitvale. *B. pygmaeus* comprised 6.8% of the total and was the most abundant parasite at Anarchist Summit. In decreasing importance were *Mesopolobus* sp., comprising 3.9%, *T. ecus* comprising 3.2%, and *Diglyphus* sp. comprising 2.4%. The remaining 24 species accounted for 19.4% of the parasitism. *S. albifrons*, *T. ecus* and *Diglyphus* sp. were reared only from cases collected on May 23-25.

Areas of highest overall host density were Fruitvale and Shoreacres with 150 and 130 cases per 100 fascicles respectively in Collection 1 (Table III). However, the percentage parasitism was highest in both collections at Rossland where host density was 81 and 67 cases per 100 fascicles in Collections 1 and 2 respectively. Calculation of the number of parasites per 100 fascicles indicated that they were most abundant at Rossland with 14.0 and Shoreacres with 7.8, both in Collection 2.

Discussion

Seasonal differences in parasitism were apparent in the two collections. Only seven species emerged from Collection 1 and these represented about 12% of the total parasitism, whereas 32 species emerged from Collection 2, constituting about 88% of the total. Reasons for the relatively low parasitism in early May could be either that the host casebearers were not at the correct stage for attack or that adults of the majority of the parasite species had not yet emerged. There may also have been an accumulation of parasites in the hosts over a period of time because emergence from the two collections took place at the same time.

Differences in parasitism between the various plots cannot be explained on the basis of host density. At Shoreacres and Fruitvale, where casebearer densities were greatest, the aggregate parasitism was 6.8% and 2.2% respectively, whereas at Rossland, where host density was between one-half to two-thirds that of Shoreacres and Fruitvale, the parasitism of 17.7% was highest. At Yahk, where host density was lowest, parasitism in Collection 1 amounted to 5.6% which was the third highest of any of the areas. Because the parasites must have transferred to the larch casebearer from other hosts in the area, the most likely cause of variation in species numbers and densities is the extent of occurrence of alternate hosts at each site.

The presence of *C. laricinellae* at Shoreacres and Rossland is interesting because its origin in British Columbia is unknown. It was imported into the western United States from Austria and England for release as a biological control agent against the larch casebearer in 1972 (Ryan and Denton 1973). However, no releases have been made in British Columbia and the closest release site in the

United States is over 200 miles from the locations where they were taken here. The possible explanations for its presence are discussed by Ryan *et al* (in press).

The previously unrecorded species were probably found in the present survey because of the large numbers of cases reared. Although many of them were present in very small numbers, it is significant that they will attack the larch casebearer, and it is conceivable that under certain conditions of weather and host density that they could become regulatory factors of consequence. *Di cladocerus*

spp., *S. albifrons*, and *B. pygmaeus* probably have the greatest potential for reducing the numbers of larch casebearer because of their wide distribution and greater abundance.

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