NOTES ON THE POPULATION AND PARASITISM OF THE LARCH SAWFLY, PRISTIPHORA ERICHSONII (HTG.) (HYMENOPTERA: TENTHREDINIDAE), IN BRITISH COLUMBIA[1]

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In British Columbia the larch sawfly, *Pristiphora erichsonii* (Htg.), was first reported in 1930 in an area about 30 miles north of Fernie. In 1933 a survey showed that the infestation covered a large area in and around Fernie. Cocoon samples were obtained at that time and were examined at the Forest Insect Laboratory, Vernon, B.C., and at the Dominion Parasite Laboratory, Belleville, Ont. No evidence of parasitism was found, and parasites were released in the infested area. The first colony of parasites, comprising 393 males and 280 females of *Mesoleius aulicus* (Grav.), was released in July, 1934, at Lizard Creek, 2 miles from Fernie.

P. erichsonii spread rapidly north and east following the distribution of western larch, *Larix occidentalis* Nutt., which, in the main, is confined to the southern interior of British Columbia. As parasites became available they were released in the newer areas of infestation to hasten establishment and distribution. Details concerning parasite releases and host distribution were given by Hopping, Leech, and Morgan (1943). At no time has *P. erichsonii* reached outbreak proportions in British Columbia except in isolated areas. The population in each of the heavily infested areas for which there are records became heavily parasitized by *M. aulicus* and subsided without serious injury to the trees.

In 1948 a project was initiated to provide colonies of *M. aulicus* from British Columbia for release in Western Ontario, Manitoba, and Saskatchewan. In that year 105,000 *P. erichsonii* cocoons, heavily parasitized by *M. aulicus*, were obtained. In 1949 one hundred and thirty thousand cocoons were collected. In 1950, after a thorough search of the infested area, only 2,500 cocoons were obtained. The numbers of cocoons collected in the 3 years do not accurately represent the change in population, but there was a reduction in 1950. All available data have been examined to determine the factor or factors responsible for the reduction in host population and its effect on *M. aulicus*.

In 1949 many of the larch trees in the infested area were affected with needle cast, the symptoms of which are a premature yellowing and early dropping of the needles. This caused some larval mortality during the feeding period, but no significant reduction in the number of cocoons collected in the most heavily infested area. It is possible that the viability of the larvae in the cocoons was reduced, but no evidence was obtained to support this theory. Emergence was normal from the 130,000 cocoons collected in October and November, 1949. and stored in an unheated laboratory room over winter, Random samples of cocoons taken from the 1948, 1949, and 1950 collections were dissected; the percentages of dead larvae were 16.5, 7.5, and 12.0, respectively (Table I). There was a decrease of 9.0 per cent. in larval mortality of *P. erichsonii* in 1949 rather than an increase, which would have occurred if needle cast had affected the viability of the larch sawfly larvae.

The winter of 1949-50 was unusually cold and a heavier-than-normal snowfall occurred. Weather records taken at the Grand Forks office of the Canada Department of Transport (14 miles from the infested area) show that the average temperature was below normal during the winter of 1949-50. On May 19, 1950, although much of the infested area was still covered with snow, a collection of cocoons was obtained. It was immediately

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placed in rearing at unheated room temperature (average, 62°F.) in Vancouver. The emergence from this collection was normal; therefore, it must be assumed that the reduction in population of *P. erichsonii* was not caused by winter mortality.

The next factor that was considered was parasitism. An increase in the percentage parasitism could have accounted for the decrease in the *P. erichsonii* population in 1950. However, there was a decrease in parasitism amounting to 6.7 per cent. (Table I).

TABLE I

Larval mortality, and parasitism, of *Pristiphora erichsonii* (Htg.) in British Columbia, 1948, 1949, and 1950.

	1948		1949		1950	
	Number	Per cent.	Number	Per cent	Number	Per cent.
Cocoons dissected	1464	100	536	100	441	100
P. erichsonii larvae dead (causes unknown)	248	16.5	40	7.5	53	12.0
living	1216	68.2	496	92.5	388	88.0
M. aulicus larvae living	829	83.5	305	61.5	213	54.9

Evidently, the mortalities caused by needle cast, winter weather, and parasitism were not responsible, individually or collectively, for the reduction in the population of *P. erichsonii* in 1950.

Finally, the diapause factor was considered. In British Columbia *P. erichsonii* normally completes its life-cycle in 1 year, but in 1950 there was evidence that a portion of the population remained in diapause. In September, 1950, the cocoons were most numerous in the area most heavily infested in 1949; previously, the centre of infestation had changed from year to year and had usually moved in a westerly direction. The cocoons were darker in colour than freshly formed cocoons normally are, and many of them were collected under trees from which cocoons had been taken in 1949. These trees showed fewer signs of larval feeding than would have been expected if the larvae that formed cocoons under them had fed on the 1950 foliage.

The first concrete evidence that some *P. erichsonii* remained in diapause throughout the summer of 1950 was found when the intact cocoons from a laboratory-reared collection were opened in August, 1950. There were 1,181 cocoons in the collection and of these 88, or 7.45 per cent., contained living *P. erichsonii* larvae. This percentage was not large enough to account for the important decrease in *P. erichsonii* population in 1950. During May and June, when normally diapause is broken and pupation occurs, the temperature in the laboratory was considerably higher than in the field. The average temperature in the laboratory was about 62°F.; at Grand Forks, which is about 1500 feet lower in elevation than the area of *P. erichsonii* infestation, the average temperatures during May and June were 51°F. and 61°F. respectively. The higher temperature in the laboratory could have been responsible for a smaller portion of the *P. erichsonii* larvae remaining in diapause in the laboratory than in the field.

TABLE II

Average weights of *P. erichsonii* cocoons in 3 size groups, 1949 and 1950.

Size of cocoons	1949		1950		Weight decrease, mg.
	Number	Average weight, mg.	Number	Average weight, mg.	
Large ($10\frac{3}{4}$ to less than $11\frac{3}{4}$mm.)	145	86.2	113	83.5	2.7
Medium ($9\frac{3}{4}$ to less than $10\frac{3}{4}$mm.)	170	73.6	229	69.2	3.4
Small (8 to less than $9\frac{3}{4}$mm.)	221	55.5	99	50.9	4.6

If a large portion of the *P. erichsonii* larvae did in fact remain in diapause in the cocoons during the summer of 1950, it would be expected that the cocoons collected in the autumn of 1950 would be similar in weight and size to those that were collected in the autumn of 1949. There was no important difference in the weights of cocoons in the two years (Table II). The slight decrease that occurred in 1950 could have been caused by desiccation during the summer of 1950.

However, there was an important difference in the percentages of medium and small cocoons (Table III). There was a large increase in the percentage of medium and a large decrease in the percentage of small cocoons in 1950. This seemed to be irrefutable evidence that the cocoons collected in 1950 could not have been part of the 1949 population as they must have been if the larvae in them had remained in diapause.

TABLE III

Percentages of large, medium, and small cocoons of *P. erichsonii*, 1949 and 1950.

Size of cocoons	1949		1950	
	Number	Per cent.	Number	Per cent
Large	145	27.1	113	25.6
Medium	170	31.7	229	51.9
Small	221	41.2	99	22.4

An explanation for this anomaly was found when the rearing data were examined. The random collection from which the 88 larvae remaining in diapause were dissected was comprised of 1,181 cocoons, and from these 634 adults of *M. aulicus* and 309 adults of *P. erichsonii* were incubated. The numbers of each and the number of *M. aulicus* that remained in diapause are shown in Fig. 1, each plotted point representing the number of specimens for a 5-mg. group; *e.g.*, from cocoons weighing 46 to 50 mg.

4 adults of *P. erichsonii* emerged. It was seen that there was complete emergence from all cocoons that weighed less than 60 mg. and that the insects remained in diapause only in the larger and heavier cocoons. The largest numbers that remained in diapause were in the 75-mg. group. This corresponds closely with 73.6 mg., the average weight of the medium-sized cocoons in 1949 (Table II). If this occurred in the field, it would explain the reduction in the number of small cocoons and the increase in the number of medium-sized cocoons in 1950 (Table III).

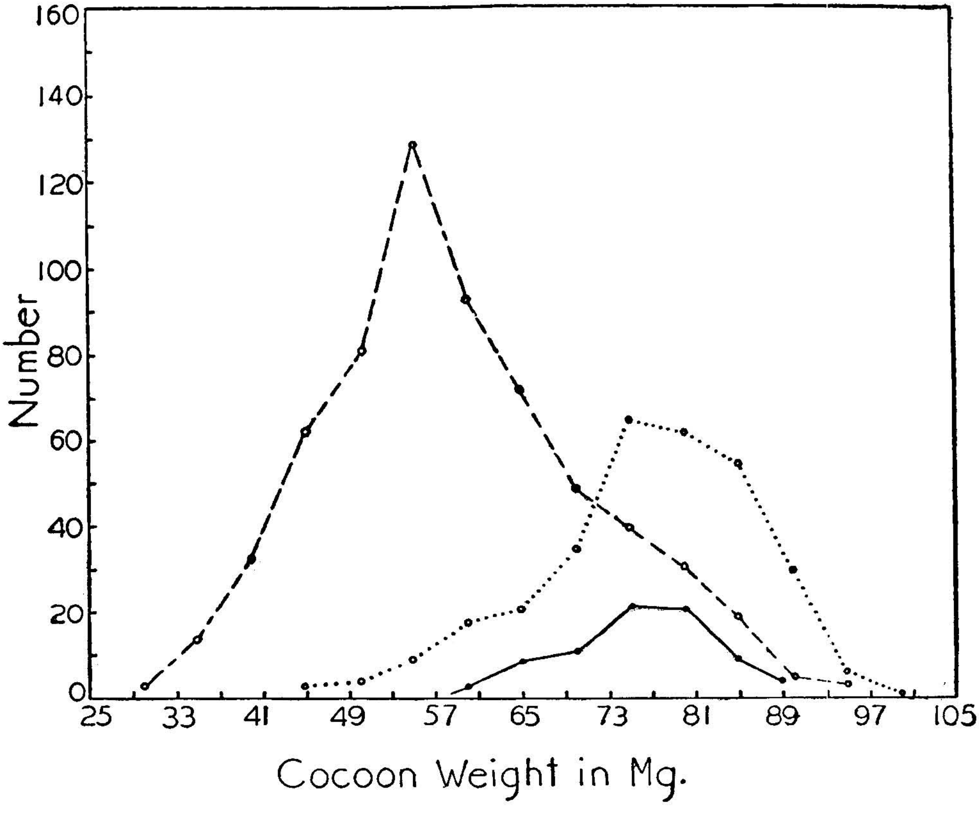

Fig. 1.—Numbers of adults of *Pristiphora erichsonii* (Htg.) (. . . .) and of *Mesoleius aulicus* (Grav.) (- - - -) that emerged, and numbers of larvae of *M. aulicus* remaining in diapause (————), from various weights of cocoons of *P. erichsonii* collected in British Columbia in 1949 and reared in 1950; each plotted point represents the number of specimens for a 5-mg. group, e.g., from cocoons weighing 46 to 50 mg. 4 adults of *P. erichsonii* emerged.

All the information obtained from field observation and laboratory rearing data supports the opinion that the reduction in abundance of *P. erichsonii* in 1950 was caused by a large portion of the population remaining in diapause. There was no evidence that needle cast, winter weather conditions, or parasites were responsible for the unusual population reduction.

Although parasites are not considered to have been responsible for the reduction in the population of *P. erichsonii* in 1950, they are an important control factor. This opinion is supported by the record of percentage parasitism obtained by dissection (Table I) and by the proportion of *M. aulicus* adults that emerged from the random collection of 1,181 cocoons of *P. erichsonii* collected in 1949 and reared in 1950 (Fig. 1). Further evidence of the effectiveness of *M. aulicus* was obtained when the diapause *P. erichsonii* larvae were dissected in August, 1950; 89.8 per cent. of them contained living *M. aulicus* larvae. This showed that the parasite had synchronized its development with that of the host, thus ensuring the continued effectiveness of the parasite.

References

Hopping, G. R., H. B. Leech, and C. V. G. Morgan. 1943. The larch sawfly, *Pristiphora erichsonii* (Hartig), in British Columbia, with special reference to the cocoon parasites *Mesoleius tenthredinis* Morley and *Tritneptis klugii* (Ratzeburg). Sci. Agr. 24: 53-63.

BIOLOGY AND CONTROL OF THE CHERRY CASEBEARER, COLEOPHORA PRUNIELLA CLEMENS, IN BRITISH COLUMBIA[1]

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An outbreak of the cherry casebearer, *Coleophora pruniella* Clem., occurred in two adjacent apple orchards at Creston in the Kootenay Valley in 1947. This is the first record of this species for the Province of British Columbia. The insect was reported causing serious damage to apple at Salem, Oregon, in 1937, by Hsiao and Mote (1939), marking the most westerly record for this species. Known since 1861, when it was described, the cherry casebearer has been a serious pest of both cherry and apple in the United States and Canada during the past 25 years. Petch and Armstrong (1926) recorded that apple orchards in the Lake St. Louis area of Quebec had been heavily infested for several years. These authors were the first to give adequate descriptions of all stages of the insect and an adequate account of the life-history. Petch and Maheux (1930) reported little damage to apple in Quebec from this species, whereas 5 per cent. injury was caused by the cigar casebearer, *Coleophora occidentis* Zell. The latter species, the only casebearer hitherto recorded as having caused damage to orchards in British Columbia, was reported by Treherne (1914, p. 25) to be present in every orchard of the Lower Fraser Valley in 1912-13. Later Glendenning (1923) noted its presence in that valley but not as a serious pest. Hutson (1931, '32) reported the cherry casebearer to be a spectacular pest of cherry in Michigan. Its depredations in orchards were first noted in 1929, although known on wild black cherry from the time of its description.

LOCALITY, VARIETIES OF FRUIT ATTACKED, AND SEVERITY OF INFESTATION

The coleophorid infestation was confined to two adjacent orchards one mile southeast of Creston, at the southern end of the Kootenay Valley. One orchard contained only mature McIntosh apple trees, the other a mixed planting with McIntosh predominating but including Delicious, Jonathan, Winter Banana, and scattered pears and cherries. All fruit varieties were attacked, McIntosh most severely; the heaviest infestation and damage occurred in the orchard with the mixed planting. The difference in severity of damage between the two orchards was due to an application of dormant oil-dinitro orthocresol to the McIntosh planting but not to the mixed planting.

The infestation was first noted in the fall of 1947, when the twigs and fruit spurs were literally covered with overwintering cases. Evidently some damage had occurred in 1947 but had not been reported by the growers. In

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