

NATURAL CONTROL OF THE EUROPEAN PEA MOTH *LASPEYRESIA NIGRICANA* ON SUMAS PRAIRIE, B.C. (Lepidoptera Olethreutidae).

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HISTORY OF AREA INVOLVED. The area now known as Sumas Prairie was a lake before the reclamation scheme, sponsored by the Provincial Department of Agriculture, was completed in the year 1924. This area, approximately ten miles long and four miles wide was at one time covered with water for the greater portion of the year.

When dyking, draining and land clearing operations were completed and agriculture took over, it was soon learned that clover and peas were among the crops which could be grown most successfully on the sandy clay soil of the old lake bed.

INTRODUCTION OF THE PEA MOTH. It became the common practice to use peas as a nurse crop, seeded down with clover, or quite often peas were grown two and three years in succession on the same field. Soon large areas were devoted to pea growing. This procedure proved very suitable for the multiplication of the pea moth, *Laspeyresia nigricana* Stephens, which was apparently present in a nearby pea growing district south of the International Boundary.

By 1933, when 3,000 acres or more were devoted to pea growing in the Sumas area, infestation by the pea moth had become very heavy and severe losses were suffered by the growers.

In 1934, officers of the Agassiz Laboratory began a study of the conditions. According to literature *Laspeyresia nigricana* was accidentally introduced into Canada from Europe sometime before 1893, and became established without any of its natural enemies. Since then it has spread to most of the pea growing areas on this continent. Under conditions similar to those found on Sumas Prairie the pest soon becomes epidemic. By experiments a rotation control was demonstrated to be effective

and practical, but this was not adopted by the growers.

PARASITE INTRODUCTION. Since this pest had several natural enemies in England, a study of the situation there was suggested by the Dominion Parasite Laboratory at Belleville, Ontario. Ewen Cameron of the Imperial Parasite Service made a study of the situation in England during the years 1936-37 and reported that *Ascogaster quadridentatus* Wesm., an egg parasite, was found in as high as 48 per cent of the pea moth larvae and *Glypta haesitator* Grav. and a species of *Angitia*, larval parasites, were attacking as high as 24 per cent. Parasite material was collected in England and sent to Canada from 1936 to 1939, when the outbreak of war caused this work to stop.

Before any imported European material was available the Belleville Laboratory propagated and made three shipments of the parasites, *Ascogaster carpocapsae* Vier. and *Macrocentrus ancylivorus* Roh., which had been reared successfully on the oriental fruit moth, *Laspeyresia molesta* Busck., a close relative of the pea moth. Total liberation of all parasites is shown in Table I.

METHOD OF TRANSPORT. Until 1938 parasites were shipped in refrigerated cages by railway express requiring four days to make the trip from Belleville to Agassiz. Only one shipment was received in which undue mortality had occurred by this method. Time, however, became an important factor, especially with shipments of egg parasite *A. quadridentatus*, as some were received too late to be liberated during the maximum egg laying period of the pea moth, which occurs about the end of June. By using non-refrigerated cages and air express, parasites could be picked up in Vancouver twelve hours after leaving the east, and delivery from Vancouver to Agassiz required an additional twenty hours. This method was used for all shipments made in 1939 without undue mor-

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TABLE I
Liberations of Parasites Made in the Chilliwack and Sumas Areas

Year	Liberations of the North American Species			Liberation Point
	<i>A. carpocapsae</i>	<i>M. ancylicvorus</i>		
1936	1266	1229		Chilliwack and Sumas
1937	50		Sumas
Total	1316	1229		

Year	Liberations of Imported European Species			Liberation Point
	<i>Ascogaster quadridentatus</i>	<i>Glypta haesitator</i>	<i>Angitia sp.</i>	
1937	34	..	14	Sumas
1938	880	735	5	Sumas and Chilliwack
1939	2367	23	44	Chilliwack
1939	2010	662	..	Sumas
1939	124	..	Nicomen Island
Total	5291	1544	63	

tality occurring. In eight shipments mortality varied from 5 to 65 per cent with an average of only 12 per cent. The following table shows the mortality by species.

TABLE II
Mortality of Parasites During Shipment

Species	Range in %	Average %
<i>A. quadridentatus</i>	5-19	10
<i>G. haesitator</i>	19-45	25
<i>Angitia sp.</i>	36-65	57

One shipment of *G. haesitator* was picked up in Vancouver thus saving 20 hours from a total of 32 hours en route. Only 13 per cent of this shipment had died at the time of liberation as compared to the average of 25 per cent in the other shipments of the same species.

RECOVERIES OF PARASITES. Large numbers of pea moth cocoons were collected each year to be used in the cultivation control experiments and some were also sent to Belleville for the purpose of parasite recovery checks. In the cultural experiments cages of cheesecloth were used; constructed over plots of soil twelve feet by three feet, artificially stocked with pea moth cocoons to test the effect of various soil cultivation practices on moth emergence. A check was also kept of the parasites that emerged.

First signs of parasitism were observed in 1938 when one specimen of *Angitia* was taken on June 25 from the experimental cages at Agassiz, in which 10,000 pea moth cocoons were being used in con-

nection with the cultivation control experiments. A second specimen of the same genus was captured in a field on Sumas Prairie in early July. These recoveries were rather surprising as only fourteen individuals of *Angitia* had been liberated the previous year.

In 1939, six specimens of *G. haesitator* and a few doubtful specimens of *Angitia* were obtained from 8,000 cocoons used in the experiments.

In 1940, one specimen of *A. quadridentatus* was obtained from 6,000 cocoons at Agassiz; and from 10,500 cocoons sent to Belleville, 1 *A. quadridentatus*, 4 *G. haesitator* and 92 *Phanerotoma* species emerged. *Phanerotoma* is apparently a native hymenopter which occasionally attacks the pea moth. The record of *A. quadridentatus* and *G. haesitator* was most encouraging as these species are largely responsible for the control of the pea moth in England.

In 1941, 6,000 cocoons at Agassiz, yielded 1 *Glypta haesitator* and 4 *Phanerotoma*, and from 3,360 cocoons sent to Belleville, 1 *G. haesitator* and 5 *Phanerotoma* were obtained.

In 1942, 2,000 cocoons at Agassiz gave 1 *A. quadridentatus*, 2 *G. haesitator* and 3 *Phanerotoma*; and from 3,350 cocoons sent to Belleville, 7 *A. quadridentatus*, 3 *G. haesitator* and 25 *Phanerotoma* emerged.

In 1943 no further cage experiments were carried on at Agassiz, but 4 *A. quad-*

ridentatus and 6 *G. haesitator* emerged from 706 cocoons sent to Belleville.

In 1944, 3,000 cocoons were sent to Belleville and these showed approximately 7 per cent parasitism, an appreciable increase.

During the summer months of 1944, specimens of *Ascogaster* and *Glypta* were occasionally caught in the net when sweeping pea fields and roadside patches of vetch. In the fall 3,800 pea moth cocoons were sent to Belleville and it was reported that 6 per cent of these were parasitized by *A. quadridentatus* and 3 per cent by *G. haesitator*.

In the pea flowering season of 1945 the presence of *A. quadridentatus* was quite noticeable, many specimens being captured in net sweeping in several different pea

might not hold for the entire Sumas Prairie area. Nevertheless the outlook is very favourable. In 1946 it is probable that one of the most destructive insect pests of peas will have been checked by its natural enemies, which were originally imported from England during the years 1937, 1938 and 1939.

We note that no recoveries were made of parasites of the oriental fruit moth, liberated in 1936 and 1937. Apparently the pea moth was not suitable as a host. It is also interesting to note that *Phanerotoma* was not recovered until after 1942.

The foregoing data in tabular form, show the gradual increase in percentage of parasitism.

SUMMARY.—1. The pea moth was introduced into the lower Fraser valley of

TABLE III
Percentage of Parasitism of the Pea Moth on Sumas Prairie

Year	No. of Cocoons	<i>Ascogaster quadridentatus</i>		<i>Glypta haesitator</i>		<i>Angitia species</i>		<i>Phanerotoma species</i>		Total Per cent
		No.	%	No.	%	No.	%	No.	%	
1937	10,000	0	0	0	0	1	.01	0	0	.01
1938	8,000	0	0	6	.07	?	?	0	0	.1
1939	6,000	1	.02	?	0	0	0	0	0	.6
	10,500	1	.01	4	.04	0	0	92	.88	
1940	6,000	0	0	1	.02	0	0	4	.07	.12
	3,360	0	0	1	.03	0	0	5	.14	
1941	2,000	1	.05	2	.1	0	0	3	.15	.76
	3,350	7	.2	3	.09	0	0	25	.74	
1942	706	4	.56	6	.85	0	0	0	0	1.4
1943	3,000	0	0	0	0	0	0	0	0	7.
1944	3,800	0	6.0	0	3.0	0	0	0	0	9.
1945	20,000	0	77.5	0	8.3	0	0	0	0	85.8

fields. A large amount of pea moth material in the form of infested pods was therefore gathered in early August, from which approximately 20,000 pea moth cocoons were obtained and shipped to Belleville in the fall. Dissection of some of this material showed 77.5 per cent and 8.3 per cent parasitism by *A. quadridentatus* and *G. haesitator*, respectively. However, as the material was all obtained, from only one field, this high percentage of parasitism

British Columbia prior to 1933; had become a serious pest by 1934. 2. Commencing in 1936 and continuing until 1939 parasites were imported from England and liberated in the affected area. 3. A steady increase in the percentage of parasitism was observed since 1937. 4. Percentage of parasitism reached 85.5 per cent in 1945; indicating that a control of this important economic pest would be effected by two of its natural enemies.

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