

A FURTHER TRIAL WITH TRICHOGRAMMA.

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In a previous article* an experiment was described in which the egg parasite, *Trichogramma evanescens*, was tested in the field for its efficiency against the Tea Tortrix, *Homona coffearia*. This experiment was repeated early in 1935, the plan and technique being the same as before, except that a unit of 5,000 parasites instead of 1,000 was used. The treatments may be recapitulated as follows, each treatment being duplicated :—

- (1) 5,000 parasites released at centre bush of plot.
- (2) As for (1), but 10,000 released.
- (3) As for (1), but 20,000 released.
- (4) 5,000 parasites released on each of two bushes.
- (5) 5,000 parasites released on centre bush every other day until 20,000 had been liberated.

Parasitised eggs were put out on December 28th, 1934, in the same way as before which proved quite satisfactory, *i.e.*, the eggs were stuck on small manilla labels by means of rubber solution, and the labels were attached to an iron rod passing through the appropriate bush. Emergence was observed to take place two days later.

The tortrix eggmass population was decidedly greater in most of the plots than in the case of the previous experiment, and in all but one of the plots parasites managed to gain a foothold. Figure 1 is a diagram of one of the plots, showing the population of eggmasses at the first examination, figures 2 and 3 showing the same at subsequent examinations.

* Tea Quarterly, Vol. VII, Part I, page 15 *et seq.*

Results in brief of plot 4a.

		Total Eggmasses.	No. of Eggmasses parasitised.
1st Examination,	January 3rd, 1935	205	0
2nd do	January 16th, 1935	313	53
3rd do	February 5th, 1935	10	3

The complete figures for the ten plots are set out in the following table:—

EXAMINATIONS

Plot	1st		2nd		3rd	
	Total Egg- masses	Parasitised Eggmasses	Total Egg- masses	Parasitised Eggmasses	Total Egg- masses	Parasitised Eggmasses
1-a	40	0	28	4	0	0
1-b	32	0	61	1	7	0
2-a	53	0	72	6	1	0
2-b	95	0	77	14	5	4
3-a	92	0	78	17	5	0
3-b	16	0	22	3	1	0
4-a	205	0	313	53	10	3
4-b	10	0	13	0	1	0
5-a	51	0	76	12	2	1
5-b	69	0	34	4	4	1

The decline in the eggmass population as shown in the third examination was so heavy that no further examinations were made.

The first examination was made too soon after the parasites emerged to record any induced parasitism, and was carried out to show roughly how many eggmasses were available at the time, and to find out whether any natural parasitism was present. 205 eggmasses were found in the plot shown diagrammatically in figure 1,

or an average of about one eggmass per bush (there were 210 bushes in the plot), a certain number of which would be too old for successful parasitism. No parasites developed in any of the 210* eggmasses found.

Figure 2 shows that 313 unhatched eggmasses were found on this plot thirteen days later, of which 53 were found to be parasitised. 7 of these were parasitised to an extent of 90% or more, one of them completely so. It is estimated that there were over 2,700 parasites forming the first field generation, which was about one quarter of the number liberated.

Figure 3 represents the state of affairs on February 5th. Only ten unhatched eggmasses were found, and three were parasitised poorly, about 90 parasites in all representing the second field generation. The number of parasites had dwindled, in 37 days, to about one-hundredth of their grand parents.

DISTANCE FLOWN BY TRICHOGRAMMA.

At the second examination on January 16th, a certain number of parasites were found to have established themselves on the outer bushes of the plot. These eggmasses must have been parasitised on or before January 9th, as the time which was found to elapse between parasitism and the blackening of the egg (the sole criterion of parasitism in making counts) at this time was about seven days. As the parasites began to emerge on December 30th, they had a maximum period of 10 days in which to reach the outer plants. Measurements showed that eighteen eggmasses had been parasitised at a distance of eight yards or more from their starting point in this time. As no bushes outside the plots were examined for parasites, it is possible that a greater distance may have been flown than the maximum $12\frac{1}{2}$ yards recorded. During this period the weather was fine, with occasionally slight airs from the N. E. The dispersion of the parasites round the compass, with regard to their starting point was fairly even, as shown below:—

Direction from starting point	Number of parasitised eggmasses
N.	20
N.E.	11
E.	14
S.E.	13
S.	13
S.W.	13
W.	16
N.W.	12

*The parasite, *I. evanescens*, introduced from Europe, can easily be distinguished from the indigenous species, *I. erosicorins*, since the first-named is very dark, while the latter is a pale form.

				2	2	4		1	2			9		
		2		1				2		2		2	1	
	3			1								4	1	
	3		1		2	1	3				4	7	1	
	1		2	2	3	1		2	1	2			1	
	1	1	3	2	2		1	3		2				
	2	1	1	1	3	2		1	2		2			
			1	1					1			1	1	
	4	1	6									2		
4		3						1	1				1	
	1	1	1	2	1	1				1	2			
2		3		1						4	2		2	1
3	3	5	1	2					1	8	1	1	1	3
	1		2	1			2	1	1		3	1		
4		1								1				

Fig. 1.

				01		01	01		01			01	01	
			03	01	04			03		01	01	04	03	
04	01	01		01	01	01		01		01	03	01	01	
	01	01		02		01		01		04	06	04	01	
	01	01	01		01		01	01	02	03	04	03		01
02		01	01			03		03	03	02	07	01		
01		01	02			01			04	03	04	01	03	
		02		02	01	01			01		01	02	02	
	01	01	01		01	01	01			01		01	01	
01	02	01	02		03	02		01		01	01	01	01	
		04		04	01	02			01			01		
	01			02	01				06	02		03		
	01	01	03	01	01			01		04		01		03
	01			03	03		01	02			01	01	01	
06				02					02			04	02	

Fig. 2.

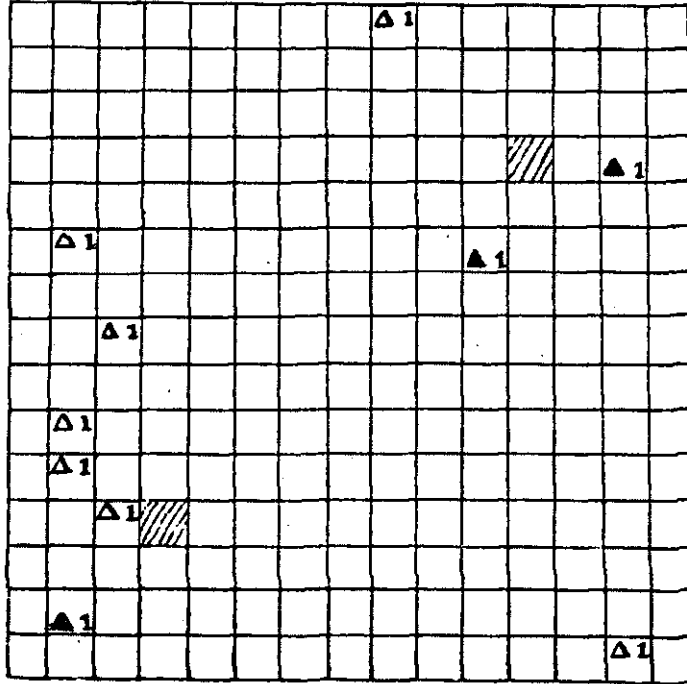


Fig. 3.

Each square represents a bush in a block fifteen bushes square. The shaded areas are those bushes on which 5,000 parasites were released.

Fig. 1.—Numbers refer to eggmasses found at the time of release of the parasites. Total population at this time was 205 eggmasses.

Fig. 2.—Figures indicate number of eggmasses per bush at date of the second examination; \circ represents unparasitised eggmasses, and \bullet parasitised eggmasses. A total of 313 eggmasses was found, of which 51, or 16.3% were parasitised.

Fig. 3.—Numbers as before, the empty triangles representing unparasitised eggmasses, and solid triangles parasitised eggmasses. The total number found was 10, of which 3, or 30% were parasitised.

The experiment again shows that the parasite entirely fails to achieve anything like control. The fundamental reason for this is undoubtedly the fact that the life periods of host and parasite are completely out of step with one another, in addition to the fact that there is practically no overlapping of Tortrix generations, which makes it impossible for the parasite to bridge the gap; and there are no alternative hosts available to it, except perhaps in numbers as rare as, or scarcer than, Tortrix eggs themselves.

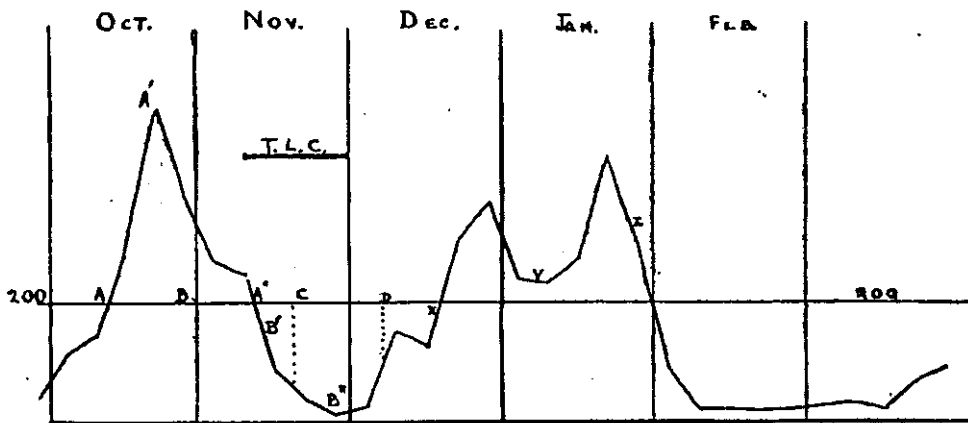


Fig. 4.

T. L. C. = *Trichogramma* Life Cycle.

The life cycle of Tortrix is 9-11 weeks in the field, while that of the parasite is about 16-19 days under similar conditions. The diagram (Fig. 4) shows the variation in the number of eggmasses in a certain area between October, 1932, and April, 1933. A line is drawn through the graph corresponding with a density of 200 eggmasses per acre. We select this figure arbitrarily as being a minimum for the parasite to gain a foothold. Suppose the parasites are put out at A, October 13th, and start parasitising right away; the first parasite of the next generation will come out on November 1, at B, where the number of eggmasses is greater than at the beginning, so that there is a good chance of a further generation. However, the second field generation will only begin at C, about November 19th, when the number of hosts has dropped considerably, and is still falling. Here one must take into consideration the very

small size of the parasite, and its relatively feeble flight. When eggmasses are scarce it has the utmost difficulty in finding hosts and so of propagating itself. The result is that the third generation will be very small indeed, beginning not earlier than December 7th (D), when host supplies are still low. The next Tortrix generation lasts about six weeks, and is totally insufficient for the parasite to reach overwhelming numbers.

Suppose now that the parasite is put out at some later date than October 13th, say the peak period of the Tortrix oviposition, in this case October 25th, A'. It may gain a better foothold than before owing to greater host numbers, but the first field generation begins to come out on the 13th of November, B', when the host numbers are rapidly dropping. The result will be much the same as before.

Let us now assume a liberation on November 10th, A'', when the host numbers are the same as in the first case, but going down instead of going up. The first field generation begins to appear about the 29th, B'', when numbers are again very low, and again owing to the great difficulty of such a small parasite finding a host in the circumstances, the next Tortrix generation begins with an insignificant parasite population to combat it.

We may, therefore, abandon our attempts to deal with the Tortrix in the October generation, and start direct on the next one, which is the largest one of the year; and in our experiments with *Trichogramma*, this is what has been done. Referring again to the graph, if a liberation is made on December 19th, X, the first field generation will begin to come out about January 7th, Y, and the next one not earlier than the 26th, Z. At this period the host population is on the decline, but if everything goes well there might be a large percentage parasitised; yet there would be no control, since the great majority of this Tortrix generation will have escaped.

There are well-marked periods throughout the year when very few eggmasses are laid, and these periods cannot be spanned by the life-cycle of *Trichogramma* because it is too short. No egg

parasite is, therefore, likely to be of value unless its cycle occupies about two months and corresponds roughly with that of the Tortrix. In such a case, the parasite could be liberated at a time most favourable to itself for finding hosts, namely at the peak of the October generation, about the 25th, in the instance chosen, and its subsequent offspring would again find plenty of hosts in the second Tortrix generation

Although the above argument has been based only on the three seasons 1932/33, 1933/34 and 1934/35, there is reason to believe that Tortrix generations occur at about the same times every year, and that such generations are well defined with hardly any overlapping.