THE CONTROL OF TEA TORTRIX BY ITS PARASITE *MACROCENTRUS HOMONAE*

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Tea tortrix (*Homona coffearea*) has at various times been regarded as one of the most important pests of the tea bush. So seriously was the pest regarded in 1928 that it was officially declared a pest and the collection of egg masses was made compulsory in an attempt to control it.

In 1937, speaking on "The Tortrix Problem" at a conference, King [1] stated "For no very clear reason Tortrix as a pest is far less in evidence than it was a few years ago"; from which it seems, particularly as compulsory egg mass collecting was in force at the time, that he had doubts concerning the efficacy of egg mass collecting as a means of control.

In November, 1935, and again in September, 1936, small consignments of a small parasitic wasp, *Macrocentrus homonae*, were received from the Institute of Plant Diseases in Java and liberated in the tea area at St. Coombs. Since then, aided by a few liberations in other districts [2] *Macrocentrus* has spread extensively and is now established in all tea districts of Ceylon as a parasite of tea tortrix. "Owing to the impressive record of *Macrocentrus homonae* in rapid colonisation and ability to deal faithfully with the Tea Tortrix a recommendation was put to the Board of Agriculture to suspend the regulations with regard to the control of Tea Tortrix." [3] This was agreed to and the regulations relating to the collection and destruction of egg masses were duly rescinded on May 12th, 1939.

Tortrix as a pest is still far less in evidence than it was a few years ago. The sceptic may well ask whether the destruction of an unknown number of caterpillars by the parasite *Macrocentrus* is really more efficient in controlling tea tortrix than was the certain destruction of millions of potential caterpillars by the collection of egg masses. What he would not ask for would be the relative costs of the work done by *Macrocentrus* and by the labour force necessary to collect the egg masses at frequent intervals. The latter is self-evident, but proof of the efficacy of the parasite, apart from general observation, is not. The following data may therefore be of interest.

Since the beginning of June, 1935, tortrix caterpillars have been collected at frequent intervals at St. Coombs in order that the extent to which they had been parasitised might be determined The collections were all made by the same assistant, Mr. D. J. William, and at each collection he spent approximately the same amount of time collecting. He did not collect all the caterpillars in a given area, nor all caterpillars from a given number of bushes, as the work was designed to determine the extent of parasitism and not the intensity of attack. But it will be evident that at those times when caterpillars were abundant many would easily be collected whereas at other times there might be the greatest difficulty in collecting any at all. Nor were the collections made at very regular intervals, but when opportunity permitted. The maximum number of collections in any one month was 7 and the mean number per month was 4 over the 6-year period June, 1935, to June, 1941. By dividing the total number of caterpillars collected in any one month by the number of collections made during that month, the mean number of caterpillars per collection for that month is obtained. It is suggested that such mean numbers afford a fair index of the intensity of infestation so long as the time devoted to collection remains fairly constant.

In Fig. 1 are shown the mean monthly collections of caterpillars made over a 6-year period beginning June, 1935, from which it will be evident that in 1935 the number of caterpillars steadily increased from June till December when the peak was reached, and then decreased gradually to a minimum in June, 1936. For the year June, 1936, to June, 1937, the curve follows a similar trend, rising to a peak in February, 1937, and again falling to a minimum about the middle of the year. In the following years the general level of tortrix attack was much lower and pronounced peaks are not evident.

The graph for the two years June, 1935, to June, 1937, is typical of the seasonal history of tea tortrix as ascertained by King [1] from a study of egg mass collection data. He concluded that there were five generations per year, the smallest generation being in June and the largest about January. The drop from the January maximum was attributed to a heavy mortality in the caterpillar stage The data here examined illustrate the same point, viz. that caterpillars are most abundant from December, (1935) to February, (1937) and are at a minimum about the middle of the year, usually June. After June, 1937, the caterpillars never became abundant, rarely exceeding 20 per collection as compared with 97 in December. 1935. The February peak of 1939 is represented by 31 per collection, and the February peak of 1941 by 13 per collection. Whatever the cause may be, it is evident that tea tortrix has been adequately controlled between June, 1937, and June, 1941.

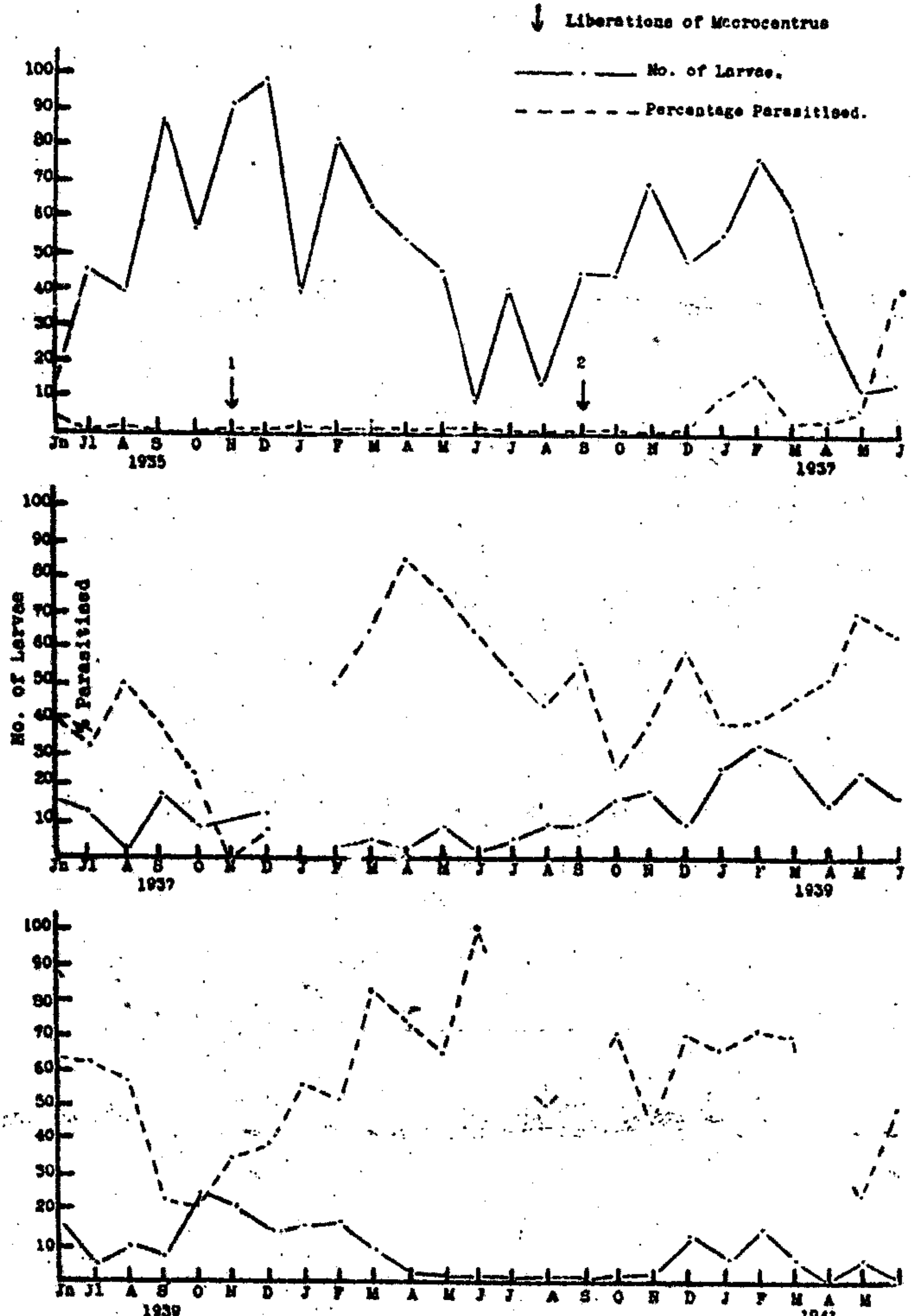

Fig. 1.—Graphs showing the mean number of tea tortrix larvae per collection during each month between June 1935 and June 1941, and the percentage of larvae parasitised by *Macrocentrus homonae*, each month.

As already stated, the real object of these investigations was to follow the activity of the parasite *Macrocentrus* in the field. The number of caterpillars found to be parasitised has been expressed as a percentage of all the caterpillars collected during each month. The results are shown in graph form also in Fig. 1. Until January, 1937, caterpillars parasitised by any parasite were counted, but after that date when *Macrocentrus* began to appear in appreciable numbers, only caterpillars parasitised by that insect were counted as parasitised. It is evident from Fig. 1 that the percentage of caterpillars parasitised by all parasites was negligible until January, 1937, when *Macrocentrus* turned up in appreciable numbers.

Small consignments of *Macrocentrus homonae* were received from Java in November, 1935, and September, 1936, and liberated in the same months. In January, 1936, one out of 152 caterpillars collected was found to be parasitised by *Macrocentrus* but the parasite was not again found till June, 1936, when one out of 45 caterpillars was parasitised. These recoveries must have been descendants of those liberated in November, 1935. In December, 1936, five caterpillars out of 240 were found to be parasitised and after that date *Macrocentrus* was found every month in which caterpillars could be found. No caterpillars could be found in July and September, 1940, and April, 1941. So there are breaks in the percentage 'parasitised' curve of Fig. 1 at those dates.

It is evident from the graphs that the decrease in the tea tortrix population was coincident with the establishment of the parasite, though that does not necessarily prove cause and effect. There are, however, very good grounds for concluding that the establishment of the parasite is the cause, and the decrease in tortrix population the effect.

No tortrix caterpillar parasitised by *Macrocentrus* ever becomes adult, and so able to reproduce its species. A high percentage of parasitism therefore means heavy mortality amongst the tortrix. The fewer tortrix that reach maturity the fewer will be the caterpillars in the next generation. Continued heavy attack by the parasite on the caterpillars must therefore result in a diminution in the caterpillar population. The graphs show that the *Macrocentrus* attack is both heavy and continuous.

A diminution in the number of caterpillars must also result in a decrease in the numbers of the parasite though not necessarily in the percentage of caterpillars parasitised. When caterpillars are few they are difficult to find, not only by the scientific collector but possibly also by the small parasite. We might expect therefore that when caterpillars are scarce, the percentage parasitised would also be low. That however has not proved always to be the case as may be seen for the period April, 1940, to November, 1940, when caterpillars were very scarce. Yet the percentage parasitised was high. That indicates a very high efficiency of the parasite in finding its prey. Such efficiency would tend to cause any increase in the number of caterpillars to be followed by heavier attack from the parasite as every female parasite would have a better chance of finding the host and fewer would fail to raise a brood. From June, 1938, to February, 1939, there was a steady though small increase in the number of caterpillars — a normal seasonal tendency. Following this rise in number came an increasing percentage parasitised from October, 1938, which continued to a maximum in March the following year. The ability of the parasite rapidly to catch up with any increase in the number of the host in this way is an important factor tending towards effective control.

In view of such evidence it becomes apparent that the decrease in the tortrix population having occurred shortly after the establishment of *Macrocentrus* was not mere coincidence but was brought about by the activities of that parasite. *Macrocentrus homonae* has proved itself to be a highly efficient parasite, and the evidence here presented indicates that it is holding the tea tortrix in check very effectively.

REFERENCES

(1). King, C. B. R.—The Tortrix Problem. *Tea Quarterly*, X, 46-53 (1937).
(2). — Annual Report for 1939. *T.R.I. Bull.* 21, p. 38 (1940).
(3). — Tortrix Control, *Tea Quarterly*, XII, 86-91 (1939).