TORTRIX CONTROL

C. B. REDMAN KING, M.A.

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Eleven years ago, as most of you will remember, Tea Tortrix was proclaimed a declared pest by notification, at the instance of a body of planters through the Planters' Association.

The regulations made were as follows:—

1. All egg-masses of Tea Tortrix on tea must be collected and burned within 24 hours of collection.
2. All larvae and pupae of Tea Tortrix on tea must be destroyed.
3. Records of collection of Tea Tortrix by weight or by number of leaves made upon all estates over 10 acres in extent shall be sent to the Department of Agriculture at such intervals not exceeding 3 months as may be required by the Department of Agriculture.

The usual practice has been to carry out collections during plucking rounds, an easy and convenient method fitting in with estate routine, but not very sound. Inquiry into the life-history, and especially into the seasonal history, of the Tortrix was initiated to see if it were possible to improve the method already adopted and recognised. This led to the discovery of 5 regular generations of Tortrix a year, and of a periodic rise and fall in the population in the same space of time. With this information, a scheme was worked out which appeared to be more efficient than the one then in vogue, and it was made the subject of a paper presented at the last conference, two years ago.

But while doing so, the situation even then was changing; and the cause was a parasite introduced from Java.

Seven years ago I had come to the conclusion by a study of available data that there might exist in Java some parasite, not at that time in Ceylon, more effective than any of those indigenous to this Island; which, indeed, were all pretty poor from our point of view. Correspondence on the subject however, came to nought and it was not until 1935 that we were able to get our first consignment of parasites from Java, after the Chairman and Director had established personal touch with the authorities in that country.

In preparation for the reception of the insects, we had chosen the most suitable position on the estate for liberation of some of the parasites, and had prepared a large number of Tortrix-affected branches in cages in the laboratory; in addition to this, a field cage was built round eight tea bushes which had been liberally supplied with Tortrix caterpillars.

As far as breeding was concerned, the parasites kept under observation were a failure, both in the laboratory and in the field cage. The place where the remainder were liberated had but a mild Tortrix attack and after several months of waiting and watching there appeared to be no result; in fact, one cluster of cocoons only was found, all of which were male. It was therefore resolved to try once more, and a further batch of parasites was received in September, 1936, most of which perished in transit. The survivors were released on St. Coombs on a Tortrix-infected area.

It was not till December, 1936, that it was found that the first lot of parasites had, in fact, survived, and were now multiplying at a fair rate. After some further observations it was decided to make a survey to estimate the extent of the region now covered by the parasites. This was accordingly done in February, 1937, just 2 years ago, and it was found that they were spread over about 50 acres round the point of liberation. A similar survey with regard to the second importation was virtually negative.

However, as the year wore on, the parasites increased their spread over St. Coombs, as well as on Cairness next door, and plans were made to start fresh centres of activity. For this purpose it was necessary to discover Tortrix concentrations of sufficient density to give the parasites a good start. As the result of enquiry, small parcels of about 100 or so males and females were liberated on Divagama in Dimbula, and on Bunyan and Queensland in Maskeliya, in October, 1937, 16 months ago. In December of the same year, parasites were put out on Edinburgh and West Holyrood estates. In 1938, Doragalla in Pussellawa, was treated in March; Roeberry

(Madulsima) in August; and Cocogalla (Madulsima) and Theresia (Dickoya) in October. That is the extent to which we started fresh foci, which were of course necessarily conditioned by the presence of sufficient Tortrix caterpillars.

I will not weary you with a list of estates on which *Macrocentrus* has now been found, but I will just mention the number of estates on which it has been discovered in various districts:—

Dimbula	...	12
Maskeliya	...	11
Pussellawa	...	3
Dolosbage	...	1
Pundaluoya	...	1
Kotmale	...	1

This is a crude picture of the situation as it is at present. We are only able to compile such a list from the material sent by estates, most of which on enquiry, reply that they have no Tortrix.

We begin to divine something of what has taken place, however, when we take into account the position of certain estates on which the parasites have been found. Take for instance Dunsinane in Pundaluoya. It is ringed about by high mountains, except towards the north. It is difficult to resist the conclusion that the little wasps flew from Pussellawa, some 6 or 7 miles from the nearest infested estate in that direction. It is highly probable that they were to be found on intervening estates at the same time also. Again, they have been found on Pen-y-lan estate, about 10 miles west of Doragalla, the nearest place on which the parasites were liberated. The intervening country is, one would think, a difficult one for such small insects to traverse in so short a time, intersected as it is with mountains and valleys. I think it fair to assume that *Macrocentrus* could also have been found on estates between the two.

At the present moment we have more information about the Maskeliya Valley than any other district. Parasites were liberated here in October, 1937, and within a year were found in some numbers from Fairlawn at one end to Hapugastenne at the other, and I think it may fairly be said that the parasite is now well established over there.

So much about its distribution for the present. Let us turn for a moment to the insect itself and watch it at work.

Those of you who have seen it will remember that it looks something like a smallish, slender mosquito. The sexes are easily distinguished, for the females are provided with a long straight ovipositor lacking in the male, which sticks out behind, and which is about as long as the body. When she has found a victim (the males having nothing to do with this part of the business) she walks up and down on the outside of the curled leaf in which the caterpillar is lying. Having worked herself up into a sort of frenzy of excitement, she raises her abdomen up and directs the ovipositor between her feet, the intention being to drive it through the leaf into the caterpillar, in which the egg is laid. I have watched this process many times, and I have been struck with the fact that the parasite is an extraordinarily bad shot, repeatedly missing the intended victim. I was particularly impressed by the poor quality of the marksmanship, since the writings of Fabre and others always stressed the deadly accuracy of this class of parasite, relating in great detail how they would select particular segments or spots to lay an egg, or particular nerve ganglia to sting and paralyse, but not to kill.

Well, that is another illusion gone. But, when all is said and done, hit and miss though its methods may be, the parasite is unquestionably extremely efficient.

From the egg stage onwards for some time, the development is shrouded in mystery. All we know is — that a number of grubs, up to about 30 or so line themselves up inside, along the intestine, and feed at the expense of the caterpillar. The latter does not *appear* to be incommoded but carries on as usual, casting its skin at intervals until full grown.

The development of the grubs within, until completed, occupies about a month, and they then pierce the skin of the caterpillar and spin cocoons in which pupation occurs. At this stage, nothing is to be seen of the caterpillar except its head. Now this is the stage which can be recognised in the field — a bundle of brown cocoons, like minute cigars inside the clustered leaf where a caterpillar is wont to be found. In about three weeks after the exit from the caterpillar, the adult insects emerge and the cycle begins once more.

The parasite was named last year by the British Museum as *Macrocentrus homonae*, the second name referring to Tea Tortrix whose official name is *Homona coffearea*. Up till the time of its introduction into Ceylon, 21 different species of parasites were already known but *Macrocentrus* is far better than all of them put together.

After its introduction, it started very slowly, but as time went on it seems to have gathered both speed and momentum. It took fifteen months to spread over 50 acres; by the end of another year it

covered about 1,000 acres; and after a further period of twelve months, bringing it to the present time, it now occupies an area of at least 600 square miles. Its efficiency may be judged from the fact that the rate of parasitism recorded from various places usually varies between 50 and 100 per cent, compared with maxima of 5 per cent of other parasites in pre-*Macrocentrus* days.

The continuous suspicion with which a research worker regards the progress of events tempts one to ask the question: "Where is the snag? Is it going to keep going at the present rate or will it fade away in the future?" We cannot answer these questions at present, but being an imported insect it may perhaps modify its behaviour, owing to differences in environment compared with Java. It has in fact shown tendencies towards modification since its arrival. I have already referred to two of them — one is the increasing rate of development in the open; the other is its ability to breed under artificial conditions which it appeared to be unable to do for a couple of years or so. Both these tendencies have been in the right direction, demonstrating a favourable response to the new environment and so at present the future may be regarded with hope.

There is however a further factor that I must not forget to mention, and that is, the appearance of natural enemies. Just as caterpillars and other pests are mostly kept in check by parasites, so also the latter may themselves be controlled by parasites, or as we call them, hyperparasites. In the last three years we have found four different insects which could be put into this category, three of which might be regarded as more or less accidental. The fourth, however, is completely hyperparasitic. It is found in Java as well as here, but its occurrence on *Macrocentrus* has been so far very rare, and I think that it may continue to be of little importance. However, there remains the possibility of others turning up which may prove to be of more significance.

I think we may assume that *Macrocentrus* will become part of the permanent environment of Tortrix. Now this pest in the past has shown periods of great activity followed by periods of eclipse. We do not know how regular these are, or how long they may be taken to be. For the last 8 or 9 years Tortrix has been on the down grade and, apart from localised areas of small extent, has not given much trouble of late. It may not be long before the opposite tendency sets in, when the great majority of eggs that hatch reach maturity, which at present they don't. If this revival comes suddenly, it may be followed by a regular Tortrix attack, as you have known it before. The population of the parasite is dependent on that of its host, but the latter always retains the initiative, and

therefore it can get away fast, and leave the parasite as it were standing. But with increasing population the parasite also increases apparently at a greater rate, so that presently the pest is caught up and held Broadly speaking, this means that when conditions are favourable for an increase in Tortrix there will be a definite attack, but it is likely to be of lesser degree and of shorter duration than formerly, and it is probable that the tea in the early part of the year will escape much damage. In the near future I do not think it will be necessary to take any artificial counter measures, since control is fully automatic, and better than anything *you* can do.

Macrocentrus has given plenty of evidence of its ability to spread, so that fresh liberations may perhaps not be necessary in the future. It will be realised, after what I have said, that it attacks the caterpillar stage, and so maintains itself in the field. We have had many applications for parasites from various estates without reference to the suitability of conditions on each estate, *i.e.*, the presence of caterpillars. Liberations can only be justified where there is an attack in progress, and the parasite is absent. I would suggest therefore, that any estate which would like assistance in this way should send in a number of caterpillars and leaf in a wooden box *with* their application, so that examination can be made as to the presence or absence of *Macrocentrus*.

That, then, is the position of affairs as it stands at present. I have outlined the control measures as adopted up to now, the history of the spread of this parasite, and its mode of attack. If I add that it seems to know no other hosts except Tortrix, and that even where Tortrix is very difficult to find, half of them may be parasitised by *Macrocentrus*, we have the story more or less complete as we know it at the present time.

In conclusion, we consider the situation to be sufficiently favourable to approach Government with a view to having Tea Tortrix removed from the Pest Ordinance, and if this comes to pass you will be relieved of the obligation to collect and destroy all egg-masses, larvae and pupae, and to send in every quarter, records of such collections.

The Chairman then invited Sir John Russell to review the proceedings of the Conference.