THE INTRODUCTION OF MIRID EGG PREDATORS (*TYTTHUS* spp.) INTO SOUTH AFRICA

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The Miridae, a family of sucking bugs, includes a number of species which feed on the eggs of other insects, and some of them have been used as biological control agents against insect pests of agricultural crops.

One of the most notable, *Tytthus mundulus* (Bredd.) (formerly *Cyrtorhinus mundulus)* has been used successfully in several countries against the sugarcane leafhopper, *Perkinsiella saccharicida* Kirk. *T. mundulus* was first encountered by Muir, an entomologist from Hawaii, who visited Australia in 1919 to collect a wasp parasite, *Drypta sp.*, to be used against *P. saccharicida.* His mission failed, but in Queensland he collected *T. mundulus,* which he introduced successfully into Hawaii, where it showed great promise against *P. saccharicida* (Muir, 1920, 1924; Swezey, 1936). For the next twenty years Hawaiian literature mentions repeatedly the status of *T. mundulus,* which became established as the most successful controlling agent of the leafhopper. It has been used successfully in Fiji against *Perkinsiella vitiensis* Kirk, (Lever, 1945), and was introduced successfully into Mauritius against *P. saccharicida* (Williams, 1957).

Introductions of *Tytthus* have not always been successful, and in Jamaica, where it was introduced against the West Indian canefly, *Saccharosydne saccharivora* (Westw.), it failed to become permanently established, although the alternate host *Peregrinus maidis* (Ashm.), was present.

The canefly and the sugarcane leafhopper are both Delphacids, and it was perhaps optimistic to think that *Tytthus* might be successfully introduced into South Africa against *Numicia viridis* Muir, which is of the unrelated family Tropiduchidae. The experiment was, however, considered worth trying, partly because in pilot experiments small shipments of *Tytthus* from Mauritius were found, in confinement, to eat *Numicia* eggs and even a nymph, and also because we have in South African sugarcane *Perkinsiella insignis* Dist., a close, if at present apparently harmless relative of *P. saccharicida.*

The history of *Tytthus* introductions shows that most success has been achieved where it has been introduced in the egg stage, or as an entire colony (Bianchi, personal communication; Williams, 1957; Muir, 1921). For egg introductions the alternate host *Peregrinus maidis* has been used. Sections of maize or sugarcane tissue containing *Tytthus* eggs were sent to the country of introduction, where the eggs and young nymphs were released as quickly as possible. In Mauritius about 24,000 nymphs, from eggs which hatched on their way from Hawaii, were released. Most of these colonies died out, but they became established at one site where 15,000 were released (Williams, 1957). At this site establishment was rapid, and two years later the insect was noted in places remote from where it had been released. The story for Hawaii was similar, although whole colonies were introduced, and *Tytthus* was actually reared there in the insectary for some time after it had become established in the field.

In South Africa, plant quarantine regulations precluded the introduction of *Tytthus* in the egg stage regardless of the source of supply.

Early consignments from Mauritius, of which there have been several in the last four years, included nymphs and adults. On each occasion regulations have required that these be quarantined in Pretoria, which has resulted in delays and excessive handling of the insects in an uncongenial climate, and only a small proportion of those sent has reached the Experiment Station at Mount Edgecombe in a healthy state. Numbers received have been far too small for successful field release, and the few survivors of later consignments were released on to insectary cultures of *Peregrinus maidis.* These never survived for more than two or three generations, despite careful regulation of temperature and humidity.

In 1968 the Plant Protection Research Institute in Pretoria agreed that if a suitably qualified member of the staff of the Experiment Station at Mount Edgecombe went to Mauritius to collect and dispatch *Tytthus,* he could be responsible there for quarantine formalities. This arrangement had the advantage that consignments would no longer require quarantining *en route,* and could reach Mount Edgecombe undisturbed within eight hours of dispatch from Mauritius. However, additional requirements now were that only adults could be sent, and that no food material could accompany them.

One of us (R.H.G.H.) went to Mauritius in January 1969 and, with the assistance of the chief entomologist, Mauritius Sugar Industry Research Institute, was able to collect, screen and dispatch to Mount Edgecombe nearly 6,000 *Tytthus* adults. In Mauritius there are three similar species, *(T. mundulus, T. parviceps* and *Cyrtorhinus lividipennis),* the adults of which are very similar in appearance, and all three were collected in the field. Although we had been offered all three species by Mauritius and *T. parviceps* had been recommended by the Commonwealth Institute of Biological Control, *T. mundulus* was our main concern since it has been most successful elsewhere. Consequently in the course of laboratory screening for unwanted insects, the other species were rejected.

Five consignments in all were sent to South Africa. In the first two, mortality was high (90% and 70% respectively) and appeared to be due to desiccation. When this was overcome by placing moist cottonwool in the outer containers, mortality was reduced almost to nil. Approximately 3,000 living

specimens were received at Mount Edgecombe, most of which were placed on insectary cultures of *Peregrinus maidis*.

Cultures of field-collected *P. maidis* were established on maize in cages as illustrated in Figure 1. The cultures had to be continuous so that *Peregrinus* and its predator could be reared progressively from one generation to the next. This was done by using cages which could be sub-divided into separate adjacent compartments, each having removable trays of maize plants. Cultures could be started in one compartment and when the plants in it degenerated, fresh ones could be placed in the adjoining compartment and the intervening glass partition removed. The insects would infest the new plants while the older ones degenerated, and there would then be present both young and old material.

Cultures were maintained at temperatures and relative humidities ranging between 25 and 30° Centigrade, and 80 and 100% RH respectively.

Throughout the year successive crops ($\frac{1}{4}$ acre) of infested maize were grown in adjoining fields as a source of fresh *Peregrinus* material for starting or augmenting cultures. When a maize crop was ploughed out, stalks were taken from it and placed in an adjoining field of younger maize, so as to continue the infestation.

Initially chances of survival seemed good. *Tytthus* adults fed readily on the *Peregrinus* eggs provided, eggs were laid and nymphs hatched out. It was at this stage that it became apparent that more than one species were present, for some nymphs were green, whereas *T. mundulus* nymphs are red. The green nymphs were placed in separate cultures, and when adults appeared they were identified by the Commonwealth Institute of Entomology as *T. parviceps* (Reuter).

At the time of writing the position with regard to *T. mundulus* is disappointing. In spite of the large numbers originally placed in cultures, they have not produced the overwhelming numbers of progeny one might have expected. Over the course of four generations their numbers have dwindled steadily, despite the fact that food has been plentiful, and conditions of temperature and humidity were carefully controlled. Specimens in the cultures have been either active and apparently healthy, or else dead; there have been no half-measures, with no visible signs of ill-health, pathogenic infection or any other progressive degeneration. There has been an occasional flush in numbers when eggs have hatched, but eggs have not been produced in the sort of numbers expected from so many adults, and nymphal mortality had been unexpectedly high.

Any defects in rearing methods are made harder to pin-point since by contrast, numbers of *T. parviceps*, which can only have originated from three or four individual adults, have increased rapidly. Both species have had identical treatment, in identical cages in the same insectary. Reasons for the fall in numbers of *T. mundulus* may be subtle, such as inability to find a mate, or for mating to occur only at a certain age, but no mention of such impediments has been met in available literature. Verma (1955) states that *T. mundulus* preferred to oviposit in old plants, and that eggs laid in young maize came to nothing. In our cultures old tissue as well as young was available, and this could hardly have been the reason for their failure.

As to the value of *T. parviceps*, we are still uncertain. It feeds readily on eggs of *P. maidis* and has been seen eating nymphs; but in South Africa this insect is not a serious pest of maize. We have been unable to find mention of any notable successes with *T. parviceps* in the literature, although it does feed upon eggs of canefly in Central America (Simmonds, personal communication).

Individuals caged in the insectary with eggs of *Perkinsiella insignis* are feeding on them readily and surviving. They have fed also on *Numicia* eggs, when these have been exposed from the leaf tissue, but numbers are still too low for extensive experimentation.

Summary

The successful introduction into various countries of the Mirid egg predator *Tytthus mundulus* Bredd., as a controlling agent for *Perkinsiella saccharicida* Kirk is discussed. Trial shipments to South Africa of *T. mundulus* showed that under insectary conditions it would feed and survive on the eggs of *Numicia viridis* Muir, and arrangements were made to introduce large numbers of adults from Mauritius. Although the operation was aimed at *T. mundulus*, a few individuals of *T. parviceps* (Reuter) were also introduced, and this species shows greater promise of becoming established than does *T. mundulus*. In South Africa both insects were reared in the insectary on eggs of *Peregrinus maidis* (Ashm.) as an alternate host. The value of *T. parviceps* as a beneficial insect is being assessed.

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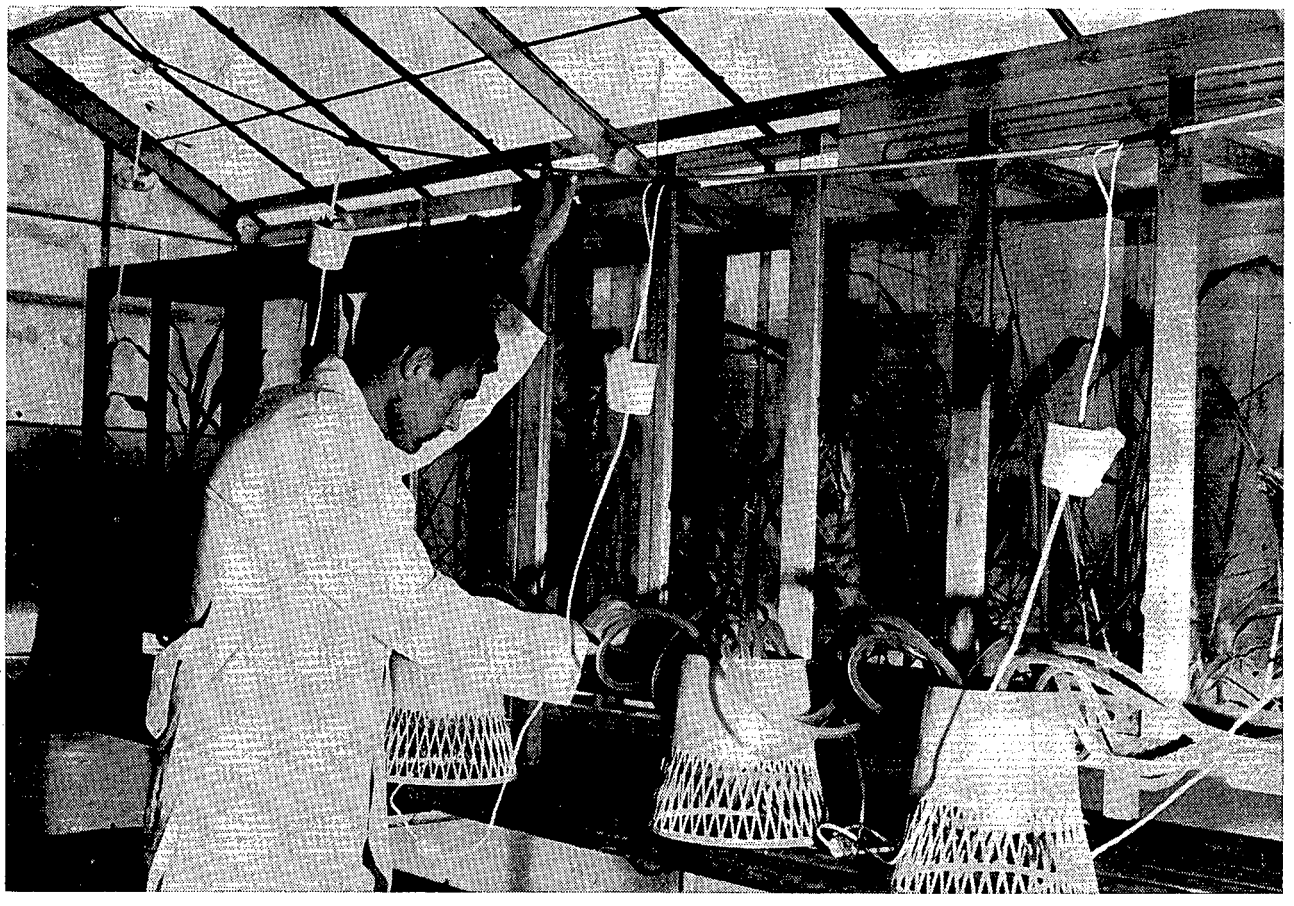

FIGURE 1: Insectary cages for rearing *Peregrinus maidis* (Ashm.).

Discussion

Dr. Dick: It is interesting that the two insects introduced were so alike that the entomologists could not distinguish between them. And yet, under exactly the same conditions in our insectary, one thrived and the other did not.

Mr. Wise: Apparently it is intended to release some of these insects in the warmer months. Has it been established that there are more Perkinsiella in the warmer months?

Mr. Harris: We will release the insects onto maize fields which harbour their preferred food-insect, *Peregrinus maidis*, and hope that they will move from them into the cane fields which should carry sufficient Perkinsiella to support a reasonable population of Tytthus.

There are actually more Perkinsiella in winter than in summer.

If the insects are successful here they will be released in Swaziland fairly soon.

Mr. Carnegie: Insects such as this have to be released in very large numbers as they disperse immediately and if they do not find one another they cannot mate.

In Mauritius 24,000 were released.

Dr. Cleasby: How do you know that these insects will not carry disease?

Mr. Carnegie: We know from literature that these insects confine themselves for food to other insects.

We keep them for some time in the insectary to ensure they are not eating other plant material.

The introduction of the insects is subject to government control.

Dr. Shuker (in the chair): May the insect not become a predator of some other useful insect, e.g. the bee?

Mr. Carnegie: There is no complete guarantee. But even if it did eat eggs which were already parasitised by one of our two Numicia parasites it would still do little harm.

Mr. du Toit: We do not know how leaf scald is carried and it is possible that they might be carriers.

Mr. Carnegie: If leaf scald is transmitted mechanically then one more insect carrier will not matter.

Mr. Harris: It is restricted to an insect egg diet so it is highly unlikely that it would puncture plant material.

Mr. Carnegie: We have at present in the insectary Numicia and Perkinsiella which have fed on leaf scald infected material and are now feeding on other material and we are waiting to see if the infection is carried over in this way.

Dr. Roth: I understand the infected material is from Swaziland. Is it certain that it is suffering from leaf scald?

Mr. Harris: The material is actually uncontaminated but we have put onto it insects that have fed on leaf scald material in Swaziland.

Dr. Roth: As long as you are sure the material in Swaziland was in fact infected with leaf scald.

Dr. Dick: Regarding the insects attacking the eggs of other beneficial insects. As far as we know Tytthus only feed on eggs of insects that lay their eggs in the foliage of plants and this is unlikely to happen except for insects that feed on the plant. There would not therefore be much chance of them attacking bees.