NOTES ON CACAO CAPSIDS IN NEW GUINEA

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Introduction.

THE history of Cacao in New Guinea goes back barely half a century, the first record of the export of processed produce in any quantity being in 1905. With only one or two minor exceptions, the New Guinea material was all brought in from Samoa, in German days, prior to the First World War.

Van Hall states that Criollo Cacao was brought from Ceylon to Samoa in 1883 and later in 1889 Forestero hybrids were imported from Ceylon. The nature of New Guinea Cacao derives through Samoa from Java, Ceylon, Trinidad and Venezuela and, according to Cheesman, it belongs to the Trinitario group and consists of hybrids from which one can obtain any type from a near-Criollo to something like pure *Theobroma leiocarpa.*

The New Guinea production has never played a major role in the Territory's economy and, indeed, prior to the Second World War, production was assisted by a bounty. With the marked world shortages after the war and the high prices being paid for cacao, planters in the Territory commenced to take a decided interest in the crop and during the past six years there has been a great increase in the area planted to cacao, although this has hardly had time yet to be reflected in the annual production figures.

With the sudden increase in the area under cacao, it would be surprising if new pests and diseases did not make themselves known as the trees matured. This has, in fact, happened and the following brief notes are intended to outline the new Cacao Capsid position as it stands to-day.

Original Outbreak.

First indication that cacao was being affected by a previously unknown pest occurred during the writer's absence from the Territory at the end of 1949. This occurred at Kabeira Plantation some 20 miles from Rabaul in New Britain. This cacao was rather severely war-damaged and a large proportion of it had died out or been completely destroyed. Here the first plantings had been made during the early 1930's and were continued until the Japanese invasion in 1941, by which time about 1,000 acres were under cacao. It is probable that the initial outbreak did not take place long before it was first noticed. During the financial year in which the Capsid was first observed the plantation suffered a drop in production of 60 per cent. It would not be possible to say how much of this should be ascribed, either directly or indirectly, to the insect, although it must have been responsible for the majority of this loss.

Species Involved.

Subsequent search, both on New Britain and the Mainland revealed several other species of Bryocorine Capsids which have been described by China and Carvalho (Bull. Ent. Res., Vol. 42 Pt. 2 p. 465). The results of their determinations and the current distribution of the various species, is as follows :—

1. *Parabryocoropsis typicus,* Ch. & Car. Gazelle Peninsula, New Britain.
2. *Parabryocoropsis duni,* Ch. & Car. Gazelle Peninsula, New Britain and Lae, New Guinea.
3. *Parabryocoropsis cheesmanae,* Ch. & Car. Kokoda, Papua.
4. *Pseudodoniella pacifica,* Ch. & Car. Gazelle Peninsula, New Britain.

Of the above species only (1) and (4) are at present of economic importance, (1) being more widely distributed but causing the same type of damage as

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(4). *P. typicus* is distributed at all levels on the Gazelle Peninsula, while *P. pacifica* is only found in any numbers above 500 feet. *P. Cheesmanae* is an isolated record of a catch made at Kokoda many years ago. It is of limited significance at present as it was taken at an elevation of 1,800 feet which is largely beyond the height at which cacao can be successfully grown. However, that is no indication that it will not develop later in mainland plantations as they come to maturity.

The limited distribution of the various species, together with the relative hardiness of the early nymphal stages, has made the imposition of some Quarantine restrictions necessary. Unfortunately, all the cacao breeding and selection work in the Territory is carried out at Keravat where the principal Capsid, *P. typicus*, is particularly bad at times. At first, all seed going out was removed from the pods (in which virtually all oviposition occurs) and packed in sawdust prior to despatch. This proved to be unsatisfactory as delays in shipping and aircraft services frequently meant that it arrived at its destination after the seed had lost a lot of its viability or had even germinated. Now the pods are dipped in Phosfone-D.D.T. or a Toxaphene-D.D.T. wash which is less trouble, inexpensive and quite lethal to eggs or first instar nymphs.

Quite recently there has been an interesting development in the Capsid position in the find at Paili Plantation, Papua, of still a further species. It has been determined as *Helopeltis clavifer* Walk. While the genus *Helopeltis* contains many species of economic importance on a particularly wide range of tropical crops and extends from the Gold Coast to Indonesia, it has not previously been recorded strictly speaking from New Guinea. As far as I am aware, *H. clavifer* has only been recorded in the New Guinea area from Japen Island in the Schouten Group off the north-west tip of Dutch New Guinea and then not in association with any economic crop.

The two Indonesian species of *Helopeltis, H. theivora* and *H. antonii*, attack, among other crops, Tea, Cacao, Cinchona, Coffee, Pepper, Ginger, Citrus and many legumes. It is highly probable that a similar position will eventually occur in New Guinea.

An interesting point in connection with the Papuan Capsid is that the cacao at Paili Plantation has only very recently come into bearing, a fact which would appear to indicate that the insect is widespread among the indigenous flora, but has not yet been given an opportunity of coming into contact with suitable crops of economic importance in New Guinea.

The only other Bryocorine Capsid in the Territory of which I am aware, is *Pachypeltis* sp., an insect which at times can cause quite severe shoot damage to Cinchonas at the Agricultural Department's Highland Experiment Station at Aiyura in New Guinea. In all probability, this species would attack cacao if it were available but, since Aiyura is located at a height of about 6,000 feet, the species is most likely strictly a highland one and may not be able to exist in the lowland cacao area. However, the likelihood of both *Helopeltis* and *Pachypeltis* attacking tea should be borne in mind.

Damage.

Unlike the West African Capsids, the local species attack the pods primarily, although *P. typicus* will attack the flush growth extensively, at times causing considerable dieback. The lesions produced are quite typical. While in the Gold Coast pod damage is not considered a serious problem, there are several factors operating in New Guinea which make the position rather different. In the case of shoot attack, the dieback is as yet uncomplicated by the entry of any pathogen such as *Calonectria*. Where the fruit is concerned, the Capsid population, for most of the year, appears to be considerably higher than it is in

West Africa. The number of feeding scars per individual (except immediately prior to, or after, ecdysis) usually varies from 40 to 80 per 24 hours so that, where a heavily infested tree occurs carrying from 10 to 40 Capsids, the amount of actual mechanical damage is very considerable. It has been our experience that the purely mechanical damage caused by feeding alone, except on pods relatively near to maturity, can cause the loss of many pods. However, an equal, if not greater, proportion of the loss is caused by secondary complications. A minor part of this is caused by entry into old lesions of some two dozen species of insects of various types—Tipulids, Anthribids, Curculionids, Bruchids, etc., which feed and breed there and hasten the breakdown of the pod. However, the larger proportion of the damage is caused by the entry of the secondary fungus, *Gleosporium* sp. which grows in and around the Capsid lesion and fructifies in the form of a raised pustule on the surface of the pod. This fungus has its most pronounced effect during the wet season, when the major part of the annual crop is present on the trees.

Even in the limited areas of cacao present at Keravat, the density of the Capsid population varies most markedly from one portion of a block to another. The conditions under which cacao is grown in New Guinea do not make for the development of typical "Capsid Pockets" as they occur in West Africa. However, there is a tendency for the insects to spread and recede in any one block, depending on whether the conditions are suitable or otherwise.

Accurate and consistent figures for fruit losses have not yet been attempted. Nevertheless, it would be safe to say that losses at Keravat Experiment Station would be of the order of 15-20 per cent., with some blocks, or portion of blocks, showing very much higher losses. Moderately accurate assessments, both on and off the Station, have shown losses running as high as 80 per cent. of the fruit currently carried. In some of these cases, population counts of trees heavily damaged have shown figures from 450 to more than 1,000 Capsids per 100 trees, so that the heavy feeding injuries, together with the follow-up losses caused by *Gleosporium*, necessarily cause heavy fruit losses.

Bionomics.

The only species which have been available locally in large enough numbers to allow any investigation of its bionomics is *P. typicus*. This species has proved to be a most difficult subject, especially in the adult stages, so much so that virtually no information is yet available about its habits, longevity, reproductive capacity, etc. Similarly, the egg stage could not be handled in the insectary. For this, it was necessary to confine random caught females on pods in the field, remove after 24 hours and examine daily until the eggs hatch—a very lengthy and not necessarily accurate process. The adult will oviposit fairly rapidly in young shoots in the insectary, but such eggs as were laid were difficult to handle.

Of the data obtained to date there appears to be little significant difference between the general life history details of the two sets of Capsids, West African and New Guinean. With *P. typicus*, the egg is of much the same type as *Sahlbergella*, etc., and is deposited in precisely the same manner. However, although *Parabryocoropsis* will oviposit under soft bark in the insectary, it shows no tendency to do so in the field as defruiting observations have shown. Apart from the adult, the basic life-history durations are as follows :—

Egg Stage	Average	14 days
	Minimum	12 days
	Maximum	17 days

Nymphal Stages	1st instar	.... 1-2 days
	2nd instar	.... 2-3 days
	3rd instar	.... 2-3 days
	4th instar	.... 2-3 days
	5th instar	.... 3-5 days

The nymphal stages will survive quite satisfactorily in even small test-tubes in the insectary while adults under similar conditions will survive only 24-48 hours. Caged in even quite large gauze cylinders in presumably suitable conditions in the field (15 in. x 10 in. enclosing a clean half to full-grown pod) very few adults survive more than four or five days and it is extremely seldom that both members of a mated pair will survive more than several days. The maximum period a mated female has been kept alive is eleven days in which twenty-six eggs were laid. It appears likely that it will be necessary to enclose whole branches complete with fruit to allow adequate flight room if any further information is to be obtained on these points.

The sex ratio shows a small preponderance of males on the average, although it is not unusual to find males outnumbering females by 4-5 to 1 on occasions.

Control.

For various reasons, work on the control of Cacao Capsids so far has necessarily had to be of an empirical nature. The problem of control is fundamentally different to that of the Gold Coast owing to the different nature of the cacao types in the two areas. This, plus the fact that the nymphs do not appear to move away from the pod on which they emerge (unless, of course, it has reached a stage of extreme deterioration or they are disturbed), makes the successful African expedient of applying a concentrated D.D.T. preparation at the point of ramification inapplicable locally.

In New Guinea, the fruit is borne at random through the tree which necessitates a complete internal coverage for effective control. Then again, mainly for reasons of rough terrain, the application of an insecticide in liquid form is a difficult proposition, although good control, especially of *Pseudodoniella pacifica,* has been obtained by the thrice-repeated application of 0.2 per cent. water-dispersible D.D.T. emulsion at reasonable cost. Theoretically, under Territory conditions, the application of the insecticide in dust form appears to be the simplest and most effective method tried yet. Proprietary BHC preparations have been satisfactory in this regard, judging empirically on reduction in numbers after application. However, more trials will have to be carried out yet before a firm recommendation can be put forward.

Allowing for the oviposition habits of *Parabryocoropsis* complete defruiting has once or twice been advocated, but this is too drastic for the Territory where picking proceeds at intervals all the year round. It has only been advised in areas just coming into bearing where fruit is not common and the amount of shoot damage is excessive.

Despite the fact that some hundreds of nymphs have been bred out during the past two or three years, there has been no sign of any internal parasite of the Capsid. Predatory action must be quite appreciable, although it is not possible to assess to what extent it prevails. The three main predators seen in action are an Attid Spider, Reduviid Bugs (*Pristhesanctus* spp.), and the "Kurukum", or Green Tree Ant (*Oecophylla smargdina*).

Conclusion.

Finally, it should be pointed out that the Cacao Capsid position in New Guinea is a very recent one and it is still in an extremely fluid state. It is not possible, therefore, to foretell how it will eventually develop.

In West Africa, although Capsids have been known and studied far more extensively and for much longer than they have in New Guinea, there is no strong indication that they have finally settled down to their permanent position as Cacao Pests.

There are still only two plantations in the Gazelle Peninsula where *P. typicus* has caused shoot and branch dieback to an extent sufficient to warrant concern. If this tendency continues, a process which may take many years, and if it is combined with a fungal infection such as that caused by *Calonectria* in West Africa, the position could become an extremely serious one.