THE CARDAMOM MIRID (*RAGWELELLUS HORVATHI*) POPPIUS (HETEROPTERA : MIRIDAE) IN PAPUA NEW GUINEA

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ABSTRACT

The mirid Ragwelellus horvathi *Poppius is potentially a serious pest of cultivated cardamoms in Papua New Guinea. In this paper information on the distribution, life-history and biology, native hosts and nature of damage is presented.*

Control of R. horvathi *by chemical and cultural methods is also briefly discussed.*

INTRODUCTION

The mirid *Ragwelellus horvathi* was first described from specimens collected early this century in the Morobe and Madang Provinces (Poppius 1912), but further specimens were not collected in Papua New Guinea until 1969, when cultivated cardamoms (*Elettaria cardamomum* (L.) Maton: Fam. Zingiberaceae) at Karimui, Chimbu Province were attacked. Several years later, adults and immature stages of this insect were observed feeding on cardamoms at Trauna Valley Farm, and on wild gingers (Fam. Zingiberaceae) at Baiyer River, both in the Western Highlands Province. More recently, *R. horvathi* has been collected from cardamoms or wild gingers growing at Kokoda, Northern Province, Brown River, Central Province and Bubia, Morobe Province. The insect is therefore widely distributed on the mainland of Papua New Guinea, at elevations from sea-level to at least 1,100 m.

At Afore, Northern Province, mirid damage to young cardamom leaves was first noticed in late 1971, but not until the dry season in mid 1973 did the damage levels cause concern. Attack occurred both on village small holder blocks and to plants on the one expatriate-owned plantation in the Sila-Afore area.

Cardamom is a new crop to Papua New Guinea and is not grown extensively at present, but conditions in certain areas appear to be ideal for the cultivation of this labour-intensive, high value crop (Brown 1968). Further notes on the cultivation and production of cardamoms by growers under Papua New Guinea village conditions have been published by Breay (1972) and Grant (1976).

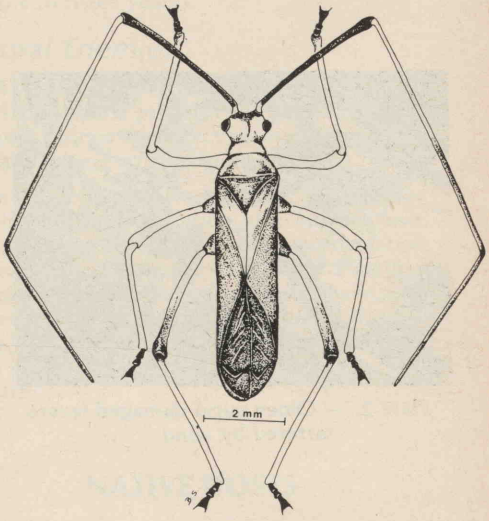

Figure 1. — *Ragwelellus horvathi* Poppius

Entomological investigations on this mirid were begun in October, 1973, and it quickly became apparent that this was another instance of an indigenous insect transferring from its native hosts to an introduced crop plant.

PLANT DAMAGE

On cardamoms, all life history stages of *R. horvathi* feed on young leaf blade tissue between the lateral veins, on leaves at the fully furled to the fully expanded stages. Leaf tissue unfolded for more than about three weeks is rarely attacked. The insects insert their stylet

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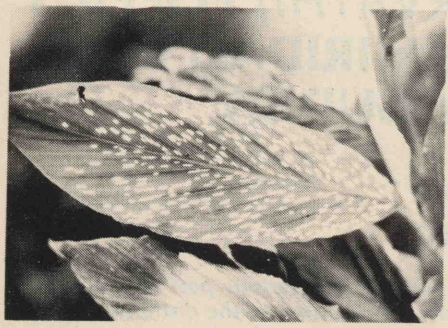

Plate 1. — *R. horvathi* feeding damage on young cardamom leaves

Plate 2. — Older mirid damaged leaves tattered by wind.

mouthparts to draw up cell contents from the leaves, thus producing a water soaked "streak" varying in width and length, from two to five cm long between the veins (*Plate 1*). After several hours, the affected cells die, and some one or two weeks later, clear "windows" or holes form in the leaf blade (*Plate 2*). In some cases, feeding on the unfurled shoot causes leaves which subsequently expand to be malformed and reduced in area. Older leaves which have been severely attacked are often badly tattered by wind and have little photosynthetic area remaining.

Some newly planted cardamom splits can be very badly damaged, with up to an estimated 70% of the leaf area damaged or destroyed. This reduction in leaf area could severely retard growth and reduce subsequent crop yield, especially on young cardamoms.

BIONOMICS OF *R. HORVATHI*

The following data were compiled from insects caged over potted cardamom plants placed outside, in the shade, at Popondetta, Northern Province, and from field studies at Afore.

Life History

Female insects inserted eggs singly into the proximal half of the mid rib on a recently expanded or almost expanded new leaf. Generally only two to three eggs were laid in each leaf, with the egg being inserted between the epiderm and mesoderm layers, and lying roughly parallel to the surfaces. Two very fine chorionic processes which protruded from the epidermal tissue were probably used in gaseous exchange.

The first instars began feeding on the soft leaf blades, usually on a more recently expanded leaf than that in which the egg was laid, within a few hours of hatching from the egg. Five nymphal stadia were passed before the immature nymphs moulted to the adult insect. During this nymphal period, the insects migrated upwards to feed on newer, softer leaf tissue. The durations in days of the various stages at Popondetta were as follows:

Stage	Mean Duration (days)	Range (days)
Egg	20.9	18-24
1st instar	4.5	3-6
2nd instar	3.5	2-4
3rd instar	4.7	4-6
4th instar	3.8	3-5
5th instar	6.4	6-7
Total Nymphal	20.3	19-22

These durations may be increased in other areas at higher elevations where cardamoms are normally grown, and which experience generally cooler temperatures.

The total generation time at Popondetta was about 50 days, of which the egg stage lasted 21, nymphal stages about 21 and the pre-oviposition period was from 6 to 8 days (3 to 5 days for females to attain sexual maturity and 3 days between mating and oviposition).

Adults (*Figure 1*) survived at least eight weeks, and females probably laid 60 to 70 eggs during their life span, at a rate of 12 to 14 per week, decreasing with age. Mating occured at most times of the day with copulation lasting up to four hours. Female *R. horvathi* probably produce a pheromone which attracts males for mating, since most pairs observed copulating in

the field were accompanied by one or more other males of the species.

In the field the insects were quite mobile, and readily took to flight (adults) or moved to escape detection, either by movement around a leaf, escape down the plant stem or by adoption of a cryptic attitude, usually in the slightly hollowed mid rib of the upper surface of the leaf.

Plant Infestation Rate

Insect infestation rates were determined by counting nymphs and adults present on the unfurled shoot and the five youngest expanded leaves of each stem on a series of plant clumps. Recording was carried out in seven different blocks at six to seven weekly intervals between October, 1973 and December, 1975.

In the Sila-Afore area, infestation of cardamom blocks was widespread, and in contiguous blocks the number of insects per plant stem was extremely uniform. This phenomenon explained why the younger clumps, although with fewer stems and consequently lower absolute numbers of mirids, suffered greater damage than the older clumps. In the latter plants, stems may have been three times the length of those in young clumps, and supported five to ten times the leaf area. Thus, the percentage of "susceptible" leaf tissue (i.e. leaves unfolded for less than three weeks) was much less in these clumps than in the large, vigorously growing clumps which had been planted out for more than 18 months.

In the field, it appeared that of the two varieties grown in the area, Mysore was less infested by the mirid than the Malabar variety. However, when the data was statistically analysed (N = 26), no difference in infestation rate was evident.

Population Levels

Data collected from the various blocks mentioned above, have indicated that insect populations fluctuated seasonally, with maximum numbers occuring in the dry season and lower numbers during the wetter periods of the year. These fluctuations were most probably caused by the growth habit of the host plants which were affected by weather conditions, and in particular by rainfall. Flush growth in cardamoms was greatest during dry spells after a period of wet weather.

Absolute numbers found during the year on mature, producing cardamom plants ranged from about 2,000 to about 30,000 mirids per hectare.

Other Factors Affecting Population Levels

From observations at Afore, it has been concluded that where the crop is grown under ideal conditions (thinned primary bush, deep leaf litter, well drained soil, etc.), the intensity of shade probably has little effect on mirid population levels. Similarly, the type of shade would appear to have no effect on populations. No differences in insect attack could be detected in cardamoms growing under thinned primary bush or thinned secondary bush shade, and some feeding damage to wild ginger was noted in very exposed areas at the edge of secondary bush. In addition, the observations revealed no differences in the susceptibility to attack between the two varieties grown in the area or between plants of different ages (several months to three years).

Natural Enemies

Mirids as a group are relatively free from attack by specific predators or parasites. Thus the possibilities for effective biocontrol of *R. horvathi* appear to be remote.

As yet, no parasites have been discovered and the level of predation also appears low, probably exerting little influence on population levels. Only two predators, a reduviid, *Euagorus* sp., and an unidentified salticid spider have been observed actually preying on the mirid, but it is likely that other general predators collected from cardamom foliage do, in fact, prey on *R. horvathi*.

NATIVE HOSTS

The insect pest would appear to have a range of host plants which occur widely in both primary and secondary bush. In primary forest surrounding badly damaged village cardamom plantings, four species of wild ginger were found on which feeding damage similar to that on cardamoms was noted. Nymphs, adult mirids and fresh feeding damage were found on two of these species. Similarly, fresh feeding damage and mirids were observed on two species of plants belonging to the family Commelinaceae and probable feeding damage was noticed on leaves of *Heliconia indica*, a commonly occurring bush species. It is likely (Henty and Womersley, pers. comm.) that *R. horvathi* feeds on *Heliconia indica* and other as yet unidentified plant species.

The host plants which have so far been identified are:

Alpinia purpurata (Vieilla) K. Shun.	(Fam. Zingiberaceae)
Alpinia sp.	(Fam. Zingiberaceae)
Elettaria cardamomum (L.) Maton	(Fam. Zingiberaceae)
Hedychium coronarium Koen.	(Fam. Zingiberaceae)
Aneilema humile Warb.	(Fam. Commelinaceae)
Pollia thyrsifolia (Bl.) Stewd.	(Fam. Commelinaceae)
Heliconia indica Lamk.	(Fam. Musaceae)

. INSECT CONTROL

Large, vigorously growing clumps planted in the field for more than 18 months generally appear to absorb insect attack to the leaves without serious setback. Insect control should therefore be mainly directed to protect younger plants. Mirid control is relatively easy and effective if the procedures outlined below are followed.

Village Blocks

All alternate host plants growing in the immediate vicinity of the cardamom block should be removed.

Growers should inspect the three or four youngest leaves and the unfurled shoot on each cardamom stem at about six-weekly intervals throughout the year, and especially from April to October or during the dry season. All adult and immature insects can be easily hand-picked and killed.

At Afore, these measures have greatly reduced insect populations in village blocks, but the importance of a six-weekly follow up kill must be stressed if effective control is to be maintained.

Large Scale Plantings

It is recommended that insects be controlled by the use of γ-BHC dust at 150 to 160 g a.i./ha (2.2 oz. a.i./ac.) applied to the whole area of young plants in April and followed by a second dusting six to seven weeks later. This treatment was very effective at Boikik Plantation, Afore during 1974. Dusting was carried out in the early morning during a gentle breeze by walking down every 10th row and using a motorised mist blower.

Further applications of insecticide at six to seven weekly intervals during the dry season may be necessary.

Costs of insecticidal control, kindly supplied by Mr G.N. Breay, Boikik Plantation, Afore and based on 1976 values are presented in *Table 1.*

TABLE 1

Cost of insecticide application to 40 ha of cardamom at Afore [1]

(Based on three applications per year, using a Solo Port 423 Misting Machine)

Application Costs	K
Machine Depreciation[2] (20% p.a. of landed cost price)	40.00
Petrol, oil, lubricants @ 4.5 l/20 ha dusted) 27 l 2 stroke fuel @ 40t/l.	10.80
Maintainence and repairs (10% p.a. of cost price)	20.00
Labour (10 man days/application)[3] 30 man days @ K10.00 p.w.	60.00
	130.80
Insecticide Costs	
12.5 - 18.3 Kg Gammexane No. 10 Dust/ha[4] @ 60t/kg and 3 applications/year	900-1,318
Total Costs	1031-1449

Cost per ha K25 80 to K36.25 per year

Notes:

1 Based on estimated 1976 prices.

2 When dusting larger areas, this figure of 20% could be reduced.

3 Under ideal conditions, this figure of 10 man days can be reduced by half.

4 Extremely good kills were obtained using the lower (12.5 kg/ha) application rate.

ACKNOWLEDGMENTS

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BOOK REVIEW

PEST CONTROL IN RICE

PANS Manual No. 3, Centre for Overseas Pest Research, London. Second edition, fully revised, 1976.

"Pest Control in Rice", PANS Manual No. 3, second edition is a completely revised and expanded version of the standby for rice workers since 1970.

Illustrations have been increased and the addition of colour plates to assist the worker in identifying common diseases and pest problems is welcome. More colour plates would have been desirable particularly as it is often the symptom that the field worker first has contact with.

Following an introductory section, it covers weeds, diseases, nematodes, molluscs, crustaceans, insects, mites, birds and rodents. Also included is a valuable section on storage methods and problems and another on pesticide application. The storage methods are generally applicable to other Papua New Guinea commodities.

Quite recent information on suitable chemicals for insect and disease control is presented both with articles on each pest or disease and also in table form. It would have been useful if the appendix had also listed manufacturers of the chemicals. Such information would have been readily available to the editors of the manual in the latest issue of the Farm Chemicals Handbook *, which lists world-wide manufacturers and brand names.

Certain errors are also noticeable. For example the colour plate of brown spot describes it as Helminthosporium leaf spot, although the text describes the disease by its now correct name of *Drechslera oryzae* for the asexual state; the valid name for the sexual state is still *Cochliobolus miyabeanus* as mentioned in the text. There are also dropped words which may be misleading; the introduction's first line missed the word "thousand" when stating that the 1974 world rice production was "323,201 metric tons".

A final criticism which is the most important is the excessive use of complex English phrasing and the use of highly technical words where simpler words are possible. Since many people throughout the world who will use this book do not speak English as a first language, it would have been more appropriate for the editors to make special efforts to use controlled English where possible.

Nevertheless the new edition is a welcome improvement on the contents of the first edition. Particularly for field officers, agriculturalists and mill managers who must make the right decisions without benefit of other resources the book is a must. The price with postage is K2.51, but it is free to government, educational and research establishments when addressed to individuals under their official title.

Peter R. Hale
National Rice Co-ordinator.

* An annual publication from Meister Publishing Company, Willoughby, Ohio, U.S.A.