

PROMECOTHECA OPACICOLLIS GESTRO (Coleoptera : Chrysomelidae) ON THE ISLAND OF TIKOPIA

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Abstract: In 1962 an outbreak of the Hispine coconut beetle *Promecotheca opacicollis* occurred on the island of Tikopia, East of the Santa Cruz group. It is described here as it affords an example of an insect species' colonisation of an oceanic island, followed by a rapid rise in numbers, leading to an apparently density induced crash. In this case there is also evidence of the means by which the insect reached the island.

INTRODUCTION

The genus *Promecotheca* includes some important pests of coconut in the SW Pacific, the adults scarifying the surface of leaflets and the larvae mining within them, and species have caused economic damage in New Guinea, Fiji, and the New Hebrides. A description of *Promecotheca opacicollis* is given by Gressitt (1957), and information on the biology of *P. reichei* Baly in Fiji and *P. papuana* Csiki in New Guinea, by Taylor (1937) and Gressitt (1959). In these two species the generation time from egg to egg is two to three months. *P. opacicollis* is distributed from the New Hebrides to Santa Cruz with Tikopia occupying an isolated position between these two island groups more than 240 km from known or probable localities of *P. opacicollis* in either, and in the Solomons area to NW sea gaps of this size appear to present major barriers to insect dispersal (Greenslade, in preparation).

Tikopia lies at approximately 12° S, 168° E, rising to over 360 m with a land area of about 10 km². On the island, contrary to the usual Pacific practice, garden crops are grown in flat coastal areas, and the majority of coconut palms are found inland up to 300 m. Firth (1936) gives a brief account of the geography of Tikopia.

OUTBREAK

In March 1962, serious insect damage to coconuts was reported from Tikopia and the island was visited by me in the following month. During the same year visits were made by my assistant in August and by my colleague, M. J. MacQuillan, in November. In 1963 reports were received for February, June and October from the Protectorate Department of Agriculture in the Eastern Solomons, and from the Melanesian Mission, both of whom gave further information in 1964 and 1965. Here my own observations are described and other accounts, including those of the Tikopians are summarised.

Seen from the sea in April 1962, the island was largely brown in color rather than the usual and anticipated green, and this was found to be due to the fronds of the coconut

palms with which it is extensively planted being almost all killed by *Promecothea* damage. At this time only the youngest three fronds remained green; the fourth and fifth were seriously attacked with large necrotic areas, and in older fronds green tissue was quite absent. There was no major variation in intensity of attack in different parts of the island except that occasional isolated palms in hill forest possessed up to eight green fronds while some others on the shore were moribund. Adult beetles were too abundant for any estimation of numbers and all development stages from the eggs onward were present, with copulation frequent among the adults. Larvae were restricted to coconut, but the adults also fed on the surface tissues of banana leaves. No natural enemies were recorded in this or later visits to the island; no predation was seen, and although all stages were dissected no parasites were found. Adult beetles flew actively and were gregarious; on some palms the center of the crown and younger fronds were completely obscured by swarms of beetles while on adjacent palms only a few hundred were present. On a banana plant there were about 250 *Promecothea* adults, with 200 on one leaf and the remainder distributed among all the others.

By August and November all stages were still present with adults abundant, but palms had improved to show averages of respectively four and seven fronds which could be classed green. In February, 1963, an average of 12 to 13 fronds were green with fewer beetles present although they were still frequent, and by October 1963 palms appeared normal and no *Promecothea* were recorded. This situation was maintained throughout 1964 until the most recent report in February 1965.

Some information was obtained from the Tikopians and is most probably reliable. The island supports a poor fauna and flora of mainly coastal and secondary forest species, many of them being widely distributed in the Pacific and the Old World tropics. Most insects collected were recognised by the Tikopians and Firth (1936) noted that they could distinguish 150 plant species. It is unlikely therefore that a brightly colored insect such as *P. opacicollis* would be present unnoticed. The Tikopians stated that:

- 1) The outbreak started in an area on SW Coast, shown as Rotoai'a on Firth's map (a), (where damage to coconuts was particularly severe in April 1962); serious attacks were first noticed here in about December, 1961 and spread rapidly.
- 2) The beetle reached a maximum before April 1962 and since then was considered stable or declining.
- 3) In a period of strong winds of variable direction within SW quadrant, during the change from SE to NW seasons in 1961, (say, in October—November) floating rafts of dead *P. opacicollis* had been deposited on the beach near the initial outbreak area; on and among these rafts some live beetles were present.
- 4) The species was not previously known on the island.

CONTROL

As with most pests of mature coconut palms insecticide treatment is not practicable. In Fiji and the New Hebrides *Promecothea* species have been controlled by means of the Eulophid parasite *Pediobius* (= *Pleurotropis*) *parvulus* (Ferr.) but this was not available at short notice for use in Tikopia. Gressitt (1957) recorded that in New Britain the arboreal ant *Oecophylla smaragdina* (F.) had some effect in preventing damage by *P. papuana* and

as Tikopia lies beyond the ant's Eastern limit (Mann 1919) consignments of leaf nests of *O. smaragdina* were sent to the island from Guadalcanal in the Solomons in August and November 1962. The ant was reported to be established by subsequent observers, but it is not known what effect it had on *Promecotheca* populations. An attempt by the writer in August 1963 to investigate this and to ship a further batch of *Oecophylla* nests was unsuccessful on account of high seas.

However an increase in green fronds between April and August 1962 preceded the establishment of *Oecophylla*, and no natural enemies were recorded, so other factors must be responsible for the decline in numbers of *P. opacicollis*. Although an epidemic cannot be ruled out it is most probable that the food supply was inadequate. Since young coconut fronds do not appear suitable for oviposition until the leaflets are free, and in April 1962 there were less than two per palm in this condition, with large numbers of adult beetles among which copulation was frequent, it is likely that there was competition for oviposition sites and larval food.

The course of the outbreak is shown in fig 1; here it is assumed that on a healthy palm the 20 youngest fronds at least will show little senescence or fungus attack and can be classed as green. If one new frond per month is produced, complete recovery from April 1962 onwards would result in the expected values shown in fig 1a and the difference between this and the observed

trend perhaps indicates that *Promecotheca* damage continued to be inflicted until the end of 1962. However the major frond discoloration is caused by larval mines so that the number of green fronds which are present provides an index of the incidence of larvae which is shown in fig 1b as the reciprocal of the number of green fronds. The time between the decline in larvae and that of the adults can be attributed to the relative longevity of the latter, but it is not clear why the development of a second *Promecotheca* outbreak did not follow the increased number of green fronds available late in 1962. It cannot be attributed to the effect of *Oecophylla* for although established the ant had not spread far beyond the original release point even by 1965. In the absence of further extensive *Promecotheca* damage it is improbable that detailed observations will be made again on such a remote island as Tikopia and this question must go unanswered.

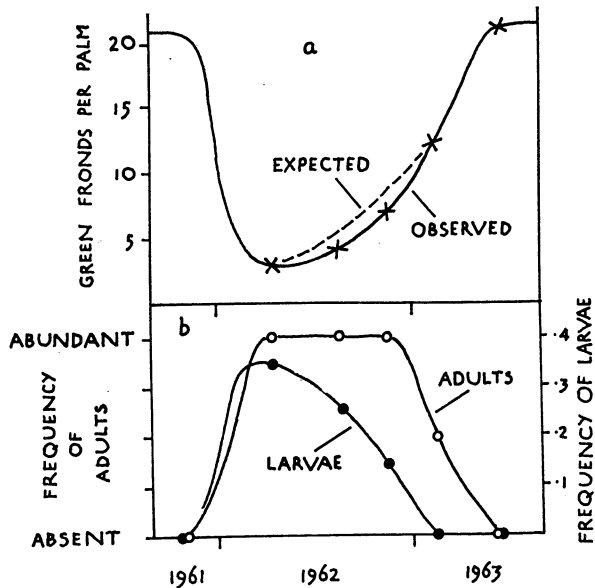


Fig. 1 The course of the *Promecotheca opacicollis* outbreak at Tikopia. a, mean number of fronds per palm classed as green; b, abundance of adult beetles and larvae, the latter shown by the reciprocal of the mean number of green fronds.

CONCLUSIONS

Tikopian accounts show that the outbreak of *P. opacicolis* spread from one focus resulting probably from storm dispersed immigrants, and the prevailing wind at the time and their point of arrival in Tikopia suggest an origin 240 km to SW in the Torres or Banks Islands N of the New Hebrides group. It is not necessary to postulate a similar outbreak in the source area as wind can concentrate air-borne insects (Rainey 1963) and *Promecotheca opacicolis* flies readily. This seems to be a case of initial wind dispersal with sea-borne survivors effecting colonisation, and very similar instances are known for the Colorado beetle *Leptinotarsa decemlineata* Say in the Channel Islands (Dunn 1949) and perhaps for the Desert Locust *Schistocerca gregaria* Forskal in the Canaries (del Canizo 1955) and elsewhere (Waloff 1960). On Tikopia the rapid increase of immigrant *P. opacicolis* can be attributed to the absence or scarcity of general predators or suitable parasites, and also to the absence of competitors, for no other insects damaging mature coconut fronds were found on the island. The final decline may have been the result of competition within the *Promecotheca* population for oviposition sites or larval food.

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