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USING THE PREDATORY ANT, *OECOPHYLLA SMARAGDINA*, TO CONTROL INSECT PESTS OF COCONUTS AND COCOA

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INTRODUCTION

Biological control of insect pests usually means using naturally occurring parasites and predators against them. There is no doubt that biological control of pests has a great deal to commend it because once established it is on-going and costs the grower little and often nothing. Very many successful introductions of parasites into new areas are known and have encouraged the search for more parasites to use against other pests.

The use of the naturally occurring predatory ants has largely been overlooked as a possible means of biological control, probably being too mundane a method to commend itself. There are certain cases where ants have been employed but writers invariably refer to the use of *Oecophylla smaragdina* and this is probably the only one documented in the tropics.

PREDATORY AND OTHER TYPES OF ANTS

Most ants living in the Old World are predatory in habit; that is, they pursue and catch their prey. These ants usually live in small nests with a queen. The most primitive ants are the driver ants which do not make nests but simply march across country devouring everything in their path.

The most highly developed ants live in the New World and are the parasol or leaf cutting ants. They live in enormous underground nests and feed on fungi grown on pieces of leaf collected from trees and taken underground to the fungus gardens.

It is important to distinguish between these two types of ants because the leaf cutting ant is not predacious and cannot be used as a biological control agent. As a whole ants can be considered beneficial, but because they can cause a great deal of harm and annoyance to people their beneficial acts pass unnoticed.

The more primitive ants depend entirely on prey as their food and such ants can only exist where there is an abundance of prey. They must, therefore, live in tropical rain forest areas where the insect cycles are more or less continuous throughout the year. Countries with a well-defined cold or dry season cannot support such an insect fauna because activity ceases for part of the year. Ants living in such seasonal situations have developed the habit of collecting and storing their food.

Many ants live on honey-dew, a sugary substance thrown off by sucking insects such as aphids, mealybugs and scale insects. These insects spend their entire lives sucking up the cell sap from plants and passing it through their bodies. They discard any excess and it drops down onto the leaves and branches of the plants on which they live. Black moulds grow on this honey-dew but ants also like the sugary liquid and swarm over the aphids, mealybugs and scale insects which provide it. The ants are not attacking the insects but 'attending' them so that they can imbibe the honey-dew. Some ants can live entirely on such substances, but others

like *Oecophylla* live partly on sugary liquids (from which they derive carbohydrates) and partly by predation on other insects (from which they derive protein). In attending the sucking insects, the *Oecophylla* ants protect them from other parasites and predators. So the presence of *Oecophylla* can lead to a build up of mealybugs and scale insects although it does tend to regulate the numbers.

The worker ants are wingless and are the ones mostly seen; they are naturally predatory in habit. The large yellow tree-nesting ant *Oecophylla* is the only one which has received special mention as an ant which can be manipulated for the benefit of man. A reference to this matter can be found in a book by P. DeBach (1964, *Biological control of insect pests and weeds*) where it is stated that the Chinese in certain states carried nests and *Oecophylla* into their citrus trees to protect them against leaf-feeding insects. Evidently, the citrus grows in a part of the country where the winters are too cold for *Oecophylla* to survive. The ant nests are transported to a warmer part and returned to the citrus the following year.

OECOPHYLLA SMARAGDINA ON COCONUTS

Oecophylla smaragdina is well known in the tropics and seems to be generally regarded as a beneficial species. A common case described concerns the control of the nutfall bug, *Amblypelta cocophaga*, on coconuts (Fig.1). After pollination the nuts normally swell up but if *Amblypelta* occurs in the palm crowns it feeds on the young nutlets and these either abort or fall off when they are about three weeks old. The bugs inject toxic saliva into the young soft nutlets causing a necrosis marked by a black scar (Fig. 2). In bad attacks the coconut palms become completely barren, not a nut being retained.

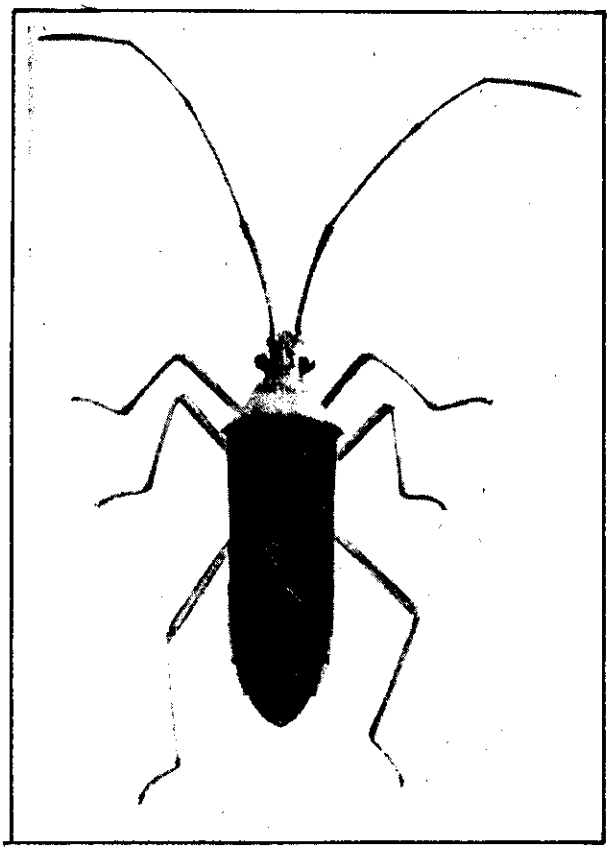
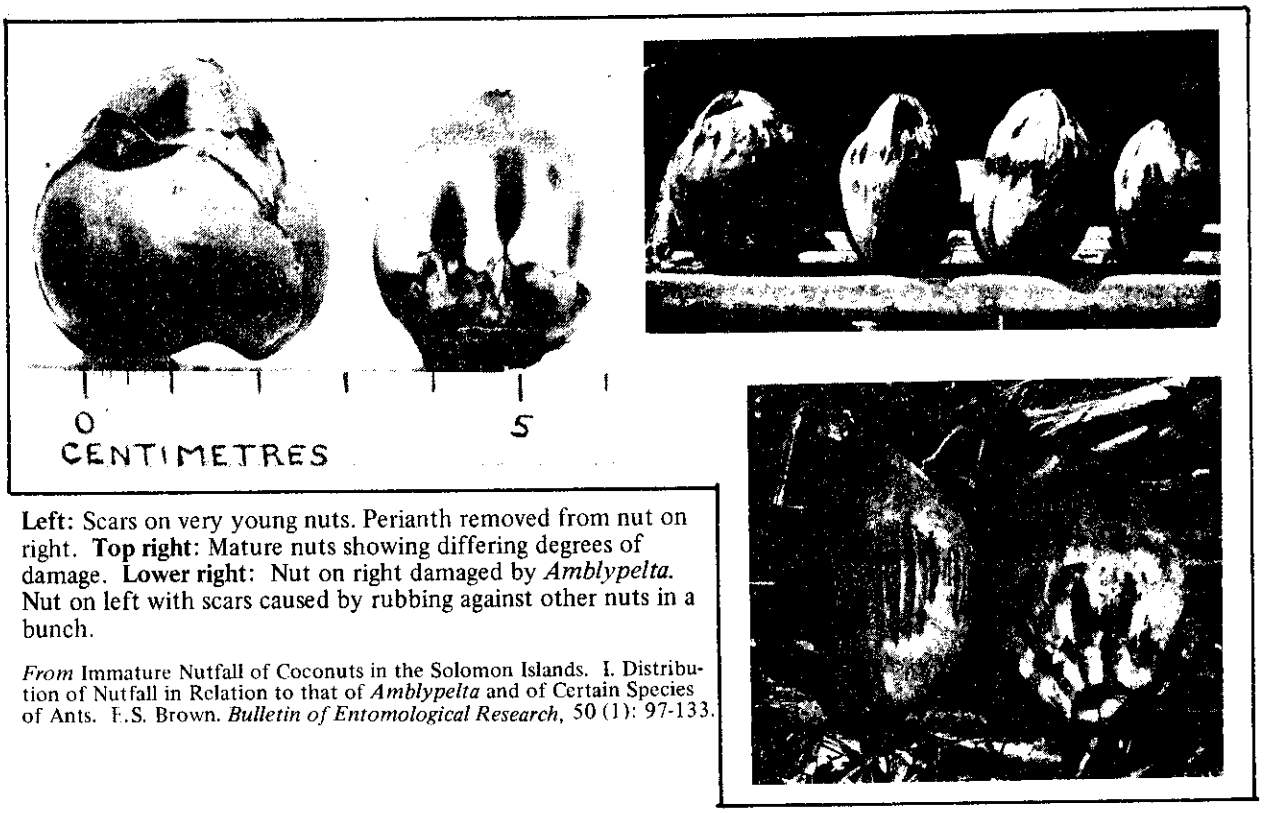


Fig. 1: *Amblypelta cocophaga:* Adult male
From Revision of the Genus *Amblypelta* Stal (Hemiptera, Coreidae), E.S. Brown. *Bulletin of Entomological Research*, 49 (3): 509-541.



Left: Scars on very young nuts. Perianth removed from nut on right. **Top right:** Mature nuts showing differing degrees of damage. **Lower right:** Nut on right damaged by *Amblypelta.* Nut on left with scars caused by rubbing against other nuts in a bunch.

From Immature Nutfall of Coconuts in the Solomon Islands. I. Distribution of Nutfall in Relation to that of *Amblypelta* and of Certain Species of Ants. F.S. Brown. *Bulletin of Entomological Research,* 50 (1): 97-133.

Fig. 2: *Amblypelta cocophaga*

Observers had always remarked that palms inhabited by *Oecophylla* were free from nutfall and retained their nuts to maturity whereas those inhabited by the small brown ant *Pheidole megacephala* suffered severely from nutfall. Obviously, *Oecophylla* drove out the *Amblypelta* bugs and no nutfall occurred.

The problem resolved itself into exchanging one ant for another. Although *Pheidole* and *Oecophylla* often shared palms, eventually *Pheidole* would drive out *Oecophylla.* How can *Pheidole* be replaced?

The removal of *Pheidole* can easily be accomplished by spraying the palm base with dieldrin (20 ml dieldrin [15 per cent e.c.] per litre of water). Before dieldrin spraying is carried out it is necessary to kill the weeds and grass growing up the base of the trunk with paraquat. When dried the vegetation is removed with a cane knife. If *Oecophylla* is already present in the plantation, it will spead naturally onto the palms vacated by *Pheidole* provided the undergrowth is dragged down by heavy chains or grazed by cattle. *Oecophylla* will not travel freely through dense undergrowth but likes highways provided by fallen fronds.

If there are no *Oecophylla* in the plantation how can they be introduced? The best way to do this is to plant an intermediate tree favoured by the ant. The most suitable one is soursop *(Annona muricata)* which grows readily from seed and is two metres high and producing fruit within two years. This tree becomes infected with mealybugs and scale insects which are favoured by *Oecophylla* as a source of honey-dew. In due course the soursop trees will become naturally infested by *Oecophylla* which will construct nests in them (Fig. 3) and also perform its beneficial acts in the coconut palms. *Oecophylla* does not normally invade coconut palms until they flower.

Fig. 3: *Oecophylla* nest in soursop tree

Tables 1 and 2 show records of two plantations; Table 1 shows the natural spread of *Oecophylla* after the removal of *Pheidole* and Table 2 shows the spread of *Oecophylla* after its introduction on soursop trees.

Table 1: Changes in ant status in a plantation attacked by *Amblypelta* after treatment to remove *Pheidole* in 1969

	1969	1970	1971	1972	1973
Number of palms	161	160	155	152	130
Number of palms with ants*					
Pheidole	132	17	14	3	0
Pheidole and *Oecophylla*	23	1	0	1	0
Oecophylla	5	51	88	104	57
Others	1	21	28	25	27
None	0	70	25	19	26
Per cent of barren palms*	64	52	15	7	6
Average number of coconuts per spadix*	1.3	2.7	5.2	4.6	5.8
Per cent of fallen nutlets scarred by *Amblypelta**	91	73	59	34	52

* Counts made in January each year.

Table 2: Changes in ant status in a plantation attacked by *Amblypelta* after treatment to remove *Pheidole* in 1969 and planting soursop trees in 1970

	1969	1970	1971	1972	1973	1974
Number of palms	92	91	90	90	88	83
Number of palms with ants*						
Pheidole	87	3	15	35	16	1
Pheidole and *Oecophylla*	3	0	2	2	0	0
Oecophylla	0	9	27	23	19	25
Others	0	1	7	1	3	1
None	2	78	39	29	50	56
Per cent of barren palms*	80.4	36.2	45.5	42.2	11.3	0.0
Average number of coconuts per spadix*	0.6	2.6	2.1	2.5	2.7	6.4
Per cent of fallen nutlets scarred by *Amblypelta*	88.0	96.0	73.7	65.0	78.6	59.6

* Counts made in January each year.

Oecophylla will drive out the nutfall bug *Amblypelta* and will also remove the spathe bug *Axiagastus cambelli.* It will also prevent infestation of coconuts by the coconut leaf beetle, *Brontispa longissima.*

Changes in ant status of a plantation do not happen overnight and several years may be needed before *Oecophylla* becomes entrenched and eliminates *Amblypelta.* Much depends on how quickly the *Oecophylla* colonies develop and then spread over the whole area.

No documentary evidence appears to be available about the effect of *Oecophylla* on *Axiagastus.* In the Russell Islands (Solomon Islands), *Oecophylla* is plentiful and well dispersed. Two islands were discovered, Laon and Ufa, on which *Oecophylla* did not exist and where its place was taken by the crazy ant, *Anoplolepis longipes.* On both these islands *Axiagastus* flourishes, causing many banana-shaped nuts to be produced. Nowhere else in the Russell group can *Axiagastus* be found although there are thousands of acres of coconuts of all ages in the islands. *Anoplolepis* is an extremely poor predator and has no effect on *Axiagastus.*

Brontispa longissima, the coconut leaf beetle (Fig. 4), does not like the presence of *Oecophylla* on palms inhabited by it. Unfortunately, *Oceophylla* does not usually colonise palms before they flower because it likes the scale insects and mealybugs which occur in coconut palms after flowering. *Brontispa* attacks palms as soon as they are planted out in the open and can stunt their growth for several years unless removed by spraying. When palms begin to flower *Oecophylla* will invade them and can then reduce the number of *Brontispa* present.

Fig. 4: *Brontispa longissima.*
From Agricultural Research in French Polynesia, R. Millaud. Economic Development Section, South Pacific Commission, *Technical Information Paper* No. 5.

OECOPHYLLA IN COCOA

If *Oecophylla* can be established in cocoa plantations, the ants will also be beneficial in this crop. The main pest of cocoa in Solomon Islands is *Pantorhytes biplageatus* (Fig. 5). This large weevil, which also occurs in Papua New Guinea, deposits eggs on the rough bark of certain cocoa varieties. The eggs hatch into larvae which can circle the trunks under the bark and so kill the trees. In bad attacks on susceptible varieties more than 50 per cent of the trees may be killed. *Oecophylla* is quite capable of driving *Pantorhytes* from the trees, the weevils being bodily thrown off. A survey of cocoa farms on the island of Malaita, where *Pantorhytes* abounds, showed that on those farms where *Oecophylla* was firmly established *Pantorhytes* was completely controlled.

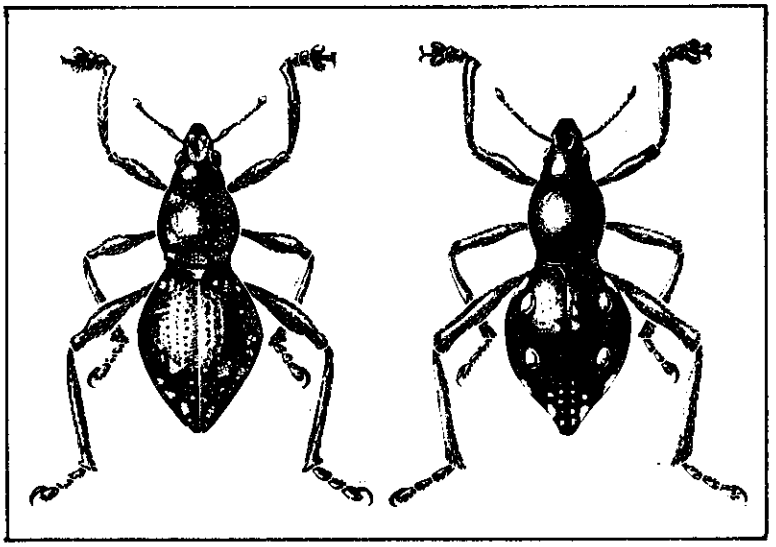


Fig. 5: *Pantorhytes* spp., Adult beetles. **Left**: *Pantorhytes biplageatus.* **Right**: *Pantorhytes quadripustulatus*
From Insect Pests of *Theobroma cacao* in the Territory of Papua and New Guinea. J.J.H. Szent-Ivany. *Papua and New Guinea Agricultural Gazette,* 13 (4): 127-147.

Oecophylla will also prevent the establishment of *Amblypelta* on cocoa but *Amblypelta* is not a serious pest of cocoa and causes a loss in yield of less than 10 per cent. It attacks the young flush leaves and also the pods.

Oecophylla will establish in cocoa, if nests are placed in the actual cocoa trees. Some farms on Malaita have more than 90 per cent of the trees infested by *Oecophylla.*

Cocoa is usually grown under shade and *Oecophylla* does not like such conditions. There is a greater chance of it establishing itself when shade is removed.

ANTAGONISTIC ANTS

Nothing works smoothly in nature and there is usually some contraint on the best laid plans for insect control; *Oecophylla* is often opposed by other ants. The case of *Pheidole megacephala* has already been mentioned but *Oecophylla* in cocoa is frequently opposed by a small black ant *Technomyrmex detorquens* which nests freely under the smallest of debris in cocoa trees. The removal of such ants is often difficult. Spraying the trees with dieldrin or gamma-BHC is successful for a time, but eventually the black ants re-establish. The same ant also occurs on coconuts, but does not develop well on this crop so has not been an obstacle to *Oecophylla* activity. A forest ant, *Iridomyrmex,* also opposes *Oecophylla,* but it only enters coconut plantations by way of secondary bush which should not be allowed to develop.

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