

The Coconut Leaf Beetle, *Promecotheca Cumingi*, and Its Control

HENRY E. FERNANDO*

Introduction

A number of species of beetles belonging to the genus or group, *Promecotheca*, are major pests of the coconut palm in many parts of South-East Asia and the Far East. *Promecotheca coerulipennis* damages coconut palms in Fiji, Tonga and Somoa, *Promecotheca papuana* in New Guinea and the Bismark Archipelago, *Promecotheca opacicollis* in New Hebrides and Santa Cruz Islands and finally *Promecotheca cumingi* in Indonesia and the Philippines, whence it has spread to Malaysia, Singapore and Ceylon.

Promecotheca cumingi was first reported to the Coconut Research Institute as a pest of coconut in Ceylon by a resident in Dehiwala in October 1970, but very likely it had been in this country for at least one year before it was detected. Since then it has spread mainly in the South-Western area of Ceylon by two methods viz:—

- (a) a gradual continuous advance along the periphery of its distribution area and
- (b) a rapid discontinuous advance into isolated pockets at several rail and bus halts along major lines of communication. The pest distribution area now has a Southern limit at Matara, a Northern limit at Bangadeniya and an Eastern limit at Hanwella, Horana and Padukka. The infestations South of Panadura and North of Ja-Ela are discontinuous and associated with railway stations and bus halts.

Entry of *Promecotheca* into Ceylon

Promecotheca has obviously entered Ceylon through our quarantines conveyed possibly from the nearest known infestation in Singapore and Malaysia by sea or aircraft. They could have reached here merely inside an aircraft or on passengers or on or in their baggage or packages moving in international transport.

Major pest introductions are rare but they do occur even in those countries with the most efficient plant quarantine services as for example the introduction of the fruit fly into Florida and the African snail and fruit fly into Hawaii. Such introductions have resulted in more stringent plant quarantine enforcement in those areas. Appropriate steps are being taken at present to strengthen and modernize our plant quarantine services in the immediate future.

* Entomologist, Central Agricultural Research Institute, Department of Agriculture and Leader, Scientific Team for *Promecotheca* Control.

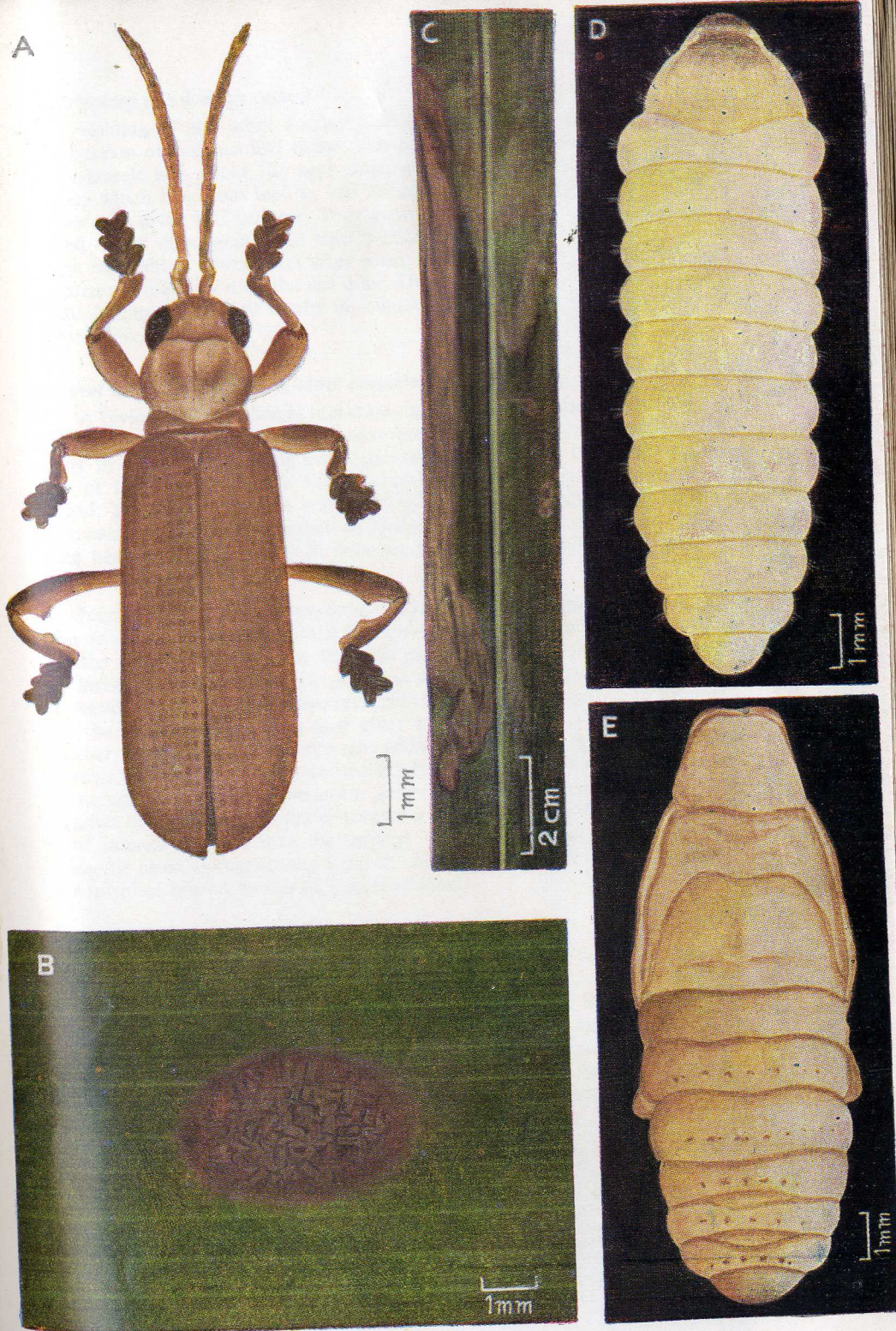


Fig. 1

- A—Adult stage of pest *Promecothea cumingi* C—Portion of a coconut leaflet showing a larval mine
 B—Egg mass of *Promecothea cumingi* D—Larval stage of *Promecothea cumingi*
 E—Pupal stage of *Promecothea cumingi*

Life history and damage caused

Feeding of the adult beetles results in narrow longitudinal streaks of destruction of coconut leaf tissue. The adults live for about 80-90 days and each female lays about 125 eggs singly on the undersides of the leaves. The larvae which hatch out feed as leaf miners destroying the leaf tissue between upper and lower leaf surfaces. They grow in size in three larval stages lasting in all about three weeks and then become pupae inside the leaf mine. This stage lasts about eleven days after which the adult emerges through a semi-circular cut made by it on the leaf mine. Destruction of leaf tissue by larval and adult feeding of the pest results in setback in growth and productivity of the palms (*vide* Fig. 1).

Control measures adopted in other countries

A review of the technical literature on *Promecotheca* shows that wherever this group of pests occurred they have been controlled to sub-economic levels either by naturally occurring insect parasites or artificially by Man's introduction of those parasites into the new environments to which the pests had spread. The latter procedure is referred to as applied biological control where Man uses one or more organisms to destroy certain other organisms. Insecticides have only been useful in delaying the spread of these pests until the parasites became available.

Numerous species of parasites destroying *Promecotheca* species have been recorded in Indonesia, the Philippines, Malaysia and other countries, but the most important are the egg parasite, *Achrysocharis promecothecae*, the larval parasite, *Dimmockia javanica* and the larval and pupal parasite, *Pediobius parvulus*. The *Promecotheca* pest has been under control in Indonesia and the Philippines by these and other natural parasites. Under conditions peculiar to Fiji the pest was brought under control by the parasite, *Pediobius parvulus*. The same parasite controlled *Promecotheca* in New Guinea while the naturally occurring *Dimmockia javanica* and *Achrysocharis promecothecae* parasites brought this pest under control in Singapore and Malaysia. It should be of interest to note that the applied biological control of *Promecotheca cumingi* is listed as one among the sixty six known examples of highly successful control of insects by the biological method.

Control of *Promecotheca cumingi* in Ceylon

A survey conducted in September 1971 showed that while a pocket of suspected disease killing the *Promecotheca* pest existed in the Dehiwala-Kalubowila area there were virtually no insect parasites of the pest other than a very low population of the egg parasite, *Achrysocharis promecothecae*. Therefore, pending introduction of the effective parasites from abroad, DDT spraying was resorted to in isolated pockets of infestation to delay pest dispersal. The area sprayed was very small compared to the then infested area of about 15,000 acres.

Meantime a Biological Control Laboratory was set up in October 1971 at Havelock Terrace, Colombo, and preparations were made to receive from abroad and multiply for liberation the important parasites of the pest.

Cultures of *Achrysocharis promecothecae* and *Dimmockia javanica* were obtained from Singapore and *Pediobius parvulus* from Fiji with the cooperation of the Commonwealth Institute of Entomology. These were bred under

quarantine conditions in our Biological Control Laboratory to ensure exclusion and destruction of hyperparasites i.e. those insects which parasitize and destroy the useful parasites.

The first release of about 500 *Dimmockia javanica* was done by the Minister for Plantation Industries, Dr. Colvin R. de Silva, near Talangama in December 1971. Since then about 68,000 of these parasites have been bred and released to multiply and spread into most of the pest infested areas.

The egg parasite, *Achrysocharis promecothecae* was first released in December 1971 and since then 1200 specimens have been released. This parasite is found endemic in Ceylon and is now giving excellent control of the pest in several areas.

Pediobius parvulus, the larval-pupal parasite was first released in January 1972 and since then 38,000 of this parasite have been bred and liberated in the pest infested areas. To date there is very little indication that this parasite is establishing itself here but a few more months of observation should give a clearer picture of its potentialities in controlling *Promecothecha* in Ceylon.

How parasites destroy the pest

A few words on how the various minute insect parasites, barely visible to the unaided eye, destroy the relatively larger pest will be useful at this stage. From what will be said briefly below it will be noted that biological control does not involve a physical combat or trial of strength between parasite and pest insect but that it is something far more subtle in its intricate relationships of victorious parasite and destroyed host pest.

Achrysocharis promecothecae, the minute egg parasite, lays its egg into the egg of the *Promecothecha* pest using its sharp swordlike egg layer or ovipositor to pierce the capsule and eggshell. The parasite larva which hatches consumes the contents of the pest egg to grow and emerge as an adult parasite to repeat the cycle of pest egg destruction.

Dimmockia javanica pierces with its ovipositor the leaf mine containing a *Promecothecha* larva and lays several eggs on the pest larva inside the mine. The parasite larvae soon hatch out and feed upon the body contents of the pest larva to destroy it eventually. Eight or more adults of *Dimmockia* thus develop on one *Promecothecha* larva and repeat the cycle of parasitization.

Pediobius parvulus similarly lays its eggs into the larvae and pupae of the *Promecothecha* pest (vide Fig. 2). The parasite larvae which hatch consume the contents of the *Promecothecha* larva or pupae thus killing them. A single larva or pupa of the *Promecothecha* pest supports the development of 15 or more *Pediobius* parasites.

Current Status of *Promecothecha* control

A recent survey of the control being achieved has shown that the parasites *Dimmockia javanica* and *Achrysocharis promecothecae* aided by naturally occurring mortality factors such as possible virus, bacterial or fungal diseases have brought the pest under control in many locations. For example the cumulative destruction of the pest by these causal agents has been as follows:—Ratmalana 69.05%, Galle 83.05%, Moratuwa 95.07%, Piliyandala Mavittara 77.07%, Piliyandala Siddaramula 62.95%, Dehiwala 94.99%, Mt. Lavinia 79.94% and Polgasovita Mattegoda 61.64% (See Fig. 3). In other areas these parasites are multiplying and spreading rapidly and the naturally occurring mortality factors are increasing in importance.

Swordlike ovipositor inserted
by parasite *Pediobius* through
leaf surface into larval body
and eggs laid therein

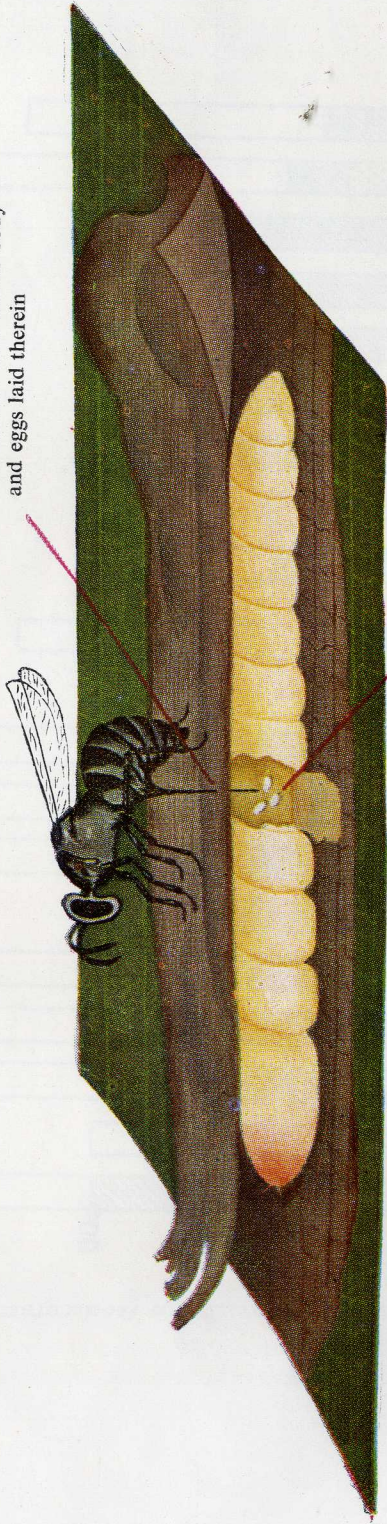
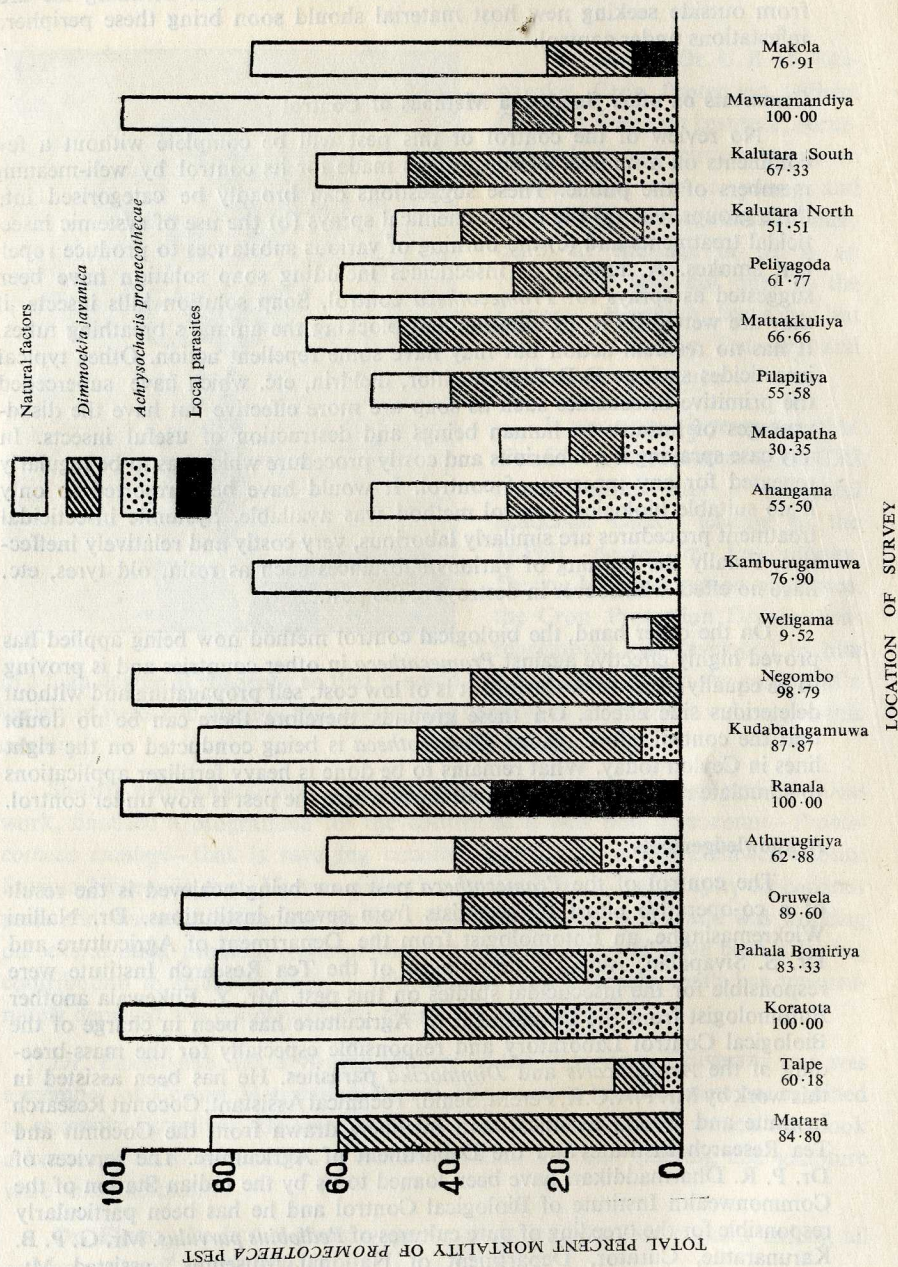


Fig. 2

Parasite *Pediobius Parvulus* parasitizing pest larva
(not to scale)

Pediobius parasite eggs laid
inside *Promecotheca* larva

FIG. 3. TOTAL PERCENTAGE MORTALITY OF *P. CUMINGI* CAUSED BY INTRODUCED PARASITES AND NATURAL FACTORS (MAY 1972)



Active *Promecotheca* infestations are now mainly confined to the periphery of the infestation area such as Horana, Padukka, Bandaragama and Kottawa. The parasites released in these areas and those invading the area from outside seeking new host material should soon bring these peripheral infestations under control.

Comments on other Suggested Methods of Control

No review of the control of this pest will be complete without a few comments on a number of suggestions made for its control by well-meaning members of the public. These suggestions can broadly be categorised into three groups. viz. (a) the use of chemical sprays (b) the use of systemic insecticidal treatments and (c) the burning of various substances to produce repellent smokes. A number of insecticides including soap solution have been suggested as sprays for *Promecotheca* control. Soap solution kills insects, if they are wetted by it, by entering and blocking the animal's breathing tubes. It has no residual action but may have some repellent action. Other typical insecticides such as D.D.T. heptachlor, dieldrin, etc. which have superceded the primitive insecticides such as soap are more effective but have the disadvantages of hazards to human beings and destruction of useful insects. In any case spraying is a laborious and costly procedure which has to be regularly repeated for any measure of control. It would have been resorted to only if no suitable biological control method was available. Systemic insecticidal treatment procedures are similarly laborious, very costly and relatively ineffective. Finally the burning of various substances such as resin, old tyres, etc. have no effect whatsoever in destroying the pest.

On the other hand, the biological control method now being applied has proved highly effective against *Promecotheca* in other countries and is proving to be equally effective in Ceylon. It is of low cost, self propagating and without deleterious side effects. On these grounds therefore there can be no doubt that the control effort against *Promecotheca* is being conducted on the right lines in Ceylon today. What remains to be done is heavy fertilizer applications to stimulate rapid leaf growth in all areas where the pest is now under control.

Acknowledgements

The control of the *Promecotheca* pest now being achieved is the result of a co-operative effort by scientists from several institutions. Dr. Nallini Wickremasinghe, an Entomologist from the Department of Agriculture and Dr. S. Sivapalan, Acting Entomologist of the Tea Research Institute were responsible for the insecticidal studies on this pest. Mr. Y. Elikewala another Entomologist from the Department of Agriculture has been in charge of the Biological Control Laboratory and responsible especially for the mass-breeding of the *Achrysocaris* and *Dimmocika* parasites. He has been assisted in this work by Mr. P.A.C.R. Perera, Senior Technical Assistant, Coconut Research Institute and several technical staff members drawn from the Coconut and Tea Research Institutes and the Department of Agriculture. The services of Dr. P. R. Dharmaddikari have been loaned to us by the Indian Station of the Commonwealth Institute of Biological Control and he has been particularly responsible for the breeding of pure cultures of *Pediobius parvulus*. Mr. G. P. B. Karunaratne, Curator, Department of National Museums, assisted Mr. D. J. Murphy of the University of Singapore in the collection, rearing and shipment of *Dimmockia* and *Achrysocaris* parasites from Singapore to Ceylon.