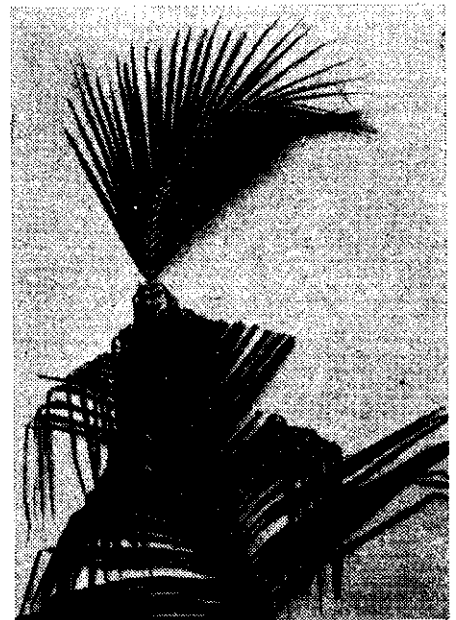




Heavily infested tree

Opened frond after attack by beetle



RHINOCEROS BEETLE

AN UBIQUITOUS PEST OF COCONUT

CHANDY KURIAN, J. ANTONY and
G.B. PILLAI

Central Plantation Crops Research Institute, Regional Station, Kayangulam

RHINOCEROS beetle, *Oryctes rhinoceros* L. is the most serious and ubiquitous pest of the coconut palm in many of the coconut-growing countries of the world. The adult beetles tunnel into the unopened fronds and spathes and cause severe damage. Its cutting and chewing of the unopened foliage results even-

tually in considerable reduction of the functional leaf surface. Attacked fronds show characteristic geometric cuts when fully opened and there may be one or more such cuts, depending on the intensity of attack. Such leaves are rendered unsuitable for thatching and other uses which they are generally put to. Quite often the unopened spathe is attacked and the inflorescence is destroyed, thus directly preventing production of nuts.

It has been estimated from the

results obtained from a field experiment that the direct attack on spathes by the beetle alone causes 5.7 per cent loss. Damage caused by the beetle attack also paves way for subsequent infestations by pests like palm weevil and infection by pathogens such as bacteria, fungi, etc. Occasional cases are known where seedlings have been killed by the repeated attack of the beetles. In India the beetle is distributed throughout the coconut growing tracts from Kerala to Assam in the

mainland and almost all the islands in the Indian Ocean. In addition to coconut the beetle is capable of attacking palms such as palmyrah, wild date, oil palm, areca, date and sago.

Breeding Habits

The rhinoceros beetle breeds generally in decaying organic debris such as farm-yard manure, rubbish heaps, dead coconut logs, coir dust or mulched and buried coconut husks mixed with other decaying organic matter.

The eggs laid in the breeding material hatch out in about ten days and the grubs feed on the decomposing organic matter throughout the larval period which lasts for about 3 to 4 months. Larvae are not able to develop in either absolutely dry or too wet breeding material. Mature larvae construct oval cocoons with breeding material and soil and undergo pupation. The pupal period lasts for about 20 days. Total duration of life-cycle from egg to adult is on an average 6 months. Male beetles can be distinguished from the females by the possession of a longer horn on the head. The long life-span of the adult beetle is correlated with the reproductive capacity and destructive potential of this pest.

Control Measures

Since the rhinoceros beetle is an ubiquitous pest which is capable of multiplying in accumulations of organic debris its control has ever been a baffling problem to plant protection workers. This difficulty is all the more great in areas where coconut plantations are contiguous with forest areas, where there will be abundant supply of breeding sources for the multiplication of the pest. Location and disposal of breeding sources of the pest and maintenance of field sanitation are essential prerequisites for evolving suitable control measures.

Control of the beetle by the mech-

anical methods is being practised in India. This consists in tackling the breeding sources and destroying the immature stages and the extraction of beetles from crowns of palms by means of beetle hooks. Hooking out beetles, unless done very carefully, may cause further injury to the palm. If the wounds are left untreated they are likely to provide grounds for infestation by another dreaded pest of the palm, viz. red palm weevil or infection by certain pathogens. It is, therefore, advisable to treat these wounds with BHC.

Insecticidal trials have revealed that BHC, Aldrin and Carbaryl at 0.01 per cent concentration can effect satisfactory control of the immature stages of the pest in their breeding sites. Field trials using 0.01 per cent BHC and Aldrin laid out in cultivators' fields showed that the rate of attack of leaves was reduced from 59.7 to 9.4 per cent with BHC and from 58.9 to 5.9 per cent with Aldrin within a period of six years. The resultant increase in yield obtained due to this pest control operation was of the order of 5 to 8 nuts per tree per year.



Unopened spathe attacked by beetle



Spraying of breeding material

Elaborate field trials are being conducted in different rainfall tracts of Kerala using BHC and carbaryl to confirm whether the results obtained in Central Kerala would hold good in other tracts as well. Trapping the beetle with insecticide treated breeding material and prophylactic filling of innermost three or four leaf axils with a mixture of 5 per cent BHC and sand in equal proportions have been also proved to be effective measures in reducing pest incidence. An integrated control operation including mechanical, sanitational and chemical methods of beetle control is being tested in an experiment in order to assess the combined efficacy of these operations. Results obtained so far are quite encouraging.

A study of the indigenous predaceous fauna in the mainland and islands of the Indian ocean has revealed the presence of numerous such forms in the mainland as compared to those in the islands.

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The more promising species among these are (1) *Santalus parallelus*, the grubs and adults of which attack and consume eggs and grubs of *Oryctes* and (2) *Agrypnus* sp. which attack and kills *Oryctes* grubs during its prolonged larval stage. By the introduction of parasitic or predaceous fauna in areas where they are absent or less abundant the population of the pest can be brought under check and damage to the crop reduced. With this objective in view the exotic predatory bug *Platyeris laevicollis* is being mass-multiplied and liberated for colonization in the Androth Island of Laccadives and at Pandalam in the mainland. Data collected so far indicate the establishment of the predator in the liberated areas.

The entomogenous fungus *Metarhizium anisopliae* which is responsible for incidence of 'green muscardine disease' on *Oryctes* populations in the field has been under investigation in India and other parts of the world for quite a long time. This fungus affects all stages of the pest except eggs. Experiments on the practical utility of this fungus in controlling the pest have shown that nature and extent of disease and spread of infection on pest depends upon not only the virulence and dose of the pathogen but is also correlated with predisposing environmental factors such as relative humidity, temperature and rainfall. High humidity and low temperature are factors favourable for the spread of the disease. This disease is more prevalent in the South West monsoon when there will be high humidity and low temperature and under such conditions it can take the role of a virulent pathogen and cause epidemics particularly in the larval populations.

In view of the ubiquitous nature of the pest and the complexity of the problem of its control it would be more efficacious to adopt the integrated method of control extensively rather than adopting control operations individually in isolated areas.

is about 4-5 kg. More than 10 kg of seeds may be considered to be a very good yield. The seed yield may come to about 30 to 40 per cent of the total fruit weight. Depending on the vigour, growth and age of the tree, the yield per tree may come to 1 to 2 kg in the 2nd year, 2 to 3 kg in the 3rd year, 4 to 6 kg in the 4th year and 8 to 10 kg in the 5th year to 10th year of its age.

From an average harvest of annatto seeds, it is roughly estimated that a grower can fetch an income of Rs 10 per tree or about Rs 1,000 from an acre of 110 trees. In general, a grower pays least attention to its regular cultural practices like manuring, watering, etc., and hence his investment on its cultivation is almost negligible. Thus obviously, a net profit of Rs 800 to Rs 1000 can be obtained from an acre of annatto trees, with least care and attention, investment and labour.

Marketing prospects and exporting possibilities. Annatto seeds have bright prospects of marketing in and abroad India. Within India, there are a few number of markets which handle considerable quantities of annatto seeds. Amongst them, the weekly markets (locally called *shandis* or *hats*) in the Koraput district of Orissa state like Kunduli, Padwa, Koraput, Jeypore, Nowrangput, Laxmipur, Pukuli, Ralagedda and Lavidi, Tuni market, Hanumakonda, Warangal and Pedapalli markets in Andhra Pradesh; and Chanda markets in Madhya Pradesh are worth mentioning.

According to a rough estimate, the quantum of seeds handled in these markets during the harvesting season, comes to about 150 to 200 metric tonnes in the markets and weekly *shandies* of Koraput district, and 30 to 50 metric tonnes in the Tuni market of Andhra Pradesh.

Out of these, a major quantity is being exported every year from

India to other foreign countries like Russia, United States of America, United Kingdom, France, Japan, Italy and Belgium. The quantum of seeds required annually by these countries is of the order of 100 to 150 tonnes by Russia, 30 to 50 tonnes by U.S.A. and U.K.; 25 to 30 tonnes by Japan and of small quantities by other countries.

Uses. A fruit dye commercially known as Annatto Dye is obtained from the pulp surrounding the seeds of annatto.

The fruit pulp is extracted and boiled and the residue is pressed into cakes. Usually, it is exported in form of cakes and utilised in commercial concerns. This dye is also obtained in a crude method for domestic uses, mainly to colour white clothes. In this process, the seeds are soaked in water for about a week and the whole mass is boiled by adding a few drops of edible oil. The coloured water is then filtered out and the clothes are soaked in it which colours them orange red.

The dye gives beautiful pink colour to wool, silk and cloth. When mixed with 'Kamala' powder it gives vivid orange-red colouration. In European countries, this dye is also used for colouring edible materials like butter, cheese, *ghee* and margarine as well as the soaps, paints and varnishes and also in the manufacture of some cosmetics.

Really, annatto has a very high commercial value and importance in the international market. For its manifold utilities in the industrial sector, it often enjoys greater demand, wider export and higher price in different parts of the World. The cultivation of annatto should therefore, be encouraged on a large scale on commercial footing in suitable areas and this would certainly fetch a fair foreign exchange for India.