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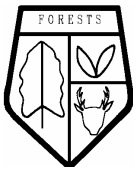


**Government of Union of Myanmar**
**Ministry of Forestry**
**Forest Department**


# Detrimental Effects of some Insects on Teak Fruit Yield

by
Aung Zeya
Forest Research Institute
January, 1982

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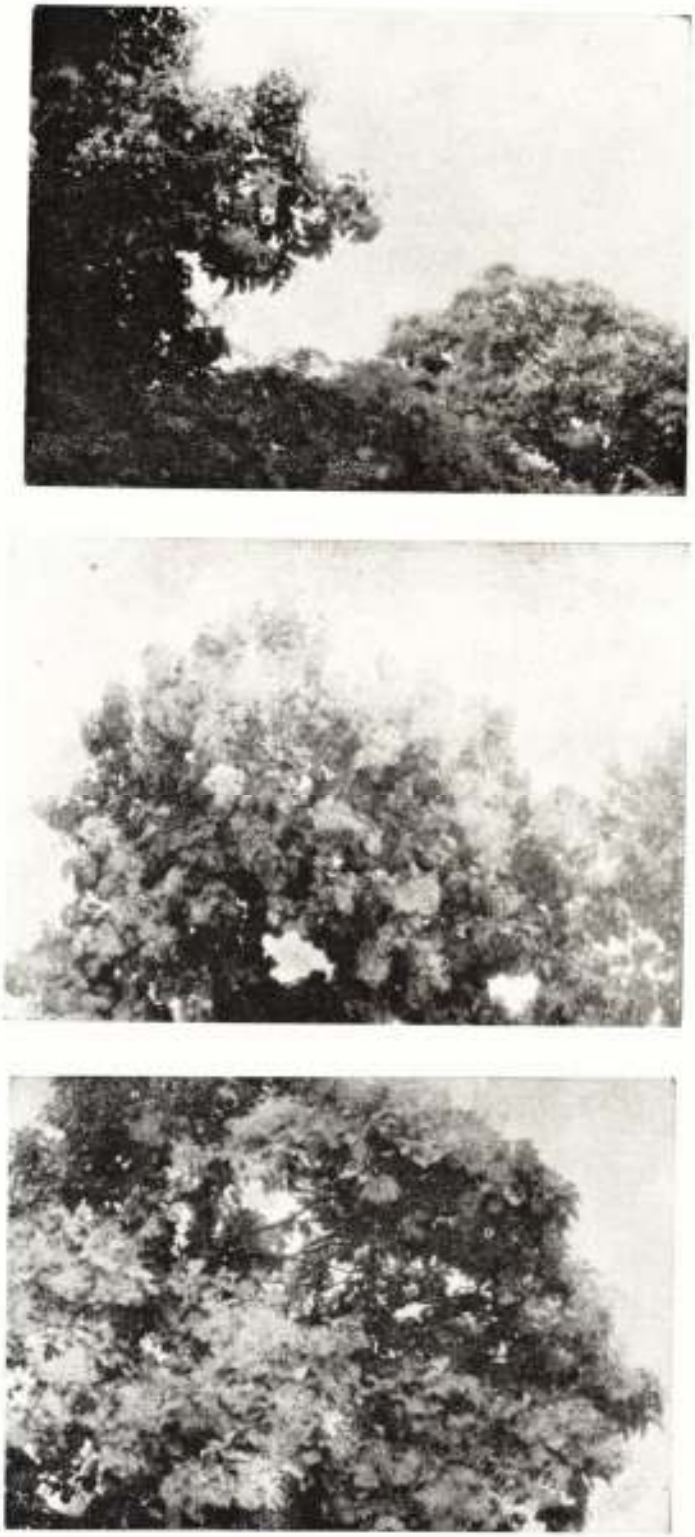
PLATE I



Flowering teak in (from top to bottom) Agricultural College Grounds in Yezin, Agricultural Research Institute Complex grounds in Yezin, and Pyinsa, near Maymyo.

# Detrimental Effects of some Insects on Teak Fruit Yield

By
Aung Zeya
Forest Protection Section
Forest Research Institute
Yezin

## Abstract

Reduction in teak fruit production and possible reduction in teak seed germination rates to insects investigated.

In certain localities, damage to teak fruits and consequent reduction in teak fruit production due to a Lepidopterous borer was found to reach a maximum of about 30 per cent with a possible further reduction of about 4 per cent in teak seed viability due to a Hemipterous sap sucker, and in others, a reduction in teak fruit production of about 10 per cent with a possible reduction in teak seed viability rate of up to about 73 per cent was detected.

Methods for protection and control of insects having detrimental effects on production of viable fruits in seed orchards are proposed.

# Contents

# 1. Introduction

Fruit production and germination of seeds in teak (Tectona grandis) has generally been known to be extremely poor (Garther, 1956; Maung Gale (2), 1958; Kermode, 1964; White and Cameron, 1965; Bryndum, 1966). In Burma, low teak fruit production coupled with poor germination rates in teak seeds have for ong plagued plantation developers, and five to nine teak fruits have been the common quantities used to assure development of a single tree in all plantations where direct sowing method is used.

An immense amount of literature has been published on possible relationships of fruit production and seed viability to many and various factors. Fruit production has been considered to have relationships with the age of seed bearing trees (Garther, 1956; Kermode, 1964; White and Cameron, 1965, Cameron, 1968) and locality (Kadambi, 1972; Gyi, 1972); seed viability has been linked to provenance (Anon., 1956; Kermode, 1957; Wijesinghe, 1963; Maung Gale (2) and Nyunt Naing, 1967; Gyi, 1972; Kadambi, 1972), seed pretreatment (Blanford, 1921; Bryndum, 1966; Gyi, 1972; Letourneux, 1957; Wijesinghe, 1963; Anon., 1956; Thein Pe, 1968; Hedegart, 1971), seed size 1/ 2/ 3/, (Gartner, 1956), combinations of seed coat formation, conditions in the embryo and structural immaturity (Joshi and Kelkar 1971), time of seed collection (Gartner, 1956; Kermode, 1964) and storage or ageing 1/ (Anon., 1956; Troup, 1921).

However, Joshi and Kelkar (1971) using a method devised by Flemion and Poole (1948) tested the viability of a sample of well developed teak seeds from a single source in India, and reported that 20 per cent of the sample were positive, 40 per cent gave feeble reaction and the remaining 40 per cent did not show any response at all to the test. The test involved use of 2,3,5 Triphenyl Tetrazolium chloride which is colourless in its oxidized form, but turns intense red or orange when reduced as by viable embryos. The test led the authors to assume that the physiological condition of the embryo alone was responsible for 80 per cent reduction in germination of the sample.

In 1976, large numbers of dry teak fruits stored in semi open bamboo sheds for plantation development in Prome forest division were found to bear insect bore-holes in them. A random examination showed an average of 57 per cent borer damage among the stored fruits. A project was therefore proposed, and later approved, to investigate the biology of the damage-causing insect and its possible relationships to the viability of teak seeds and the consequent reduction in germination rates. But during the course of the investigation, a larger number of insects were found to be adversely affecting normal teak fruiting. Some of 2 the insects destroyed teak fruits while in their early stages of development thereby directly affecting production, and others did damage by sucking the sap of the succulent fruits during early developmental stages possibly upsetting the physiological functions of normal fruit formation.

In view of the economic importance of teak, and the need for production of large quantities of good seeds bearing desirable genetic characters for the development of extensive plantations of this valuable tree species, the investigation has been extended to include relationships between insects and seed viability as well as fruit yield.

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1/ Silvicult. Res. Rept., Madras, 1939-40.
2/ Burma Forest Bulletin, 24, 1931.
3/ Silvicult. Res. Rept., Uttar Pradesh, 1929-30.

This paper is essentially a preliminary report based on the findings of the investigations carried out during the period between May and December, 1981, on insects damaging teak seeds, and is a part of a research objective to identify and evaluate control alternatives for insects damaging economically important forest tree species.

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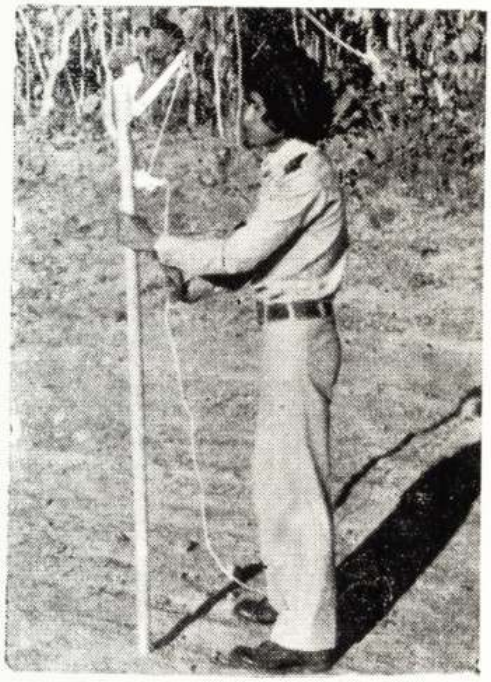
1/. Indian Forester, 1907, p.407

## 2. Materials And Methods

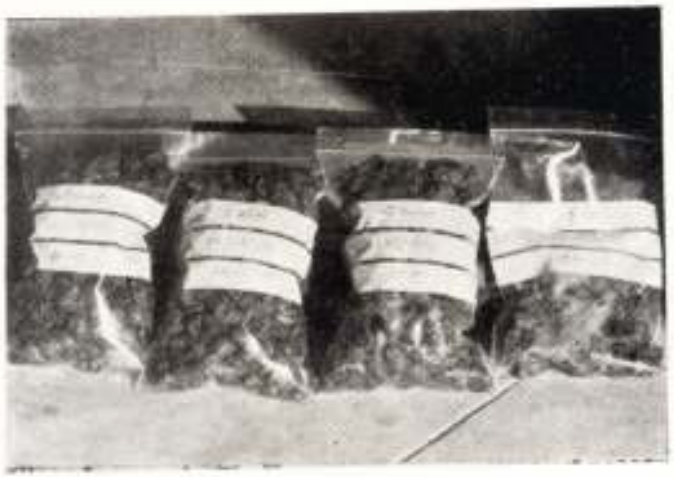
All leak fruits examined in this series of investigations were collected from trees with heights of 20-25 ft. in the Agricultural College grounds and the Agricultural Research Institute complex grounds in Yezin, forests around Pyinmana Golf course and teak plantations in Pyinsa which lies about 16 miles from Maymyo along Mandalay Maymyo Road. The first three places are situated around latitude 96˚16'E and longitude 21 54 N. Selection of localities representing different meterological conditions and topographywas not made due to the inavailability of transportation to search for or regularly visit the selected sites for observation. Trees having greater heights were notchosen due to the situation of the foower heacs whicg, in this tree species, lie terminally on main axes making theit intact removal extremely hazardous or almost impossible without mechanical assistance such as self-erecting ladders or helicopters. In thisseries of observations, telescopic pull-rope operated ranch cutters with 5 ft. detachable wooden sections were used to obtain flower heads tor examination (pl .II , figs.1,2,3 ).These and other equipment were carried to the observation sites and back to the laboratories in four-wheel driven Land Rovers or Mazda Jeeps whenever these transports were available. Fruits from five flower heads each from six randomly selected teak trees in each locality were sampled and closely examined on the spot and the results recorded; (pl. III, fig. 4). The samples were brought back to the laboratories in sealed plastic bags for closer examination, and storage for further investigations (pl . III,fig.5).

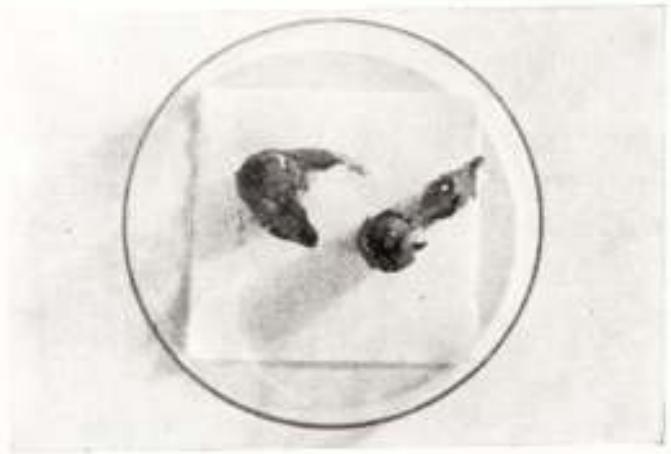
Insects or larvae that were actually or apparently doing camage to teak fruits were reared through in the laboratories in petridishes lined at the bottom with moist filter papers for identification and life cycle studies (pl. III, fig.6),but these studies had to be abandonen due to unforeseen circumstances.



Figs. 1-3. Clockwise from top left.
Operation of telescopic branch cutters.
Attachment/detachment of telescopic sections.
Flower heads being removed from teak trees.

**PLATE III**





Figs. 4-6. From top to bottom

(4) Teak fruits being sampled and recorded after removal of flower head.

(5) Sampled teak fruits packed for dispatch.

(6) Fruit borers being reared in the laboratory.

## PLATE IV

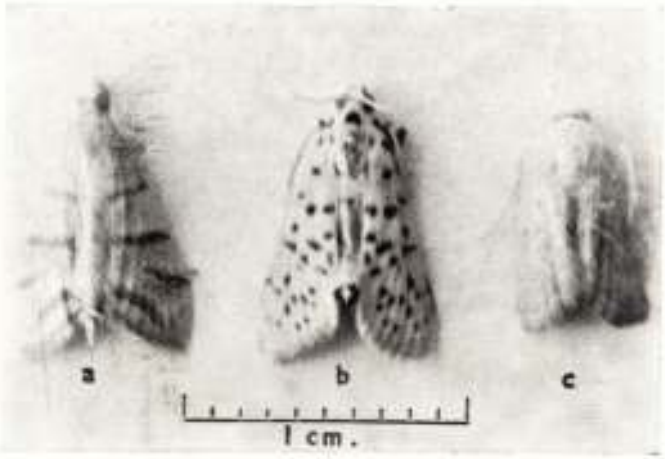



Fig. 7. Adult stages of fruit borers, (from left to right)
(a) *Pagyda salvalis*
(b) *Dichochrosus punctiferalis*
(c) Unidentified fruit borer.

Figs. 8-9. Fruits destroyed by borers.
Note larva on fruit.

PLATE V

Figs. 10-12. From top to bottom
Fruits completely damaged by borers.
Damaged fruits from stocks stored for planting by Silviculture Section.
Fruits with the exocarp removed (scarified), or stones in preparation for germination tests by the Silviculture Section
Note extent of damage to seeds.

# 3. RESULTS

## 3.1 Tnsects attacking teak fruits

Four species of insects belonging to two different ormers were observed to attack teak truits during the present series pf observations made between July and December, 1981.Of the four species, three belonged to the order Leppidoptera and one to the order Hcmiptera.

## 3.2 The Lepidopterous insects

Of the three Lepidopterous insects, two were summarily identified as *Pagyda salvalis* (pl.IV, fig.7a) and *Dichochrosus punctiferalis* (pL.IV,fig.7b), both belonging to the family pyralidae; the other Lepidopterous insect (pL. IV, fig. 7c) remains unidentified due to the inavailability of relevant literature, but it also appeared to belong to the family pyralidae.

## 3.3 Method of attack

The larvae of all the three Lepidopterous species attack teak fruits in early stages of development by boring into fruit through the outer spongy layer or exocarp into the stone or endicarp which contained the seed chambers each tightly enclosing an enbryo and usually numbering four. The larvae were observed to bore successively into each of the seed chambers of the still succulent stone of the developing fruit and usded the embryos inside them as food, thus destroying the stone almost totally. The fruit and the seeds within are mace useless for propagation in this manner (pL. IV, figs. 8-9; pL.V,figs. 10-12).

## PLATE VI

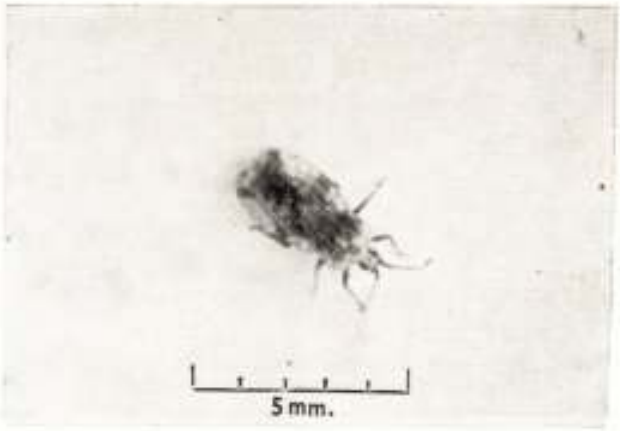



Fig. 13. Live Hemipterous sap sucker.

Fig. 19. Teak fruits with no visible faults.
(Clockwise from top) Fruit stored for sowing; note loss of pubescence on surface. Mature fruit with pubescence still retained. Green fruit.

Fig. 20. teak fruit on which fungal growth has been initiated. Note black spots of fungal growth on fruit and sucker at center.

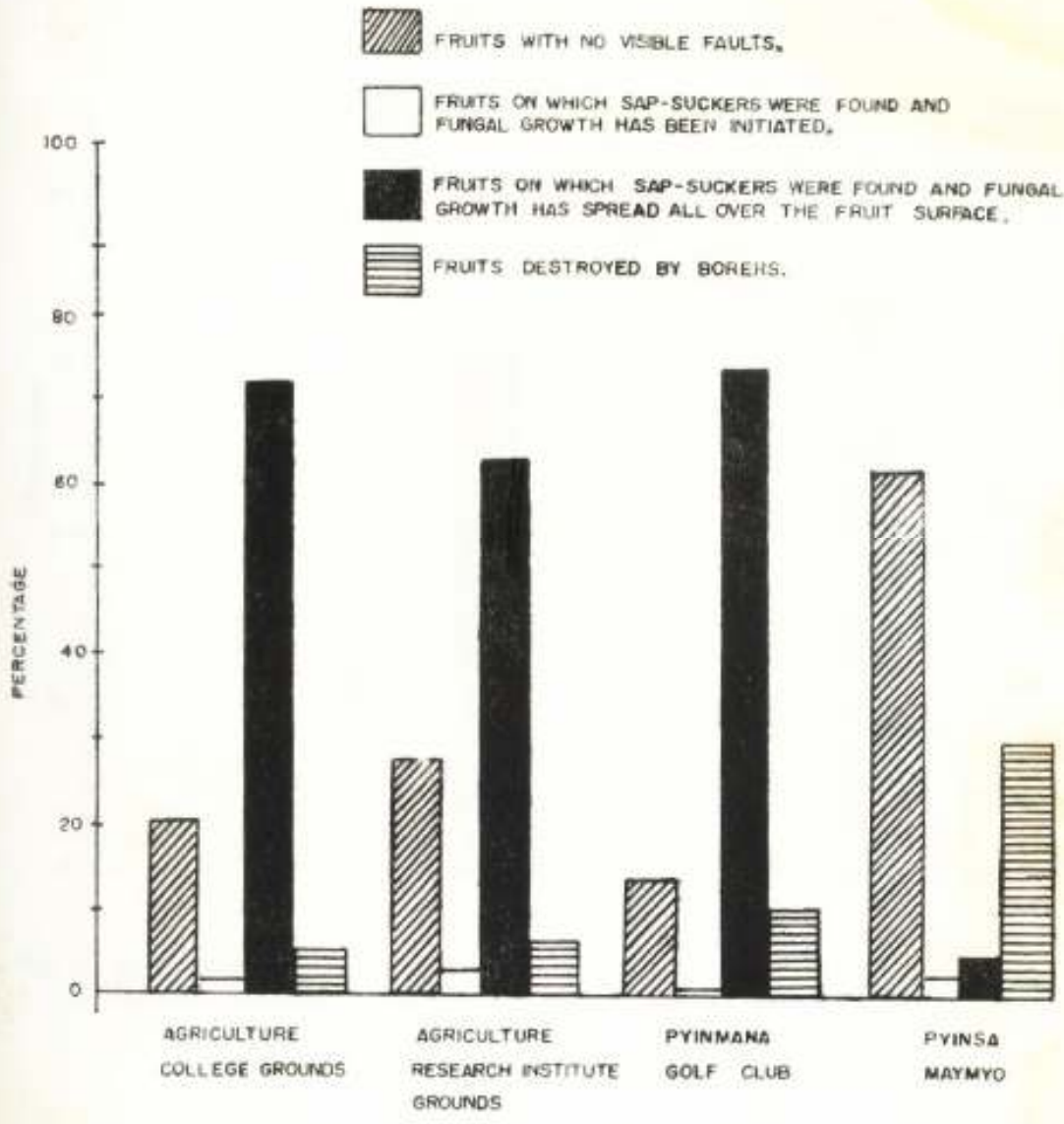



Fig. 14. A comparison of the results of observations on teak fruits made in September, 1981.

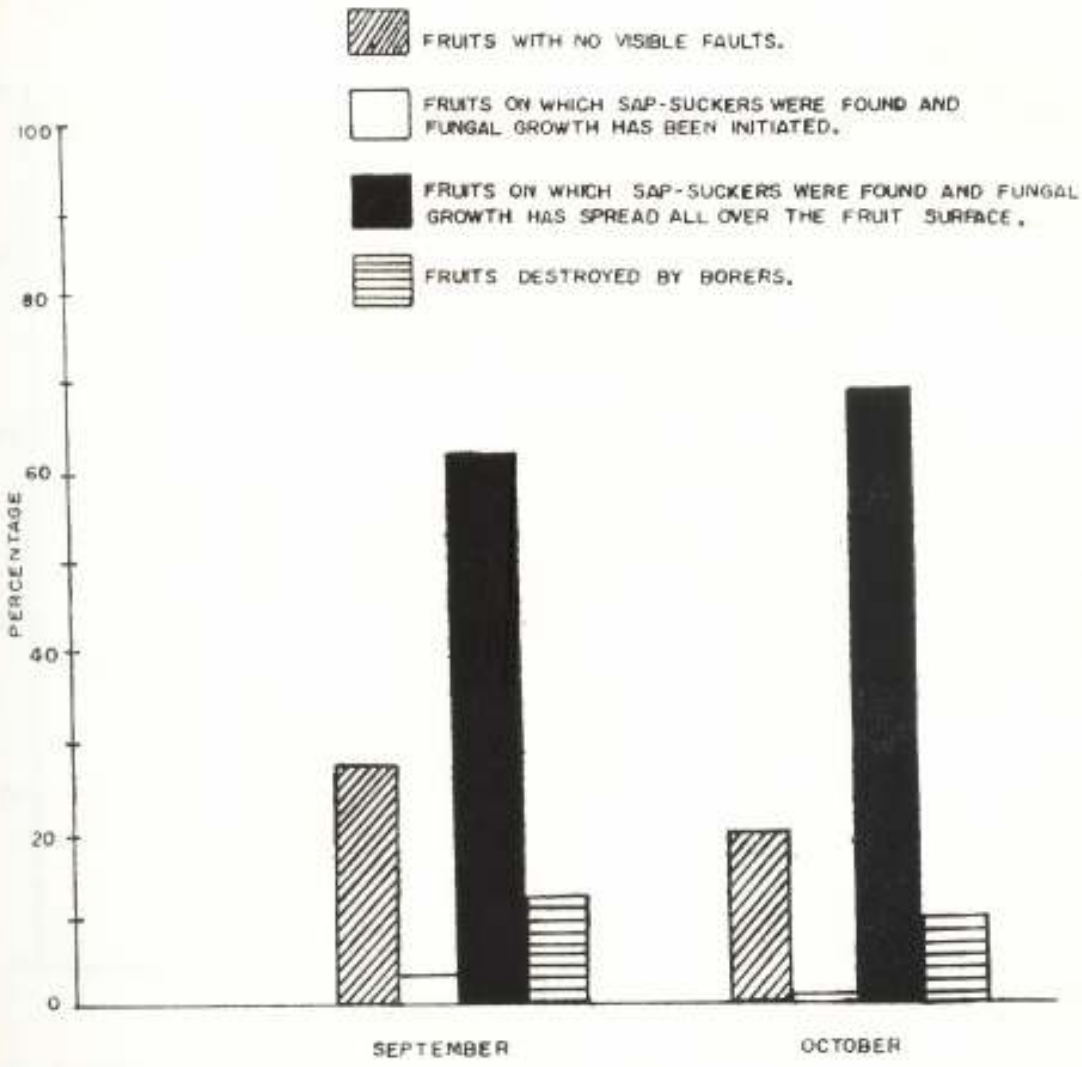



Fig. 15. A comparison of the results of observations made on teak fruits from trees in the Agricultural Research Institute complex grounds during different periods.

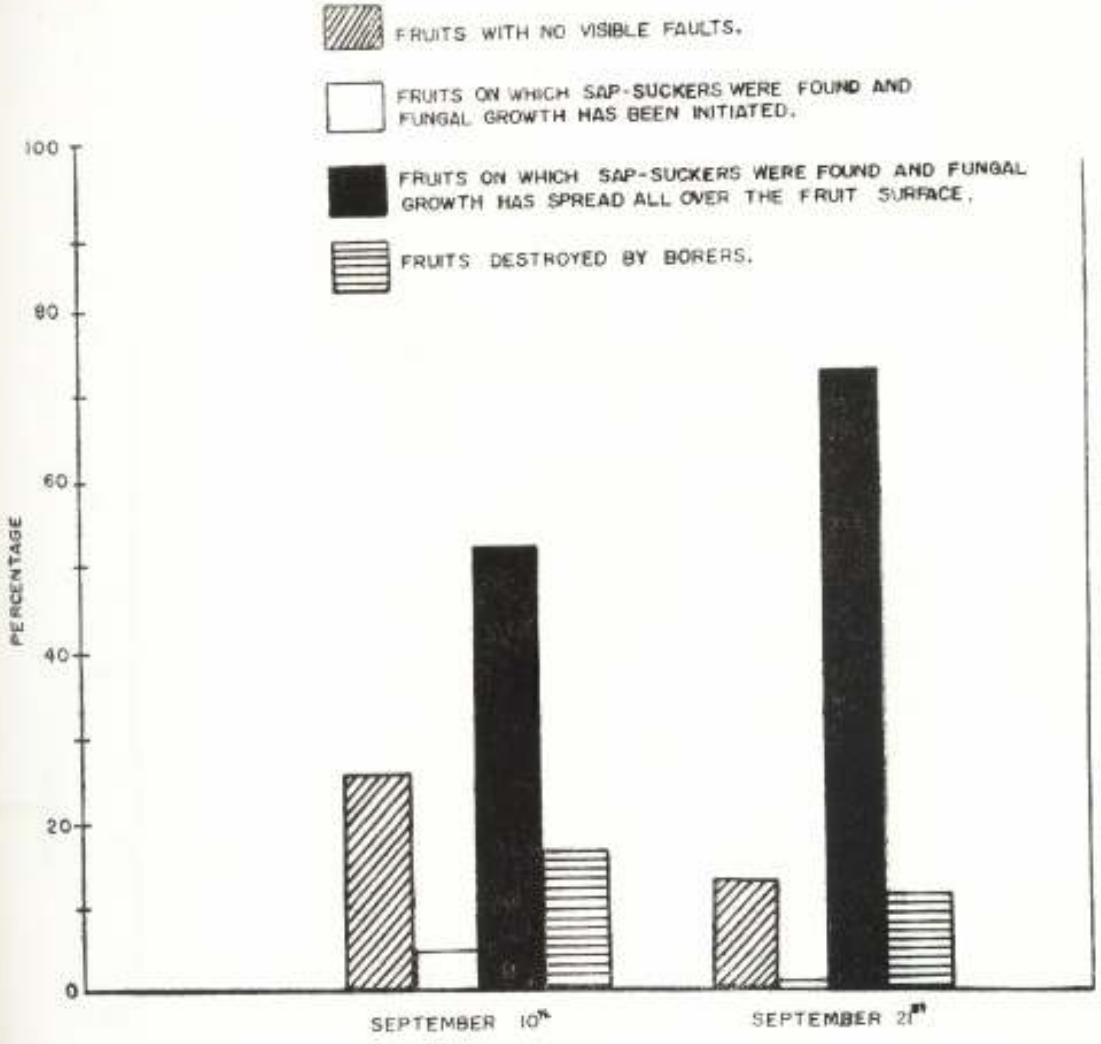



Fig. 16. A comparison of the results of observations made on teak fruits from trees in the forests around Pyinmana golf club during different periods.

**PLATE X**

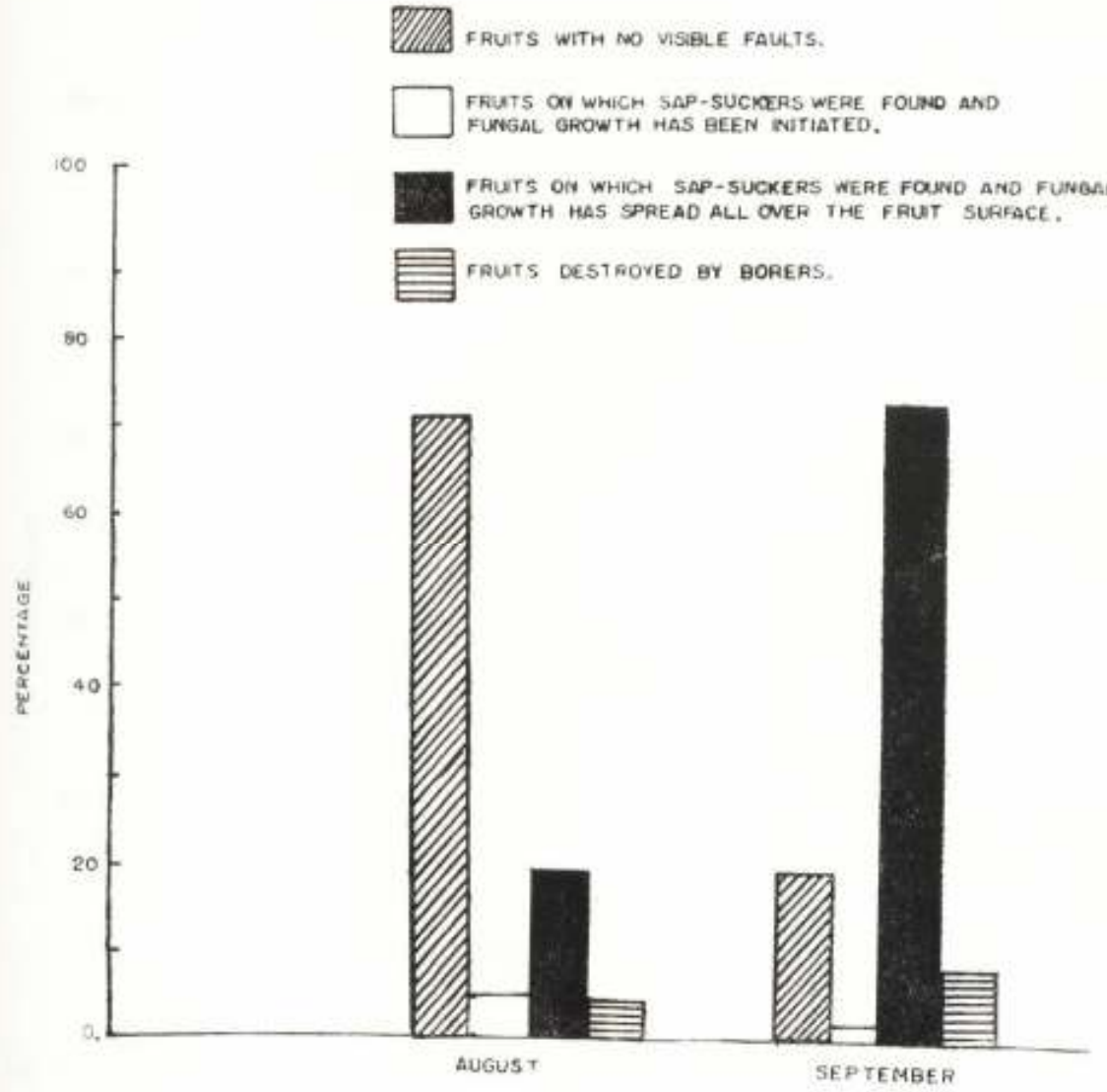



Fig. 17. A comparison of the results of observations made on teak fruits from trees in the Agricultural College grounds during different periods.

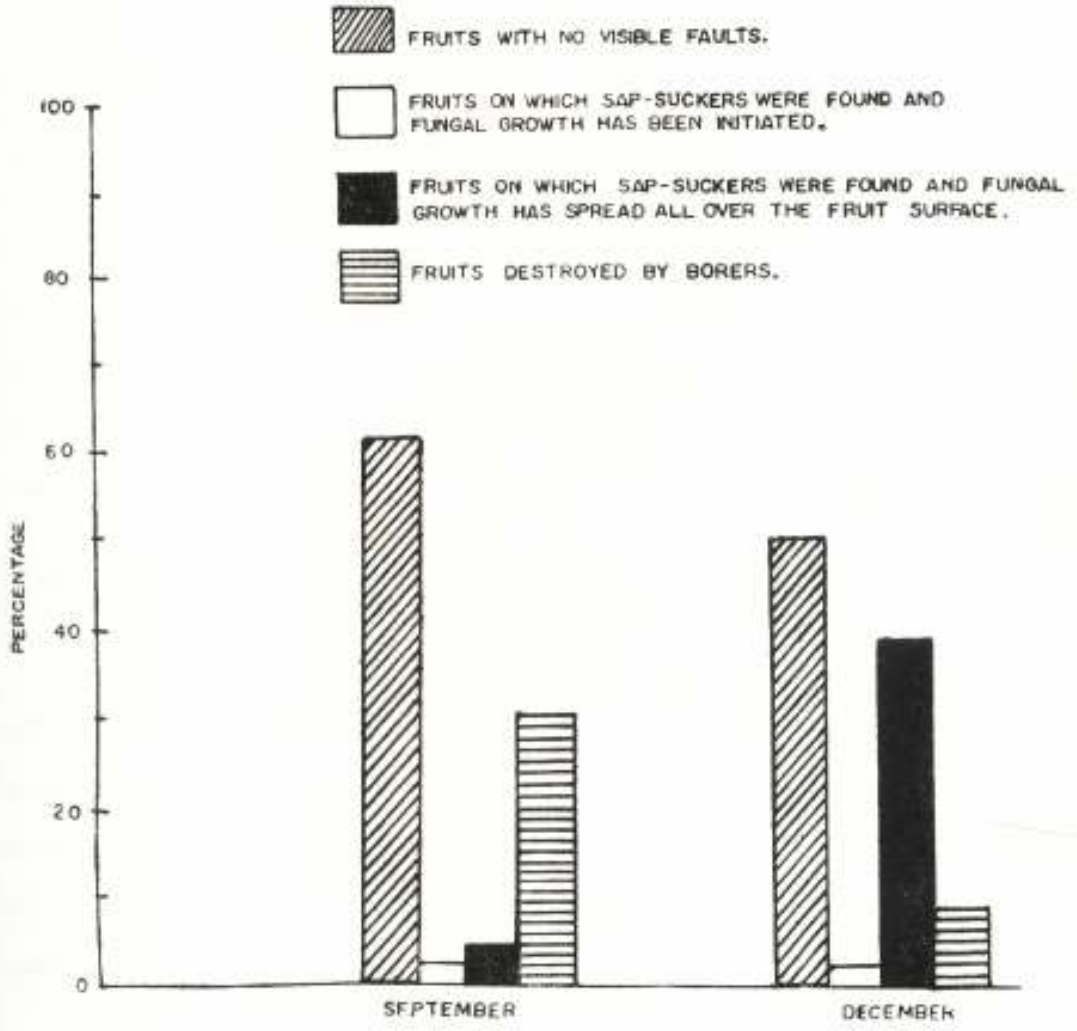



Fig. 18. A comparison of the results of observations made on teak fruits from trees in teak plantations at Pyinza, Maymyo at different periods.

## 3.4 The Hemipterous insects

This insect also remains unidentified due to the unavailability of relevant literature (pL. VI, fig. 13) but it will be identified in due course.

## 3.5 Method of attack

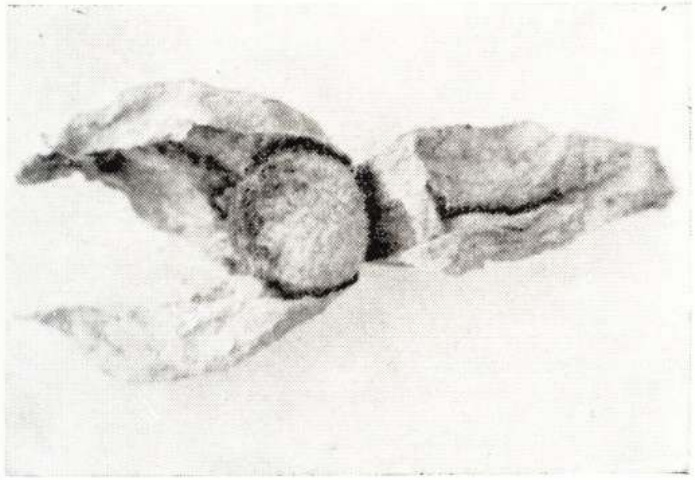
Insects belonging to the order Hemiptera usually feed by piercing their long proboscis of snouts through plant tissues and sucking the sap, and in so doing possibly also inject a toxic fluid of saliva which causes the death of the cells in the plant tissues they feed on.

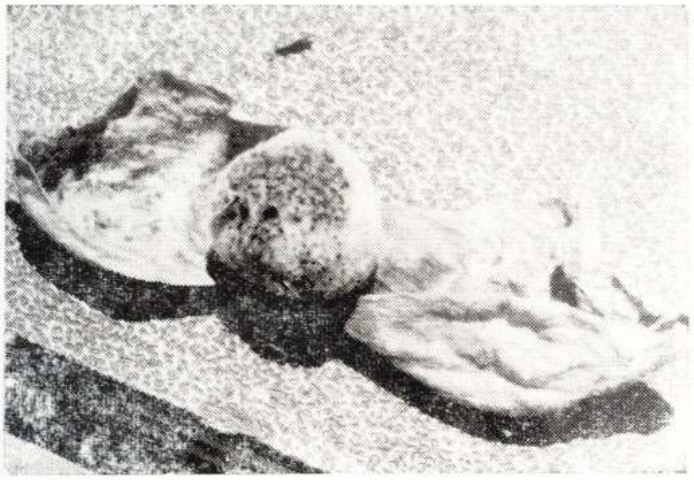
## 3.6 Extent of damage by insects to teak fruits

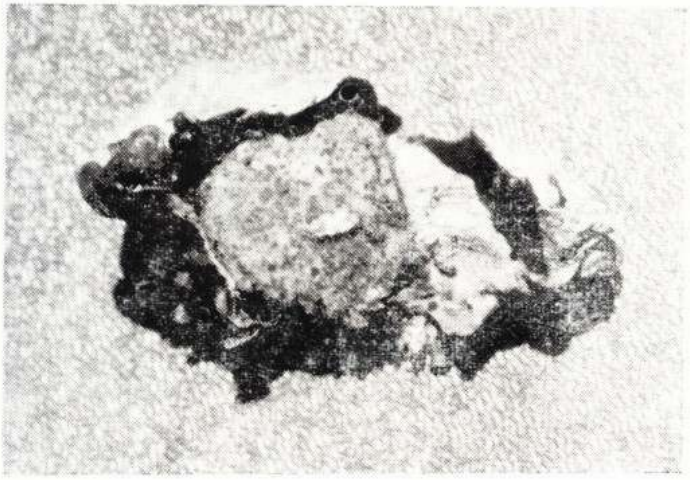
A comparison of the results of observation made in September, 1981, on the numbers of fruits damaged by Lepidopterous insects (fruit borers), Hemipterous insects (sap suckers), fruits on which sap suckers were found and fruits with no visible faults in per cent of the total number of fruits examined with respect to the localities where examinations were made is given in pL. VII, fig. 14.

A comparison of the results of observations in individual localities at different periods is given in pL. VIII-XI, figs. 15-18.

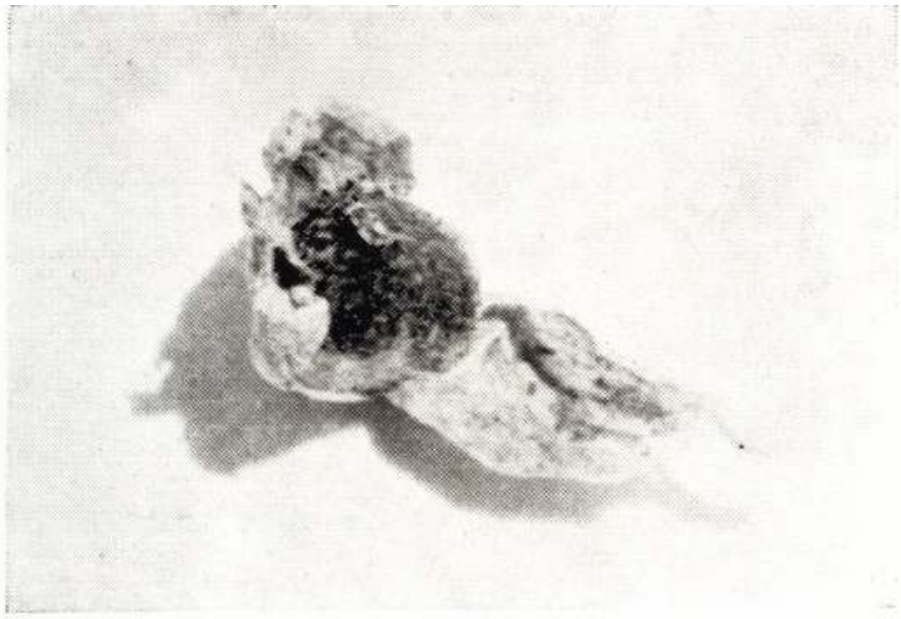
## PLATE XII

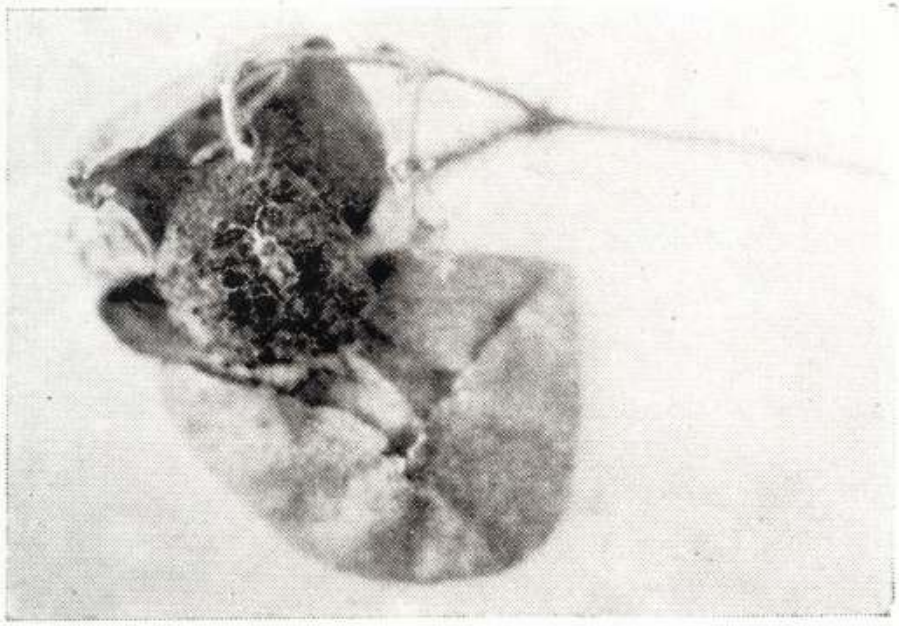






Figs. 21-23. Fruits showing progress of fungal growth. Note total blackening of fruit surface at bottom.





Figs. 24-25. Fruits at advanced stage of fungus formation.
Note total blackening of fruit surface by the fungus.

## 3.7 Taxonomic status and life cycles of the insects

Detailed taxonomic investigation on the three Lepidopterous fruit borers and the Hemipterous sap sucker will be carried out, and the life cycles and habits of all four insects will be studied in due course.

## 4. Dicussion

The results of the present series of observations demonstrate that insects definitely caused a direct fruit production loss and that this loss caused by the fruit borers alone ranged from a minimum average of more than four per cent in certain localities to a maximum average of 30 per cent during September, 1981, alone, which indeed is a high percentage loss in any production process.

Furthermore, the number of teak fruits attacked by sap suckers and its possible consequence is alarming . The number of fruits attacked in this case ranged from a minimum average of five per cent to a maximum average of 73 per cent of the total number of fruits collected in September along . It must be mentioned here that a Hemipterous insect, *Tingis beesoni,* defoliates and kills 25 ft. high *yemane* (*Gmelina arborea)* trees by sucking the sap from bases of the leaves (Zeya, 1981). The leaves first turned necrotic before falling and a 'sooty mould' grows over all the surfaces of the trees' appendages (Beeson, 1941).

Similarly, a black mould or fungal growth has always been observed to associated with the presence or the Hemipterous insect in the present series of observations (pL. VI, fig. 20; pL. XII, figs. 21-23; pL.XIII, fig. 24-25). Fruits with no visible faults are shown in pL. XII, fig. 19. Teak fruits in very early stages of development on which this insect occurred were always found to have initial fungal growth or were completely grown over with the black fungus, and fruits in the latter case appeared to be retarded in growth. However, the stage of fruit development at which this insect begins its attack is not known. Although very large numbers of these insects were observed on fruits of trees where this insect occurred, very low numbers of fruits completely covered over with the black fungus were present (pls. VII-XI. figs. 14-18). This may well be due to premature falling off of retarded, defective fruits before maturation. In times of fruit shortage, collection of fruits for plantation development may have to be made without regard to internal fruit conditions. This possibly could be one of the reasons, if not the main, for poor germination of teak seeds.

Germination and other tests on fruits attacked by the Hemipterous sap-sicker will be conducted when fruits from observation trees ripen about February to June in 1982.

Applying control measures to harmful insects without knowledge of their life cycles and habits is always extremely difficult if not impossible, and consequently exorbitantly expensive. To study life cycles and habits of teak fruit insects, close, constant examination of flower heads will have to be made on low, flowering observation trees from high and stout scaffoldings erected round them. Building of these scaffoldings at far flung observation sites calls for a larger trained staff, more equipment and regular transportion, bigger expenses and, above all, larger amount of time.

But sacrifices will have to be made in studying life cycles and habits of economically important insects like the teak fruit insects, because they are basic to successful control of all harmful insects as they are witb rearing rearing of all beneficial animals like poultry and bees.

The key to control of all harmful insects is careful and constant observation. In the case of teak seed orchards with low flowering trees, control can be achieved with reasonable budgets. Careful and constant observation of flower heads and their vicinities will reveal the presence of the insects illustrated in this report. Application of the following pesticides at rates and intervals stated at first detection of the insects is suggested.

**Insecticides**

Dichlorvos 1/
Phosphamidon 2/

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1/, 2/. The brand names of these chemicals in stock at forestry outposts are 'Nagos' and 'Dimecron' respectively.

**Amount of insecticides in mixture**

| | | |
|---|---|---|
| Dichlorvos .. | .. | 25 ccs. |
| Phosphamidon.. | .. | 50 ccs. |
| Water 1/ | .. | .. 25 ccs. |
| Total | .. | 100 ccs. |

Note. Do not store the mixture; use it immediately.

**Working solution of mixture**

1 oz. of soap powder and 20 ccs. of above insecticide mixture in 2 gallons of water and shake thoroughly.

**Equipment**

Ordinary 2-gallon knapsack sprayer.

**Methods of spraying**

Spray all flower heeds thoroughly. For high trees, attach nozzle on long poles all flower heads as thoroughly as possible. Leaved and other appendages need not be sprayed.

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1/. Water has been added for easy measurement.

**Interval of spraying**

In this case, spray flower heads every 3 days as long as presence of the insects illustrated in this report are observed; or spray at some intervals for 6 months from beginning of fruiting of teak. Fruiting can be detected by removing flower heads and examining them.

The possibility of the insecticide application suggested in this report affecting insects beneficial to teak pollination is slight since the attack of harmful insects began only after fruit formation. Forthermore, application of the contact-stomach insecticides with a half life of about 1 day at times unfrequented by pollinating insects (moths are almost always nocturnal) minimizes danger to these insects. The effect of the systemic insecticides with slightly longer half life appears to be also slight, if at all, since pollinating insects do not confine themselves to a single tree or place, or feed on the plant tissues.

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