ENTOMOLOGY BULLETIN: NO.48
FOREST INSECT PESTS OF PAPUA NEW GUINEA
4. Defoliators of *Pinus* (Pines) in the highlands

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INTRODUCTION

Among the many kinds of insects that attack trees those that eat the leaves are called defoliators. The most common defoliators are young stages of the group Lepidoptera (butterflies, moths) known as caterpillars.

In the highlands of Papua New Guinea there are large areas of poor soils which support a natural vegetation of grassland. It is difficult to get most trees to grow there, but introduced pines of the group *Pinus* are an exception. One of these, *Pinus patula*, grows well in these conditions, and has been selected by the Department of Forests as a plantation tree. Unfortunately the caterpillars of a number of moths have fairly quickly taken a liking to this pine, and now these insects are rapidly causing a pest problem.

Established highlands plantations of *Pinus patula* are at the moment limited to the Eastern Highlands Province.

DESCRIPTION

There are nine different kinds of caterpillars that are known to feed on *Pinus patula* in plantations in this country. These moths can be considered either as current pests of importance, or important pests of the future, and for these reasons all nine different kinds of caterpillars are included here.

The caterpillars (fully fed stage) and pupae (with cocoons) for the nine different kinds of moths are illustrated in figure 1. The present day importance of each moth is shown by the number of stars (*) (Figure 1).

LIFE HISTORY AND HABITS

The life history of these moths consists of three stages. The egg (first stage) is laid by the parent female, on some part of the tree. The caterpillar (second stage) emerges out from the egg and feeds on the leaves (called needles in pines). The caterpillar grows and then enters the pupa stage or the resting stage (final stage).

The pupa, which in some cases is wrapped in a silken cover (the cocoon) may be found either on the tree or in the soil at the foot of the tree. The young adult which emerges from the pupa usually has wings, but the female adults of the two bag-worm caterpillars emerge without wings.

Lymantria ninayi, takes four months to complete its life cycle in the Lapegu Plantation near Goroka. There are three generations produced in one year. This moth has a large caterpillar.

Alcis papuensis, a much smaller moth, goes through its development in ten weeks. This moth produces at least five generations in a year.

Details of the life histories for the other moths are not yet known.

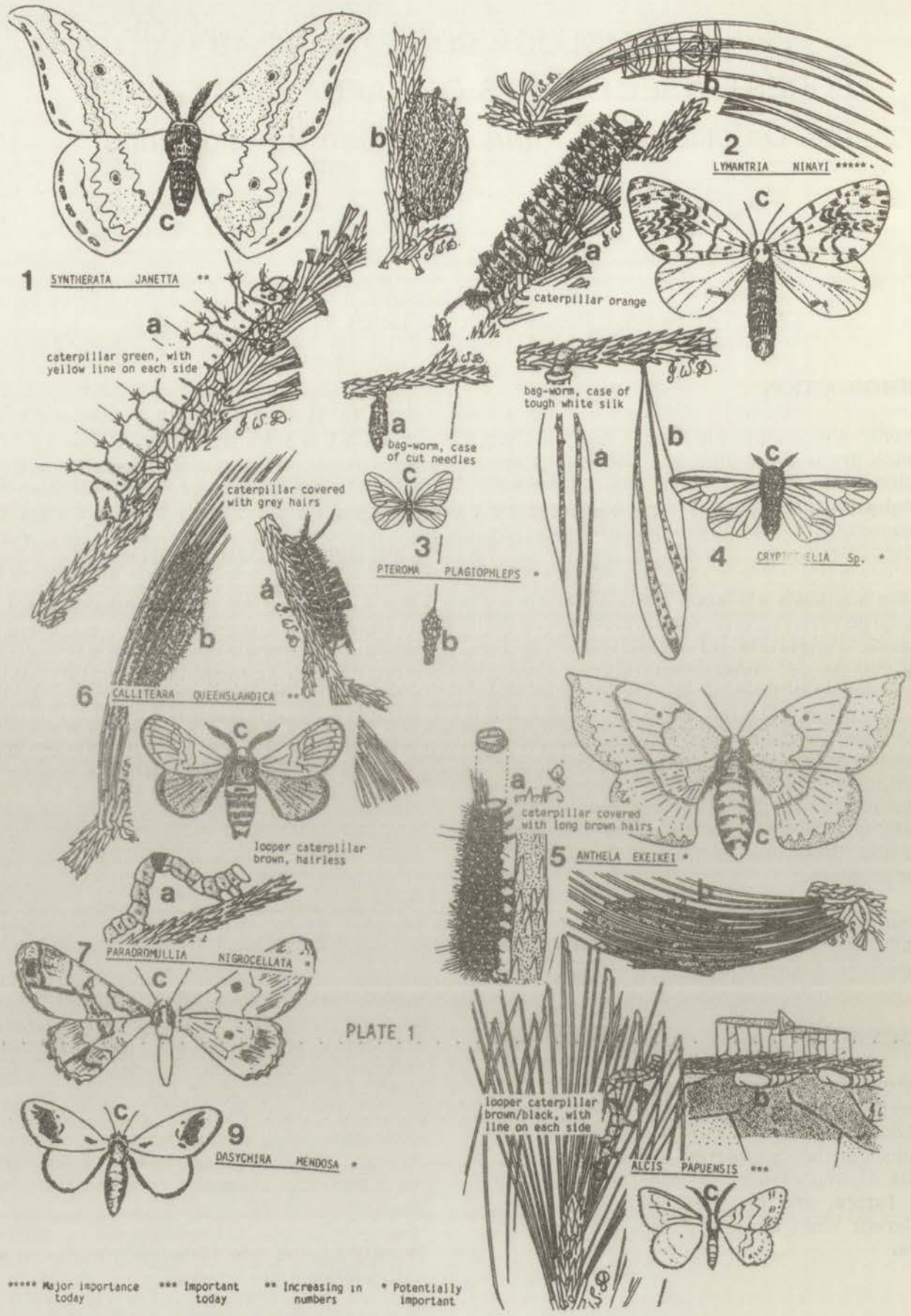
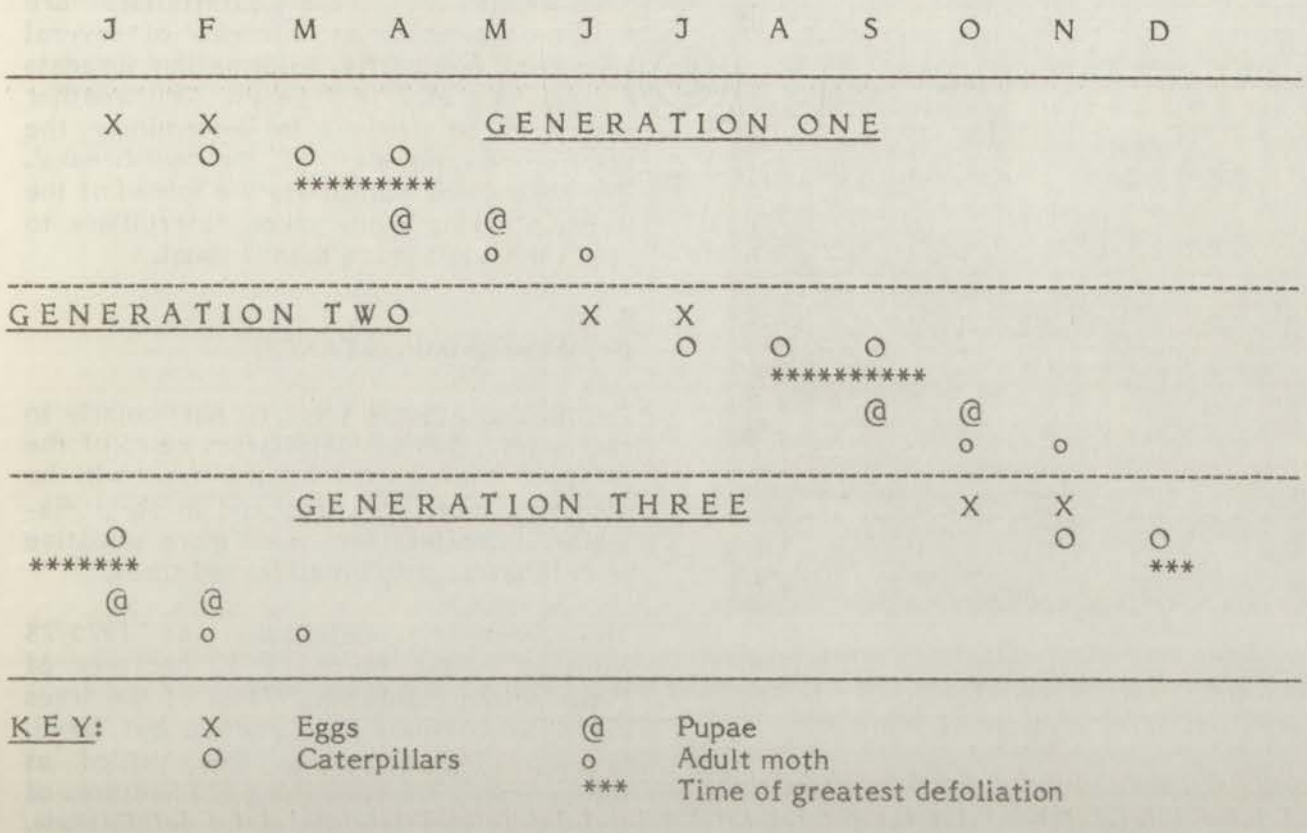


Fig. 1: Caterpillar defoliators of Pinus *in the Eastern Highlands.*



KEY: X Eggs @ Pupae
O Caterpillars o Adult moth
*** Time of greatest defoliation

Life cycle of the moth Lymantria ninayi *at Lapegu Plantation near Goroka.*

Spread of these insects within the plantations is usually brought about by flight of the adult female moth. Where the females are wingless, as in the bag-worms, or poor fliers, as in *Lymantria*, this spread is achieved by the very small, newly hatched caterpillar. After feeding on the egg-shell, these newly hatched caterpillars climb to the top of the trees, and are blown away on strands of silk.

DESCRIPTION OF DAMAGE

Young caterpillars and old caterpillars, of the smaller kinds of moths, feed on the new leaves, while the large old caterpillars feed on leaves of any age. *Lymantria*, and the large silk moth caterpillar, *Syntherata*, are both very heavy defoliators in the final caterpillar stage. Both bite through a bunch of leaves at one go. This results in most of the leaves falling to the floor. When *Lymantria* caterpillar numbers are large the floor is always covered in wasted green needles as deep as to the ankle. Affected trees appear grey from a distance.

The small *Alcis* looper caterpillar is quite different. It bites each needle separately, usually along one side only. This causes the needles to break and hang down. Where caterpillars of this looper are abundant trees look brown because of the many dead needles hanging on the tree.

Caterpillar 'Out-Breaks'

When the numbers of caterpillars of any kind of moth increase suddenly there is said to be an 'out-break' of that insect. Defoliation of the trees increases as the number of caterpillars increase by hundreds of thousands. It is at this time of 'out-break' that greatest damage is done to the pine trees.

In 1975 to 1978, at Lapegu Plantation, there was a *Lymantria ninayi* 'out-break'. The 'out-break', which lasted 3 years, caused the defoliation many times of *Pinus patula* over an area of 200 hectares.

Since then there have been only small scale 'out-breaks' of this moth, affecting plantation areas of up to 10 hectares.

Defoliation of Pinus patula. *(This photo was taken in June 1977, at Lapegu Plantation. The trees are 11 years old).*

Alcis papuensis is the other moth that has had 'out-breaks'. These have never been as large as those of *Lymantria*, never more than 20 hectares being defoliated.

The other seven moths have so far never been numerous enough to have reached 'out-break' numbers, but over the last ten years they have all become more common.

End of 'Out-Breaks'

The large 'out-break' of *Lymantria* ended in 1978 because of a virus disease of the insect. Viruses are microscopic organisms, and there are many kinds that cause disease in insects. The organism in this case was a virus natural to this country. Work done on this insect disease at the Institute of Virology, Oxford, England, and in the field at Goroka, has shown that this virus attacks only *Lymantria*. Within the plantations various natural mechanisms spread the virus, the most important being wet weather. This virus is considered to be a major cause limiting the numbers of *Lymantria* caterpillars. A different virus has been found in caterpillars of *Alcis papuensis*. This too is believed to be of great importance in restricting the numbers of caterpillars of this moth.

'Out-breaks' of these caterpillars are believed to occur at intervals of several years; for *Lymantria*, information suggests a frequency of 7 to 9 years. Dry weather seems to be critical in determining the occurrence and size of the 'out-breaks'. The absence of rain limits the spread of the virus, allowing many more caterpillars to reach the adult stage than is usual.

ECONOMIC IMPORTANCE

Defoliation affects the tree particularly in two ways. Severe defoliation can kill the tree, or the growth of the tree will be affected, both in height and in stem diameter. Conifers are much more sensitive to defoliation than broad leaved trees.

The *Lymantria* defoliation of 1975/78 resulted in the death of 50 hectares of *Pinus patula* plantation. Most of the trees killed were small in diameter, but large, fast growing dominants were killed as well. Among the remaining 150 hectares of trees that survived the many defoliations, none put on any stem diameter growth in the succeeding year, and very little was put on in the year following that either.

Assuming that defoliation of this amount occurs every 8 years it is estimated that the Lapegu Plantations would lose K1 million for every tree rotation of 20 years, for the total area of 2000 hectares making up the plantation.

No figures are available for losses caused by *Alcis*, or for any of the other defoliators, but these would be added to the losses caused by *Lymantria*.

Besides losses of pine trees caused by insect defoliation, other losses are caused by rots in the surviving trees, as defoliated trees are much more susceptible to fungus diseases.

CONTROL

It is intended that the grassland areas under *Pinus* will be greatly increased in the Highlands. This means that losses by defoliators will certainly get bigger. In

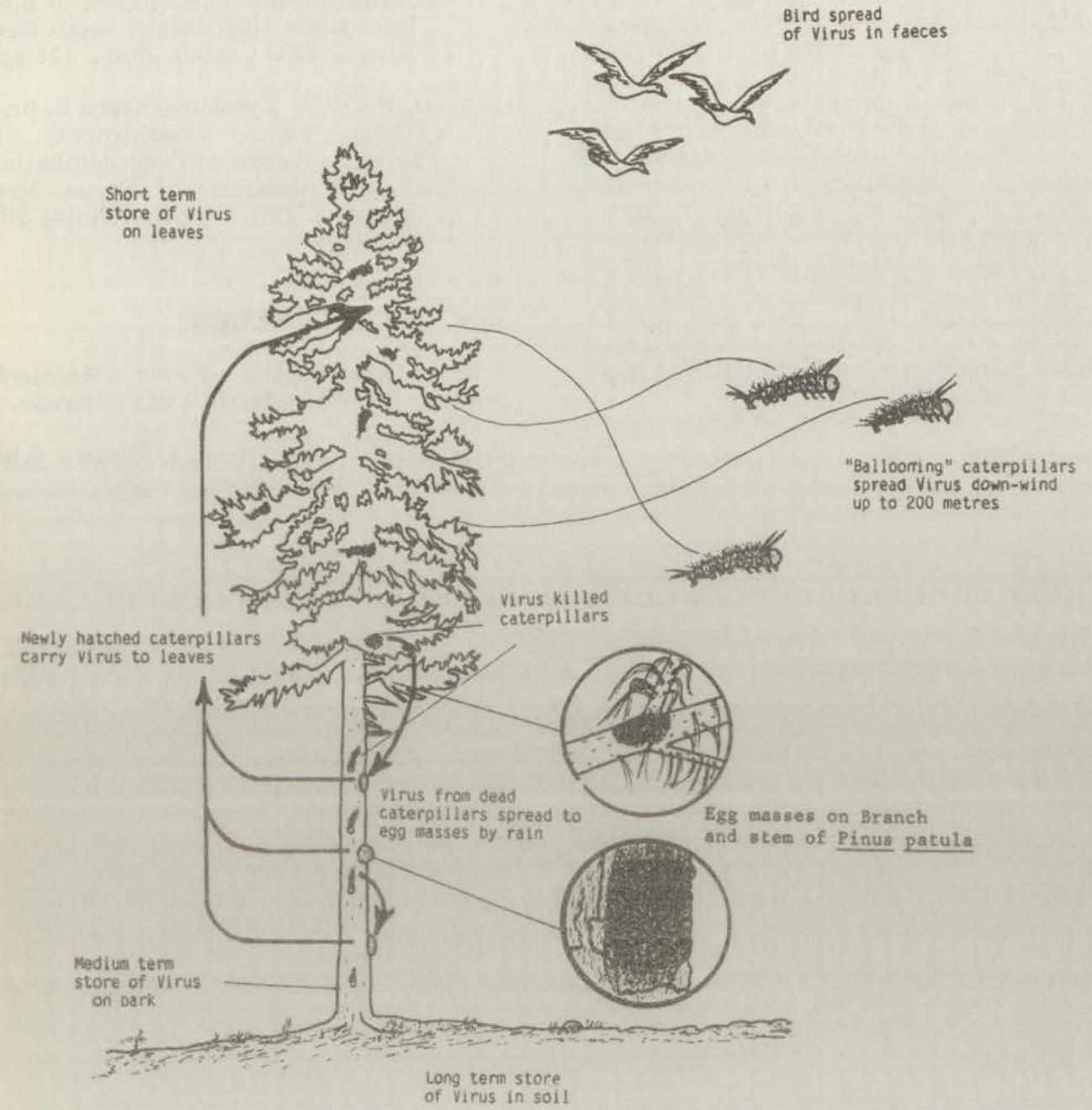


Fig. 2: *The natural spread of the virus disease of* Lymantria ninayi *in the plantation environment (after Entwistle 1983).*

Europe and North America microorganisms, such as bacteria and viruses, are used successfully to control caterpillar 'out-breaks' in forest plantations. The information now available on the disease occurence in *Lymantria* and *Alcis* will therefore be developed to allow the use of these indigenous microorganisms to prevent 'Out-Breaks' in the Highlands. At the same time potential microorganisms against the other *Pinus* defoliators will be looked for. This, it is hoped, will be carried out from a biological control laboratory established in this country where microorganisms can be separated, purified, and stored for use in control programmes. Fieldwork will be carried out to determine suitable aerial spraying techniques for application of these microorganisms as well.

FURTHER READING

Entwistle, P.F. (1983) Viral spray trials for control of insect defoliation of pine Trees in the Highlands of Papua New Guinea. *EEC Consult. Proj.*, 128 pp.

Roberts, H. (1979) *Lymantria ninayi* B. Br. (Lep., Fam. Lymantriidae) a potential danger to *Pinus* defoliation in the Highlands of Papua New Guinea. *Trop. For. Res. Note*, SR. 37., 12pp.

FURTHER INFORMATION

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(Illustrations: Caterpillars and Pupae - *J.W. Dobunaba*; Adult Moths - *E. Saya.*)