THE DEVELOPMENT OF A POPULATION OF *PANTORHYTES SZENTIVANYI* MARSHALL (COLEOPTERA: CURCULIONIDAE) WITHIN A CACAO PLANTING IN PAPUA NEW GUINEA

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ABSTRACT

The early stages of a population of Pantorhytes szentivanyi *within a* Theobroma cacao *planting are briefly described. The cacao, when four years old, was only lightly infested in border areas by the larval progeny of immigrant adults. Seven months later, the first generation of adults to arise within the trial area appeared. This event was followed by a rapid expansion of the population throughout the entire trial area. A second generation of adults emerged six months later, and was followed by a further increase in the number of larvae. Because of continued oviposition by adults of all former generations the emergences of subsequent generations were indistinguishable.*

INTRODUCTION

PANTORHYTES szentivanyi Marsh. is a serious pest of *Theobroma cacao* L. in the Northern District of Papua New Guinea. The larvae bore channels in the sapwood of the cacao tree and cause serious damage by structurally weakening the trees. Damage also includes ringbarking of branches and, less frequently, of the trunk. Prolonged infestation causes a general debilitation which frequently results in the death of trees. The apterous adults (Lamb *et al.* 1971) cause damage through feeding on hardening flush growth.

Extensive planting of cacao took place in the Northern District between 1960 and 1964 following the implementation of several Rural Development Schemes. By 1965 many of these new plantings had begun to show signs of infestation, the adults having entered the plantings from primary host plants in surrounding areas of secondary forest. By 1967 it was considered a major threat to the success of the cacao industry in the Sangara, Popondetta and Oro Bay areas.

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METHOD

The data on which this study is based were collected from an area of cacao on "Manaba" Plantation, one of the Soldier Settlement Scheme Plantations in the Northern District. The area under observation consisted of 0.61 ha. of cacao planted under *Leucaena* shade which had been subsequently thinned. The cacao and shade were planted in May 1963.

The area was originally chosen for studies of the incidence of *Oncobasidium theobroma* Talbot and Keane dieback and for this purpose the cacao trees in the trial area were plotted in September 1966. At the time of plotting, *P. szentivanyi* adults and larvae, if present, were at an unobservable level. In March 1967, a few larval channels were noted and the collection of data on the numbers of adults and larvae in the area was begun. To simplify data recording, each row was assigned a letter and each tree in each row a number (see *Figure* 1). Thereafter, and at irregular intervals until the cacao dieback trial was abandoned in October 1968, the numbers of adults and larvae were recorded for each tree.

Semi-skilled labour was used to collect the adults and to locate larval channels. Both adults and larvae were killed at the time of scoring. Larval channels were then treated by painting the surface of the tree over the channel with a 1.5 per cent a.i. solution of fenthion in water.

Removal of adults would have had little effect on the overall population trends as only between 10 and 20 per cent of the total adults

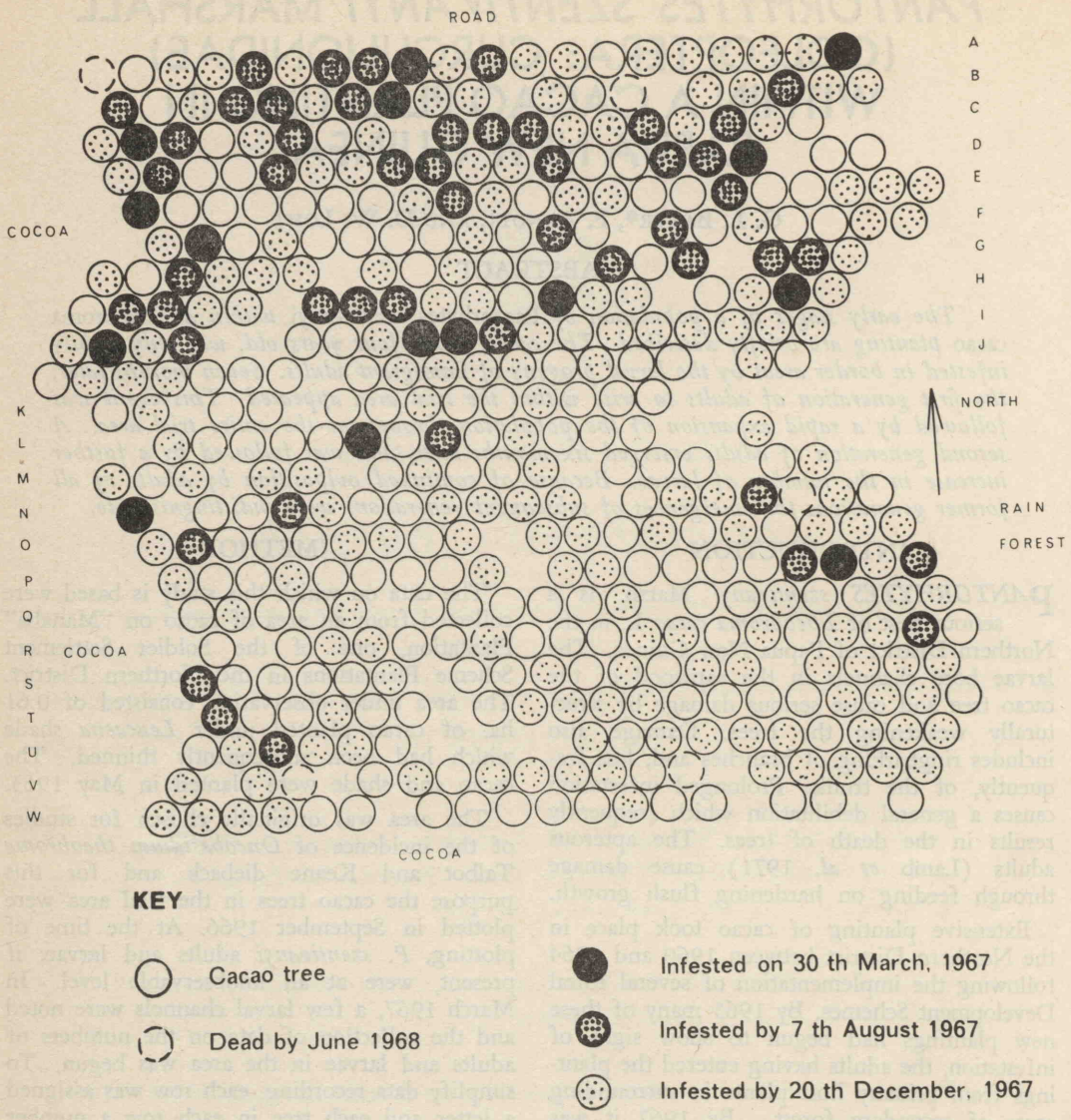

Figure 1—A plot of the trial area showing the spread of *Pantorhytes szentivanyi* between March 1967 and December 1967. Rows A to J are referred to in the text as the upper portion and rows K to W as the lower portion of the trial area

are removed at any one scoring (Baker, unpub. data). With larvae, a proportion was never removed or treated for a variety of reasons—e.g., many were inaccessible, those channels containing very young larvae were not detected, and those containing prepupae and pupae may have been confused with old, unoccupied channels. As a fairly constant proportion of the total larvae present escaped detection during scoring, the treatment, although reducing absolute numbers of adults which subsequently emerged, had little effect on the overall population trend.

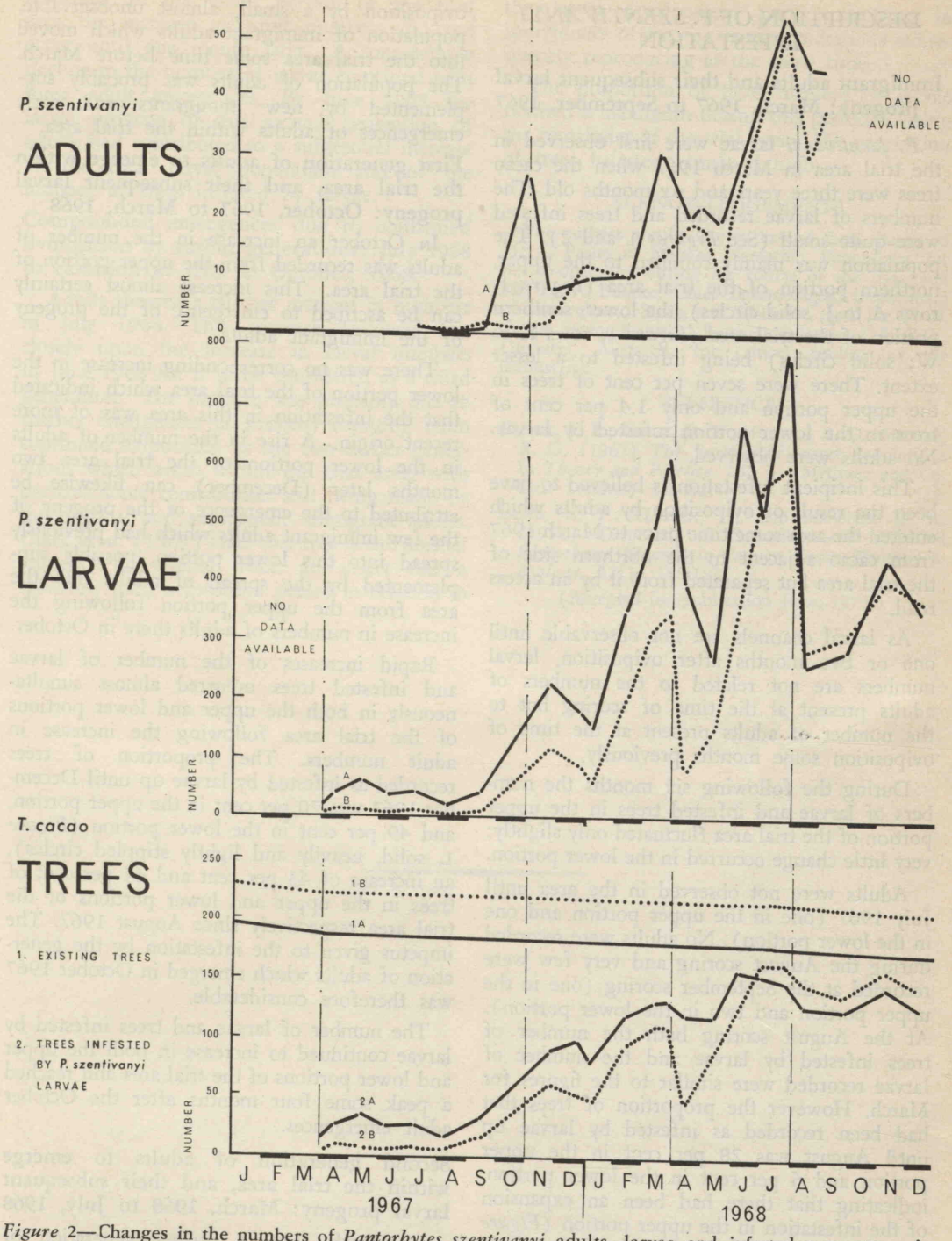

Figure 2—Changes in the numbers of *Pantorhytes szentivanyi* adults, larvae and infested cacao trees in two contiguous areas of cacao over a period of two years. A—solid lines represent data from upper portion of trial area; B—broken lines, data from lower portion (Refer *Figure* 1). The small loss of trees shown was due mainly to death caused by cacao root rots (*Fomes* spp.)

DESCRIPTION OF *P. SZENTIVANYI* INFESTATION

Immigrant adults and their subsequent larval progeny: March, 1967 to September, 1967

P. szentivanyi larvae were first observed in the trial area in March 1967 when the cacao trees were three years and six months old. The numbers of larvae recorded and trees infested were quite small (See *Figures* 1 and 2). The population was mainly confined to the upper, northern portion of the trial area (*Figure* 1, rows A to J; solid circles), the lower, southern portion of the trial area (*Figure* 1, rows K to W; solid circles) being infested to a lesser extent. There were seven per cent of trees in the upper portion and only 1.4 per cent of trees in the lower portion infested by larvae. No adults were observed.

This incipient infestation is believed to have been the result of oviposition by adults which entered the area some time prior to March 1967 from cacao adjacent to the northern side of the trial area but separated from it by an access road.

As larval channels are not observable until one or two months after oviposition, larval numbers are not related to the numbers of adults present at the time of scoring but to the number of adults present at the time of oviposition some months previously.

During the following six months the numbers of larvae and infested trees in the upper portion of the trial area fluctuated only slightly; very little change occurred in the lower portion.

Adults were not observed in the area until July 1967 (one in the upper portion and one in the lower portion). No adults were recorded during the August scoring and very few were recorded at the September scoring (one in the upper portion and two in the lower portion). At the August scoring both the number of trees infested by larvae and the number of larvae recorded were similar to the figures for March. However the proportion of trees that had been recorded as infested by larvae up until August was 28 per cent in the upper portion and 6 per cent in the lower portion, indicating that there had been an expansion of the infestation in the upper portion (*Figure* 1, solid circles and heavily stippled circles). This expansion of the infestation in the upper portion of the trial probably resulted from oviposition by a small, almost unobservable, population of immigrant adults which moved into the trial area some time before March. The population of adults was probably supplemented by new immigrants and early emergences of adults within the trial area.

First generation of adults to emerge within the trial area, and their subsequent larval progeny: October, 1967 to March, 1968

In October an increase in the number of adults was recorded from the upper portion of the trial area. This increase almost certainly can be ascribed to emergence of the progeny of the immigrant adults.

There was no corresponding increase in the lower portion of the trial area which indicated that the infestation in this area was of more recent origin. A rise in the number of adults in the lower portion of the trial area two months later (December) can likewise be attributed to the emergence of the progeny of the few immigrant adults which had previously spread into this lower portion, possibly supplemented by the spread of adults into the area from the upper portion following the increase in numbers of adults there in October.

Rapid increases of the number of larvae and infested trees occurred almost simultaneously in both the upper and lower portions of the trial area following the increase in adult numbers. The proportion of trees recorded as infested by larvae up until December 1967 was 70 per cent in the upper portion, and 49 per cent in the lower portion (*Figure* 1, solid, heavily and lightly stippled circles), an increase of 43 per cent and 44 per cent of trees in the upper and lower portions of the trial area respectively since August 1967. The impetus given to the infestation by the generation of adults which emerged in October 1967 was therefore considerable.

The number of larvae and trees infested by larvae continued to increase in both the upper and lower portions of the trial area and reached a peak some four months after the October adult emergences.

Second generation of adults to emerge within the trial area, and their subsequent larval progeny: March, 1968 to July, 1968

In March 1968 a further generation of adults began to emerge in the upper portion, giving an increase in the number of adults

recorded. In the lower portion of the trial area the increase in adult numbers did not occur until one month later. A considerable decline in the number of larvae coincided with these adult emergences. By June 1968 the larval progeny of this second generation of adults had contributed to a substantial increase of the total larval population and of the number of trees infested by larvae.

Compounded emergences due to continued oviposition by earlier generations: July 1968 to cessation of trial in October, 1968

Adults showed a further increase in numbers in July 1968. This increase followed too closely upon the increase in larval numbers in June 1968 for it to be considered as a third generation. The increase was probably due to further emergences of progeny resulting from continued oviposition by the two earlier generations which arose within the trial area, with perhaps some contribution still being made by the original and subsequent immigrant adults. Clark *et al.* (1967) state that this is the normal sequence of events when an insect has a relatively long oviposition period in relation to the larval development period resulting in individuals of two or more generations subsequently reproducing at the same time.

The proportion of trees infested by larvae reached a maximum during this period. During the remainder of the trial period the proportion of trees infested remained high.

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