

QUEENSLAND DEPARTMENT OF PRIMARY INDUSTRIES

DIVISION OF PLANT INDUSTRY BULLETIN No. 760

**VERTICAL DISTRIBUTIONS OF TOBACCO LOOPER
(PLUSIA ARGENTIFERA GUENEE) (LEPIDOPTERA:
NOCTUIDAE) EGGS AND LARVAE ON THREE
TOBACCO VARIETIES IN NORTH QUEENSLAND**

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SUMMARY

Mature, flowering tobacco plants of the varieties Sirone 2, Hicks Q46 and CSIRO 40T, which were widely cultivated in the Mareeba-Dimbulah district of north Queensland in the 1973-74 growing season, were destructively sampled. Results indicated that *Plusia argentifera* Guenee female moths preferentially selected leaves in the lower half of the plants as oviposition sites. Little difference was recorded in the patterns of egg-laying on the three varieties. After eclosion, first instar larvae were also found on similar parts of the plants, indicating that they were relatively sedentary.

The distributions of eggs and first instar larvae implied that covering the bottom leaves of mature, flowering tobacco plants with non-systemic insecticides is required for the control of *P. argentifera*.

I. INTRODUCTION

The tobacco looper (*Plusia argentifera* Guenee) is one of the most serious pests of flue-cured tobacco in the Mareeba-Dimbulah district of north Queensland (Broadley 1974a). Populations of this species increase gradually during the growing season (July to December), and over 100 larvae have been recorded on single plants in unsprayed blocks of tobacco by late November or early December (Broadley, unpublished data). These larvae generally feed on the tissues in the interveinal areas of the leaf blade, and most severe damage is caused by penultimate and ultimate instars (Cunningham 1971, 1975).

Losses can be reduced if young larvae are destroyed in the early stages of development before they can injure leaf tissues. To achieve this goal, the patterns of distribution of *P. argentifera* eggs and larvae on major tobacco varieties must be known, for two important reasons. Firstly, the control of tobacco looper in the field in north Queensland is currently based on the use of non-systemic or partially systemic insecticides (Broadley 1974a, 1975), and these are most effective when placed on parts of the plants where the immature looper stages are found. Incomplete coverage will result in inadequate control and the problem is magnified where non-residual chemicals are used. For example, the insecticide methomyl, currently recommended for tobacco looper control (Broadley 1975), has a half-life of 3 to 6 days (Harvey and Reiser 1973), and therefore should contact larvae before any degradation occurs (Broadley 1977). Secondly, the effectiveness of spraying equipment and spraying technique can be assessed by comparing coverage actually obtained with that found to be necessary from vertical distribution studies on species such as the tobacco looper. McNee (1972a, b) assessed tobacco spray equipment by using a fluorescent tracer technique.

This study aims to define the variations in vertical distributions of tobacco looper eggs and larvae on three tobacco varieties, so that a more rational approach to *P. argentifera* control can be developed.

II. METHODS AND MATERIALS

Tobacco varieties Sirone 2, Hicks Q46 and CSIRO 40T constituted a major proportion of the commercial tobacco crops grown in the Mareeba-Dimbulah district in the 1973-74 season. Seedlings of these varieties were transplanted into 30 plant plots in the field on 13 August 1973. Normal cultural practices (Anon. 1976) plus weekly applications of insecticide and fungicide, were employed during the growth period of the crop. Pesticide sprays were discontinued several weeks before sampling to ensure tobacco looper infestations developed naturally on unsprayed plants.

After 59 days in the field, the mature flowering plants were destructively sampled. Plant height, total number of leaves per plant and numbers of eggs and first instar larvae per leaf were recorded. Leaves were numbered consecutively from the base of the plant upwards. Twenty, nineteen and ten uniform plants of varieties CSIRO 40T, Hicks Q46 and Sirone 2 respectively, were sampled.

III. RESULTS

A comparison of varieties based on mean plant height and mean number of leaves indicated the possibility of morphological differences (table 1). Sirone 2, for example, was slightly taller and had a mean of three more leaves per plant than CSIRO 40T. Statistical tests to determine whether these differences were significant, could not be applied, as plants were not selected randomly from the plots.

TABLE 1
MORPHOLOGICAL CHARACTERISTICS OF THREE TOBACCO VARIETIES

Variety	No. of Plants Sampled	Mean Height (cm)	Standard Deviation (cm)	Mean Total No. Leaves per Plant	Standard Deviation
CSIRO 40T	20	158.6	6.184	19.1	1.333
HICKS Q46	19	170.8	6.222	20.3	1.453
SIRONE 2	10	171.8	8.011	22.3	1.251

MEAN NUMBER OF EGGS PER LEAF

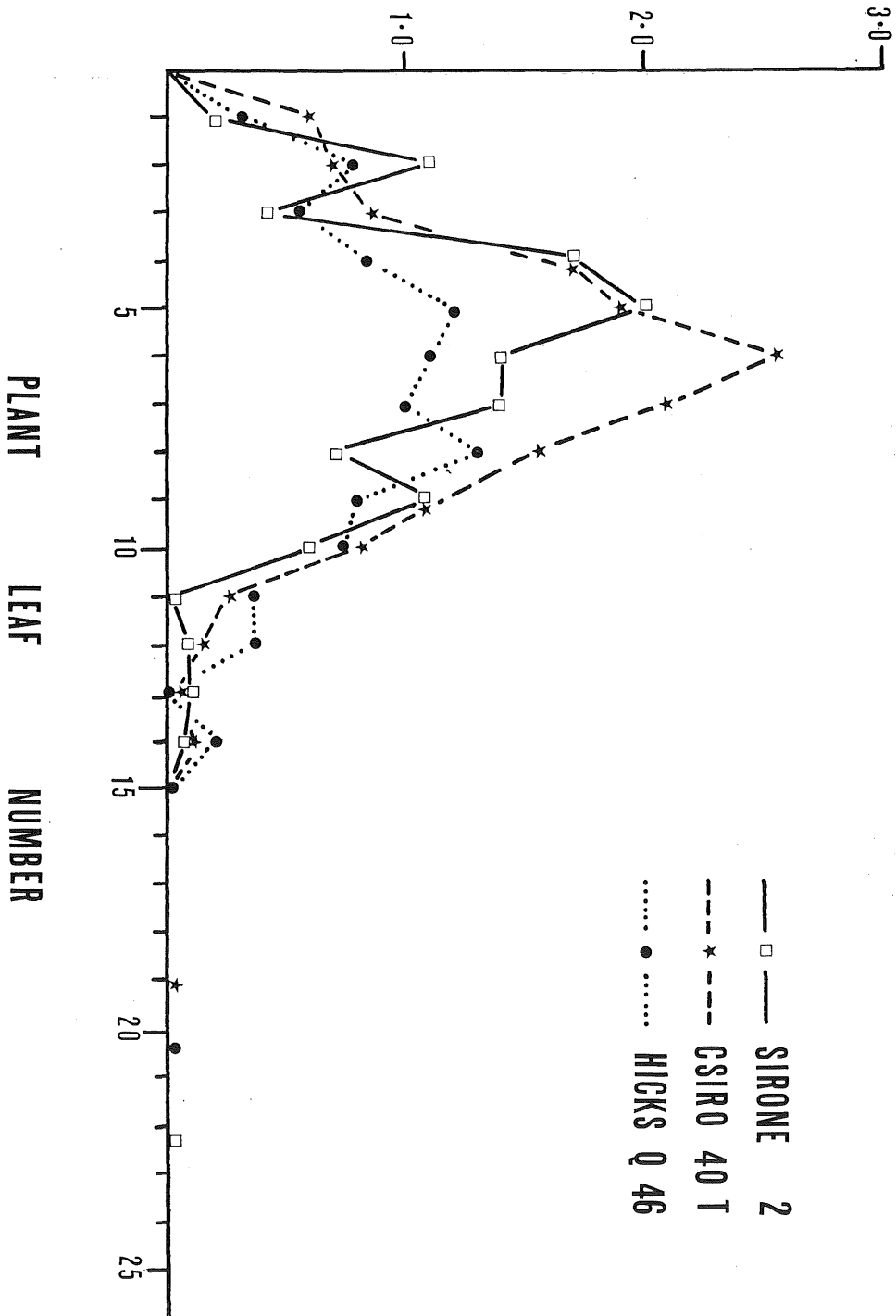


Figure 1. Distribution of *P. argentifera* eggs over mature, flowering plants of three varieties.

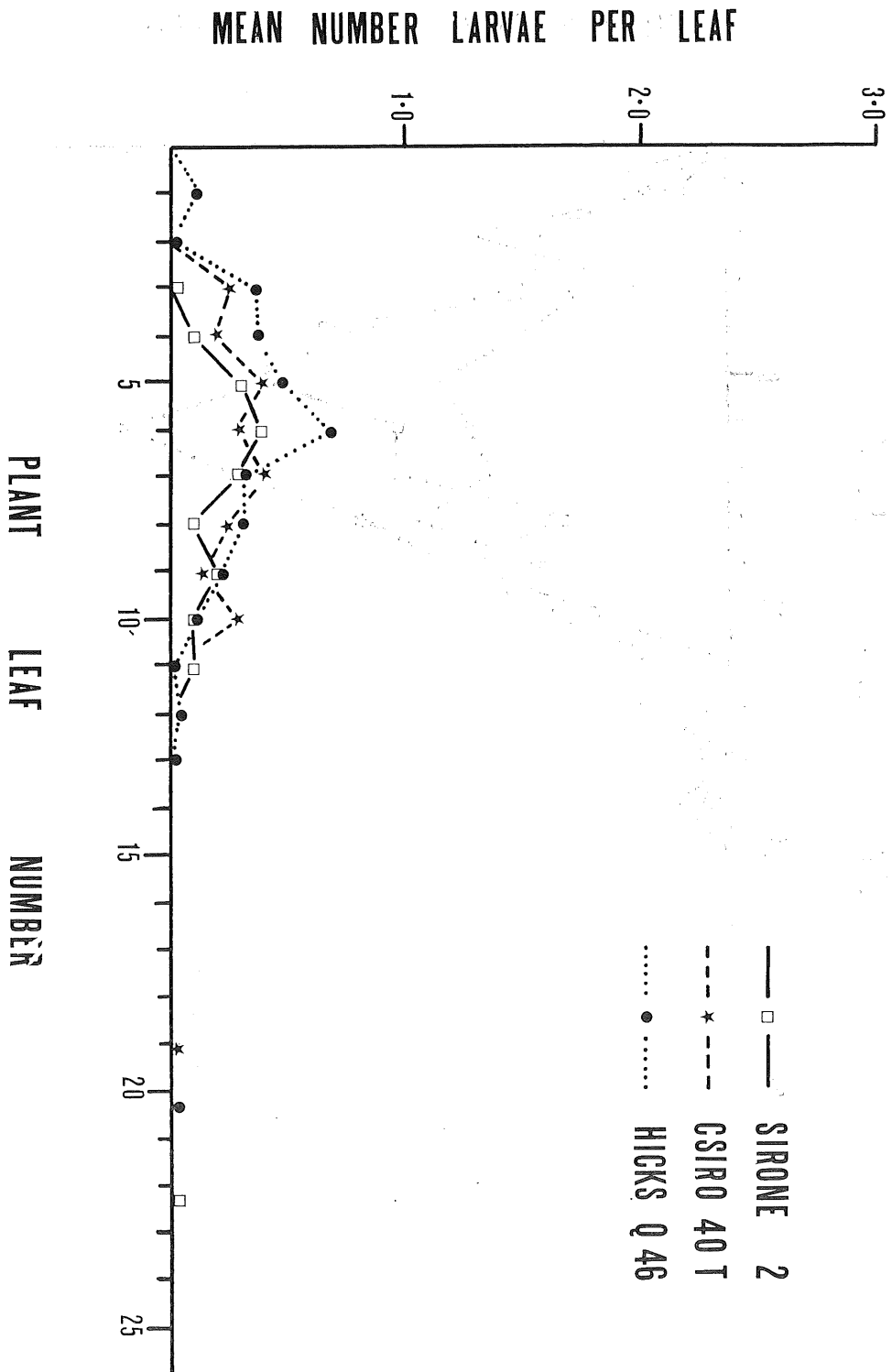


Figure 2. Distribution of *P. argentifera* first instar larvae over mature, flowering plants of three varieties.

The tobacco looper population existing on the plants at sampling consisted primarily of eggs and first instar larvae. Mean incidences of these stages per leaf for each variety are presented in figures 1 and 2. Despite possible differences in absolute numbers of each stage per plant, similar patterns of oviposition on the three varieties could be discerned: the lower leaves were the preferred oviposition sites with most eggs being found between the second and tenth lowest leaf of the plant (figure 1). No eggs were located above the fifteenth leaf on any variety. First instar larvae, which hatched from the eggs, exhibited a distribution pattern for each variety similar to that recorded for the eggs (figure 2). Again, a marked preference for the lower leaves of the plant was noted.

IV. DISCUSSION

The infestation appeared to be unaffected by any pesticide residues that might have been present on the plants at time of sampling. The high populations of young larvae, and the apparent absence of any mortality in them, supported this hypothesis. Consequently, it was presumed that distributions of eggs reflected normal behaviour patterns of *P. argentifera* females that might be expected to occur in the field and that the distribution of larvae hatching from them was also normal.

A knowledge of larval distributions and oviposition patterns is extremely important in defining spray coverage requirements. In figures 1 and 2, it was shown that distributions of eggs and first instar larvae were essentially similar on mature flowering plants of three varieties i.e. they were confined mostly to the lower leaves. These observations are supported by those of Cunningham (1969) and probably explain why several authors (e.g. Mortiss 1963) have stated that effective control is appreciably more difficult to achieve in a tall, well grown crop than in a small, immature one. At maturity, approximately half the leaf area to be sprayed is situated in the lower one-third of the plant (McNee 1974), and this is where a high proportion of eggs and first instar larvae are located. Proper coverage of these lower leaves (the foci of infestation) is difficult to obtain with spraying equipment presently available (McNee 1974).

An insect activity prediction service (Broadley 1974b) operates in north Queensland to help growers obtain better timing of spray applications. Growers are also advised to inspect their paddocks regularly for developing infestations, which are heralded by a sharp increase in the number of eggs per plant. A practical application of this study is the definition of plant leaves for three varieties, where growers should concentrate their searching efforts, when trying to detect new outbreaks of *P. argentifera*.

Tobacco looper vertical distribution patterns are likely to be affected by interactions with other species in a multiple-pest situation. For example, tobacco budworms (*Heliothis* spp.) can destroy the plants' apical meristematic tissue, and this results in extensive suckering (Broadley 1974c). The subsequent change in growth habit may influence oviposition patterns, and consequently larval distributions. However, in a well grown crop which has little budworm damage, the overall effect of such interactions will be of minor importance.

Further investigations to elucidate the reasons for the distribution patterns of eggs and first instar larvae are required. Possible explanations include the lower trichome density (Barrera and Wernsman 1966) and lower nicotine content of the lower leaves (Green 1970), the more favourable microclimate in the lower portions of the plant, the fact that the bottom leaves are more suited for the mechanics of oviposition, or a combination of a number of these factors.

Adult female *P. argentifera* moths selected the leaves in the lower half of mature, flowering tobacco plants as egg-laying sites, and this oviposition pattern was quite similar on the three varieties examined in the field viz. CSIRO 40T, Sirone 2 and Hicks Q46. First instar larvae were also located on the lower leaves, suggesting that they remain in the vicinity of the egg chorions after hatching. Tobacco growers wishing to control these larvae, which cause little damage, must direct their insecticide sprays towards the lower leaves of the three varieties for effective control. Conversely, coverage of the upper ten leaves of the plants, will result in poor control. Tobacco spray equipment should be evaluated in the light of this information.

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