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Chrysodeixis argentifera (Guenée) (Lepidoptera: Noctuidae) egg and larval distributions on flue-cured tobacco plants in north Queensland

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Summary

The distributions of *Chrysodeixis argentifera* (Guenée) eggs and larvae on unsprayed flue-cured tobacco plants var. CSIRO 40T were studied in the Mareeba–Dimbulah district of north Queensland in 1971 and 1972. It was found that 93.31% of eggs, 99.02% of first and second instar larvae, 97.00% of third and fourth instar larvae, and 86.12% of fifth and six instar larvae were located on the ventral surfaces of the leaves. These patterns were not significantly affected by plant stage or level of infestation by *C. argentifera.* The implications of these distributions in *C. argentifera* control are discussed.

1. Introduction

Serious damage by the tobacco looper (*Chrysodeixis* (= *Plusia*) *argentifera* (Guenée)) can occur when larvae are left unchecked on flue-cured tobacco (*Nicotiana tabacum* L.), especially if plants are at a developmental stage which cannot compensate for photosynthetic tissue losses (Cunningham 1975). Final and penultimate instar larvae cause most damage (Cunningham 1971; 1975) by feeding in the interveinal regions of lugs and cutters, that is, lower and middle leaves (Smith and Saunders 1961; Cunningham 1969).

Cunningham (1971) is the only worker who has reported on the distributions of *C. argentifera* immature stages on leaf surfaces. He recorded that 97% of tobacco looper eggs were laid on the ventral surfaces of a wild tobacco (*Nicotiana glauca* Graham) in the laboratory.

As a change from residual to non-residual insecticides occurred in 1969 (Cunningham 1971), distributions of insect pests on tobacco plants became significant in relation to placement of insecticide near oviposition and feeding sites. The objectives of this study were to define the distributions of *C. argentifera* eggs and larvae on a commercial tobacco variety, in order to develop effective insecticidal control strategies.

2. Materials and methods

Eight experimental areas of 0.1 ha to 0.12 ha were selected from commercial crops of the then blue mould (*Peronospora hyoscyami* de Bary) tolerant variety CSIRO 40T, grown in the Mareeba-Dimbulah district of north Queensland in the 1971–72 and 1972–73 seasons. Plants in the experimental blocks received no fungicide, and only limited insecticide applications—three sprays of the non-residual (Harvey and Reiser 1973) insecticide methomyl 0.025% a.c. at 300 L ha^{-1} were applied at weekly intervals after transplanting to assist plant establishment.

Groups of plants (range 25 to 64) were randomly selected in the experimental areas, and marked with pegs. Commencing on the fourth week after transplanting, the following variables were assessed twice a week for each pegged plant:

Number of green leaves: The number of non-senescing leaves per plant (excluding apical leaves less than 2.5 cm long) was determined.

Number of eggs and larvae: Larvae were visually categorized into first and second instars, third and fourth instars, and fifth and sixth instars (Cunningham 1971). Both eggs and larvae were counted *in situ*.

Distributions of immature stages: *C. argentifera* eggs and larvae are almost invariably located on the leaves. Therefore, their positions on the plant were defined as on either the dorsal or ventral leaf surfaces.

Regression analysis was used to relate mean percentage incidence of egg and larval instars on the ventral leaf surfaces to plant development stage and level of infestations, using data from each sampling date.

3. Results

Mean incidences of eggs, first and second instar larvae, third and fourth instar larvae, and fifth and sixth instar larvae on ventral surfaces of the leaves were 93.31%, 99.02%, 97.00%, and 86.12% respectively (table 1).

Regression analysis showed no relationship of plant size and infestation level with the percentages of eggs and larvae on the undersides of the leaves (table 2).

Table 1. *C. argentifera* **distributions on tobacco plants**

Stage	Number of samples	Mean percentage incidence on ventral leaf surfaces ± S.E.	Range (%)
Eggs	51	93.31 ± 0.90	77.59–100
First and second instar larvae	47	99.02 ± 0.21	95.12–100
Third and fourth instar larvae	42	97.00 ± 0.58	86.67–100
Fifth and sixth instar larvae	35	86.12 ± 1.92	55.17–100

Table 2. Regression analysis relating percentage incidence of immature *C. argentifera* on ventral leaf surfaces to plant size and infestation level

Stage	F–test †	Regression equation *	S.E. b_1	S.E. b_2
Eggs	N.S.	$Y = 98.07 - 0.28X_1 - 0.25X_2$	0.20	0.23
First and second instar larvae	N.S.	$Y = 100.55 - 0.09X_1 - 0.03X_2$	0.05	0.04
Third and fourth instar larvae	N.S.	$Y = 97.02 + 0.05X_1 - 0.63X_2$	0.15	0.38
Fifth and sixth instar larvae	N.S.	$Y = 101.22 - 0.93X_1 - 0.20X_2$	0.50	0.55

* $Y = a + b_1X_1 + b_2X_2$

Y = percentage of given stage on ventral leaf surfaces; X_1 = mean number of green leaves per plant; X_2 = mean number of given stage per plant.

† Significance of F–test for regression: N.S. = $P > 0.05$.

4. Discussion

Because plants received only three applications of the non-residual insecticide, methomyl (Harvey and Reiser 1973), it is likely that egg and larval distributions remained largely unaffected by chemical residues.

The preponderance of eggs on the ventral leaf surfaces of var. CSIRO 40T are in agreement with the pattern found for *N. glauca* by Cunningham (1971), who noted during oviposition, hovering moths grasp the edge of a leaf blade, and curl the ovipositor under the leaf margin to deposit an egg.

Larvae of all developmental stages exhibited a distinct preference for the undersides of the leaves, though fifth and sixth instar larvae were found more frequently on the dorsal leaf surfaces, than were earlier instars. Possible reasons include mobility of larger larvae, greater tolerance to adverse meteorological conditions, reduced incidence of biological mortality agents, or a combination of two or more of the above factors.

The observed distributions of eggs and larvae have practical implications. Firstly, because most of the eggs and larvae are on the ventral surfaces, coverage of the undersides of the leaves is essential, if non-residual, non-systemic ovicides or larvicides are to be used for control. Spraying equipment must be capable of this coverage, for all plant growth stages. Secondly, tobacco growers must concentrate on the undersides of the leaves when determining the extent of *C. argentifera* infestations in their crops.

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