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Life cycle of Diamondback moth, *Plutella xylostella* (L.) (Lepidoptera: Plutellidae), in Puerto Rico[1]

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ABSTRACT

The life cycle of the diamondback moth, *Plutella xylostella* (L.), the worst pest of cabbage in Puerto Rico, was studied. Description of the stages, including measurements of the larva (body length and head capsule width), and duration of the stages are given. The average duration in days of the egg, larva, prepupa, pupa and adult was 3, 11.7 (4 instars), 1, 3.6 and 11.1, respectively. Larval length and head capsule width in mm for the 1st, 2nd, 3rd and 4th instar was 1.2, 2.1, 3.7, 7.0 and 0.15, 0.24, .40, 0.56, respectively.

INTRODUCTION

Local cabbage production in Puerto Rico in 1980–81 amounted to 87,000 hundredweight with a farm value of $631,000 (2).

Cabbage is attacked by many insects in Puerto Rico, but diamondback moth, *Plutella xylostella* (L.), is the most damaging and limiting factor in local production. According to Salinas (9), this species occurs world-wide from the arctic to approximately latitude 50° S. In temperate zones the diamondback moth has from 2 to 7 generations a year (5, 6, 7) whereas in warmer and tropical regions it may produce 12 or more generations a year (1, 8).

According to Wolcott (10), the insect was first identified in Puerto Rico by Möshler, probably in 1890, from a single male collected by Dr. Gundlach, and was recorded as a pest on various cruciferous crops by Barrett in 1904; Tower, 1908; Jones, 1915; and Cotton, 1918. In 1967–68 and 1972–73, major outbreaks of the insect were experienced by local farmers who suffered great losses in their crops in spite of routine spraying with diazinon. Cabbage plantations at the Fortuna and Isabela substations were severely infested with up to 500 caterpillars per plant (3).

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The objective of this research was to obtain information on the life cycle of the insect to provide practical information for timing applications of control measures. Studies of the life cycle of *P. xylostella* had not been conducted before in Puerto Rico.

MATERIALS AND METHODS

The life cycle of *P. xylostella* was studied at the Pioneering Entomological Research Laboratory of the University of Puerto Rico, Mayagüez, from September through November 1982. Eggs were obtained from moths reared on potted cabbage plants grown in a greenhouse. Eggs were placed singly in each cup, daily observations made and the changes recorded. On hatching, the larvae were reared in medicine cups (28 ml) with perforated caps to permit the exchange of gases, and plaster was placed in the bottom to maintain humidity. Cabbage was provided as food and was changed as necessary. Pupae were individually held in No. 3 gelatin capsules and the emerging moths sexed. Paired adults were transferred to 160 ml plastic cups. Each cup was provided with a 20% honey solution in a capillar tube attached to the cap as food source. Harcourt (4) has shown that an external food source is necessary to rear this insect. Cabbage was provided as a surface for oviposition. Larvae body length and the head capsule width were measured.

RESULTS AND DISCUSSION

DESCRIPTION OF THE STAGES

Egg

The eggs, oval and intense yellow (fig. 1A) are laid singly or in groups of not more than eight, mainly on the underside of the leaves. Before hatching, the egg turns dark; the coiled larva can be observed through the chorion. Infertile eggs are pale yellow. Egg stage varied from 2 to 4 days (table 1).

Larval instars

The larva is equipped with biting mouth parts, a pair of true legs on each of the three thoracic segments, and a pair of prolegs on the fourth, fifth, sixth, and last abdominal segments. Tables 1 and 2 provide data on the average duration of the instars, measurements of the length of the larvae and of the head capsules. Larval length and head capsule width for the 1st, 2nd, 3rd, and 4th instars was 1.2, 2.1, 3.7, 7.0, and 0.15, 0.24, 0.40, 0.56 mm, respectively.

The newly hatched larva is a light, translucent gray without pronounced setae (fig. 1A). Immediately after hatching the larva bores through the epidermis mining the leaf tissues. At the end of the first

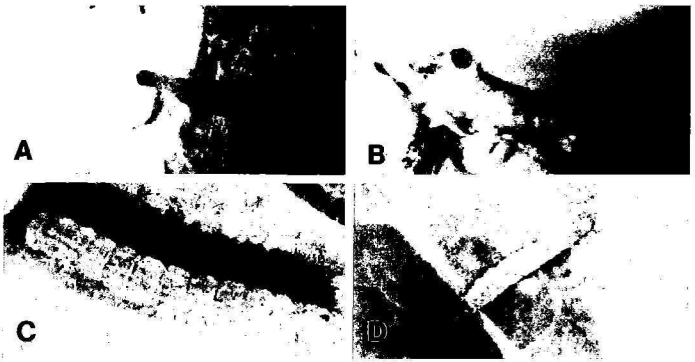

FIG. 1.—Eggs and larval instars. A. Eggs and first instar (20 ×), B. Second instar (20 ×), C. Third instar (20 ×), and D. Fourth instar (5 ×).

TABLE 1.—*Life history of the diamondback moth (***Plutella xylostella** *(L.), September to November 1982*

Stage	Minimum	Maximum	Average
		Days	
Egg (136)[1]	2.0	4.0	3.0
Larvae			
1st (99)	1.5	5.0	3.1
2nd (76)	1.0	10.0	3.2
3rd (64)	1.0	4.0	2.6
4th (53)	1.5	7.0	2.8
Prepupa (50)	0.5	1.0	1.0
Pupa (41)	3.0	5.0	3.6
Adult (41)	6.0	21.0	11.1
Male (20)	7.0	14.0	10.0
Female (21)	6.0	21.0	12.0
Total (41)	22.5	39.0	29.0

[1] Number of specimens observed.

instar the caterpillar emerges from the mine, spins protective threads and moults beneath, a behavior observed for all instars.

In the second instar the larva does not mine the tissue, but frequently feeds with the head and thorax buried in the leaf. This behavior was also observed in the third instar larva. The color and setae are the same as in the first instar (fig. IB).

In the 3rd instar the body color is translucent yellowish-green and setae become more visible and distinctly black (fig. 1C).

In the 4th instar, the body is intense green. This stage damages cabbage most. Every day an individual 4th-instar larva consumed ca. 25% of the 2.5 cm^2 of cabbage provided as food (fig. 1D).

Prepupal period

Visible external changes which take place during this stage include reduction in body length, increase in body width, and a change to a

TABLE 2.—*Larval length and head capsule width of the diamondback moth,* **Plutella xylostella** *(L.), September to November, 1982*

	Length			Head capsule width		
Larva	Minimum	Maximum	Average	Minimum	Maximum	Average[1]
			mm			
1st	0.88	1.54	1.20	0.11	0.18	0.15
2nd	1.50	2.54	2.10	0.15	0.25	0.24
3rd	2.60	4.54	3.70	0.33	0.52	0.40
4th	4.54	8.59	7.00	0.40	0.70	0.56

[1] Average from 40 fresh-killed specimens per instar.

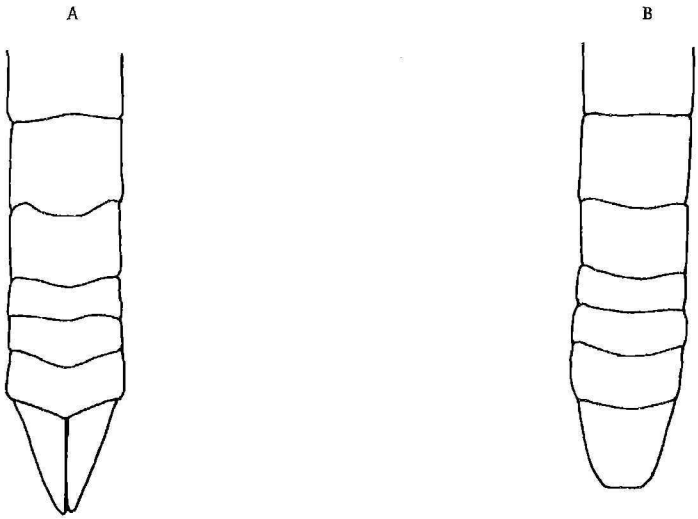

FIG. 2.—Adult ventral abdominal segments. A. Male; B. Female.

lighter green. The prepupa spins the cocoon. The last larval molt occurs during this period, giving rise to the pupa. This period lasts from 0.5 to 1 day.

Pupal stage

The pupa is of the obtect type, yellowish to light green. This color first changes to light brown, and later to dark brown with maturity. This stage lasts from 3 to 5 days.

Adult stage

The general color of the moth is brownish gray; the female is usually paler than the male. The inner borders of the forewings are whitish; when united on the dorsal area, the wings form the typical diamond shaped markings. The sexes are identified by the anal abdominal segment; in males it is divided longitudinally in the ventral area (fig. 2A), whereas in females it is not divided (fig. 2B).

The longevity of the adults averaged 11.1 days; the males live from 7 to 14 days and the females from 6 to 21 days (table 1). The females lay from 40 to 50 eggs daily.

RESUMEN

Se estudió el ciclo de vida de la alevilla del dorso de diamante, *Plutella xylostella* (L.), la plaga más dañina del repollo en Puerto Rico. El trabajo incluye la descripción y la duración de todas las etapas del ciclo de vida de este insecto y mediciones de las larvas (largo del cuerpo y ancho de la cápsula cefálica). La duración media de las etapas de huevo, larva, prepupa, pupa y adulto fue 3, 11.7, 1, 3.6 y 11.1 días, respectivamente. La longitud de la larva y el ancho del armazón cefálico en milímetros para la primera, segunda, tercera y cuarta fase larval fueron de 1.2, 2.1, 3.7, 7.0 y 0.15, 0.24, 0.40 y 0.56, respectivamente.

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