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NOTES ON *PSEUDOSPHINX TETRIO* (L.) (SPHINGIDAE) IN PUERTO RICO

JORGE A. SANTIAGO-BLAY[1]
Biology Museum, Biology Department, University of Puerto Rico,
Río Piedras, Puerto Rico 00931

ABSTRACT. An egg cluster of *Pseudosphinx tetrio* (L.) (Lepidoptera:Sphingidae) was reared to determine the duration of each developmental stage. The adult emerges after 53 days following oviposition: eggs eclose in three or more days (n = 90, sd = 0); the mean time span of the five larval instars is 24 days (n = 22, sd = 0.8), or if six stages, 29–30 days (n = 2); prepupa, close to four days (n = 22, $\bar{x}$ = 3.8, sd = 0.5); pupa, about 22 days (n = 22, $\bar{x}$ = 22.2, sd = 0.5). Larvae feed on Apocynaceae such as: *Plumeria* spp., *Allamanda cathartica*, and *A. violacea*. All stages, including the egg, are illustrated and briefly described. The morphometric variation of most stages is reported, as well as notes on the coloration of the newly molted larvae and pupae, and other data on the biology of the species.

One of the most popular ornamental trees in Puerto Rico is *Plumeria rubra* L. (Magnoliophyta: Apocynaceae), known locally as ramo or pucha de novia, frangipani or alelí. Especially during July to September, *P. rubra* trees are attacked by larvae of the sphingid moth *Pseudosphinx tetrio* (L.) (Fig. 2), which can defoliate and deflower a tree in a few days. *Pseudosphinx tetrio* has been reported as feeding in other *Plumeria* species in Puerto Rico such as *P. alba* and *P. obtusa* (Martorell, 1976) but has not been recorded feeding on species in other genera. The association of *P. tetrio* with *Plumeria* spp. was suggested by Fabricius (1775), when he described the moth under the name *Sphinx plumeriae* (Cadiou, pers. comm.). Haber (1984) described the floral biology of *P. rubra* in Costa Rica.

This moth is widespread throughout the American tropics and has been reported from the southern United States (McDonnough, 1938; Hodges, 1971) to Paraguay and southern Brazil (Moss, 1920; Forbes, 1930). In Central America it has been suggested as a possible coral snake mimic (Janzen, 1980). This species is also known from the Caribbean, having been reported from Cuba under the name of *Sphinx asdrubal* (Poey, 1832), Jamaica (Gundlach, 1891), the Dominican Republic (Druce, 1881–1900), and the Puerto Rico Region (Dewitz, 1877; Gundlach, 1891; Forbes, 1930; Martorell, 1945, 1976; Wolcott, 1948; and Medina-Gaud & Martorell, 1974).

There is only one nearly complete account of the duration of development of this species (Dinther, 1956), although partial observations have been reported earlier (Merian, 1726; Sepp, 1852, both cited by Dinther; and Janzen, 1983).

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[1] Present postal address: Department of Entomological Sciences, University of California, Berkeley, California 94720.

The purpose of this paper is to report the duration of the developmental stages in the life history of *P. tetrio*. I will also add other biological information that was gathered during the study.

MATERIALS AND METHODS

An egg cluster was collected during the afternoon of 14 August 1982 in a xerophytic forest near road 333, 8 km from Guanica, a small town in southwest Puerto Rico. The cluster was placed in a polyurethane box, subsequently transferred to a plastic jar, and then placed in an incubator at 24–26°C, 24 h darkness. Humidity was provided by placing wet pieces of towels in the jars. After eclosion 30 larvae were placed individually in 30 ml cups and fed with *P. rubra* (red variety). After the third instar each larva was transferred to a 1000 ml jar. The containers and the larvae were cleaned with tap water at least every two or three days. When the pupal stage was reached, all food was removed from the jars. Prior to the emergence of adults, a piece of the central vein of a *P. rubra* leaf was placed in the jar in order to facilitate climbing and wing expansion. After emergence, several adults of each sex were kept in a 0.1 m^3 plastic box and fed with sugar water.

A previous partial rearing, from which data was taken on prepupal and pupal weight loss and some of the stage duration, had been done under similar conditions except for the dark-light period which had been about 12–12 h.

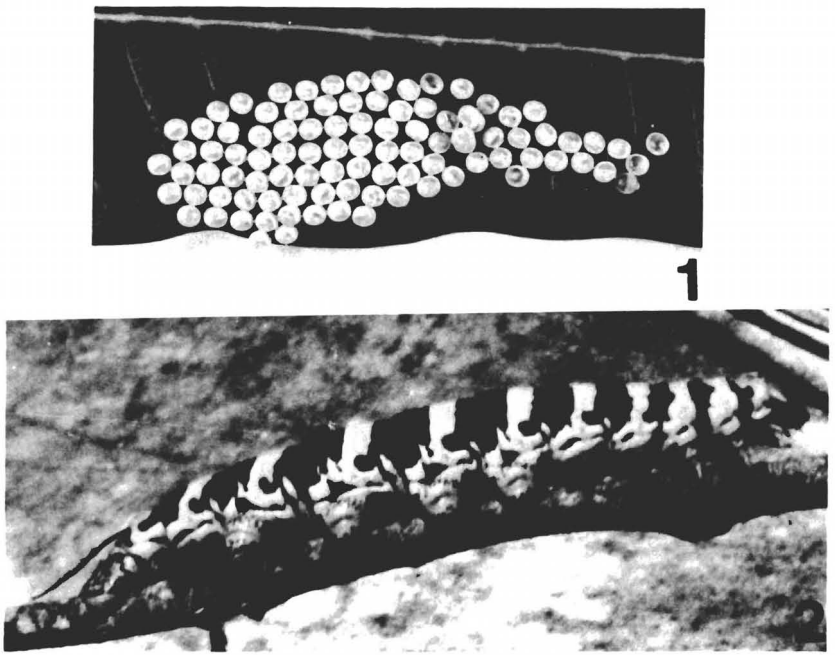
Eggs were measured with an ocular micrometer. All other measurements were made, usually during the first day of the appearance of the instar, using a metric ruler except for the cephalic width which was measured with a caliper. To measure the length of the larvae, the insect was allowed to remain inactive, and then it was firmly held by the extremities and measured.

Sixty other larvae, kept in groups of less than 12 specimens, were regularly fed with leaves of the apocynaceans *Allamanda cathartica* L., *A. violacea* G. Gardn. & Fielding, *Nerium oleander* L., and occasionally, *P. rubra*.

RESULTS AND DISCUSSION

Egg

The egg cluster consisted of 96 eggs (Dinther, 1956, reported a maximum of 69) and was found on the upper surface (Dinther, 1956, reported clusters only on the lower surface) of a *Plumeria obtusa* leaf. All but two eggs were laid in a single layer and generally, very close to or touching each other (Fig. 1). The cluster lacked a cover like that secreted by other moths. The eggs showed no sculpturing except for minute punctures on the surface. They were pale green, ellipsoidal,



FIGS. 1 & 2. *Pseudosphinx tetrio* stages: **1,** egg cluster; **2,** fifth larval instar.

and measured 2.2 × 2.5 mm (n = 11, sd < 0.1). Ninety of the 96 eggs hatched, two larvae were found with part of their intestine protruding from a lateral injury, which I presumed was caused either by the edges of the shell or by cannibalism of other larvae. Two of the six eggs that failed to hatch had a small hole in one of the extremes (parasitism?). Eclosion takes place synchronously, at least three days (n = 90, sd = 0) after oviposition.

Larva

The color of the newly molted, eruciform larva of each instar is light yellow and dark gray in alternating transverse rings. Several hours later, the larvae acquired the typical yellow and black coloration (Fig. 2).

Larval length and head capsule width increase in successive instars but tail length decreases after the third instar, probably due to reabsorption or to breakage followed by the production of a new but shorter tail. Table 1 summarizes the morphometric variation among these structures throughout the five, or six, larval instars. The results are in general agreement with those reported by Dinther (1956).

TABLE 1. Morphometric variation of total larval length, cephalic capsule width, and tail length in *Pseudosphinx tetrio* (L.). All measurements in mm. Usually there are five larval instars, a sixth was reached by a few specimens, two of which did not pupate.

Character	n / $\bar{x}$ / sd	Instar 1	2	3	4	5	(6)
Total larval length	n	30	29	29	28	28	4
	$\bar{x}$	17.0	13.0	20.7	34.3	63.0	69.3
	sd	0.4	1.9	2.8	4.0	9.4	5.7
Cephalic capsule width	n	30	29	28[a]	28	28	4
	$\bar{x}$	1.0	2.0	3.0	4.8	7.1	8.8
	sd	0	0.2	0	0.4	0.7	0.5
Tail length	n	30	29	27[b]	28	27	3[a]
	$\bar{x}$	3.9	7.3	12.4	11.8	11.1	9.7
	sd	0.3	1.1	1.1	3.1	4.6	5.0

[a] One measure not taken.
[b] Two broken tails, not measured.

Larvae fed with *P. rubra* passed through five larval instars, less frequently six. Fifth instar larvae can consume three to four leaves per day. The mean duration of each instar is: 1st = 3.2 days (n = 29, sd = 0.5); 2nd = 4.2 days (n = 29, sd = 0.5); 3rd = 4.6 days (n = 28, sd = 0.9); 4th = 5.5 days (n = 28, sd = 0.8); 5th = 6.5 days (n = 24, sd = 1.0); a mean total of 24.0 days (n = 22, sd = 0.8). If a sixth instar is present, eight more days are needed for a total of 29–30 days. Larvae that reach a sixth instar have a shorter fourth and fifth instars (4.5 and 5 days, respectively).

Other larvae were fed leaves of *Allamanda cathartica* and *Nerium oleander*, after being fed during the first two days with *P. rubra* leaves. Offered alone, *A. cathartica* leaves were eaten slowly, but those of *N. oleander* remained almost untouched. Other larvae were fed with *A. violacea* leaves.

Based on the available information, I presume that *P. tetrio* larvae rarely feed on *Allamanda* spp. in nature. An examination of the collection and of the accession cards at the Entomology Museum, Agricultural Experiment Station, Río Piedras, Puerto Rico, revealed only one record of *P. tetrio* larvae feeding naturally on *A. cathartica*. *Allamanda cathartica* constitute a new plant host record for *P. tetrio* in Puerto Rico. Other larvae were offered leaves of *Pterocarpus indicus* (Fabaceae), *Carica papaya* (Caricaceae), *Bambusa vulgaris* (Poaceae), *Lagerstroemia speciosa* (Lythraceae), *Calotropis procera* (Asclepiadaceae), and *Wedelia trilobata* (Asteraceae), but all the leaves remained untouched and many larvae died of starvation.

FIGS. 3–5. *P. tetrio* stages: **3,** pupa; **4,** male; **5,** female.

Prepupa

This stage is characterized by the shortening and darkening of the body, reduction of the prolegs, and bending of the tail. By the end of the prepupal stage, the larva has spun a silken case using also part of the uneaten foliar material. This period lasts almost four days (n = 22; $\bar{x}$ = 3.8, sd = 0.4; n = 30; $\bar{x}$ = 4.0; sd = 0.2 in the previous partial rearing). During the prepupal stage the organism loses 38.9% of its weight at the beginning of this stage (initial mean weight = 12.15 g; sd = 2.64; final mean weight = 8.74 g; sd = 1.68; n = 24).

Pupa

The newly formed pupa is yellow. After the second to the third hours, brown spots appear on its surface, and by the sixth hour the color has darkened to yellowish brown with lateral dark stripes on the thorax and rings on the abdomen. Later the pupa acquires the typical

uniformly dark brown coloration (Fig. 3). During this stage there is a mean weight loss of 18.2% (initial mean weight = 8.74 g, sd = 1.68; final mean weight = 7.15 g, sd = 1.45; n = 24). Female pupae are slightly longer (L) and wider (W) than males (♀, n = 10, $\bar{x}_L$ = 72.1 mm, sd = 3.1; $\bar{x}_W$ = 17.2, sd_W = 1.1; ratio L/W = 4.2; ♂, n = 12, $\bar{x}_L$ = 69.6, sd_L = 2.0; $\bar{x}_W$ = 16.0, sd_W = 0.4; ratio L/W = 4.4). The pupal stage lasts about 22 days (n = 22, $\bar{x}$ = 22.2, sd = 0.5; n = 30, $\bar{x}$ = 21.4, sd = 0.6 for a previous partial rearing).

Adult
(Figs. 4, 5)

Adult females measure slightly more in length (L), width (W), and wingspan than males (♀, n = 7, $\bar{x}_L$ = 59.7 mm, sd = 2.3; $\bar{x}_W$ = 15.3, sd_W = 1.2; n = 3, wingspan range 134–150; ♂, n = 9, $\bar{x}_L$ = 56.7, sd_L = 4.4; $\bar{x}_W$ = 13.9, sd_W = 0.6; n = 4, wingspan range 107–129). Wingspan values are similar to those reported by Dinther (1956). Adults kept in captivity lived up to 10 days but no eggs were laid.

It is interesting to speculate about why this cycle remained little known for such a long time. Apparently, this is partly due to the susceptibility of some stages to infections (Moss, 1920; Janzen, 1983; and Abreu, pers. comm.). In addition, earlier reports lack information about rearing conditions, which may have been inappropriate and might have caused unsuccessful rearing attempts.

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