BIOLOGY AND FEEDING PREFERENCE OF TOBACCO BUDWORM, *Helicoverpa assulta* (Guenee)

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Portion of MS thesis in Entomology conducted by the senior author in UP at Los Baños.

Funded by the Philippine Council for Agriculture and Resources Research.

Accepted for publication 5 November 1979.

ABSTRACT

The mean life cycle of tobacco budwom, *Helicoverpa assulta* (Guenee), reared in the laboratory on artificial diet is 48 days. Copulation started three to four days after emergence. Oviposition started one day after mating with peaks on the fifth to seventh day. A female can lay an average of 219 eggs. Average longevity is nine days for males and 11 days for females. Corn (*Zea mays* L.), sorghum (*Sorghum vulgare* Pers.), tobacco (*Nicotiana tabacum* L.), tomato (*Lycopersicum esculentum* Mill.), cotton (*Gossypium hirsutum* L.), and "silisilihan" (*Physalis angulata* L.) were the most preferred hosts for feeding among the 20 plants tested in the laboratory. Tobacco and "silisilihan" were the primary hosts in the field. Larval coloration varied with the host plant fed on.

Ann. Trop. Res. 1: 135-141.

INTRODUCTION

Helicoverpa assulta Guenee *(= Heliothis assulta)* is one of the species of the *Heliothis* group that was earlier recognized as distinct, although it was at times considered conspecific with *Heliothis armigera* (Hampson, 1893). Together with the genera *Heliothis* and *Schinia,* the genus *Helicoverpa* belongs to subfamily *Heliothidinae*, family *Noctuidae (Phalaenidae).*

The occurrence of tobacco budworm, *H. assulta,* in the Philippines has been reported by Capco (1957) and Hardwick (1965). However, this insect pest was not given serious attention probably because of its morphological and color similarity with other *Helicoverpa* species during its immature and adult stages

(Kirkpatrick, 1961). Recently, Ramos and Rejesus (1977) confirmed that *H. assulta* attacks tobacco in the country.

Kirkpatrick (1962) and Hardwick (1965) studied mainly the developmental stages of this species. This paper deals on the biology of *H. assulta,* its field host range and feeding preference on other host plants besides tobacco.

MATERIALS AND METHODS

Collection and Mass Rearing of Test Insect. — Larvae of *Helicoverpa* species were collected from tobacco plants in the Ilocos Regions. The insects were reared to adults in synthetic diet in the laboratory. The adults of *H. assulta* were separated from *H. armigera* by means of wing pattern, coloration and genetalic characters. The identified pairs were placed separately in cages for oviposition.

Life History Study. — Newly-laid eggs were collected and placed in Petri dishes lined with moist absorbent paper. The appearance of the eggs, incubation period and eclosion of the larvae were noted. Newly-hatched larvae were transferred individually into rearing bottles containing synthetic diet. The molting process and duration of each larval instar were observed. The pupal period, fecundity and longevity of mated adults were recorded.

Survey of Host Plants in the Field. — A survey was conducted around UP at Los Baños and experimental areas of the Cyanamid Chemical Co. which were planted to corn, sorghum and tobacco to determine the occurrence of *H. assulta.* Larvae were collected at random from each crop per area and these were reared to adults for species identification. Collections were also made from fields planted to corn in Tarlac and tobacco in Isabela; in five towns in Ilocos Norte, namely: Currimao, Badoc, Pinili, Paoay and Batac; and from fields with the weed *Physalis angulata* (L) locally known as "silisilihan".

Feeding Preference. — Fifteen third instar larvae reared previously on artificial diet were transferred individually into single containers and were allowed to feed on six host plants: sorghum heads, corn kernels, tobacco leaves, cotton balls, tomato and "silisilihan" fruits. The cultures were kept at room temperature (27-32°C). Feeding consumption was recorded after 48 hr. From then on, the insects were provided with enough food until pupation. Weight and sizes of larvae and pupae, percent pupation and percent adult emergence were recorded. Quantitatively, feeding preference was determined by the percent weight loss of larvae. Qualitatively, consumption was determined using the following index rating:

1 - No sign of feeding
2 - Slight feeding (less than

25%)
3 - Moderate feeding (25 but less than 50%)
4 - High feeding (50 but less than 75%)
5 - Severe feeding (75 to 100%)

The same index rating was followed in determining the feeding responses of the larvae on other crops such as cabbage, cucumber, squash, watermelon, muskmelon, garlic, okra, beans and sponge gourd.

RESULTS AND DISCUSSION

Life History and Habits.

The average life cycle of *H. assulta* is 31.5 days. The duration of the developmental stages is shown in Table 1.

Mating and Oviposition. Copulation started three to four days after emergence. The adults preferred dark cages for mating. Oviposition started one day after mating with peak oviposition occurring on the fifth to seventh day. Oviposition period lasted from one to seven days. Females laid eggs on paper lining the cage or on leaf surfaces on host plants. Eggs laid varied from 80-859 with an average of 219 eggs.

Eggs. Incubation period varied from 24-72 hr. The egg is globose and spherical with flattened base (Fig. 1a) with a diameter of 0.40-0.56 mm. The chorion is provided with a series of longitudinal ridges and depressions. Eggs were laid singly, rarely in mass. The eggs were apple green at first changing to brownish yellow when they were about to hatch.

Larva. There are six larval instars with a total larval period of 27 days. The different instars are differentiated from each other by their size and body pigmentation. The body length varies from 1.26-3.58 mm, for the first instar; 4.0-7.5 mm, second instar; 10.5-17.5 mm, third instar; 18.0-23.5 mm, fifth instar; and 24.2-32.2 mm, sixth instar.

The general body color is ochre yellow in the first instar which changed to green, reddish green, reddish yellow, brownish yellow and dark blue-green to almost black as the larva reaches the sixth instar (Fig. 1b). The color depended upon the diet of the larvae. Larvae reared on their natural host (tobacco) acquired darker colors after feeding for several hours. This observation confirms the earlier findings of Quaintance and Brues (1905), Hardwick (1965), and Ramos and Rejesus (1977) that nutrition affects larval coloration.

The measurement of the head capsule of the different larval instars ranged from 0.23-2.48 mm with a growth ratio decreasing from 1.83-1.53 from the first to the fifth instar (Table 2).

Pupa. The mean diameter of the pupa (widest area) is 4.02 mm with a mean length of 13.05 mm. It is subovate with rounded anterior part and sub-fusiform abdomen (Fig. 1c). Two slits representing the genital opening are closer together

Table 1. Duration of developmental stages (in days) of *Helicoverpa assulta* reared on synthetic diet.

Developmental Stage	Range	Mean
Incubation of Eggs	1.0 - 3.0	2.00 ± 1.00
Laval Period		
First Stadium	2.5 - 5.0	3.75 ± 1.25
Second Stadium	4.0 - 5.0	4.65 ± 0.75
Third Stadium	3.0 - 5.0	4.00 ± 1.00
Fourth Stadium	3.0 - 4.0	3.50 ± 0.50
Fifth Stadium	3.0 - 5.0	4.00 ± 1.00
Sixth Stadium	4.0 - 6.0	5.00 ± 1.00
Total Larval Period	19.5 - 30.5	26.90 ± 6.50
Pupal Period	8.0 - 15.0	11.00 ± 3.50
Longevity of Adult	3.0 - 17.0	10.00 ± 7.00
Total Developmental Period	31.5 - 65.5	47.90 ± 17.00

in male than in female pupa. The pupa is light brown on the abdomen and shiny apple green on the ventral part of the thorax. The color changed from brown to dark brown as the pupa matures. The pupal period lasts from 8-15 days.

Adult. The wing expanse of the male *H. assulta* varies from 27.0 to 33.5 mm and the female from 30.0 to 34.4 mm. The male moth is greenish yellow to golden brown while the female moth is orange to orange brown (Fig. 1d). Wavy markings are distinct on the outer marginal band of the forewings.

Longevity of Adults. Longevity of mated moths varies from 3 to 13 days with an average of 9 days for males and 11 days for females.

Field Host Range.

Helicoverpa larvae were observed to be very abundant in tobacco, cotton, sorghum, corn and "silisilihan". The population was very high in Batac, Ilocos Norte in both tobacco and corn areas where "silisilihan" plants were abundant.

Feeding Preference.

Of 20 species of plants tested in the laboratory, only six species were fed on readily by *H. assulta* larvae. They include tobacco, *Nicotiana tabacum,* L.; "silisilihan", *Physalis angulata* L.; cotton, *Gossypium hirsutum* L.; corn, *Zea mays* L.; sorghum, *Sorghum vulgare* Pers.; and tomato, *Lycopersicum esculentum* Mill. On the average, the consumption was highest for "silisilihan" (59.9%) followed in decreas-

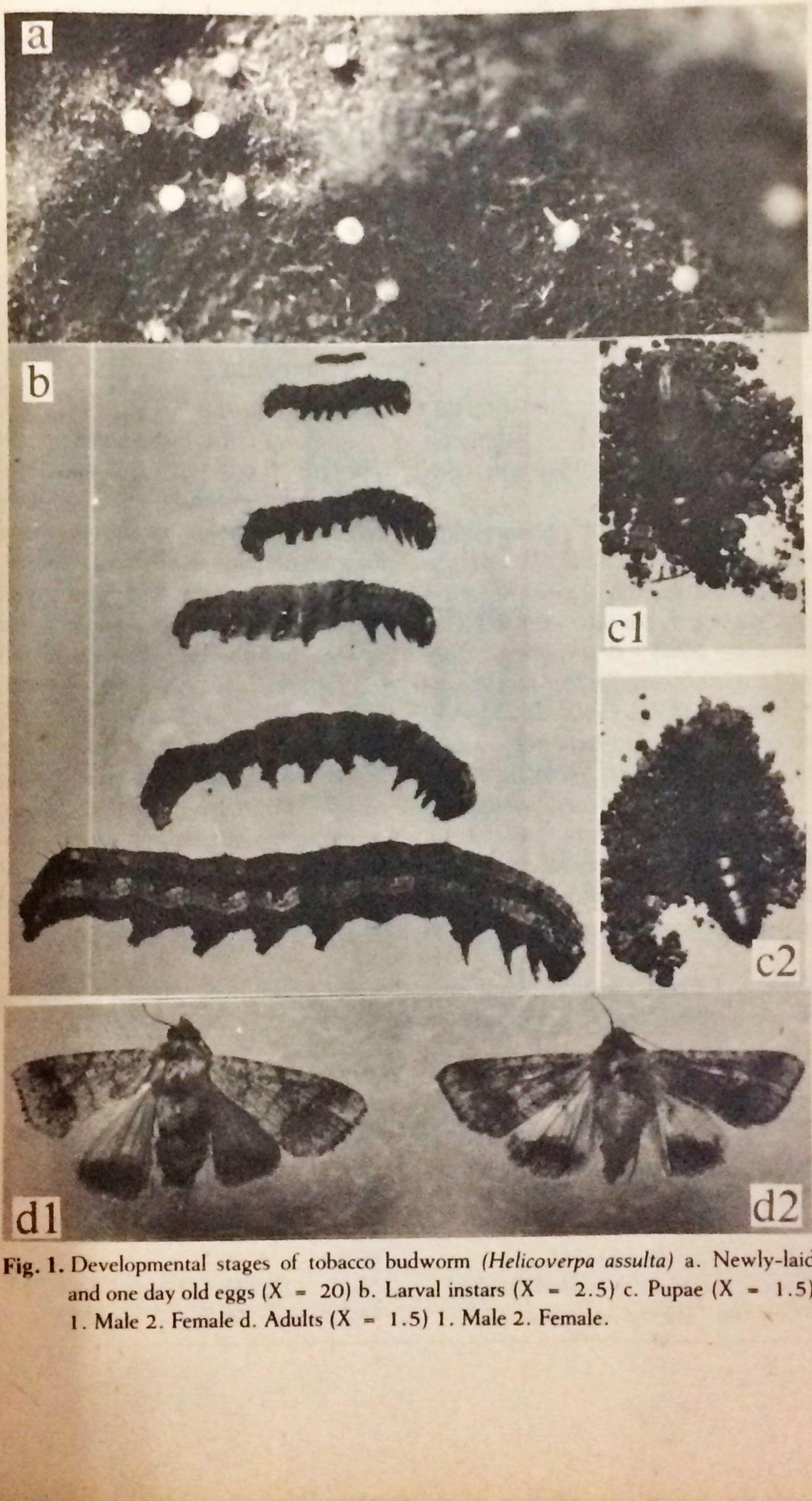

Fig. 1. Developmental stages of tobacco budworm *(Helicoverpa assulta)* a. Newly-laid and one day old eggs (X = 20) b. Larval instars (X = 2.5) c. Pupae (X = 1.5) 1. Male 2. Female d. Adults (X = 1.5) 1. Male 2. Female.

Table 2. Width of the larval head capsules and growth ratio of *Helicoverpa assulta* reared on synthetic diet.

Instar	Mean Width (mm)	Growth Ratio
First	0.20	1.83
Second	0.42	1.79
Third	0.74	1.49
Fourth	0.99	1.45
Fifth	1.56	1.53
Sixth	2.51	

ing order by cotton (48.9%), sorghum (35.6%), tobacco (34.5%), tomato 13.9%) and corn (10.7%).

Although percent consumption was lowest in corn, 86.7% of the larvae pupated, the highest reported and lowest in tomato with 53.3%. Percent adult emergence was highest in cotton, 73.3%, and lowest in tomato, 33.3% (Table 3). Mortality of larvae varied depending upon the host plant used (Table 3).

The mean sizes and weight of pupae reared on corn, "silisilihan" and tobacco were relatively larger and heavier compared to those reared on cotton, sorghum and tomato (Table 4).

Although the larvae reared on different host plants exhibited similar body colorations in the early instars, the color changed when they reached the third instar, depending on their diet. The green phase of the fifth and sixth instar larvae was dominant in larvae reared on tobacco, cotton balls, tomato fruits and "silisilihan". Reddish yellow and dark-green to almost black were dominant in larvae reared on corn and sorghum, respectively. Variations were probably due to the varying degree of carotene content of each diet (Ramos and Rejesus, 1977).

Table 3. Percent pupation, adult emergence and mortality of *Helicoverpa assulta* reared on different hosts in the laboratory.

Host	Pupation (%)	Emergence (%)	Mortality (%)
Cotton (*Gossypium hirsutum* L.)	80.0	73.3	26.7
Corn (*Zea mays* L.)	86.7	53.3	46.7
Sorghum (*Sorghum vulgare* Pers.)	73.3	53.3	46.7
Tobacco (*Nicotiana tabacum* L.)	80.0	66.7	33.3
Tomato (*Lycopersicum esculentum* Mill.)	53.3	33.3	66.7
"Silisilihan" (*Physalis angulata* L.)	66.7	66.7	33.3

Table 4. Average size and weight of *Helicoverpa assulta* pupae from larvae reared on different hosts plants in the laboratory.

Host	Diameter (mm)	Length (mm)	Weight (g)
Cotton (*Gossypium hirsutum* L.)	**4.58**	**17.48**	**0.1902**
Corn (*Zea mays* L.)	**4.94**	**18.79**	**0.3119**
Sorghum (*Sorghum vulgare* Pers.)	**3.31**	**12.80**	**0.1119**
Tobacco (*Nicotiana tabacum* L.)	**4.76**	**17.93**	**0.2151**
Tomato (*Lycopersicum esculentum* Mill.)	**4.31**	**16.46**	**0.1821**
"Silisilihan" (*Physalis angulata* L.)	**4.91**	**17.93**	**0.2740**

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