BIOLOGY OF THE GREATER SPIKE MOTH, *Tirathaba rufivena* Walker

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ABSTRACT

The biology of the greater spike moth *Tirathaba rufivena* Walker, an important insect pest of coconut, was studied in the laboratory. The insect underwent 5 larval instars and its developmental period from egg hatching to adult emergence varied slightly between sexes, the males with a mean of 33.65 days and the females 34.91 days. The adult male and female moths lived for an average of 4.29 days and 5.25 days, respectively. The greater spike moth larva is cruciform, brownish white with alternating 2 and 4 brown dots on each body segment. The adult is a light brown moth with green reflection and bright red veins on the forewings. A tiny black braconid parasite was found attacking the larva of the greater spike moth.

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KEY WORDS: Greater spike moth. *Tirathaba rufivena.* Insect pest. Coconut. Development. Morphology. Natural enemy.

INTRODUCTION

The coconut palm has been considered one of the world's major crop plants and the Philippines as the largest producer and exporter of coconut products (Child, 1974). The land area devoted to coconut production in the country still increases each year. However, it was shown that the average yield of coconut remains remarkably low compared to other countries. Such low productivity is attributed to several factors, foremost of which is the damage caused by pests. One of the pests attacking coconut is the greater spike moth, *Tirathaba rufivena* Walker. This insect pest is particularly destructive to the coconut inflorescence, causing immature nutfall as shown by a detailed study in the Malay Peninsula (Corbett, 1932). The early instar larvae of the greater spike moth construct silk galleries among the coconut in-

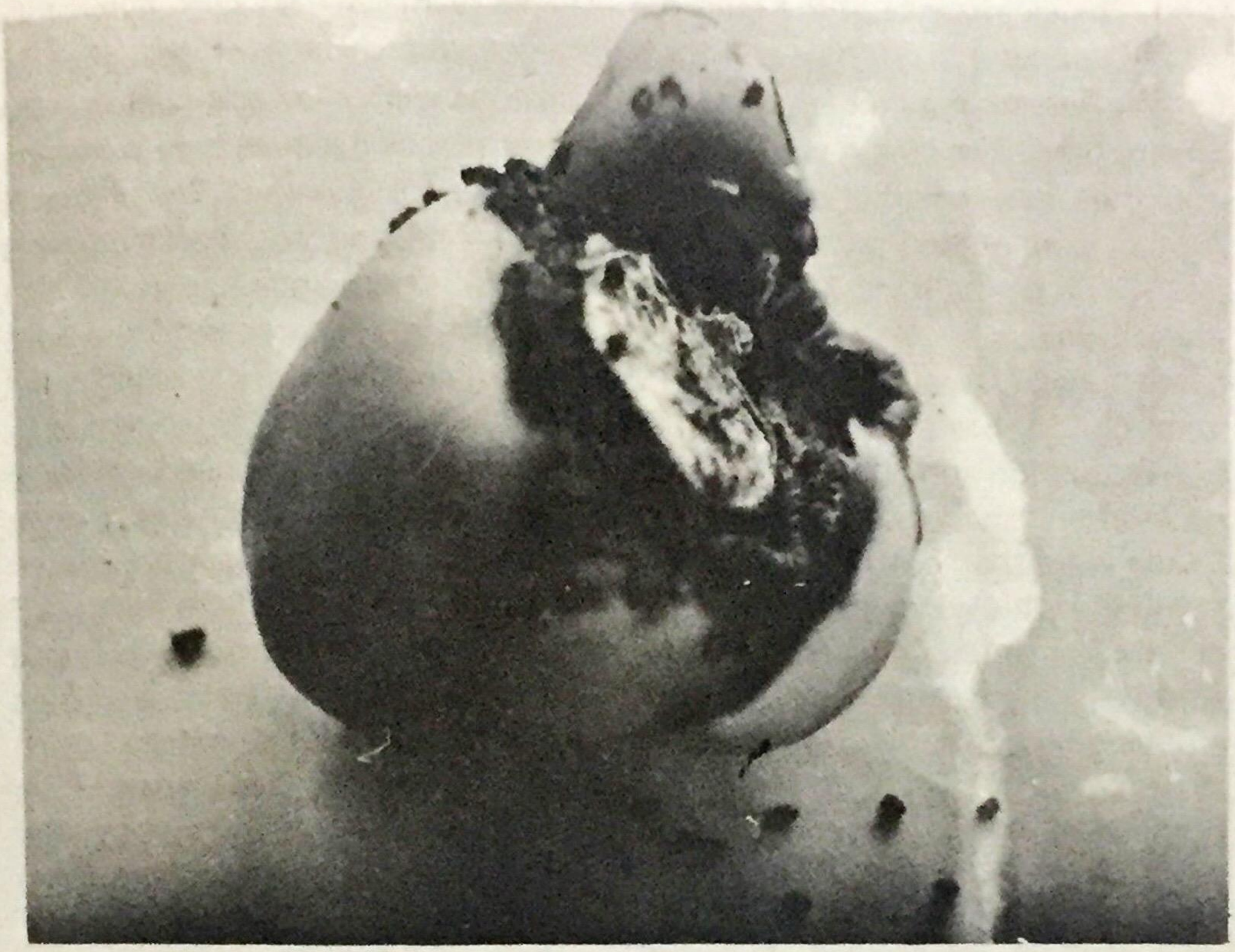

Fig. 1. Close-up of the coconut button damaged by *Tirathaba rufivena* showing a dirty white appearance as a result of their feeding activity.

florescences. As they grow, the larvae construct larger and longer runways which become conspicuous among the flowers and which give affected inflorescences a a dirty appearance (Fig. 1).

Available literature on the biology of the greater spike moth is scanty. Lever (1969) briefly described the biology of the pest in Malaya. He reported that the insect underwent 5 larval instars with a total developmental period of 4 1/2 weeks. On the other hand, Gabriel (1975) described only the damage caused by *Tirathaba* species on coconut in general. However, a thorough knowledge on the biology and behavior must be known to serve as basis for implementing a rational control program for this pest.

MATERIALS AND METHODS

Mass Rearing of Insect. — Male and female coconut inflorescences infested with the greater spike moth were collected from the field and were brought to the laboratory. They were dissected individually and examined for presence or absence of the greater spike moth larvae. Two to 4 larvae, depending on their size were placed in individual rearing jars (10 cm high x 4.5 cm diameter) which were provided with sliced coconut buttons as larval

food. The cleanliness of the cultures was maintained every day and food for the larvae was changed from time to time. The larvae were reared until they reached adult emergence. Adults were mated in rearing ball jars (20 cm high x 13 cm diameter) which were covered with nylon tulle. The jars were provided with cotton balls soaked in 20% honey solution and coconut buttons as food and oviposition substrates. These were then placed in a plastic container with water to protect the culture from ants. Eggs laid by these field-collected insects were used for studying their biology.

Life History and Behavior. — The life cycle of the greater spike moth, *Tirathaba rufivena* Walker was studied for 2 generations. Eggs of the insect which were laid on the walls of the rearing jars, nylon tulle cover and surface of the coconut buttons were allowed to hatch in the same places because they were very delicate for transfer. The dates of egg laying and egg hatching were noted. Incubation period and changes in appearance of the eggs from oviposition to hatching were recorded.

A total of 145 individuals were reared for 2 generations. Upon hatching, these larvae were placed in small glass jars (10 cm high x 4.5 cm diameter) which were provided with sliced coconut buttons as food and covered with fine-meshed nylon tulle to prevent the larvae from escaping. Younger and more tender portions of the buttons were given to the earlier instars while the harder and more fibrous portions were given to the later instars. The indi-

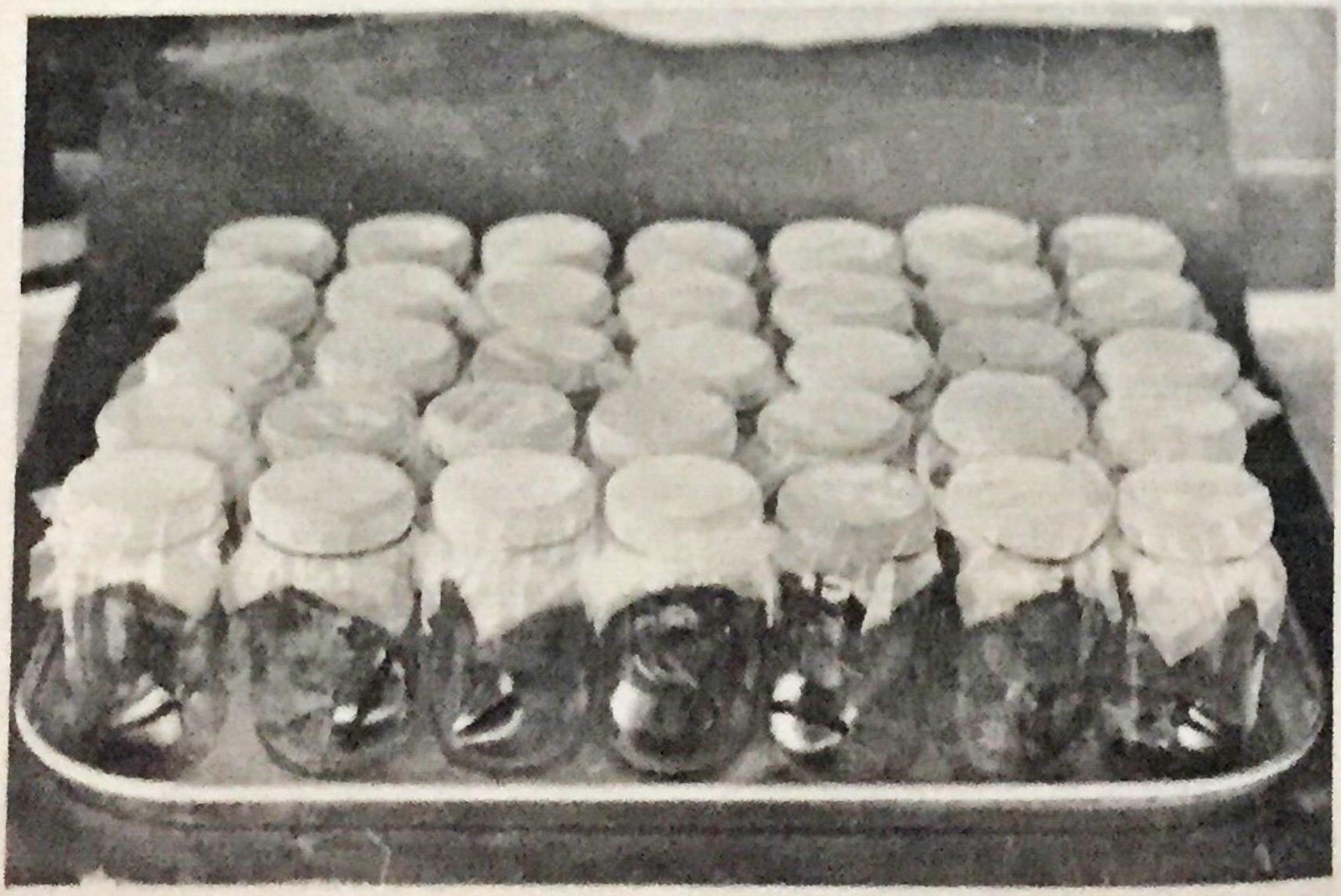

Fig. 2. Rearing set-up of *Tirathaba rufivena* Walker provided with sliced coconut buttons as food.

vidual cultures were then placed in an aluminum tray with water to protect them from ants (Fig. 2).

All cultures were observed daily for changes in their appearance during the different stages of development, the characteristic feeding habits and behavior of destructive stage(s), number of larval stadia, total length of larval and pupal stages, total developmental period, manner of molting and other pertinent biological observations. Mortality of larvae and pupae was also recorded. Upon emergence, the male and female adults were paired and allowed to mate and their mating behavior was also observed.

Morphological Features.— The eggs, larvae, pupae and adults of the greater spike moth were examined under a stereoscopic microscope and close-up photographs of the different life stages and photomicrographs of the minute structures such as legs, wings and genitalia were taken.

Natural Enemies.— Larvae and pupae of the greater spike moth were collected from the field and reared separately to observe whether parasites emerged from them. The appearance of the parasitized and healthy insects were compared. Parasites that emerged were examined under a stereoscopic

Table 1. Duration (days) of the developmental stages of the greater spike moth, **Tirathaba rufivena** Walker.[1]

Developmental Period	Male		Female	
	Range	Mean	Range	Mean
Incubation Period	4-5	4.03 ± 17.00[2]	4-5	4.08 ± 0.28
Larval Development				
First Stadium	2-4	2.82 ± 0.66	2-4	2.95 ± 0.57
Second Stadium	2-4	2.47 ± 0.65	2-4	2.44 ± 0.62
Third Stadium	2-4	2.50 ± 0.61	2-4	2.61 ± 0.62
Fourth Stadium	3-5	3.91 ± 0.61	3-5	4.00 ± 0.79
Fifth Stadium	6-13	8.62 ± 2.21	6-14	9.37 ± 2.25
Total Larval Period	16-25	20.32 ± 2.47	17-25	21.37 ± 2.09
Pupation Period	6-11	9.30 ± 0.90	8-13	9.46 ± 0.95
Egg Laying to Adult Emergence	28-39	33.65 ± 2.36	31-39	34.91 ± 0.22
Longevity of Adults	3-5	4.29 ± 0.67	4-6	5.25 ± 0.70

[1] Data based on 105 individuals reared for 2 generations.

[2] Mean ± standard deviation.

microscope and preliminary identification was done using appropriate taxonomic keys. These parasites were sent to the Museum of Natural History at UPLB, College, Laguna for confirmation of identification.

RESULTS AND DISCUSSION

Life History and Description.

Length of Life Cycle. — The insect underwent 5 larval instars and the total larval period lasted from 16 to 25 days for males and 17 to 25 days for females (Table 1). The pupal period lasted from 6 to 11 days for the males and 8 to 13 days for the females. The length of the life cycle from egg laying to adult emergence varied slightly between sexes, the males lived for 28 to 39 days and the females for 31 to 39 days. The female adult spike moths lived longer than the males, which is the usual pattern for most insects.

Oviposition and Incubation Period of Eggs. — The female moth started to lay eggs 1 to 2 days after emergence. In the laboratory, the eggs were laid singly or in masses on the coconut inflorescences, on rough surfaces of rearing containers and on the nylon cloth provided as cover. This indicated that the female moth was indiscriminate in choosing its oviposition site.

The newly laid eggs which were soft, hyaline and ovoid in shape measured 0.7 mm long and 0.5 mm wide. When viewed under a stereoscopic microscope, the egg surface had square-like grids. Three days after egg laying, an irregular brownish mass appeared at the center of the egg which indicated the start of embryonic development. On the fourth day, the larva inside was already discernible through the very transparent eggshell especially the yellowish brown head capsule which occupied a greater portion of the egg. Incubation period lasted from 4 to 5 days for both males and females with means of 4.03 days and 4.08 days, respectively (Table 1). The eggs had a 77.4% hatchability.

Larval Development. — The newly hatched larva tended to be gregarious at first and did not feed immediately on the female inflorescence provided as food. After a few hours, it moved sluggishly towards the coconut button, started feeding on the soft portion and made small tunnels on the surface. As the larva grew older, it bore bigger and deeper tunnels, fed towards the center and stayed inside while continuous larval molting occurred. Prior to each molt, the larva in all instars ceased to feed and became sluggish. Through the continuous expansion and contraction of its body, a slit was made at the dorsothoracic region. The larva shed its cuticle from the anterior to the posterior portion of the body.

First instar larva measured 1.5 mm in length and 0.5 mm in width. It had a dark brown head capsule and thoracic band. The body was whitish when newly hatched and turned dark later. Each body segment was alternated with 2 and 4

dark brown dots and its sides were provided with a pair of hairy projections. As the larva grew older, the body size increased and spots became more prominent. The later instars attained a length of 22 mm on the average and a width of 3.5 mm.

Pupation.— An inactive non-feeding stage preceded pupation. At the start of prepupation, the larva ceased feeding and shortened to about 2/3 of its body length. Then it positioned itself on one side of the rearing container, attached itself to the sliced button provided and started spinning silk around its body using some of its feces as framework. This process continued for several hours until the whole body was covered with silk threads. The ovoid cocoon gradually darkened and hardened. The pupa measured 17 mm in length and was yellowish brown at first then turned dark later.

Emergence of Adults and Mating Behavior.— The moth inside the cocoon started to expand and move when about to emerge. The constant movement of the moth inside caused one end of the pupal cocoon to open and allowed the adult to emerge. The head came out first, followed by the rest of the body. Initially, the wings were sticking to the body but later they were gradually stretched allowing the moth to move and fly.

The adult male and female moths were 11 mm and 15 mm long, respectively. Both were light brown with a green reflection and bright red veins on the forewing (Fig. 3).

Male and female adult moths were not found to mate during day-

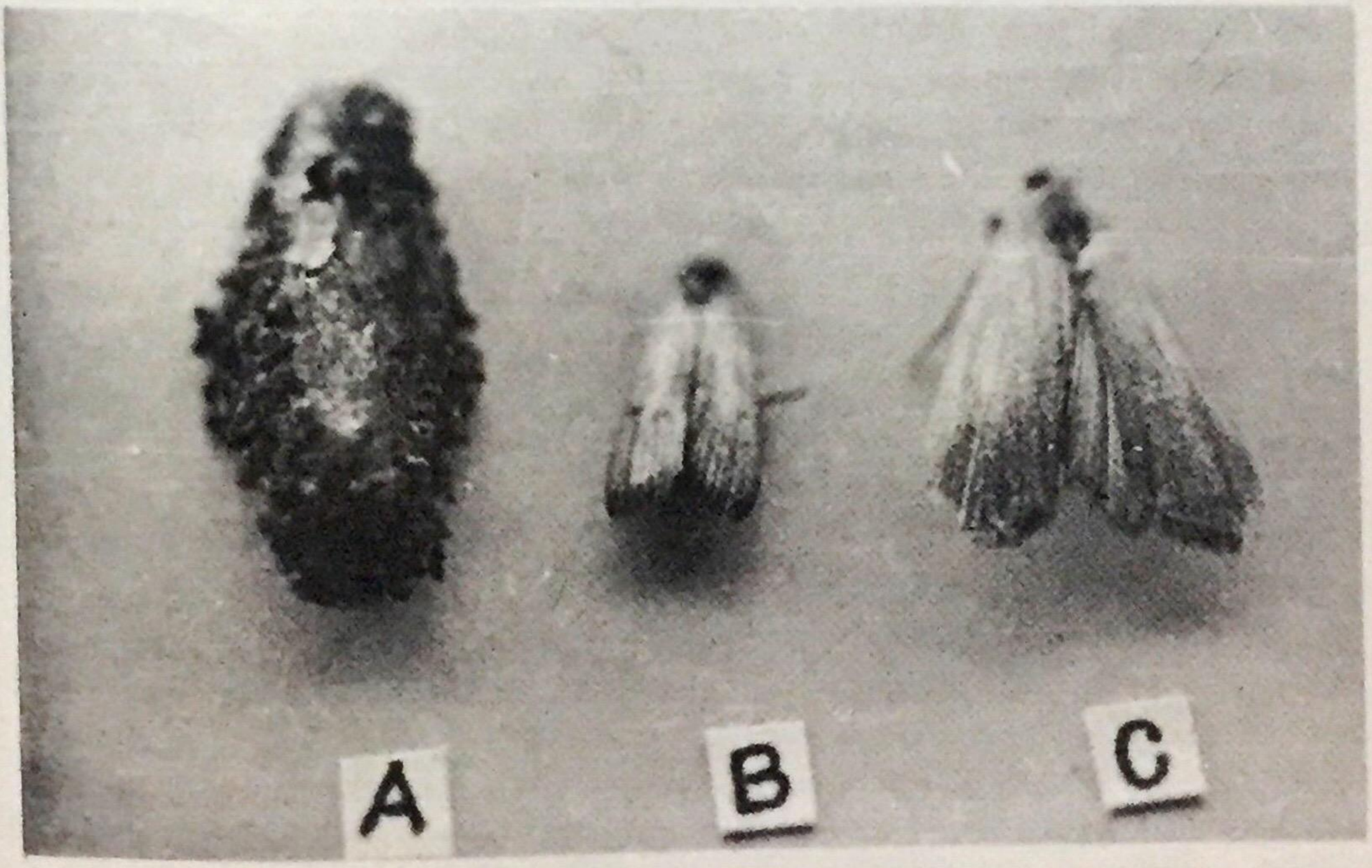

Fig. 3. Adults of *Tirathaba rufivena* (Walker).
A. Pupa B. Male C. Female

time. It was probable that mating occurred at night or early morning.

Mortality of Larvae and Pupae.

Mortality of the greater spike moth occurred at different stages of larval growth and during the pupal stage. However, higher mortality (9.66%) was observed during the second larval instar as compared with other stages (Table 2). Mortality of second larval instar was attributed mainly to microbial attack.

Natural Enemy.

Only one species of parasite was found attacking the third instar larvae of the greater moth and parasitization happened only once during the period of study. Low parasitization was probably due to the ability of the greater spike moth larva to tunnel deep into the coconut spike so that the parasites were unable to attack them. The parasite observed attacking the larva was a tiny black braconid wasp with the characteristic features of *Apanteles* sp. The parasitized larva came out from its tunnel and died outside the spike. Its body turned dark and dried up after the parasite had emerged.

Table 2. Mortality (%) of the different larval instars and pupa of the greater spike moth reared on coconut inflorescence.[1]

Developmental Stage	% Mortallty
Larval Instar	
First Instar	4.83
Second Instar	9.66
Third Instar	2.76
Fourth Instar	3.45
Fifth Instar	4.14
Pupa	2.76
Total	27.6

1 Data based on 145 individuals reared for 2 generations.

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