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Biology of yam mealybug, *Planococcus pacificus* Cox (Hemiptera: Pseudococcidae)

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ABSTRACT

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The mealybug, *Planococcus pacificus* Cox, is one of the most important insect pests attacking stored yam in the Philippines. This paper reports the results of our study on the life history of the insect on greater yam (*Dioscorea alata* var Kinampay). The insect underwent four development stages for the male and three for the female. The total developmental period (egg to adult) lasted 28-30 (28.79) days for the male and 28-30 (33.70) days for the female. The female laid 7-132 eggs/mass for its entire life span. A male to female ratio of 1:4.43 was recorded. Adult male lived shorter (1-4 days) than the female (4-11) days.

Keywords: Yam mealybug, *Planococcus pacificus* Cox, life history study

INTRODUCTION

The genus *Planococcus* is composed of several species which are serious agricultural pests. They attack cocoa, fig, coffee, grapevine, pomegrante, citrus,pineapple, various ornamentals and root crops (Cox and Wetton, 1988; Williams, 1982)

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Williams (1982) reported that *Planococcus dioscorea* attacks stored yam in considerable number. It may be known only from Papua New Guinea and Solomon Islands but is closely related to a certain species in Southeast Asia.

In the Philippines, Uichangco (1934) recorded a species of mealybug (*Pseudococcus lilacinus*) feeding on yam tubers and producing white waxy coatings and exudates which form an efficient protection from rain, heat, drying and parasitic and predatory enemies. He stated further that mealybugs in the country have high biotic potential which is likely augmented by the parthenogenecity and ovoviviparity of many Philippine forms.

Mealybugs maintain a symbiotic relation with the ubiquitous ants. They can also survive considerable drying of the tissues of yam tubers. *P. citri* was observed by Nwankiti *et al.* (1988) to infest stored yam in Africa. The same species was also mentioned by Kay (1973) as the one attacking stored yam in the West Indies. On the other hand, *P. halli* is considered a distinct species commonly infesting yam in both the West Indies and Africa (Cox and Wetton, 1988).

In this study, the mealybug attacking stored yam in the Philippines has been identified as cs Cox, a species closely related to *P. citri* in Papua New Guinea, Solomon Islands, Tahiti, and the rest of Southeast Asia and the West Indies.

The biology of this mealybug had been studied in other crops such as grapevine (Ullah , 1991). However, there had been no report yet on the life history of the insect on yam. *P. pacificus*, is one of the most important pests attacking stored yam in the Philippines, thus, information on its life history is one of the prerequisites in formulating effective control measures against it.

MATERIALS AND METHODS

Collection and mass rearing of mealybugs

Mealybug-infested yam tubers (var Kinampay) and live mealybug

specimens were collected from storage houses in yam growing areas in Leyte and Bohol, Philippines. They were brought to the laboratory for mass rearing to be used for biological studies.

The collected insects were placed in wire-screened cages (77 cm x 35 cmL x 35 cmW) to start a stock culture . The cages were provided with yam tubers as source of food and oviposition substrate.

Life history studies

The life cycle of *Planococcus pacificus* was studied for two generations with 100 reared individuals per generation. The first instar nymphs were placed in plastic cups (3.5 cm x 4 cm) with the use of a fine brush. Cubes of yam tubers with skin still intact were used as feeding substrate because yam cubes without intact skin were not preferred by the insect. The rearing materials and feeding substrates were disinfected with 80-95% ethyl alcohol for 10-20 minutes, blotted dry, and air-dried prior to placing the insect inside the rearing cup to minimize microbial contamination. The cups were covered with nylon tulle. The nymphs were reared inside the cup until the adult stage.

The cultures were observed daily. The duration of each stadium and the total developmental period were noted. Newly emerged adults were paired and allowed to mate. The mating behavior of adults and egg laying of mated females were observed. Other biological parameters such as mortality of immatures, longevity of adults, sex ratio, fecundity and feeding habits were likewise recorded.

The newly-laid eggs from the first generation females were collected and used for the second generation study.The data obtained from the two generations were incorporated and analyzed.

RESULTS AND DISCUSSION

Life history and behavior

The duration of the different stages of development of yam mealybug (*Planococcus pacificus*) is presented in Table 1. The male mealybug underwent four development stages - egg, nymph, pupa and adult - all of which took 30-45 (42.72 days) while the female underwent three development stages which lasted 40-58 (47.23) days. The female did not have a pupal or cocoon stage. The nymph passed through three instars in 28-30 (28.78) days for the male and 28-38 (33.70) days for the female. The male pupated in 3-5 (3.2) days. The paired adults started mating a day after emergence. The female lived longer, 4-11 (6.91) days than the male, 1-4 (2.11 days).

Table 1. Duration (days) of the development stages of *Planococcus pacificus* Cox reared on yam tubers (var. Kinampay) for two generations*

Development Period	Male Range	Male Mean	Female Range	Female Mean
Incubation period	5-9	6.01 + 2.09	5-11	7.32 + 1.90
Nymphal period				
First instar	8-13	10.73 + 1.12	9-16	11.54 + 1.73
Second instar	6-13	10.61 + 2.22	8-17	12.43 + 2.75
Third instar	8-18	12.20 + 0.77	13-20	16.13 + 2.59
Total nymphal period	28-30	28.78 + 0.74	28-38	33.70 + 2.36
Pupal period	3-5	3.20 + 1.61		
Total developmental period	30-45	42.72 + 4.71	40-58	47.23 + 5.51
Longevity of adults	1-4	2.11 + 0.34	4-11	6.91 + 0.89

*Data based on 134 individuals (32 males and 102 females)

Oviposition and incubation

The adult female mealybug started to lay eggs 3-6 (3.72) days after emergence. The eggs were laid in mass (11-13 egg masses) with 7-132 (68.64) eggs/mass. Most of the eggs were laid during the first two days of oviposition. Before egg laying, the female adult started producing a cotton-like material attached to its abdominal tip. This material serves as a protective covering and cushions the eggs upon oviposition.More cottony materials are produced when more eggs are laid. Egg hatchability ranged from 95 to 100 (98.71)%.

Nymphal and pupal development

Newly-hatched nymphs were sluggish and tended to aggregate themselves on the first day on the spot where they hatched.Later, they became restless and wandered on the tubers, hence this phase of development is also called the crawler stage. Prior to molting, the mealybugs limited their movements until ecdysis occurred. The nymph that had molted appeared fragile and sedentary. It moved about only when disturbed or searching for food. This behavior was observed until the last nymphal stage and sometimes even up to the adult stage. The insect changed its color from cream to powdery white. Its legs were no longer visible as its body enlarged out of proportion relative its legs.

The male nymph, which went through the pupal or cocoon stage, assumed an oval shape during the second and third instar. It became rectangular when about to pupate. During this stage, the insect anchored on the substrate and gradually changed its swelling form into a flat cocoo-like stucture. Morpho-anatomical changes occured in 3-5 days within the pupa. Afterwards, the male adult emerged from the posterior end of the cocoon.

Sex ratio and longevity of adults

Out of the 200 individual insects reared for two generations, 134 (67%) reached the adult stage. Of this figure, 32 were males and 104 were females, or a male to female ratio of 1:3.17. Longevity of the male was 1-4 (2.11) days, that of the female, 4-11 (6.91) days.

Table 2. Percent mortality of the nymphs and pupae of *Planococcus pacificus* Cox reared on yam tubers (var. Kinampay) for two generations*

Stage of development		Mortality (%)
Nymph		
	First instar	19.22
	Second Instar	9.87
	Third	3.85
Pupa		0.06
Total		33.00

*Data based on 200 individually reared mealybugs

Mortality of larvae and pupae

A total mortality of 33% was recorded from two generations of different stages of development (Table 2). Early instars registered the highest mortality among the development stages. This was attributed to microbial contamination of the substrate which affected the immatures.

Description of life stages

Egg

Ovoid; soft; yellowish cream to orange cream; length, 0.225-0.50 mm; Eggs turned creamy orange when about to hatch.

Nymph

First instar. Newly-hatched nymphs soft, cream-colored to peach, devoid of any markings; legs and head visible; crab-like in appearance,later phase with powdery white tinge at the back of body; body cleavage visible; length, 1.0.05-1.5 mm; 0.5-1.35 mm. (Fig. 1)

Second Instar. Body convex, peach with powdery covering and powdery white hair-like appendage along sides; legs not visible dorsally; length 1.75-2.00 mm; width, 1.0-1.5 mm.

Figure 1. Nymphs and female adults of yam mealybug *(Planococcus pacificus* Cox)

Third instar. Similar to second instar in appearance except that powdery white color and appendage are more prominent; length, 2.0-2.5 mm; width, 1.5-2.0 mm.

Pupa

Cocoon-like structure flat with silken materials protecting the immature; length, 1.25-1.75 mm; width 0.75-1.00 mm.

Adult

Male adult ant-like with membranous wings; body black with two white filamentous markings on abdomen; length, 2-3 mm; width, 1.5-2.0 mm.

Female is similar to third nymphal instar but bigger; length 2-3.5 mm; width 1.5-2.5 mm; body oval, legs slightly stout; translucent spores present on hind coxa and tibia; edges of body sclerotized with white powdery setae.

Natural enemies

There were no natural enemies found on mealybugs collected in Bohol and Leyte.

CONCLUSION

The mealybug, *Planococcus pacificus* Cox was studied on greater yam, *Dioscorea alata* (var. Kinampay). The male and female mealybugs underwent four and three developmental stages, respectively. The total developmental period was completed in 30-45 (42.72) days for the male and 40-58 (47.23) days for the female. The short life cycle and high reproductive potential of the female mealybugs can cause relatively high damage to yam tubers during the 3-6 months dormancy period when no precautionary and control measures are implemented prior to and during storage of yam.

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