Progress on the Artificial Rearing of the Armyworm, Spodoptera (Laphygma) exigua Hb. and Radiation Sterilization in the Male of this Species

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Abstract

The armyworm, Spodoptera exigua Hb. was reared for 6 more generations in an artificial medium containing Mung bean as a major component. By improving the rearing temperature and humidity conditions, better rearing results were obtained. The average percentage of development from eggs to pupae, from eggs to adults, and from pupae to adults was 41.7 ± 4.93, 38.44 ± 6.32 and 88.1 ± 1.48 respectively. The pupal weight was also calculated. In sterilization studies, the 3-day-old male pupae were subjected to gamma rays at 0, 5 and 10 Krads. Upon emerging into adults, they were mated with non-irradiated female moths. Male moths emerged from pupae subjected to 10 Krads of gamma rays could significantly induce infertility in eggs deposited.

Introduction

The armyworm, Spodoptera exigua Hb. Was reported as a serious pest of several agricultural products such as citrus, cotton, tobacco etc. (Atkins, 1960; Anwar, 1968). In Thailand, this insect is a serious pest of onion (Allium ascaloicum and Allium cepa) at the present time. Studies on the effects of x-rays and gamma rays on this species were previously carried out (LaBreque and Keller, 1965; Anwar, 1968). The artificial rearing of this insect using Pinto bean or Wheat-germ as main component was also reported (Shorey and Hale, 1965; Anwar, 1968).

Our previous work concerned the rearing of this armyworm and the lethal effect of gamma rays on this insect)Loaharanu and Chiravathanapong, 1970). We reported the results of rearing of the first 3 generations. However, the results of rearing from generation 4 to generation 8 were not significantly different from those of the first 3 generations.

Present report concerns the progress in the rearing of this insect for 6 more generations by improving the rearing temperature and humidity conditions. This report also covers radiation sterilization in the male of this species.

Objectives

1. To improve the artificial rearing technique for the armyworm, Spodoptera exigua Hb.

2. To investigate the sterilizing effect of gamma rays on males of this armyworm.

Materials and Methods

1. A. Spodoptera exigua Hb. (the 8^{th} generation) reared in the artificial medium at 25-26°C with 55-60 % relative humidity was used as the parent generation for the present rearing.

B. In this study the rearing temperature was 27 ± 1°C with 70-75 % relative humidity.

C. The artificial medium was prepared from the following compositions:

a. Soaked Mung bean	106.6 g.
b. Dried Brewer's yeast	16.0 g.
C. Ascorbic acid	1.6 g.

d. Vitamin diet fortification mixture	1.5	g.
e. Methyl-P-hydroxy benzoate	1.0	g.
f. Sorbic acid	0.5	g.
g. Formaldehyde (40 %)	1.0	ml.
h. Agar	6.4	g.
i. Water	320.0	ml.

This rearing formula was modified from that reported by Shorey and Hale (1965). Prior to mixing the compositions, Mung been was heated to boil and soaked in the water over night. All the compositions were mixed on a Waring blendor. Petridish and glass vials were used as rearing containers for larvae. Beakers (100 ml. cap.) were used as mating containers for adult moths. Eggs were deposited on the paper which lined the inner wall of the beakers.

2. Eggs and larvae were surface disinfested by sodium hypochlorite and neutralized with sodium-thiosulfate as described in the work of Pink bollworm (Mangum, et al., 1969).

3. In rearing studies, six successive generations of the armyworm were reared. In each generation, 50 eggs were reared for each replicate (total 9 replicated). The percentages of development from eggs to pupae; from eggs to adults; from pupae to adults and the pupal weight were studied and calculated.

4. For radiation sterilization, the insect was sexed at pupal stage. The 3-day-old male pupae were irradiated at 0,5 and 10 Krads of gamma rays, Upon emerging into adults, they were mated with non-irradiated females. In each replicated, 9 pairs of moths were mated with a total of 9 replicates for each dosage. Eggs deposited on the first day were collected. The number of eggs and percentages of egg hatch were recorded.

Results and Discussion

1. Results of the rearing of Spodoptera exigua Hb. for 6 generations were shown in Table 1. The average percentages of development from eggs to pupae, from eggs to adults, and from pupae to adults was 41.7 ± 4.93, 38.44 ± 6.32 and 88.1 ± 1.48 repectively. The average pupal weight was 63.93 ± 2.18 mg/pupa. The percentage of development from eggs to adults was much higher than previously obtained (Loaharanu and Chiravathanapong, 1970). This was probably due to the change in rearing temperature and humidity conditions. The percentage of development from pupae to adults and the pupal weight were similar to those previously reported.

Table 1. Development of the Armyworm, Spodoptera exigua Hb. in an artificial medium.

Generation	mean % of development			mg/pupa
	Eggs to pupae	Eggs to Adults	Pupae to Adults	
1	38.67	32.89	86.63	65.28
2	40.89	35.11	87.36	61.47
3	34.00	30.67	87.63	63.81
4	45.56	44.44	88.93	60.19
5	44.44	41.78	90.67	65.79
6	46.67	45.78	87.41	63.79
Average	41.7 $\pm$ 4.93	38.44 $\pm$ 6.32	88.1 $\pm$ 1.48	63.39 $\pm$ 2.18

2. Results of radiation sterilization in male Spodoptera exigua Hb. were shown in Table 2. Males were subjected to gamma rays at pupal stage and were subsequently mated with non-irradiated females. The percentage of egg hatch due to males irradiated at 0, 5 and 10 Krads was 87.8 $\pm$ 7.75, 86.1 $\pm$ 8.8 and 61.1 $\pm$ 5.90 respectively. Male moths emerged from pupae subjected to 10 Krads led to a significant decrease in the percentage of egg hatch. The percentage of mortality of male moths irradiated at 10 Krads (as pupal stage) was 7.1 in 10 days.

Anwar (1968) reported that male moths emerged from pupae (8-day-old) subjected to 50 Krads of gamma rays could reduce the fertility of eggs to 0.5 %. Although we worked on pupae at younger age, our further studies would also cover irradiation of the pupae at higher doses of radiation.

Table 2. Fertility of eggs deposited by non-irradiated female moth mated with irradiated male

Doses applied to male pupae (Krads)	Eggs deposited on the first day/9 pairs	
	No.	% of Hatch
0	378	(a) 87.8 ± 7.75
5	409	(b) 86.1 ± 8.8
10	379	(c) 61.1 ± 5.90

(a) and (b) are not significantly different from each other(at 5 % level).

(c) is significantly decreased (at 1 % level) when compared with (a).

Summary

1. The armyworm, Spodoptera exigua Hb. was reared for 6 more generations with improvement in rearing temperature and humidity conditions. The average percentage of development from eggs to pupae, from eggs to adults, and from pupae to adults was 41.7 ± 4.93, 38.44 ± 6.32 and 88.1 ± 1.48 respectively. The pupal weight was 63.39 ± 2.18 mg/pupa. The percentage of development from eggs to adults was much higher than that previously obtained.

2. Male moths emerged from pupae subjected to 10 Krads could induce significant decrease in the percentage of egg hatch. The mortality of these male moths was 7.1 in 10 days.