

Short Communication

The effect of gamma irradiation on the ovaries and testes of *Plodia interpunctella* (Phycitidae: Lepidoptera)

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***Plodia interpunctella* (Hubn) male and female full grown pupae were exposed to 50, 150, 250 and 350 Gy. The ovaries and testes were investigated following the emergence of the moth. Irradiation of female pupae reduced the number of developing oocytes and fewer eggs were laid. This effect was referred to the reduction in the length of ovariole. Irradiation further induced oocyte reabsorption as compared to its occurrence in untreated insects. These effects were directly proportional to the dose applied. Exposure of male pupae to gamma rays led adversely to a decrease in the overall size of the testes in some of the emerged moths.**

Key words: *Plodia interpunctella*, gamma rays, ovaries, testes.

INTRODUCTION

The Indian meal moth, *Plodia interpunctella* (Hubn) is considered one of main pests of stored products in Egypt and many countries in the world. Larvae infest flour as well as other stored products or food. The problems of widespread use of insecticides to compact pests of stored products, led to the establishment of much safer or effective means to control insects. Among these approaches is ionizing irradiation to induce insect sterilization. The application of ionizing radiation for controlling insects infesting grain and grain products appears promising and has advantages, over commonly used methods of control (Qureshi et al., 1970; Brower, 1975). The effect of gamma irradiation on the reproductive biology of certain Lepidopteran insects was previously studied by Abddel-Salam (1983) on *Ephestia kuehniella* (Zell), El-Halafawy (1983) on *Spodoptera littoralis* and Ahmed (1992) on *Corcera sephalonica* (Staint). The present investigation was carried out in order to study the effect of certain doses of gamma irradiation on the changes in measurement of the ovaries and testes of *p. interpunctella* (Hubn) adults treated as full grown pupae which will be applied for further control

of the population of the pest.

MATERIALS AND METHODS

The stock culture of the Indian meal moth, *P. interpunctella* (Hubn) was reared in the laboratory with a constant temperature of 27 ± 1 °C and relative humidity of 60 ± 5%.

Newly emerged adults were allowed to mate and oviposit in inverted 0.95 L jars with screen bottom. Eggs that fell through the wire mesh were collected daily in open Petri dishes and counted. The technique described by Brower (1976) was used to collect large number of pupae. Full grown pupae were irradiated with 50, 150, 250 and 350 Gy of gamma radiation.

For the investigation of the irradiated and untreated female moth, groups of twenty insects at each dose were used, treated pupae as well as an equal number of control insects. Each test was three replicated in fold, insects were anesthetized and dissected in a physiological saline solution, and the ovaries were examined soon after emergence to estimate the number of oocytes in ovaries and the length of ovarioles.

Other groups of female pupae were subjected to a range of 50 to 350 Gy of gamma irradiation and the emerged adults were paired with the untreated and unmated males. Observations were made on the number of eggs laid. Also the ovaries were examined immediately after the natural death of the female to estimate the number of oocytes in ovaries.

For investigation of the irradiated and unirradiated male moths, groups of twenty insects at each dose were replicated three times. Insect were dissected at the following intervals; 0, 24 and 48 h

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Table 1. Effects of gamma irradiation of *P. interpunctella* treated as full grown pupae on the number of oocytes in the ovaries of newly emerged virgin females.

% Reduction in length of ovariole	Length of ovariole (mm)	% Reduction in total no. of oocytes	Average number of oocytes				Dose (Gy)
			Per ovariole	Total No.	Left ovary	Right ovary	
5.7	10.0	16.7	34.4	275.2	141.6	133.6	50
13.2	9.2	28.6	29.5	235.8	121.4	114.4	150
33.9	7.0	37.8	25.8	206.5	106.3	100.2	250
41.5	6.2	63.9	14.9	119.0	61.2	57.8	350
0.0	10.6	0.0	41.3	330.4	170.0	160.4	Control

Table 2. Examination of ovaries after the natural death of moths of *P. interpunctella* irradiated as full grown pupae.

	Dose (Gy)				
	350	250	150	50	Zero
Average No. of oocytes soon after emergence	119.0	205.6	235.8	275.2	330.4
Average No. of eggs laid per female	0.0	40.6	72.9	103.7	236.0
Average No. of oocytes in ovaries after death	6.0	12.8	18.2	26.6	36.7
% of reabsorbed oocytes	94.9	74.0	61.4	52.7	22.2

following adult emergence to measure the dimensions of testes (length × width).

RESULTS AND DISCUSSION

Data recorded in Table 1 show the irradiation of pupae clearly reduced the number of oocytes in ovaries of emerging females. This effect became more marked with the higher irradiation doses. When full grown pupae were exposed to 50, 150, 250 and 350 Gy, the number of oocytes per ovariole was reduced to an of average 34.4, 29.5, 25.8 and 14.9 oocytes respectively, as compared with 41.3 oocytes in the control. In terms of the total number of oocytes in both ovaries this number decreased to 257.2, 235.8, 206.5 and 119.0 oocytes in the ovaries of newly emerged females irradiated late in the pupal stage with 50, 150, 250 and 350 Gy, respectively as compared to 330.4 oocytes in the untreated females. Taking the number of oocytes in untreated insects as a basic for calculation, the rate of reduction was calculated to be 16.7, 28.6, 37.8 and 63.9% at the previously mentioned doses respectively. The reduction in the number of developing oocytes leads to a proportional decrease in ovariole length (Table 1). The present results agreed with those obtained by El-Halafawy (1983), El-Shrief et al. (1987), Ahmed (1992), Abdel et al. (1996) and Mikhael (2003).

Table 2 depicts a comparison between treated and untreated insects regarding the average number of eggs per ovary at moth emergence, the number of eggs laid per female, the number of eggs found in ovaries of a copulated female immediately after its natural death as well as the number of resorbed oocytes. From Table 2, it

is evident that the number of oocytes in the process of reabsorption was higher in treated insects than in untreated ones. This effect is dose dependent. When full grown pupae were exposed to 150 Gy; 72.9 eggs were laid and 61.4% were reabsorbed as compared to 236.0 eggs deposited and 20.0% reabsorbed in untreated insects.

Irradiation of *P. interpunctella* pupae clearly reduced the number of developing oocytes in the emerged moth and this reflected in a decrease in the length of ovariole and reduction in egg deposition due to the degeneration of oocytes. Gamma irradiation did not only led to a reduction in number of eggs laid but also reduced the number of egg rudiments after oviposition. This effect was completely correlated with reducing the reproductive capacity of *P. interpunctella*.

The reduction of oocytes in ovaries, egg production and oocytes remaining in the ovaries after death were due to egg absorption. Similar results were obtained with Abdel-Salam (1983), El-Nnaggar (1990), Boshra and El-Naggar (1994), Abdel and Haiba (1996), Mikhael (2003), Abd-Elwahed (2004) and Hafez and Hamed (2004).

Reabsorption of developing oocytes is a common feature in Lepidopteran insects (Chapman, 1975), it is further induced following irradiation. Table 3 shows that the irradiation of male pupae had an effect on the overall size of testes in the emerging moth. Immediately, after moth emergence, that is, zero hours the testes of untreated males measured 1.0 × 0.84 mm (length × width). Meanwhile the male gonads that emerged from moths of full grown pupae that were exposed to 50, 150, 250 and 350 Gy, measured 0.88 × 0.73, 0.80 × 0.70, 0.71 × 0.61 and 0.70 × 0.56 mm respectively. Forty eighty

Table 3. Effect of gamma irradiation of *P. interpunctella* treated as full grown pupae on size (length × width) of testes at different intervals in newly emerged moths.

Time following male eclosion (h)							Dose (Gy)
48.0		24.0		Zero			
Width	Length	Width	Length	Width	Length		
0.63	0.78	0.69	0.84	0.73	0.88	50	
0.60	0.71	0.64	0.76	0.70	0.80	150	
0.50	0.55	0.53	0.63	0.61	0.71	250	
0.45	0.53	0.50	0.61	0.56	0.70	350	
0.95	1.13	0.93	1.1	0.84	1.0	Control	

hours after emergence in untreated insects, little change was observed in the size of the gonads. As for irradiated full grown pupae, the testes were further reduced in size (Table 3). This may signify atrophy of the enclosed testicular follicles. These finding agreed with those obtained by Hasaballa (1984), El-Shreif et al. (1987), Boshra (1992), Abdel Baki et al. (1996), Samira et al. (2001) and Mikhael (2003).

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