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Influence of Radiation Dose on Some Biological Aspects of the Peach Fruit Fly, *Bactrocera zonata* (Saunders) (Diptera: Tephritidae)

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Abstract: The effect of radiation dose on adult emergence, deformed pupae, sex ratio, and sterility of male adults of *Bactrocera zonata* (Diptera: Tephritidae) was studied. Results indicated that the averages of adult emergence were decreased by increasing the exposure time before adult emergence and gamma radiation doses. The percentages of adult emergence were 94.12, 92.05 and 92.02 % for irradiated pupae (IRP) at 8-days-old with 10, 30 and 50 Gy, respectively. Averages of the adult emergence were 93.40, 89.01 and 86.20 % for IRP with 10, 30 and 50 Gy at 7-days-old pupae, respectively. At 6-days-old pupae, percentage of adults emergence were 92.03, 87.23 and 85.20 % for IRP with 10, 30 and 50 Gy, respectively, compared with 94.50 % for unirradiated pupae. The percentage of deformed pupae was decreased by increasing the exposure time before adult emergence and by decreasing gamma radiation doses. The highest percentages of sex ratio (male/total) was recorded for IRP at 7-days-old with 30 Gray (Gy) (60.21%), followed by 56.03 and 47.03 % for flies obtained from IRP with 50 and 10 Gy, respectively. Results indicated that sterility percentages of *B. zonata* males were significantly higher when pupae irradiated with different doses at 7-days-old pupae than those of 8-, and 6-days-old pupae. It is observed also that sterility percentages of males irradiated at 7-days-old pupae were not significantly different between doses 30 and 50 Gy. Present results indicated that 30 Gy is a preferable gamma radiation dose to obtain the highest sterility of males of *B. zonata* when applied on pupae at 7-days-old (2-days before adult emergence).

Key words: Peach fruit flies, *Bactrocera zonata*, quality control, sterility

INTRODUCTION

Quality control is important for monitoring the performance of mass reared insects for use in the sterile insect technique (SIT) (Boller *et al*. 1981). To meet this requirement, routine quality control tests on egg hatchability, pupal weight and size, percent adult emergence, longevity, flight dispersal, and mating ability are used. The effect of irradiation must also be assessed and threshold values for each quality control parameter need to be established (Resilva *et al*., 2007).

PFF is a newly recorded species of fruit flies in Egypt last decade (El-Minshawy *et al*., 1999). Since this species is gradually increases its host range, their significant damage to Egyptian agriculture is increasing year after year. Because newly fields are adding to the orchards, overcropping operations, also the difficulties to choose suitable methods of control in view of the awareness of problems associated with the use of insecticides as cover spray.

Because of *B. zonata* is one of the most serious polyphagous insect pests (Fletcher, 1987), a feasibility study based on an integrated control program was initiated. The quality control procedures being developed for this species were based on those developed for the Mediterranean fruit fly, *Ceratitis capitata* (Wiedemann). These studies will provide baseline data for the development of quality control protocols for an expansion of *B. zonata* field programs with an SIT component in the future. The present work aims to study, in the laboratory, the effect of irradiation and threshold values for each quality control parameter.

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MATERIALS AND METHODS

Laboratory Rearing Technique:

The initial culture of PFF, *B. zonata*, has been obtained from infested mango fruits which were collected from a farm at Kom-Hamada district (60 Km southward of Damanhour City) in August 2004.

The insect was reared in the laboratory according to the rearing method described by El-Aw *et al.* (2003). According to such method, the infested fruits were kept under the laboratory conditions (26.0 ± 2.0°C and 70.0 ± 5.0 % R.H.). Plastic jars were furnished by sterilized sand and the infested fruits were placed inside the jars until pupation. Pupae were collected daily and transferred to adult rearing cages (30 X 30 X 30 cm). The different sides of the adult cages were coated with wire screen except one side which has a sleeve opening (for daily examination) and the cage floor was made of wooden sheet.

Mass Rearing Technique:

The newly emerged flies were provided with adult food consists of sugar mixed with hydrolyzate protein (3:1w/w) and wet cotton as a source of water. The adults of both sexes were mated in the cages. Cups of Guava juice covered with muslin were placed in the cages as an oviposition site. The deposited eggs were collected every 24 hours and washed with tape water. The collected eggs were placed on an artificial diet formulated as described by El-Aw *et al.* (2003). The diet was kept in plastic jars and stored in refrigerator until use.

The eggs were placed on the surface of the diet inside plastic cups (9 cm diameter and 5 cm height). These cups were covered for the first three days with pieces of thick cloth lid to safe the moisture in the cups for egg hatching. During the larval growth the thick cloth was replaced with muslin fabrics until larval full-grown then the muslin lids were removed and the cups which containing the grown larvae were put inside large plastic jars furnished with sand. The matured larvae were jumped out and pupated in the sand. Pupae collected and transferred to the rearing cages to start a new generation.

Quality Control of Irradiated Population of PFF:

Preparation of samples of pupae of PFF, *B. zonata*, observation, and gathering of data were done by following or modifying the procedures in the manual for "Product Quality Control and Shipping Procedures for Sterile Mass-Reared Tephritid Fruit Flies" (FAO/IAEA/USDA, 2003).

Pupal Irradiation:

Samples of *B. zonata* pupae obtained from the stock colony were held in glass vials 1-, 2- and 3-days before adult emergence These pupae (8-, 7- and 6-days-old) were irradiated with three different doses of $Cobalt^{60}$ (10, 30 and 50 Gy) as a source of gamma radiation using a Cobalt unit at Atomic Energy Institute, Giza, Egypt. After irradiation, samples of pupae were prepared for the following tests. Percentages of adult emergence, deformed pupae and sex ratio (males/total) for unirradiated and irradiated pupae with three doses of gamma rays (10, 30 and 50 Gy) at 8-, 7- and 6-days-old were calculated.

Sterility of PFF Male:

Male adults obtained from pupae irradiated with three doses of gamma rays (10, 30 and 50 Gy) at 8-, 7- and 6-days-old were confined with an equal number of normal females, obtained from unirradiated pupae, in plastic cups (10 cm height and 5 cm diameter). These cups were provided with adult food consists of sugar mixed with hydrolyzate protein (3:1w/w) and wet cotton as a source of water. The cups were coated with muslin fabric as an oviposition site. After the occurrence of mating, the tubes were provided with fruit scent as an attractive substance for oviposition. The deposited eggs were collected every three days and washed with tap water to remove the residues of the attractive substance from the surface of the egg shell, then rowed on black filter paper. After three days, the eggs were examined and the non hatched eggs were counted. Among the control group, the same procedures described above were repeated using unirradiated male and female flies.

Statistical Analysis:

All of the above-mentioned data of the present experiments were tested in a randomized complete block design with 5 replications evaluated, and subjected to an analysis of variance (ANOVA), and least significant differences (L.S.Ds) following the method of Steel and Torrie (1984) according to which the data were transformed, when described, using square root and angular transformation.

RESULTS AND DISCUSSION

Effect of Gamma Radiation on Adult Emergence PFF, B. zonata:

Data in Table (1) show the effect of gamma radiation on adult emergence of PFF, *B. zonata*. Results indicated that the highest percent of adult emergence was 94.12 % for irradiated pupae (IRP) at 8-days-old with 10 Gy, which reduced to 92.05 and 92.02 % for IRP with 30 and 50 Gy as compared with control value (94.50 %). The adults percentages emergence decreased by increasing the exposure time before adult emergence and by increasing gamma radiation doses; adult emergence values were 93.40, 89.01 and 86.20 % for IRP with 10, 30 and 50 Gy at 7-days-old pupae, respectively. The same trend was achieved at 6-days-old pupae, where the highest percentage of adults emergence was 92.03 % for IRP with 10 Gy, then decreased to 87.23 and 85.20 % by increasing the rays dose to 30 and 50 Gy, respectively, compared with 94.50 % for unirradiated pupae (control). However, emergence, longevity and sexual competitiveness of the males of *C. capitata* decreased at a higher dose level (Zumreoglu and Akman, 1987).

The present results may be confirmed by Katiyar and Valerio (1964) who found a margin between the doses required inducing sterility and that which causes severe deleterious effects in *C. capitata.* While doses of 8-10 K-rad induced high levels of sterility and adults emergence from irradiated mature pupae which is not significantly affected until dose of 20 K-rad are used. When 4-day-old laboratory rearing and wild strain pupae of Mediterranean fruit fly were exposed to the 6 and 10 k-rad gamma radiation, adult's emergence was poor compared with the control (Akman and Zumneoglu, 1978). So, our results are harmony with the results of Hashem (1979) who mentioned that adult emergence of *C. capitata* from pupae treated with 10-K rad gamma irradiation were inversely proportional with age before adult emergence and Saleh *et al.* (1981) who noticed declines in larval pupation and adult emergence in treated *Culex pipens* and *Aedes aegypti* with UV-irradiation. On the other hand, statistical analysis of the adult emergence data of *B. philippinensis* showed no significant difference for all doses tested compared to the control group (Resilva *et al*., 2007).

Effect of Gamma Radiation on Pupal Deformation of PFF, B. zonata:

Data in Table (1) revealed that the lowest percentage of deformed pupae of PFF was 4.5 % recorded at 8- days-old pupae for IRP with 10 Gy, then increased to 8.7 and 9.5 % for IRP with 30 and 50 Gy, respectively. The percentage of deformed pupae was decreased by increasing age of pupae at the exposure time before adult emergence. The lower percentage of deformed pupae at 7-days-old was 3.7 % recorded for irradiated pupae with 10 Gy, followed by 5.5 and 7.4 % for IRP with 30 and 50 Gy, respectively. The same trend was achieved at 6-days-old pupae where deformed pupae was increased by increasing the rays dose; 2.1, 3.4 and 5.2 % for IRP with 30 and 50 Gy, compared with 1.4 % for unirradiated pupae (control).

In general, data showed significant effects on deformation of pupae dependent on gamma radiation doses. The percentage of deformed pupae was inversely proportional to rays dose. Results are in agreement with those of Hashem (1979) and Calkins (1989), who mentioned that medfly irradiated as pupae 3-days before adult emergence had higher mortality than flies that were irradiated 1-day prior to eclosion. Draz *et al.* (1997) mentioned that the irradiated Mediterranean fruit fly pupae one day before eclosion with doses ranged between 100 and 150 Gy seemed to have no deleterious damage.

Effect of Gamma Radiation on the Sex Ratio of PFF, B. zonata:

Data in Table (1) indicated that the higher percent of sex ratio (males/total) was 48.02 % for flies irradiated as pupae with 10 and 50 Gy, respectively, while it was 41.10 % for irradiated flies with 30 Gy at 8-days-old pupae, as compared with 52.02 % (males/total) for unirradiated flies. The highest sex ratio (males / total) was recorded at 7-days-old pupae was achieved for flies irradiated as pupae with 30 Gy (60.21%), followed by 56.03 and 47.03 % for flies irradiated as pupae with 50 and 10 Gy, respectively. The same trend was achieved for irradiated flies as pupae with 30 Gy at 6-days-old pupae e.g. 49.10 % (males / total), which decreased to 47.20 and 45.01 % for flies irradiated as pupae with 50 and 10 Gy, respectively, compared with 52.02 % for unirradiated flies. It can be concluded that the highest percentages of sex ratio was achieved for exposure pupae at 7-days-old pupae (2-days-old before adult emergence) with 30 Gy of gamma rays, followed by 50 Gy for exposure pupae at the same time. Statistical analysis of data in Table (1) revealed that all tested doses caused significant effects on sex ratio at different time intervals.

Table 1: Effect of gamma radiation doses on adult emergence, pupal deformation, and sex ratios of PFF, *B. zonata*, irradiated as pupae at 8-, 7- and 6-days-old.

Parameter	Irradiation time of pupae (Days)	Radiation dose (Gy)				L.S.D $_{0.05}$
		control	10	30	50	
Adult emergence (%)	8	94.50 ± 0.025	94.12 ± 0.011[a]	94.05 ± 0.02[a]	92.02 ± 0.01$_b$	1.80
	7	94.50 ± 0.025[a]	93.40 ± 0.01[a]	89.01 ± 0.01[b]	86.20 ± 0.03[c]	1.89
	6	94.50 ± 0.025[a]	92.03 ± 0.015[b]	87.23 ± 0.02[c]	85.20 ± 0.05[d]	1.89
Deformed pupae (%)	8	1.40 ± 0.20[d]	4.50 ± 0.13[c]	8.70 ± 0.20 [b]	9.50 ± 0.10[a]	0.25
	7	1.40 ± 0.20[d]	3.70 ± 0.110[c]	5.50 ± 0.10 [b]	7.40 ± 0.20[a]	0.35
	6	1.40 ± 0.20[d]	2.10 ± 0.30[c]	3.40 ± 0.11[b]	5.20 ± 0.020[a]	0.28
Sex ratio (male/total) (%)	8	52.02 ± 2.10[a]	48.02 ± 2.40[b]	41.10 ± 1.10[c]	48.02 ± 0.10[b]	1.06
	7	52.02 ± 1.20[c]	47.04 ± 1.20[d]	60.21 ± 5.00[a]	56.03 ± 2.20[b]	1.86
	6	52.02 ± 0.20[a]	45.01 ± 2.20[d]	49.10 ± 1.10[b]	47.20 ± 1.1[c]	1.06

Means followed by the same letter(s) are not significantly different according to L.S.D.$_{0.05}$.

Table 2: Effect of different doses of gamma rays on male sterility percentages of the PFF irradiated as pupae at 8-days-old when mated with unirradiated females.

Egg laying days	Percentages of unhatched eggs (%)			
	Radiation dose (Gy)			
	Zero	10	30	50
1st	16.0 ± 1.00	33.75 ± 0.12	75.0 ± 1.00	95.50 ± 0.70
5th	31.0 ± 1.00	20.48 ± 0.50	75.0 ± 1.00	95.50 ± 0.70
9th	25.0 ± 1.00	33.61 ± 0.54	81.0 ± 1.40	94.00 ± 1.41
13th	31.0 ± 1.00	35.30 ± 1.13	86.0 ±.1.00	96.50 ± 0.71
17th	8.33 ± 1.00	34.84 ± 1.01	70.0 ± 2.00	95.50 ± 0.70
21th	12.0 ± 1.20	41.39 ± 1.00	77.0 ± 1.20	95.00 ± 1.41
25th	7.00 ± 1.30	38.53 ± 0.64	82.0± 1.00	89.00 ± 0.00
29th	10.33 ± 0.57	45.79 ± 0.71	71.0 ± 2.00	93.50 ± 1.70
33th	15.60 ± 1.00	36.00 ± 1.00	71.0 ± 3.00	92.00 ± 4.24
37th	16.00 ± 1.00	35.00 ± 0.58	99.0 ± 1.50	96.00 ± 1.41
41th	15.66 ±1.52	43.23 ± 1.12	95.6 ± 0.10	95.50 ± 0.70
Mean± S.D.*	17.0 ± 8.22[d]	36.23 ± 6.43[c]	80.23 ± 9.54[b]	94.36 ± 2.42[a]
L.S.D$^{.0.05}$	1.74	1.39	1.61	3.44

Means followed by the same letter(s) are not significantly different according to L.S.D.$_{0.05}$.
*L.S.D = 1.77

Effect of Gamma Radiation on Male Sterility of PFF, B. zonata:

Mean numbers of unhatched eggs deposited by normal female flies mated with unirradiated- and irradiated-males as pupae with 10, 30 and 50 Gy, were tabulated in Table (2). Data demonstrate that the percentages of unhatched eggs for unirradiated males ranged from 7.0 to 31.0 % at the whole time of the experiment. The percentages of unhatched eggs ranged from 20.48 to 45.79 % for female flies mated with males irradiated as pupae with 10 Gy. The same trend of non hatched eggs was obtained by increasing the gamma ray dose; 70.0 to 99.0 % and 89.0 to 96.5 % for females mated with irradiated males with 30 and 50 Gy, respectively. However, the general mean sterility value was increased by increasing the gamma rays dose i.e. 36.23, 80.23 and 94.36 % for males irradiated as pupae with 10, 30 and 50 Gy, respectively, compared with 17.0 % for unirradiated males.

Table 3: Effect of different doses of gamma rays on male sterility percentages of the PFF irradiated as pupae at 7-days-old when mated with unirradiated females.

Egg laying days	Percentages of unhatched eggs (%)			
	Radiation dose (Gy)			
	Zero	10	30	50
1st	16.0 ± 1.00	33.87 ± 0.10	98.50 ± 0.50	96.57± 0.60
5th	31.00 ± 1.00	30.60 ± 1.01	99.00 ± 1.00	100.0 ± 0.01
9th	25.00 ± 1.00	43.00 ± 1.00	99.50 ± 0.50	100.0 ± 0.01
13th	31.00 ± 1.00	40.00 ± 1.00	95.23 ± 0.23	99.95 ± 0.07
17th	08.33 ± 1.00	44.33 ± 0.90	94.34 ± 0.10	95.95 ± 0.01
21th	12.00 ± 1.20	47.20 ± 1.15	99.00 ± 1.00	99.99 ± 0.10
25th	07.00 ± 1.30	45.0 ± 1.00	99.96 ± 0.06	99.95 ± 2.00
29th	10.33 ± 0.57	35.26 ± 1.41	99.66 ± 0.05	100.0 ± 0.00
33th	15.60 ± 1.00	40.00 ± 1.00	99.66 ± 0.60	100.0 ± 0.00
37th	16.00 ± 1.00	44.00 ± 1.00	99.53 ± .0.55	99.90 ± 0.07
41th	15.66 ±1.52	46.0 ± 1.00	98.96 ± 0.95	100.0 ± 0.00
Mean± S.D.*	17.0 ± 8.22[c]	40.84 ± 5.34[b]	98.60 ± 1.66[a]	99.67 ± 1.01[a]
LSD	1.74	1.74	1.07	0.04

Means followed by the same letter(s) are not significantly different according to $L.S.D._{\cdot 0.05}$.
*$L.S.D._{\cdot 0.05}$ = 1.84

Table 4: Effect of different doses of gamma rays on male sterility percentages of the PFF irradiated as pupae at 6-days-old when mated with unirradiated females.

Egg laying days	Percentages of unhatched eggs (%)			
	Radiation dose (Gy)			
	Zero	10	30	50
1st	16.00 ± 1.00	17.62 ± 0.54	25.07 ± 1.00	40.50 ± 0.70
5th	31.00 ± 1.00	21.34 ± 0.56	40.30 ± 1.12	33.80 ± 3.40
9th	25.00 ± 1.00	25.29 ± 1.12	36.17 ± 1.04	35.66 ± 0.57
13th	31.00 ± 1.00	31.73 ± 0.64	41.18 ± 1.05	39.30 ± 0.61
17th	08.33 ± 1.00	28.16 ± 1.03	23.48 ± 1.00	35.00 ± 1.00
21th	12.00 ± 1.20	28.11 ± 1.02	42.16 ± 1.04	34.33 ± 1.52
25th	07.00 ± 1.30	39.54 ± 0.51	43.0 ± 1.00	45.00 ± 1.00
29th	10.33 ± 0.57	37.23 ± 1.07	27.22 ± 1.07	51.00 ± 1.00
33th	15.60 ± 1.00	33.16 ± 1.04	40.21 ± 0.21	49.66 ± 0.57
37th	16.00 ± 1.00	30.13 ± 0.81	31.60 ± 0.53	48.00 ± 1.00
41th	15.66 ±1.52	28.16 ± 1.04	37.53 ± 0.50	47.66 ± 3.78
Mean± S.D.*	17.0 ± 8.22[d]	29.23 ± 0.25[c]	36.27 ± 17.37[b]	41.81 ± 6.59[a]
LSD	1.74	1.5	1.55	2.96

Means followed by the same letter(s) are not significantly different according to $L.S.D._{\cdot 0.05}$.
*$L.S.D._{\cdot 0.05}$ = 1.79

Table (3) indicated the average percentages of unhatched eggs for females mated with irradiated males as pupae at 7-days-old. Data show that the percentages of unhatched egg ranged from 30.6 to 47.2 % for females mated with irradiated males with 10 Gy, Such percentages ranged from 94.34 to 99.96 % and 96.57 to 100.0 % for females mated with irradiated males with 30 and 50 Gy, respectively. When the averages of percentages of unhatched eggs were considered, the general mean indicated that sterility was increased by increasing the dose of gamma rays; 40.84, 98.60 and 99.67 % at 10, 30 and 50 Gy, respectively, compared with 17.0 % for females mated with unirradiated males.

Also, the sterility values of males irradiated 6-days-old pupae are shown in Table (4). Data revealed that unhatched eggs percentages ranged from 17.62 at 39.54 % for irradiated males with 10 Gy, and ranged from 23.48 to 42.16 % and 33.8 to 51.0 % for irradiated males with 30 and 50 Gy, respectively. The general means of sterility percentage were 29.23 and 36.27 and 41.81 % at 10, 30 and 50 Gy, respectively, compared with 17.0 % for unirradiated males.

It is concluded from the present results that the male sterility of *B. zonata* was increased by increasing the dose of gamma rays. So, according to the slopes of the sterility-dose-response lines, there was evidence that sterility of males values depend on dose rate and exposure time before adult emergence. It is observed that there was a positive relationship between the dose of gamma rays and the sterility percentage of male flies of *B. zonata*. Such sterility was differed from exposure time of irradiated pupae to another. However, pupal irradiation of *B. philippinensis* with doses lower than 67 Gy did not prevent egg hatch (Resilva *et al*., 2007).

It is observed from the present results that the general means of sterility percentages of males irradiated at 8-days-old pupae were 2.13-, 4.72, and 5.55-folds higher for males irradiated with 10, 30 and 50 Gy, respectively, than those of unirradiated ones. When males of *B. zonata* irradiated at 7-days-old pupae, such sterility percentages were 2.40-, 5.80-, and 5.86-folds higher in males irradiated with 10, 30 and 50 Gy, respectively, than those of unirradiated ones. Application of gamma radiation on pupae of *B. zonata* at 6-days-old pupae caused increasing in sterility percentages by about 1.72-, 2.13- and 2.46-folds higher in irradiated males with 10, 30 and 50 Gy, respectively. However, it is concluded that sterility percentages of *B. zonata* males were significantly higher when pupae irradiated with different doses at 7-days-old pupae than those of 8-, and 6-days-old pupae. It is observed, also that sterility percentages of males irradiated at 7-days-old pupae were not significantly different between doses 30 and 50 Gy. Present results indicated that 30 Gy is the preferable gamma radiation dose to obtain the highest sterility of males of *B. zonata* when applied on pupae at 7-days-old pupae (2-days befor adult emergence). Zumreoglu and Akman (1987) reported that the level of sterility in males of *C. capitata* increased with the increasing doses of radiation. Prasad (1992) found that the ideal dose of gamma radiation for male sterilization of Mediterranean fruit fly, *C. capitata*, was found to be 9 K-rad applied to mature pupae. However, the high level of sterility probably is due to the detrimental effect of gamma radiation on the less developed reproductive system of immature pupae pupae of *C. capitata* (Akman and Zumneoglu, 1978).

Our results indicated that doses of gamma rays, 30 and 50 Gy applied to pupae of PFF 7-days-old (2-days before adult emergence) induced sterility in males between 98.60 and 99.67 %. These results agree with Hooper and Katiyar (1971) who found that males sterility of *C. capitata* increased with increasing dose of gamma radiation to reach 98.5 % at 9 k-rad and 99.8 % k-rad, Hafez and Shoukry (1972), Ohinata *et al. (*1977), who found that the reduction in egg hatchability proportional to increase in radiation dose on *C. capitata*. However, complete sterility in both males and females of the melon fly, *Dacus. cucurbitae* were obtained when pupae irradiated 2 days before eclosion with 6 k-rad (Anwar *et al*., 1971). Resilva *et al*. (2007) found that females of *B. philippinensis* irradiated as pupae with 25 and 40 Gy were not sterile with egg hatch of 25.0 and 3.2%, respectively. When pupae were irradiated at 50 Gy and above, 100% sterility was achieved in all adult females.

Generally, adults are more radio-resistant than pupae, which are more resistant than larvae, and fully grown pupae are more resistant to gamma radiation than developing pupae (Ahmad *et al.,* 1990, Dongre *et al.,* 1997). Mansour (2003) and Hallman (2003), found that sterilizing dose of a species depending on developmental stage and age at irradiation. In general, the sterility dose seems to be differ from laboratory to another; in Hawaii, Steiner *et al*. (1962) found that the sterility dose ranged from 8.4 to 10 K-rad, in France, Feron (1964); in Egypt, 10 K-rad by Ezzat (1966) and 4 k-rad by Shoukry (1974). Within Diptera, Coleoptera, and Hemiptera, radiation doses vary widely among families and ranged from 20-200 Gy, with a mean dose for sterilization ranges from 20 to 160 Gy in Diptera (Bakri *et al*., 2005). Results of Resilva *et al*., (2007) suggested that the best irradiation range to achieve complete sterility of *B. philippinensis* with a Gamma-cell 220 should be between 67 and 74 Gy. However, present results highlight the need for further efforts to standardize experimental dosimetry and irradiation procedures for PFF and provide a suitable platform for guiding future research on this serious pest, the newly recorded species of fruit flies in Egypt last decade.

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