LATENT EFFECTS OF IRRADIATION ON CERTAIN BIOLOGICAL ASPECTS OF GRAPE VINE MOTH *LOBESIA BOTRANA* DEN. & SCHIFF.(LEPIDOPTERA, TORTRICIDAE)

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Abstract

Certain biological aspects of three successive generations of *Lobesia botrana* resulted from the progeny of parental males irradiated with 10 and 20 krad were studied. Two crosses of treated males x normal females and normal males x treated females were examined and compared with normal males x normal females. The egg incubation period of the three successive generations was insignificantly differed except with 20 krad in case of F1 progeny. The total larval period of both F1 and F2 was significantly varied with the treatment, whereas that of F3 was insignificantly affected. The irradiation with 10 and 20 krad significantly affected the pupal period in case of F1 only. Finally, the total life cycle of both F1 and F2 was significantly affected by irradiation with 10 and 20 krad, but that of F3 was insignificantly affected.

INTRODUCTION

The grape vine moth, *Lobesia botrana* Den. & Schiff. (Lepidoptera, Tortricidae) is considered as one of the most harmful pestes destroying berries of various grape vine varieties in all growth stages. Females lay eggs on inflorescence buds, immature and mature berries (Korashy, 1991).

Different approaches are usually attempted to manage this pest, among which dominates the use of chemical insecticides. However, highly effective insecticides create several problems such as undesirable chemical residues, environmental pollution, disturbance of the natural agro-ecosystem and appearance of insecticide-resistant strains.

In the past decade, the increasing resistance to insecticides, along with the more restrictive use of many chemical pesticides, has prompoted research for new avenues of insect control. Many researchers have studied the possibilities of population suppress through the release of radiation-sterilized insects (North & Holt, 1968; Walker & Quintana, 1968; Proshold & Bartell, 1970, 1972 and 1973; La Chance *et al.*, 1973; Brower, 1975, 1976, 1979, 1980 and 1981; Carpenter *et al.*, 1987 and Korashy, 1991).

The present study includes further detailed investigation on the inheritance of semi-sterility induced by gamma radiation throughout three successive generations of *L. botrana* and the biological characteristics for use in genetic control.

MATERIALS AND METHODS

Rearing Technique

All pupae used in the study were obtained from rearing *L. botrana* larvae on artificial diet (Gabel, 1981) under laboratory conditions of 27± 2ºC, 65 ± 5% R. H. and a photoperiod of 16 L: 8 D in plastic containers of 7cm diameter and 10 cm height. Excess moisture was avoided by placing tissue paper directly under the container cover. Stripes of corrugated cardboard (1.3 cm wide) were provided as pupation sites. When pupae are to be tested, the stripes with pupae were collected when the pupae were within 24 hrs of emergence, as judged by their dark brown colour. The stripes were opened apart and pupae were pulled from their cocoons and irradiated at the desired doses of 10 and 20 krad.

Irradiation Source

The pupae of *L. botrana* were irradiated by Co-60 source delivering gamma radiation at the Middle East Regional Radioisotope, Cairo, Egypt. The average dosage of the source when testing began was 70 Gy / minute and decay of the source was computed each month.

Experimental Technique

Male pupae were segregated and aged 7 days (1-day before emergence) before irradiation. Then, these pupae were treated in a Co^{60} irradiator at a dose rate of 0.1 krad / min. Doses used were 0.0 (control) and sub sterilizing doses of 10 and 20 krad. Immediately after irradiation, parental males were paired with unirradiated virgin females and equal numbers of control pairs were set up. Pairs were placed in groups (50 couples for each) in cages that were incubated at the abovementioned controlled-laboratory conditions. Eggs of every treatment were separately collected and reared on artificial diet.

To study the post- emberyonic development of progeny of irradiated males with 10 and 20 krad, the F_1 progeny of the treatments were used where each treated male was placed with two normal females and two treated females were placed with normal male in the rearing cages. The same technique was repeated with both F_2 and F_3 and every treatment was replicated 10 times. Incubation period of eggs, larval and pupal durations and total span were recorded for progeny of different crosses for F_1, F_2 and F_3 in both treatments of 10 and 20 krad.

RESULTS AND DISCUSSION

1- Effect on F_1 individuals

Data presented in Table (1) indicate the effect of irradiation on F_1 progeny of males of *L. botrana* treated with 10 and 20 krad where two crosses of F_1 treated males x normal females and F_1 treated females x normal males were done. The incubation period was insignificantly prolonged in case of treatment with 10 krad, but with 20 krad it more significantly increased (in case of treated males x untreated females) than the untreated individuals. The total larval period, pupal period and total life cycle were significantly prolonged due to irradiation with both 10 and 20 krad when compared with control. The total larval periods of F_1 progeny irradiated as a parent male with 10 and 20 krad were 25.70, 24.50 and 18.30, 18.70 days for the two crosses of treated males x normal females and treated females x normal males, respectively comparing with 17.55 days for untreated individuals. The pupal periods were 8.95, 7.85 days (in case of 10 krad) and 8.50, 8.00 days (in case of 20 krad) for the two tested crosses, successively, while for the control it was 7.20 days. The total life cycle ranged between 29.95-38.60 and 30.40-37.25 days for individuals treated with 10 and 20 krad, consecutively, while that recorded for untreated individuals was 28.25 days. There was great increase in the total life cycle of F_1 male progeny with both 10 and 20 krad . It increased significantly by 9 days more than that of control.

It is clear that transmission of lethality factors was higher for male than female progeny at the two tested doses, where the all examined aspects were more longer with treated males than that of treated females.

The results are in agreement with those obtained by Proshold and Bartell (1970 and 1972), Brower (1975, 1976 and 1979) and Korashy (1991) who stated that the survival of immatures of F_1 progeny resulted in irradiated males of *Heliothis virescens* (the first) *Plodia interpunctella*(the second), and *Lobesia batrana* (the third) was significantly increased. In the contrary La Chance *et al*, (1973) reported that the survival of immature stages of the F_1 progeny of *Pectinophora gossypiella* was significantly decreased at all irradiation doses to F1 males.

2- Effect on F_2 individuals

Data in Table (2) show the life cycle of F_2 progeny treated with 10 and 20 krad. The incubation period was insignificantly increased with the two crosses and ranged between 3.65-4.00 days for the treated individuals compared with 3.50 days for the control. The larval period of treated males or females significantly prolonged than control and it is interest to notice that F_2 males was little affected than the F_2 females. On the other hand the treated F_2 males and females with 10 or 20 krad less

insignificantly increased the pupal period that ranged between 7.55-7.80 days compared with 7.20 days for the untreated individuals. The total life cycle of treated males or females was significantly prolonged than control due to irradiation with 10 or 20 krad. The F_2 irradiated males crossed with normal females recorded 32.50 and 30.85 days for the total life cycle at 10 and 20 krad, respectively. But, that recorded for the F_2 treated females crossed with normal males were nearly equal (31. 40 and 31.15 days) at 10 and 20 krad, successively. The total life cycle for the untreated individuals was 28.25 days.

Walker and Quintana (1968) found that during irradiation of male and female of the sugar cane borer, *Diatraea saccharalis*, low exposure were delivered where few of the offspring died. Among the tested survivors of F_2 hatchability and survival to adult was extremely low. On the other hand, Carpenter et al. (1987) found that a 10- krad dose of radiation induced deleterious effects that were inherited through the F_2 generation of corn ear worm.

3- Effect on F_3 progeny

As shown in Table (3), the all tested biological aspects of F_3 progeny of *L. botrana* treated as parents with both 10 and 20 krad, were insignificantly affected with the treatment. The eggs of treated individuals hatched after 3.70-3.85 days comparing with 3.50 days for the untreated ones. The total life cycle of treated larvae ranged between 17.65-18.20 days, whereas that of untreated larvae was 17.55 days. The range of pupal period for treated individuals was 7.40-7.60 days compared with 7.20 days for the control. Finally, the total life cycle was nearly equal, where the range was 28.90-29.45 days for the treated individuals, but that recorded for the untreated ones was 28.25 days. It is clear to indicate from these results that transmission of lethality was eliminated at the egg stage in the three successive generations, but larval span lethality appeared especially in the first and second generations and then eliminated in the third one. Also, transmission of lethal factors occurred more with males than with females.

These data agree with the results of Brower (1979) who mentioned that recovery of reproductive ability began in the F_2 generation of *P. interpunctella* and continued into F_3 generation.

Table1.Total life cycle (in days) of F_1 of *L. botrana* irradiated with 10 and 20 krad.

Treatment	Incubation period		Total larval period		Pupal period		Total Life cycle	
	10 krad	20 krad	10 krad	20 krad	10 krad	20 krad	10 krad	20 krad
Control	3.50± 0.136 (3-5)		17.55±0.312 (16-20)		7.20±0.172 (6-9)		28.25±0.502 (25-34)	
F_1 $T^{\delta} \times N^{\varphi}$	3.95± 0.169 (3-5)	4.25±0.204 (3-6)	25.70±0.589 (22-30)	24.5±0.592 (21-29)	8.95±0.235 (7-10)	8.50±0.286 (7-11)	38.60±0.655 (33-43)	37.25±0.692 (32-43)
F_1 $T^{\varphi} \times N^{\delta}$	3.80±0.156 (3-5)	3.70±0.147 (3-5)	18.30±0.252 (17-20)	18.70 ±0.341 (17-22)	7.85±0.196 (7-10)	8.00±0.288 (6-10)	29.95±0.499 (28-34)	30.40±0.407 (28-34)
"F" test	N. S.	*	*	*	*	*	*	*
L.S.D at 0.05	-	0.451	1.258	1.249	0.584	0.599	1.645	1.577

N. S. means the differences were insignificant.
* means the differences were significant.

Table 2. Total life cycle (in days) of F_2 of *L. botrana* irradiated with 10 and 20 krad.

Treatment	Incubation period		Total larval period		Pupal period		Total life cycle	
	10 krad	20 krad	10 krad	20 krad	10 krad	20 krad	10 krad	20 krad
Control	3.50± 0.136 (3-5)		17.55±0.312 (16-20)		7.20±0.172 (7-9)		28.25±0.502 (25-34)	
F_2 $T^{\sigma} \times N^{\varphi}$	4.00± 0.205 (3-6)	3.65±0.167 (3-5)	20.85±0.549 (18-25)	19.65±0.0.443 (17-24)	7.65±0.167 (7-9)	7.55±0.223 (6-10)	32.50±0.763 (29-38)	30.85±0.488 (26-35)
F_2 $T^{\varphi} \times N^{\sigma}$	3.85±0.022 (3-5)	3.70±0.147 (3-5)	19.90±0.452 (17-25)	19.45±0.366 (17-23)	7.65±0.149 (7-9)	7.80±0.172 (7-9)	31.40±0.617 (28-39)	31.15±0.386 (28-34)
"F" test	N. S.	N.S.	*	*	N.S.	N.S.	*	*
L.S.D at 0.05	-	-	1.200	0.594	-	-	1.65	1.269

N. S. means the differences were insignificant.
* means the differences were significant.

Table 3.Total life cycle (in days) of F_3 of *L. botrana* irradiated with 10 and 20 krad.

Treatment	Incubation period		Total larval period		Pupal period		Total life cycle	
	10 krad	20 krad	10 krad	20k rad	10 krad	20 krad	10 krad	20 krad
Control	3.50± 0.136 (3-5)		17.55±0.312 (16-20)		7.20±0.172 (6-9)		28.25±0.502 (25-34)	
F_3 T^{δ} x N^{φ}	3.85± 0.167 (3-5)	3.75±0.160 (3-5)	17.95±0.266 (16-20)	17.65±0.466 (16-22)	7.40±0.197 (6-9)	7.50±0.224 (6-10)	29.20±0.433 (26-32)	28.90±0.523 (26-33)
F_3 T^{φ} x N^{δ}	3.75±0.143 (3-5)	3.70±0.147 (3-5)	18.20±0.445 (15-21)	17.80±0.457 (15-21)	7. 50±0.185 (6-9)	7.60±0.197 (6-9)	29.45±0.456 (27-33)	29.10±0.523 (25-33)
"F" test	N. S.	N.S.	N. S.	N.S.	N.S.	N.S.	N. S.	N.S.

N. S. means the differences were insignificant.

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التأثيرات المتأخرة للإشعاع علي بعض المظاهر البيولوجية لدودة ثمار العنب

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معهد بحوث وقاية النباتات – الدقي – الجيزة

تم دراسة بعض الصفات البيولوجية في دورة ثمار العنب لثلاث أجيال متتالية ناتجة من تشعيع الآباء بجرعتين ١٠، ٢٠ كيلو راد. حيث أجريت تهجينات بين ذكور معاملة مع إناث عادية، ذكور عادية مع إناث معاملة إضافة إلي ذكور عادية مع إناث عادية للمقارنة. وقد وجد أن فترة حضانة البيض للأجيال الثلاثة لم تتأثر معنوياً بالمعاملة فيما عدا المعاملة بجرعة ٢٠ كيلو راد في الجيل الأول. وقد اختلفت فترة حياة الأطوار اليرقية معنوياً خلال الجيلين الأول والثاني ولكنها لم تتأثر في الجيل الثالث. كذلك تأثرت فترة حياة طور العذراء بدرجة معنوية في الجيل الأول فقط عند المعاملة بجرعتي ١٠، ٢٠ كيلو راد وأخيرا وبحساب فترة الحياة الكلية نجد أنها تأثرت بدرجة معنوية بالمعاملة بجرعتي ١٠، ٢٠ كيلو راد في كلا الجيلين الأول والثاني فقط في حين كان التأثير بدرجة غير معنوية في الجيل الثالث.