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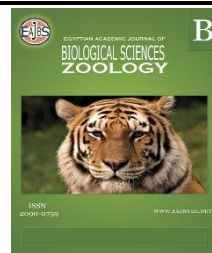


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Effect of Different Doses of Gamma Irradiation on Biology and Life Table of *Tetranychus urticae* Koch (Acari: Tetranychidae) of Two Ornaments Plants

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ABSTRACT

Developmental times, reproduction rate and life table parameters of *Tetranychus urticae* Koch of two ornaments plants Marshmallow and Salvia treated with four doses of gamma radiation 15, 25, 35 and 45 Kilo rad was studied under laboratory conditions at $25 \pm 2^\circ\text{C}$, 65% RH. The results indicate that applied of gamma radiation had a significant effect on the duration of male and female feeding on salvia and Marshmallow leaves irrigated. The life cycle and generation period of irradiated females increased with increasing doses of gamma radiation and were significantly higher than the control. The female oviposition and longevity periods of *T. urticae* significantly increased with an increased dose of gamma radiation. The mean fecundity and daily rate significantly decreased with increasing doses of gamma radiation on salvia and marshmallows. A significant positive correlation was found between all immature stages, generation, and oviposition periods and the dose of gamma radiation. The Intrinsic rate of increase (r_m) and net reproductive rate (R_0) of *T. urticae* was the lowest at 45 Kilo rad (0.148 female/female/day and 20.59 female/female) and the highest value was found at control (0.256 female/female/day and 44.70 female/female), respectively on salvia leaves. The radiation of salvia and Marshmallow seeds reduced the fecundity of *T. urticae* females and prolonged the generation time than in control.

INTRODUCTION

The two-spotted spider mite, *Tetranychus urticae* Koch (Acari: Tetranychidae) is one of the most important pests in many cropping systems worldwide. Its host plants (nearly 1161 plant species) comprise vegetables, fruits, crops, and a wide range of ornamentals (Migeon and Dorkeld 2022). *Tetranychus urticae* feeds on tender tissues, usually on the lower leaf surface, where it sucks out cell chloroplasts and other contents; the corresponding sites of the upper leaf surface appear as whitish or yellowish stippling. At a low density of attack, the stipplings are quite distinct from the green tissues of the leaf surface, but as mite feeding continues they may join up and become brownish or yellow-brown. In addition, mite webbing develops on the lower leaf surface, and at high population, densities may cover the leaves, flowers and fruits, or the entire plant. Severe damage induces the leaves to dry and drop, and the plant may die Saito (1985).

More than 2,000 years ago, the herb Marshmallow, *Althaea officinalis* L. (Malvaceae) was utilized as both a food and a medicinal. It is a species of flowering plant, which is used in herbalism and as an ornamental plant. Its leaves were used to make poultices by the Arabs, which they applied to the skin to soothe irritation. Mucilage, a gooey substance, can be found in both the root and the leaves. It can be used to coat the throat and stomach to lessen irritation when combined with water to create a slick gel. To relieve chapped skin, it is additionally applied topically (Basch *et al.*, 2003).

Salvia, *Salvia splendens* Sellow ex Schult (Lamiaceae), It is grown for ornamental purposes, and there are many types with colours ranging from deep purple to white. Native to Brazil, salvia is a delicate, herbal perennial plant. It is located in a warm, humid climate. The plant can reach 1.3 metres in height. For optimum growth, salvia prefers healthy soil with plenty of sunshine and well-drained soil (Vankar *et al.*, 2011).

Many researchers observed that gamma irradiation causes significant changes in pest biology concerning reproduction; irradiation at low irradiation doses eliminated most *Alternaria*, *Fusarium*, leafhopper, cotton leaf worm and two-spotted spider mite (Megali, 1987; Hussein *et al.*, 1999; Ramakrishna *et al.*, 1991; Abdu El-Nour and Ibrahim, 2006 and Hussein *et al.*, 2005 and 2007).

The present study was conducted to determine the effects on the biology and life table parameters of *T. urticae* of two ornamental plants.

MATERIALS AND METHODS

Experimental Design:

Marshmallow and Salvia seeds were subjected to irradiation by gamma rays. The seeds of each crop were divided into five similar, mature and equal size treatments. The first treatment was kept as a control without any treatment, while the other four treatments were irradiated with gamma rays in the dose of 15, 25, 35 and 45 Kilo rad for Marshmallows and Salvia. Irradiation was conducted in the Middle Eastern Regional Radioisotope Center for the Arab countries in Cairo, using Cobalt 60 as a source of radiation. The irradiation process during April 2021 lasted 10 minutes per Kilo Rad (Hussein *et al.*, 1999 and Hussein *et al.*, 2005). The seeds of two plants were sown in pots (30 cm), and the leaves from the cultivated seeds of different treatments were taken in polyethylene pages and directly transferred on the same day to the laboratory for rearing *Tetranychus urticae* Koch. The stock colony of *T. urticae* was collected from castor plants.

Experiments were carried out in 5 replicates at $25 \pm 2^\circ\text{C}$, $65 \pm 5\%$ RH. and 16:8 light (L): dark (D). After one month of sowing, one leaf from Marshmallow and Salvia treatments was chosen. Fifty male and female individuals were placed in the arena of each four treatments and control and kept for 24 hours to mating and deposited eggs. Sixty hatching larvae were transferred using a fine soft brush to rear on equal area disks (2.0cm in diameter) of the Marshmallow and Salvia fresh leaves from the control and the other 4 treatments and left to continue their life span. The leaf disks were examined twice daily to determine the duration of each developmental stage, the longevity of females and males, life cycle, pre-oviposition, oviposition and number of eggs laid by a single female was counted during the longevity of female (Elhalawany and Abdel-Wahed, 2013).

The survival rate of all females was recorded. Life table parameters were estimated according to (Birch, 1948) using the Life48, BASIC Computer programmed (Abou-Setta *et al.*, 1986).

Statistical Analysis:

The duration of life stages of mites, reproduction and fecundity parameters were compared between the five treatments and one-way analysis of variance (ANOVA) using

SAS statistical software (Anonymous, 2003). Mean separation was conducted using Fisher's LSD ($P = 0.05$) in the same program. The relationship between irrigated dose and mean developmental rate of each stage was determined using linear regression, $Y = a \pm bx$, whereas: a =Intercept, b =slope of temperature.

RESULTS AND DISCUSSION

Development and Biology of *Tetranychus urticae* on Salvia Leaves:

The results, as seen in (Table 1) indicate that applied dose rates had a significant effect on the duration of females feeding on salvia leaves irrigated. The mean duration of immature stages and life cycle of irradiated females increased with increasing doses of gamma radiation, and at a different dose of gamma radiation, the life cycle of females was significantly higher than the control. The life cycle was 11.90, 13.69, 14.03 and 15.83 days for 15, 25, 35 and 45 Kilo rad compared with 11.55 days of the control, respectively). The shortest generation period was at control (17.75 days) and the longest at 45 Kilo rad (24.29 days).

The female oviposition and post-oviposition periods of *T. urticae* were different at different doses of gamma radiation. The shortest period was 6.93 and 1.33 days for control, and the longest for 45 Kilo rad was 11.0 and 3.13 days. The longest female longevity was 22.59 days for 45 Kilo rad and the shortest one for control was 14.47 days Table (1).

The mean fecundity and daily rate decreased with increasing doses of gamma radiation. The highest was 83.13 eggs/female with a daily rate of 12.0 eggs/female/day for control, while, the lowest was 28.53 eggs/female with a daily rate of 2.60 eggs/female/day for 45 Kilo rad. The radiation doses of 15 Kilo rad and above significantly reduced total laid eggs compared with the control (Table 1).

Table 1: Effect of different doses of gamma irradiation on duration and longevity of *Tetranychus urticae* female reared on salvia leaves.

| Stages Dose | Egg | Larva | Proto- nymph | Deuto- nymph | Immature | life cycle | Generation | Pre- oviposition | Oviposition | Post- oviposition | Longevity | Fecundity | Daily rate | life span |
|----------------|-------|-------|-----------------|-----------------|----------|---------------|------------|---------------------|-------------|----------------------|-----------|-----------|---------------|--------------|
| Control | 3.11b | 2.83d | 2.90c | 2.71c | 8.44d | 11.55c | 17.75d | 6.20cd | 6.93e | 1.33e | 14.47e | 83.13a | 12.0a | 26.02e |
| 15 | 3.11b | 3.02c | 2.88c | 2.89c | 8.79c | 11.90c | 17.80d | 5.90d | 8.67d | 1.83d | 16.40d | 73.53b | 8.51b | 28.30d |
| 25 | 3.75a | 3.22b | 3.19b | 3.53b | 9.94b | 13.69b | 20.22c | 6.53c | 9.73c | 1.97c | 18.23c | 54.13c | 5.57c | 31.92c |
| 35 | 3.77a | 3.32b | 3.23b | 3.71b | 10.26b | 14.03b | 21.63b | 7.60b | 10.40b | 2.53b | 20.53b | 38.13d | 3.68d | 34.56b |
| 45 | 3.91a | 3.84a | 4.12a | 3.95a | 11.91a | 15.83a | 24.29a | 8.47a | 11.00a | 3.13a | 22.59a | 28.53e | 2.60e | 38.42a |
| r | 0.91 | 0.95 | 0.84 | 0.97 | 0.95 | 0.96 | 0.94 | 0.88 | 0.98 | 0.97 | 0.99 | -0.98 | -0.98 | 0.98 |
| a | 3.04 | 2.74 | 2.76 | 2.74 | 8.07 | 11.11 | 16.75 | 5.63 | 7.16 | 1.23 | 14.04 | 86.65 | 11.66 | 25.16 |
| b | 0.020 | 0.020 | 0.024 | 0.029 | 0.074 | 0.095 | 0.149 | 0.054 | 0.990 | 0.038 | 0.183 | -1.29 | -0.21 | 0.278 |
| P-value | 0.031 | 0.014 | 0.073 | 0.006 | 0.012 | 0.010 | 0.0155 | 0.0461 | 0.0014 | 0.0044 | 0.0007 | 0.0022 | 0.001 | 0.001 |
| LSD.0.05 | 0.203 | 0.15 | 0.19 | 0.21 | 0.34 | 0.40 | 0.61 | 0.43 | 0.37 | 0.44 | 0.71 | 1.45 | 0.26 | 0.90 |

Means within a column followed by the same letter were not significantly different at 5%. a =Intercept, b =slope of temperature, r = correlation

Statistical analysis of data in Table (1) indicated that a significant positive correlation was found between all immature stages, generation, pre-oviposition, oviposition, post-oviposition periods and life span ranged (from 0.84 to 0.98) and dose of gamma radiation. The duration increased when the dose rate was increased. Whereas, a significant negative correlation between fecundity and daily date and dose of gamma radiation, the fecundity decreased when the dose rate was increased.

Similar results in Table (2) for males the mean duration of immature stages and longevity of irradiated males increased with increasing doses of gamma radiation, and at the different doses of gamma radiation, the life cycle of males was significantly higher than the control. The life cycle was 10.64, 12.89, 12.49 and 13.73 days while, longevity

was 13.69, 13.63, 15.0 and 18.69 days for 15, 25, 35 and 45 Kilo rad compared with 9.75 and 11.81 days of the control, respectively. A significant positive correlation was found between all immature stages, longevity and life span ranging (from 0.71 to 0.96) and dose of gamma radiation. The duration increased when the dose rate was increased.

Table 2: Effect of different doses of gamma irradiation on duration and longevity of *Tetranychus urticae* male reared on salvia leaves.

| Stages Dose | Egg | Larva | Proto-nymph | Deuto-nymph | Immature | life cycle | Longevity | life span |
|----------------|--------|--------|-------------|-------------|----------|------------|-----------|-----------|
| Control | 2.60 c | 2.21 c | 2.71 c | 2.60 c | 7.52 c | 9.75 d | 11.81 d | 21.56 e |
| 15 | 2.93 b | 2.59 b | 2.91 c | 2.21 d | 7.71 c | 10.64 c | 13.69 c | 24.32 d |
| 25 | 3.46 a | 3.26 a | 3.49 a | 2.68 c | 9.43 b | 12.89 b | 13.63 c | 26.51 c |
| 35 | 3.18 b | 3.13 a | 3.19 b | 3.00 b | 9.31 b | 12.49 b | 15.00 b | 27.49 b |
| 45 | 3.68 a | 3.13 a | 3.23 ab | 3.70 a | 10.05 a | 13.73 a | 18.69 a | 32.41 a |
| r | 0.90 | 0.86 | 0.71 | 0.79 | 0.93 | 0.94 | 0.91 | 0.96 |
| a | 2.93 | 2.33 | 2.80 | 2.22 | 7.36 | 9.75 | 11.32 | 21.08 |
| b | 0.0220 | 0.0221 | 0.0124 | 0.0254 | 0.0598 | 0.0892 | 0.1348 | 0.2239 |
| P-value | 0.0346 | 0.0578 | 0.1709 | 0.1059 | 0.0217 | 0.0156 | 0.0284 | 0.0063 |
| LSD.0.05 | 0.27 | 0.24 | 0.26 | 0.23 | 0.45 | 0.60 | 0.73 | 0.81 |

Means within a column followed by the same letter were not significantly different at 5%. a=Intercept, b=slope of temperature, r= correlation

Development and Biology of *T. urticae* on Marshmallow Leaves:

Obtained results presented in Tables (3 and 4) showed that when a Marshmallow seed was irradiated with gamma rays in doses of 15, 25, 35 and 45 Kilo rad, the duration of immature stages and generation period of irradiated females increased with increasing doses of gamma radiation. The developmental times were significantly longest at 45 Kilo rad (13.37 and 10.34 days) and shortest at control (9.05 & 8.66 days) for females and males, respectively. The shortest generation period was at control (15.86 days) and the longest at 45 Kilo rad (20.24 days).

The female oviposition periods of *T. urticae* were significantly different at different doses of gamma radiation. The shortest period was 7.73 days for control and the longest for 45 Kilo rad was 11.47 days. The longest female longevity was 19.93 days for 45 Kilo rad and the shortest one for control was 16.31 days. The mean fecundity and daily rate decreased with increasing doses of gamma radiation. The highest was 85.93 eggs/female with a daily rate of 11.15 eggs/female/day for control, while, the lowest was 28.40 eggs/female with a daily rate of 2.48 eggs/female/day for 45 Kilo rad (Table 3).

Statistical analysis of data in Table (3) showed that a significant positive correlation was found between female immature stages, generation, oviposition periods and life span ranging from (0.79 to 1.0) and dose of gamma radiation. The duration increased when the dose rate was increased. However, significant negative correlation between fecundity and daily date and dose of gamma radiation, the fecundity decreased when the dose rate was increased.

The current results agree with the finding by Megali (1987) indicating that the incubation period was prolonged by increasing the irradiation dose of the tetranychid mite *Eutetranychus africanus* (Tucker). Hussein *et al.* (1999) found the effect of gamma rays on *T. urticae*, the egg production of females decreased to 26% of control when increasing doses from zero to 25Krad. The hatchability of *T. urticae* eggs decreased as radiation increased. The best estimates of the doses of radiation that would prevent 100% of the eggs from hatching were 43.6, 55.1 Gy and in excess of 280 Gy, respectively (Baptiste *et al.*, 2003). Hussien *et al.*, (2005) showed that the female life cycle and incubation period were linearly prolonged by increasing the irradiation dose at 45 krad to 185.7% and 180% respectively. Mortality of (larvae, nymphs and adults) was also increased to reach 69.1%, 64.1% and 58.6% respectively. The rate of eggs/female was negatively affected and recorded to decrease by 69.28%. Abdu El-Nour and Ibrahim (2006) showed that when

irradiated females of *Tyrophagous putrescentiae* at 10, 20, 40 and 60 kard, the mean number of eggs laid per female were 39.0, 31.6, 29.2, 25.25, 18.25 and 6.85 eggs, respectively. Elhalawany and Abdel-Wahed (2013) indicated that females and males reached maturity after 15.4 and 14.5 days at 25°C on Kostata persimmon variety, while these values ranged was 14.8 and 12.2 days for females and males, respectively, on Hachiya variety. The oviposition period lasted 11.23 days and the daily rate was 6.23 eggs/female on Kostata cultivar. Osouli *et al.*, (2014) evaluated the effect of gamma radiation on the longevity and the total number of eggs of *T. urticae* Koch. The results showed that the total number of eggs laid by females was significantly reduced with a linear trend by 250 Gy irradiation.

Table 3: Effect of different doses of gamma irradiation on duration and longevity of *Tetranychus urticae* female reared on El Khatami leaves.

| Stages Dose | Egg | Larva | Proto-nymph | Deuto-nymph | Immature | life cycle | Generation | Pre-oviposition | Oviposition | Post-oviposition | Longevity | Fecundity | Daily rate | life span |
|-------------|--------|--------|-------------|-------------|----------|------------|------------|-----------------|-------------|------------------|-----------|-----------|------------|-----------|
| Control | 2.41d | 2.27e | 2.17c | 2.20d | 6.63d | 9.05d | 15.86c | 6.81a | 7.73e | 1.77b | 16.31c | 85.93a | 11.15a | 25.36d |
| 15 | 2.88c | 2.69d | 2.75b | 2.55c | 8.00c | 10.87c | 16.79b | 5.92b | 8.40d | 2.13a | 16.45c | 76.80b | 9.17b | 27.33c |
| 25 | 2.98bc | 2.89c | 2.93b | 2.85b | 8.67b | 11.65b | 17.05b | 5.40b | 9.73c | 1.33c | 16.47c | 54.13c | 5.57c | 28.12c |
| 35 | 3.17b | 3.15b | 2.89ab | 2.80b | 8.84b | 12.01b | 17.48b | 5.47b | 10.40b | 1.30c | 17.17b | 44.67d | 4.30d | 29.18b |
| 45 | 3.56a | 3.39a | 3.13a | 3.29a | 9.81a | 13.37a | 20.24a | 6.87a | 11.47a | 1.60b | 19.93a | 28.40e | 2.48e | 33.31a |
| r | 0.98 | 1.00 | 0.93 | 0.96 | 0.98 | 0.99 | 0.89 | -0.14 | 0.99 | -0.52 | 0.79 | -0.98 | -0.99 | 0.94 |
| a | 2.43 | 2.28 | 2.30 | 2.20 | 6.80 | 9.23 | 15.46 | 6.22 | 7.50 | 1.87 | 15.60 | 89.64 | 11.35 | 24.84 |
| b | 0.0236 | 0.024 | 0.0193 | 0.0221 | 0.0662 | 0.0089 | 0.0891 | -0.005 | 0.0851 | -0.010 | 0.0691 | -1.32 | -0.200 | 0.1590 |
| P-value | 0.0026 | 0.0001 | 0.0225 | 0.009 | 0.0028 | 0.0021 | 0.0432 | 0.8239 | 0.0017 | 0.3701 | 0.1108 | 0.0026 | 0.0018 | 0.0171 |
| LSD.0.05 | 0.24 | 0.19 | 0.21 | 0.25 | 0.34 | 0.40 | 0.71 | 0.53 | 0.35 | 0.26 | 0.65 | 1.06 | 0.30 | 0.83 |

Means within a column followed by the same letter were not significantly different at 5%. a=Intercept, b=slope of temperature, r= correlation.

Table 4: Effect of different doses of gamma irradiation on duration and longevity of *Tetranychus urticae* male reared on El Khatami leaves.

| Stages Dose | Egg | Larva | Protonymph | Deutonymph | Immature | life cycle | Longevity | life span |
|-------------|---------|---------|------------|------------|----------|------------|-----------|-----------|
| Control | 2.16 c | 2.09 b | 2.25 a | 2.16 a | 6.50 b | 8.66 b | 10.40 b | 19.06 b |
| 15 | 2.65 ab | 2.25 b | 2.67 a | 2.33 a | 7.25 ab | 9.90 a | 10.13 b | 20.02 c |
| 25 | 2.64 ab | 2.66 a | 2.39 a | 2.15 a | 7.20 ab | 9.84 a | 10.13 b | 19.97 b |
| 35 | 2.46 bc | 2.25 b | 2.65 a | 2.46 a | 7.36 a | 9.83 a | 10.31 b | 20.14 b |
| 45 | 2.93 a | 2.38 ab | 2.66 a | 2.38 a | 7.41 a | 10.34 a | 14.31 a | 24.65 a |
| r | 0.79 | 0.47 | 0.70 | 0.67 | 0.87 | 0.88 | 0.65 | 0.69 |
| a | 2.26 | 2.18 | 2.33 | 2.17 | 6.70 | 15.66 | 9.41 | 22.34 |
| b | 0.0127 | 0.057 | 0.0076 | 0.0052 | 0.0184 | 0.0498 | 0.0682 | 0.1715 |
| P-value | 0.1156 | 0.4258 | 0.1921 | 0.2185 | 0.0538 | 0.0484 | 0.2312 | 0.1964 |
| LSD.0.05 | 0.31 | 0.35 | 0.40 | 0.34 | 0.75 | 1.56 | 0.85 | 2.04 |

Means within a column followed by the same letter were not significantly different at 5%. a=Intercept, b=slope of temperature, r= correlation.

Life Table Parameters of *T. urticae* on Salvia Leaves:

The values of life table parameters of the two-spotted spider mite, *T. urticae* on salvia leaves treated with different doses of gamma radiation are shown in **Table (5)**. The most important parameters, T_c , r_m , and R_0 of *T. urticae* differed between the doses of radiation. The shortest generation time (T_c) of *T. urticae* at control (14.83 days) and the longest one for 45 Kilo rad (20.43 days). The Intrinsic rate of increase (r_m) value of *T. urticae* was the lowest at 45 Kilo rad (0.148 female/female/day) followed by 35 Kilo rad (0.150 female/female/day) and the highest value was found at control (0.256 female/female/day). Similarly, the Net reproductive rate (R_0) value was lowest at 45 Kilo rad (20.59 female/female) and the highest R_0 value of *T. urticae* was determined at control (44.70 female/female). The shortest doubling time (DT) was found at control (2.70 days) and the longest one for 45 Kilo rad (4.68 days). The gross reproductive rate (GRR) increased with radiation decreasing from 27.99 offspring/individual for 45 Kilo

rad to 49.16 offspring/individual for 15 Kilo rad. The lowest survival rate was 75.0% for 35 and 45 Kilo rad.

Table 5: Life table parameters of *Tetranychus urticae* on salvia leaves treated with different doses of gamma irradiation.

| Parameters | Control | Irradiation treatments (Kilo rad) | | | |
|--|---------|-----------------------------------|-------|-------|-------|
| | | 15 | 25 | 35 | 45 |
| Mean generation time (T_c) ^a | 14.83 | 15.10 | 17.42 | 17.96 | 20.43 |
| Doubling time (DT) ^a | 2.70 | 2.86 | 3.48 | 4.62 | 4.68 |
| Net reproductive rate (R_0) ^b | 44.70 | 38.99 | 32.20 | 14.97 | 20.59 |
| Intrinsic rate of increase (r_m) ^c | 0.256 | 0.242 | 0.199 | 0.150 | 0.148 |
| Finite rate of increase (λ) ^c | 1.29 | 1.27 | 1.22 | 1.16 | 1.15 |
| Gross reproductive rate (GRR) ^d | 52.69 | 46.16 | 38.08 | 20.4 | 27.99 |
| Sex ratio (φ /total) | 0.70 | 0.70 | 0.70 | 0.72 | 0.72 |
| Survival rate % | 85.0 | 85.0 | 85.0 | 75.0 | 75.0 |

^a Days, ^b female/female, ^c female/female/day, ^d offspring/individual, $R_0 = \sum(l_x \times m_x)$; $T_c = \sum(x \times l_x \times m_x) / \sum(l_x \times m_x)$; $r_m = \ln(R_0)/T$; $DT = \ln(2) / r_m$, $\lambda = \exp(r_m)$ and $GRR = \sum m_x$.

Life Table Parameters of *T. urticae* on Marshmallow Leaves:

The values of life table parameters of the two-spotted spider mite, *T. urticae* on Marshmallow leaves treated with different doses of gamma radiation are shown in Table (6). The shortest generation time (T_c) and doubling time (DT) of *T. urticae* at control (12.10 and 2.15 days) and the longest periods for 45 Kilo rad (17.71 and 4.68 days). The Intrinsic rate of increase (r_m) value was lowest at 45 Kilo rad (0.148 female/female/day) and the highest value was found at control (0.322 female/female/day). The net reproductive rate (R_0) value was lowest at 45 Kilo rad (13.91 female/female) and the highest R_0 value of *T. urticae* was determined at control (49.57 female/female). The gross reproductive rate (GRR) increased with radiation decreased from 20.25 offspring/individual for 45 Kilo rad to 55.78 offspring/individual for 15 Kilo rad compare with control as 61.96 offspring/individual. The lowest survival rate was 70.0% for 35 and 45 Kilo rad.

Table 6: Life table parameters of *Tetranychus urticae* on marshmallow leaves treated with different doses of gamma irradiation.

| Parameters | Control | Irradiation treatments (Kilo rad) | | | |
|--|---------|-----------------------------------|-------|-------|-------|
| | | 15 | 25 | 35 | 45 |
| Mean generation time (T_c) ^a | 12.10 | 14.07 | 15.33 | 15.42 | 17.71 |
| Doubling time (DT) ^a | 2.15 | 2.57 | 3.12 | 3.39 | 4.68 |
| Net reproductive rate (R_0) ^b | 49.57 | 44.27 | 30.45 | 23.45 | 13.91 |
| Intrinsic rate of increase (r_m) ^c | 0.322 | 0.269 | 0.222 | 0.204 | 0.148 |
| Finite rate of increase (λ) ^c | 1.38 | 1.30 | 1.24 | 1.22 | 1.16 |
| Gross reproductive rate (GRR) ^d | 61.96 | 55.78 | 40.8 | 33.95 | 20.25 |
| Sex ratio (φ /total) | 0.72 | 0.72 | 0.75 | 0.75 | 0.70 |
| Survival rate % | 80.0 | 80.0 | 75.0 | 70.0 | 70.0 |

These results are in agreement with the finding by Kasap (2002) showed that the development time of *T. urticae* averaged 10.4 days on cucumber at 25 °C. The intrinsic

rate of increase (r_m) was 0.247 females per female a day, the net production rate (R_0) was 110.7 females per female and the mean generation time was 21.9 days. Elhalawany and Abdel-Wahed (2013) found that on persimmon leaf discs at 25°C, the net reproductive rate of increase (R_0) was 34.34 and 47.22 female/female on Kostata and Hachiya cultivars, respectively. The innate capacity for increase (r_m) was 0.177 and 0.203 female/female/day and the Gross reproduction rate (GRR) was 57.0 and 76 offspring/individual, on Kostata and Hachiya cultivars, respectively.

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ARABIC SUMMARY

تأثير الجرعات المختلفة من الاشعاع علي بيولوجى وجدول الحياة للعنكبوت الأحمر العادي (أكاري: تيترانيكيدي)

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تم دراسة فترة التطور ومعدل والتكاثر وجدول الحياة للعنكبوت الأحمر العادي عند التربية على اوراق نباتين من أشجار الزينة السالفيا والخطمية التي تم معاملة بذورها باربعة معدلات من شعة جاما 15، 25، 35، 45 كيلوراد تحت ظروف المعمل علي درجة حرارة 25م ورطوبة نسبية 65%. وتشير النتائج المتحصل عليها أن المعاملات التي تعرضت للإشعاع كان لها تأثير معنوي على فترة التطور للذكور والاناث على كل من السالفيا والخطمية. زادت فترة دورة الحياة وفترة الجيل في الاناث المعاملة بالاشعاع بزيادة الجرعة وكانت اطول من الكنترول (الغير معامل) مع وجود اختلاف معنوي بينها. سجل زيادة معنوية بين فترة وضع البيض وفترة الطور الكامل للاناث المعاملة بزيادة جرعة الاشعاع. بينما قلت الكفاءة التناسلية ومعدل وضع البيض بزيادة جرعة الاشعاع. سجل علاقة ارتباط موجبة معنوية بين فترات التطور للعنكبوت الأحمر وفترة الجيل وفترة وضع البيض وبين جرعة الاشعاع. سجل اقل معدل للزيادة الذاتي واقل معدل لصافي التكاثر للاناث التي ربيت علي جرعة 45 كيلوراد فكانت (0.148 انثي/أنثي/يوم، 20.59 انثي/ انثي) بينما سجلت أعلى معدل للزيادة الذاتي واعلي معدل لصافي التكاثر للاناث الغير معاملة (الكنترو) فكانت (0.256 انثي/أنثي/يوم، 44.70 انثي/ انثي) علي التوالي. كان تعريض نباتات السالفيا والخطمية المعاملة بالاشعاع ادى الي خفض الكفاءة التناسلية وزيادة فترة الجيل للعنكبوت الأحمر بمقارنة بالكنترول.