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BIOLOGICAL STUDIES ON THE RED PALM WEEVIL, *RHYNCHOPHORUS FERRUGINEUS* (OLIVIER) (COLEOPTERA: CURCULIONIDAE) REARED ON NATURAL AND ARTIFICIAL DIETS

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ABSTRACT: **The biological aspects of the red palm weevil, *Rhynchophorus ferrugineus* (Olivier), were affected significantly when larvae fed on three different types of food i.e., sugarcane stem pieces, date palm tissues and an artificial diet under laboratory conditions of 27 ± 2 °C. and 70 ± 5 % R.H. The results obtained clearly indicate that the mean incubation period of RPW eggs lasted 3.16±0.17, 3.16±0.16 and 3.09±0.17 days for sugarcane stem pieces, date palm tissues and artificial diet, respectively, while hatchability percentages were 84.1±4.82, 86.5±4.86 and 81.9±4.84 % in case of the above mentioned diets. Also, the mean larval duration fed on sugarcane stem, date palm tissues and artificial diet was 67.62±4.16, 37.26±2.04 and 45.19±2.91 days, successively. The mean total cocoonal duration (pre-pupal, pupal and adult inside cocoon periods) significantly differed due to the type of larval food, where they were 26.06±1.49, 18.66±1.06 and 22.54±1.30 days on sugarcane stem pieces, date palm tissues and artificial diet, respectively. The mean percentage of emerged females (sex ratio) was 53.06±4.16, 54.58±3.74 and 51.14±3.48 % for the three food types, respectively. Female longevity was significantly affected according to diet type showing 81.5±6.46 days on sugarcane; 91.3±6.04 days on date palm tissues and 95.2±6.75 days on artificial diet. The averages of male longevity periods were 92.4±6.84, 93.4±5.37 and 97.8±5.96 days for sugarcane stem pieces, date palm tissues and artificial diet, successively. The highest mean numbers of eggs laid per female (fecundity) was recorded on the artificial diet and decreased on other**

two diets, where they were 275.0±23.55, 259.4±25.91 and 222.3±22.74 eggs / female on artificial diet, date palm tissues and sugarcane stem pieces, consecutively. Mean total life cycle and generation periods were significantly affected by different foods.

Key words: Red palm weevil, *Rhynchophorus ferrugineus*, development, diets, laboratory rearing, biological parameters.

INTRODUCTION

The red palm weevil, *Rhynchophorus fierrugineus* (Olivier) (Coleoptera: Curculionidae), is an economically important tissue-boring pest and it is a serious menace pest for the different cultivated palms in many parts of the world. The main recorded host plants are the coconut palm (*Cocos nucifera*), the date palm (*Phoenix dactylifera*), the sago palm (*Metroxylon sago*), sugar palm (*Arenga saccharifera*), canary island palm (*Phoenix canariesis*), indian date palm (*Phoenix sylvestris*), California palm (*Washingtonia filifera*), palmyra palm (*Borassus flabellifera*) and oil palm (*Elaeis guineesis*) that reported by Banks (1906), Ghosh (1912), Buxton (1920), Leefmans (1920) and Rahalkar *et al.* (1985). In Egypt, Sharkia Governorate, this species of palm weevils was first recorded in 1992 (Saleh, 1992). The insect first record was in India as a serious pest of coconut palm (Lefroy, 1906 and Nirula, 1956). This weevil has been spread westwards very rapidly since the mid 1980's (Gomez and Ferry, 1999), It was found in the Kingdom of Saudi Arabia, the United Arab Emirates, and the Sultanate of Oman in 1985 (Abozuhairah *et al.*, 1996; El-Ezaby, 1997 and Kaakeh *et al.*, 2001), Savaran region of Iran in 1996 (Faghih, 1996), southern of Spain in 1994 (Barranco *et al.* 1996), and Israel, Jordan, Palestine and the occupied territories in 1999 (Kehat, 1999). The commercialization of date palm growing in the Middle East has created ideal conditions for the rapid spread of the red palm weevil among countries in this region (Abraham *et al.*, 1998 and Murphy and Briscoe, 1999).

Eggs are laid in the injured leaf petioles of soft crown in 5 to 20 years - old date palm trees. Hatching larvae tunnel through the soft wood into the heart of the trunk where they complete their life cycle. Many generations passed in the same palm. Therefore, neither the larvae nor the damage caused can be seen directly. At times, a brownish

viscous liquid can be seen oozing from small holes in the crown/or trunk. Often the attack by the weevil is discernible only when the palm has been extensively damaged. Previous attempts at laboratory for rearing of *R. ferrugineus* were reported by Rahalkar *et al.* (1973, 1978 and 1985); Rananavare *et al.* (1975); Faghih (1996); Salama and Abdel-Razek (2002); Alfazairy, Ahlam *et al.* (2003); El - Sebay *et al.* (2003) and Kaakeh (2005). The biology of this weevil species was also reported by Abraham (1971), Butani (1975), Giblin *et al.* (1989) and El-Ezaby (1997).

The present study aims to investigate the effects of natural plant diets (sugarcane and date palm tissues) and an artificial diet on the biological aspects of red palm weevil, *R. ferrugineus*, under laboratory conditions aiming to find the best diet for the insect development and reproduction to be used in the insect mass rearing for irradiation treatment of newly emerged adult stage as a new approach of insect control.

MATERIALS AND METHODS

Biological experiments on the red palm weevil, *Rhynchophorus ferrugineus* (Oliv.) were carried out under laboratory conditions of 27 ± 2 °C. and 70 ± 5 % R.H. at The Department of Plant Protection, Faculty of Agriculture, Zagazig University.

Different stages of RPW were collected from highly infested palm tree orchards at Belbies and Wadi El-Moullak districts in Sharkia Governorate, East Delta, Egypt. Such stages were then transferred to a rearing room under conditions mentioned above. Collected stages were reared on fresh and soft shred sugarcane stem tissues and were kept in plastic containers (22 x 14 x 6.5 cm.).

Rearing on Different Diets

To adapt the collected insects, newly emerged adults of red palm weevil from the culture were reared on both artificial and two natural diets of sugarcane and date palm tissues for several generations before using in the experiments and executed as follows:

Rearing on artificial diet

Artificial diet contents are sugar-cane bagasse, coconut cake, yeast, sucrose, essential minerals and vitamins, agar, water and food preservatives, according to the method described by Rahalkar *et al.* (1985).

Ten replicates each consisted one pair (male and female) newly emerged reared on the same diet were used and put in an oblongate opaque – white plastic boxes tightly covered with perforated covers (12.5 x 9 x 6.5 cm). Insects were reared on artificial diet as a site for oviposition and source of food for adults. The plastic boxes were checked daily and replaced with fresh ones. Eggs were collected by using a fine moistened brush and arranged on a dampish filter paper in Petri dishes.

To study the incubation period and hatchability of eggs, 10 replicates each consisted of 100 eggs freshly laid were used; the eggs were kept in darkness under laboratory conditions, the eggs were examined daily and the incubation period and hatchability were estimated.

100 newly hatched larvae were obtained and divided into 10 replicates; each replicate was consisted of 10 newly hatched larvae. By means of fine brush, the larvae are introduced individually into these rearing cups and then tightly covered with a perforated cover. The food was changed whenever necessary or consumed. These cups were checked daily, at the end of larval development, some of the palm bark fibers were placed near the larvae to help them to pupate.

After cocoons construction, they were removed from cups and put in plastic containers (25x14x11 cm) between two layers of a dampish date palm bark fibers and covered with a perforated cover. These containers were daily observed; the inspection of these cocoons was carried out by opening each of them from its posterior end during inspection and then enclosed according to Hussein, 1998. The followed observations i.e., of pre-pupal, pupal duration, periods of adults inside cocoons and natural mortality percentages were recorded.

Ten replicates of newly emerged adults were used; each replicate of one couple was put in plastic container (12.5x 9 x 6.5cm) and tightly covered with a perforated cover. The artificial diet served as a site for oviposition and a source of food for adults. Eggs were collected on a dampish filter paper in Petri dishes. Numbers of eggs laid by each female were estimated. Pre-oviposition, oviposition, post-oviposition periods, longevity of both sexes,

fecundity of eggs of the adult females, life cycle period and generation interval were recorded.

Rearing on sugarcane

Adults were reared on freshly shred sugarcane stem tissues as a site for oviposition and source of food for adults. The sugarcane pieces were checked daily and replaced with fresh ones. Eggs were collected. 10 replicates each consisted of 100 eggs newly laid were used; the incubation period and hatchability were estimated.

One hundred of newly hatched larvae were obtained and divided into 10 replicates; each replicate consisted of 10 newly hatched larvae. One internodes of sugarcane stem was longitudinally cut and make a tunnel at the end of both sides of the internodes and put one newly hatched larva, and then the two halves were closed by rubber bands. Pieces were arranged in a plastic tray (50 x 30 x 15 cm) and stored in cages inside rearing room. Observations were taken daily and sugarcane pieces were removed weekly and replaced with other freshly ones, (Rahalkar *et al.*, 1985). Small plastic tube (3 cm. in diameter and 6 cm. in depths) as an artificial site for pupation then put in a plastic containers (25 x14 x11 cm). These tubes were examined daily until emergence of adults. The emerged adults were taken and each pair was put in plastic container (12.5 x 9 x 6.5 cm). All biological aspects mentioned above were estimated.

Rearing on date palm heart tissues

Pieces of date palm heart tissues namely aljomara of Zaghloul variety was used as a site for oviposition and also as a source of food for adults. The date palm pieces were checked daily and replaced with fresh ones. All biological aspects mentioned above were estimated.

Statistical Analysis

Data were analyzed as a completely randomized design according to procedure outlined by Steel and Torrie (1980). Differences in each parameter were evaluated by analysis of variance (ANOVA) using F. test.

RESULTS AND DISCUSSION

Immature Stages

Egg stage

Incubation period

Data presented in Table 1 show that the mean incubation periods of RPW eggs lasted 3.16 ± 0.17,

3.16 ± 0.16 and 3.09 ± 0.17 days for sugarcane stem pieces, date palm tissues and artificial diet, respectively. Insignificant difference was found between sugarcane and palm tissues, while it was significant between artificial diet and each of the two natural tested diets. Data obtained agree with those of Rahalkar *et al.* (1985), Faghih (1996), Liao *et al.* (1997), Ramachandran (1998), Muralidharan *et al.* (2000), Butani (2002) and Alfazairy, Ahlam *et al.* (2003) who found that egg stage of the red palm weevil lasted 2 - 4, 1-6, 6-10, 2-5, 2.4±0.22, 2-5 and 2-3 days, successively.

Hatchability

Results given in Table 1 reveal that mean percentages of eggs hatching were 84.1 ± 4.82, 86.5 ± 4.86 and 81.9 ± 4.84 for sugarcane stem pieces, date palm tissues and artificial diet, respectively. Highly significant differences were found between the three tested rearing diets. The present data are in agreement with those published by Kaakeh (2005) who stated that eggs hatchability on the artificial diet and palm leaf-base was in the range from 74.31% to 93.3%, and also by Kalleshwaraswamy and Jagadish (2005) on sugarcane, where hatchability ranged between 73.51 and 76.05 %.

Table 1. Effect of three diets used in the rearing of the red palm weevil, *Rhynchophorus ferrugineus* (Oliv.) on some biological aspects under laboratory conditions (27 ± 2 °C. and 70 ± 5 % R.H.)

Biological aspects	Diets			L.S.D. 0.05	F. test
	Sugarcane stem pieces	Date palm tissues	Artificial diet		
	Mean ± S.E.	Mean ± S.E.	Mean ± S.E.		
Incubation period of eggs	3.16 ± 0.17 a	3.16 ± 0.16 a	3.09 ± 0.17 b	0.03	*
Eggs hatchability	84.1 ± 4.82 b	86.5 ± 4.86 a	81.9 ± 4.84 c	2.19	**
Larval duration	67.62 ± 4.16 a	37.26 ± 2.04 c	45.19 ± 2.91 b	6.87	**
Total cocoonal duration	26.06 ± 1.49 a	18.66 ± 1.06 c	22.54 ± 1.30 b	0.38	**

Larval stage

Larval duration

The results compiled in Table 1 indicate that the larval duration of RPW fed on sugarcane stem, date palm tissues and artificial diet differed significantly from diet to other as such durations were 67.62 ± 4.16, 37.26 ± 2.04 and 45.19 ± 2.91 days, respectively. Generally, the larvae fed on date palm tissues had the shortest larval duration, while it was the longest on sugarcane. Data obtained are in harmony with the findings of some investigators such as Butani (1975) who found that the larval duration ranged from 24-61 days on date palm and Rahalkar *et al.* (1978 and 1985) who reported that the larval period of RPW reared on sugarcane was longer than that reared on the artificial diet, and the durations from egg to pre-pupa were 5 1-75, 38-49 days when the insects were reared on sugarcane stems and artificial diet, successively. On the contrary, our results disagree with those of Kaakeh (2005) who mentioned that the developmental times of larvae reared on artificial diet and palm leaf-base ranged from 70.8 to 102.2 days.

Larval mortality Percentage

Data given in Table 2 clear that statistical analysis of the results prove that no significant differences were found in the percentages of the natural larval mortality of RPW when fed on the three tested foods i.e., sugarcane stem pieces, date palm tissues and artificial diet, where the mean average percentages of larval

Table 2. Natural mortality percentages of larval and cocoonal stages of the red palm weevil, *Rhynchophorus ferrugineus* (Oliv.) under laboratory conditions (27 ± 2 °C. and 70 ± 5 % R.H.)

Natural mortality percentages	Diets			L.S.D. 0.05	F. test
	Sugarcane stem pieces	Date palm tissues	Artificial diet		
	Mean ± S.E.	Mean ± S.E.	Mean ± S.E.		
Larval mortality	12.01 ± 2.91	10.06 ± 3.33	10.99 ± 1.24	-	N.S.
Cocoonal mortality	5.0 ± 2.45	4.11 ± 2.66	4.12 ± 2.66	-	N.S.

mortality were 12.01 ± 2.91, 10.06 ± 3.33 and 10.99 ± 1.24 %, respectively. The obtained data contradict with those of Hussein (1998) who mentioned that the larval mortality of the RPW reared on date palm under laboratory conditions for three consecutive generations throughout one year reached 79 %, 84.5 % and 85.83 % in the three generations, alternatively.

Stages inside cocoon

Total cocoonal duration

As clearly shown in Table 1 the mean total cocoonal duration (pre-pupal, pupal and adult inside cocoon periods) high significantly differed according to the type of larval food. The mean total cocoonal duration was 26.06 ± 1.49, 18.66 ± 1.06 and 22.54 ± 1.30 days, when the larvae were fed on sugarcane stem pieces, date palm tissues and artificial diet, consecutively. Obtained data are confirmed with those of Butani (1975) who found that the pupal duration ranged from 18-34 days on date palm and also of Ramachandran (1998) who reported that the total mean of cocoonal duration was 26 days ranged from 18 to 40 days on date palm.

Cocoonal mortality percentage

Data in Table 2 display the cocoonal mortality and no significant differences were found between the cocoonal mortality percentages of RPW when the larvae fed on the three tested foods. The averages percentages of cocoonal natural mortality was 5.0 ± 2.45, 4.11 ± 2.66 and 4.12 ± 2.66 % when the larvae were reared on sugarcane stem, date palm tissues and artificial diet, respectively. The present results disagree with those obtained by Hussein (1998) who showed that the highest pupal mortality was 51.61% in the 2 nd generation, while the lowest mortality 23.53 % was reached in the third generation and the first generation exhibited 33.53 %.

Adult Stage

Sex ratio

Sex ratio of emerged adults measured as females percent from the total number of emerged adults differed and depended on larval foods where larvae fed on sugarcane stem pieces, date palm tissues and artificial diet showing significant differences Table, 3. The mean percentages of emerged females were 53.06 ± 4.16, 54.58 ± 3.74 and 51.14 ± 3.48 % for the three aforementioned food types,

respectively. Obtained data agree with those of Muralidharan (2000) who mentioned that the sex ratio (male: female) was 1:1.33. However, these results disagree with those obtained by Hussein (1998) who reported that the mean percentages of emerged males were 58.33, 50.0, 50.0 and 60.0 % when the weevil was reared on Zagloul, Hayani, Amry date palm varieties and ornamental palm, respectively.

Adult Longevity

Female longevity

Pre-oviposition period

As obviously shown in Table 3, the mean pre-oviposition period of emerged females from larvae fed on artificial diet was significantly shorter than other two food types, where the mean pre-oviposition period was 5.2 ± 0.52, 4.8 ± 0.71 and 3.6 ± 0.37 days for the three

Table 3. Effect of three diets used in the rearing of the red palm weevil, *Rhynchophorus ferrugineus* (Oliv.) on some biological aspects under laboratory conditions (27 ± 2 °C. and 70 ± 5 % R.H.)

Biological aspects	Diets			L.S.D. 0.05	F. test
	Sugarcane stem pieces	Date palm tissues	Artificial diet		
	Mean ± S.E.	Mean ± S.E.	Mean ± S.E.		
Sex ratio (% of females)	53.06 ± 4.16 b	54.58 ± 3.74 a	51.14 ± 3.48 b	0.78	*
Pre-oviposition period	5.2 ± 0.52 a	4.8 ± 0.71 a	3.6 ± 0.37 b	0.61	*
Oviposition period	62.5 ± 6.59 b	75.8 ± 5.99 a	80.2 ± 6.60 a	5.16	**
Post- oviposition period	13.8 ± 1.34 a	10.7 ± 0.91 b	11.4 ± 0.87 b	1.06	*
Adult longevity :					
Female	81.5 ± 6.46 b	91.3 ± 6.04 a	95.2 ± 6.75 a	4.65	**
Male	92.4 ± 6.84 b	93.4 ± 5.37 a	97.8 ± 5.96 a	1.45	**
Rate of oviposition	3.60 ± 0.21	3.42 ± 0.17	3.43 ± 0.19	-	N.S.
Fecundity of eggs	222.3 ± 22.74 b	259.4 ± 25.91 a	275.0 ± 23.55 a	20.60	**
Life cycle duration (egg – egg)	98.17 ± 5.79 a	60.93 ± 2.41 b	70.47 ± 4.98 b	11.63	*
Generation duration (egg – death of adult)	174.47 ± 10.56 a	147.43 ± 8.63 b	162.07 ± 9.78 a	24.67	*

tested food types, successively. Data obtained was almost in agreement with those of Kaakeh (2005) who mentioned that the pre-oviposition periods of females emerged from larvae reared on artificial diets, sugarcane, palm heart, and palm leafbase ranged from 3.15 to 3.61 days showing significant differences concerning the three larval foods. Also, Justin *et al.* (2008) mentioned that the female weevil commences oviposition during 1 to 7 days.

Oviposition period

Data in Table 3 clear that the mean oviposition periods were 62.5 ± 6.59, 75.8 ± 5.99 and 80.2 ± 6.60 days when the larvae fed on sugarcane stem pieces, date palm tissues and artificial diet, respectively. Analysis of variance using F. test proved that the oviposition period differed high significantly due to the type of food, where the shortest oviposition period (62.5 ± 6.59 days) was recorded with sugarcane stem pieces, but the longest one (80.2 ± 6.60 days) was on artificial diet. The present results slightly disagree with the findings of some authors such as Muralidharan (2000) who mentioned that the oviposition continued 43.9±2.35 days, and also with Justin, *et al.*, (2008) who stated that this period ranged from 25 to 63 days. On the contrary, similar results were obtained by Alfazairy, Ahlam *et al.* (2003) who found that the oviposition period was 81.5 ± 5.9 days (57-126 days) and 85.5 ± 8.2 days (37-118 days) for cooked diet and sugarcane pieces, respectively.

Post-oviposition period

The post-oviposition period of RPW females resulted from larvae reared on different foods are shown in Table 3. It is clear that these periods were 13.8 ± 1.34, 10.7 ± 0.91 and 11.4 ± 0.87 days for sugarcane stem pieces, date palm tissues and artificial diet, consecutively. Statistical analysis of results demonstrates that the effect of food type on the post-oviposition period of RPW female proved to be significant at 0.05 level of probability. On the other hand, no significant differences for such period of females which their larvae were fed on either date palm tissues or artificial diet. Data obtained disagree with the finding of Alfazairy, Ahlam *et al.* (2003) who found that the post-oviposition period was 29.9 ± 2.8 days (21-50 days) and 18.2 ± 4.5 days (5-52 days)for cooked diet and sugarcane pieces, alternatively.

Total female longevity

In respect of mean longevity of adult females emerged from larvae of RPW fed on different food types, the results compiled in Table 3 show significant differences between averages of female longevity emerged from larvae fed on sugarcane stem pieces and each the other two food types. The longest female longevity was 95.2 ± 6.75 days for adult females emerged from artificial diet, whereas the shortest one was 81.5 ± 6.46 days for females emerged from sugarcane stem pieces. The data obtained disagree with those published by some investigators such as Muralidharan (2000) who mentioned that the longevity of adult females was 58±3.49 days on date palm. Alfazairy, Ahlam *et al.* (2003) found that adult females longevity was 113.9 ± 8.5 days (80-180 days) and 106.9 ± 5.7 days (44-174 days) for cooked diet and sugarcane pieces, respectively. Muthiah and Nair (2006) revealed that the adult longevity on different foods varied from 27 to 56 days and this may be due to the food used of coconut which may contain some different components comparing with those in the present work.

Male longevity

As clearly shown from the data in Table 3, the RPW male longevity high significantly differed as influenced by food larval types, where the means of males longevity were 92.4 ± 6.84, 93.4 ± 5.37 and 97.8 ± 5.96 days for sugarcane stem, date palm tissues and artificial diet, successively. The data obtained are not in harmony with the findings of Muralidharan (2000) who stated that longevity of adult male was 70±6.95 days on date palm. Also; Alfazairy, Ahlam *et al.* (2003) found that adult males longevity was 100.3 ± 9.7 days (77-162 days) and 100.1 ± 5.1 days (79-137 days) for cooked diet and sugarcane pieces, respectively.

Daily rate of oviposition

Results given in Table 3 clear that the differences between means numbers of eggs laid daily by female were statistically insignificant. The mean numbers were 3.60 ± 0.21, 3.42 ± 0.17 and 3.43 ± 0.19 eggs /day/ female for the females resulted from larvae fed on the three tested foods (sugarcane stem pieces, date palm tissues and artificial diet), respectively. Meanwhile, the present results are almostly in

agreement with those obtained by Alfazairy, Ahlam *et al.* (2003) and Kaakeh (2005). The first author found that the daily rate of oviposition (eggs / day/female) was 2.7 and 2.8 eggs for cooked diet and sugarcane pieces, respectively. The second investigator mentioned that the average number of eggs deposited daily per female reared on artificial diet and palm leaf-base ranged from 1.28 to 3.03 eggs.

Fecundity of eggs

Considering the mean number of eggs laid per female resulted from larvae fed on different food types, the results presented in Table (3) clearly demonstrate that the number of eggs laid per female varied high significantly according to the type of its larval food. From the obtained results, it is evident the insect RPW fecundity of eggs can be arranged descendingly as follows: 275.0 ± 23.55, 259.4 ± 25.91 and 222.3 ± 22.74 eggs / female for females emerged from larvae fed on artificial diet, date palm tissues and sugarcane stem pieces, respectively. The data obtained are in disagreement with those published by Salama *et al.* (2009) who found that eggs production was the highest for palm crown being 338 ±37.24 eggs per female, but the lowest production(117.0 ±18.9 eggs per female) was obtained on sugarcane. Whereas, the findings of some authors such as Butani (1975), Muralidharan (2000), Kalleshwaraswamy and Jagadish (2005) and Justin *et al.* (2008) confirm the present results.

Life cycle duration

The total period of life cycle (egg – egg) at different tested food types were 98.17 ± 5.79, 60.93 ± 2.41 and 70.47 ± 4.98 days for sugarcane stem pieces, date palm tissues and artificial diet, respectively. Such data clear that the food types significantly affected the life cycle of RPW. Similar trends were recorded by Rahalkar *et al.* (1985), Muralidharan (2000) and Muthiah and Nair (2006).

Generation duration

The data compiled in Table 3 show means of generation period calculated from the date of eggs deposition to the death of emerged female adult. Statistical analysis showed significant differences between durations of generation when the larvae fed on different food types. The mean durations of generation were 174.47 ± 10.56, 147.43 ± 8.63 and 162.07 ± 9.78

days for sugarcane stem pieces, date palm tissues and artificial diet, respectively. These results agree with the findings of Salama *et al.* (2009) who found that the duration of generation was the shortest on palm crown, but it was longer on sugarcane. Contrarily, our results are not in harmony with those of Kaakeh (2005) who mentioned that the generation span for the red palm weevil, reared on artificial diet and palm leaf-base ranged from 93.2 d to 131.3 days.

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دراسات بيولوجية علي سوسة النخيل الحمراء المرباة علي بيئات طبيعية وصناعية

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تأثرت السمات الحيوية لسوسة النخيل الحمراء معنوياً عندما ربيت اليرقات علي ثلاثة أنواع مختلفة من الغذاء وهي أنسجة قصب السكر وأنسجة نخيل البلح وبيئة صناعية تحت الظروف المعملية (٢٧ ± ٢ °م، ٧٠ ± ٥٪ رطوبة نسبية). اوضحت النتائج المتحصل عليها أن متوسط فترة حضانة البيض كانت ٣,١٦ ± ٠,١٧، ٣,١٦ ± ٠,١٦ ، ٣,٠٩ ± ٠,١٧ يوم علي قصب السكر ونخيل البلح والبيئة الصناعية علي التوالي. بينما سجلت النسبة المئوية للفقس ٨٤,١ ± ٤,٨٢ ، ٨٦,٥ ± ٤,٨٦ ، ٨١,٩ ± ٤,٨٤ ٪ لقصب السكر ونخيل البلح والبيئة الصناعية علي التوالي. وجد أيضاً أن متوسط طول فترة اليرقة علي قصب السكر ونخيل البلح والبيئة الصناعية كانت ٦٧,٦٢ ± ٤,١٦، ٣٧,٢٦ ± ٢,٠٤ ، ٤٥,١٩ ± ٢,٩١ يوم علي التوالي، أختلف معنوياً متوسط إجمالي طول فترة الشرنقة (فترة ما قبل العذراء والعذراء والحشرة الكاملة داخل الشرنقة) بسبب اختلاف نوع غذاء

اليرقات حيث كانت ٢٦,٠٦ ± ١,٤٩ ، ١٨,٦٦ ± ١,٠٦ ، ٢٢,٥٤ ± ١,٣٠ يوم علي قصب السكر ونخيل البلح والبيئة الصناعية علي التوالي. وكانت متوسط النسبة الجنسية للإناث ٥٣,٠٦ ± ٤,١٦ ، ٥٤,٥٨ ± ٣,٧٤ ، ٥١,١٤ ± ٣,٤٨ ٪ للأغذية الثلاثة علي التوالي.

تأثرت معنوياً طول فترة حياة انثي الحشرة الكاملة تبعاً لإختلاف البيئة الغذائية المرباة عليها اليرقات حيث كانت ٨١,٥ ± ٦,٤٦ يوم علي قصب السكر، ٩١,٣ ± ٦,٠٤ يوم علي نخيل البلح ، ٩٥,٢ ± ٦,٧٥ يوم علي البيئة الصناعية. تبين أن متوسط طول فترة حياة الذكر كانت ٩٢,٤ ± ٦,٨٤ ، ٩٣,٤ ± ٥,٣٧ ، ٩٧,٨ ± ٥,٩٦ يوم علي قصب السكر و نخيل البلح والبيئة الصناعية علي التوالي.

ثبت أن أعلي متوسط لعدد البيض الذي تضعه الأنثى سجل علي البيئة الصناعية حيث كان ٢٧٥ ± ٢٣,٥٥ بيضة/أنثي وانخفض علي البيئات الأخري حيث كانت ٢٥٩,٤± ٥,٩١، ٢٢٢,٣ ± ٢٢,٧٤ بيضة /أنثي علي نخيل البلح و قصب السكر علي التوالي. وجد أن المتوسط الإجمالي لطول دورة الحياة وطول فترة الجيل تأثرت بشكل معنوي باختلاف الغذاء.