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BIOLOGICAL STUDIES ON THE MEALYBUG *Maconellicoccus hirsutus* (GREEN)(HEMIPTERA: PSEUDOCOCCIDAE) REARED ON POTATO SPROUT TUBERS UNDER LABORATORY CONDITIONS.

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ABSTRACT

This study was suggested to determine some biological aspects of this insect pest under laboratory conditions on potato sprout tubers. Obtained results can be summarizes as follows: The first, second and third nymphal instars lasted for 8-14, 7-16 and 10-19 days, respectively according to generation. Pre-ovipostion, oviposition and post-oviposition periods were 11-21, 49-67 and 6-15 days, respectively. Oviposition periods greatly influenced with prevailing laboratory temperature and humidity. Pre-oviposition, oviposition and post-oviposition periods were positively affected with temperature in the first second and third generations for each of period. Highest fecundity per female recorded in the first generation whereas lowest one took place in the third generation. The longest longevity average occurred in third generation followed by that in the second generation. . Whereas lowest one took place in the first generation. Incubation period averages were in the first, second and third generations lasted for 3-12, 10-31 and 30-45 days, respectively. Total life cycle completed in 94-164 days in first generation, 110-234 in second generation and 207-399 days in third generation

Keywords: Biological studies, mealy bug, *M. hirsutus* and sprouting Potato ubers.

INTRODUCTION

Maconellicoccus hirsutus (Green)(Hemiptera: Pseudococcidae) is a polyphagous insect pest which feeds on a wide range of important species including hibiscus, citrus, coffee, sugar cane, annonas, plums, guava, mango, okra, sorrel, teak, mora, pigeon pea, peanut, grape, maize, asparagus, chrysanthemum, beans, cotton, soybean, rose, and other fiber crops just to name a few of its hosts. Host plants extend to 76 families and over 200 genera.(Ranjan, 2006; Ujjan & Shahzad, 2007; Reddy *et al.*, 2009). The feeding of *M. hirsutus* causes malformation of shoots and leaves believed to be caused by the injection of a toxic saliva (Kairo *et al*., 2000). In addition to lowering the aesthetics of the plant, this deformation can also result in lowered crop yields and in heavy infestations, plant mortality (Kairo *et al*., 2000 and Chong *et al*. 2008). Like other sap sucking insects, *M. hirsutus* also excretes a sugary honeydew on which sooty mold develops, further deteriorating the quality of the agricultural or forest product (Gonzalez-Gaona *et al*., 2010). The presence of large quantities of wax, characteristic of *M. hirsutus* infestations, also reduces the aesthetic and commercial value of ornamentals (Kairo *et al*., 2000).

The pink hibiscus mealybug is a serious economic threat to agriculture, forestry, and the nursery industry. As it feeds, using a piercing and sucking process, the pink hibiscus mealybug injects into the plant a toxic

saliva that results in malformed leaf and shoot growth, stunting and occasionally death. Leaves show a characteristic curling, similar to damage caused by viruses. Heavily infested plants have shortened internodes leading to a “bunchy top” appearance. A heavy black sooty mold may develop on an infested plant's leaves and stems as a result of the mealybug's heavy honey-dew secretions. When fruits are infested, they can be entirely covered with the white waxy coating of the mealybug. Infestation can lead to fruit drop, or fruit may remain on the host in a dried and shriveled .the studies condition. If flower blossoms are attacked, the fruit sets poorly. reported the presented study aimed to explore some biological aspects of *M. hirsutus* under laboratory conditions throughout summer, autumn, winter and spring seasons to evaluate the effect of potato sprout tubers on the initial life history of *M. hirsutus*

MATERIALS AND METHODS

Experiments were conducted under laboratory conditions located at Plant Protection Research Institute (ARC), Dokki, Giza Governorate throughout mid May 2009 till late at day- maximum temperature average 37.7±0.9°C, and night minimum temperature average 25.1 ± 0.2 °C and the daily mean relative humidity ranged 44.5–54.5%**.** Potato sprouts were used in rearing of the pink hibiscus mealy bug, *M. hirsutus*. Tubers were kept in isolation from any insect infestation using a carto cylindrical box of 8cm long and 12cm diameter.

1-Insect Source :

In order to have a good supply of pink hibiscus mealy bug a colony was made available for different aspects of the work and maintained under a routine rearing method in the lab. Reproducing scales obtained from different field at different periods were allowed to settle on potato sprouts by collecting leaves and branches of *Hibiscus tiliaceus* (Malvaceae) trees heavily infested of *M. hirsutus*, carefully separated under a stereomicroscope .

2-Rearing:

To infest potato sprouts tuber in the lab. five newly hatched nymphs (crawlers) were transferred carefully to each clean tuber using a fine moistened camel’s hair brush (5%). The sprouting potato tubers were observed every 24 hours until the crawlers settled on different tuber. Dead crawlers were replaced with newly hatched ones. Only one crawler was allawed on each tuber .The location of each crawler was marked with a circle using indelible ink **.**

Daily inspection of infested potato sprouts were made and all until producing another progeny. Records were taken for each crawler to record the durations of the three nymphal stages.The prevailing laboratory day-max.temp., night-min. temp. and daily mean relative humidity were daily recorded.

To evaluate the pre-oviposition, oviposition and post-oviposition periods, a ten potato sprouts were used and kept each in a suitable carton cylindrical box of 8cm long and 12cm diameter**.** Newly emerging females

(one/ potato sprouts) were transferred carefully the potato sprouts were daily inspected, until insects settled on the potato sprouts, then daily observed to obtain the pre-oviposition, oviposition and post-oviposition periods as well as fecundity and adult longevity .

Fecundity of female was calculated as the sum of deposited and un-deposited eggs. Undeposited eggs were counted by dissecting dead mature females under the stereoscopicbinocular.The incubation period was determind as the period between the deposition of the first egg and the emergence of the first crawler.This period was estimated by inspecting 20 individual eggs deposited in female egg sac with the aid of a stereomicroscope. Twice a day for newly hatched crawler. After mother scale forming egg sac, the egg sac was inspected to follow up eggs production. The generation period was also estimated.

3- Statistical analysis:

Obtained data were subject to statistical analysis using the (ANOVA) and the Duncan's multiple range as described by Snedecor (1970).

RESULTS AND DISCUSSION

1-Duration of the nymphal stage:

The durations of the three nymphal instars during the three successive annual generations under prevailing laboratory conditions are presented in Table (1).The 1st, 2nd and 3rd instars lasted for 8-14, 7-16 and 10-19 days, respectively, in the first generation**;** 5-12, 6-15 and 8-18 days, in the second generation and 14-30, 14-33 and 24-36 days in the third generation. The shorter durations occurred during the second generation (8.8±0.56 **,** 10.25±0.75 and 13.8±0.83)) as compared with to the first one with (11.45±0.39, 11.15 ±0.48 and 14.65±0.81) average and the third generation with (20.9±1.17,21.25±1.39 and29.7±0.72). The total nymphal period (from egg hatching until adult emergence) was 37.25±0.91 days in the 1st generation, 32.8±1.21 days in the 2nd generation and 71.8±2.34 days in the 3rd generation**.** Significant differences were attained between duration periods of nymphal instars and between generations. Nymphs reared on potato sprouts during the first generations at 34.1±0.25 °C (D. Max. T), 32.9±0.23 °C as well as 50.5±0.77 % (D. M. R. H.) developed to adult females significantly faster than those reared at 28.3±0.78 °C (D. Max. T), 27.1±0.75 °C and 51.6±0.05 % (D. M. R. H.). The mean developmental period for nymphal instars and thus nymphal stage were inversely proportional with the increas in temperature. For instance, when the nymphal stage duration was shorter (32.8±1.21days) during 2nd generation, the daily mean temp. was high (34.6 °C) in comparison with the respective period during the first and third generation. These results were compairable with those by several authors on *Icerya purchasi* Kuwana(Hemiptera: Margarodidea) (1922) in Japan stated that the durations of different nymphal instars lasted 14-21, 14-21 and 12-50 days for 1st, 2nd, and 3rd nymphal instars, respectively; Bodenheimer (1951) in Palestine 12-19, 40- 18 and 11-24 days in the three nymphal instars, respectively; Monastero and Zaazmi

(1959) in France stated that the three instars were 22-45, 15-25 and 35-37 days respectively. On the other hand, Ezz (1965) in Egypt found that three nymphal instars of *Icerya aegyptiaca* (Doulgas) (Hemiptera: Margarodidea)ranged 10-46, 7-30 days and 10-48 days; Azab *et al* (1969) in Egypt recorded 19, 9.8 and 20.7 days, respectively for three nymphal instars of *Icerya aegyptiaca*. Sharaf El-Den *,et al* (2009) in Egypt found that three nymphal instars of *Icerya seychellarum*. (Hemiptera: Margarodidea) Such differences in results may be due to prevailing laboratory conditions, differences in insect species and host plants.

Table (1): Durations of *M. hirsutue* nymphal instars on Potato sprouts during the three successive annual generations under laboratory conditions.

Duration of nymphal instars					
No. of G.	**No. of parameters**	**1st N. instar**	**2nd N. instar**	**3rd N. instar**	**Total N. instar**
1st Generation	Range	8-14	7-16	10-19	25-49
	Mean S.E	11.45**b** ±0.39	11.15**b** ±0.48	14.65**b** ±0.81	37.25**b** ±0.91
	Date	12-5/3-6	28-5/14-6	12-6/26-6	12-5/26-6
	Tem/Max. Tem/Mini. RH%	34.1±0.12 32.7±0.12 48.9±0.34	34.7±0.20 33.5±0.11 52.2±0.79	33.6±0.13 32.6±0.12 50.5±1.02	34.1±0.25 32.9±0.23 50.5±0.77
2nd Generation	Range	5-12	6-15	8-18	19-45
	Mean S.E	8.8±0.56**c**	10.25±0.75**c**	13.8±0.83**c**	32.8±1.21**c**
	Date	1-7/2-8	10-7/15-8	25-7/1-9	1-7/1-9
	Tem/Max. Tem/Mini RH%	35.3±0.2 32.2±0.11 51.6±0.45	34.9±0.21 32.3±0.11 52.1±0.41	33.9±0.21 32.7±0.31 53.2±0.21	34.7±0.33 34.4±0.12 52.3±0.38
3rd Generation	Range	14-30	14-33	24-36	52-99
	Mean S.E	20.9 **a** ±1.17	21.25**a** ±1.39	29.7**a** ±0.72	71.8**a** ±2.34
	Date	23-8/8-11	5-9/29-11	20-9/6-1	23-8/6-1/2010
	Tem/Max. Tem/Mini RH%	29.9±0.29 28.1±0.27 51.7±1.41	28.9±0.28 28.0±0.27 51.6±0.44	26.2±0.15 25.2±0.21 51.8±0.61	28.3±0.78 27.1±0.75 51.6±0.05

Initial numbers used for each nymphal instar were 20
Means within a column followed by different letter are significantly differ at 5% .

2- Duration of the pre-pupal and pupal stages

The durations of the pre-pupal and pupal stages during the three successive annual generations under prevailing laboratory conditions are presented in Table (2). The pre-pupal and pupal stages lasted for 11-23 and 17-25 days, respectively,in the first generation, 8-17 and 9-18 days, in the second generation and 15-33 and17-37 days, in the third generation. The shorter durations occurred during the second generation (12.4±0.69 and 11.95±0.66) as compared with to the first one with (15.85 ±0.57 and 20.7±0.57) average and the third generation with (25.45±1.46 and 25.5±1.37).The total period (pre-pupal and pupal stages) was 18.27±1.71days in the 1st generation,12.17±0.16 days in the 2nd generation and 25.47±0.17 days in the 3rd generation.

Table (2): Durations of *M. hirsutus* pupal, stage and reared potato sprouts during the three successive annual generations under laboratory conditions.`

No. of G.	No. of parameters	Pre pupae	Pupa	Total pre-pupal and pupal stages	Adult Male
1st Generation	Range	11-23	17-25	28-48	1-6
	Mean S.E	15.85**b** ±0.82	20.7**b** ±0.57	18.27±1.71**b**	3.2**a** ±0.31
	Date	8-6/1-7	19-6/20-7	8-6/20-7	8-7/21-7
	Tem/Max. Tem/Mini RH%	34.3±0.21 32.8±0.32 49.9±0.41	34.3±0.31 32.9±0.42 50.1±0.50	34.31±0.01 32.8±0.04 50.0±0.07	35.1±0.42 33.9±0.51 51.2±0.51
2nd Generation	Range	8-17	9-18	17-35	1-4
	Mean S.E	12.4**c** ±0.66	11.95**c** ±0.69	12.17±0.16**c**	2.35**b** ±0.20
	Date	25-7/31-8	2-8/9-9	25-7/9-9	10-8/11-9
	Tem/Max. Tem/Mini RH%	35.2±0.41 33.1±0.60 51.9±0.22	35.3±0.71 33.5±0.71 52.3±0.41	35.3±0.04 33.3±0.14 52.1±0.14	34.9±0.60 32.9±0.91 53.3±0.33
3rd Generation	Range	15-33	17-37	32-70	1-3
	Mean S.E	25.45**a** ±1.37	25. 5 **a** ±1.46	25.47±0.17**a**	1.9**c** ±0.18
	Date	20-9/26-12	4-10/14-2	20-9/14-2	20-10/14-2
	Tem/Max. Tem/Mini RH%	29.1±0.71 28. ±0.11 51.1±0.45	28.9±0.31 28.1±0.30 51.6±0.45	29.0±0.07 28.05±0.35 51.35±0.17	27.5±0.51 25.2±0.21 51.9±0.71

Initial numbers used were 20 (adult females)
Means within a column followed by different letter are significantly differ at 5%.

3-Oviposition Periods & Fecundity :

Based on Table (3) the oviposition periods of *M. hirsutus*, during the three successive annual generations revealed the followings; the non-fertilized females started to lay eggs after their third molting. Statistical analysis showed that the pre- oviposition period was significantly different in generations tested, being less 16.9±0.67 days in the 1st generation at 33.33 °C and 50.1 % R. H. than that during the 2nd generation (20.25±0.66 days) at 34.1 °C and 50.9 % R. H. and the 3rd generation (51.65±1.96 days) at 28.9°C and 49.7 % R. H. This period decreased with temperature increase.

Unfertilized females continued to lay eggs for 49-166 days. Significant differences were obtained in oviposition period between, generations, being shorter (54.7±1.8 days) in the 1st generation at 33.25 °C and 50.2±0.21 % R. H. while longer (131.35±6.4 days) in the 3rd generation at 27.65 °C and 49.2±0.21% R. H. Fecundity of females on potato sprouts ranged 79-201eggs per female in 1st generation , 39 to 101 eggs/female in the 2nd generation and 36 -98 eggs/female in the 3rd generation . These differences were significant .The highest fecundity was recorded in the 1st generation (117.1±9.59 eggs/female) .

Table (3): Oviposition periods of *M. hirsutus* reared on potato sprouts during the three successive annual generations under laboratory conditions.

No. of G.	No. of parameters	Pre oviposition periods	oviposition periods	Total no. of eggs / female (Fecundity)	post oviposition periods
1st Generation	Range	11-21	49-67	79-201	6-15
	Mean S.E	16.9**c** ±0.67	54.75**c** ±0.61	117.1**a** ±9.59	11.3**b** ±0.58
	Date	12-6/16-7	22-6/23-7	22-6/12-9-2009	10-8/24-9
	Tem/Max. Tem/Mini RH%	34.37±0.15 32.3±0.13 50.1±0.31	34.4±0.61 32.1±0.31 50.2±0.21	34.38±0.01 32.2±0.07 50.15±0.04	35.3±0.11 34.8±0.21 50.4±0.45
2nd Generation	Range	13-27	64-123	39-101	4-8
	Mean S.E	20.25**b** ±0.66	87.05**b** ±0.69	80.55**b** ± 4.7	5.85 **c** ±0.20
	Date	1-8/27-9	14-8/2-1	14-8/2-1	25-10/7-1
	Tem/Max. Tem/Mini RH%	34.71±0.51 33.4±0.60 50.9±0.44	33.9±0.71 32.1±0.51 49.9±0.17	34.31±0.28 32.7±0.45 50.4±0.35	33.7±0.72 32.1±0.51 50.0±0.12
3rd Generation	Range	34-66	78-166	36-98	13-23
	Mean S.E	51.65**a** ±1.96	131.35**a** ±6.48	71.95**c** ±4.46	17.0**a** ±0.60
	Date	17-10/11-2	19-11/26-7	19-11/26-7	5-2/10-8
	Tem/Max. Tem/Mini RH%	29.9±0.33 27.9 ±0.51 49.7±0.21	28.1±0.12 27.2±0.51 49.2±0.21	29.0±0.63 27.6±0.24 49.5±0.17	26.5±0.31 26.9±0.31 49.9±0.21

Initial numbers used were 20 (adult females)
Means within a column followed by different letter are significantly differ at 5% .

The post-oviposition period varied from 4 to 23 with differences between post-oviposition periods significant. The shorter differences between generation period (5.85±0.20days) was observed in 2nd generation at 32. 9°C and 50.0 % R. H., follow (11.3±0.58days) in 1st generation at 35. 0°C and 50. 4 % R. H..and the longer period (17.0±0.60 days) occurred in the 3rd generation at 26.7 °C and 49.9 % R. H

Results in Table (3) also showed that the oviposition period was greatly influenced by the prevailing laboratory temperature. The pre-oviposition,oviposition and post-oviposition periods were positively affected .Similar results for oviposition periods and fecundity were reported by Bodenheimer (1951) in Palestine, Ezz (1965) in Egypt ,Azab *et al* (1969) and Sharaf El-Den ,*et al* (2009)) in Egypt.

4-Female Longevity:

Longevity of females shown in Table (4) ranged between 66 and 255 days according to conditions with significant differences between the three annual generations. The longest longevity averaged 200.0±8.54 days at 27.75 °C and 49.4 % R. H. in 3rd generation, while that in the 2nd generation averaged 113.15±5.10 days at 34.8 °C and 50.1 % R.H. and the shortest longevity averaged 82.95±3.08 days at 33.8°C and 50.2% R.H. Therefore, longevity of females was negatively correlated with temperature contrary to the average number of eggs/female (fecundity).

In this respect Schrader (1930) in Pennsylvania reported that the longevity of adult of *I. purchasi* lasted two or three months. Sharaf El-Den ,*et al* (2009)) in Egypt reported that the longest longevity average occurred in first generation followed by that in the second generation. for *I. seychellarum*.

5-Incubation period:

Results given in Table (4) showed that this period ranged 3-12 days in the 1st generation, 10-31 days in the 2nd one and 30-45 days in the 3 rd generation with significant differences. However, the egg incubation period averages were 8.25±0.60 days, 19.0±1.83 days and 39.2±1.16 in the 1st , 2nd a and 3 rd generations , respectively, with temperatures averaged 34.1°C , 33.9 °C and 27.6°C found that the respectively, .These results are in agreement with those obtained on *I. purchasi* by Kuwana (1922) in Japan, (21-27 days), Peng (1935) in China, (9- 27 days), Geier and Baggiolini (1950) in Switzerland, (36 days) Bodenheimer (1951) in Palestine (16-35 days), Monastero and Zaazmi (1959) in France, (15-30 days), Ezz (1965) in Egypt, found that the incubation period of *I. aegyptiaca* ranged between 4-17 days and Azab *et al* (1969) in Egypt pointed out that eggs of *I. aegyptiaca* hatch, 8.6 days at 29.7 ^{o}C and 10 days at 24 ^{o}C. Sharaf El-Den *et al* (2009)) in Egypt found that the incubation period averages were nearly similar in both generations for *I. seychellarum*.

6-Total life cycle

In Table (4) results revealed that the life cycle was completed in 94-167days in 1st generation , 110-234 days in the 2nd generation and 207-399days in the 3rd generation . Temperature and RH had significant effect. The life cycle was longer (311.05 ± 14.06 days) at mean temp. 27.7 ^{o}C with 50.4±0.49%RH. in 3rd generation, (147.0±10.40 days) was at mean temp. 33.6 ^{o}C. with 51.2±0.46 %RH. in 2nd generation and (128.45±5.69) was at mean temp. 34.1 ^{o}C. with 50.3±0.39 %RH. in 1st generation. In this respect, Kuwana (1922) in Japan, recorded four months for *I. purchasi* under favorable conditions to complete life cycle: Ramachandra and Cherian (1944) in Switzerland reported that the generation duration of *I. purchasi* varied according to temperature and lasted 43-240 days; Azab *et al* (1969) in Egypt recorded 105.4 days at 26.4 ^{o}C and 87.2 days at 28.7 ^{o}C for *I. aegyptiaca* Khalaf (1987) in Fars, found that the life cycle of *I. purchasi* lasted from 70 - 140 days; and Sharaf El-Den *at el* (2009)) in Egypt reported that total life cycle completed in 217-376 days in first generation and 180-384 in that of the second generation for *I. seychellarum*.

7-Generations

Determination of the number of annual generations of *M.hirsutus* under laboratory conditions was conducted. Three overlapping generations could be reared in the lab. as shown in Table (5).

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The 1st generation lasted for about four months under mean tem. 31.5 °C and 50.1 % R. H. The average durations of nymphs, adult females and incubation periods (Tables 1 & 4) were 37.25 ± 0.91, 82.95 ± 3.08 and 8.25±0.61 days, respectively. Under mean lab. temp.28.0 °C and 51.0 % R. H., the 2nd generation lasted for about 7-months .Under these conditions, nymphal, adult females and egg stages lasted 32.8 ± 1.21 , 113.15±5.10 and 19.0±1.83 days.respectively,and the 3rd generation lasted for about 9-months. The average durations of nymphs, adult females and incubation periods were 71.8±2.34, 200.0±8.54 and 39.2±1.16 days respectively.

Generation duration depended on the prevailing temperature with negative correlation. The present results are in agreement with the findings of Azab *et al* (1969) and Aly (1980) in Egypt reporting two annual generations for *I. aegyptiaca* and for *I. seychellarum*. Khalaf (1987) in Fars, found that *I. purchasi has* 4 generations year. and Sharaf El-Den *et al* (2009)) in Egypt reported two annual generations for *I. seychellarum* .

Table (5): First and last occurrence of different stages of *M. hirsutus* reared on potato sprouts during the three successive annual generations under laboratory conditions.

Generations		First and last occurrence of							
		Nymphal stage			Adult female	Egg stage	Pre-pupa	pupa	Adult male
		1st instar	2nd instar	3rd instar					
First	From	12/5/2009	28/5/2009	12/6/2009	12/6/2009	22/6/2009	8/6/2009	19/6/2009	8/7/2009
	To	3/6/2009	14/6/2009	26/6/2009	24/9/2009	12/9/2009	1/7/2009	20/7/2009	21/7/2009
Second	From	1/7/2009	10/7/2009	25/7/2009	1/8/2009	14/8/2009	25/7/2009	2/8/2009	10/8/2009
	To	2/8/2009	15/8/2009	1/9/2009	7/1/2010	2/1/2010	31/8/2009	9/9/2009	11/9/2009
Third	From	23/8/2009	5/9/2009	20/9/2009	17/10/2009	19/11/2009	20/9/2009	4/10/2009	20/10
	To	8/11/2009	29/11/2009	6/1/2010	10/8/2010	26/7/2010	26/12/2009	14/2/2010	14/2/2010

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دراسات بيولوجية على حشرة بق الهبسكس الدقيقي على درنات البطاطس تحت الظروف المعمليه

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أُجريت هذه الدراسة على بعض الخصائص البيولوجية لبق الهبسكس الدقيقي عند تربيته على درنات البطاطس تحت الظروف المعملية على درنات البطاطس. ويُمكن تلخيص أهم النتائج التي تم التوصل إليها فيما يلي:

1-إستغرقت فترات كُلٍ من العُمر الأول، الثاني والثالث للحورية 8 – 30، 6 - 33 و 8 – 36 أيام على التوالي. وتراوحت مدة طور الحورية من 19 إلى 99 يوماً، كما كانت هناك علاقة عكسية بين مدة طور الحورية والزيادة في درجةِ الحرارة. كما إستغرقت فترات كلٍ من طور ما قبل العذراء ، طور العذراء والحشرة الكاملة للذكر 8 - 33 ، 9- 37 و 1- 6 أيام على التوالى.

2-عندما تم حجز الأنثى على درنات البطاطس، إستغرقت فترات ما قبل وضع البيض، وضع البيض و بعد وضع البيض 11 – 66، 49 – 166 و 4 -23 أيام على التوالي، ولقد تأثرت تلك الفترات بدرجة كبيرة بدرجات الحرارة والرطوبة السائدة في المعمل، حيث تأثرت فترة ما قبل وضع البيض عكسياً بارتفاع الحرارة بينما حدث العكس لكُلٍ من فترة وضع البيض وفترة ما بعد وضع البيض.

3-تراوحت الخصوبة (العدد الكليّ من البيضِ الناتج من كل أنثى) من 36 – 201 بيضة حسب الجيل، حيث سُجلت أعلى خصوبة للأنثى في الجيل الأول بالمُقارنة بالجيل الثاني والثالث.

4-تفاوتت مدة حياة الأنثى من 66 – 255 أيام حسب الظروف المعملية السائدة، حيث كان متوسط أطول فترة لحياة الأنثى في الجيل الثالث بالمقارنة بالجيل الأول و الثاني.

5- تراوحت مدة حضانة البيض من 3 – 45 أيام، مع وجود فروق معنوية بين فترات الحضانة في الاجيال الثلاثه.

6- إستغرقت فترة دورة الحياةِ 94 – 164 أيام في الجيل الأول، و 110 – 234 أيام في الجيل الثاني 207-399 أيام فى ألجيل الثالث وأوضح التحليل الإحصائي وجود تأثير لدرجة الحرارة على متوسط دورة الحياة بينما لم يكن للرطوبة النسبية أي تأثير.

7-تمت تربية ثلاث أجيال لهذه الآفة على درنات البطاطس في المعمل. ولقد إستغرق الجيل الأول حوالي أربعة شهور ، بينما إستغرق الجيل الثاني حوالي سته شهور وإستغرق الجيل الثالث أحد عشر شهراً..

قام بتحكيم البحث

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Table (4): Female longevity, incubation period and total life cycle of *M. hirsutus* reared on potato sprouts during the three successive annual generations of under laboratory conditions.

Generations	Female longevity					Incubation period					Total life cycle				
	Range (Mean ± S.E) (days)	First and last dates of Occurrence	Laboratory conditions averages			Range (Mean ± S.E) (days)	First and last dates of Occurrence	Laboratory conditions averages			Range (Mean ± S.E) (days)	First and last dates of Occurrence	Laboratory conditions averages		
			D. Max. T. °C	N. Min. T. °C	D. M. R. H. %			D. Max. T. °C	N. Min. T. °C	D. M. R. H. %			D. Max. T. °C	N. Min. T. °C	D. M. R. H. %
First	66-103 (82.95 ± 3.08) **c**	12/6 till 24/9	34.6 ± 0.24	33.1 ± 0.07	50.2 ± 0.07	3-12 (8.25 ± 0.61) **c**	22/6 till 23/7	34.6 ± 0.61	33.7 ± 0.42	50.3 ± 0.44	94-164 (128.45 ± 5.69)**c**	12/5 till 24/9	35.4 ± 0.21	32.9 ± 0.37	50.3 ± 0.39
Second	81-158 (113.15 ± 5.10) **b**	1/8/2009 till 7/12/2010	37.1 ± 0.25	32.5 ± 0.35	50.1 ± 0.25	10-31 (19.0 ± 1.83 **b**	14/8 till 28/10	34.7 ± 0.11	33.2 ± 0.21	50.2 ± 0.11	110-234 (147.0 ± 10.40)**b**	1/7 till 7/1/2010	34.6 ± 0.21	32.7 ± 0.39	51.2± 0.46
Third	125-255 (200.0 ± 8.54)**a**	17/10/2009 till 10/8/2010	28.2± 0.80	27.3 ± 0.24	± 49.4 ± 0.11	30/45 (39.2± 1.16)**a**	19/11/2009 till 29/3/2010	28.2± 0.12	27.0± 0.11	49.2± 0.21	207-399 (311.05± 14.06)**a**	23/8/2009 till 10/8/2010	28.2± 0.60	27.2± 0.40	50.4± 0.49

Initial number used was 20

Means within a column followed by the different letter are significantly differ at 5%.