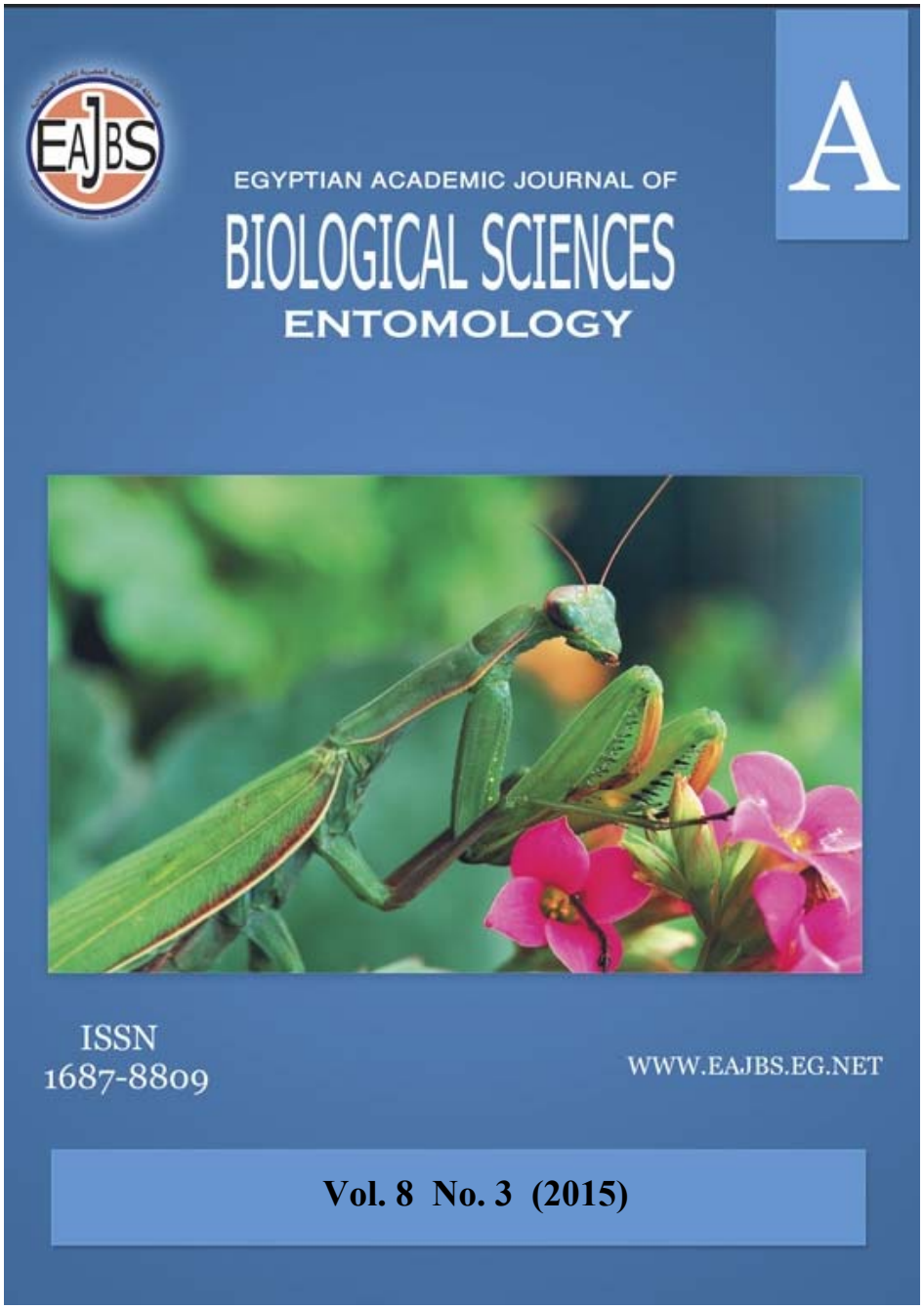

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Biological Studies of *Earias insulana* (Boisd.) Field Strains at Different Constant Temperature Degrees

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ABSTRACT

Earia insulana (Boisd.) (Lepidoptera: Noctuidae) larvae and/or pupae (cocoons) were collected from five different cotton varieties (Giza 45, Giza 86, Giza 87, Giza 88, and Giza 92) have been grown in Sakha, Kafr El-Sheikh-Governorate at the end of cotton season 2014. Some biological aspects of these populations were investigated under laboratory conditions at three constant temperatures (25, 27 and 30˚C).

The present results concluded that, the tested temperatures had main effect on stages durations, survival, adult emergence percentages, sex ratio, and fecundity of field SBW strain. Regardless the variety of cotton general trend of results indicated that, the highest, moderate and lowest percentage of emerged moths were recorded at 25ºC, 30ºC and 27ºC, respectively. In addition, sex ratio were almost 1:1 but tend to females at 25ºC while in reverse to male at 30ºC. At 27ºC sex ratio was 2♀: 1♂. Moreover, the fecundity of developed female from tested varieties recorded its highest values at 25ºC and sharply decreased at 27ºC. While, at 30ºC, the emerged female lost its fecundity except females of Giza 45 deposited 169.0 eggs / female. Furthermore, the tested temperature may be reliable for one developed stage of spiny bollworm and not reliable for another of same population. Also, cotton variety had highly significant effect on the studied biological aspects on its pest SBW, as well as, the interaction between cotton variety and temperature. Regardless temperature, duration of larval stage was 29 & 25.0 days on cotton varieties Giza 45 and Giza 87 at 25ºC, respectively. Although, the respective duration of generation in both cases acquire 50 days and 39.1 days, the reproductive capacity of SBW of Giza 45 equal ten times of that when fed on Giza 87. In addition, the larval mortality was higher in population of Giza 87. Depending on the aforementioned conclusion, cotton variety Giza 45 is more susceptible to SBW infestation. The authors arranged the susceptibility of tested cotton varieties to SBW infestation in descending order as follow: Giza 45, Giza 88, Giza 87, Giza 92 and Giza 86. These composite relations need to further vision to study the insect ecology, biology, physiology and economic damage. However, the use of less susceptible cultivars can be considered as a part of IPM control program.

INTRODUCTION

Spiny bollworm (SBW), *Earias insulana* (Boisd.) (Noctuidae: Lepidoptera) is a polyphagous insect.

In Egypt, SBW is a serious pest of cotton, *Gossypium barbadense* L. and other summer crops (Nada *et al.* 2010) and had been recorded as most destructive insect pests, responsible for a great economic losses of cotton bolls in Egypt and worldwide. Each SBW larva can damage up to 3 squares and 1 boll in 1-2 plant (Durán *et al.* 2000). However, Dhillona and Sharmab (2004) indicated that, the longer time, that *E. insulana* larvae have taken to pupate may be due to specific antibiotic effects or poor nutritional quality of reared food (tested cotton varieties). Al ameer *et al*. (2010) reported that, the increase of concentration of gossypol in cotton is desirable in the relationship between concentration of gossypol and ratio of infestation by boll worm pests and cotton yield. Syed *et al*., (2011) recorded the effect of host plant and temperature on the biology of *E. vittella*. And, Shan *et al*. (2012) and El-Sayed (2014) revealed that, temperature played vital role in the development and growth rate of *E. vittella* and *E. insulana.*

This work was carried out to study the effect of five cotton varieties (Giza 45, Giza 86, Giza 87, Giza 88, and Giza 92) on the biology of *E. insulana* (field strain) under three constant temperatures (25°, 27°, and 30±1 °C) and 70-80 % R. H. to find out which of these varieties is more resistance to overcome the high percentages of infestation with SBW. The selected cotton varieties are of extra-long staple cotton. Moreover, cotton varieties, Giza 88 and Giza 86 account about 20% and 70% percent, respectively of Egyptian total production (web site of cotton research institute).

MATERIALS AND METHODS

At the end of cotton season 2014, five populations of *E. insulana* (Boisd.) ,were collected from five cotton varieties , (Giza 45, Giza 86, Giza86, Giza88 and Giza92) which had been grown in Shahka, Kafr - El-Shaikh - Governorate. SBW Larvae and / or pupae (cocoons) population / variety were collected from infested cotton bolls and each population is related to a cotton variety act larvae or pupae of Giza 45, Giza 86 etc.).

The collected full grown larvae and / or pupae were kept separately in glass tubes (2 X 7 cm) plugged with sterilized cotton wool until moths emergence in the laboratory at room temperature. The emerged moths were sexed, transferred to a chimney glass cages and fed with 10% sucrose solution. The deposited eggs were transferred to glass jars and incubated at 25°C and 70-80 % relative humidity. Three replicates of newly hatched larvae (range between 350-700 larvae/variety) were transferred individually and fed on artificial diet described by Rashad & Ammar (1985) at the tested temperature degrees (25°, 27° & 30°C) where some biological aspects of a complete generation of SBW were pursuit. The Larval duration, pupal period were determined and the percentages of emerged moths were calculated. The longevity of adult females and males were recorded. In addition, the emerged moths were paired and transferred to glass cages for egg deposition, where daily following up of the cages were conducted until moths death to determine the adults longevity, female pre-oviposition, oviposition and post-ovipostion periods. Additionally, the numbers of eggs/ female and hatchability percentages as well as egg incubation period were recorded.

Statistical analysis:

Analysis of variance (ANOVA one & two ways) was conducted on all data using Costat computer program software. Means were compared by Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Resulted newly hatched larvae of SBW field strain got from cotton variety Giza 45, Giza 86, Giza 87, Giza 88 and Giza 92 incubated at 25˚C & 70 % – 80 % R.H. were reared on artificial diet at (25˚, 27˚ and 30˚C.) to study some of its biological aspects.

Larval stage:

As shown in Table (1), the highest larval mortality percentages (62.86 %, 90 % and 74%) were recorded between larvae of Giza 87 at 25˚C, Giza 87 at 27˚C and Giza 45 at 30˚C, respectively. On contrary, the lowest mortality percentages (26.25 %, 65.7 % and 41.67 %) were recorded between larvae of Giza 88 at 25˚C, Giza 92 at 27˚C and at 30˚C, respectively.

Table 1: *Earias insulana* Mortality % and durations of larval and pupal stages of field strain collected from five cotton varieties & reared at different constant temperatures.

Temp. ◦C	Variety	Initial No. of larvae	larval Duration* ±S.E. (days)	Larval Mortality	Pupation %	Pupal Period* ±S.E. (days)	Pupal Mortality %	Larval and pupal Duration* ± S.E. (days)
25	Giza45	216	29.0^{a}±0.4	52.78	47.22	8.54^{b}±0.55	11.12	37.65^{a}±1.48
	Giza 86	42	23.42^{c}±0.87	30.95	69.05	7.33^{c}±1.08	0.0	30.76^{c}±2.92
	Giza87	210	25.0^{b}±0.50	62.86	37.14	8.87^{b}±0.62	10.04	34.27^{b}±1.67
	Giza88	80	19.33^{e}±0.51	26.25	73.75	9.1^{b}±0.63	3.75	28.46^{d}±1.74
	Giza92	242	21.58^{b}±0.51	43.80	56.2	10.16^{a}±0.66	34.71	31.13^{c}±1.79
F value			244.78^{***}			7.79^{***}		62.72^{***}
LSD			0.62			0.69		1.013
27	Giza45	240	24.55^{c}±0.84	76.25	23.75	7.00^{c}±0.08	3.75	31.55^{b}±1.10
	Giza 86	160	30.92^{a}±1.16	71.87	28.13	6.6^{d}±0.11	12.77	37.52^{a}±1.51
	Giza87	180	28.41^{b}±1.42	90.00	10.0	8.06^{b}±0.14	1.67	36.47^{a}±1.86
	Giza88	150	18.88^{e}±1.11	82.00	18.0	10.04^{a}±0.11	0.0	28.93^{c}±1.45
	Giza92	140	20.40^{d}±1.04	65.71	34.29	5.60^{e}±0.10	13.58	26.00^{d}±1.48
F value			115.73^{***}			140.42^{***}		81.30^{***}
LSD			0.97			0.31	37.5	1.11
30	Giza45	280	28.81^{a}±1.52	74.00	26.0	7.02^{b}±0.45	11.71	35.84^{a}±1.90
	Giza 86	140	21.36^{b}±1.57	60.00	40.0	6.17^{c}±0.46	7.14	27.56^{b}±1.96
	Giza87	140	19.88^{c}±1.58	67.14	32.86	6.13^{c}±0.47	7.15	26.73^{bc}±1.99
	Giza88	90	17.90^{d}±1.68	53.33	46.67	7.40^{b}±0.50	7.78	26.12^{bc}±2.11
	Giza92	84	15.08^{e}±1.50	41.67	58.33	11.04^{a}±0.45	0.0	25.25^{c}±1.88
F value			123.05^{***}			64.08^{***}		66.83^{***}
LSD			1.28			0.70		1.43

*Means followed by the same letter in a column are not significantly different at the 5% level of probability.

Concerning to the SBW larval period results presented in Table (1) recorded significant wide variation based on the difference of their collected cotton varieties for all the examined temperatures. The shortest larval period (15.08±1.5 days) was observed associated with cotton variety Giza 92 at 30˚C. On contrary, the longest one recorded with larvae of variety Giza 86 (30.92 ±1.16 days) at 27˚C with no significant difference with larvae of Giza 45 at 25˚C (29.0 ±0.4 days). The corresponding ranges were (19.3 ±0.5 days to 29 ±0.4 days), (18.88 ±1.1 days to 30.92 ±1.16 days) and (15 ±0.08 days to 28.81 ±1.52 days) at 25˚C, 27˚C & 30˚C, respectively, according the differences of the larval populations. In this respect, Dhillona and Sharmab (2004) indicated that, the longer time, that *E. insulana* larvae have taken to pupate may be due to specific antibiotic effects or poor nutritional quality of reared food (tested cotton varieties) while, Shan *et al*. (2012) revealed that, temperature played vital role in the development and growth rate of *E. vittella.*

Pupal stage:

As shown in Table (1), the highest percentage of pupation were scored (73.75%

& 37.1%) C in (Giza 88 & Giza 87, respectively) at 25˚; while the lowest one occurred at 27˚C, ranged between (10.0 & 34.29%) in Giza 87&Giza 92, respectively. Whereas, the highest pupal mortality recorded by 34.71 % in population of Giza 92 at 25ºC. While at 27ºC and 30ºC, no mortality was recorded among both pupal populations of Giza 88 and Giza 92, respectively.

Furthermore, the cotton varieties act significant role on *E. insulana* pupal period, whereas the longest period recorded (10.16 ±0.66 days&11.04 ± 0.45) days in the case of Giza 92 at (25 & 30 ˚C), respectively. The shortest pupal period (5.6 days) was observed associated with (Giza 92) at 27˚C followed by (6.13 days) in (Giza 87) at 30˚C. However, this aspect differed up to the experimental cotton varieties based on the differences of tested temperature, it ranged between (7.33 & 10.16) days at 25˚C, (6.6 & 10.04) days at 27˚C and (6.13 & 11.04) days at 30˚C.

In addition, it is obvious that, the greatest values of the larval and pupal duration were (37.65 ±1.48 & 34.27 ± 1.67), (37.52 ±1.48 & 36.47 ± 1.86), and (35.84 ±1.9), associated with (Giza 45 & Giza 87) at 25˚C, (Giza 86 & Giza 87) at 27˚C and (Giza 45) at 30˚C comparing to the other experimental varieties under the tested temperatures. This may be due to natural resistance of the previous cotton varieties to the SBW infestation.

Furthermore, ANOVA (two way analyses) revealed highly significant effect of cotton variety as well as, the interaction between temperature and cotton variety on the durations of larvae, pupae and the period from hatch to adult stage of *E. insulana*. As shown in Table (2), the longest period of larvae (27.7 days) was recorded for population of Giza 45. While that of pupal stage was (9.47 days) was recorded for population of Giza 92. In addition, the period from egg hatch to reach adult stage scored highest value (35.4 days) when larvae fed on cotton Giza 45. In this regarde, Khan and Rao (1960) reported that, the host has a great influence on developmental period, oviposition, fecundity, and longevity of adults of *E. insulana*. Tsai and You (1962) reported a wide variation in *E. fabia* larval duration due to food type of *G. hirsutum* cotton. Syed *et al*., (2011) recorded the effect of host plant and temperature on the biology of *E. vittella*.

Table 2: Effect of cotton varieties on larval, pupal periods and periods from hatching eggs to the adult emergence of SBW field populations.

Variety	Larval stage(days) *	Pupal Stage (days) *	Days from egg to adult stage*
Giza 45	27.7 a	7.7 d	35.4 a
Giza 86	24.6 b	6.36 e	30.9 c
Giza 87	21.6 c	3.01 c	31.8 b
Giza 88	18.8 d	8.76 b	28.6 d
Giza 92	18.7 d	9.47 a	28.1 d
LSD 0.5	0.42	0.29	0.57
F value	51.0***	25.5***	39.4***

*Means followed by the same letter in a column are not significantly different at the 5% level of probability.

Adult moths' emergence and longevity:

Obtained results in Table (3) show the adult SBW emergence % of female and male as well as their longevity under different constant temperatures. Population of variety Giza 92, Giza 87& Giza 45 gave the lowest % of emergence for adult female (12.4, 6.11 & 6.43%) under (25º, 27º & 30ºC.), respectively, while the high values (36.25.15 & 12.92 & 17.86&17.86%) were observed associated with population of (Giza 88, Giza 45, Giza 86& Giza 92) at (25& 27º&.30) ºC. respectively. On the

other hand, the lowest % of male emergence was 9.1% at 25ºC with population of Giza 92 variety. In contrary, the highest one was 40.48% associated with population of Giza 86 & Giza 92 at 25º &30ºC.

Also, as shown in Table (3) temperature and cotton variety play marked and significant effect on adult (female & male) longevity. The maximum female and male longevity (27.45 & 24.40) days were obtained at 25˚C by feeding on variety Giza 45, while the shortest longevity of female & male moths were (7.96 &8.23 days) occurred in the case of Giza 86 at (30˚ &27˚C) , respectively.

Table 3: Adult emergence %, adult longevity, pre- oviposition, oviposition period, post- oviposition periods of *E. insulana* populations reared on 3 constant temperatures.

Temp ˚C	Variety	Initial no. of hatch	No. of emerged adult	% of emerged adult	% Adult emergence		Longevity (days)*		Pre-oviposition period ±S.E. (days)	Oviposition period (days ± S.E.)	Post oviposition period ±S.E. (days)
					♀	♂	♀	♂			
25◦	**Giza45**	216	78	36.1	20.37	15.74	27.45^{a}	24.40^{a}	12.33^{b} ± 3.06	4.60^{a}± 0.88	8.30^{b}± 2.96
	Giza 86	42	29	69.05	28.57	40.48	10.25^{d}	10.44^{b}	3.00e ± 4.67	3.00^{b}± 1.00	7.00^{c}± 2.00
	Giza87	210	57	27.1	12.38	14.76	12.23^{c}	11.29^{b}	4.50^{d} ± 1.53	2.50^{c}± 0.67	4.50^{d}± 2.08
	Giza88	80	56	70.0	36.25	33.75	24.69^{b}	24.03^{a}	15.66^{a} ± 4.48	3.30^{b}± 2.33	4.30^{d}± 2.85
	Giza92	242	52	21.49	12.4	9.1	23.53^{b}	22.95^{a}	9.66^{c} ± 5.61	3.00^{b}± 1.00	9.00^{a}± 1.73
F value			1954.4***				70.67***	52.57***	638.74***	13.87***	302.27***
LSD			1.24				1.41	1.46	0.63	0.58	0.42
27◦	**Giza45**	240	48	20.0	12.92	7.08	26.20^{a}	24.12^{a}	12.00^{b} ± 2.67	26.00^{a}± 6.33	13.00^{a}± 3.33
	Giza 86	160	25	15.63	7.5	8.13	8.75^{d}	8.23^{d}	-	-	-
	Giza87	180	15	8.33	6.11	2.22	10.45^{d}	9.83^{d}	-	-	-
	Giza88	150	27	18.0	12	6.0	17.61^{c}	17.77^{c}	5.50^{c}± 2.60	6.50^{c}± 2.60	6.50^{b}± 3.06
	Giza92	140	29	20.17	7.14	13.57	23.55^{b}	21.58^{b}	14.00^{a}± 5.55	8.00^{b}± 4.51	5.50^{b}± 2.03
LSD			1.33				1.91	2.34	1.49	1.37	1.17
F value			814.7***				44.69^{***}	19.68^{***}	114.5^{***}	740^{***}	139.67^{***}
30◦	**Giza45**	280	40	14.29	6.43	7.86	20.88^{a}	21.22^{a}	12.50± 2.65-	2.00± 1.20	7.60± 0.33
	Giza 86	140	46	32.86	17.86	15	7.96^{d}	10.14^{d}	-	-	-
	Giza87	140	36	25.71	15.71	10	10.56^{c}	11.77^{c}	--	-	-
	Giza88	90	35	38.89	20	18.88	13.15^{b}	13.65^{b}	-	-	-
	Giza92	84	49	58.33	17.86	40.48	11.65^{c}	10.80^{cd}	-	-	-
LSD			1.24				1.44	1.38	-		
F value			226.2***				46.71^{***}	38.27^{***}	-		

*Means followed by the same letter in a column are not significantly different at the 5% level of probability.

Results indicated that, Giza 45 performed the highest longevity of both female & male moths of *E. insulana* for all examined temperatures (25 & 27& 30˚C) comparing to the other cotton varieties studied. In this regard, Sundraraj and David (1987) found that *E. vitella* female longevity recorded 14.60 and 14.13 days respectively, but male longevity was 10.76 and 9.33 days on okra and cotton. While, Al-Mehmmady (2000) reported that female longevity recorded 14.00 and 14.20 days but male longevity were 12.45 and 13.36 days at 30.6 and 32.5˚C. Also, (Karimzadeh *et al*., 2006) showed that, survival and reproduction of plant-feeding insects are dependent on the quantity and quality of nutrients in their host plant.

Pre-oviposition, oviposition and post-oviposition periods:

The values presented in Table (3) performed significant efficiency on pre-oviposition period of *E. insulana* tested on cotton varieties at the experimental temperatures, it varied between (3.0± 4.67 &15.66 ± 4.48 days) at 25˚C for female populations of Giza 86 and Giza 88, respectively. At 27˚C, female populations of Giza 86 and Giza 87 did not deposit any eggs as well as all population at 30 ˚C, except that of Giza 45 with pre-oviposition period of 12.50 ± 2.65 days.

The oviposition period varied significantly based on both cotton varieties and the tested temperature .At 25˚C , females of SBW population at variety Giza 45 recorded the longest period (4.6± 0.88 days), while variety Giza 87 showed the shortest period (2.0 ± 1.20 days). An inverse effect was observed as temperature increased to 30˚C., where only SBW females that developed from Giza 45 has completed life cycle by depositing eggs. These results reflect the importance of selecting specific degrees of temperature to cultivate these cotton varieties to reduce the SBW infestation.

Post- oviposition period of SBW varied between (4.30±2.85& 9.0 ±1.73) days from populations of Giza 45 & Giza 92 when reared on 25˚C. While ,the females population of Giza 92 performed its moderate value (5.5± 2.03) days at 27˚C. Dhillona and Sharmab (2004) found that pre-oviposition period in *E. vitellla* was longer on *G. arboreum* genotype (2.42 days) than on *G. hirsutum* genotypes (1.44–2.00 days), while the reverse was true for oviposition and post-oviposition periods. Syed *et al*., (2011) found that pre-oviposition, oviposition and post-oviposition periods of *E. vittella* varied when feeding on different host plant., Fayez (2011) showed that different temperature (18˚C-34˚C) affect moth longevity, pre-oviposition, oviposition and post -oviposition periods of SBW fed on artificial diet. At 34˚C, male and female moths' lives shorter than others.

Sex ratio, fecundity and fertility:

Data in Table (4) revealed that, sex ratio between emerged SBW moth was nearly 1:1 at 25˚C, Where it tend to female (1.3 & 1.4) for populations of Giza 45 Giza 92, respectively. On contrary, it tends to male (1.1-2.3) for populations of tested varieties at 30˚C. But at 27˚C, the ratio of female were twice that of male (1.8; 2 & 2.8:1) for emerged moth of cotton varieties Giza 45, Giza 87 & Giza 88. On opposite, sex ratio between emerged female and male moths of Giza 92 was (1:1.9).

In respect of reproduction, the numbers of laid eggs per SBW female and the egg hatchability percent varied according to their developed varieties. At 25˚C the highest number of deposited eggs recoded (164.0 & 401.0) eggs/female associated with (Giza 88 & Giza 45 respectively.) by egg hatchability percent of (72.56 & 80.29) % respectively. While, the highest number of deposited eggs was 38.0 eggs/female of (Giza 88) at 27˚C by eggs hatchability percent of 89.47 %. Diverse effect towards fecundity of SBW female was observed at 30˚C. Where only SBW females that developed from Giza 45 deposited eggs (169.0eggs / ♀) & 80.47% egg hatchability but all the female of other varieties at the same degree did not deposited any eggs, These results clarified that Giza 45, Giza 86 and Giza 87 at 27˚C and Giza 86, Giza 87, Giza 88 & Giza 92 at 30˚ were resistant varieties to SBW infestation. In this regard, Fayez (2011) found that, the highest number of laid eggs /female and egg hatchability percentages were recorded at 26˚C. (Singh and Bichoo, 1989) reported that fecundity of the females whose larvae were reared on *G. hirsutum* was greater than those reared on *G. arboreum*, which might be due to the variation in nutritional quality of the food, and the antibiosis components of resistance.

Table 4: Sex ratio of the SBW emerged moths, no.egg /♀, incubation period and percentages of egg hatchability for different populations at three constant temperatures.

Temp. Degree ◦C.	Variety	Sex ratio ♀	Sex ratio ♂	No. Eggs /♀	Incubation period ± S.E (days)	% Hatchability	Generation (days)
	Giza45	1.3	1.0	401.0	5.33^{b} ± 1.13	80.29	50.0 a
	Giza 86	1.0	1.4	9.0	4.00^{c} ± 0.00	33.33	-
	Giza87	1.0	1.2	48.0	4.25^{c} ± 1.00	50.0	39.1 b
	Giza88	1.1	1.0	164.0	6.90^{a} ± 2.07	72.56	51.0 a
	Giza92	1.4	1.0	36.0	4.41^{c} ± 0.50	75.00	40.4 ab
F value					114.80^{***}		
LSD					0.36		
27◦	Giza45	1.8	1.0	24.0	6.28^{a}±0.71	75.00	
	Giza 86	0.92	1.0	7.0	3.00^{c}±0.00	57.14	
	Giza87	2.8	1.0	-	-	-	
	Giza88	2.0	1.0	38.0	5.24^{b}±0.96	89.47	
	Giza92	1.0	1.9	32.0	5.43^{b}±1.00	87.5	
F value					31.44^{***}		
LSD					0.64		
30◦	Giza45	1.0	1.2	169.0	3.69±9.63	80.47	
	Giza 86	1.0	1.2	0.0	-	-	
	Giza87	1.0	1.93	0.0	-	-	
	Giza88	1.0	1.1	0.0	-	-	
	Giza92	1.0	2.3	0.0	-	-	
F value					-	-	
LSD					-	-	

Incubation period:

The incubation period of *E. insulana* eggs ranged between (4.00 & 6.9) days at 25˚C for populations of (Giza 86 & Giza 88), respectively (Table 4).While, at 27˚C the incubation period ranged between (3.00 & 6.28) days in populations of (Giza 86& Giza 45) respectively. The only resulted adult females of SBW from Giza 45 variety deposited eggs at 30˚C with incubation period 3.69 days. Syed *et al*. (2011) reported that incubation period varied from 2.3 to 5 days in *E. vitellia* on okra. Also, Shah *et al.* (2011) recorded that the lowest incubation period for *E. vittella* was 2 days on 35 ºC and the highest 4 days on 27 ºC. Al-Mehmmady (2000) found that the incubation period of *E. vitellia* was 2.42 days at 31˚C. At the level of genotypes, Dhillon and Sharmab (2004) reported that larval survival and incubation period were significantly lower on *G. arboreum* than on *G. hirsutum*.

Concerning to generation duration of SBW at 25 ºC, it was found that, the longest recorded for population of Giza 45 (50 days), while the shortest one were for population of Giza 86 (39.1 days) (Table 4).

The present results concluded that, the constant tested temperature had main effect on stages durations, survival, adult emergence percentages, sex ratio, and fecundity of field SBW strain. Regardless the variety of cotton general trend of results indicate that, the highest, moderate and lowest percentage of emerged moths were recorded at 25ºC, 30 ºC and 27 ºC, respectively. In addition, sex ratio were nearly 1:1 but tend to female at 25 ºC while tend to male at 30 ºC. While, at 27 ºC sex ratio was 2♀: 1♂. Moreover, the fecundity of developed female from tested varieties recorded its highest values at 25ºC and decreased sharply at 27 ºC. While at 30 ºC, the emerged female lost its fecundity except the females of Giza 45 deposited 169 eggs / female. Furthermore, the tested temperature may be reliable for one developed stage of *E. insulana* and not reliable for another of same population. It is clear that there were less or even no mortalities in pupal stage comparing to larval stage. However, Temperature is an important environmental factor that affects rate of development and the success of an insect of economic importance to obtain a useful orientation for good forecast

and prediction system of it (Dahi, 2003).

Also, cotton variety had highly significant effect on the studied biological aspects on its pest, *E .insulana,* as well as, the interaction between cotton variety and temperature. However, duration of larval stage on cotton varieties Giza 45 and Giza 87 was 27.7 & 21.6 days, respectively (Table 2). Although, the respective duration of generation in both cases acquire 50 days and 39.1 days at 25ºC, the reproductive capacity of SBW of Giza 45 equal ten times of that when fed on Giza 87. Additionally, the larval mortality was higher in population of Giza 87. So, the authors concluded that, cotton Variety Giza 45 is more susceptible to SBW infestation than cotton variety Giza 87. Depending on aforementioned results, cotton variety Giza 45 is more susceptible to SBW infestation. The tested varieties could be arranged up to the susceptibility to SBW in descending order as follow: Giza 45, Giza 88, Giza 87, Giza 92 and Giza 86, respectively. These results agree with finding of El-Mezayyen (2004). Al-Ameer *et al.* (2010) found insignificant increase of susceptible of Giza 86 genotypes to infestation of green bolls by *E. insulana* than Giza 92. And add that, the increase of concentration of gossypol in cotton is desirable in the relationship between concentration of gossypol and ratio of infestation by bollworm pests and cotton yield.

These composite relations need further study of insect ecology, biology, physiology and economic damage vision to enhance biological and chemical control methods as part of an IPM strategy as reported by Dhillon and Sharmab (2004) and Du *et al*. (2004.

Technically, it is important to make allowances for cultivation of the resistance cotton varieties in the adequate environment to reduce SBW infestation.

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ARABIC SUMMERY

دراسات بيولوجية على سلالة حقلية من دودة اللوز الشوكية تحت درجات حرارة ثابتة

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جمعت يرقات وعذارى دودة اللوز الشوكية من حقول قطن بمحافظة كفر الشيخ زرعت بأصناف جيزة 45 و جيزة 86 و جيزة87 جيزة 88 و جيزة92. وزعت اليرقات والعذاري (فرديا / صنف) فى أنابيب زجاجية نظيفة وأحكمت بسدادت من القطن المعقم وحفظت تحت الظروف الطبيعية للمعمل حتى خروج الفراشات. غذيت أزواج الفراشات على محلول سكرى 10%. تم حفظ البيض الناتج على 25◦ م حتى الفقس. تم تربية الفقس على بيئة صناعية وتمت المتابعة حتى إكتمال الجيل وذلك فى حضانات على درجات حرارة محكمة (25◦ م ، 27 ◦م ،30◦م) ورطوبة نسبية70 %-80%. تم تسجيل طول مدة طوري اليرقة والعذراء وطول عمر الحشرة الكاملة والنسبة الجنسية و فترة ما قبل وضع البيض وفترة وضع البيض وما بعد وضع البيض وعدد البيض وكذلك فترة حضانة البيض ونسبة الفقس وطول مدة الجيل ونسبة الموت فى طورى اليرقة و العذراء. وذلك لمعرفة تأثيركلا" من الحرارة و صنف القطن والتأثير المشترك لهما على النواحى البيولوجية السابق ذكرها لحشرة دودة اللوز الشوكية حتي يستفاد من ذلك فى مكافحة الحشرة.

ويمكن تلخيص أهم النتائج فيما يلي:

1- أقل فترة من فقس البيض وحتى خروج الحشرة الكاملة سجلت 28 يوم على درجة 25◦ م للحشرات التى تغذت يرقاتها على صنف القطن جيزة92 .

2- أعلى نسبة مئوية لخروج الفراشات كانت 78% عندما تتغذى اليرقات صنف القطن جيزة45.

3- النسبة النسية للفراشات كانت تقريبا 1 : 1 وتميل أكثر للإناث عند درجة 25◦ م وللذكور عند درجة 30 ◦م بينما تضاعفت نسبة الإناث عند 27◦م حال تغذى اليرقات على صنف القطن جيزة 88.

4- بشكل عام أعلى قيمة للكفاءة التناسلية سجلت عند27◦م بينما فقدت الحشرة كفاءتها تماما عند 30◦م ماعدا التى تصيب يرقاتها القطن صنف جيزة 45.

5- أطول فترة لجيل كامل من الحشرة يستغرق 50 يوم عندما تتغذى اليرقات على القطن صنف جيزة45 بينما كانت أقل فترة للجيل 39.1 يوم عندما تتغذى اليرقات على القطن صنف جيزة 87.

6- الترتيب التنازلى لمدى قابلية صنف القطن للإصابة بدودة اللوز الشوكية بناءا" على فترة الجيل و الكفاءة التناسلية كالأتى: القطن صنف جيزة 45 - جيزة 88 - جيزة 87القطن- جيزة 92 - صنف جيزة 86 .