EFFECT OF TEMPERATURE AND FOOD TYPE ON CERTAIN BIOLOGICAL ASPECTS OF *SESAMIA CRETICA* LED. (LEPIDOPTERA:NOCTUIDAE)

EL-LAKWAH, F. A.[1], A. A. DARWISH[1], E.A.H. SHERIEF[2] and EMAN M. EL-GOHARY[2]

1. Plant protection Dept., Fac. of Agric., Moshtohor, Benha univ., Egypt.
2. Plant Protection Research Institute, A.R.C., Dokki, Giza

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Abstract

This work aimed to investigate the effect of various temperatures (30, 25 and 20ºc at 65± 5% R.H. and different type of foods namely Maize (*Zea mays* L.), Sweet sorghum (*Sorghum bicolor* L.), Sugar cane (*Saccharum Spp.*) and artificial diet) on certain biological aspects of *Sesamia cretica* Led. The results showed that, temperature had a significant effect on the biology of *S. cretica.* At 25ºc the fecundity was higher, on the other hand the total deposited eggs decreased at lower temperature 20ºc compared with higher ones (25 & 30ºc). The duration of immature stages of *S. cretica* was significantly influenced by different types of food at various temperatures. Maize (*Zea mays* L.) was the most favorite type of food for *S. cretica* where as the fecundity increased and life cycle shortened compared with other types of food i.e., Sweet sorghum (*Sorghum bicolor* L.), Sugar cane (*Saccharum Spp.*) and artificial diet.

Key words: *Sesamia cretica*, biological aspects.

INTRODUCTION

Crops of family gramineous are considered of great economic importance for local consumption. Maize (*Zea Mays L.*) is the stable food for the majority of Egyptian farmer's. Maize foliage and grains are also a major constituent in cattle foods, due to its economic importance the area cultivated annually with corn reached about 2.1 million Feddan. This area is cultivated in multiple plantations throughout along period extending from March to October in order to be used as fodder plant or for seed production. Larvae of *Sesamia cretica* feed inside maize seedling causing rotten of these plants. The highest rates of infestation to maize plants by *S. cretica* occur during April followed by March and then May cultivation (El- Saadany *et. al.,* 2000). Therefore, this pest may be considered the most serious economic pest of maize as the loss in the final yield is normally proportional to the percentage of dead hearted plants. The damage caused by these pests are direct (grain destruction) and indirect (stalk lodging, scab appearance, losses at mechanical harvesting). In addition, this pest playing an important role which infested different crops such as Sorghum . So

the aim of this work was to study the effect of different temperatures (20, 25, 30 ◌c and different sources of food namely, Maize (*Zea mays* L.), Sweet sorghum (*Sorghum bicolor* L.), Sugar cane (*Saccharum Spp.*) and artificial diet on some biological aspects of *S. cretica*.

MATERIALS AND METHODS

Rearing of *Sesamia cretica*, Corn Stalk borer at different temperatures*:*

Large number of *S. cretica* larvae were collected from field of maize and confined individually in glass vials about 10×5 cm each. Each vial was provided with a piece of about 3cm long cut from the top of a fresh green maize plant as larval food. Also a piece of cotton wool was added to each vial to serve as pupation site and the vial was covered on the top by muslin cloth. Vials were cleaned and plant pieces were renewed every couple of days and as the larvae grew older, they were fed on tender cuttings of maize stems of more than days until it pupate. The vials were kept at an average temperature of 27±2°c and at 65±5%R.H. The obtained pupae were sexed and every couple was placed in plastic cup of 30×10 cm. covered on the top by muslin cloth kept in position by a rubber band for moth's emergence. Maize seedlings in one plastic pot were exposed to the emerged moths of *S. cretica* for oviposition egg that are about to hatch were collected and supplied with fresh succulent rolled leaves as suitable food supply for the hatching larvae. All vials were kept in an incubator at different temperature, 30, 25, 20 °c and 65 ±5 % R.H. This technique is followed according to Awadallah, 1974 , EL-Metwally *et. al.,* 1997 and Hafez *et. al.,* 2003. Duration of larvae, pupae, moth, adult emergence and larval development in addition to fecundity were recorded.

Rearing of *S. cretica* on different types of food:

Newly hatched larvae of *S. cretica* obtained from laboratory were reared on different source of food i.e. Maize (*Zea mays* L.), Sweet sorghum (*Sorghum bicolor* L.), Sugar cane (*Saccharum Spp.*) and Artificial diet. One larva was placed individually in the glass vials about 5×10 cm. Each vial was provided with a piece of different sources. Vials were cleaned and plant pieces were renewed with fresh one every couple of days and as the larvae grew older. For the artificial diet larvae were placed on the surface of each vial which was plugged with cotton wool. Pupae were sexed, weighted and placed individually in similar glass vials, each vial was provided with a piece of moistened cotton wool. The vials were also plugged with cotton. Each pair of newly emerged moths (male and female) was introduced into a lantern glass cage, fitted on a plastic pot of about 10 cm. in diameter containing 2 to 3 maize seedlings

for depositing eggs. All vials were kept in an incubator at 25 °c and 65 ±5 % R.H. This technique is followed according to Abul-Nasr *et. al.,* 1968, EL-Metwally *et. al.*, 1997 and Hafez *et. al.,* 2003. Duration of larvae, pupae, moth, Adult emergence and larval development in addition to fecundity were recorded. The data obtained were subjected to statistical analysis by Duncan's (1955) multiple range tests were used to determine the significance of the differences between mean values of the treatments.

RESULTS AND DISCUSSION

1. Effect of different temperatures on some biological aspects of *Sesamia cretica* fed on maize plant:

The effect of temperatures on life cycle, adult longevity and fecundity of *S. cretica* was investigated at 30, 25 and 20°c and 65±5% R.H. in the laboratory. Results given in Table (1), indicated that the larval duration was longer at 20°c and shorter at 30°c and intermediate at 25°c where its values were 28.07, 31.05 and 34.56 days for 30, 25 and 20°c, respectively. Pupal stage duration was shorter at 30°c and longer at 20°c and 25°c came in between them, there values were 9.50, 12.10 and 13.17 for 30.25.20°c, respectively. The mean pupal weight was higher at 25°c and nearly similar to that at 30°c and it was the shortest at 20c whereas their values were 234.86, 266.79 and 190.95 mg. at 30, 25 and 20°c respectively. The female life cycle duration was 43,49.61 and 56.25 days at 30,25 and 20°c , respectively and adult longevity was shorter at 20°c and it was nearly similar for 30 and 25°c where its values were 12.74, 13.50 and 11.25 days for 30, 25 and 20°c ,respectively . Fecundity was 275.22 eggs / female at 20°c lower than at 30c its value was 350.87 eggs / female and was higher at 25°c were it was 395.10 eggs/ female. The percent of adult emergence and adult development were nearly similar for 30 and 20♁c, while it was shorter at 25°c. On the other hand the life span was affected by different temperature and reached maximum value at 20♁c (67.51 days) followed by 25♁c (61.81 days) and (55.82 days) at 30♁c. The generation was completed in 44.87, 51.60 and 58.90 days for female on maize plants at 30, 25 and 20♁c, respectively, statistical analysis revealed that there are significant differences between the different temperatures and the generation periods.

Table 1. Effect of different temperatures on some biological aspects of *Sesamia cretica* Led. female reared on maize plants at 65 ±5% R.H.

Biological aspects	Temperature degree		
	30°c	25°c	20°c
Incubation period (day)	5.42±0.081c	6.46 ±0.070b	8.52±0.509a
L.S.D	0.51		
1st instars 2nd instars 3rd instars 4th instars 5th instars Larval duration (day)	2.54 ±0.060 3.37 ±0.000 4.42 ±0.094 5.33 ±0.098 12.41 ±0.000 28.07 ±0.153c	2.95 ±0.167 3.75 ±0.053 4.80 ±0.000 5.80±0.140 13.75 ±0.310 31.05±0.070b	3.62±0.457 4.82±0.310 5.65±0.538 5.80±0.070 14.67±0.457 34.56±0.395a
L.S.D	0.73		
Pupal stage duration (day)	9.5 ±0.053c	12.10±0.509b	13.17±0.310a
L.S.D	0.64		
Pupal weight (mg)	234.86 ±0.125a (185.96-260.18)	266.79±0.070b (246.12-286.71)	190.95 ±0.509c (175.13-204.11)
L.S.D	19.79		
Life cycle (day)	43 ±0.162c	49.61±0.310b	56.25±0.457a
L.S.D	0.98		
Generation (day)	44.87±0.102c	51.60±0.538b	58.90±0.310a
L.S.D	1.26		
Preoviposition Oviposition Postoviposition Adult longevity (day)	1.87±0.235 10.04±0.509 0.83±0.105 12.74±0.346b	2.40±0.245 10.50±0.576 0.60±0.136 13.50±0.346a	2.65±0.236 8.26±0.456 0.34±0.245 11.25±0.509c
L.S.D	0.70		
Fecundity	350.87±0.198b	395.10±0.310a	275.22±0.457c
L.S.D	38.65		
Adult emergence % % Adult Female	87.50 37.50a	82.76 34.48b	85.48 37.09a
L.S.D	1.99		
Adult development%	34.28a	28.57b	32.86a
L.S.D	1.40		
Life span (day)	55.82±0.572c	61.81±0.509b	67.51±0.310a
L.S.D	1.86		

± Standard Error

Means in rows followed by the same letter are not significantly different at p=5% according to Duncan's multiple range test (Duncan, 1955).

The adult male emerged from pupal stage earlier than female and mated it. Data in Table (2) show the effect of different temperatures on some biological aspects of *S. cretica* male. The egg hatched after an average of (5.32, 6.26 and 8.42) days for males at different temperature of 30, 25 and 20°c, respectively, with significant differences between the values obtained the different temperatures.

Table 2. Effect of different temperatures on some biological aspects of *Sesamia cretica* Led. male reared on maize plants at 65 ± 5% R.H.

Biological aspects	Temperature degree		
	30°c	25°c	20°c
Incubation period (day)	5.32±0.457c	6.26±0.088b	8.42±0.060a
L.S.D	0.68		
1st instars	2.34±0.088	2.64±0.028	3.43±0.133
2nd instars	3.06±0.396	3.46±0.138	4.53±0.060
3rd instars	4.13±0.133	4.39±0.088	5.43±0.028
4th instars	5.12±0.138	5.50±0.396	5.60±0.396
5th instars	12.21±0.060	13.32±0.088	14.53±0.088
Larval duration (day)	26.96±0.134c	29.31±0.145b	33.52±0.138a
L.S.D	1.60		
Pupal stage duration (day)	9.12±0.029c	11.21±0.028b	12.70±0.457a
L.S.D	1.03		
Pupal weight (mg)	193.86±0.396a (177.20-205.21)	174.35±0.060b (165.22-186.11)	173.62±0.133b (160.25-190.22)
L.S.D	13.08		
Life cycle (day)	41.40±0.457c	46.78±0.088b	54.64±0.060a
L.S.D	0.94		
Longevity (day)	10.75±0.457b	11.25±0.138a	8.43±0.088c
L.S.D	0.91		
Adult emergence %	87.50	82.76	85.48
% Adult Male	50a	48.28b	48.39b
L.S.D	1.19		
Adult development%	45.71a	40b	42.86b
L.S.D	1.48		
Life span (day)	52.25±0.138c	58.21±0.025b	62.55±0.457a
L.S.D	4.05		

± Standard Error

Means in rows followed by the same letter are not significantly different at p=5% according to Duncan's multiple range test (Duncan, 1955).

Larval duration was longer at 20 ◌c and shorter at 30 ◌c and intermediate at 25◌ c whereas its values were 26.96, and 29.31 and 33.52 days for 30, 25 and 20 ◌c, respectively. For life cycle values were 41.40, 46.78 and 54.64 days at the previous same range of temperature. The adult longevity decreased at lower temperature compared with higher temperature (8.43 and 10.75 days). On the other hand the life span durations were increased at 20 ºc .Their values were 62.55, 58.21 and 52.25 at 20, 25, and 30◌ c respectively. Statistical analysis revealed highly significant differences between life span durations at different temperatures for female and male. The mean pupal weight was greater at 30 ◌c and nearly similar at 25 and 20◌c whereas its values were 193.86, 174.35 and 147.35 mg at 30, 25, and 20 ◌c respectively. Adult life span was longer at 20ºc and shorter at 30ºc and 20ºc came in between. The corresponding values were 52.25, 58.21 and 62.55 days at 30, 25 and 20ºc respectively. Statistical analysis revealed no significant differences between temperatures and the percent of adult emergence and adult development because values were nearly similar.

2. Effect of different types of food on some biological aspects of *S. cretic*:

The corn stem borer, *S. cretica* successfully completed its development on the four tested foods at 25°c and 65±5% R.H.

Data in Table (3) indicated that the duration of immature stages and mature stages of *S. cretica* were significantly and insignificantly influenced by various type foods. These values were (49.61, 55.11, 57.22 and 62.10 days) for life cycle of *S. cretica* when fed on *Zea mays*, *Shorghum bicolor*, *Sugar cane* and artificial diet, respectively. The results showed clearly that maize was the most suitable food for rearing *S. cretica*. Pupal weight was higher on maize followed by *Sorghum bicolor, Sugar cane* and artificial diet and it was significantly influenced by the different sources of food where reached to highly weight (266.79 mg) for which reared on *Zea mays* followed by *Sorghum bicolor* 202.74 mg , artificial diet 194.15 mg and *Sugar cane* 191.90 mg. The total deposited eggs for female are different among source of food. On maize fecundity were highly 395.10 eggs / female compared with different sources. The generation was completed in (51.60, 57.62, 61.32 and 63.05 days) for female on *Zea mays*, *Sorghum bicolor*, *Sugar cane* and artificial diet, respectively, statistical analysis revealed that there are significant differences between the different sources of food. On the other hand the life span durations were increased on artificial diet 71.38 day followed by, *Sugar cane* 67.47, *Sorghum bicolor* 66.65 and 63.11 day on *Zea mays*. Statistical analysis revealed highly significant between the different sources of food. The obtained results not agree with those of Ranjbar-e-Agbdam (2002) who reared *S. Cretica* on two semi artificial and three natural diets (Sorghum, Maize and Sugarcane stems) for rearing under laboratory

conditions. In vivo rearing of *S. Cretica* had no success on semi artificial diets, while on maize were more successfully than sorghum. Food quality had no effect on the adult fertility of *S. Cretica* but it moth laid more eggs on maize than sorghum.

Table 3. Effect of different of foods on some biological aspects of *Sesamia cretica* Led. female at 25^0c and 65 ±5 %R.H.

Biological aspects	Food Type			
	Zea mays	*Sorghum bicolor*	*Sugar cane*	Artificial diet
Incubation period (day)	6.46±0.070b	6.56±0.368b	7.64±0.285b	8.89±0.245a
L.S.D	0.74			
1st instars	2.95 ±0.167	2.85±0.121	2.80±0.106	3.72±0.145
2nd instars	3.75 ±0.053	4.90±0.145	4.95±0.165	5.88±0.156
3rd instars	4.80 ±0.000	5.15±0.189	5.15±0.195	7.05±0.365
4th instars	5.80±0.140	7.12±0.244	7.30±0.125	7.61±0.154
5th instars	13.75 ±0.310	15.62±0.156	17.25±0.145	19.07±0.252
Larval duration (day)	31.05±0.070b	35.64±0.234b	37.45±0.243a	43.33±0.265a
L.S.D	5.93			
Pupal stage duration (day)	12.10±0.509a	12.91±0.159a	12.13±0.368a	9.88±0.189a
L.S.D	2.54			
Pupal weight (mg)	266.79±0.070a (246.12-286.71)	202.74±0.244b (196.15-214.12)	191.90±0.524b (170.35-210.25)	194.15±0.544b (186.22-210.11)
L.S.D	30.85			
Life cycle (day)	49.61±0.310b	55.11±0.236a	57.22±0.239a	62.10±0.145a
L.S.D	8.97			
Generation (day)	51.60±0.538b	57.62±0.185a	61.32±0.125a	63.05±0.368a
L.S.D	5.74			
Preoviposition	2.40±0.245	2.81±0.256	3.10±0.265	3.40±0.253
Oviposition	10.50±0.576	8.18±0.456	5.90±0.244	5.66±0.236
Postoviposition	0.60±0.136	0.55±0.236	1.25±0.256	0.22±0.252
Adult longevity (day)	13.50±0.346a	11.54±0.245b	10.25±0.156b	9.28±0.025b
L.S.D	1.81			
Fecundity (day)	395.10±0.310a	326.79±0.562b	284.65±0.542c	209.16±0.189d
L.S.D	20.34			
Adult emergence %	82.76	78.79	77.18	60
% Adult Female	34.48b	50a	35.08b	35.38b
L.S.D	6.90			
Adult development%	28.57b	47.14a	28.57b	32.86b
L.S.D	6.46			
Life span (day)	63.11±0.509b	66.65±0.236a	67.47±0.368a	71.38±0.185a
L.S.D	7.42			

± Standard Error

Means in rows followed by the same letter are not significantly different at p=5% according to Duncan's multiple range test (Duncan, 1955).

Data in Table (4) show the effects on some biological aspects of *S. cretica* male. The egg hatched after an average of (6.26, 6.36, 6.50 and 7.09) days for males with no significant differences between the different sources of food *Zea mays*, *Sorghum bicolor*, *Sugar cane* and artificial diet, respectively. Larval stage duration was longer on artificial diet and it was shorter on *Zea mays* where its values were 29.31, 31.26, 32.33 and 41.36 days for *Zea mays*, *Sorghum bicolor*, *Sugar cane* and artificial diet, respectively, while life cycle was longer on artificial diet and shorter on *Zea mays* where its values were 46.78, 49.56, 52.53 and 57.09 days, at the previous same range of sources.

Table 4. Effect of different foods on some biological aspects of *Sesamia cretica* Led. male at 25◌c and 65±5 % R.H

Biological aspects	Food Type			
	Zea mays	*Sorghum bicolor*	*Sugar cane*	Artificial diet
Incubation period (day)	6.26±0.088a	6.36±0.245a	6.50±0.325a	7.09±0.320a
L.S.D	1.08			
1st instars	2.64±0.028	2.78±0.244	2.42±0.212	3.36±0.245
2nd instars	3.46±0.138	4.73±0.239	4.87±0.245	5.36±0.236
3rd instars	4.39±0.088	4.84±0.345	5±0.248	6.50±0.346
4th instars	5.50±0.396	6.37±0.254	5.25±0.225	7.50±0.244
5th instars	13.32±0.088	12.54±0.346	14.79±0.369	18.64±0.326
Larval duration (day)	29.31±0.145b	31.26±0.401b	32.33±0.425b	41.36±0.456a
L.S.D	2.68			
Pupal stage duration (day)	11.21±0.028b	11.94±0.245b	13.70±0.257a	8.64±0.251c
L.S.D	1.72			
Pupal weight (mg)	209.16±0.060b (177.22-213.11)	174.35±0.267c (165.22-186.11)	158.09±0.249d (145.15-172.20)	182.83±0.312b (167.31-190.22)
L.S.D	7.91			
Life cycle (day)	46.78±0.088c	49.56±0.346c	52.53±0.345b	57.09±0.239a
L.S.D	2.99			
Adult longevity (day)	11.25±0.138a	10.79±0.246a	9.29±0.216b	8.42±0.207c
L.S.D	1.08			
Adult emergence %	82.76	78.79	77.18	60
% Adult male	48.28a	28.79c	42.10b	24.62d
L.S.D	3.29			
Adult development%	40a	27.14c	34.28b	22.86d
L.S.D	4.23			
Life span (day)	58.21±0.025b	60.35±0.289b	62.45±0.218b	72.27±0.244a
L.S.D	5.21			

± Standard Error

Means in rows followed by the same letter are not significantly different at p=5% according to Duncan's multiple range test (Duncan, 1955).

The adult longevity was shorter on artificial diet and longer on *Zea mays* where its values were 11.25, 10.79, 9.92 and 8.42 days at the previous same range of sourses. on the other hand the life span durations were longer on artificial diet and shorter on *Zea mays* and *Sorghum bicolor* where its values were 58.21, 60.35,60, 62.45 and 72.27 days for *Zea mays*, *Sorghum bicolor*, *Sugar cane* and artificial diet, respectively. Statistical analysis revealed highly significant between the different sources for female and male. The mean pupal weights were 209.16, 174.35, 158.09 and 182.83 mg for *Zea mays*, *Sorghum bicolor*, *Sugar cane* and artificial diet, respectively. Statistical analysis revealed low significant differences between the different sources and the percent of adult emergence and adult development because it was nearly similar. This results refers to the importance of using artificial diet when we want to make ahuge rearing of this pest for different studies compare with rearing on fresh food which need to renew daily.

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تأثير درجة الحرارة ونوع الغذاء على بعض المظاهر البيولوجية لدودة القصب الكبرى

Sesamia creticae **Led. (Lepidoptera: Noctuidae)**

فارس أمين محمد اللقوه[1] , أحمد عبدالغفار درويش[1] , السيد على حسن شريف[2] , إيمان مصطفى الجوهرى[2]

1. قسم وقايه النبات – كليه الزراعه بمشتهر – جامعه بنها

2. مركز البحوث الزراعيه – معهد بحوث وقايه النباتات – الدقى – الجيزه

يهدف هذا البحث الى توضيح تاثير درجة الحرارة ونوع الغذاء على بعض المظاهر البيولوجية لدودة القصب الكبرى للاستفاده منها فى برنامج IPM لهذه الافه والتى تعتبر من اهم الثاقبات التى تصيب محصول الذرة الشامية و بينت نتائج هذه الدراسه مايلى:

كان لدرجة الحرارة تاثير معنوى على دورة حياة دودة القصب الكبرى بالأضافة الى مدة معيشتها وخصوبتها وذلك عند تغذيتها على درجات حرارة مختلفة حيث بلغت دورة حياة هذة الأفة (43 ,49.61 ,56.25) يوم وذلك بتربيتها على نباتات الذرة الشامية على درجات حرارة مختلفه هى 20,25,30 درجة مئوية على التوالى ورطوبه نسبيه مقدارهاحوالى 65% وكان لدرجة الحرارة المنخفضة تاثيرا معنويا فعال حيث أدت الى تقليل خصوبة الأناث بمقارنتها بدرجات الحرارة العالية حيث بلغت كمية البيض الموضوعة لكل انثى (350.87,395.10,275.22 بيضة / أنثى) وذلك على درجات حرارة 30,25,20 درجة مئوية ويتضح من ذلك أن درجة الحرارة المثلى لوضع البيض هى 25 درجة مئوية وكان للأختلاف فى درجات الحرارة تاثير معنوى على دورة حياتها ولكن كان له تاثير ضعيف على مدة معيشتها بينما كان هذا التاثير معنوى جدا على مدة طول العمر حيث بلغت أقصاها عند درجة حرارة 20درجة مئوية (62.55 يوم) بينما قصرت هذة المدة بزيادة درجة الحرارة فكانت 52.25 على درجة حرارة 30 درجة مئوية. وعند تربية هذة الأفة على عوائل مختلفة وهى الذرة الشامية و السورجم والقصب بالاضافة الى تربيتها على بيئة صناعية وذلك على درجة حرارة ٢٥درجة مئوية ورطوبه نسبيه مقدارها 65% وزادت معدلات وضع البيض للأناث وذلك عند التغذية على العوائل سابقة الذكربمقارنتها بالبيئة الصناعية كما زادت مدة الوصول الى الطور البالغ أما بالنسبة لوزن العذارى فكان نبات الذرة الشامية أفضل هذة العوائل المرباه عليها حيث بلغت كمية البيض الموضوعة للانثى 399.10 بيضه يليه السورجم وقصب السكر ثم البيئة الصناعيه حيث كانت كمية البيض التى وضعتها الانثى هى 326.79 و284.65 و209.16 بيضه على التوالى.