Life cycle and fecundity of *Spodoptera exigua* (Lep.: Noctuidae) on five soybean varieties

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Abstract

Effect of five soybean varieties (Sahar, JK, BP, Williams and L17) on life cycle and fecundity of the beet armyworm, *Spodoptera exigua* (Hübner) was evaluated at temperature of 25 ± 1°C, 60 ± 5% R.H. and a photoperiod of 16: 8 (L: D) h. The preimaginal development period of males and females was longest on L17 (30.17 ± 0.28 and 29.63 ± 0.23 days) and shortest on BP and Sahar. The adult longevity of males and females was longest on Williams (13.86 ± 1.14 and 20.20 ± 1.12 days) and shortest on Sahar (9.36 ± 0.59 and 12.75 ± 0.69 days), respectively. The life span was longest on L17 (44.86 ± 0.85 days) and shortest on Sahar (39.00 ± 0.50 days). The highest percentage of egg and larval mortality was observed on L17 (73.48 and 39.35%, respectively), but the highest percentage of pupal mortality was on Sahar (12.50%). The lowest percentage mortality of egg (57.96%) and larval (10.81%) stages was obtained on Williams. The pupal weight of females was heaviest on Sahar (88.10 ± 3.01 mg) and lightest on BP (73.00 ± 4.18 mg) compared to the other varieties. The highest number of eggs laid per female per day was 58.19 ± 4.53 on L17 and the lowest number of eggs was 37.91 ± 3.01 on BP. The results showed that total number of eggs laid per female was highest on Williams (569.50 ± 29.8 eggs) and lowest on Sahar (448.90 ± 19.5 eggs). Knowledge of the biology of *S. exigua* on soybean varieties can aid us to detect and monitor the pest infestation, variety selection and crop breeding.

Key words: life cycle, development period, *Spodoptera exigua*, fecundity, soybean

چکیده

چرخه‌ی زندگی و باروری کرم برگ‌خوار چغندرقند، *Spodoptera exigua* (Hübner)، روی پنج رقم سویا در شرایط آزمایشگاهی در دمای ۱ ± ۲۵ درجه‌ی سیلسیوس و رطوبت نسبی ۵ ± ۶۰٪ و دوره‌ی نوری ۱۶ ساعت روشنایی و ۸ ساعت تاریکی مورد بررسی قرار گرفت. طولانی‌ترین دوره‌ی رشد قبل از بلوغ در نرها و ماده‌ها روی رقم L17 (۰/۲۸ ± ۳۰/۱۷ و۰/۲۳ ± ۲۹/۶۳) مشاهده شد. همچنین، کوتاه‌ترین طول دوره‌ی رشد قبل از بلوغ نر و ماده به‌ترتیب مربوط بـه رقـم BP و سحر بود. طولانی‌ترین و کوتاه‌ترین طول عمر حشرات کامل نر به‌ترتیب روی رقم Williams (۱/۱۴ ± ۱۳/۸۶ روز) و سحر (۰/۵۹ ± ۹/۳۶ روز)، و حشرات کامل ماده به‌ترتیب روی رقم Williams (۱/۱۲ ± ۲۰/۲۰ روز) و سحر (۰/۶۹ ± ۱۲/۷۵ روز) مشاهده شد. طولانی‌ترین و کوتاه‌ترین دوره‌ی زندگی کرم برگ‌خوار چغندرقند به‌ترتیب روی رقم L17 (۰/۸۵ ± ۴۴/۸۶ روز) و سحر (۰/۵ ± ۳۹/۰۰ روز) بود. بالاترین درصد مرگ و میر مرحله‌ی تخم و لارو (به‌ترتیب ۷۳/۴۸ و ۳۹/۳۵ درصد) در رقم L17 و بیشترین درصد مرگ و میر شفیره (۱۲/۵۰ درصد) در رقم سحر مشاهده شد. همچنین، کم‌ترین درصد مـرگ و میـر مرحله‌ی تخم و لارو (به‌ترتیب ۵۷/۹۶ و ۱۰/۸۱ درصد) در رقم Williams به‌دست آمد. حداکثر و حداقل وزن شـفیره‌هـای ماده مربوط به رقم سحر (۳/۰۱ ± ۸۸/۱۰ میلی‌گرم) و BP (۴/۱۸ ± ۷۳/۰۰ میلی‌گرم) بود. بیشترین تعداد تخم گذاشته‌شده در هر روز توسط هر فرد ماده ۴/۵۳ ± ۵۸/۱۹ عدد در رقم L17 و کم‌ترین آن ۳/۰۱ ± ۳۷/۹۱ عدد در رقـم BP مـشاهده شـد. نتایج به‌دست آمده نشان داد که حداکثر تعداد تخم گذاشته‌شده توسط هر فرد ماده در طول عمر، ۲۹/۸ ± ۵۶۹/۵۰ عدد در رقم Williams و حداقل آن ۱۹/۵ ± ۴۴۸/۹۰ عدد در رقم سحر می‌باشد. آگاهی از زیست‌شناسی *S. exigua* روی ارقام مختلف سویا در تشخیص و ردیابی آفت، انتخاب و اصلاح ارقام به ما کمک می‌کند.

واژگان کلیدی: چرخه‌ی زندگی، طول دوره‌ی رشد، *Spodoptera exigua*، باروری، سویا

Introduction

Soybean, *Glycine max* (L.) Merrill, is a high cash crop and plays an important role in socio-economic well being of the people, commercially produced in Golestan, Mazanedaran and Moghan regions of Iran (Naseri *et al.*, 2009). The beet armyworm, *Spodoptera exigua* (Hübner) is a pest of economically important crops including soybean in Iran (Mojtahedi, 1979) and many parts of the world (Abdullah *et al.*, 2000; Idris & Emelia, 2001). Chemical control is being used to overcome the outbreak of the beet armyworm. However, it was reported that *S. exigua* have developed resistant to almost all insecticides used against it (Huffman *et al.*, 1996). Resistance and residue problem with conventional insecticides have caused researchers to identify alternative ways to chemical control. Stability of plants for growth and development of phytophagous insects is an important factor for the establishment of a pest population on a crop plant. The physical and volatile signals emanating from plant lure the insect on its surface whereas chemical and nutritional factors of the food substrate determine consumption, development and survival in the larval stages and egg production in adult stage (Singh & Mullick 1997; Naseri *et al.*, 2009). Study of the effect of different host plants on the biology of insects is an important strategy in understanding host plant suitability for insects (Azidah & Sofian-Azirun, 2006). Host plant resistance is an important tool of pest management that is not detrimental to the environment and it also reduces expenses for growers (Kennedy *et al.*, 1987). Identification of host plant resistance mechanisms can enable proper selection of resistant genotypes that can be used in plants breeding programs (Kranthi *et al.*, 2002). Effect of different host plants on life history of *S. exigua* has been studied at laboratory conditions by Azidah & Sofian-Azirun (2006). They reported that the long bean, *Vigna unguiculata* L., was found to be the most suitable for the growth and development of *S. exigua*. Idris & Emelia (2001) studied the development and feeding behaviour of *S. exigua* on different food plants including chilli (*Capsicum annum*), tomato (*Lycopersicon esculentum*), okra (*Abelmoschus esculentus*), onion (*Allium aflatunense*) and brinjal (*Solanum melongena*). They reported that the development period was shorter for larvae fed on onion and okra compared to the other host plants. Antibiotic effect of insect resistant soybean on common cutworm, *Spodoptera litura* Fabricius (Lep.: Noctuidae) and its inheritance was studied by Komatsu *et al.* (2004), who suggested that a cultivar named Himeshirazu depressed the weights of individual common cutworm larvae and prolonged the duration of the larval stages.

This research was aimed to investigate the effect of five soybean varieties on the life cycle and fecundity of *S. exigua*. The information derived from this study would help us to develop a comprehensive pest management program for soybean.

Materials and methods

Source of plants and the insect

Seeds of five soybean varieties including Sahar, JK, BP, Williams and L17 were obtained from the Seed and Plant Improvement Research Institute (Karaj, Iran) and were planted in suitable soil and compost mixture in 20 cm diameter plastic pots. The leaves of different soybean varieties were transferred to a growth chamber at 25 ± 1°C, 60 ± 5% R.H. and a photoperiod of 16: 8 (L: D) h and used for feeding of larval stages. The beet armyworm specimens were originally collected from sugar beet fields in Ghafar Behi village in Azarbaijan-e Gharbi province. The beet armyworm populations were reared on different soybean varieties for one generation in a growth chamber under given conditions before they were used in the experiments.

Experiments

Adult moths emerged from the larvae, which had already been reared for one generation on the examined soybean varieties were used in the experiments. In order to obtain the eggs of the beet armyworm, 20-25 pairs of female and male moths were kept inside oviposition Plexiglas container (14 cm diameter, 19 cm height), which were closed at the top with a fine mesh net. A piece of wax paper was inserted in the container on which the females lay their eggs. After 12 h, the laid eggs were collected from the container and were used in the experiments. The number of 219, 200, 225, 176 and 230 eggs of *S. exigua* were used to collect data on Sahar, JK, BP, Williams and L17 soybean varieties, respectively. The eggs were checked daily and their incubation periods were recorded. Newly hatched larvae were kept individually in plastic dishes (8.5 cm diameter, 3 cm height) with a hole covered with a fine mesh net for ventilation, containing the fresh leaves of different plants tested. The petioles of detached leaves were inserted in water-soaked cotton wool to maintain freshness. A fine camel's hair brush was used for transferring younger larvae to the Petri dishes. Fresh food material was provided as required, and observations were recorded daily for the mortality/survival of larvae in the same instar or moulting in next instar through pupation and adult emergence. Head capsule width or exuviae from moulting were used to discriminate the larval instars. Sixth instar larvae were kept in plastic containers (3 cm diameter, 5 cm height) for pre-pupation and pupation. Larval, pre-pupal and pupal periods and their mortality were recorded on different soybean varieties. After emerging of adults, a pair of female and male moths (with 19-25 replications) were transferred into each transparent plastic container (11 cm diameter, 12 cm height), which was closed at the top with a fine mesh net for ventilation. A small cotton wick soaked in 10% honey solution was placed in the oviposition containers to provide a source of carbohydrate for adult feeding. Pre-oviposition, oviposition and post-oviposition periods, daily fecundity (eggs/female/day) and total fecundity (eggs per female, during adult life time) and adult longevity were recorded until the death of last female in the cohort.

Statistical analysis

The data resulted from the effects of different soybean varieties on development period, oviposition period, fecundity, adult longevity and pupal weight of beet armyworm were subjected to the one-way analysis of variance (ANOVA) using the statistical software Minitab 14 (MINITAB, 2000). The means associated with the host plant for each variable were compared using the Student-Newman-Keuls (SNK) test at $\alpha = 0.05$ when significant values were obtained. Factorial analysis of variance were attributed to determine interactions between sex × variety × biological parameters of *S.exigua.* The mortality rate of different life stages of *S. exigua* on soybean cultivars were compared with proportions test using Minitab ver. 14 software (MINITAB, 2000).

Results

Development period and adult longevity

The results of the development period and adult longevity of *S. exigua* reared on different soybean varieties are given in table 1. Egg incubation period was not affected by various soybean varieties. However, there were significant differences in larval period ($F = 6.872$; df = 4, 231; $P < 0.01$), pupal period ($F = 11.474$; df = 4, 234; $P < 0.01$), development period ($F = 16.377$; df = 4, 230; $P < 0.01$), adult longevity ($F = 7.994$; df = 4, 227; $P < 0.01$) and life span of *S. exigua* among the soybean varieties ($F = 7.896$; df = 4, 235; $P < 0.01$). The larval and pupal periods, development period and total life span (male and female) were longest on L17 (table 1). However, the shortest development period of the beet armyworm males and females was on BP and Sahar, respectively. The adult longevity of *S. exigua* males was longest when the larvae reared on Williams (13.86 ± 1.14 days) and shortest on Sahar (9.36 ± 0.59 days) variety. Female longevity of *S. exigua* was significant difference on five soybean varieties (F = 6.036; df = 4, 116; $P < 0.01$), which was shortest when the larvae reared on Sahar (12.75 ± 0.69 days) and longest on Williams variety (20.20 ± 1.12days) (table 1). The life span of the beet armyworm was longest on L17 (44.87 ± 0.85 days) and shortest on Sahar variety (39.00 ± 0.50 days).

Table 1. Development period and adult longevity (mean ± SE) of *S. exigua* on different soybean varieties.

Biological parameter (Days)	Soybean varieties (Mean ± SE)				
	Jk	**Sahar**	**L17**	**Williams**	**BP**
Incubation period	3.00 ± 0.00 [a] (n = 74)	3.00 ± 0.00 [a] (n = 68)	3.00 ± 0.00 [a] (n = 61)	3.00 ± 0.00 [a] (n = 74)	3.00 ± 0.00 [a] (n = 66)
Larval period:					
Male	17.37 ± 0.27 [a] (n = 24)	17.14 ± 0.32 [a] (n = 22)	18.22 ± 0.41 [a] (n = 18)	17.07 ± 0.24 [a] (n = 28)	15.73 ± 0.40 [b] (n = 22)
Female	17.44 ± 0.33 [ab] (n = 25)	16.74 ± 0.17 [b] (n = 19)	18.26 ± 0.26 [a] (n = 19)	16.59 ± 0.24 [b] (n = 37)	17.54 ± 0.48 [ab] (n = 22)
Pupal period:					
Male	7.75 ± 0.14 [c] (n = 24)	8.77 ± 0.11 [a] (n = 22)	8.94 ± 0.21 [a] (n = 18)	8.17 ± 0.10 [b] (n = 29)	8.34 ± 0.12 [b] (n = 23)
Female	7.28 ± 0.11 [b] (n = 25)	7.10 ± 0.07 [b] (n = 20)	8.32 ± 0.20 [a] (n = 19)	7.24 ± 0.10 [b] (n = 37)	7.04 ± 0.17 [b] (n = 22)
Pre-imaginal development period:					
Male	28.12 ± 0.35 [b] (n = 24)	28.91 ± 0.33 [b] (n = 22)	30.17 ± 0.28 [a] (n = 18)	28.22 ± 0.27 [b] (n = 27)	26.91 ± 0.38 [c] (n = 23)
Female	27.72 ± 0.30 [b] (n = 25)	26.84 ± 0.16 [b] (n = 19)	29.63 ± 0.23 [a] (n = 19)	26.86 ± 0.23 [b] (n = 37)	27.59 ± 0.52 [b] (n = 22)
Adult longevity:					
Male	12.37 ± 0.87 [ab] (n = 24)	9.36 ± 0.59 [b] (n = 22)	13.06 ± 1.19 [ab] (n = 18)	13.86 ± 1.14 [a] (n = 29)	12.48 ± 1.01 [ab] (n = 23)
Female	14.84 ± 1.25 [bc] (n = 25)	12.75 ± 0.69 [c] (n = 20)	16.68 ± 1.30 [abc] (n = 19)	20.20 ± 1.12 [a] (n = 37)	17.68 ± 1.39 [ab] (n = 22)
Life span:					
Male	40.50 ± 0.91 [ab] (n = 24)	38.27 ± 0.68 [b] (n = 22)	43.33 ± 1.05 [a] (n = 18)	42.90 ± 1.35 [a] (n = 29)	39.96 ± 1.21 [ab] (n = 23)
Female	42.56 ± 1.20 [ab] (n = 25)	39.80 ± 0.70 [b] (n = 20)	46.32 ± 1.27 [a] (n = 19)	46.17 ± 1.24 [a] (n = 37)	45.73 ± 1.49 [a] (n = 22)
Pre-oviposition period	3.13 ± 0.24 [b] (n = 25)	3.65 ± 0.20 [ab] (n = 20)	4.42 ± 0.27 [a] (n = 19)	4.20 ± 0.22 [a] (n = 25)	4.32 ± 0.28 [a] (n = 22)
Oviposition period	9.27 ± 0.75 [ab] (n = 25)	7.05 ± 0.59 [c] (n = 20)	8.58 ± 0.45 [bc] (n = 19)	10.60 ± 0.49 [ab] (n = 25)	11.14 ± 0.82 [a] (n = 22)
Post-oviposition period	2.09 ± 0.46 [b] (n = 25)	1.40 ± 0.29 [b] (n = 20)	3.74 ± 0.91 [ab] (n = 19)	6.32 ± 0.95 [a] (n = 25)	6.27 ± 1.00 [a] (n = 22)

The means followed by different letters in the same rows are significantly different ($P < 0.05$, SNK).

Perecentage of mortality

Percentage of mortality of *S. exigua* on different soybean varieties are shown in fig. 1. The highest and lowest percentage of egg and larval mortality was observed on L17 (73.48 and 39.35%, respectively) and Williams variety (57.96 and 10.81%, respectively). There was significant difference between egg mortality of *S. exigua* on L17 and Williams varieties ($P < 0.01$), and between Williams and BP varieties ($P < 0.01$). The larval mortality was significantly different on Williams in comparison to Sahar, JK and L17 varieties ($P < 0.01$). The highest percentage of pupal mortality was on Sahar variety (12.50%). No pupal mortality was observed on L17 and Williams varieties. There was significant difference in the pupal mortality of *S. exigua* on Sahar in comparison to Wiliams and L17 ($P < 0.01$); although, pupal period was not significantly different on other varieties.

Factorial analysis of variance showed that larval period, pupal period, pre-imaginal developmental period, adult longevity and life span were significantly differed on soybean varieties. All above biological parameters (except larval period) were also significantly different in males and females (sex). The interactions between sex and variety were significant for larval, pupal and pre-imaginal development periods while the interactions between sex and variety were not significant for adult longevity and life span (table 2).

Pupal weight and fecundity

Pupal weight and fecundity of *S. exigua* on various soybean cultivars are given in table 3. The pupal weight of *S. exigua* males was not significant difference on soybean varieties, but female's pupal weight was significantly affected by soybean varieties (F = 4.519; df = 4, 104; $P < 0.01$). The pupal weight of beet armyworm females was the heaviest on Sahar (88.10 ± 3.01 mg) and lightest on BP (73.00 ± 4.18 mg) compared to the other varieties. The fecundity (eggs laid per day and total eggs laid per female) were significantly different on five soybean varieties ($P < 0.01$). The highest number of eggs laid per day was 58.19 ± 4.53 on L17 and the lowest number of eggs was 37.91 ± 3.01 on BP. Different soybean varieties as larval food significantly affected the total number of eggs per female (F = 3.337; df = 4, 88; $P < 0.05$). The results showed that total number of eggs laid per female was highest on Williams variety (569.50 ± 29.8 eggs per female) and lowest on Sahar variety (448.90 ± 19.5 eggs per female) (table 3).

The soybean varieties were significantly affacted the pre-oviposition (F = 4.483; df = 4, 103; $P < 0.01$), oviposition (F = 6.388; df = 4, 103; $P < 0.01$) and post-oviposition (F = 8.476;

df = 4, 103; $P < 0.01$) periods of *S. exigua*. The pre-oviposition period was longest on L17 (4.42 ± 0.27 days) and the shortest on Jk (3.13 ± 0.24 days) and Sahar (3.65 ± 0.20 days) varieties. The oviposition and post-oviposition periods were longest on BP (11.14 ± 0.82) and Williams (6.32 ± 0.95) varieties, respectively and both of these parameters were shortest on Sahar variety (table 1).

Table 2. The effect of soybean varieties and sexes on biological parameters of *S. exigua*.

Biological parameters	Source of variation	df	Sum of squares	Mean squares	F value	*P* value
Larval period	Variety	4	78.109	19.527	8.73	0.0001
	Sex	1	2.532	2.532	1.13	0.288
	Variety × Sex	4	26.445	6.611	2.96	0.021
Pupal period	Variety	4	30.683	7.671	18.81	0.0001
	Sex	1	57.439	57.493	140.87	0.0001
	Variety × Sex	4	10.558	2.639	6.47	0.0001
Pre-imaginal development period	Variety	4	169.110	42.277	17.58	0.0001
	Sex	1	32.149	32.149	13.36	0.0003
	Variety × Sex	4	45.039	11.260	4.68	0.001
Adult longevity	Variety	4	961.754	240.438	8.22	0.0001
	Sex	1	1010.538	1010.538	34.54	0.0001
	Variety × Sex	4	128.885	32.221	1.10	0.357
Life span	Variety	4	1014.721	253.680	7.35	0.0001
	Sex	1	558.920	558.920	16.19	0.0001
	Variety × Sex	4	119.837	29.959	0.87	0.484

Table 3. Pupal weight and fecundity (mean ± SE) of *S. exigua* on different soybean varieties.

Soybean varieties	Pupal weight (mg)		Fecundity	
	Male	Female	Eggs/day	Eggs/female
JK	75.56 ± 1.96 [a] (n = 24)	75.73 ± 3.74 [ab] (n = 25)	52.59 ± 3.51 [b] (n = 25)	458.3 ± 28.9 [ab] (n = 25)
Sahar	73.91 ± 3.11 [a] (n = 22)	88.10 ± 3.01 [a] (n = 20)	57.88 ± 5.23 [b] (n = 20)	448.9 ± 19.5 [b] (n = 20)
L17	74.44 ± 3.48 [a] (n = 18)	78.37 ± 1.98 [ab] (n = 19)	58.19 ± 4.53 [b] (n = 19)	552.2 ± 34.6 [ab] (n = 19)
Williams	73.09 ± 2.79 [a] (n = 29)	87.81 ± 2.97 [a] (n = 37)	57.39 ± 3.49 [b] (n = 25)	569.5 ± 29.8 [a] (n = 25)
BP	72.33 ± 3.05 [a] (n = 23)	73.00 ± 4.18 [c] (n = 22)	37.91 ± 3.01 [a] (n = 22)	481.6 ± 30.5 [ab] (n = 22)

The means followed by different letters in the same columns are significantly different ($P < 0.05$, SNK).

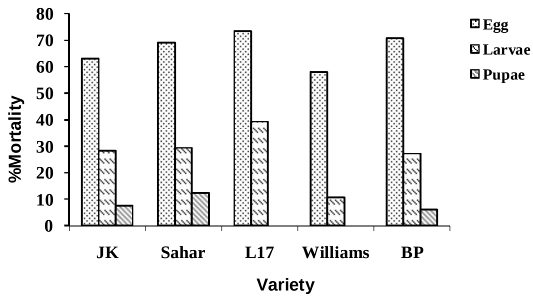

Figure 1. Percentage of mortality of *S. exigua* immature stages on different soybean varieties.

Discussion

Plant species differ greatly in suitability as hosts for specific insects when measured in terms of survival, development and reproductive rates. Shorter development periods and greater total reproduction of insects on a host-plant indicate greater suitability of a host plant (van Lenteren & Noldus, 1990).

Since there was no variation in egg incubation period (3.00 days) of *S. exigua* on the five soybean varieties, this indicated that host plant type does not affect incubation period. Azidah & Sofian-Azirun (2006) and Sivapragasam & Syed (2001) also found the incubation period of *S. exigua* to be 3 days, but Randolph (1963) and Afify *et al.* (1970), and Khalid Ahmed *et al.* (1997) stated that this parameter was between 2 to 3 days and 2.8 to 3.1 days, respectively, mostly depended on temperature.

Differences in the larval period of beet armyworm on the five soybean varieties can be attributed to the differences in nutrients or secondary compounds of the soybean varieties (Bernays & Chapman, 1994). The larval period of *S. exigua* on Sahar, Williams and BP was nearly similar to those reported by Azidah & Sofian-Azirun (2006) on cabbage (16.71) and Greenberg *et al.* (2001) (16.9 days). However, Huffman *et al.* (1996) and Berdegue *et al.* (1998) have reported that the larval period of *S. exigua* was within 16 days on shallot, 10 to 24 days on cotton and 21.3 days on common weed (*Chenopodium murale*) and 16.5 days on celery, respectively. Some possible reasons for such disagreement may be due to physiological differences depending on the host plant, genetic differences as a result of laboratory rearing or variation in geographic populations of the pest, as well as experimental conditions.

The pupal period was also influenced by the larval as observed by Azidah & Sofian-Azirun (2006). However, it is not in agreement with the findings of Berdegue *et al.* (1998) and Idris & Emelia (2001). This difference is associated with different host plants or different plant parts consumed by the larvae, which may be very different in primary and secondary chemicals. The pupal period of the pest varied from 7.510 days on JK to 8.622 days on L17. According to the literature, pupal period of *S. exigua* was 7.5 days on celery (Berdegue *et al.*, 1998) and 9.02 to 10.21 days on shallot and lady's finger, respectively (Azidah & Sofian-Azirun, 2006).

Adult longevity of *S. exigua* ranged from 9.36 to 13.86 days for male and 12.75 to 20.20 days for female. Azidah & Sofian-Azirun (2006) have reported that male longevity of *S. exigua* adult developed from larvae rearing on different host plants was 8.61 days on cabbage to 13.60 days on lady's finger. However, female longevity of beet armyworm adult was also reported as 11.33 days on cabbage to 13.85 days on long bean. We were unable to locate previous studies on the iteraction of the effect of sex and variety on biological parameters.

This study revealed that mortality of different stages of *S. exigua* ere influenced by soybean varieties. Yoshida & Parrella (1992) and Meade & Hare (1991) reported that survival to pupation ranged from 40% to 100% on various chrysanthemum cultivars and from 27.5% to 82.5% on different celery cultivars. According to Greenberg *et al.* (2001), higher survival rate and shorter development time yielded higher values of growth index, thus indicating better food quality. Thus, we suggest that Williams variety is the most suitable host plant and provides the best food quality for *S. exigua.* Prevoius studies were also shoewd that the survival rate of *S. exigua* differed of different host plants (Abdullah *et al*., 2000; Azidah & Sofian-Azirun, 2006; Shafqat *et al.*, 2010). Reduction of pupal weight is often observed in many insect species fed on insect resistance lines (van Duyn *et al.*, 1972; Beach *et al.*, 1985; Komatsu *et al.*, 2004). The mean pupal weight of *S. exigua* females on different soybean varieties was almost similar to those reported by Abdullah *et al.* (2000) on an artificial diet (78.70 mg). The lower suitability of some soybean varieties as a host plant for *S. exigua* may be due to the presence of some phytochemicals in these varieties acting as antixenotic and/or antibiotic agents or absence of some primary nutrients essential for growth and development of *S. exigua* in the soybean varieties.

The results of this research showed that the pre-oviposition and oviposition periods were influenced by different soybean varieties. Chu & Wu (1992) reported that the pre-oviposition and oviposition periods were 2.07 and 4.89 days on artificial diets at 27°C, which were shorter than those reported here. The fecundity of *S. exigua* was affected by different soybean varieties. The highest value of total number of eggs was obtained on Williams variety (595.5 eggs per female). The minimum number of oviposited eggs was recorded on Sahar variety (448.9 eggs per female). Abdullah *et al.* (2000) reported that beet armyworm produced 472.5 eggs on soybean leaf. The present study demonstrated significant differences in life cycle and fecundity of *S. exigua* reared on 5 soybean varieties. Future studies should focus on testing a wide range of host plants species especially soybean varieties for the development and fecundity of *S. exigua* and, also, assessment of the chemical components of the host plant species would help to better understand the mechanism of host suitability.

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