



Effect of host plant difference on the biology and life table parameters of *Spodoptera littoralis* (Lepidoptera: Noctuidae)

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Abstract:

The biological aspects and life table of larvae of the cotton leafworm, *Spodoptera littoralis* (Boisduval) (Lepidoptera: Noctuidae) were studied under laboratory conditions on the leaves of three plant hosts, castor, onion, and pepper. The study revealed that onion leaves are not favourable for *S. littoralis* so larvae feeding on onion leaves could not complete the whole life cycle, but could complete the total larval instars only. While, both pepper leaves and castor leaves (Control) *S. littoralis* complete their life cycles and life span. It is worth noting that the total larval stage of *S. littoralis* feeding on castor leaves (Control) was recorded at 35.6 days while the total larval stage on onion leaves was decreased than control and recorded at 34.6 days, but the total larval stage on pepper leaves was higher than control and recorded 37.9 days. The incubation period, life cycle and generations periods for larvae fed on castor leaves were higher than larvae fed on pepper leaves that recorded 6.7, 60, and 63.3 days, respectively, on castor leaves and 9, 72.2, and 77.5 days, respectively, on pepper leaves. The longevity and life span of both female and male was lower on castor leaves than on pepper leaves. The longevity of females and males was 13.6 and 6.3 days, respectively, for castor leaves, and 20.7 and 10 days, respectively, for pepper leaves. Also, the life span of females and males was 73.6 and 66.3 days, respectively, on castor leaves; and 92.9 and 82.2 days, respectively, on pepper leaves. Also, the results showed that the daily mean number of deposit eggs was higher on castor leaves (32.4) than on pepper leaves (21.4). Also, the results demonstrated that *S. littoralis* had a capacity to multiply about 1.91 and 1.55 on castor and pepper leaves, respectively. So, castor leaves are a more suitable host plant for *S. littoralis* than onion or pepper hosts.

Introduction

Sweet pepper (*Capsicum annuum* L.) is a very important crop for both the local and export markets (Shehata *et al.*, 2013). It is known for its antioxidant properties as it is a good source of vitamins A and C as well as

phenolic compounds (Shotorbani *et al.*, 2013). Also, it is believed to prevent certain types of cardiovascular diseases, cancer, atherosclerosis, and hemorrhage (Marin *et al.*, 2004).

Onion (*Allium cepa* L.) is one of the most important commercial

vegetable crops that are grown in India and used as spices, vegetables, or medicines. The genus *Allium* also contains a number of other species such as the Japanese bunching onion (*Allium fistulosum*), Egyptian onion (*Allium proliferum*), and Canada onion (*Allium canadense*). There are over 600 species of *Allium*, distributed throughout Asia, Europe, North America, and Northern Africa. The bulb and leaves are rich in minerals like calcium, carbohydrate, and phosphorous. Also, it contains proteins and vitamin C (Slimestad *et al.*, 2007).

The cotton leafworm, *Spodoptera littoralis* (Boisduval) (Lepidoptera: Noctuidae) is one of the most destructive lepidopterous pests in Egypt (Azab *et al.*, 2001). The effect of larval diet on the biology of the pest has been studied by many authors, Badr (1967) and Patel *et al.* (1968). Moussa *et al.* (1960) indicated that *S. littoralis* feeds on approximately 112 plant species belonging to 44 families. Some authors namely, Rizk *et al.* (1988) and Adham *et al.* (2009) mentioned the biology of *S. littoralis* and the effect of different hosts on the development and reproductive capacity. Also, Velasco and Walter (1993) reported that the survival of insects and larvae in the growth and reproductive phase were highly affected by food and quality.

The present study aimed to evaluate the effect of pepper leaves and onion leaves on the biology and life table of *S. littoralis* as methods of control.

Materials and methods

1. Rearing insect:

A laboratory strain of cotton leaf worm, *S. littoralis* (Maintained for above 30 generations) supplied from the division of the cotton leafworm of Plant Protection Research Institute (PPRI), Dokki, Egypt. First larval stages were reared on unsprayed pepper and onion leaves and compared with

castor leaves (As control) in the laboratory under constant conditions of 27 ± 2 °C, photoperiod of 14L:10D, and $65 \pm 5\%$ RH.

2. Application method:

The experiment was conducted as follows: The first instar larvae of *S. littoralis* were reared on onion leaves, pepper leaves, and castor leaves (As control), and the biology was followed. After the emergence of an adult female, as the result of nutritional difference and separation of one female in each replicate for each kind of food, the daily number of eggs laid was evaluated and counted carefully for life table calculation.

3. Statistical analysis:

L.S.D. values were calculated by Costat program (Costat software, 1990) and life table results were analyzed by the life table program (Abou-Setta *et al.*, 1986).

Results and discussion

1. Effect of food difference on the biology of *Spodoptera littoralis* :

The results in Table (1) indicated that 1st instar larvae reared on onion leaves, could not complete the life cycle, it completes the larval stage only that was less than larvae reared on pepper leaves and castor leaves and recorded 34.6, 37.9, and 35.6 for onion leaves, pepper leaves and castor leaves, respectively. CABI (2014) listed the main hosts' crops of *S. littoralis* in Europe, *Allium* spp. (Onion) was one of these hosts. Al-Shannaf (2011) indicated that pepper was one of the main hosts of *S. littoralis*. The incubation period, total larval stages, and total life cycle of *S. littoralis* increased with the pepper host plant than with the castor plant. The incubation period was 9 and 6.7 days on pepper and castor plants, respectively, and this increase was significant. Also, the total life cycle of *S. littoralis* on the pepper host plant was higher than the castor plant, respectively, which was

72.2 and 60 days for pepper and castor, respectively.

Table (1): Effect of different plant hosts on the life cycle of *Spodoptera littoralis* at 65± 5% RH.

Host plant	Incubation period	Average period of different developmental larval instars (in days)						Total larval stage	Pre-pupa	pupa	Life cycle
		1 st	2 nd	3 rd	4 th	5 th	6 th				
Pepper leaves	9± 0.5	6.3± 0.6	7.7± 1.7	8.3± 0.8	5± 0.9	5.3± 0.6	5.3± 0.6	37.9± 0.5	5.3± 0.6	20± 0.5	72.2± 1.5
Onion leaves	9± 0.5	7.7± 0.8	5.7± 0.3	4.3± 0.8	4.3± 0.3	6.3± 1.2	6.3± 0.8	34.6± 0.5			
Castor leaves	6.7± 0.3	8.3± 0.6	5± 0.5	5.3± 0.3	4± 0.5	4± 0.5	9± 0.5	35.6± 0.8	4± 0.5	13.7± 0.6	60± 1.1
L. S.D. at 0.05	0.67							0.11		0.66	0.09

Data in **Table (2)** demonstrated that female generation and female and male longevity increased significantly with pepper host plant than with castor plant. The female generation was 77.5 and 63.3 days with pepper and castor plants, respectively, while the female longevity was 20.7 and 13.6 days for pepper and castor plants, respectively. Male longevity was 10 and 6.3 days for pepper and castor plants, respectively.

The life span of *S. littoralis* in females and males decreased with the castor plant than with a pepper host plant and this decrease was significant

Table (2): Effect of different feeding on longevity and life span of both males and females of *Spodoptera littoralis* at 65± 5% RH.

Food	Duration of different adult stages (In days)						
	Female					Male	
	Pre-oviposition	Generation	Post-oviposition	Longevity	Life span	Longevity	Life span
Pepper leaves	5.3± 0.3	77.5± 1.4	3.7± 0.3	20.7± 0.6	92.9± 4.6	10± 0.4	82.2± 1.8
Castor leaves	3.3± 0.3	63.3± 0.9	2.3± 0.3	13.6± 0.5	73.6± 4.4	6.3± 0.3	66.3± 1.3
L. S.D. at 0.05		0.13		0.13	0.13	0.93	0.13

Data in **Table (3)** demonstrated that the oviposition period decreased significantly with the castor host plant than with the pepper plant which was 8 and 11.7 days for castor and pepper plants, respectively. The total average of eggs was lower with the pepper host plant than the castor plant, so, the daily mean of deposit eggs was lower with

which were 73.6 days with castor and 92.9 days with a pepper host plant of female, while it was 66.3 and 82.2 days with castor and pepper host plants of male, respectively. These results contrasted with Al-Shannaf (2011) who studied the effect of thirteen host plants on food consumption and some biological aspects for larvae of *S. littoralis* and indicated that larvae fed on pepper leaves had a shorter life span than larvae fed on castor leaves. The results revealed that castor plants were more suitable host plants than pepper plants.

the pepper host plant than the castor plant which was 32.4 eggs on castor plants and 21.4 eggs on pepper plants. Although the oviposition period was lower on castor than on pepper, the daily mean number of deposit eggs was higher on castor than on pepper plants. These results were in agreement with Al-Shannaf (2011) that proved that female

moths produced from larvae fed on castor bean oil leaves laid the highest number of eggs 2171 eggs; but pepper produced the least number 790 eggs, respectively.

Table (3): Effect of different temperatures on the oviposition period and fecundity of females of *Spodoptera littoralis* at 65 ± 5% RH.

Temperature °C	Oviposition period (In days)	Number of deposited eggs	
		Total average	Daily mean
Pepper leaves	11.7± 0.3	249.8± 0.6	21.4
Castor leaves	8± 0.5	259.1± 1.2	32.4
L. S.D. at 0.05	0.93		

2. Life table parameters:

The calculated life table parameters which have been taken into consideration in the present study were generation (T), net reproduction rate (R_o), intrinsic (r_m), finite rate of increase (λ), and generation doubling time (G.D.T.), all these data present in Table (4). The net reproduction rate (R_o) was 114870 and 73290 days within a single generation on leaves of the castor and pepper, respectively. The duration of one generation of *S. littoralis* as shown in the same table lasted about 65.82 and 77.51 days on leaves of the castor and pepper, respectively. The value of the intrinsic rate of increase (r_m) which expresses the relationship between fecundity, generation time, and survival differed from one host plant to another. Castor leaves have a higher value of r_m than pepper leaves. The higher value of (r_m) is attributed to a greater rate of fecundity per female (R_o) and shorter generation time (r_m = log R_o /T) at the

favourable host than the other. However, when the values of the r_m were converted to the finite rate of increase (λ) by the procedure outlined it is clear that the population of *S. littoralis* had a capacity to multiply about 1.19 and 1.55 on castor and pepper leaves, respectively. The generation doubling time (G.D.T.) has values of 7.99 and 9.75 the castor leaves have a higher result than pepper leaves.

Similar results on the life table of *S. littoralis* were in harmony with El-Sayed *et al.* (1973) and Mohamed (2003), which proved that female moths prefer egg laying on the same host plant. Also, Al-Shannaf (2011) proved that *S. littoralis* female moths produced from larvae fed on castor bean oil leaf, laid the highest number of eggs 2171.8 and 2139.6 eggs; but pepper leaves produced the least number, 790.6 and 778.1 eggs, in two generations, respectively.

Table (4): Effect of host difference on life table parameters of *Spodoptera littoralis* female

Parameters	<i>Spodoptera littoralis</i> fed on castor leaves	<i>Spodoptera littoralis</i> fed on pepper Leaves
Net reproduction rate (R _o)	114870	73290
Mean generation time (T)	65.82	77.51
Intrinsic rate of increase (r _m)	0.177	0.145
Finite rate of increase (λ)	1.19	1.55
Generation doubling time (G.D.T.) (days)*	7.99	9.75

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