



Short Communication

Comparative biology of *Spodoptera frugiperda* (JE Smith) on maize and sorghum

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Abstract

Biology of fall armyworm, *Spodoptera frugiperda* (JE Smith) was studied under laboratory conditions on maize and sorghum. The studies revealed that the larval period was shorter when the larvae were fed on maize as compared to sorghum. The adult longevity was longer in maize-fed larvae. Fecundity was also higher when the larvae were reared on maize plants.

Key words: *Spodoptera frugiperda*, maize, sorghum

The fall armyworm, *Spodoptera frugiperda* belonging to order Lepidoptera and family Noctuidae, is one of the most invasive pests of maize (Assefa and Ayalew 2019; Kenis *et al.* 2022). It has a wide host range of up to 353 plant species belonging to 76 families (Montezano *et al.* 2018). Its high fecundity and strong ability to migrate is probably attributed to its infestation in newer areas replacing other stem borers like *Busseola fusca* Fuller and *Chilo partellus* Swinhoe infesting maize (Wan *et al.* 2021). Yield losses to the tune of 8 to 20 million tonnes by this pest have been reported in Africa alone (Anon. 2020), where its first incidence was reported in 2016 only (Georgen *et al.* 2016). *S. frugiperda* invaded into India in 2018 when it was first reported from Karnataka (Sharanabasappa *et al.* 2018). Subsequently, the major outbreak of this invasive pest was reported in Una district of Himachal Pradesh during *Kharif* 2020 when its incidence ranging from 37.1 to 64.7% was observed on maize (Sharma 2021). In the present investigations, an attempt was made to study the biology of this pest under laboratory conditions on maize and sorghum to find out its preference for the host plants.

Seedlings of maize and sorghum were raised in plastic pots (dia: 100 mm). These pots were filled with a mixture of soil and farm yard manure (FYM) in equal proportions. Twenty pots were maintained for

each crop. The mass culture of *S. frugiperda* in laboratory was started from field-collected larvae. The larvae, identified by a characteristic inverted 'Y' mark on head and four dots arranged in a square pattern on the 8th abdominal segment, were collected from the field and transferred to plastic vials (100 mL) provisioned with tender maize leaves. The larvae were fed till pupation and then left undisturbed until adult emergence. The freshly emerged moths from mass culture were used in further laboratory studies. These male and female moths in the ratio of 1:1 were released in the ovipositional jar (20 x 15 cm²). Cotton swabs soaked in 10% honey solution were given as food for adult moths. Folded blotting papers were provided for resting and egg-laying by female moths. The open end of ovipositional jar was covered with muslin cloth held tightly in position by a rubber band. The jar was regularly inspected for egg laying. When the egg-laying commenced, blotting papers having egg masses of *S. frugiperda* were removed and replaced with new ones. The collected egg masses were placed in plastic boxes (19 x 12 cm²) and were kept in an insectary under controlled conditions (Temperature: 25±2°C; RH: 60-65%, Photoperiod: 14L:10D).

For studying growth and developmental biology of *S. frugiperda*, 30 neonates were gently picked up with camel hair brush and placed singly in plastic Petri plates (diameter: 9 cm) having Whatman blotting

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paper at the base. These larvae were fed with tender and succulent leaves of these host crops. Only 1st and 2nd instars of *S. frugiperda* were reared in the Petri plates. Whereas, 3rd to 6th instar larvae were shifted to plastic vials having perforated lids. These larvae were also daily provided with fresh leaves. The pupae forming after completion of larval stage were left undisturbed in the same vials till the emergence of adults.

Observations were recorded on durations of immature stages viz., egg, larva and pupa to work out incubation period, larval period and pupal period, respectively. Similarly, data on pre-oviposition, oviposition and post-oviposition periods were noted to get longevity of adult female. Likewise, male moths were also observed to know their longevity. In addition, fecundity of female was also observed.

The data presented in Table 1 revealed that the mean incubation period of *S. frugiperda* eggs obtained from females whose larvae were reared on maize and sorghum was statistically similar and lasted for 2.55 and 2.57 days, respectively. However, the total duration of larva reared on maize was significantly shorter (16.89 days) than that on sorghum (17.84 days). Wijerathna *et al.* (2021) also reported that larval period of *S. frugiperda* on maize was 16 days. Nandhini *et al.* (2023) reported larval duration of 14.40 days on maize. Similarly, Sharanabasappa *et al.* (2018) found the larval period of *S. frugiperda* to last for 14 – 19 days. Also, Ashok *et al.* (2020) observed that the larval stage of *S. frugiperda* lasted for 14.48

days on maize under controlled conditions (Temperature- 27°C, RH- 70%, Photoperiod- 14L:10D). Thus, these earlier studies corroborated the present findings. On the other hand, pupal period of *S. frugiperda* was statistically at par with each other when larvae were reared on maize (10.27 days) as well as sorghum (10.30 days). Rashed (2023) reported pupal period of *S. frugiperda* as 9.93 days on maize. Similarly, Salem *et al.* (2021) stated that the pupal duration of this pest on maize was 10.75 days. Krishnarao *et al.* (2022) also found its pupal duration to last for 10.13 days on maize. Therefore, the present results agree with results of these authors. Generally, the males of *S. frugiperda* comparatively lived longer than females. At the same time, longevity of adult male and female where larval stages were fed on maize and sorghum was 8.28, 8.00 and 11.32, 10.15 days, respectively (Table 1). Longevity of male and female adult on maize was 8.30 and 10.33 days, respectively (Krishnarao *et al.* 2022). The adult males survived for 11.1 days (Ashok *et al.* 2020) and for 6 – 7 days (Kranthi *et al.* 2021). These earlier results are also in close proximity to durations observed in present studies.

The pre-oviposition period of *S. frugiperda* females derived from larvae fed on maize and sorghum was statistically at par with each other and was recorded to be 3.50 and 3.45 days, respectively (Table 2). However, the female from maize-fed females oviposited for statistically longer duration (4.50 days) than those where larvae were fed on sorghum (3.40

Table 1. Durations of immature stages of *Spodoptera frugiperda*

Host plant	Biological parameter				
	Incubation period	Larval period	Pupal period	Adult longevity (Days) [*]	
	(Days)	(Days) [*]	(Days) [*]	Male	Female
Maize	2.55 (1.88)	16.89 (4.23)	10.27 (3.36)	8.28 (3.05)	11.32 (3.51)
Sorghum	2.57 (1.89)	17.84 (4.34)	10.30 (3.36)	8.00 (3.00)	10.15 (3.34)
CD (P=0.05)	NS	0.07	NS	0.02	0.04

^{*}Figures within parentheses are square root transformed means

Table 2. Pre-oviposition, oviposition, post-oviposition periods and fecundity of *Spodoptera frugiperda*

Host plant	Pre-oviposition period (Days) [*]	Oviposition period (Days) [*]	Post-oviposition period (Days) [*]	Fecundity (No. of eggs/female) [*]
Maize	3.50 (2.12)	4.50 (2.35)	3.35 (2.08)	827.5 (28.7)
Sorghum	3.45 (2.11)	3.40 (2.10)	3.30 (2.07)	538.2 (23.2)
CD (P=0.05)	NS	0.04	NS	(1.0)

^{*}Figures within parentheses are square root transformed means

days). On the other hand, the post-oviposition period was statistically similar for females whose larvae were fed on maize and sorghum. But, the females from larvae reared on maize laid significantly a greater number of eggs than those on sorghum. The respective fecundity of females for maize and sorghum-reared larvae was 827.5 and 538.2 eggs per female. According to Praveen and Mallapur (2019), the fecundity of *S. frugiperda* female was 680 and 650 eggs per female on maize and sorghum, respectively. Likewise, Nandhini *et al.* (2023) reported the

fecundity of *S. frugiperda* as 720 and 725 – 850 eggs per female on maize and sorghum, respectively. The fecundity of female observed in current studies is in consonance with these earlier reports.

The studies concluded that host plants influenced the overall biological parameters of *S. frugiperda*. The adults lived longer on maize plants and the fecundity was also higher on maize plants as compared to sorghum.

Conflict of interest: There is no conflict of interest among the authors in this research paper.

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