

LIFE CYCLE OF AN INVASIVE FALL ARMYWORM, *SPODPTERA FRUGIPERDA* (J. E. SMITH) (LEPIDOPTERA : NOCTUIDAE) ON SUGARCANE

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ABSTRACT : Roving surveys during December 2018 revealed the occurrence of fall army worm (FAW) on sugarcane at Belagavi district in Karnataka. Newly planted sugarcane crop of 30-45 days old in some pockets of Hukkeri taluka having initial damage of 0-5 per cent incidence. As life history of invasive pest is important to know the vulnerable parameters, so life cycle of fall armyworm, *Spodoptera frugiperda* (J. E. Smith) on sugarcane was studied during December 2018 to January 2019 under laboratory conditions at ARS, Sankeshwar of UAS, Dharwad, Karnataka. Incubation period ranged from 2-3 days with a mean of 2.40 days. Each larvae passed through six distinct instars over a period of 16-22 days. Duration of the pupal period was about 13-14 days. Pre-oviposition, oviposition and post oviposition periods ranged from 4-5, 2-3 and 3-4 days, respectively. In captivity, female laid eggs in groups on sugarcane leaves. The female adult survived for 10.40 days with a range of 9-11 days compared to male which survived for 8.60 days with a range of 7-9 days. The total life cycle of male and female ranged from 38-48 and 40-50 days, respectively. Study of life history of invasive pest as occurring in India is important for identifying the life stages, its spread and also for planning control strategies.

Key words : *Spodoptera frugiperda*, life cycle, sugarcane, Belagavi, adult longevity, eggs.

INTRODUCTION

The fall armyworm (FAW) *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera: Noctuidae) native to America is one of the important invasive polyphagous pests. It occurs in several countries such as Brazil, Argentina and the USA (Porwell *et al*, 2004; Clark *et al*, 2007), causing economic losses in a variety of crops such as maize, soybean, cotton and beans (Pogue, 2002; Nagoshi, 2007; Bueno *et al*, 2010) and number of weeds, such as *Ipomea* sp. or crops such as rice, maize and other grasses (Nabity *et al*, 2011). Recently, severe incidence of FAW was reported from African countries such as Sao Tome Nigeria, Benin and Togo (Goergen *et al*, 2016). The pest, which is indigenous in the America, is highly polyphagous, causing economic damage in various crops such as maize, sorghum, beans and cotton (Abrahams *et al*, 2017; Day *et al*, 2017). This invasive pest was first reported in West Africa in late 2016 (Goergen *et al*, 2016); by early 2017, the pest invaded Sub-Saharan Africa.

The occurrence of this new invasive pest was reported for the first time from India by Sharanabasappa and Kalleshwarswamy (2018). Biology of FAW as occurring in India is important for identifying the life stages, its spread and also for planning control strategies. Hence, this is first study on the biology of FAW on

sugarcane under laboratory conditions.

MATERIALS AND METHODS

The culture of FAW was initiated with egg mass collected from maize field and after hatching they transferred to sugarcane leaves (cv - Co 86032) on which recently field infestation was noticed at Hukkeri, Belagavi during December 2018. The larvae were reared using insect breeding circular lid. Grown up larvae were reared on tender shoots of sugarcane. Rearing was carried out in the laboratory where room temperature of 20-24°C and 60-70% RH. In each rearing cage, pair of male and female adults was released. The adults were fed 10% honey solution soaked on cotton pads offered in small plastic caps inside and replaced daily. Male and female adult longevity were observed with their release in a rearing cage (30 × 30 × 45 cm). The larval and pupal period, sex ratio and adult emergence were also observed. Pre-oviposition, oviposition and post oviposition period were also observed.

RESULTS AND DISCUSSION

Survey conducted in and around Hukkeri, taluka, where the younger crop (30-45 days old) was infested by fall armyworm, *S. frugiperda*. Less damage was recorded on ratoon sugarcane as well as older crop.



Eggs laid on sugarcane leaves



First instar feeding on tender shoots of sugarcane



Pupa



Adult

Plate 1 : Biology of fall army worm on sugarcane.

Table 1 : Incidence of *Spodoptera frugiperda* at Hukkeri taluka 2018-2019.

S. No.	Villages	Cropping pattern	Crop age	Larval instar	Per cent damage
1.	Badakundri	Chickpea+Sugarcane	40 days	2 nd insatr	5 per cent
2.	Bellad Bagewdi	Maize followed by Sugarcane	30 days	1 st and 2 nd instar	5-10 per cent
3.	Hullollhatti	Maize followed by Sugarcane	35 days	1 st and 2 nd instar	5 per cent
4.	Sadapur	Maize followed by Sugarcane	40days	1 st and 2 nd instar	5 per cent
5.	Belavi	Maize followed by Sugarcane	35days	1 st and 2 nd instar	5 per cent
6.	Sankeshwar	Maize followed by Sugarcane	40days	1 st and 2 nd instar	5 per cent

Newly sown sugarcane crop of 30-45 days in some pockets of Hukkeri taluka having initial damage of 0-5 per cent incidence. More incidence was observed on maize + sugarcane intercropping and also where the farmers followed *rabi* crops as sugarcane and maize. Incidence was also noticed in one of the sugarcane trial at Bellad Bagewadi (Table 1).

Egg : Egg masses were collected from maize field after hatching they were transferred to sugarcane leaves (Plate 1). Incubation period ranged from 2-3 days with a mean of 2.40 days.

Larva : First instar larvae were greenish with a black head (Plate 1) and turned greenish brown in the second instar. The third instar was brownish with three dorsal

and lateral white lines. Fourth to the sixth instar were brownish black and had three white dorsal lines and a light lateral lines. The frons had a white inverted "Y" line. Each larva passed through six distinct instars over a period of 16-22 days. The larval period tends to be about 14-30 days has been reported (Pitre and Hogg, 1983). Sharanbasappa *et al* (2018) reported each larva passes through 6 distinct instars over a period of 14-19 days.

Pupa : Full grown larvae stopped feeding during prepupal period, turned greenish and turned bright brown colour (Plate 1). Duration of the pupal period was about 13-14 days (Table 1).

Adult : Forewing of male is shaded with gray and brown, with triangular white patch at the apical region

Table 2 : Biology of *Spodoptera frugiperda* reared on sugarcane leaf.

S. No	Stages	Mean \pm SD	Ranges (days)
1.	Incubation period	2.40 \pm 0.50	2-3
2.	Larval period		16-22
	I st Instar	2.60 \pm 0.40	2-3
	II nd Instar	2.80 \pm 0.30	2-3
	III rd Instar	2.20 \pm 0.70	3-4
	IV th Instar	2.40 \pm 0.60	2-3
	V th Instar	3.20 \pm 0.70	3-4
	VI th Instar	4.40 \pm 0.60	4-5
3.	Pupal period	13.60 \pm 0.30	13-14
4.	Pre ovipositional period	4.20 \pm 0.70	4-5
5.	Ovipositional period	2.40 \pm 0.50	2-3
6.	Post ovipositional period	3.6 \pm 0.70	3-4
7.	Adult longevity		
	Male	8.60 \pm 0.60	7-9
	Female	10.40 \pm 0.70	9-11
	Total Life Cycle		
	Male	37.00 \pm 9.50	38-48
	Female	38.00 \pm 8.20	40-50

and circular spot at the center of the wing (Plate 1). The forewings of females are uniform grayish brown to a fine mottling of gray and brown. The hind wing is silver white with a narrow dark border in both male and female. The morphological characters of adults described here are similar as reported earlier (Oliver and Chapin, 1981). Pre-oviposition, oviposition and post oviposition period ranged from 4-5, 2-3 and 3-4 days, respectively.

Fecundity : In captivity, female laid eggs in groups on sugarcane leaves. Eggs were golden yellowish and ultimately turned to black in colour before hatching.

Total life cycle : The total life cycle of male and female ranged from 38-48 and 40-50 days, respectively (Table 2). The female adult survived for 10.40 days with a range of 9-11 days compared to male 8.60 days with a range of 7-9 days (Table 1).

Population introduced to India is performing same biological parameters as that of the reports from America and Africa. Life cycle study clearly provides basic information about life stages and larval period on sugarcane. To conclude, the pest shift its host range other major crops in state and adjoining states in India to survive in the absence of maize and maintain the population in India throughout the year. Further detailed investigations on biology on cultivable varieties of sugarcane need to be studied.

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