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BIOLOGY OF FALL ARMYWORM, *SPODOPTERA FRUGIPERDA* (J.E. SMITH) ON SORGHUM

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ABSTRACT

The biology of fall armyworm, *Spodoptera frugiperda* (J.E. Smith) on sorghum was studied during *Kharif,* 2019 under laboratory conditions (26±2°C temperature and 75±5% relative humidity) at the Department of Entomology, Rajasthan College of Agriculture, MPUAT, Udaipur. The nucleus culture of FAW was initiated with the larvae collected from sorghum and maize field, Agronomy farm, RCA, Udaipur and were morphologically identified. These larvae were reared on artificial diet. The freshly laid eggs from this nucleus culture were taken to study the biology of fall armyworm. After hatching, newly emerged 40 larvae were individually reared on fresh small bits of sorghum leaves, these leaves were changed daily as food. After the completion of larval period, the pupae were transferred gently into egg laying chambers for the emergence of the adults and the chamber were provided with 10% honey solution soaked cotton wicks placed separately in small petri plates. The female was observed laying eggs with the fecundity of 964 eggs. The incubation, total larval (I to VI instar), pupal, pre oviposition, oviposition and post oviposition period were recorded to be from 2-3, 12-19, 8-12, 3-4, 2-3 and 4-5 days, respectively. The male and female longevity were 7-11 and 10-13 days, respectively. The total life cycle of male and female was observed to be 33-45 and 36-47 days, respectively.

Key words: *Spodoptera frugiperda,* sorghum, biology, fecundity, larval period, pupal period, longevity.

INTRODUCTION

The fall armyworm, *Spodoptera frugiperda* (J.E. Smith) is native to the tropical and subtropical region of America and is one of the most important pest causing enormous damage in the region (Luginbill, 1928). Fall armyworm, *S. frugiperda* is highly polyphagous, causing economic damage to various crops such as maize, sorghum, beans and cotton (Abrahams *et al.,* 2017 & Day *et al.,* 2017). *S. frugiperda* has invaded Africa, with first reported in West Africa in late 2016 (Goergen *et al.,* 2016) and in late 2016 and 2017 in parts of Southern, Eastern and Northern Africa (FAO, 2017). Recent reports were confirmed the occurrence of fall armyworm in 28 countries in Africa (Day *et al.,* 2017 & Cock *et al.,* 2017) indicating the rapid spread of the pest in the African continent, threatening the food security of millions of people. In India, it was reported for the first time on maize from Shivamogga district of Karnataka during May-June 2018 (Sharanabasappa *et al.,* 2018). Fall armyworm is of serious concern due to its notorious and polyphagous behaviour. The main reason for its fast spread might be its strong capacity to fly and disperse long distances. The invasion of this pest could also be due to advances in agriculture, global trade and transport and human activities despite strict quarantine norms. Immediate focus of research on this pest is the need of the hour for which, a complete knowledge of biology of *S. frugiperda* plays a great role for identifying the life stages and also for planning IPM strategies. Keeping in view the above facts, the study on "Biology of Fall Armyworm, *Spodoptera frugiperda* (J.E. Smith) on Sorghum" was carried out under Laboratory condition.

MATERIALS AND METHODS

The biology of fall armyworm, *Spodoptera frugiperda* (J.E. Smith) was studied during *Kharif,* 2019 under laboratory conditions *i.e.* 26±2°C temperature and 75±5% relative humidity at the Department of Entomology, RCA, MPUAT, Udaipur. The nucleus culture of FAW was initiated with the larvae collected from sorghum and maize field, Agronomy farm, RCA, Udaipur. These larvae were morphologically identified and reared on artificial diet (chickpea rich diet). The freshly laid eggs from this nucleus culture were taken to study the biology of fall armyworm. After hatching, newly emerged 40 larvae were individually reared on fresh small bits of sorghum leaves, these leaves were changed daily as food. After the completion of larval period, the pupae were transferred gently into egg laying chambers for the emergence of the adults and the chamber were provided with 10% honey solution soaked cotton wicks placed separately in small petri plates. In each chamber, pair of male and female adults was released. Eggs were collected and kept in an insect breeding dish circular for hatching. The number of eggs were counted and then examined at an interval of 24 hr for hatching. The incubation period, I to VI instar larval period, pupal period, pre-oviposition, oviposition, post-oviposition period, male and female longevity, total male and female life cycle were observed.

RESULTS AND DISCUSSION

Gravid female laid eggs in clusters ranged on the under or upper surface of the sorghum leaf or muslin cloth under Laboratory conditions. The eggs were dorso-ventrally flattened, initially these were pale green for one day turned to golden yellowish and ultimately turned to black before hatching. The fecundity of female was 964 eggs (Table 1). The incubation period ranged from 2-3 days with a mean of 2.67 days. The egg hatching per cent ranged from 93-96. The first instar larvae were greenish with a black head, I instar period ranged from 2-3 days with a mean of 2.48 days. The II instar larvae were greenish brown and period ranged from 2-3 days with a mean of 2.55 days. The III instar larvae were brownish with three dorsal and lateral white lines and period ranged

Table: 1. Biology of Fall armyworm, *Spodoptera frugiperda* on sorghum leaf (n=40)

Insect stages	Mean ± SD	Range (days)
Incubation period	2.67±0.47	2.00–3.00
I instar larva	2.48±0.51	2.00–3.00
II instar larva	2.55±0.50	2.00–3.00
III instar larva	2.10±0.30	2.00–3.00
IV instar larva	2.13± 0.33	2.00–3.00
V instar larva	2.53±0.51	2.00–3.00
VI instar larva	5.23± 0.80	4.00–6.00
Total larval period	17.00± 1.69	13.00–20.00
Pupal period	10.18±1.26	8.00–12.00
Pre oviposition period of female	3.63±0.49	3.00–4.00
Oviposition period of female	2.58±0.50	2.00–3.00
Post oviposition period of female	4.53±0.51	4.00–5.00
Male adult longevity	8.63±1.05	7.00–1.00
Female adult longevity	10.73±0.72	10.00–13.00
Total life cycle (egg to adult) of male	38.48±2.63	33.00–45.00
Total life cycle (egg to adult) of female	40.58±2.67	36.00–47.00
Fecundity/female (number of eggs)	964.35±30.42	800.00–1000.00
Egg hatchability (%)	94.60±1.08	93.00–96.00

from 2-3 days with a mean of 2.10 days. The IV to VI instars larvae were brownish black and frons had a white inverted "Y" line. The period of IV, V and VI instars larvae were ranged from 2-3, 2-3 and 4-6 days, respectively with the mean of 2.13, 2.53 and 5.23 days, respectively. The total larval period was ranged from 13-20 days with a mean of 17 days. The larval period tends to be about 14 – 30 days has been reported (Pitre and Hogg, 1983). During the pre-pupal period, the full-grown larva stopped feeding, turned greenish and the bright brown colour. The pupal period was ranged from 8-12 days with a mean of 10.18 days. Similarly, Debora *et al.* (2017) studied the pupal period of *S. frugiperda* on maize was 8.54 days. The distance between genital opening and anal slot is more in case of female pupa than the male pupa. The forewing of male is shaded with gray and brown with triangular white patch at the apical region and circular spot at the center of the wing, while, 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 adult described here are similar as reported earlier (Oliver and Chapin, 1981). Pre-oviposition, oviposition and post oviposition period of female ranged from 3-4, 2-3 and 4-5 days, respectively with the mean of 3.63, 2.58 and 4.53 days, respectively. The adult male and female longevity ranged from 7-11 and 10-13 days, respectively with the mean of 8.63 and 10.73 days, respectively. The total life cycle of male and female ranged from 33-45 and 36-47 days, respectively (Table 1). Similarly, Sharanabasappa *et al.* (2018) observed that the fecundity of *S. frugiperda* was 1064 eggs/female, while incubation period, total larval period, pupal period were recorded to be from 2–3, 14–19 and 9–12 days, respectively. The complete life cycle of male and female was recorded to be 32–43 and 34–46 days, respectively on natural food *i.e.* sorghum leaf.

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