Indian Journal of Entomology 85(4): 991-993 (2023) DoI. No.: 10.55446/IJE.2022.532

# BIONOMICS OF FALL ARMY WORM *SPODOPTERA FRUGIPERDA* (J E SMITH) ON MAIZE

**N T Dileep Kumar* and K Murali Mohan**

Department of Entomology, College of Agriculture, University of Agricultural Sciences GKVK, Bangalore 560065, Karnataka, India
*Email: dileepyadhu1996@gmail.com (corresponding author)

**ABSTRACT**

**The fall army worm *Spodoptera frugiperda* (J E Smith) is an invasive pest in India on maize crop, and noticed to be polyphagous. Its biology was studied under laboratory conditions at the Department of Agricultural Entomology, College of Agriculture, GKVK, Bengaluru, Karnataka, India. The incubation, total larval and pupal period were observed to be of 2.80, 15.70 and 10.04 days, respectively. The total lifecycle of male and female took 35.05 and 38.30 days, respectively. Preoviposition, oviposition and post-oviposition period were 2.95, 3.10 and 4.50 days, respectively.**

**Key words:** *Spodoptera frugiperda*, bionomics, invasive, incubation period, larval period, pupal period, longevity, total life cycle, instars, oviposition period, post-oviposition period

The fall army worm *Spodoptera frugiperda* (J. E. Smith) (Noctuidae: Lepidoptera), is a new invasive species in India and known for polyphagous behaviour (Montezano et al., 2018). It is native to the Americas and found in most parts of the Western Hemisphere. Of late, the pest was noticed in West and East Africa. Currently, this pest is damaging crops in over 20 African countries (Goergen et al., 2016; Abrahams et al., 2017; Cock et al., 2017). In Brazil and United States, the pest has been reported to causes 32-60% reduction in yield (Hruska and Glandstone, 1988; Wiseman and Isenhour, 1993; Lima et al., 2010). In India, a quick roving survey at Karnataka suggested that pest can cause the damage ranging from 9 to 62.5% on maize (Ganiger et al., 2018; Shylesha et al., 2018). It has been reported for the first time in Karnataka state, India on maize (Ganiger et al., 2018; Sharanabasappa et al., 2018). Subsequently, it has been reported from other maize growing states viz., Tamil Nadu, Andhra Pradesh, Telangana, Maharashtra, Gujrat and northeastern states (Swamy et al., 2018; Srikanth et al., 2018; Chormule et al., 2019). This pest is occurring in serious proportions, causing significant damage to maize. It is important to know the biology and feeding behaviour of this. The earlier reports on the bionomics on artificial diet include Nagamandla and Uma (2019). In the present study, the bionomics are studied on its natural host maize under laboratory conditions.

## MATERIALS AND METHODS

The initial culture of *S. frugiperda* was collected from the maize fields near College of Agriculture, University of Agricultural Sciences, GKVK, Bengaluru, Karnataka. The field collected larvae were reared on maize leaves placed in plastic rearing boxes and fresh maize leaf bits were provided every day till the end of larval stage in laboratory (27±2ºC, 60-75%RH, L12:D12 photoperiod). The grown-up larvae were transferred to the cages containing a layer of coco-peat as substrate for pupation. The pupae were collected and placed in an oviposition cage for adult emergence. The moths on emergence were provided with young maize seedlings as substrate for the oviposition and cotton soaked in 10% sugar solution as their food. Ten pairs of adults were maintained separately in ovipositional cages to record the fecundity. Egg masses were collected every day and individual larval rearing (n=25) was continued using maize leaf bits as feeding substrate till pupation. The observations on life stages viz., egg, larva, pupa and adults were recorded daily. The parameters like preoviposition period, oviposition period, post-oviposition period, egg period, larval period (instars-wise), pupal period, adult longevity (Male and Female) and total length of life cycle in days were observed.

## RESULTS AND DISCUSSION

Egg: The mated females laid eggs in masses of 80 to 250 on both surfaces of leaves, whorls and at the base of the young seedlings (Fig. 1). Freshly laid egg masses were light green in colour covered with greyish scales. A single gravid female was noticed to lay 3 to 4

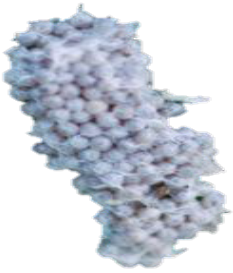

Fig. 1. Egg mass

Fig. 2. 1st Instar larva

Fig. 3. 2nd Instar larva

Fig. 4. 3rd Instar larva

Fig. 5. 4th Instar larva

Fig. 6. 5th Instar larva

Fig. 7. 6th Instar larva

Fig. 8. Pupae

Fig. 9. Male Adult

Fig. 10. Female Adult

egg masses with overall fecundity of 780 to 1200 eggs per female. A mean incubation period of 2.80 days was observed. The observations are similar as reported earlier (Luginbill, 1928; Sparks, 1979; Sharanabasappa et al., 2018). Larva: There were six instars in one life cycle. First instars were greenish in colour with black head and seen in congregation when they hatched (Fig. 2). The second instar larvae were turned to light brownish colour with series of black spots on the body (Fig. 3). Third instar larvae were brown in colour with well-developed head capsule and developing hair like setae all over the body (Fig. 4). Fourth instar larvae were greenish brown with prominent black spots and well-developed cuticular setae all over the body (Fig. 5). Later instars were dark brown with three whitish dorsal lines. Head with well-developed inverted-Y suture was noticed. On eight abdominal segments the black spots were arranged in square manner, but were arranged in trapezoidal manner on remaining abdominal segments (Fig. 6, 7). Larval period was completed on an average of 15.70 days and same was observed to differ depending on the rearing temperature. The similar morphological observations and larval durations were recorded in the earlier reports (Sharanabasappa et al., 2018; Ganiger et al., 2018; Deole and Paul, 2018).

Pupa: Before going for pupation larvae stops feeding. Initially pupae were light green in colour, later turned to dark brown colour with well-developed cremaster at anal end (Fig. 8). The mean pupal period of 10.04 days were recorded. Similar pupal characters with pupal period ranging from 6 to 14 days were recorded (Deole and Paul, 2018; FAO, 2018). Contrarily, varying pupal period of 8.54 to 9.70 days was observed depending on host plant larvae fed (Silva et al., 2017). Adult: The adults of *S. frugiperda* are varying in their morphology. Male adult moths with greyish brown body, light brown coloured fore wing with whitish triangular patch at apical margin and distinct circular spot at the centre (Fig. 9). Adult female with uniform greyish brown forewing without any distinct markings on wing (Fig. 10). Hind wings of both the sexes were whitish with brown border. The longevity of male adult was 7.90 days with a total length of life cycle 35.05 days. But female adults were survived longer compared to male adults with longevity of 11.20 days and total length of life cycle was 38.30 days. The pre-oviposition, oviposition and post-oviposition periods of 2.95, 3.10 and 4.50 days were observed. The similar observations on adult male and female morphology were made by Ganiger et al. (2018) during their report of occurrence of fall armyworm in Karnataka, India. Adult insect were recorded to have longevity of 2 to 3 weeks (FAO, 2018). Contrarily, Deole and Paul (2018) reported adult longevity of 5 to 7 days, the variations may be attributed to feeding of adult insects with sugar solution, where it enhances longevity of adults.

## REFERENCES

Abrahams P, Bateman M, Beale T, Clottey V, Cock M, Colmenarez Y, Corniani N, Day R, Early R, Godwin J, Gomez J, Moreno P G, Murphy S T, Oppong-Mensah B, Phiri N, Pratt C, Richards G, Silvestri S, Witt A. 2017. Fall armyworm status impacts and control options in Africa: preliminary evidence note. CABI, Wallingford, U.K..https://www.cabi.org/Uploads/isc/Dfid%20Faw%20Inception%20Report04may2017final.pdf [accessed 1 Sept. 2017].

Chormule A, Shejawal N, Sharanabasappa, Kalleshwaraswamy C M, Asokan R, Swamy H M M. 2019. First report of the fall armyworm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera, Noctuidae) on sugarcane and other crops from Maharashtra, India. Journal of Entomology and Zoology Studies 7: 114-117.

Cock M J W, Beseh P K, Buddie A G, Cafa G, Crozier J. 2017. Molecular methods to detect *Spodoptera frugiperda* in Ghana, and implications for monitoring the spread of invasive species in developing countries. Scientific Reports 7: 4103.

Deole S, Paul N. 2018. First report of fall army worm, *Spodoptera frugiperda* (J.E. Smith), their nature of damage and biology on maize crop at Raipur, Chhattisgarh. Journal of Entomology and Zoology Studies 6: 219-221.

FAO, 2018. Integrated management of the Fall Armyworm on maize: A guide for Farmer Field Schools in Africa., pp: 7.

Ganiger P C, Yeshwanth H M, Mohan K M, Vinay N, Kumar A R V, Chandrashekara K. 2018. Occurrence of the new invasive pest, fall armyworm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae), in the maize fields of Karnataka, India. Current Science 115: 621-623.

Goergen G, Kumar P L, Sankung S B, Sankung, Togola A, Tamo M. 2016. First Report of Outbreaks of the Fall Armyworm *Spodoptera frugiperda* (J E Smith) (Lepidoptera, Noctuidae), a New Alien Invasive Pest in West and Central Africa, PLoS ONE 11: 1-9.

Hruska A J, Gladstone S M. 1988. Effect of period and level of infestation of the fall armyworm, *Spodoptera frugiperda*, on irrigated maize yield. Florida Entomologist 71: 249-254.

Lima M S, Silva P S L, Oliveira O F, Silva K B, Freitas F C L. 2010. Corn yield response to weed and fall armyworm controls. Planta Daninha 28: 103-111.

Luginbill P. 1928. The fall armyworm. USDA Tech. Bull. No., 34.

Montezano D G, Specht D R, Sosa-Gómez V F, Roque-Specht J C, Sousa-Silva S V, Paula-Moraes J A, Peterson, Hunt T E. 2018. Host Plants of *Spodoptera frugiperda* (Lepidoptera: Noctuidae) in the Americas. African Entomology 26: 286-300.

Nagamandla R S, Uma M T. 2019. Bionomics of fall armyworm *Spodoptera frugiperda* (J.E. Smith) on artificial diet. Indian Journal of Entomology 81: 788-791.

Sharanabasappa, Kalleshwaraswamy C M, Asokan R, Swamy H M M, Maruthi M S, Pavithra H B, Hegde K, Navi S, Prabhu S T, Goergen G. 2018. First report of the fall armyworm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera, Noctuidae), an alien invasive pest on maize in India. Pest Management in Horticulture Ecosystem 24: 23-29.

Sharanabasappa, Kalleshwaraswamy C M, Maruthi M S, Pavithra H B. 2018. Biology of invasive fall army worm Spodoptera frugiperda (J.E. Smith) (Lepidoptera: Noctuidae) on maize. Indian Journal of Entomology 80: 540-543.

Shylesha A N, Jalali S K, Gupta A, Varshney R, Venkatesan T, Shetty P. 2018. Studies on new invasive pest *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae) and its natural enemies. Journal of Biological Control 32.

Silva D M D, Bueno A D F, Andrade K, Stecca C D S, Neves P M O J, Oliveira M C N D. 2017. Biology and nutrition of *Spodoptera frugiperda* (Lepidoptera: Noctuidae) fed on different food sources. Scientia Agricola 74: 18-31.

Sparks A N. 1979. A review of the biology of the fall armyworm. Florida Entomologist 62: 82-87.

Srikanth J, Geetha N, Singaravelu B, Ramasubramanian T, Mahesh P, Saravanan L. 2018. First report of occurrence of fall armyworm *Spodoptera frugiperda* in sugarcane from Tamil Nadu, India. Journal of Sugarcane Research 8: 195-202.

Swamy H M M, Asokan R, Kalleshwaraswamy C M, Sharanabasappa, Prasad Y G, Maruthi M S. 2018. Prevalence of "R" strain and molecular diversity of fall armyworm *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae) in India. Indian Journal of Entomology 80: 544-553.

Wiseman B R, Isenhour D J. 1993. Response of four commercial corn hybrids to infestations of fall armyworm and corn earworm (Lepidoptera: Noctuidae). Florida Entomologist 76: 283-292.

Manuscript Received: January, 2022; Revised: April, 2022;
Accepted: April, 2022; Online Published: May, 2022
Online First in www.entosocindia.org and indianentomology.org Ref. No. e22004