

First report of Fall Armyworm, *Spodoptera frugiperda* (J.E.Smith), an invasive pest on maize and sorghum in Haryana, India

Ankit Kumar^{1*}, Maha Singh Jaglan², Yogesh Kumar³ and Surender Singh Yadav⁴

^{1,3}Department of Entomology, CCSHAU Hisar 125 001, Haryana, India

⁴Directorate of Research, CCSHAU, Hisar 125 001, Haryana, India

²Coordinator, KVK, Karnal, 132 001, Haryana, India

(Received 7 March, 2023; Accepted 13 May, 2023)

ABSTRACT

The occurrence of *Spodoptera frugiperda* (Lepidoptera: Noctuidae), is reported for the first time on maize and sorghum in Haryana (India). During the field visits the crop was found infested with distinguished damage symptoms. The per cent plant infestation was very high with window holes and saw dust like frass on leaves and whorl. The larvae were found on damaged plants and later on collected and reared in insect rearing laboratory, Department of Entomology, CCS Haryana Agricultural University-Hisar for identification and further studies. The pest is identified as fall armyworm, *Spodoptera frugiperda* (J.E. Smith) as per morphological characters observed. This is the first confirmed report for invasion of fall armyworm to cause severe damage in maize and sorghum crop in Haryana, India.

Key words: Maize, Sorghum, Invasive, *Spodoptera frugiperda*

Introduction

Fall armyworm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae), is a very destructive pest and polyphagous in nature with high mobility and fecundity. It is native to tropical and subtropical America since, 1797 with wide host range of more than 353 plant species from 76 plant families. A severe outbreak of *S. frugiperda* on corn and millets was documented in 1912 and cause up to 73 per cent yield loss in maize (Huang *et al.*, 2020; Du Plessis *et al.*, 2020; Prassanna *et al.*, 2018; Montezano *et al.*, 2018). This invasive pest was first reported in West Africa in late 2016 and invaded in Sub-Saharan Africa (CABI, 2019; Goergen *et al.*, 2016). The adult's moth can fly continuously for over 24h and cover more than 100 km a day (Chen *et al.*, 2022). Recent

reports confirmed the occurrence of fall armyworm in 28 countries in African continent indicating the rapid spread of this pest (Cock *et al.*, 2017; Day *et al.*, 2017). In India, its presence was confirmed in May 2018 by the University of Agricultural and Horticultural Sciences, Shivamogga, Karnataka (Sharanabasappa *et al.*, 2018a). Invasion of this pest is mainly due to increased transboundary movement of agricultural commodities, anthropogenic activities and climate changes (Paini *et al.*, 2016). It infests maize plants at all growth stages *i.e.*, from seedling to tasseling by destroying young plants, causing defoliation and grain deterioration that leads to reduction of yield quality and quantity (Peairs and Saunders, 1979). It occurs throughout the year with overlapping generations depending upon host availability and congenial climatic condi-

tions (Abrahams *et al.*, 2017). Recently, this pest was found damaging the maize and sorghum crop in Haryana. The studies on biological parameters of *S. frugiperda* has also been conducted to identify all the life stages, life history, its survival and spread to plan the effective management strategies.

Materials and Methods

A field's survey was planned to investigate the insect pest damage in maize growing areas during August-September, 2019 at Hisar and Yamunanagar districts of Haryana. The crop was at different growth stages in different fields in the surveyed area. The crop of maize and sorghum showed distinguished damage pattern and symptoms with dry excreta/faecal matter by pest on leaves and in central whorl. The damaged plants were examined to know the pest. The larvae observed were very large in size with different colour and morphological characteristics from other known pests pertaining to maize and sorghum. The larvae were collected from different farmer's field and reared in the laboratory, Department of Entomology, CCSHAU-Hisar for identification and further biological studies.

Results and Discussion

(i) Field infestation and symptoms: The larvae were found to feed on leaves and central whorl of maize plant by making elongated patches in the form of irregular spots surrounded with faecal matter of larvae. All the life stages of insect were reported in the field (egg to adult). The adults were swift fliers. The infestation was noticed as newly emerged larvae feed by scrapping the leaves leaving behind the white elongated patches (Fig. 1-A). Later instars larvae damage the crop by making windows in leaves, feeding leaf margins and moved towards central whorl thereafter (Fig.1-B). Later instars were also noticed to feed in central whorl that was filled with dry and fresh faecal matter (Saw dust like frass), confirming the feeding by the pest (Fig. 1-C & D). The field was looked as grazed by animals because of central whorl damage. The late instars larvae has also been noticed prefer to feed on reproductive stage (Tassels and developing cobs) of maize voraciously. These symptoms are also similar to those reported by (Navasero *et al.*, 2019; Chormule *et al.*, 2019).

(ii) Identification of *S. frugiperda*: The females laid



Fig. 1. Damage symptoms by *S. frugiperda* - Scrapping of leaves, leaving behind the white elongated patches (A), Window holes and saw dust like frass on leaves (B), Larvae in central whorl along with larval head exuviae(C), Damaged plant whorl/heart, larvae and faecal matter on maize (D).

eggs in masses and covered with grayish colored scales. The larva of *S. frugiperda* passed through six larval instars. The first instar larvae were light greenish to dark brown in colour with black head and turned greenish brown with reddish brown head in second instar. The four black dots were prominent in late instars on 1st to 7th abdominal segment in trapezoid pattern. The third instar was greenish brown to dark brown with three dorsal and lateral white lines. Fourth instar larvae were brownish black with white dorsal lines and alight lateral line (Fig.1-B). Black tubercles were found dorsally on the body which bears spines. The late instars (4th to 6th) had a more prominent white inverted "Y" line on frons and four black dots which are arranged in a square pattern on 8th abdominal segment (Fig. 2). The full grown larvae shows colour variation from yellowish brown to dark brown, dull grey to almost black (Pogue, 2002). Freshly formed pupa were soft and greenish in colour, later on the pupa becomes shiny reddish-brown, which were characterized by a pair of straight thorns at the end. The genital opening in female pupa was present on 7th abdominal segment while it was present on 9th segment in male pupa (Fig. 3-A&B). Forewings of female moth were less conspicuous, varying in colour from uniform

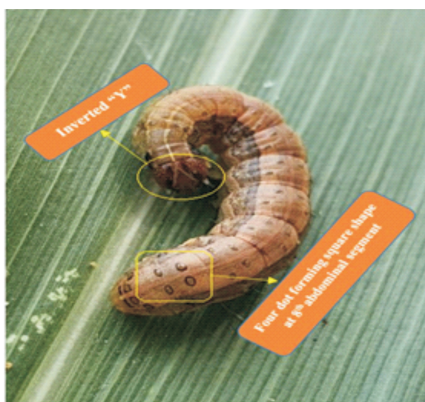


Fig. 2. White Inverted 'Y' lines on head and dots on last abdominal segment forming a square on larvae

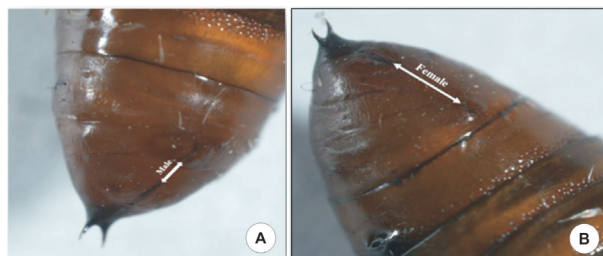


Fig. 3. Distinguishing characters of male pupa (A) and female pupa (B)

greyish brown to delicate grey with brown spots. Male forewings were brown and grey scaled with a white triangular patch at the apical and a circular spot in the mid of the wing. Both males and females have silvery white hind wings with a narrow dark margin (Rashed *et al.*, 2022; Sharanbasappa *et al.*, 2018b). The findings on damage and morphological characterization validate the species as *S. frugiperda* and this is the first confirmed report of this invasive species fall armyworm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae) in maize and sorghum crop from Haryana, India.

Specimen Examined: Haryana, India: 24 specimens, Hisar, coll. Ankit Kumar and Yogesh Kumar from maize and sorghum crop; 8 specimens Yamunanagar, coll. Maha Singh Jaglan from maize.

Comments: This species, *S. frugiperda* is reported first time from Haryana.

Host Plant: Poaceae: Maize (*Zea mays* L.) and sorghum (*Sorghum bicolor* L.)

References

Abrahams, P., Beale, T., Cock, M., Corniani, N., Day, R., Godwin, J. and Vos, J. 2017. *Fall Armyworm Status.*

Impacts and control options in Africa: Preliminary Evidence Note (April 2017), CABI, UK. Retrieved from <http://www.invasivespecies.org/Uploads/InvasiveSpecies/FAWinception-report.pdf>.

CABI, 2019. Fall Armyworm photo guide – identification. Posters and leaflets. FAO/CABI. 2 pp.

Chen, H., Wang, Y., Huang, L., Xu, C.F., Li, J.H., Wang, F.H., Cheng, W., Gao, B.Y., Chapman, J.W. and Hu, G. 2022. Flight capability and the low temperature threshold of a Chinese field population of the fall armyworm. *Spodoptera frugiperda*. *Insects*. 13: 422.

Chormule, A., Shejawal, N., Sharanabasappa, Kalleshwaraswamy, C.M., Asokan, R. and Mahadeva Swamy, H.M. 2019. First report of the fall Armyworm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera, Noctuidae) on sugarcane and other crops from Maharashtra, India. *J. Entomol. Zoo*. 7(1): 114-117.

Cock, M.J.W., Beseh, P.K., Buddie, A.G., Cafa, G. and 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(1): 4103.

Day, R., Abrahams, P., Bateman, M., Beale, T., Clotney, V., Cock, M. and Witt, A. 2017. Fall armyworm: Impacts and implications for Africa. *Outlooks Pest Manag.* 28: 196–201.

Du Plessis, H., Schlemmer, M.L. and Van den Berg, J. 2020. The effect of temperature on the development of *Spodoptera frugiperda* (Lepidoptera: Noctuidae). *Insects*. 11(4) : 228.

Goergen, G., Kumar, P.L., Sankung, S.B., Togola, A. and Tamo, M. 2016. First report of outbreaks of the fall armyworm a new alien invasive pest in West and Central Africa. *PLoS ONE*. 11(10).

Huang, Y., Dong, Y., Huang, W., Ren, B., Deng, Q., Shi, Y., Bai, J., Ren, Y., Geng, Y. and Ma, H. 2020. Overwintering distribution of fall armyworm (*Spodoptera frugiperda*) in Yunnan, China, and influencing environmental factors. *Insects*. 11(11) : 805.

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

Navasero, M.V., Navasero, M.M., Burgonio, G.A., Ardez, K.P., Ebuenga, M.D., Beltran, M.J., Bato, M.B., Gonzales, P.G., Magsino, G.L., Caoili, B.L. and Barrion-Dupo, A.L. 2019. Detection of the fall armyworm, *Spodoptera frugiperda* (JE Smith) (Lepidoptera: Noctuidae) using larval morphological characters, and observations on its current local distribution in the Philippines. *Philipp. Entomol.* 33(2): 171-184.

Paini, D.R., Sheppard, A.W., Cook, D.C., De Barro, P.J., Worner, S.P. and Matthew, B.T. 2016. Global threat

- to agriculture from invasive species. *PNAS*. 113(27): 7575-7579.
- Peairs, F.B. and Saunders, J.L. 1979. The fall armyworm, *Spodoptera frugiperda* (JE Smith). A review. *CEIBA*. 23: 93-104.
- Pogue, M.A. 2002. World revision of the genus *Spodoptera* Guene'e (Lepidoptera: Noctuidae). *Mem. Am. Entomol. Soc.* 43: 1-202.
- Prasanna, B.M., Huesing, J.E., Eddy, R. and Peschke, V.M. 2018. Fall armyworm in Africa: a guide for integrated pest management. First Edition. CIMMYT. USAID.
- Rashed, H. S.A., Khalil, M.S., Khalwy, K.M. and El-Ghbawy, I. A. 2022. Appearance of Fall armyworm, *Spodoptera frugiperda* as A New Invasive insect pest on Maize Plants in the Nile Delta, Egypt. *J. Plant. Prot. & Pathology*. 13(10): 231-234.
- Sharanabasappa, Kalleshwaraswamy, C.M. and Maruthi, M.S. 2018a. Biology of invasive fall army worm *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae) on maize. *Indian J. Entomol.* 80(3): 540-543.
- Sharanabasappa, Kalleshwaraswamy, C.M., Asokan, R., Mahadeva Swamy, H.M., Maruthi, M.S., Pavithra, H.B., Kavita, H., Navi, S., Prabhu, S.T. and Goergen, G. 2018b. First report of the fall armyworm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae), an alien invasive pest on maize in India. *Pest Manag. Hortl. Ecosyst.* 24(1): 23-29.
-
-