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First report of fall army worm, *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera: Noctuidae) on maize (*Zea mays*) from Madhya Pradesh, India

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Abstract

In recent times, India is witnessing a huge damage in maize crop due to attack of an invasive polyphagous pest i.e. Fall army worm, which has been first reported from Shivamogga district of Karnataka in May 2019. Now, it has expanded and stretched across the different states of the country and has also been observed in few areas / pockets of Jabalpur, Dhar and Indore districts of Madhya Pradesh. The insect samples collected from these places resembled the morphological characters of Fall army worm, *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera: Noctuidae), as reported by various scientists, which confirms the presence of the pest in the state, and in the near future it may create a massive havoc for the maize growers of Madhya Pradesh.

Keywords: Fall army worm, *Spodoptera frugiperda*, maize, Madhya Pradesh

Introduction

This communication records Fall armyworm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae), as a new invasive pest on maize (*Zea mays* L.) with some preliminary observations.

The Fall armyworm (FAW) is a highly voracious polyphagous pest (Murua *et al.*, 2009) [7], native to tropical and subtropical regions of USA, which is mainly reported from primary host maize but it has also been reported from other secondary hosts like rice, sorghum, sugarcane and many vegetables (Abrahams *et al.*, 2017 and Day *et al.*, 2017) [1, 3]. Its infestation in the maize crop can be seen in both the vegetative and reproductive stages, causing yield losses ranging from 15 - 73% (Hruska and Gould, 1997) [5].

During vegetative stage, the first two instars feed gregariously on the underside of young leaves causing the characteristic skeletonizing or 'windowing effect' and the later instars feed and move deep inside the whorls, thus killing the growing point, whereas during the reproductive stage of the crop, the larvae are found to bore in the cob which are filled with frass (Luginbill, 1928) [6]. The explosive spread and dispersal of *S. frugiperda* can be attributed to the human aided transport and natural migration as it has the ability to fly hundreds of kilometers in one windy night. Moreover, the short developmental cycle and high fecundity of *S. frugiperda* is also adding to its invasivity (www.iita.org) [12].

In India, FAW was first reported from the maize fields at College of Agriculture (UAHS), Shivamogga, Karnataka on 18th May 2019 (Sharanabasappa *et al.*, 2018b) [11]. Now, it has expanded and stretched across the states of Andhra Pradesh (Venkateswarlu *et al.*, 2018) [14], Bihar (Sarfaraz *et al.*, 2018) [9], Chhattisgarh (Deole and Nandita, 2018) [4], Karnataka (Sharanabasappa *et al.*, 2018b) [11], Tamil Nadu (Srikanth *et al.*, 2018) [12] and Maharashtra (Chromule *et al.*, 2019) [2]. Recently, FAW has also been observed from tank area and engineering fields of JNKVV, Jabalpur (23.16°N and 79.93°E), Badwi and Dhamnod villages of Dhar district (22.22°N and 75.47°E) and Hatod village of Indore district (22.80°N and 75.73°E) of Madhya Pradesh.

During field survey the FAW larvae were found feeding on the maize crop. It can be visualized that the FAW may become a serious pest for many other crops of economic importance in due course of time.

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Therefore it was thought pertinent to study its life cycle on maize under *in vitro* conditions, to figure out every detail about the biology and behaviour of FAW.

Materials and Methods

The present study was conducted in the Biocontrol Research & Production Centre, Department of Entomology, Jawaharlal Nehru Agricultural University, Jabalpur (M.P.). Survey for the occurrence of FAW was done in the maize growing areas of Madhya Pradesh. It was carried out on 50 plants randomly selected per spot and ten such spots per field were observed. Estimation of leaf damage was done by counting the damaged leaves per plant. The larvae of FAW were collected from a number of locations in Jabalpur, Indore and Dhar districts of M.P. (Table 1) and reared under laboratory conditions as per the methodology suggested by Santos *et al.* (2003) [8].

S. frugiperda adults was kept in breeding jars for egg laying. The breeding jars were covered with muslin cloth and wet cotton so as to maintain proper humidity. Maize leaves were kept as food every day for different larval stages of *S. frugiperda* to keep them alive. The duration of instars of *S. frugiperda* was recorded by observing exuvium shed after each moult. Observations were recorded on various developmental periods *viz.*, pre oviposition period, oviposition period, adult longevity and fecundity during the course of investigation. The colours of the various stages were also observed.

Results & Discussion

The insect was identified as per the key characteristics mentioned by Sharanabasappa *et al.* (2018a) [10] and confirmed as FAW.

Eggs: *S. frugiperda* laid eggs on the maize leaves, inner walls of the jars and on the cloth that covered the breeding jars. The oviposition period ranged from 2 to 5 days with a mean of 3.5 days. The eggs were laid in mass of 19 to 150 eggs in 1 to 2 rows. The average fecundity per female was 939 eggs which was slightly lower than that reported by Sharanabasappa *et al.* (2018b) [11]. The incubation period lasted for 2-3 days which corroborates with the findings of Sharanabasappa *et al.* (2018b) [11]. The eggs were dome shaped, slightly greenish in colour, but prior to hatching they turned shiny cream white or greyish (Table 2 and 3) (Plate 1). The mean post ovipositional period was 3.5 days and it ranged from 3 to 4 days which was slightly lower than that reported by Sharanabasappa *et al.* (2018b) [11] (mean 4.30 days). The variation in the ovipositional behavior of FAW moth might be attributed to differences in temperature, humidity, photoperiod and light intensity (Luginbill, 1928) [6]. Therefore, the variations reported in present findings from that of previous authors may be attributed to the changed climatic condition, photoperiod

duration, nutritional intakes and light intensity.

Larvae: The larvae underwent five moultings resulting into six morphologically distinguishable instars. The first, second, third, fourth, fifth and sixth stadium lasted for 1.5-3, 2-3, 2-3, 2-4, 2-4 and 4-6 days with an average of 2.25, 2.5, 2.5, 3.0, 3.0 and 5.0 days, respectively. The total larval period varied from 13.5 to 23 days with an average of 18.25 days. The present findings were in conformity with the findings of Luginbill (1928) [6] and Sharanabasappa *et al.* (2018b) [11]. Immediately after hatching, the neonate larvae aggregated to form a group on or near egg mass to disperse after 1-2 days (Table 2). Initial instars (first to third instar) exhibited orange to reddish colour but as the development progressed, the colour of larvae changed to black with some reddish patches in the abdomen and four dark coloured pinnaculæ arranged in a square on dorsal 8th and 9th segment became clearly visible from fourth instar onwards (Table 3) (Plate 2).

Pupae: The pupal period varied from 9 to 11 days with a mean of 10.00 days and is in accordance with the findings of Santos *et al.* (2003) [8] and Deole and Nandita (2018) [4] (Table 2) (Plate 3). Sexual dimorphism was observed in the pupal stage which was differentiated and identified as per the characters mentioned in Table 3.

Adults: The adults were pale brownish in colour (Plate 4). The male moths were smaller in size as compared to females. Moreover, they can be distinguished on the basis of the spots and patches present on their forewings (Table 3). The longevity of male and female moth ranged from 7-9 days and 8-13 days with an average of 8.0 and 10.5 days, respectively. Similar findings have been reported by Sharanabasappa *et al.* (2018b) [11] (8.20 and 10.80 days for male and female moths). Whereas, findings of Deole and Nandita (2018) [4] contradicted from the present findings, as they reported shorter longevity of moths *i.e.* 5 to 7 days. The differences in duration of various life stages of *S. frugiperda* and a slightly extended life span on whole when compared to the studies done by Sharanabasappa *et al.* (2018b) [11] might be due to changed climatic condition and nutritional value of different hosts.

Extent of damage: The overall mean plant and leaf damage in western Madhya Pradesh ranged from 0.7 to 49.9% and 25.4 to 65.2% with an average of 9.51% and 33.22%, respectively. Plant and leaf damage was found to be highest in the fields of Dhar district (13.8 and 31.2%, respectively), followed by Jabalpur district (11.65 and 28.75%, respectively) and minimum in Indore district (3.1 and 26.6%, respectively) (Table 1).

Table 1: Status of FAW on Maize in three districts of Madhya Pradesh

Districts	Latitude & Longitude	Altitude (Ft above mean Sealevel)	Date of observation	Plant damage (%)		Leaf damage (%)	
				Mean	Range	Mean	Range
Jabalpur	23.16°N 79.93°E	1322	30-03-2019	11.65	0.0 - 26.7	27.85	0.0-78.90
Indore	22.80°N 75.73°E	1833	02-04-2019	3.10	0.7- 7.4	46.60	27.3-65.2
Dhar	22.22°N 75.47°E	535	26-03-2019	13.80	10.8 – 49.9	31.20	25.4-41.5

Table 2: Biological parameters of *S. frugiperda* reared on maize

Parameters	Duration (in days)	
	Range	Mean
Pre oviposition	3-4	3.5
Oviposition	2-5	3.5
Post oviposition	3-4	3.5
Incubation	2-3	2.5
1 st instar larva	1.5-3	2.25
2 nd instar larva	2-3	2.5
3 rd instar larva	2-3	2.5
4 th instar larva	2-4	3.0
5 th instar larva	2-4	3.0
6 th instar larva	4-6	5.0
Total larval period	13.5-23	18.25
Pupa	9-11	10.00
Male longevity	7-9	8.00
Female longevity	8-13	10.5
Total life cycle (Male)	33 -46	39.5
Total life cycle (Female)	34-50	42.0

Temp. 25 ± 5 °C and RH 70 ± 10 %

Table 3: Morphological characters of different immature and adult stages of *S. frugiperda*

Stage	Morphological characters
Egg	Slightly greenish in colour, prior to hatching turned shiny cream white or greyish
Larva	
First instar	Light yellow in colour with two black colored setae per segment
Second instar	Light gray in color and no. of setae per segment varied between 2-4
Third instar	Brownish in colour on dorsal surface and dark grey on the ventral side with 4 setae per segment
Fourth instar	Same as third instar but larger in size, inverted Y- shaped yellow colour mark on head and four dark coloured pinnaculæ arranged in square on dorsal 8 th and 9 th segment becomes clearly visible
Fifth instar	Same as fourth instar but with more vigour
Sixth instar	Same as fifth instar but larger in size
Pupa	
Male	Distance between genital opening and anal slot is less
Female	Distance between genital opening and anal slot is more
Adult moth	
Male	Forewings light brown and straw in color White blotch mark near the tip of each forewing is more pronounced.
Female	Forewings dark brown with light and dark markings White blotch mark is not very much clear in appearance.



a) Egg mass

b) Eggs near to hatch

Plate 1: Egg stage of *S. frugiperda*



Plate 2: Fully mature larva of *S. frugiperda*



Plate 3: Pupal stage of *S. frugiperda*



a) Female

b) Male

Plate 4: Adult moth

Conclusion

The insect samples collected from Jabalpur, Indore and Dhar districts in Madhya Pradesh resembled the morphological characters of Fall army worm, *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera: Noctuidae), as being reported by various scientists, which confirms the presence of the pest in the state, which may emerge as a metastasizing nuisance for the maize growers of Madhya Pradesh. Moreover, due to its polyphagous and sturdy nature, it may become a potential threat for other crops too, thus, putting the whole agriculture production and food security of the state at stake. So, more and more concern must be drawn towards efficient

management and control of this pest by developing suitable IPM module and identifying the efficient chemical control measures.

References

1. Abrahams *et al.* Fall Armyworm: Impacts and Implications for Africa. *Outlooks on Pest Management* 2017;28(5):196-201.
2. Chormule A, Shejawal N, Kalleshwaraswamy CM, Asokan R, Mahadeva SHM. 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* 2019;7(1):114-117
3. Day *et al.* Fall Armyworm: Impacts and Implications for Africa. *Outlooks on Pest Management* 2017;28:196-201.
4. Deole S, Nandita P. 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* 2018;6(6):219-221
5. Hruska AJ, Gould F. Fall armyworm (Lepidoptera: Noctuidae) and *Diatraea lineolata* (Lepidoptera: Pyralidae): Impact of larval population level and temporal occurrence on maize yield in Nicaragua. *Journal of Economic Entomology* 1997;90(2):611-622.
6. Luginbill P. The fall armyworm. USDA 1928. Technical bulletin, 34.
7. Murúa M, Juárez M, Prieto S, Gastaminza G, Willink E. Distribución temporal y espacial de poblaciones larvarias de *Spodoptera frugiperda* (Smith) (Lep.: Noctuidae) en diferentes hospederos en provincias del norte de la Argentina. *Journal Rev IndAgríc de Tucumán* 2009;86(1):25-36.
8. Santos LM, Redaelli LR, Diefenbech LMG, Efrom CFS. Larval and pupal stage of *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae) in sweet and field corn genotypes. *Braz. J. Biol* 2003;63(4):627-633.
9. Sarfaraz A, Zakkia M, Mohammad DM. First record of the fall armyworm, *Spodoptera frugiperda* (J. E. Smith, 1797) (Lepidoptera: Noctuidae), an evil attack on paddy in Magadh, Bihar (India). *Journal of Emerging Technologies and Innovative Research* 2018;5(12):546-549.
10. Sharanabasappa, Kalleshwaraswamy CM, Maruthi MS, Pavithra HB. Biology of invasive Fall army worm *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae) on maize. *Indian Journal of Entomology* 2018a;80(3):540-543.
11. Sharanabasappa *et al.* First report of the Fall armyworm, *Spodoptera frugiperda* (J E Smith) (Lepidoptera:

- Noctuidae), an alien invasive pest on maize in India. Pest Management: in Horticultural Ecosystems 2018b;24(1):23-29.
12. Srikanth *et al.* First report of occurrence of fall armyworm, *Spodoptera frugiperda* in sugarcane from Tamil Nadu, India. Journal of Sugarcane Research 2018;8(2):195-202.
 13. www.iita.org/news-item/fall-armyworm-has-reached-the-indian-subcontinent: Fall armyworm has reached the Indian subcontinent
 14. Venkateswarlu U, Johnson M, Narasimhulu R, Muralikrishna T. Occurrence of the fall armyworm, *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera: Noctuidae), a new pest on bajra and sorghum in the fields of agricultural research station, Ananthpuramu, Andhra Pradesh, India. Journal of Entomology and Zoology Studies 2018;6(6):811- 813.