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Fall army worm *Spodoptera frugiperda* (J.E. Smith) new formidable challenge pest in maize crop: A review

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Abstract

The global agriculture often faces new threats from invasive alien insect pests, pathogens, weeds etc requiring immediate attention and co-operative action to manage the pestilence. In this regard, the fall armyworm (FAW), *Spodoptera frugiperda* is a notorious pestiferous insect with high dispersal ability, wide host range and high fecundity that make it one of the most severe economic pests. It is the first confirmed report of occurrence of new invasive pest on maize fields in Raigarh district of Chhattisgarh. Identification of FA W has been carried out employing nature of damage indicating that there was moist sawdust-like frass near the funnel and upper leaves and morphological character based on maize crop. Its high pestiferous nature poses a formidable challenge to Indian agriculture warranting immediate action before it assumes a serious proportion.

Keywords: Fall armyworm, *Spodoptera frugiperda*, Chhattisgarh, India, maize

Introduction

The invasive agricultural pest Fall Armyworm (FAW), *Spodoptera frugiperda*, pose a serious threat to agriculture and cost billions of dollars in terms of reduced production and productivity. Originally from the tropical regions of the United States, Argentina, and the Caribbean region and is a serious pest of maize in Brazil and other countries. The FAW is a polyphagous pest that feeds on at least 100 plant species belonging to 27 families (Pogue 2002) [12]. FA W has been confirmed in over 43 African countries (Prasanna *et al.*, 2018) [13]. It is reported to cause a 34% reduction in grain yield (Lima *et al.*, 2010) [11] and annual loss up to US dollars 400 million in Brazil (Figueiredo *et al.*, 2005) [7]. In addition, it is reported to cause major damage to economically important cultivated grasses such as rice, sorghum, and sugarcane as well as 23 horticultural crops like cabbage, beet, tomato, potato and onion besides cotton, pasture grasses, peanut, soybean, alfalfa and millets (Chapman *et al.*, 2000; CABI, 2016) [5, 3]. This pest has been detected for the first time on the Indian subcontinent in mid-May 2018 in maize fields at the College of Agriculture, (UAHS), Shivamogga. Similar information has also just been released based on independent investigations by the National Bureau of Agriculturally Important Microorganisms (NBAIR) under the Indian Council of Agricultural Research (Shylesha *et al.* 2018) [14]. FAW has spread quickly due to its short reproductive cycle and ability to travel long distances quickly in the adult (moth) stage. Therefore, urgent attention and preparedness on the threat of FAW is crucial. The FAW flies on prevailing winds, has a short life-cycle, and attacks a wide range of crops, rendering it a serious economic risk to our farmers. It is classified as an A1 quarantine pest on the list of the European and Mediterranean Plant Protection Organisation (EPPO), and is a quarantine pest in South Africa. A survey was conducted by Krishi Vigyan Kendra, Raigarh, Department of Agriculture, Raigarh District and maize growers to assess the incidence and confirm its presence entire the district during January 2019 and we report the occurrence of *S. frugiperda* in different maize growing areas located in Dharamjaigarh block of Raigarh district.

Materials and Method

Nature of Damage of fall army worm, *S. frugiperda*

A study was conducted to identify the new invasive pest infesting maize in farmers field on hybrid maize- 502 and 9081 in Raigarh district of Chhattisgarh during January 2019. Symptoms were recorded different crop stages of maize.

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Sample collection

The larvae were found to cause damage from vegetative stage to immature cob stage. Larvae were collected from the different villages of Dharamjaigarh block of the district. The observation was recorded 10 randomly selected plants in one square meter area at different crop stages.

Results and Discussion

Nature of Damage of fall army worm, *S. frugiperda*

Fall armyworm incidence was noticed in a maize field located in Sagarpur and Baysi village, Dharamjaigarh block, Raigarh district, Chhattisgarh on January 2019. Maize plants damaged by the larvae showed characteristic shot holes on the leaves. Neonate's larvae feeding on leaf gregariously and leaf becomes dry, then larvae were moved to other leaf for feeding. Grown up larvae were found confined to whorls and feeding between the leaves showing distinctive symptom of ragged appearance. A mass of faecal matter accumulated within the whorl (Fig. 1). Larvae feeding on developing cob as well as silk were also noticed. Very early symptoms of fall armyworm resemble other stem borers damage like small holes and "window pane" feeding on the leaves emerging from the whorl is common. Although initial symptoms of damage were similar, thresholds and control measures differ. Therefore it is important to find the live larvae and determine which insect is causing the damage. Larger fall armyworm larvae were consuming large amounts of leaf tissue resulting in a ragged appearance to the leaves similar to grasshopper damage. Larger larvae were found deep in the whorl often below a "plug" of brown frass. Beneath this plug, larvae were protected. Larvae were also found feeding in to the ear. Goergen *et al.* 2016 [8] studied that, farmers were also able to recognize the fall armyworm based on different indicators, and the majority of them observed larvae attacking maize plants. The larvae caused severe damage at all maize crop growth stages; however, the damage was more serious at early growth stages of the plants (vegetative stage). Similarly, Deole *et al.* 2018 [6], Abrahams *et al.* 2017 [1], Sisodiya *et al.* 2018 [15] and Capinera, 2017 [4] were also found that, fall army worm late-instar larvae damage the growing points of the plants causing defoliation and dead hearts (death of the growing tip). Furthermore, older larvae burrow into maize tassels and ears, causing extensive damage.

Sample collection

Survey for the occurrence of *S. frugiperda* was conducted in different maize growing areas of Dharamjaigarh block of Raigarh district and larvae were collected from the damaged plant. Young larvae are difficult to identify morphologically as the early instars resemble those of several other noctuids. The mature larvae were recorded 3.1-3.5 cm long and marked with whitish-yellow inverted 'Y' on the head with distinct black spots (pinacula) on the body. The four black spots on the 8th abdominal segment were arranged in a square and on

the 1 to 7th and 9th segment arranged in a trapezoidal pattern (Fig. 2). Grown up larvae were dark brown with granular texture all over the body. All the larval characters noticed were resembled those of *S. frugiperda*. *S. frugiperda* late instar showing inverted "Y" on head capsule and four black dots in a square pattern on eighth abdominal segment was also recorded by Hardke *et al.*, 2015 [9] and Anonymous, 2017 [12].

Our field observation demonstrated its establishment in parts of Raigarh district. All developmental stages of maize plant are attacked but severe damages occurred on young plants. The crop stand was 15 days, 30-35 days, 40-45 days and 55-60 days old in different localities surveyed. On survey period 15 days old maize crop on an average 5 plant damaged out of 10 plants and 2 full grown larvae/ two- three instar larvae were collected in every plants and 30-35 days old crop their 3 to 4 plant damaged out of 10 plants with 1-2 full grown larvae/ two- three instar larvae were collected but in other one location 30-35 days old crop on average 80-90 percent infestation was noticed in one acre area. In 40-45 days and 55-60 days old maize crop on an average 1-2 plant damaged out of 10 plants and 1 full grown larvae/ three-fourth instar larvae were collected in infested plants by *S. frugiperda*.

Cannibalistic behaviour was also seen when 15 larvae were kept in one plastic box. Jason *et al.*, 200, Deole S. 2018 [6] and Paul N., 2018 also observed cannibalism in *S. frugiperda* larvae commonly even when food was not limiting, but occurred more frequently at low food quantities and or high rearing densities. The sex of the larvae had no effect on the incidence of cannibalistic behaviour, however the probability of cannibalism occurring was affected by larval stage. The frequency of cannibalism was significantly higher among fifth and sixth-instar larvae than among earlier instars.

Conclusion

The arrival of FAW in Chhattisgarh has made it clear that the pest will cause destruction globally. At this point, the port of entry of the fall armyworm into Chhattisgarh is not yet determined but entire the Raigarh district is located dance forest and large mountain. As this pest is reported to have remarkable dispersal capacity, high reproductive capacity, the absence of diapause and wide host range, it is likely to spread to the entire state. Hence, there is urgency for nationwide coordinated efforts to contain the pest. The present investigation may help the researchers to throw a light on the above said issues.

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Fig 1: Damage symptoms of *S. frugiperda* in maize field (Larva feeding inside the whorl with fecal matter and Shot hole symptoms on the outer leaves)



Fig 2: Different larval instars of fall army worm *S. frugiperda* (Raised four black spots on 8th abdominal segment and inverted 'Y' on head of fully grown larva)

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