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An Emerging Biotic Constraint Fall Armyworm (*Spodoptera frugiperda* J. E. Smith) (Lepidoptera: Noctuidae) of Maize

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Abstract

Fall Armyworm poses an escalating biotic threat to maize cultivation. This polyphagous pest targets over 100 different hosts, causing significant harm to economically vital crops like Rice, Sorghum, Sugarcane, as well as horticultural crops and others like cotton, groundnut, soybean, alfalfa, and millets. This lepidopteran pest, with its voracious larval feeding habits, has rapidly emerged as a significant constraint, causing substantial yield losses in maize crops. The severity of FAW infestation, particularly on young crops, necessitates strategic and integrated pest management approaches to safeguard agricultural productivity. The life cycle involves distinct stages, including egg deposition, larval development, pupation, and adult emergence. Diverse management strategies, encompassing cultural practices like deep ploughing, timing of sowing windows, and the application of synthetic and biopesticides. Furthermore, the incorporation of natural enemies such as *Telonomus* sp., *Trichogramma* sp., and *Campoletis chloridae* in biocontrol measures reflects the ongoing efforts to counter the menace of FAW.

Key words: Fall Armyworm, Life cycle, Damage and Management

Introduction

The fall armyworm, scientifically identified as *Spodoptera frugiperda* Smith, derives its name from the feeding habits of its larval phase. In Latin, "Frugiperda" translates to "lost fruit," highlighting its ability to harm crops and result in significant yield reduction. It's crucial to emphasize that, contrary to its colloquial name, FAW is a caterpillar and not a genuine "worm." The term effectively paints a picture of advancing larval masses, reminiscent of an army, creating destruction in their path. [1].Originally from the Americas, the fall Armyworm (FAW) is present in various countries, such as Mexico, Brazil USA and Argentina[3]. Over 100 different hosts are targeted by FAW, a polyphagous pest. Furthermore, significant harm has been

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documented to be inflicted on economically vital cultivated grasses belongs to Poaceae family such as Rice, Sorghum and Sugarcane, along with some horticultural crops like Cabbage, Tomato, Beet, etc. as well as cotton, groundnut, soybean, alfalfa, sugarcane and millets [4]. In India, maize (*Zea mays* L.) is cultivated in an area of 90.27 lakh ha with a productivity of 30.70 q/ha [8]. The crop is infested by an array of pests including shoot fly, stem borer, aphids, mites, cob worm and web worm which together result in yield loss of 15 to 25% [9]. But, the fall armyworm (FAW) leads to substantial maize yield reductions ranging from 57.6% to 58% [5].

Life cycle [6]

- **Egg –** Females deposit their eggs in clusters on leaves and whorls, each egg adorned with a golden-colored tuft of hair. The incubation period lasts for 2 to 3 days.
- **Larvae –** Larvae go through six instars and complete their development within a span of 14 to 19 days.
- **Pupa -** The process of pupation occurs beneath the soil, and the pupal stage lasts for duration of 9 to 12 days.
- **Adult –** Females exhibit a lifespan ranging from 32 to 43 days, while males have a longevity range of 34 to 46 days.

Morphological characteristics

On the mature larva, a white 'Y'-shaped capsule is observed inverted on the head, and four well-defined black spots are present on the 8th abdominal segment [2]. The forewings of male moths exhibited shades of grey to brown, featuring an indistinct reniform spot at the joint of M 3 and Cu A1 veins and a triangular white color patch near the apical margins. In contrast, the forewings of female moths displayed a more uniform coloration. [7].

Nature of Damage

The severity of fall armyworm infestation was notably higher on young crops, commencing at around 20-22 days of crop age. Neonate larvae engaged in feeding on the leaves by scraping off chlorophyll, resulting in the formation of a silvery transparent membrane in the early stages, ultimately leading to the development of white elongated patches.

Fig. 1 Larvae of *Spodoptera frugiperda*

Fig. 2 Damage symptoms

Subsequent instars caused the formation of 'window pane' patterns on the leaves, accompanied by the presence of damp sawdust – like frass near the funnel and upper leaves [2].

Management

- Deep ploughing is typically done in the height of summer.
- Typically, late in the growing season, the fall armyworm makes its appearance. Therefore, to prevent infestation by the fall armyworm, late sowing in kharif crops should be abstained from. Additionally, the seeding of kharif maize should be constrained to the earliest and narrowest sowing windows to disturb the continuous availability of the host range. This is because an early harvest assists maize ears in avoiding the heightened concentrations of armyworms that emerge later in the season. [10].
- Sex pheromones are employed to attract and capture male insects.
- The process of creating poison bait involved combining 5.0 kg of jageery with 4 to 5 L of water. To this mixture, 625.00 ml of monocrotophos 36 SL are introduce. Subsequently, this solution blends with 50 kg of rice or wheat bran and enclosed in gunny or plastic bags, where it was left to ferment for a period of 48 hours. [11].
- Foliar application of Chlorantraniliprole 18.5% EC, Spinosad 45% SC, Indoxacarb 14.5% SC [12] and Emamectin benzoate 5% SG [13].

Sr. no.	Host	Host stage	References
1.	***Telonomus sp.***	**Egg parasitoids**	**14**
2.	***Trichogramma sp.***	**Egg parasitoids**	
3.	***Campoletis chloridae***	**Endo larval parasitoids**	**15**
4.	***Exorista sorbilans***	**Endo larval parasitoids**	

Conclusion

FAW has spread to various countries, including Mexico, Brazil, the USA, and Argentina.The notable polyphagous nature of FAW, targeting a diverse range of crops beyond maize, underscores its potential to wreak havoc on global agricultural ecosystems. FAW causes significant damage to maize crop in India. The challenges posed by FAW are multifaceted, ranging from the deceptive colloquial nomenclature to its rapid spread across various continents. The presented insights into its life cycle, morphological characteristics, and nature of damage elucidate the complexities associated with managing and mitigating its impact on maize cultivation. Various management strategies are employed like cultural, physical, mechanical, biological and chemical control.

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