The first report on Fall Armyworm, *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera: Noctuidae) as an invasive pest in banana from Kerala, South India and notes on its behaviour

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The fall armyworm (FAW), *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera: Noctuidae), a notorious pest of maize was recorded from India as an invasive insect pest severely damaging maize crop during 2018 from Karnataka state, South India (Ganiger *et al.*, 2018). Native to the tropical region of the western hemisphere from the United States to Argentina, it was reported as the most important pest of corn in Brazil (Shylesha *et al.*, 2018) causing 34% reduction in maize grain yield amounting to an annual loss of US$ 400 million (Ganiger *et al.*, 2018). Later this invasive pest got introduced into Africa in 2016 (Goergen *et al.* ) and to Ghana in 2017 (Ganiger *et al.*, 2018) causing severe economic loss, thus warranting decisive management strategies. Its highly polyphagous nature coupled with the potential to spread into the new regions of the globe had lead IITA (2018) to observe, “Further expansion of FAW to countries adjacent to India such as Bangladesh, Nepal, Pakistan, and beyond will put the maize production of the whole Asian continent seriously at risk with dire economic consequences.” After its report from India in 2018, FAW had invaded Bangladesh, Thailand, Myanmar, China, Sri Lanka and Nepal (Kushal *et al.*, 2020).

FAW had been reported from peninsular Indian states of Karnataka, Tamil Nadu, Andhra Pradesh, Telengana (Venkateswarlu *et al.*, 2018) as a pest that prefer crops belonging to the Graminae family *viz.*, maize, millet, sorghum, sugarcane, rice, wheat and other field crops like cowpea, groundnut, potato, soybean, cotton, etc. The conspicuous absence of reports on this pest from Kerala leads to renewed interest in the probable finding of their damage to economically important crops that have yet to record its infestation.
Materials and Methods

Surveys were undertaken regularly for detecting and identifying new and emerging insect pests of banana in Kerala. During 2020, a progressive banana farmer had informed about a severe attack of caterpillars on the banana with a hitherto unseen mode of attack in his field to the notice of the authors. Field visits were promptly conducted and damage symptoms and associated larvae that caused it was documented. As the larvae collected resembled noctuid species, they were brought to the laboratory for detailed observation.

The populations of suspected FAW from Edavaka Panchayat (Lat 1°46’53.2416” N, Long 75° 50.136” E) of Mananthavadi Block (Wyanadu District) were collected and brought to the entomology laboratory at Banana Research Station, Kannara, Thrissur, Kerala for rearing and studies on both morphological and molecular characterization as well as for the presence of natural parasitization.

Results and Discussion

The larvae collected were identified as *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera, Noctuidae) using differentials mentioned in Ganiger *et al.* (2018) and Venkateswarlu *et al.* (2018). The caterpillars had a prominent white inverted “Y” mark on the head (Fig. 1) and with distinct four black spots on the dorsum of 8th abdominal segment that are arranged in a square (Fig. 2). The larvae closely resembled armyworm in the outline. The pupae were reddish-brown in colour with the cremaster having two spines (Fig. 3).

Damage symptoms

The incidence of *S. frugiperda* was observed in a banana orchard having 5000 plants that were planted in June and August, 2020. Young larvae were greenish grey in colour with greyish blackhead were found feeding on margins of the leaf petioles and margins of pseudostems. But 3rd instars onwards the larvae were found feeding into the first 2-3 whorls of the pseudostem in young plants. They showed a marked affinity for the first and second whorls. Large and mature caterpillars with a dark grey head and dull brown body with white sub-dorsal and lateral white lines were found feeding within these feeding holes by inserting their anterior body into it.
The pseudostem of young banana plants of variety Nendran was seen with numerous feeding damages and boreholes 3-5 cm diameter on the surface with 1-3 cm depth (Fig. 5 and 6).

In the controlled condition of the lab, the caterpillars were also seen boring into petioles and making numerous shot holes or windows on the young leaves (Fig. 7). The presence of the larvae was confirmed by the copious amount of fecal pellets in and around the feeding areas. 3rd instar larvae were seen feeding on the spindle leaves by staying in the whorls. The mature larvae pupate inside on the outer whorls of pseudostem (Fig. 8). In a curious observation, the adult moths were found hiding within leaf axils of young plants in the orchard (Fig. 9). The incidence ranged from 1-3 larvae per plant with a maximum incidence of 20% recorded from the orchard.

**New record of banana as a host and host range**

According to Invasive Species Compendium, CABI (2020), *S. frugiperda* feeds on the leaves, stems and reproductive parts of more than 350 plant species. Shylesha *et al.*, (2018) point to the preference of *S. frugiperda* to crops of the Graminae family including many economically important plants such as maize, millet, sorghum, sugarcane, rice, wheat, etc. and on other field crops like cowpea, groundnut, potato, soybean, cotton, etc. They were reported to infest plants of 27 families (Goergen *et al.*, 2016). A scan through the available literature reveals scant reports on damage to banana plants by FAW, with an exception of the mention of *Musa* (Banana) and *Musa x paradisiaca* (plantain) as main and other hosts respectively in Invasive Species Compendium, CABI (2020). In India, FAW is mostly reported from maize and other graminaceous crops and had already spread to most parts of the Indian subcontinent covering maize farms in 20 states. Ganiger *et al.*, (2018) cautioned about the possible spread to other crops and call for a swift survey of the pest and to contain it at the earliest. The present natural infestation of *Spodoptera frugiperda* from banana is the first report of banana as a host plant for this invasive pest from India and points to its high adaptability and potential to spread. Even though maize is not a major crop in Kerala, the present incidence proves its potential to establish and build pestiferous populations in an economically important crop like banana with far-reaching ramifications. Further studies on its molecular characteristics including management options are being undertaken.
References


(1) White inverted “Y” mark on the head, (2) Distinct four black spots on the dorsum of *Spodoptera frugiperda* larva (3) Pupal character

(4) Mature larva feeding into the pseudostem, (5) Feeding damage to banana plant (6) *S. frugiperda* larva feeding on the outer whorls

(7) Shot holes on lamina by FAW larva (8) Pupation within pseudostem (9) Adult *S. frugiperda* hiding in leaf axil of banana