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Threat of fall armyworm in India and it's management- A Review

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Abstract

The Fall Armyworm (*Spodoptera frugiperda*) is crop pest specie commonly known as FAW. It is an insect which is native to America. Firstly it was migrated to Africa in January 2016 and later it spread to several Asian countries. In India, it was first reported in Karnataka in July, 2018 and subsequently found in other states like Andhra Pradesh, Telangana, Tamil Nadu, Maharashtra and Odisha. The Indian Council of Agricultural Research (ICAR) - National Bureau of Agricultural Insect Resources (NBAIR) issued an alert on 30th July, 2019 as based upon the prevalence of FAW in the maize fields in Chikkaballapur (Karnataka). Later on, it spread to 8-10 districts of Karnataka. The pest mainly attacks on maize, sugarcane crop. It has caused significant damage on maize and sugarcane crop in various states of India in 2019.

Keywords: Fall Armyworm, Sugarcane, Tamil Nadu, Maize etc.

Introduction

Fall Armyworm (*Spodoptera frugiperda*) (Lepidoptera: Noctuidae) (J.E.Smith) commonly known as FAW is native to tropics and sub tropics of America (Andrews K L). It feeds on nearly 80 species of crop plants mainly maize, sugarcane etc. Several dicotyledonous vegetables, cotton, wild grasses are also the host for FAW (Srikanth *et al.*, 2018) [15]. It has been first reported in Africa in 2016, as an invasive alien pest (Goergen *et al.*, 2016) [9], and further it spread to 30 countries of the continent and cause significant damage to maize crop (FAO, 2017) [8]. In India, it was first reported in Karnataka in July, 2018 and subsequently found in other states like Andhra Pradesh, Telangana, Tamil Nadu, Maharashtra and Odisha (Anonymous, 2019) [2]. The deadly pest destroyed crops in nearly 10 states of India. It has been spread to neighbouring countries like Sri Lanka, Nepal, Cambodia, Bangladesh (Parsanna, 2018, Singh *et al.* 2017a; Singh *et al.* 2017b; Singh *et al.* 2017c; Singh *et al.* 2018; Tiwari *et al.* 2018; Tiwari *et al.* 2019a; Tiwari *et al.* 2019b; Kour *et al.* 2019; Singh *et al.* 2019) [20, 21, 22, 23, 24, 26]. FAW has migrated to nearly 50 countries of Asia and Africa in the recent two years (FAO, 2017) [8].

First sight in India

The Entomologists C.M. Kalleshwara Swamy and Sharanabasappa first detected FAW in the research fields of maize at the University of Agricultural and Horticultural Sciences, Shimoga, Karnataka (Anonymous 2019) [2]. In 2018, a few maize farmers from Chikballapur district of the Karnataka state reported a pest infestation to A N Shylesha, scientist at the National Bureau of Agricultural Insect Resources [NBAIR] (Anonymous 2019) [2]. Bakshi Ram, Director of the Coimbatore-based ICAR- Sugarcane Breeding Institute, stated in December 2018 about the infestation of FAW in two districts of Tamil Nadu (Padhee, 2019) [16]. In 2018, Andhra Pradesh reported about FAW in maize growing affected areas of East and West

Godavari districts, Srikakulam and Vizianagaram (Padhee, 2019) [16]. FAW's first arrival was reported primarily on maize by several sources (EPPO, 2018; Shylesha *et al.*, 2018; Sharanabasappa *et al.*, 2018) [7, 28]. The first confirmed report of occurrence of FAW in sugarcane in India appears to be in Maharashtra in September 2018 (Chormule *et al.*, 2019a & b) [5, 6].

Biology and Life cycle of FAW

The FAW varies from light tan to black colour with three light yellow stripes down the back (ICAR-ADVSIORY, 2018) [11]. There is a dark wide stripe and yellow-red blotch stripe on each side also (FAO, 2017) [8]. The larvae of FAW have four pair of pro-legs (Besin, 2018) [3]. It may resemble with corn earworm but 'Y' shaped (fig. a) white inverted mark on its front head differentiates it. FAW has brown head with dark honeycombed markings (FAO, 2017) [8].



a) FAW with 'Y' shaped marking



b) moth of FAW

The moth population of FAW are capable to migrate very easily (nearly from 100-500 km per night) before laying of eggs. It completes its life cycle in 30-45 days (Shylesha *et al.*, 2018) [28]. In cooler temperature, it may extend upto 60-90 days also. The female moth of FAW lays 1500 eggs on an average, which lasts to 2-3 days in warmer weather. It has six larval instar stages before pupation (Shylesha *et al.*, 2018) [28]. The larval stage lasts for 14-30 days depending upon temperature and humidity (FAO, 2017) [8]. According to AN Shylesha (Entomologist, NBAIR) spread of FAW is due to Indian climatic conditions. A single female moth can lay up to 1,500 eggs when the temperatures are between 15 and 30 °C. The adult moth can travel across 100 km a night, which also aid its spread quickly to great distances and make it dangerous pest (Anonymous 2019) [2].

Symptoms and effects on maize and sugarcane crop

India produces nearly 20 million tonnes of maize very year. FAW mainly attacks maize crop as a defoliator in young stage

and as a cob borer in maturity stage (Srikanth *et al.*, 2018) [15]. Irregular holes in leaves and feeding on leaf margins are the typical symptoms (fig. d) of FAW in sugarcane crop. Leaves of infested plants showed skeletonization, irregular holes (fig. c) or windows on the lamina and margin feeding symptoms in both mother shoots and tillers (ICAR-SBI, 2018) [11]. Late maturing and late planted maize are more infested with the FAW (Besin, 2018) [3]. It can cause serious damage on leaf sheath, ear (ICAR-SBI, 2018) [11]. In some plants, the central shoot was nibbled, apparently by grown-up larvae, and in many plants the spindle was sheared. Infested shoots and tillers, however, did not show meristem damage (ICAR-ADVSIORY, 2018) [11]. In severely affected plants, mature larvae, visible or hidden in the whorl, amidst large quantities of fresh faecal pellets were observed; patches of dry frass were seen on older outer leaves (Srikanth *et al.*, 2018) [15].



c) Initial attack of FAW in maize crop



d) Damage of FAW in sugarcane crop

The sugarcane has also been included in host list of FAW throughout world (CABI 2018, EPPO 2018) [4, 7]. In November, 2018 in Pugalur, Karur district of Tamil Nadu observed first pest symptoms and suspected occurrence of FAW India, infested farms were examined and assessed. In affected plants of sugarcane leaves show gregarious neonate larval feeding symptoms (Srikanth *et al.*, 2018) [15]. Affected plants do not show drying (Besin, 2018) [3]. Both mother shoot and tillers in a clump displayed damage but when it split open meristem damage was not observed (ICAR-ADVSIORY, 2018) [11]. Many reports indicates that first primary target of FAW is maize crop, after that it subsequently attacks hosts like sorghum, sweet corn (Anonymous, 2019) [2]. FAW attacks on sugarcane in Maharashtra and Tamil Nadu after six months of occurrence in maize (Srikanth *et al.*, 2018) [15].

Survey and monitoring of FAW

FAW is a polyphagous pest, it can damage number of crops. It can travel hundreds of kilometres during its life cycle and egg laying capacity of female FAW is also profuse (Padhee, 2019) [16]. Therefore to control and monitor the pest, it is very much important to aware the farmers. A mass awareness campaigns are organized at village and block levels by agriculture department and KVK's (Padhee, 2019) [16]. The extension workers need to be aware the farmers about recognition of FAW at various stages of pest (eggs, early stages/instars of the larvae) and to manage/control the pest with IPM and other techniques (FAO, 2017) [8].

Continuous surveys needed, during early stages of the crop. Regular inspection in crop field at early stage help to control the pest infestation and expansion at maturity stage (ICAR-SBI, 2018) [11]. Checking of armyworm activity in maize crop can be started from mid-June (Padhee, 2019) [16]. Few days before tasselling, large larvae in whorls of crop will be pushed out when tassels emerge, these larvae may attack young ears also (Besin, 2018) [3]. Regular monitoring of FAW in maize can be done, until silk begins to dry. Pheromone traps are also used to monitor the pest in sweet corn and maize (Besin, 2018) [3]. In sugarcane crop, ratoon crop and plant should be monitored from germination phase to tillering phase, to assess succession of pest at different stages. Routine inspection should be done in besiding crops also like sorghum, paddy and cotton (Srikanth *et al.*, 2018) [15]. Sensitization of factory personnel and growers to report occurrence based on symptoms (CABI, 2018) [4].

Management of FAW

The seedlings are moved from infested areas to other area to monitor and restrict FAW dispersal (Padhee, 2019) [16]. Seedlings introduced for planting should be examined for the presence of FAW and treated with insecticide (ICAR-SBI, 2018) [11]. If the seedlings originate from FAW prone area, prophylactic or quarantine treatment may be resorted to (ICAR-ADVISORY, 2018) [11]. Clean cultivation should be practised, as it can survive in grasses. Intercropping with pulses reduces incidence and attack of FAW, as enhanced biodiversity enhances natural populations (ICAR-NBAIR 2018b) [12, 13]. Cane tops movement should be avoided, to prevent its dispersal (Srikanth *et al.*, 2018) [15]. Earthing-up is likely to disturb the soil and expose the hiding larvae and pupae to the action of general predators (FAW ADVISORY). Destruction of larval stages from infested plants should be carried out (Padhee, 2019) [16].

Till now, no insecticide is registered to control FAW in India, but Chloropyriphos and Monocrotophos are recommended for early season lepidopteran insects like shoot borer (Ramasubramanian and Srikanth 2015) [18]. Judicious use of insecticides recommended for use in sugarcane like chlorpyriphos and monocrotophos at 2-3 ml/l of water ensuring that the spray fluid is directed to the whorls, spot application is also applied if it is seen on patches of leaf in early stage (ICAR-ADVISORY, 2018) [11]. Earlier application of neem oil/azadirachtin can prevent oviposition and early larval feeding (ICAR-ADVISORY, 2018) [11]. Treatment of introduced seedlings with insecticide prophylactically or after inspection for the presence of damaging stages.

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