FALL ARMYWORM *SPODOPTERA FRUGIPERDA* ATTACK ON SUGARCANE: AN ADVISORY

**Background**

The fall armyworm (FAW) *Spodoptera frugiperda* is native to tropical and subtropical regions of the Americas. The lepidopteran pest feeds on leaves and stems of more than 80 plant species causing major damage to economically important cultivated grasses such as maize, rice, sorghum and sugarcane. It has been reported as a minor pest on several dicotyledonous vegetable crops and cotton, besides wild grasses.

Fall armyworm has been documented as eradicated or absent in Germany, Netherlands and Slovenia. It has been reported for the first time from the African continent in 2016 as an invasive alien pest and has subsequently spread to more than 30 African countries where it causes significant damage to maize crop and has great potential for further spread and economic damage. In 2018, FAW was reported on maize from the Indian subcontinent in Hassan, Chikkaballapur, Davanagere, Shivamogga and Chitradurga districts of Karnataka. The pest has also been reported mainly on maize in Maharashtra, Tamil Nadu, Andhra Pradesh, Telangana and, recently, Mizoram.

**Occurrence in sugarcane**

Earlier reports of FAW occurrence on sugarcane are limited to Latin American countries. Despite the recent invasion of Africa, its attack of sugarcane has not yet been confirmed in the continent. However, after its first appearance on maize in different states of southern India, the pest has been reported attacking sugarcane in Maharashtra. In Tamil Nadu, it has been observed damaging sugarcane in Modakurichi, Erode dt and Pugalur, Karur dt, in November 2018. Entomologists of the ICAR-Sugarcane Breeding Institute, Coimbatore, inspected the farms and identified the pest as fall armyworm. Subsequently, it has been reported in sugarcane crop from Satyamangalam and Udumalpet. Stray occurrence of the pest was also noticed in Coimbatore. In view of its likely spread in the sugarcane belt, the present advisory is being issued to enable its monitoring and management with the available information.

**Field symptoms**

Armyworm is known to attack maize as a defoliator in the young stage and as a cob borer in the mature stage. In sugarcane, however, it has appeared on the young crop, as was observed in the farms inspected in Erode and Karur districts in November 2018. Irregular holes or windows in leaves of affected plants and feeding on leaf margins were the typical symptoms (Fig. 1a). In some plants, nibbling and shearing off of central shoot was also observed, apparently due to damage by grown-up larvae (Fig. 1b). Meristem damage and deadhearts were not observed though the pest is known to cause such symptoms in maize. In severely affected plants, large
quantity of fresh frass pellets could be seen in the whorl with mature larva visible (Fig. 1c) or hidden (Fig. 1d) in the whorl. Older leaves showed patches of dry frass on outer leaves. Affected plants, however, did not show symptoms of withering or drying. Examination of older crop in the affected areas did not show symptoms but it needs to be seen if the pest can attack grown-up stages of sugarcane.

Fig. 1. Fall armyworm damage in sugarcane: (a) leaf damage; (b) nibbling of central shoot; (c) grown-up larva visible in the whorl; (d) grown-up larva partly hidden in the whorl
Identification

The pest can be identified in the field with the help of typical morphological features. Grown-up larvae are dark brown with a white inverted Y-shaped marking on the head. The abomenal segments show distinct black spots (pinnaculae) which are arranged in a square pattern on 8\textsuperscript{th} segment and (A8)13 and in trapezoid pattern on 9\textsuperscript{th} segment (Fig. 2a). Pupa is brown in color with the abdominal tip possessing two spines (Fig. 2 b & c). Moths possess greyish brown fore wings with three distinct marks in males (Fig. 2c) which are absent in females (Fig. 2d).

Fig. 2. Life stages of fall armyworm in sugarcane: (a) grown-up larva with markings on head and abdomen (b) pupa and abdominal tip with two spines (c) male moth (d) female moth
Interim management strategy

Pending long-term research efforts and development of effective management strategies, it is imperative to outline and adopt provisional prophylactic and curative management tactics to prevent its proliferation in sugarcane. The following are some interim measures on the basis of the information available in worldwide literature for maize and in the light of our experience with invasive pests like woolly aphid in sugarcane.

Survey and monitoring

i. Regular surveys need to be conducted, particularly in young crop, in registered and unregistered cane areas to detect the occurrence of FAW. Routine inspection of grown-up crop in the vicinity of young crop would reveal the possible expansion of the pest to the maturity phase.

ii. Both plant and ratoon crop should be monitored from the germination and tillering phases to maturity phase to assess the progression of the pest and preference of different stages.

iii. Besides sugarcane, other crops recognized worldwide as major hosts, such as maize sorghum and paddy should be monitored to understand and assess the host shifting behavior of FAW.

iv. Growers need to be sensitized to report the occurrence of the pest in their farms.

Preventive measures

i. Transport of cane to long distances for crushing or as seed material should be avoided or monitored to prevent accidental dispersal through infested leaves.

ii. Movement of cane tops should also be avoided to prevent possible dispersal, though the suitability of older crop is not clear presently.

iii. Movement of seedlings from infested areas to other areas for planting purpose should be avoided or monitored to prevent the entry and dispersal of the pest in new areas.

iv. Since FAW is known to survive on grasses, clean cultivation should be practiced.

v. Enhanced diversity, particularly intercrops with pulses, has been reported to reduce FAW incidence and enhance natural enemy populations. However, it should be practiced with caution since the pest is polyphagous. Intercrop of maize in sugarcane should be avoided.

vi. Sex pheromone lures of FAW being sold in the market need to be used after stringent field validation.

vii. Light earthing-up and fertilizer application should be followed without delay. Earthing-up is likely to disturb the soil and expose the hiding larvae and pupae to the action of general predators. Fertilizer application can boost plant growth and facilitate quick recovery from low level damage.
viii. Collection and destruction of visible larval stages from infested plants should be carried out wherever possible.

ix. Biological control recommendations are based on published literature and not on detailed experimentation in India. They can be followed for long-term benefit in a routine and prophylactic manner until conclusive evidence emerges on the effectiveness of specific biocontrol agents.

Curative measures

i. Early application of plant products like azadirachtin or neem oil may prevent oviposition and early larval feeding.

ii. Assessment of field incidence levels on the basis of damage symptoms or larval presence on the leaves or whorls will help in decision making for insecticide application. Percent FAW incidence can be assessed by selecting 5-10 spots randomly in the field and counting infested plants among 50 plants, both mother shoots and tillers, at each spot. Since no economic thresholds are available for FAW in sugarcane, 5-10% attack rate can be used for deploying insecticidal control.

iii. Since no insecticides are registered against FAW in sugarcane in India, chlorpyrifos and monocrotophos, recommended for early season lepidopteran pests like shoot borer, can be used following the arbitrary threshold level of 5-10% incidence. Ensuring that the spray fluid is directed to the whorls, spot application may be followed if infestation is seen in patches in the early stages but this may need constant monitoring and repeated application. Judicious deployment of insecticides is advised as resistance has already been reported elsewhere though not in India yet. Chlopyrifos application in focal fields at both Modakurichi and Pugalur under the supervision of the factory personnel was found effective with no subsequent recurrence of the pest.

Team Entomology
ICAR-Sugarcane Breeding Institute