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FALL ARMYWORM (*SPODOPTERA FRUGIPERDA*): AN EMERGING DESTRUCTIVE PEST OF MAIZE

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Introduction

Maize (*Zea mays*) is known as the queen of cereals and is widely cultivated as a cereal grain that was domesticated in Central America. Maize (*Zea mays*) is one of the world's important food crops, which supplies >5% energy. Maize has become a staple food in many parts of the world, maize production is surpassing that of wheat or rice, maize is also used for animal feed, and other maize products, such as corn starch and corn syrup. The six major types of maize are dent corn, flint corn, pod corn, popcorn, flour corn, and sweet corn. Many insect pest attacks on maize crop but fall armyworm is a serious pest in current year. More than 40 species of insect pests have been recorded on maize crops. Maize fall armyworm *Spodoptera frugiperda* (Lepidoptera: Noctuidae) FAW causing hefty yield losses. Firstly empirical the FAW *Spodoptera frugiperda* in Africa results in gigantic damage. "The hungry caterpillar is threatening a global food disaster". FAW is a polyphagous lepidopteran pest. The destructive phase of fall armyworm (June - August) is when the minimum average temperature overtakes 10°C, feeding in large numbers on the leaves and stems. It is rapidly spreading throughout tropical and subtropical regions of the landmass. FAW is a migratory insect known to cause serious damage to maize crops under warm and humid conditions. The summer season provides a favorable environment for the insect to quickly multiply and spread to more areas.

This pest was first observed in Shivamogga, Karnataka on 18th May 2018. FAW was later reported in Madhya Pradesh, Andhra Pradesh, Maharashtra, Tamil Nadu, Odisha, Telangana, Bihar, West Bengal, etc.

Host range : Fall armyworm is a polyphagous pest and wide host range there is an attack on field crops, vegetable crops, etc.

❖ Field crops	❖ Vegetable crops	❖ Other crops
• Rice	• Cucumber	• Apple
• Maize	• Tomato	• Grape
• Sugarbeet	• Spinach	• Orange
• Sorghum	• Turnip	• Papaya
• Oat	• Sweet potato	• Orange
• Wheat	• Sweet corn	• Peach

Life cycle : The fall armyworm has four life stages: egg, larva, pupa, and adult.

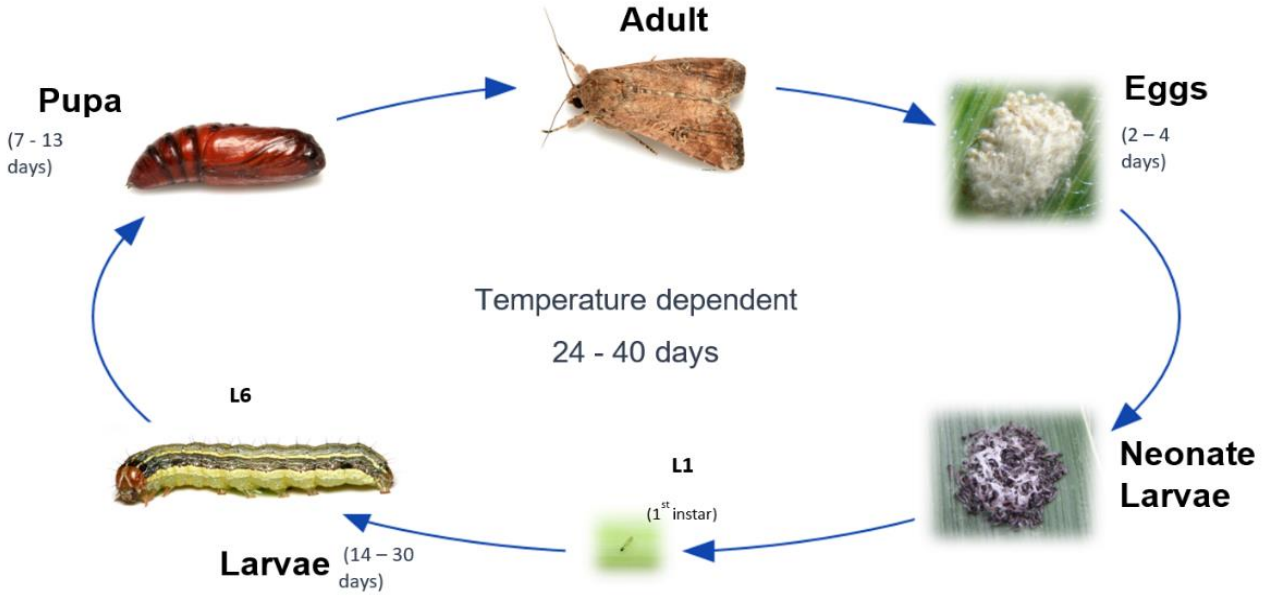

Figure:- 1

Eggs : The fecundity of the female moth is high. Female moths drop out eggs under the surface of the leaves in eggs masses. 50 -200 eggs are in egg masses. Approximately 1500 – 2000 eggs produced by her life span.

Figure:- 2

Larva : Immature stage of fall armyworm larva is brown to gray, green, or yellow-green color. Newly emerged larvae encircle itself with silken thread to the lower body after hatching. The initially emerged instar (1^{st}to3^{th}) larvae consumed the little leaf material, while the 4^{th} & 5^{th} instar larvae destroyed more than 90% of green foliage. This means during the earlier stage (1^{st} to 3^{rd} instar larva) damage is very minor not taken care of but after it causes serious damage (4^{th} & 5^{th} instar larvae)over a short time. The most active time of caterpillar is early morning to late evening and feed throughout the day.

Figure:- 3

Inverted "Y" on the head, is the most prominent characteristic of fall armyworm larva .this found between the eyes (Figure 3), and three whitish stripes on the head.

Pupa : Fall armyworm larvae carry time 2-3 weeks to reach the pupa stage. fully grown larvae passage into the ground converting the pupa. (Figure 4)

Figure:- 4

Adult : Both (male & female) adult moths are different morphological characteristics. forewing of Male moth chiefly brown-gray color with has a triangular white spot. The Fore wing of the female moth is distinctly marked with constant grayish-brown color. The hind wing is rainbow silver-white with a limited dark border in both sexes. The adult moth is a nocturnal insect and most active during warm, humid evenings they are complete many generations in one year. Most generations arise in the southern territory because the warmer climate

‘Female moth’

‘ Male moth’

Figure:- 5

FAW biology & Identification

Spodoptera *frugiperda* is a serious agricultural pest. The origin place is a tropical-subtropical region. It lacks diapause mechanisms and undergoes diapause in the mild climate of South Florida. The larval stage has 6 instars and feeds on many agriculture crops with a wide host range. FAW adults are nocturnal pests and do the feeding and mating activities; female insect species mate more times using a pheromone to attract the male adult species of FAW.

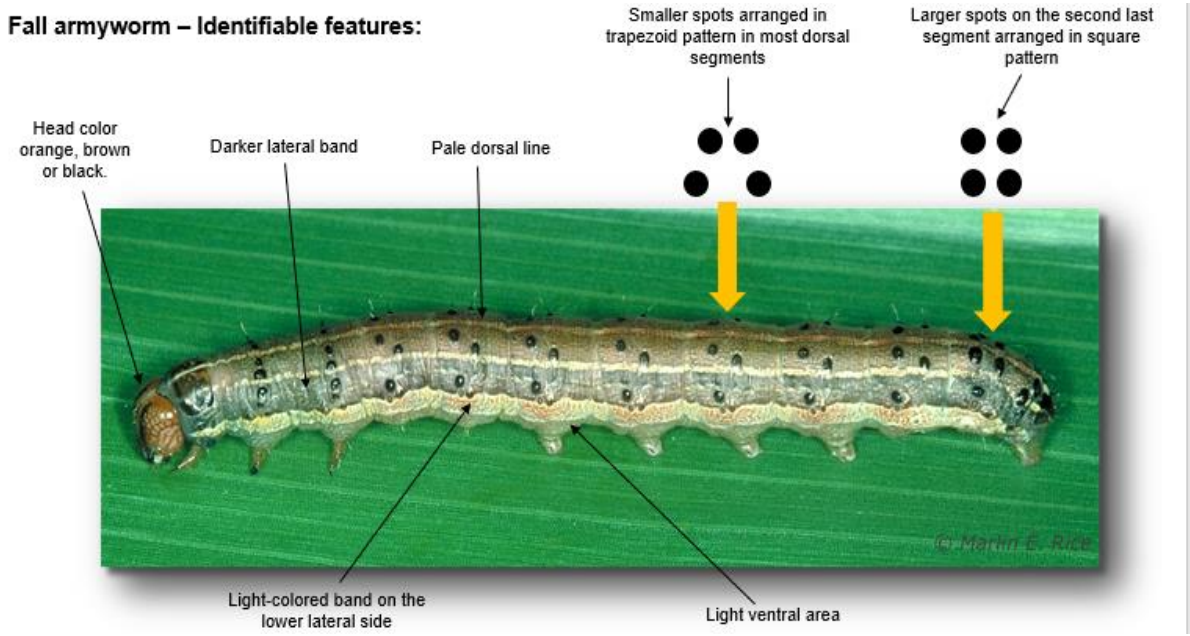

Figure:- 6

Damage symptom and management:-

Symptom-based treatment is very much effective and essential for the management of FAW because of two reasons;

- The stage of symptom indicates the stage of larval instar and its growth.
- The larval instar and its growth help to choose pesticide/control measures.

1. Elongated papery window of all sizes

- This symptom is caused by 1st and 2nd instar larvae and larvae scrapping on the leaf surface.
- Spread all over the leaves in a few adjacent plants including the crops.

✓ **Early identification of this symptom is a must for effective management of FAW**

Figure:- 7

Management

1. 5% Neem Seed Kernel emulsion (NSKE) or azadirachtin 1500ppm @ 5ml/L water.
2. *Bacillus thuringiensis* variety kurstaki formulations used (Dipel 8 l @ 2ml/L of water or Delfin 5WG @ 2g /L water).
3. Entomopathogenic fungi *Metarhizium anisopliae* (1 x 10^8 cfu/g) @ 5g/L or *Nomuraea rileyi* rice grain formulation (1 x 10^8 cfu/g) @ 3 g/L water.

2. Ragged-edged holes

- This symptom is caused by 3rd and 4th instar larvae
- Larvae feeding cause ragged-edged round holes on leaves.
- The size of holes increases with the growth of larvae.

Figure:- 8

Management

This stage need chemical control :-

1. Emamectin benzoate 5 SG @ 0.4 g/L
2. Spinosad 45 SC @ 0.3 ml/L
3. Chlorantraniliprole 18.5 SC @ 0.4 ml/L

3. **Significant leaf damage**
   - The larva consumes voraciously until it reaches the fifth instar, shedding bigger portions of leaves.
   - The 6th instar larva defoliates the leaves significantly and produces a large volume of faeces

Figure:- 9

Management

- Pesticides are not effective to control the 5th and 6th larval instar. The only effective control at this stage is poison baiting

Poison bait

- 10 kg rice bran and 2 kg jaggery should be combined in 2-3 liters of water and left to ferment for 24 hours. Add 100g Thiodicarb 75 percent WP. If the balls are too sticky, add additional sand when rolling.
- In the evening, the bait should be applied to the plant's whorl.

4. Damage to staminate and pistillate

- 6th instar larvae, affect the vulnerable part of the maize 'staminate & pistillate'.
- This stage of tassel damage is the greatest mutual which does not lead to economic damage but bore into the corn ear rapidly impacting the output. Zea mays' var. saccharata is more prone to FAW damage, which renders the pistillate unmarketable.

Figure:- 10

Management

- Chemical management is not appropriate at this time since larvae hiding inside the corn ear would not be exposed to the spray, and it is also not recommended to spray pesticides on sweet corn.
- Selecting a cultivar with a tight husk and husk covering the tip may provide some protection from FAW.

Other management Practices

1. Cultural regulator approaches/mechanical regulator approaches

- After the harvest, burn the crop remains at least 12cm deep to destroy the eggs, larvae, and pupa.
- To adopt the crop rotation Eg: cassava
- Intercropping with pigeon pea, groundnut, and beans reduces the incidence.
- If you notice the number of eggs or caterpillars are few then handpick and crush them. This is only practical for small gardens or few affected plants.
- Birds and certain predatory insects feed on FAW

Conclusion

Fall armyworm (*Spodoptera frugiperda*) is a destructive pest native to Americans, recently invaded India, and presently causing economic damage in maize. The study shows that there was a relationship between knowledge of *S. frugiperda* and the use of management practices. Increased use of pesticides to manage fall armyworm posses health and environmental risks, besides the high cost for farmers and governments.

Research into cultural and indigenous practices used by farmers will offer an opportunity for alternative and sustainable management practices.