Integrated Pest Management for Fruit Borer in Tomato

J. K. Gupta[1] and Krishna Avatar Meena[2]*

[1]Assistant Professor (Entomology),
College of Agriculture, Lalsot, SKN Agriculture University, Jobner
[2]Assistant Professor (Entomology),
College of Agriculture, Jhilai, SKN Agriculture University, Jobner

Corresponding Author
Krishna Avatar Meena
Email: krishnameena.kvk.kumher@sknau.ac.in

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ABSTRACT

Tomato is an important vegetable crop in India. For small farmers, it is one of their key sources of revenue. However, insect pests frequently attack tomato crop, with *Helicoverpa armigera* (Hubner) being the most notorious among them in India. The farmer communities who cultivate tomatoes use very high levels of chemical pesticide. The agro-ecosystem and human health are under danger because of the alarming rise in the chemical management of *Helicoverpa*. However, this practice has resulted in the creation of pests that are resistant. Consequently, there is increasing interest in creating sustainable management techniques that rely less on chemical pesticides. A thorough understanding of pest biology and dissemination demands in-depth expertise to achieve such a great aim. An integrated pest management strategy that is working to produce healthier crops and maintain a better sustainable agro-ecosystem is necessary for management of *Helicoverpa*. The primary objective of integrated pest management is to keep pest populations below levels that cause economic damage. The integration of suitable measures prevents the growth of the pest population. With the least amount of harm to the agro-ecosystem, integrated pest management seeks to cultivate healthy crops. 90% of fruit can be harmed by *Helicoverpa*, which also reduces production by 30-40%.

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill.) is one of the most important vegetable crops grown in India for fresh market and processing. It is cultivated though out the year due to the fact that it is adoptable to variable climatic conditions and remunerative to the farmers. In India, tomato is grown in an area of 8.54 lakh hectares and with production of 213.23 lakh tones, like other vegetables, is more prone to insect pests and diseases mainly due to its tenderness and softness as compared to other crops. It is devastated by an array of pests like borers and sucking pests; however, the major damage is caused by fruit borers. Realization of the highest crop yield potential is significantly hindered by the attack of fruit borers *viz*., *Helicoverpa armigera* (Hubner). They cause damage to the developing fruits with a resultant yield loss ranging from 20 to 60 per cent (Tewari *et al*., 1984; Lal and Lal, 1996). Solely dependence on the chemical pesticides and their indiscriminate use to manage these insect pests resulted in development of resistance in target pests (Armes *et al*., 1992) and harmful pesticide residues in fruits. It also results in erosion of sustainability and ill effects like pesticide residues on produce, pest resurgence, secondary outbreak of this pest (Fitt, 1989; Mehrotra, 1991), environmental pollution and health hazards to consumers as well to the farmers. Since employment of single strategy proved to be a disaster with several adverse effects with variable efficacy levels of pest control, promotion of adoptable strategies in an integrated approach is the need of the hour to manage tomato fruit borer. Such integrated pest management practices need to be encouraged and popularized for adoption at field level on a wider scale to reduce trust on pesticides. IPM module with components *viz*., use of pheromone traps for monitoring and mass trapping in combination with use eco-friendly bio-control agents like HaNPV and adoption of cultural practices are effective techniques to bring down pest infestations and can help in ensuring growth of healthy crops. Proper adoption of these IPM technologies with care from the nursery stage of the crop will ensure efficient management of the pest at a low cost, thus helping the resource poor farmers. Hence, an attempt was made to evaluate on the use and adoption of IPM modules for management of tomato fruit borers at the farmer's fields and to popularize these technologies among the farmers.

Taxonomic position

Kingdom: Animalia

Phylum: Arthropoda

Class: Insecta

Order: Lepidoptera

Family: Noctuidae

Genus: *Helicoverpa*

Species: *armigera*

Crop Pest Scenario

The presence of tomato fruit borers poses a significant challenge for tomato growers worldwide. This insect has a wide host range and can attack other crops such as cotton, sorghum, lablab, pea, chilli, groundnut, tobacco, okra, maize, tomato, soybean, safflower, gram, *etc*.

The damage caused by tomato fruit borers can lead to reduce yield, poor fruit quality, and marketability issues.

Distribution

Tomato fruit borers are widely distributed in many regions across the world. They are prevalent in tropical and subtropical climates, where temperatures and humidity are favorable for their survival and reproduction. However,

they can also occur in temperate regions during the warm seasons.

Nature of Damage

The tomato fruit borer larvae cause direct damage to tomato plants by feeding on the fruits. They create tunnels within the fruit, leading to rotting and decay. The affected fruits become unmarketable, unfit for human consumption, reducing the crop's yield and quality. In addition, the entry points made by the larvae can serve as entry points for secondary infections, further compounding the damage.

Life history of fruit borer

The life cycle of tomato fruit borer consists of four main stages: egg, larva, pupa, and adult. Adult moths are greenish to brown with a 'V' shaped speck on forewings and dull black border on the hind wing. The female of this insect lays eggs on the tomato plant, usually on the leaves or fruits singly. After 6-7 days, the eggs hatch, and the larvae emerge. The larvae are voracious feeders and cause severe damage to the tomato crop. Full-grown larva is about 2" long, greenish with dark brown gray lines and dark and pale bands. It shows colour variation from greenish to brown. The larval duration is about 14 days. They bore into the fruits, feeding on the pulp and seeds. Larvae go through several instars before entering the pupal stage. It pupates in soil for 10-12 days. The life cycle is prolonged during winter season, particularly in northern India. Finally, adult moths emerge from the pupae and repeat the cycle. One generation is completed in about 28 days under favorable conditions.

Eggs Larva Pupa Adult

Integrated management of Tomato Fruit Borer

To manage tomato fruit borers effectively through integrated pest management (IPM) approaches are recommended (Revathi and Jacob, 2019). IPM involves combining various control strategies to minimize pest populations and reduce crop damage. Some key components of IPM for tomato fruit borers include:

Cultural Control

- Implementing crop rotation, proper sanitation, and removing crop residues can help disrupt the pest's life cycle and reduce their population.
- Follow deep ploughing after harvesting of the crop to expose the pupae for natural death, provides efficient defense.
- Grow African marigold (*Tagitus erecta*) as a trap crop. Grow simultaneously 40 days old African tall marigold and 25 days old tomato seedling at 1:10 rows to attract *Helicoverpa* adults for egg laying.
- Install light traps to draw in and kill adult moths.

Physical and Mechanical Control

- Additionally, hand-picking of larvae in a restricted region. Collect and destroy the infested fruits and grown-up larvae.
- Install pheromone trap with Helilure at 15/ha and change the lure once in 15 days.

Biological Control

- Inviting insectivorous birds to help control the fruit borer can be accomplished by placing 15- 20 bird perches per ha.
- Encouraging natural enemies of tomato fruit borers, such as mirid bugs, parasitic wasps, and predators like spiders and birds, can help to manage their populations.
- Biological control agents can be introduced or conserved in the field. Release *Trichogramma chilonis* 6 times @ 50,000/ha per week coinciding with flowering time based on ETL.
- Release *Chrysoperla carnea* at weekly interval at 50,000 eggs or grubs / ha from 30 days after planting

Host Plant Resistance

Breeding and cultivating tomato varieties with tolerance or resistance to tomato fruit borers can provide an effective long-term solution. These resistant varieties can tolerate pest infestations and reduce the extent of damage. Grow less susceptible genotypes, such as Rupali, Roma, Pusa red plum. Grow resistant cultivars like BT 1, T 32, T 27, Punjab Kesari, Pant Bahar *etc*.

Chemical Control

Judicious use of insecticides can be employed when necessary, taking into consideration the pest's life cycle and threshold levels. It is essential to follow the recommended application guidelines and select insecticides with minimal impact on beneficial organisms and the environment.

Spray any one of the following insecticides with 500 litre water/ha.

- Azadirachtin 1.0% at the rate of 1.0 to 1.5 litre or 5% Neem seed kernel extract to manage early stages of larvae.
- Use of NPV at 250-300 larval equivalent (LE) per hectare in combination with jaggery at 20 g per litre of water. Repeat spray at 10- day interval effective against fruit borer.
- *Bacillus thuringiensis* 1 g per litre of water
- Spinosad is effective against *Helicoverpa armigera* of Tomato at 73 to 84 gm *a.i*. per ha and is very safe to three important predators (Ghosh *et al*., 2010).
- Novaluron 10 EC 350-400 ml/ha.
- Chlorantraniliprole 18.5 SC 150 ml/ha.
- Indoxacarb 14.5 SC 400-500 ml/ha.
- Lambda cyhalothrin 5 EC 300 ml/ha.
- Quinalphos 25 EC 1250 ml/ha.

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