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Fruit Flies: A Pest of Concern in Mango

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Abstract

Fruit flies are quarantine pests and major impediments to the horticulture sector, domestic market and export of fresh fruits. This article examines the Oriental fruit fly, *Bactrocera dorsalis,* infestation in mango with reference to its host range, bionomics, seasonal variations with management perspectives to reduce crop losses aimed at sustainable fruit production.

Keywords: Economics, Fruit Flies, Management, Quarantine

Introduction

Mango, regarded as the 'king of fruits', is renowned for its strong aroma, delectable taste and expectational nutritional value. As a tropical fruit crop, it holds a great deal of importance in both the Indian economy and culture. It adds substantially to the income of farmers as well as the export earnings. Various problems are faced by mango-growing farmers; among these, insect pests remain the major challenges. Of the various insect pests, fruit flies appear to be one of the most serious and economically important groups. Fruit flies belong to the Tephritidae family, having 5,000 species under 500 genera into which they are classified (Scolari *et al.*, 2021). Fruit flies occupy tropics, subtropics and even temperate regions of the world, causing huge damage to fruit production. It has a wide host range, good reproductive success and can affect fruits both before and after harvest. The presence of these species has adverse effects on the quality and quantity of fruits domestically and internationally, where the species is likely to pose quarantine problems.

Fruit Flies: A Persistent Threat in India

Bactrocera dorsalis (Hendel) (Diptera: Tephritidae) is one of the most destructive insect pests that has invaded over 65 countries, mainly within Asia and Africa. It also began its onward march into other regions comprising parts of America. The pest has received global attention because of its polyphagous behaviour and rapid expansion potential across tropical and subtropical regions. One of the important key strategies in *B. dorsalis* success is its reproductive rate (Scolari *et al.*, 2021). The female flies have a long, narrow and highly flexible ovipositor with which they insert eggs deep into the healthy tissue of the fruit host. Each female is capable of laying hundreds of eggs during her lifetime. Eggs are white, elongated and elliptical in shape, often deposited in clusters beneath the fruit's outer skin. After hatching, the larvae, also known as maggots, have access to the fruit pulp and devour it, causing the fruit to deteriorate internally and become unfit for sale. The most damaging stage is represented by the third-instar maggots, which are cylindrical in shape and creamy white in color. When the maggot is completely grown, it usually leaves the fruit through exit pores and falls to the ground, where it burrows into the earth to pupate. The pupal stage is protected from predators by a tan to dark brown puparium that allows it to blend in with the soil.

Adult flies can be distinguished from other species by their pair of antennal spots, a dark-colored thorax with two

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parallel lateral post-sutural vittae and a narrow costal band. Its face features circular black spots and its femora are yellow in colour. The abdomen represents two horizontal black stripes and a longitudinal median stripe that extends from the base of the third segment to the tip of the abdomen. These markings create a T-shaped pattern; however, the specific pattern varies considerably. The ovipositor of the female is highly specialized, slender, sharply pointed and retractable, which is perfectly adapted for piercing fruit surfaces and depositing eggs in concealed sites (Figure 1). The morphological characters, high reproductive potential, broad host range (over 150 host plants) and multivoltinism make this species one of the world's challenging fruit pests. Its presence takes a toll on domestic production and international trade, especially in high-value fruits (Doorenweerd *et al.*, 2018).

Figure 1: Different life stages of the fruit fly, *B. dorsalis*

Challenges and Integrated Management Approaches

B. dorsalis is considered to be a significant pest in both local and export markets and its wide distribution within the country has become a matter of concern. In Northern India, adult populations generally hibernate during the cold months and re-emerge with rising warmth. In contrast, the incidence in the southern and coastal regions occurs throughout the year, reaching peak populations in summer when the minimum night temperature becomes conducive to their reproduction and dispersal. Climate change adversely impacted fruit fly population dynamics, reproduction rate and geographical abundance (Choudhary *et al.*, 2025). Seasonal influences like increased humidity and intermittent rainfall patterns may facilitate *B. dorsalis* to create havoc in new agro-climatic zones, thus intensifying the threat to horticultural crops especially on mango production. Since *B. dorsalis* is polyphagous, it has been reported on diverse crops. The broader host range of the pest enables it to survive and reproduce during the 'off-season', making control operations complex and resource-intensive.

Globally, India is the largest producer of tropical and subtropical fruits, is heavily impacted by the fruit fly infestations. Depending on the variety, orchard hygiene, climatic conditions and management modules, *B. dorsalis* losses in mango production ranged from 10 to 80%. Quarantine issues result from these infestations and detrimental effects on productivity and quality (Figure 2). Among the biotic constraints, larval stages of fruit flies are of serious concern. Many countries do not allow the import of fruits from India merely because of the threat of exotic fruit flies and other insect pests. Few countries with strict phytosanitary regulations would most probably reject imports showing any possible symptom of fruit fly damage,

Figure 2: Fruit fly infested mango fruits

resulting in reduced trade value, financial losses and missed export opportunities. The management of *B. dorsalis* is quite challenging due to its multivoltine (several generations) life cycle within the year and adaptability to a wide range of environmental conditions (Fezza *et al.*, 2024). Nevertheless, the integrated pest management (IPM) techniques may keep the population under check. Through timely and appropriate control measures such as monitoring, sanitation, baiting, biological control and judicious use of chemicals effectively reduce *B. dorsalis* population (Deepak *et al.*, 2023). Monitoring is an essential element of pest management planning and action. This pest can be successfully managed by the incorporation of IPM tactics such as:

1. Monitoring and Survey

• Use of pheromone traps to know the population trends in different seasons.

• Regular scouting to check the infection signs.

2. Cultural Control

• Field sanitation and clean cultivation to reduce infestation.

• Ploughing topsoil depth of 5-10 cm to expose pupae to the predators, parasites and direct sunlight.

• Collection and destruction of fallen, infested and fruits showing ovipunctures or oozing symptoms.

• To eliminate possible breeding conditions, one must bury harvested fruits in a deep hole.

• The fruits have to be harvested early since they tend to be less susceptible to fruit flies when green and mature.

• Maintaining consistent crop and field sanitation practices to disturb the pest life cycle.

3. Physical Control

• Use of physical barriers with netting or bagging to protect fruits from infestations.

• Oviposition of fruit flies can be prevented by trapping them with attractants.

• Installation of methyl eugenol (ME) traps at a density of 6-10 traps acre^{-1}, to lure male fruit flies.

• Control of adult fruit flies with bait sprays, composed of insecticides with protein hydrolysate, molasses or jaggery at 10 g l^{-1} for every fortnightly interval before fruiting.

4. Biological Control

• Introduction of biological control agents targeting fruit fly larvae and eggs. For example, *Opius incisi* (Braconid) is a naturally occurring larval parasitoid against the fruit fly.

• Inclusion of EPF: Entomopathogenic fungi to suppress the fruit fly population.

5. Chemical Control

• Application of insecticides in a targeted manner during peak periods of fruit fly activity.

• Utilization of bait sprays combining attractants with insecticides to minimize non-target effects.

• Raking the soil near the infested tree and drenching with a suitable insecticide like chlorpyriphos 20 EC @ 2.5 ml l^{-1} to arrest the pupal development.

Conclusion

Fruit flies are the major constraint in market access and biosecurity. Proper identification of fruit fly species, along with routine scouting and monitoring, helps in formulating an effective management plan. Furthermore, to strengthen the fruit production, farmers' awareness and sound policy measures are vital to safeguard the trade in the long run.

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