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The Guava Fruit Fly: Challenges and Eco-Friendly Management

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SUMMARY

The Guava Fruit Fly (Bactrocera dorsalis) is a major pest of guava and other fruits, causing significant economic losses to farmers worldwide. This insect is particularly challenging to manage due to its high reproductive potential, wide host range, and resistance to many conventional insecticides. However, eco-friendly management strategies have been developed that can effectively control this pest while minimizing environmental harm. These include the use of biological control agents, such as parasitoids and predators, as well as cultural practices like sanitation, trapping, and intercropping. In this review, we discuss the challenges posed by the Guava Fruit Fly and the various eco-friendly approaches available for its management. We also highlight the importance of integrated pest management (IPM) strategies that combine different control measures to achieve effective and sustainable pest control. Overall, the use of eco-friendly management practices for the Guava Fruit Fly offers a promising solution to this pest problem, while promoting environmentally friendly and sustainable agriculture.

INTRODUCTION

Guava, known for its pleasant aroma and high nutritional value, is often referred to as the "poor man's apple" in tropical regions. It is a highly nutritious tropical fruit that is rich in vitamins A and C, dietary fiber, and antioxidants. It is a popular fruit that is consumed fresh or processed into juices, jams, jellies, and other food products. Guava is also used in traditional medicine for its various health benefits, such as treating diarrhoea, constipation, and high blood pressure. However, guava production is severely affected due to various constraints, with insect pests being a major issue. Although about 80 species of insects have been recorded on guava, only a few are recognized as regular pests that cause significant damage. The fruit fly is the most significant insect pest and can cause considerable losses, making it a major limiting factor in obtaining good quality fruits. Fruit flies are highly destructive pests and are known to affect a wide range of tropical and sub-tropical fruits and vegetables. Crop losses caused by fruit fly infestations can range from 20-80 per cent, depending on factors such as crop locality, season, and variety. As a result, fruit fly control is crucial for maintaining high-quality guava fruit production.

Nature of damage of fruit fly

The guava tree bears aromatic and flavourful fruits with an edible rind and soft white, yellow, or pink flesh which is susceptible to rapid infestation by fruit flies. When guava fruits reach their ripening stage, they emit a strong musky scent that attracts fruit flies. Using their needle-like ovipositor, female fruit flies puncture the fruit's skin to deposit their eggs into the flesh, leading to infestation. After the eggs hatch, maggots emerge and begin to feed on the fruit's flesh, causing damage that leads to rotting due to microbial decay. Infestations are indicated by tiny punctures in the fruit's surface that leak juice when squeezed. Initially, oviposition marks can be difficult to detect, but within one to two days, they appear as distinct brownish spots around the puncture site.

Biology of fruit fly

The biology of fruit flies varies depending on the factors such as climate, the availability of preferred hosts, and the presence of natural bioagents. The life cycle of the *Bactrocera dorsalis* includes three distinct larval instars. These larvae exhibit a unique jumping movement pattern, which serves as a defense mechanism. Fruit fly adults typically mate at dusk.

Egg

Female fruit flies lay their eggs by seeking out soft tissues in suitable fruit. The females use their needle-like ovipositor to lay eggs in batches beneath the skin of ripened or ripening fruits, typically 5-10 days after mating. Each female can lay between 10-30 eggs during each oviposition, and over the course of its lifetime, can lay more

than 1200 eggs. The eggs are spindle-shaped, measuring about 1mm in length, and have a creamy white coloration (Kapoor, 2000).

Maggot

Maggots, which are creamy white in colour, cause damage to fruits by tunnelling and feeding on their pulpy content. They primarily feed on decaying fruit tissue. The maggot goes through three larval stages, with the period ranging from 10-14 days.

Pupae

After completing the larval feeding stage, third instar larvae burrow into the soil and pupate inside a puparium, typically at a depth of 6 cm. This transition from feeding to wandering occurs when the larva reaches a critical nutritional or developmental stage.

Adult

After spending 8-10 days in the puparium, adult flies emerge and dig their way out of soil or debris. Adults obtain nutrients from nectar, dew, and fruit by feeding on host plants. By feeding on host plants, flies reach sexual maturity within 10-20 days and mate to start a new cycle of damage.

Total developmental period

The total life cycle of fruit flies lasts around 1-2 months. Fruit flies are facultative breeders and are multivoltine in nature, meaning they have more than one generation per year. *B. dorsalis*, for instance, can complete 3-5 generations per year. In tropical areas, it can complete 5-10 generations per year, while in subtropical areas, it is less than 4.

Management of fruit fly

The presence of fruit fly larvae and pupae in decaying fruits and soil creates a challenge in managing the pest as they provide shelter and protection against insecticides. To address this issue, Entomologists and Ecologists are now turning to Integrated Pest Management (IPM) as an eco-friendly approach to reduce pest populations before they reach economic injury levels, while also promoting healthy crop growth without disrupting the agro-ecosystem. This article presents several techniques that can be utilized to develop effective management strategies for this harmful and damaging pest of guava.

Cultural control

Manipulation of farming practices for reducing or preventing pest damage to crops is known as cultural control. The different cultural practices are discussed below;

Early harvesting

To prevent infestations caused by fruit flies, harvesting fruits early can be an effective strategy. This is especially true for fruit fly species that infest fruits when they are almost ripe (Manrakhan, 2020). However, for species that attack small, green, and immature fruits, early harvesting may not be an effective solution. It is possible to avoid fruit fly infestations by harvesting crops at a stage of maturity when the fruit or vegetable is no longer susceptible to fruit fly attack.

Crop Sanitation

Maintaining cleanliness and hygiene in the area around fruit trees is crucial in minimizing the fruit fly population in the orchard. It is highly recommended to collect and dispose of any fallen, overripe, and infested fruits as it can reduce the number of resident fruit flies.

Soil raking

During the summer season, the destruction of residual pupae is critical in preventing infestation. Raking the soil around guava trees can be an effective method for achieving this.

Bagging of fruits

The practice of bagging fruits during their development has proven effective in reducing physical damage and improving colour at harvest, while also serving as a management tactic for the guava fruit fly. Bagging individual fruits with a transparent polypropylene bag (20µ gauge) and covering them with a paper piece to partially block sunlight has been identified as the most effective option (Bishnoi, 2020).

Sterile Insect Technique (SIT)

To control the population of fruit flies, a technique called sterile insect release involves the release of a significant number of sterile males that mate with wild females. These males are made sterile through methods such as irradiation, chemo-sterilization, or genetic manipulation. The term "sterility" or "sterile insect" used in sterile insect programs refers to the inheritance of dominant lethal mutations that result in the death of offspring (Pereira *et al*., 2013).

Trapping

Controlling fruit flies during their larval stage, when they cause damage to fruits, is challenging because traditional insecticides in the form of dust or sprays cannot effectively reach and kill the maggots. Therefore, the most effective management strategy is to target adult flies before they have a chance to lay eggs. This can be done through the use of traps or insecticides that target the adult fly population.

MAT (Male annihilation technique)

The male annihilation technique (MAT) is a popular method used to manage fruit flies, which involves killing male flies to reduce their chances of mating. Methyl eugenol (ME) is a male attractant that can lure fruit flies from a distance of up to 800 meters. When combined with an appropriate trapping technique, the use of pheromones like methyl eugenol has proven to be effective in monitoring and suppressing fruit flies over large areas, through the male annihilation technique (MAT), and even in completely eradicating various species of fruit flies.

BAT (Bait annihilation technique)

The bait annihilation technique (BAT) is becoming increasingly relevant in the management of fruit flies since it is effective in suppressing the population of female fruit flies, which are the primary factor for reproduction. To monitor and directly control this damaging pest, female attractive baits are highly desirable. Since female fruit flies require a protein source for the development of their gonads and eggs, protein hydrolysate has been identified as an effective attractant for them.

Quarantine significant

The spread of fruit fly infestations between countries can occur through the movement of materials, posing a risk of introducing the pest into non-infested areas. As a result, importing countries that do not have the pest are reluctant to accept infested guava fruits from affected countries. In order to prevent the entry and establishment of fruit flies, quarantine restrictions have been put in place by importing countries. Certain species of fruit flies are classified as high priority quarantine pests in many countries.

Chemical control

Relying solely on insecticides for controlling fruit fly infestation is insufficient as the larvae cause internal damage to fruits which is difficult to manage through the use of chemical agents. Synthetic chemicals pose significant problems as fruit is often consumed raw, and their toxic residues persist in the soil for extended periods, impacting the microbial flora and fauna of guava orchards.

CONCLUSION

In conclusion, fruit fly management is a crucial aspect of guava production, as fruit flies can cause significant damage to the fruit, resulting in reduced yields and lower quality produce. Effective management strategies include cultural practices such as sanitation, pruning, and the use of insecticides, bait traps, and fruit bagging. It is important to implement an integrated pest management (IPM) approach to fruit fly management, which combines various control methods to achieve long-term control of the pests while minimizing the impact on the environment and non-target organisms. Farmers and growers should also be aware of the regulations and

guidelines governing the use of pesticides in their region, and use them responsibly to avoid negative impacts on human health, the environment, and the sustainability of the production system. Overall, the successful management of fruit flies in guava requires a proactive and holistic approach, involving the implementation of best practices and the adoption of sustainable methods to ensure the long-term productivity and profitability of guava orchards.

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