GreenariA
Go Green, Learn Green
An Agricultural Monthly e-Magazine
Volume 02, Issue 05, 2024
e- ISSN: 2584-153X
Article ID: G-24-0501

GREENHOUSE INSECT PEST MANAGEMENT

Devaraj R and Sala Srivarsha*
PG Scholar, Department of Entomology, SASRD, Nagaland University
***e-mail:** srivarshasala@gmail.com

INTRODUCTION

A greenhouse is a specially designed structure that maintains a suitable environment for plant growth, including temperature and humidity. However, the warm and humid conditions also provide an ideal environment for insect pests to thrive. Unlike in the outdoor environment, natural enemies that help control pest outbreaks are not present in the greenhouse. As a result, pest outbreaks can develop rapidly and cause serious damage to crops if not addressed properly. Pest outbreaks require susceptible hosts, the presence of pests, and favorable environmental conditions for pests to proliferate. To prevent outbreaks, it is important to select resistant plant varieties, regularly monitor for pests, and implement proper cultural practices to reduce the likelihood of an infestation. In addition to causing damage, some insects can also carry diseases, which can have a chronic effect on crop health.

COMMON GREENHOUSE PEST

No matter how protected it seems from the outside, the condition inside the greenhouse permits the insect pest to grow rapidly. Before the condition gets out of hand and causes economic loss early detection and proper diagnosis must be taken. Some common and important insect pests to watch out for are aphids, thrips, whiteflies, mealybugs, mites, fungus gnats, armyworms, cutworms and caterpillars.

Aphids

Aphids are tiny, soft-bodied insects that suck sap. They can be seen in groups especially on the underside of leaves but not exclusively. The aphids commonly found in greenhouses are usually in the crawling stage, so they can't fly. Most of the sap sucked by aphids passes through their body and drops outside as honeydew. This sugary substance attracts ants, so if you see ants, aphids are probably present too. This combination can lead to black sooty mold on the leaves, which can affect the plant's ability to photosynthesize.

Aphids infestations can also cause curling or puckering of leaves. Besides being insect-borne, aphids can also carry disease-causing agents. To manage this infestation, it's usually necessary to control the insect population by spraying insecticide two to three times, with an interval of seven to ten days between each application. This will help prevent significant economic losses.

Aphids reproduce rapidly, and every one of them in the greenhouse is female. They can reproduce asexually, and each adult female aphid can give birth to six to ten offspring per day for 20-30 days of its lifespan. This means that a large population can develop in a very short time.

Thrips

Thrips are tiny, slender insects ranging from brown to black and difficult to spot in the naked eye. Thrips feed by rasping the plant surface and sucking out the sap fluid resulting in mottling and silvery appearance in case of severe infestation. It also distorts the plant's leaves and affects flower formation and bud opening. Through contaminated plant materials and poor greenhouse conditions most of the time the winged adults emerge, and the female thrips inserts the eggs into the slits in the leaves. The eggs hatch within two to seven days.

Various thrips species act as vectors in causing diseases. The most severe are the onion thrips and western flower thrips were the vectors of tomato spotted wilt virus or impatiens necrotic spot virus.

Whiteflies

Whiteflies are a common and serious pest in greenhouses. They are almost the same size as aphids and have characteristic white powdery wings. When disturbed, they flutter from the underside of the leaves. Female whiteflies lay about 150 eggs at a rate of 25 eggs per day, and they complete their life cycle in 21-36 days depending on the greenhouse conditions. Their infestation can cause premature leaf drop and yellowing of leaves. Like aphids, they also secrete honeydew, which results in black sooty mold.

The sweet potato whitefly is a notorious pest among other whiteflies. It is resistant to insecticides, has a broader host range, and has high reproductive potential. Its life cycle can be as short as 20-25 days, and it acts as a vector for geminivirus in tomatoes. To control whiteflies, proper sanitation of the greenhouse and control of vectors should be adopted by spraying insecticides about three times at regular intervals of three to four days.

Mealybug

Mealybugs are soft-bodied insects that are small and oval-shaped. They can be found in clusters on leaves, stems, and flowers, and have an outer covering of mealy or waxy substance that acts as a protectant from insecticidal spray. Mealybugs suck sap from plants, resulting in yellowing and slower growth, similar to aphids and thrips. They also secrete honeydew, which attracts ants and can lead to the formation of sooty mold. Mealybugs usually enter greenhouses through infested plant material and can affect a wide range of plants, but they are often first seen on crotons. Some mealybugs lay eggs, while others give birth to young ones.

Mites

Mites are tiny eight-legged creatures that belong to the spider family and feed on plant sap by piercing the plant tissue. Their small size makes it difficult to spot them during the initial period of infestation. However, as their population grows, tiny black, brown, or red spots can be observed, followed by the appearance of fuzzy webs around the leaves. Mite-infested plants usually show yellowing, drying, and a loss of vigor. The two-spotted spider mite and the cyclamen spider mite are two species that can cause serious and persistent problems in the greenhouse. To manage mite infestation, it is recommended to spray miticides with an alternate mode of action due to the wide resistivity nature of mites.

The two-spotted spider mites are light to dark green and have two distinct black spots over the abdomen. They feed on the underside of the leaf, resulting in a mottled or speckled appearance on the upper side of the leaves. Heavy infestations may result in the formation of fine webbing that covers the leaves.

The cyclamen spider mites are tiny, elliptical, semi-transparent, greenish mites. They thrive in temperatures around 60 degrees Fahrenheit and can complete their lifecycle within two weeks. Depending on the plant, this mite may infest either the whole plant or concentrate around the buds, resulting in upward curling and distortion of leaves. Infested leaves may become darker than healthy ones.

Fungal Gnats:

The greenhouse's high humidity and organic growing media provide ideal conditions for the growth and development of fungus gnats. These larvae are serious pests as they feed on the root hairs, and can even attack the crown or stem of the plant, resulting in a loss of vigor and wilting. The adults are small black flies with one pair of clear antennae. They lay tiny ribbon-like yellowish white eggs in the growing media present in the greenhouse, which hatch within four days. One adult fungus gnat can lay up to 100-150 eggs in less than a week. You can easily find the incidence of gnats by disturbing the soil as they are present in large numbers in the soil.

Cutworms, Armyworms, Loopers and other Caterpillars

All caterpillars are in the immature stages of moths. They feed on the leaves, stems, and fruits of many types of plants. Infestations can occur when moths enter through ventilators or when infested plants are brought into the greenhouse. Cutworms can be serious pests for younger plants. They hide in the soil or mulch during the day and eat the plants at night. The cabbage looper can also be a pest for greenhouse crops, especially lettuce. It can be identified by its pale green color, three pairs of prolegs, and looping movement that is similar to measuring worms. To detect these insects, watch out for cut plants or leaves with large sections removed. Sprays containing Bacillus thuringiensis are effective against these pests.

CLIMATIC FACTORS - A DECISIVE INFLUENCE ON INSECT PEST DYNAMICS

In the intricate dance of nature within a greenhouse, climatic factors play a pivotal role in shaping the dynamics of insect populations. Temperature, humidity, and light are significant variables that influence both the pests and the efficacy of pest management strategies. Recognizing and harnessing these climatic factors can enhance the effectiveness of Integrated Insect Pest Management (IPM) programs.

Temperature Considerations

Greenhouses are designed to maintain specific temperature ranges conducive to plant growth. However, these controlled temperatures also create an environment suitable for the rapid reproduction of pests. Understanding the optimal temperature range for specific insects allows greenhouse operators to anticipate and address potential outbreaks.

• **High Temperatures:** In warmer conditions, the life cycle of many pests accelerates, leading to quicker population growth. Regular monitoring and adjusting greenhouse temperatures within appropriate limits can help mitigate this acceleration.

• **Low Temperatures:** On the other hand, cold temperatures may impact the activity of certain pests. Allowing the greenhouse to experience periodic freezes in winter can be an effective cultural practice to control soft-bodied insects.

Humidity Management: Humidity levels in greenhouses influence the development and behaviour of insects. High humidity can create favourable conditions for the proliferation of pests, particularly those that thrive in damp environments.

• **Ventilation**: Adequate ventilation is crucial to maintaining optimal humidity levels. Proper airflow helps prevent the buildup of moisture, reducing the risk of fungal mosquito infestations and minimizing conditions conducive to other humidity-dependent pests.

• **Watering Practices:** Over-watering contributes to increased humidity, creating potential breeding grounds for pests. Implementing precise watering practices and ensuring good drainage can help control humidity levels.

LIGHTING EFFECTS ON PEST ACTIVITY

Light availability within the greenhouse not only influences plant growth but also affects the behaviour of certain insects. Understanding the interplay between light and

pest activity enables more targeted pest management.

• **Phototaxis:** Some insects exhibit phototaxis, meaning they are attracted to light. Yellow sticky traps strategically placed in areas with sufficient light can aid in trapping these pests, facilitating early detection.

• **Light Intensity**: Adjusting light intensity based on the specific needs of cultivated plants can indirectly impact pest populations. This nuanced approach helps create an environment that is less favourable to certain light-sensitive pests.

SANITATION PRACTICES FOR GREENHOUSE PEST MANAGEMENT

In the realm of greenhouse insect pest management, adopting simple sanitation practices is pivotal to thwart potential infestations. Regular inspections of incoming plants, ensuring a pest-free environment, and proper disposal of plant waste are indispensable measures. Keeping the greenhouse area clean, with well-maintained doors and screens, minimizes the risk of invasive weed infestations. The elimination of standing water pools reduces breeding grounds for pests like fungal mosquitoes, contributing to a healthier plant environment. Additionally, the removal of debris and garbage, along with meticulous cleaning post-production cycles, fortifies the greenhouse against pest resurgence. By prioritizing sanitation, greenhouse operators establish a foundation for effective pest control and sustainable plant health.

INTEGRATED INSECT PEST MANAGEMENT:

In the greenhouse, insect problems can escalate quickly, posing a threat to plant health and overall productivity. The absence of natural enemies that regulate insect populations outside necessitates a proactive and integrated approach. This approach involves combining cultural practices, early detection, and strategic pesticide use to effectively manage and control greenhouse insect infestations.

1. Cultural Practices

• **New Plant Inspection:** Thoroughly inspecting new plants before introduction helps prevent accidental pest infiltration.

• **Ventilation Maintenance:** Keeping doors, screens, and ventilators in good condition contributes to a healthier greenhouse environment.

• **Clean Soil Use:** Employing clean or sterile soil minimizes the risk of introducing pests.

• **Sanitation Methods:** Proper waste disposal, removal of plant waste, and regular cleaning contribute to pest prevention.

2. Early Detection and Diagnosis

• **Monitoring with Sticky Traps:** Implementing yellow sticky traps aids in the early detection of flying insects such as White flies, thrips, and fungal mosquitoes. Focusing on areas near entry points and ventilation. Conduct weekly inspections to promptly identify and diagnose pest infestations.

• **Regular Plant Inspections:** Inspecting plants regularly, especially under leaves, allows for early identification of pests.

• **Spray Sampling:** Spraying plant parts on plain paper facilitates the removal and identification of small and elusive insects.

Additional Cultural Practices

• **Winter Freeze:** Whenever possible, allow the greenhouse to freeze in winter to eliminate soft insects like flies.

• **Yellow Clothing Avoidance:** Discourage insect attraction by avoiding the use of yellow clothing in the greenhouse.

3. Biological Control

In addition to cultural practices and pesticide use, incorporating biological control agents into greenhouse pest management enhances sustainability. Commercially available beneficial organisms play a crucial role in controlling specific greenhouse pests. Some notable Beneficial Organisms commercially available for Greenhouse pest management include

Beneficial organism	Pest controlled
Parasitic wasps, *Aphidius colemani*	Aphid
Predatory mites, *Amblyseius cucumeris* and *Amblyseius mckenziei*	Thrips
Parasitic wasps, *Encarsia formosa*	Whiteflies
Predatory mites, *Amblyseius californicus*, *Phytoseiulus longipes* and *Phytoseiulus persimilis*	Spider mites
Leafminer parasite, *Dacnusca sibiriica* and *Diglyphus isaea*	Serpentine Leaf miner and Fungus Gnats
Lady beetles, *Hippodamia convergens* and *Cryptolaemus montrouzeri*	Various soft-bodied insects and eggs
Green lacewings, *Chrysoperla carnea*	Various soft-bodied insects and eggs

LEVELS OF PEST CONTROL WITH BENEFICIAL ORGANISMS

The effectiveness of biological control agents varies based on multiple factors, including the species of pests involved, the specific natural enemy used, timing of releases, and greenhouse conditions. For optimal results:

• **Early Release:** It is crucial to release beneficial organisms early in response to the first signs of pest infestation.

• **Temperature and Humidity:** Consider greenhouse temperature and humidity levels when selecting beneficial organisms, as these conditions influence their development and effectiveness.

• **Pesticide Usage:** The success of biological control is affected by the use of pesticides before and after the release of beneficial organisms.

Biological control, while requiring more time than traditional pesticides, offers a sustainable, long-term solution to manage greenhouse pests.

4. Chemical Control:

In Greenhouse Insect Pest Management, while natural enemies play a vital role in maintaining a balanced ecosystem, their

efficacy may be insufficient when confronting severe pest infestations. In such cases, strategic integration of insecticidal soaps or non-residual insecticides becomes crucial to mitigate losses and prepare the ground for the introduction of natural enemies. Some Strategies for reduction of pests with insecticides include:

STRATEGIC PEST REDUCTION WITH INSECTICIDES

1. Knowledge of Pest Biology:

Understanding the life cycle and behaviour of pests is imperative for effective management. This knowledge informs decisions on when to employ insecticides and when to introduce natural enemies.

2. Monitoring for Informed Action:

Regular monitoring of pest populations provides critical insights. The decision to release natural enemies or use insecticides is guided by real-time data on the severity of infestations.

3. Limiting Insecticide Applications:

Unnecessary insecticide applications before and after releasing natural enemies should be avoided. To minimize disruption to the ecosystem, target treatments to specific pest "hot spots" rather than treating the entire greenhouse.

4. Selective, Short Residual Pesticides:

Opt for selective pesticides with a short residual effect, such as Bacillus thuringiensis (Bt) products. These can control specific pests like caterpillars without compromising the effectiveness of natural enemies.

CONCLUSION

Greenhouse insect pest management is a multifaceted challenge that demands a comprehensive approach. Integrating cultural practices, early detection, judicious pesticide use, and biological control agents creates a balanced strategy for effective pest control. By adopting these strategies, greenhouse growers can mitigate the impact of insect pests, ensuring the health and productivity of their crops in a sustainable and environmentally friendly manner. These practices contribute to a sustainable and productive greenhouse environment, ensuring the continued success of greenhouse agriculture.