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Issue Article

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PEST AND DISEASE CONTROL IN THE GREENHOUSE

***Abstract**: The right selection and application of pesticides when necessary, along with early detection and diagnosis, are essential to greenhouse pest management. Aphids, fungus gnats, thrips, whiteflies, caterpillars, leafminers, mealybugs, mites, slugs, and snails are some typical and significant pests to keep an eye out for. Aphid feeding can cause stems or leaves to pucker or curl; this leaf distortion frequently shields aphids from contact insecticides. Each female plant in a greenhouse is able to give live birth to daughters seven days after its own birth. Winged aphids typically enter the greenhouse through openings to start an infestation. Thrips are little, thin insects that are around 1/25 of an inch long. They have four wings that are kept flat over their backs and are each fringed with a row of long hairs. Nymphs eat similarly to adults and go through four molts as they grow. Leafminers are tiny fly larvae that eat their host's leaves. By eating between the upper and bottom surfaces of the leaf, they harm plants. When completely developed, the larva can emerge from the leaf or pupate on the ground or it can pupate in the leaf tissue.*

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Introduction

The warm, humid conditions and abundant food in a greenhouse provide an excellent, stable environment for pest development. The natural enemies that keep pests in check outside are frequently absent from greenhouses. For these reasons, pest problems frequently arise indoors more quickly and severely than they do outside. If pest problems are not identified and addressed, they may become chronic.

Insect pest management for ornamentals and vegetables in greenhouses depends on a number of variables. Effective cultural practices can reduce the potential for infestation initiation and growth. The right selection and application of pesticides when necessary, along with early detection and diagnosis, are essential to greenhouse pest management. Plants grown in float systems are also infested by the same pests that attack plants grown in traditional greenhouse techniques 2. Bloodworms, shore flies, and fungus gnat problems are particularly common in float systems.

Some insects found in greenhouses have the potential to infect plants with diseases, which are frequently more harmful than the harm incurred during feeding. Some of the aphids, leafhoppers, thrips, and whiteflies are among these insect "vectors." In these situations, early insect control is required to manage the diseases.

Early detection and diagnosis of pest insects are necessary to make control decisions before the issue gets out of hand and you suffer financial loss because greenhouse conditions allow for the rapid development of pest populations. Aphids, fungus gnats, thrips, whiteflies, caterpillars, leafminers, mealybugs, mites, slugs, and snails are a few typical and significant greenhouse pests to keep an eye out for 8.

Small, sluggish insects with soft bodies known as aphids or plant lice live in colonies on the leaves and stems of their host plants. They are sucking insects that pierce a leaf or stem with their beaks to siphon off plant sap. In general, they prefer to feed on tender, young growth and are typically found on and under the youngest leaves. The only insects with two cornicles or tubes that resemble exhaust pipes, on their abdomen are aphids 6.

Over the course of their 20 to 30 day lifespan, adult aphids can give birth to six to ten young per day. Massive populations can develop in a short amount of time.

Aphid feeding can cause stems or leaves to pucker or curl; this leaf distortion frequently shields aphids from contact insecticides. A large portion of the plant sap that they consume passes through their bodies and ends up as "honeydew" on the leaves. Ants, which consume honeydew, are frequently discovered in close proximity to aphid infestations. Often, leaves with honeydew develop black sooty mold.

Aphids proliferate quickly. Each female plant in a greenhouse is able to give live birth to daughters seven days after its own birth. These female aphids, which reproduce asexually, may have wings or not.

Additionally, aphids can spread dangerous viral infections 4. Controlling the insect that spreads the disease is typically necessary for managing these disorders. Winged aphids typically enter the greenhouse through openings to start an infestation.

To manage aphid infestations, insecticide treatments must frequently be repeated. Depending on the severity of an infestation, two to three applications spaced at three to seven-day intervals are typically required. To prevent the emergence of resistance, it is necessary to alternate the insecticide chemicals used to control aphids.

Picture 1- Aphids types (V Nguyen)

Aphids that are tan or otherwise discolored in comparison to the other aphids may be parasitized aphids known as "mummies." These naturally occurring parasitic wasps, which are crucial for controlling aphids, are smaller than aphids. When these parasites first appear, they pierce a small hole in the upper abdomen of the dead aphid and start looking for prey 10.

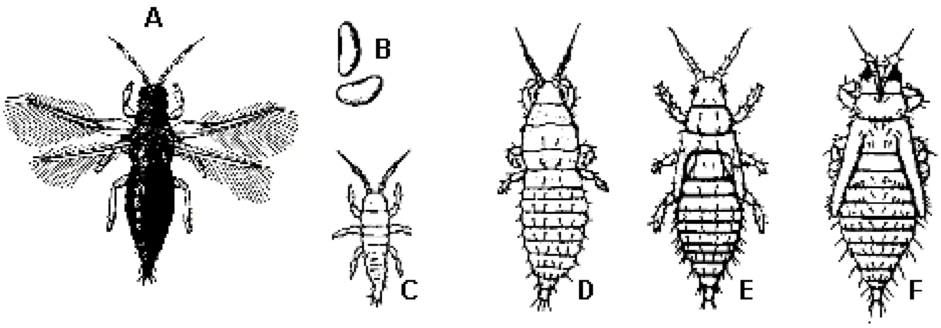
The eye-catching crimson "worms" that may be seen squirming in float plant water are known as bloodworms. These long, cylindrical larvae resemble the larvae of fungus gnats in that they lack legs and have a recognizable brown head. Hemoglobin, the same oxygen-carrying substance present in human blood, is what causes the red color. This bug can grow in water with very little oxygen since hemoglobin is present.

Animal watering troughs, stagnant water, and other collections of standing water are common places for bloodworms to live. Although they are closely related to mosquitoes, the adults of these insects do not feed on blood and do not have sucking mouthparts. The larvae, which have chewing mouthparts, typically eat algae or other aquatic organic matter.

Because these pests need a lot of moisture, avoiding overwatering will help control the amount of moisture in the growing medium. Fungus gnats that lay eggs find peat-based potting mixtures and highly organic soils to be particularly alluring. On ornamentals and nursery plantings in the greenhouse, sprays or drenches containing Bacillius thuringiensis Serotype H-14 (Gnatrol) can be used to control fungus gnat larvae. Ineffective against shore flies is this treatment.

Thrips are little, thin insects that are around 1/25 of an inch long. They come in a variety of hues, from pale brown to black. They have four wings that are kept flat over their backs and are each fringed with a row of long hairs. Thrips that feed on plants harm crops when they infest the blooms, buds, and immature fruits.

Thrips consume food by rasping the sap-oozing surface of the plant. The appearance of heavily infested leaves is mottled or silvery. Eggs are deposited in leaf slits by female thrips. In two to seven days, eggs will hatch. Nymphs eat similarly to adults and go through four molts as they grow. During the final nymphal stage before becoming adults, they are dormant 3.



Picture 2- A. Adult B. Egg C-D. Larvae E. Prepupa F. Pupa (NC Extension)

Many species can be found in greenhouses. In the greenhouse, a variety of plants are targeted by thrips. Azalea, calla lily, croton, cyclamen, cucumber, fuchsia, ivy, and rose are among the hosts that are most vulnerable. Many different thrip species also spread plant diseases. The tomato spotted wilt virus or the impatiens necrotic spot virus are transmitted by the western flower thrips and onion thrips, which are the most dangerous. This virus affects a variety of plant species.

Greenhouse and Sweet Potato Whiteflies Fuchsias, poinsettias, cucumbers, lettuce, tomatoes, and other greenhouse plants frequently have whiteflies, which are a major pest. These favored hosts can be utilized as indicator "plants" to notify greenhouse managers of the earliest indications of whitefly infestations through routine monitoring. All stages of whiteflies may be present on the bottom surface of the leaves.

These sap-sucking insects' females may produce 150 eggs every day at a pace of 25. Before settling down to eat, the freshly emerging crawler travels only a short distance. The pupal stage, from which the adult emerges, is created after three larval molts. Depending on the conditions in the greenhouse, the full life cycle takes 21–36 days. Although the greenhouse and sweet potato whiteflies look similar, their biology and methods of control are different. Both types of whiteflies entirely grow on the undersides of leaves. 20 to 25 days may be the length of their life cycle 5.

The sweet potato whitefly is more adaptable to different hosts, has a greater capacity for reproduction, is more resistant to pesticides, and possesses a formidable system of phytotoxic enzymes. The tomato-borne gemini viruses are spread by this whitefly. Proper sanitation and management of the whitefly vectors are essential for controlling these viruses. Immature whiteflies are typically unaffected by insecticides that are used to control adult whiteflies. Insecticides used to control adults must be applied frequently, two to three times with three to four days between sprays, in order to control infestations because adult whiteflies frequently continue to emerge after these applications. Less frequently, at seven to fourteen-day intervals as necessary, growth regulators used to control immature stages can be used to manage infestations.

Leafminers are tiny fly larvae. By eating between the upper and bottom surfaces of the leaf, they harm plants. Damaged sections are narrow and twisting, with a pale tint. The larva gets wider as it develops. When completely developed, the larva can either emerge from the leaf or pupate on the ground or it can pupate in the leaf tissue. Each female fly will lay between 50 and 100 eggs by pushing them into holes carved out of the surface of the leaf 9.

Picture 3- Leafminer and damage (bottom)

Mealy bugs are tiny, soft-bodied insects that consume plant sap like aphids. The thick layer of mealy or waxy secretions that covers these insects offers some defense against contact pesticides. Some species produce eggs, while others deliver live young. Mealybugs frequently generate enormous amounts of honeydew, similar to aphids, which causes sooty mold on leaves and other plant components.

Almost any component of the plant might become infected with mealybugs. Mealybugs can affect a wide range of greenhouse plants, but they are frequently first noticed on crotons, hoyas, and bamboo palms. Mealybug infestations are frequently accompanied by the sighting of ants, which feed on honeydew.

Mites are pests that feed on sap and harm a variety of greenhouse plants. Two species, the cyclamen mite and the two-spotted spider mite, can result in significant and enduring issues. By puncturing tissue with their mouthparts and sucking out cell contents, these mites obtain their food. Light to dark green in color, two-spotted spider mites have two recognizable black dots on their abdomen 0.

Picture 4- two-spotted spider mite (Surendra Dara)

When originally deposited, eggs are round and transparent. The larva has three pairs of legs when it first hatches, but by later stages, it will have four pairs. Compared to females, males have smaller, more angular abdomens. The two-spotted spider mite can cause severe infestations that result in fine webbing that may cover the entire plant 7.

Biological Control

Pest populations may often be controlled using biological control over a longer period of time than with chemicals. Natural enemies need time to spread out from release locations and look for hosts or prey. As soon as the pest is found in the greenhouse, the appropriate natural enemies should be unleashed. Natural enemies typically fail to completely remove an infestation and cannot act quickly enough to manage pests that are already generating significant losses. Before releasing the natural enemies, it is often advised to use an insecticidal soap or another non-residual insecticide to decrease the infestation. Determining when to release pests requires an understanding of pest biology and regular monitoring of pest populations.

Before and after the release of natural enemies, greenhouse managers should avoid using superfluous insecticide/miticide treatments. If at all possible, use a pesticide with short residual selection. For instance, products made from Bacillius thuringiensis (Bt) can be used in greenhouses to control caterpillars without harming the environment.

Pesticide Management

Operators of greenhouses must maximize the efficacy of insecticides and miticides. When the pest is present, a pesticide must be sprayed at the right rate to achieve sufficient control. To reach the target pest through dense vegetation, there must be coverage and enough pressure. For sucking insects that infest the bottom surface of leaves, this is particularly significant. Some crops' canopies can be opened by removing older, lower leaves to allow for greater spray coverage. Sometimes it takes several applications of an insecticide or miticide to keep a pest at a manageable level. Pests might develop resistance to insecticides because there aren't many chemicals suitable for greenhouse use.

When managing a particular pest, managers should alternate between various insecticides for subsequent administrations. Pesticides from various chemical classes with various modes of action must be included in rotations to control the pests. This will stop or at least delay the emergence of pesticide resistance to a specific substance. Plants that can be legally sprayed with the same pesticide and are frequently infested by the same pest should be grouped together to facilitate pesticide applications. This will lessen the possibility of applying incorrectly to crops that are not labeled. Infestations can also spread to other areas of the greenhouse if infected material is moved around the greenhouse.

Conclusion

Pest populations may be controlled using biological control over a longer period of time than with chemicals. Natural enemies need time to spread out from release locations and look for hosts or prey. As soon as the pest is found in the greenhouse, the appropriate natural enemies should be unleashed. Operators of greenhouses must maximize the efficacy of insecticides and miticides. To reach the target pest through dense vegetation, there must be coverage and enough pressure. Some crops' canopies can be opened by removing older, lower leaves to allow for greater spray coverage.

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