

# Pesticide Certification Information

## #25

**STUDY MANUAL  
FOR GREENHOUSE  
GROWERS**

**WEST VIRGINIA UNIVERSITY  
EXTENSION SERVICE  
AN EQUAL OPPORTUNITY/  
AFFIRMATIVE ACTION INSTITUTION**

# STUDY MANUAL FOR GREENHOUSE GROWERS

## GENERAL INSECT INFORMATION

Because of the wide diversity of ornamental plants, there is a large number of insect pests that may require control. You cannot possibly identify all of the insects you will encounter so you will need the assistance of your County Extension Agent, Extension Entomologist and others. However, there are certain kinds of insects that attack a large number of plants, and therefore should be recognized by the commercial pesticide applicator.

Pests of ornamentals may be divided into two groups by the way they feed: (1) insects with sucking mouthparts (i.e. aphids, scales, mealybugs, thrips, mites, whitefly) and (2) insects with chewing mouthparts (i.e. caterpillars, cutworms).

Damage by pests with sucking mouthparts is basically similar in that beak-like mouthparts are used to pierce the plant tissue and suck the plant juices. Damaged foliage is usually mottled. Plants may eventually wilt due to excessive loss of plant juices.

Damage by pests with chewing mouthparts is basically similar, in that portions of the plant are bitten off and consumed. The insect may feed on leaves, flowers, stems, or roots.

## GENERAL DISEASE INFORMATION

Plant diseases are difficult to diagnose and control due to the size of the pathogenic organisms involved. Because of the size of the organisms involved, disease diagnosis requires the identification of symptoms or the reaction of plants affected by these organisms. These symptoms may include leaf spotting, mottling, chlorosis, canker, galls on roots and stems, and discoloration of roots.

There are environmental conditions which may also simulate plant diseases so they must be distinguished from actual pathogens. Such things as frost injury, dog urine burn, and nutrient deficiencies are not corrected by pesticide applications.

Unless of the pathogenic organism is known, the chemical or cultural practice used to control the symptom may not work. Identifying a root problem as a root rot when it is actually a nematode problem will not be cured by applying a fungicide --a nematicide is required.

Diseases may be classified into four general groups according to the basic causal organism. Diseases caused by fungi are the most common, and the easiest to control. Bacterial, virus and nematodes are the other three causal agents.

## INSECTS

### **MITES (Red Spider)**

#### Description

Mites may be distinguished from insects by the absence of discernible body segmentations and the presence of eight, rather than six legs. Many are so small that they cannot be detected without the use of a hand lens or magnifying glass. They vary widely in color, but most of the ones found in the greenhouse are reddish. Often their presence is not detected until they become very numerous and cause obvious plant damage. The mite damage frequently appears as bronzing on the foliage. A thin webbing in which mites may be seen may be associated with mite infestation.

#### Life History

Reproduction is usually continuous on greenhouse crops, and increases as the temperature goes up.

#### Control

Chemical control needs to be at frequent intervals because of rapid reproduction. There are specific chemicals, called miticides, that are effective, along with certain systemics.

## MEALYBUGS

### Description

Mealybugs are soft-bodied insects which are usually covered with a powdery or cottony, wax-like covering. They vary in length from 1/5 to 1/3 inch. Mealybugs are able to move about throughout their lives, but tend to stay put.

### Life History

The life history of most mealybugs is about the same. The mature female deposits her eggs in a waxy sac beneath the rear end of her body. The eggs hatch in about 10 days and the young crawlers (without the covering) begin to feed by inserting their mouthparts into the plant tissue and sucking out the sap.

### Damage

Mealybugs are among the most serious of greenhouse pests. They injure plants by sucking sap. The masses of wax from their bodies and their egg sacs render the plant unsightly. The honeydew they excrete serves as a medium for the growth of sooty mold. They may be very troublesome on foliage plants.

### Control

Control is difficult because of the cottony covering. Best control is secured when they are in the young crawler stage.

## SCALE

### Description

Scale insects constitute a very large group of plant feeders and may occur as a greenhouse pest or on outdoor ornamentals. They have sucking mouthparts and feed on plant juices. Most that are encountered in the greenhouse are the armored scales.

### Life History

Scale insects pass through three stages: egg, nymph, and adult. During part of the nymph stage the scales move about on the plant. This period is generally referred to as the crawling stage. Once the crawlers insert their mouthparts into the plant they cannot move again.

### Damage

Scales damage plants by sucking the plant juices from leaves and stem, causing dead areas to appear. If left uncontrolled, defoliation occurs and the plant may die. Very prevalent on foliage plants.

### Control

They are much easier to control when young, especially in the crawler stage.

## APHIDS

### Description

Aphids or plant lice, are small soft-bodied sucking insects that infest nearly all types of plants. Their color varies from green to reddish to black. They usually cluster in colonies on the underside of leaves and on new growing points or buds. Adults may be either winged or wingless.

### Life History

Reproduction may be continuous on greenhouse crops. Green peach aphid will winter over on the Canada plum out of doors.

### Damage

Both nymphs and adults suck the sap from the plant, causing discoloration and curling of the leaves. Severe damage may cause stunting or death of the plant. Aphids secrete a honeydew

which may make a plant unsightly because of the development of soft mold fungus. Green peach aphid may transmit disease to potato plants.

#### Control

Frequent use of a suitable insecticide is necessary because of repeated generations.

### **THRIPS**

#### Description - Life History - Damage - Control

Thrips are minute, slender insects with rasping-sucking mouthparts. A generation is normally completed in about two weeks, and in warm climate thrips breed all year long.

Thrips feed on both foliage and flowers. Their damage shows up as a graying of foliage or minute spotting of flowers. They are especially troublesome on gladioli and roses, but may occur on other plants.

Control is by concentrated efforts in applying insecticides, and control of weeds about the plantings.

### **GREENHOUSE WHITEFLY**

#### Description

The greenhouse whitefly is a universal pest of greenhouse plants. By many it is considered to be the most important pest of greenhouse plants. The adult whitefly is about 1/16 inch long with powdery white wings. The immature forms resemble scale insects and are about the size of a small pinhead, oval, flattened and light green in color.

#### Life Cycle

Eggs are laid on the underside of plant leaves. A small crawler hatches from the egg and moves about freely before settling down to feed. Once the crawler inserts its mouthparts into the plant and begins to feed, it transforms into a scale-like sedentary stage which feeds for some time and then pupates. Adults emerge and fly around from plant to plant seeking sites to lay eggs.

#### Damage

Damage from whitefly feeding appears as spotting and chlorosis of the foliage. With heavy infestations there may be an accumulation of honeydew which may become covered with a black fungus called sooty mold. They may become troublesome on outdoor flowers and vegetables.

#### Control

Frequent use of suitable insecticides is necessary. Treat every 4 days for 4 applications to clean up infestation.

### **EARWIGS**

#### Description

The mature earwig is about 5/8 inch long. The color is dark reddish-brown except for the legs, antennae and wing covers which are yellowish-brown. The insect is readily distinguished by the presence of a pair of pincers on the rear end.

#### Life History

Earwigs hibernate over winter and the females lay eggs in nests in the soil in early spring. The young feed mostly on dead plant material although they may eat aphids and small caterpillars. They are mostly active at night and hide during the day. They are frequently found about the foundation of buildings and in the greenhouses.

#### Damage

Earwigs are scavengers, feeding on decaying plant material or on animal matter both dead and alive. The European earwig, however, is a nuisance because it also chews all types of living plants in the greenhouses.

## Control

Treatment of areas under benches and about foundations with an insecticide.

## **DISEASES**

### **POWDERY MILDEW**

Powdery mildew is caused by several different species of fungi. The disease appears as a white to light grayish powdery coating on the surface of leaves, stems and fruits. Infected leaves may be curled or twisted or turn yellow and die. Small spots may enlarge and cover the entire leaf or bud.

Unlike those of most other fungi, powdery mildew spores do not require free water for germination. High humidity at the leaf surface is sufficient. This occurs when cold nights change to warm days, when plants are crowded in the bench, or grown without sufficient air circulation.

Good ventilation and sanitation will lessen the problems.

### **LEAF SPOTS**

Leaf spots are the most common disease of plants. They are caused by various fungi and bacteria, the size, shape and color of the spot being generally rather constant for the causal agent. The spots often have a definite margin and may have conspicuous concentric zones. If numerous, the spots may coalesce forming blotches.

Most leaf spot diseases flourish during wet cloudy weather, or when the foliage is kept syringed during cloudy periods. Some may be serious enough to call for control measures other than general sanitation and good cultural practices.

### **BOTRYTIS OR GRAY MOLD**

Botrytis blight, or gray mold, has been reported on a great many plants grown in greenhouses. The fungus can live on dead tissue or organic matter. It is present in almost all soils and there is a ready supply of spores which can attack and rapidly develop in plants whenever conditions are favorable. High humidity greatly favors the development of the disease. It can also develop over a wide temperature range.

The damage begins as a small spot on the leaves or flowers which enlarges rapidly becoming a grayish-brown color with a dark water soaked margin. Powdery masses of gray spores form, beginning near the original center and spreading in all directions. The spores are airborne, so that even a small spot of the disease can provide a source of infection. Proper ventilation to control humidity and sanitation are essential to keep the disease from spreading.

### **DAMPING-OFF**

Damping-off is the destruction of young seedlings by soil organisms. There are two types. Pre-emergence damping-off kills the seeds before germination, or soon after. The young plants never emerge from the soil.

Post-emergence damping-off is the rotting or wilting of seedlings soon after they emerge from the soil. Succulent stems have a water-soaked, then necrotic and sunken zone at ground level, and the little plants fall over the ground. Root decay follows. This type of damping-off is most common in greenhouses.

Many fungi living in the soil can cause damping-off; Pythium and Rhizoctonia are the most common. These organisms are present in virtually all soils unless the soil is sterilized.

### **ROOT ROT**

Root rot is a common disease problem of all ornamentals. Its first symptoms generally appear on the above-ground parts as a gradual loss of vigor, yellowing of leaves or wilting.

Diseased roots appear decayed, generally brown to black, and may be musky or spongy. Common root organisms are the fungi Pythium and Phytophthora. These organisms normally inhabit soil everywhere. Excess moisture is always essential for the organism to become established. This problem is occasionally confused with root injury caused by excess fertilization.

### **STEM ROT**

The pathogen most commonly associated with stem rot of ornamentals is Rhizoctonia. It is commonly in most soils and may move with the soil, in infected plant debris, or on cuttings.

Affected plants may first wilt during the day, then recover at night. However, the wilting symptom increases in severity. In addition, the stem may be brown and sunken at the soil line. Under extreme moist conditions, brown mycelium may be visible on the surface of the stem.

Chrysanthemums, geraniums, petunias, zinnias and other herbaceous ornamentals are quite susceptible to stem rot.

### **BACTERIAL LEAF SPOT**

Bacterial leaf spot may begin as a light green, water-soaked area. Later, the spots may turn brown to black. Spots generally appear more irregular in shape than fungal leaf spots. The bacterium can enter the water-conducting system of some plants and cause stem and/or root diseases. Under warm, moist conditions the leaf spot will appear soft and mushy. However, under dry conditions the same spot may be brittle.

The bacterium generally overwinters in plant debris and is introduced to the plant in splashing rain or in watering. Bacteria do not enter the plant directly, but require either plant injury or a natural plant opening for entrance. It may be readily spread from plant to plant when taking cuttings with a knife. Once the bacterium enters the plant and multiplies there is virtually no practical control.

### **WEED CONTROL IN GREENHOUSES**

Weeds in greenhouses are more than unsightly. They provide breeding grounds for insects, mites, slugs and diseases. Control of weeds under benches is simple. Since this also provides pest control, in this instance an ounce of herbicide is worth pounds of insecticides.

Not all herbicides should be used inside a greenhouse. Many herbicides that are commonly used to control weeds in the lawn or field are volatile, and when used indoors may injure virtually all plants. Many of the commonly used herbicides, such as 2,4-D are growth regulators. These materials in small quantities may cause the plant to exhibit unusual growth habits and the symptoms may be confused with a disease.