INSECT AND MITE PEST MANAGEMENT FOR POINSETTIAS

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Integrated pest management is a pest control scheme which uses a variety of management tools in addition to pesticides. In a real integrated pest management program, diseases, weeds, and plant growth are considered as well as insects and mites. IPM is a complex program as each crop must be considered individually. Fortunately, poinsettia is a crop which is amenable to IPM for several reasons. Poinsettias have relatively few insect and mite pests. Poinsettias are not grown year round so there is a break in the production cycle. This is a discussion of the insect and mite management practices of an IPM program for poinsettias.

Clothing

Avoid carrying insects into the greenhouse by not wearing white, blue, yellow or green clothing. Aphids, thrips and whiteflies are attracted to yellow, green and blue. Thrips are also attracted to white.

Quarantine

Inquire of your supplier if he is having whitefly or mealybug problems. At least then you will know what to expect. In addition, inspect all plant material before bringing it into the greenhouse. Keep new plant material in a separate section for a week or more before incorporating new material into the production area. Highly resistant thrips, aphids and whiteflies are readily transported throughout the greenhouse industry on cuttings and plants.

Screening

Screening can significantly reduce numbers of insects flying into greenhouses. Even thrips are excluded by several screening materials on the market. A word of caution: the finer the screen, the greater the resistance to air flow into the greenhouse. To compensate, the grower must make the area of the screening materials two to eight time greater than the cooling pads or air inlets to the greenhouse. Polyspun (tobacco canvas) requires an area two times the area of the cooling pads. Vispore 400 requires an area five times as large. Vispore 1600 screening requires at least 7 1/2 times as large a screen as cooling pad opening!

Monitoring

Constant vigilance for insects, mites and disease is required for effective pest management. Assign certain employees the responsibility of scouting for insects and other pests on a regular basis (weekly the winter and twice weekly in summer). Keep written records of where various pests are found. Monitor pests by using yellow sticky cards, yellow pan traps, and by examining the foliage and occasionally the roots.

Record Keeping

Keep a log of pest type, locality, abundance and all pesticides applied. These records can be of long term benefit as many pests tend to appear about the same time each year. Short term benefits include knowing what pests

survive a pesticide application. This can alert you to the possibility of poor timing, poor application of the treatment, or pesticide resistance in the pest population. A change in the kind of treatment or pesticide can be made before the crop is significantly damaged.

Biological Control

Biological control organisms can be used in a pest management scheme for poinsettias, especially for caterpillar and spider mite control. *Bacillus thuringiensis* will control caterpillars on poinsettia and can be used with regular chemical pesticides. Predaceous mites are available to control spider mites, but the grower must refrain from using other synthetic insecticides while using the predaceous mites. *Encarsia formosa* parasitic wasps can be used to control the greenhouse whitefly, but again synthetic pesticides cannot be used at the same time. Insecticidal soap can be used in conjunction with *Encarsia* wasps if the soap is applied when the parasites are in the "black scale" stage.

Pest Recognition

It is important to be able to recognize the different pests in all stages of development. The most mixed up pests are shore flies and fungus gnats. Shore flies breed in algae and do little direct damage to poinsettias (If plants are infested with *Pythium*, it is possible for shore flies to spread the disease around in the greenhouse.) However, shore flies are very resistant to pesticides. Fungus gnats breed in decaying roots and overwatered peat moss. Fungus gnats can be very damaging to poinsettia cuttings and plants, but fungus gnats can be controlled with pesticides. Another common mistake is to assume that parasitized aphids are a new kind of tan aphid which cannot be killed with insecticides. Unfortunately pesticides are sometimes expended uselessly against shore flies and parasitized aphids.

Shore Flies are small (2 mm), black flies with reddish eyes and spotted gray wings (Figure 1). Shore flies resemble eye gnats, fruit flies or vinegar flies in general shape. Shore flies are sometimes confused with fungus gnats which are about the same size and color. (Fungus gnats are shaped more like miniature mosquitoes and have relatively long legs and antennae.) Neither adult nor immature shore flies feed upon ornamental plants. The damage caused by shore flies consists primarily in the excrement ("fly specks") left on the foliage of bedding plants and other ornamentals and the spread of *Pythium aphanidermatum* from infected plants to uninfected plants. Because shore flies are often confused with fungus gnats, control efforts are often wasted (fungus gnats may be harmful to plants but are relatively easy to control; shore flies are harmless but are very difficult to control with insecticides). Sometimes shore flies become so abundant in greenhouses that the sheer numbers of flies becomes a deterrent to customers browsing or even employees working.

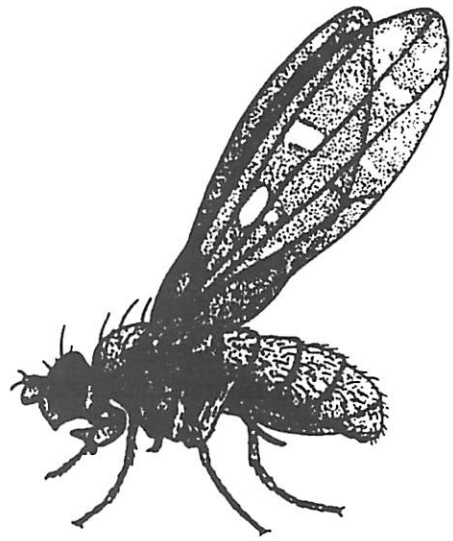

Figure 1. Adult shore fly.

Shore flies are commonly found in greenhouses where they breed in algae growing on the potting mix, pots, benches and floors. Females scatter eggs right on the surface of the potting mix. The eggs hatch in 2 to 3 days. The

INTEGRATED CROP MAN

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		March	April	May	June	
Production Events		Potting stock plants, building stock for cuttings		Pinching stock plants, building up cutting supply		Apj stoc roo
Diseases	Bacterial Soft Rot					
	Botrytis Blight					4
	Root Rot	5				
	Stem Rot	5				
	Wet Rot				6	
Insects and Mites	Earwigs					
	Fungus Gnats					
	Leafliers					
	Mealybugs	10				
	Shore Flies	11				
	Spider Mites				12	
	Thrips			13		
	Whiteflies	14				

[1] Cycocel or Bonzi applications may be needed to control shoot elongation on stock plants.

[2] Cycocel or Bonzi applications may be needed to control height on finished plants. Do not apply Bonzi after October 5 or after start of short days, if pulling black cloth over the crop.

[3] Control temperatures using fan and pad cooling to help prevent bacterial soft rot.

[4] Spray or fumigate as needed for control. Controlling relative humidity during autumn through evening ventilation can help reduce the incidence of botrytis.

[5] Apply substrate (growth medium) drenches, rotating chemicals with each application.

[6] Fungicide sprays may be needed for control.

[7] Earwigs are a pest mainly during rooting of cuttings. Drench infested Oasis cubes for control.

AGEMENT CALENDAR FOR POINSETTIAS

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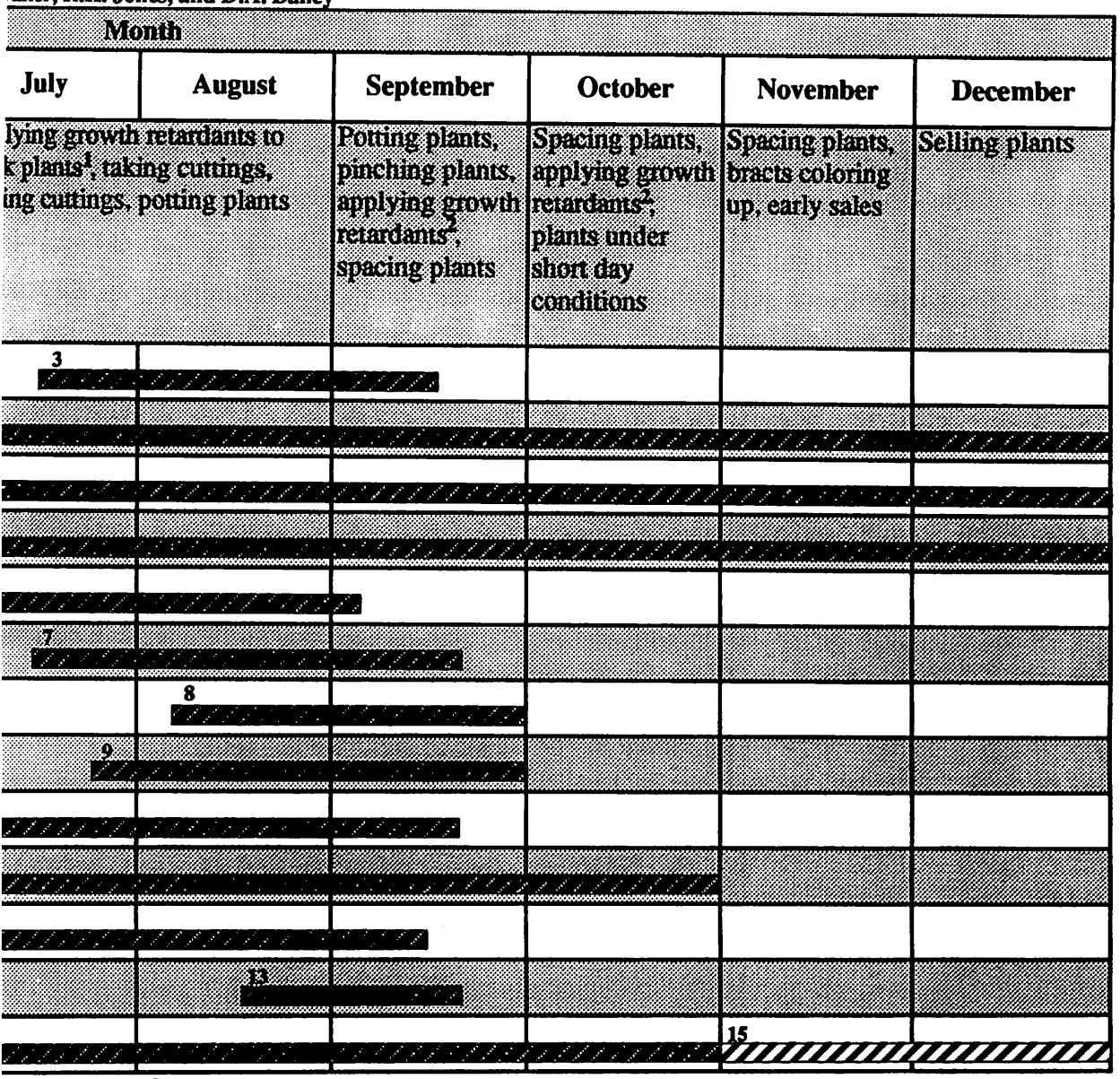

[8] Drench or granular applications may be needed for control of larvae; spray for adults.
[9] Screen to exclude moths; pyrethroids effectively control larvae.
[10] Primarily a stock plant pest; thorough spray coverage is needed for effective control.
[11] Resistant to pesticides; algae control is necessary to reduce shore fly populations.
[12] Spider mites are mainly a hot, dry weather pest.
[13] Screen to exclude adults; crop monitoring and correct timing of pesticides are essential for control.
[14] Crop scouting and proper timing of pesticides are essential for effective control.
[15] Try to eradicate whiteflies prior to bract coloration.

larvae are found within the crust of algae and very top layer of potting mix. The maggots feed on bacteria and yeasts as well as diatoms and flagellates growing on the surface of the potting mix. The larvae mature in 3 to 6 days and pupate inside the skin of the last larval stage (this kind of pupa is called a puparium). The last larval skin affords the relatively tender and completely helpless pupa protection from environmental hazards (including insecticides). Some of the puparia are found on top of the potting mix or are very close to the surface. A new generation of adult flies emerges 4 to 5 days later. The adults crawl about on the surface of the potting mix, on the plants or they fly about the pots and plants. The flies move and fly rapidly but generally stay close to their breeding sites. The adults feed primarily on diatoms and flagellates on the surface of the potting mix, mats etc.

Fungus Gnats are slender with comparatively long legs and antennae (Figure 2). They are grayishblack and about 2.5 mm

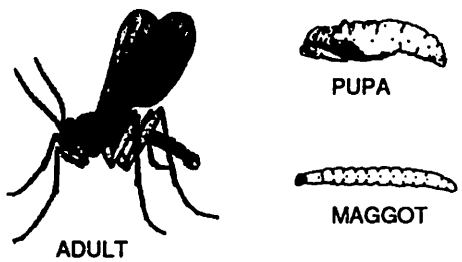

Figure 2. Fungus gnat life stages.

long. Fungus gnat maggots feed on the roots of carnations, Easter lilies, geraniums, peppers, poinsettias, and organic matter. They are also pests of house plants. Damage first become apparent when plants lose their healthy appearance and wilt. Adult fungus gnats are usually noticed before injury caused by the maggots is apparent. Adults and larvae inhabit moist, shady areas. Adults live about 1 week, during which time each female deposits 100 to 150 eggs. They are laid in strings of 3 to 40 in the top of the soil, usually near stems of plants. They hatch within 4 days in the greenhouse. There is a tendency for the progeny of each female to be all one sex. The larvae begin feeding on the root hairs and roots usually in the upper cm of medium, working their way up the plant and into the stem; however, they also feed on any organic matter in the soil. Being somewhat gregarious, the larvae often form clusters in the soil. They mature in about 14 days, after which they construct a pupal case, made of silk and debris, in the soil. The pupal stage lasts about 3.5 days. The adults are weak fliers, but they run rapidly on the soil surface or may remain motionless.

Clean cultural practices and lack of excessive watering may help prevent fungus gnat infestations. Since fungus gnats prefer potting mixes containing peat moss and abundant moisture, consider using bark mixes and avoid overwatering ornamental plants. Decoy pots of sprouting grain are attractive to females, which will lay their eggs in these pots. Afterwards, the pots should be submerged in boiling water or the contents destroyed in some manner every 2 weeks to destroy the eggs and maggots. Fungus gnats have few efficient natural enemies. Some species of fungus gnats in mushroom houses have developed up to 47 fold resistance to a pyrethroid insecticide.

Leaftiers are small caterpillars which tie the leaves of pointsettia together and feed within the shelter thus formed. Two species of leaf tiers are found on poinsettias in North Carolina, the obliquebanded leafroller and a leaf tier with no common name, *Platynota flavedana*. Obliquebanded leafroller adults are 1.7-3.3 cm dark deep yellow to reddishbrown moths with pale orangeyellow (males) to deep yellow (females) hind wings (Figure 3). Female moths are larger than males. There are two broods of obliquebanded leafrollers in North Carolina. Moths have been collected from late April through October. The caterpillar is a small greenish worm which ties the leaves of poinsettia together and feeds within. *Platynota flavedana* female moths are reddish brown and fairly evenly marked. Males are blackish brown with

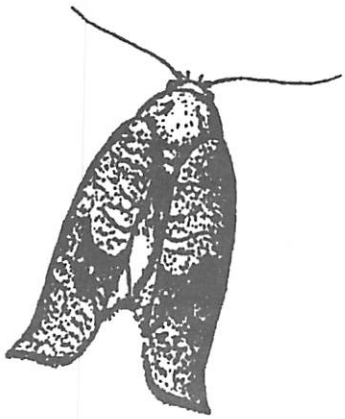

Figure 3. Adult of oblique banded leafroller.

contrasting reddishocre tips of the wings. There are 2 to 3 broods of *Platynota flavedana* each year. Moths have been collected from April to October. The slender caterpillars are greenish or brownish (Figure 4). They tie the leaves of poinsettia together with silk and feed within. Leaves that are not directly fed upon are distorted because they grow unevenly because of the silk tying them together even after the caterpillar has matured.

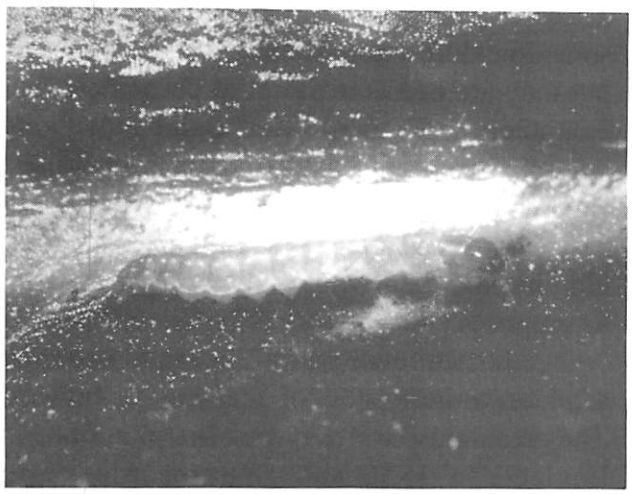

Figure 4. Caterpillar of Platynota flavedana.

Mealybugs are small, soft, oval insects without wings (except for males). Some species are covered with fluffy wax and others have long tails. Male mealybugs are tiny, gnatlike insects with two wings and long tails. With those species of mealybug which lay eggs, the eggs are very small but are covered by a conspicuous dense, fluffy, white mass of wax called the ovisac. Very young nymphs are flat, oval and yellow. Older nymphs of some species are covered with fluffy, white wax. Mealybugs

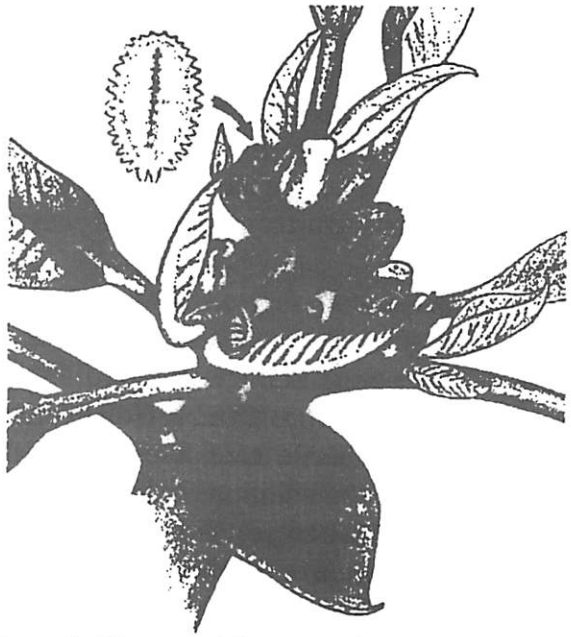

Figure 5. Citrus mealybugs on poinsettia.

damage plants by inserting their thread-like mouthparts into any part of the plant, injecting saliva, and sucking out sap. Mealybugs excrete honeydew, a sweet, sticky liquid. Sooty molds often grow in the honeydew causing infested plants to become black. The citrus mealybug has a toxin in its saliva which causes its host plants to drop leaves and buds. Small numbers of mealybugs are easily overlooked as they tend to wedge into crevices on plants (Figure 5). After the first batch of eggs hatches, the mealybugs become more noticeable. As their numbers increase, mealybugs of all sizes can be found crawling around or feeding on all surfaces of the plant. Each female usually lays from 200 to 600 eggs. After several weeks, nymphs develop into adults.

Mealybugs are not easy to control. Because the eggs are often protected in an ovisac, it is difficult to get a pesticide through the fluffy wax to kill them. (This is one case where the use of a spreader sticker may be called for. Use an adjuvant with which you have experience or an adjuvant which is recommended by the company that makes the pesticide you are using. Before using a pesticide or pesticide/spreader

combination which is new to your program, be sure to try it on a small number of plants before treating a large number.) Therefore it is very important to "scout" plants regularly in order to detect mealybugs before their numbers build up and the insects form their "nests" of wax and eggs.

A predaceous insect, the Australian lady beetle, is commercially available should a grower want to incorporate biological control into his pest management program. However, the Australian lady beetle cannot be obtained at certain times. In addition, lady beetles are somewhat sensitive to pesticides so the grower would have to curtail or eliminate the use of most pesticides.

Sweetpotato whitefly has become a major pest of cotton in southern California and Arizona due to a remarkable acquisition of resistance to pesticides commonly used for cotton pest suppression. In 1986 in Florida, the sweetpotato whitefly suddenly became a greenhouse pest on poinsettias where it exhibited extraordinary resistance to certain pesticides.

Sweetpotato whitefly eggs develop for about six days. Tiny "crawlers" hatch and crawl about until they insert threadlike mouthparts into the bottom of the leaf to feed. The crawler molts into a scalelike insect (nymph) which also sucks out sap (Figure 6). The nymph grows and molts a second time and a few days later molts into a third nymph. The third nymph molts into the fourth stage which eventually ceases to feed. Inside the fourth nymphal skin the adult whitefly develops. Adults emerge from the fourth nymphal skin through a T-shaped slit about a month from the time the egg was laid. Females live about two weeks and lay 28 to 300 eggs each. In very host weather, development may take only two weeks and in cool weather, development may take much longer. Except for slightly smaller size, slightly more yellowish color and the tendency for the adults to wrap the wings around their bodies a little tighter than usual, adult sweetpotato whiteflies are difficult to distinguish from many other whitefly species. There are other species of whiteflies which sometimes infest ornamentals in the greenhouse, but they are not as resistant to pesticides. For example, citrus whiteflies and bandedwing whiteflies are occasionally found in greenhouses. Bandedwing whiteflies are apparently not resistant to pesticides and can be easily eliminated. Citrus whiteflies are more difficult to suppress.

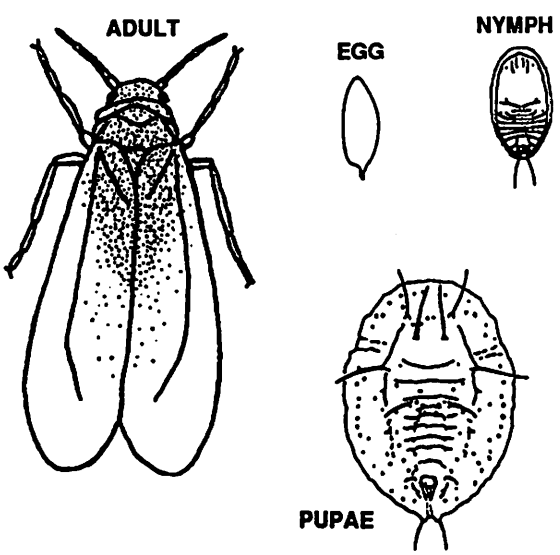

Figure 6. Sweetpotato whitefly life stages.

Greenhouse whiteflies are consistently a major whitefly pest of greenhouse flowers. The greenhouse whitefly was first described in England in 1856 and first recorded as a greenhouse pest in the United States in 1870.

Greenhouse whiteflies reproduce relatively slowly (1 generation each 30 to 45 days). Each female may lay up to 400 eggs and may live almost 2 months although most probably live 30 to 40 days and lay 60 to 80 eggs (Figure 7). Whiteflies are usually found on the lower surface of new leaves. Here they insert eggs which hatch into young called crawlers. Once it starts to feed, the young whitefly probably does not change locations until the adult emerges about 23 days later. Adults are pale green to yellow at first but soon secrete a white, waxy bloom.

surrounded by a purplish-red margin. Occasionally, lesions coalesce resulting in the girdling and death of stems. Brown spots up to one cm appear on leaf blades. These are usually concave on the upper surface giving the leaf a puckered appearance. Severely affected leaves drop prematurely. A grayish-brown velvety layer of fungal growth (spores) may be found in the depressed spots on stems. Conidia are spread to healthy plants by splashing water.

Scab is a more common disease on poinsettias grown outside in Florida than it is under greenhouse production in North Carolina. Wild hosts outside the production areas in Florida are important sources of the pathogen.

Wet Rot. Wet rot caused by the fungus *Choanephora cucurbitarum* occurs on both stock plants and on cuttings under mist propagation. The pathogen is capable of killing plants in all stages of production.

The symptoms of wet rot on poinsettia plants are a soft, wet, mushy decay of leaves, petioles and stems. If the stems are green and actively growing, they become soft, wet, flaccid and wilt or droop before collapsing. If the stems are somewhat woody, only necrosis occurs. Small plants and rooting cuttings may be destroyed in only a few days when weather conditions are favorable for disease development. On large multi-stemmed stock plants, the fungus may kill the plant stem by stem.

The pathogen usually sporulates profusely on diseased plant parts, especially on stems. The fungus produces single celled sporangiophores (stalks), each bearing a cluster of black spores on the end. The sporangiophores are long and very abundant, giving the appearance of a coarse, hairy or "whiskery" growth. The spores can be spread by water, wind, movement of plants (cuttings), hands, knives and insects.

Under North Carolina conditions, this is primarily a disease of stock plants and cuttings under mist. This fungus attacks the flowers a wide variety of plants including squash, okra, petunia and hibiscus.

Alternaria Blight or Leaf Spot. A new leaf spot or blight disease of poinsettia caused by the fungus *Alternaria euphorbiicola* was first observed in Florida in 1984. Symptoms of this disease can be confused with bacterial canker or scab. This disease has not been reported in North Carolina.

Leaf infections initially appear as 1 to 3 mm diameter spots with tan centers, dark thin margins and a chlorotic halo. As spots enlarge, they often progress along lateral leaf veins. Spots enlarge to form irregular necrotic lesions, 25 mm across or larger. Leaves with several spots become chlorotic and abscise.

Spores of *Alternaria euphorbiicola* are air-borne and can survive dry periods to cause disease when moisture becomes available. Environmental conditions in outdoor production areas are more favorable for disease development than greenhouse conditions, presumably because of frequent prolonged periods of leaf wetness. Outdoor production and wild host sources of spores make this an important disease in Florida. It should be less important in North Carolina if growers start with disease-free plants and grow them in greenhouses using a watering system that keeps the foliage dry.

Diseases Caused by Bacteria

Bacterial Canker. Bacterial canker is caused by *Corynebacterium poinsettiae*. It is not as wide spread today as in the past, probably due to healthier rooted cuttings and use of watering systems that keep above ground plant parts dry.

The most prominent symptoms are water-soaked areas on the lower stem or narrow water-soaked streaks often extending several centimeters along branches. These lesions are associated with exuded droplets of latex that dry to form pale yellow or golden crusts. Infected plants frequently have malformed, small bracts, are stunted and retarded slightly in development. Under conditions of low moisture, marginal

wilting of leaves has been observed. Severely diseased branches may be girdled and die. Plants may grow out of visible symptoms yet retain internal low populations of the bacteria. Cuttings taken from these plants frequently show disease symptoms in later stages of production. In North Carolina, this disease is often seen in late stages of finishing.

The disease is spread by vegetative propagation of cuttings from apparently healthy plants. The bacteria can also be spread during pinching, by infested irrigation water, and on knives when taking cuttings.

Bacterial Soft Rot. Soft rot caused by the bacteria *Erwinia carotovora* and *E. chrysanthemi* is a common disease problem in North Carolina during and just after propagation. These bacteria are most likely to cause problems on succulent tissue, under hot wet conditions; wounded or bruised tissue is highly susceptible. Infected tissue becomes water soaked, and develops into a soft mushy rot. The disease can develop very rapidly on cuttings under mist. After propagation, *Erwinia chrysanthemi* causes chlorotic spots that rapidly coalesce forming large irregular chlorotic areas. Petioles turned black, shrivel and associated leaves wilt within a few hours. Chlorotic areas turned black, stems collapse and affected tissues become soft and water soaked.

Greasy Canker or Bacterial Stem Canker. Greasy canker caused by the bacteria *Pseudomonas viridaflava* has been reported from California and Florida. This bacterial disease appears as rapidly advancing oily or greasy canker associated with pruning wounds. Leaf spot bract and bud blight have also been observed.

This disease occurs at all temperatures as long as the relative humidity is high. Disease severity increases at higher temperatures (27–32°C or 80–90°F). Disease progress is arrested when relative humidity is reduced; infected tissue then becomes tan to brown and papery.

Control of Poinsettia Diseases.

Control of poinsettia diseases requires a total program starting with good planning before the plants arrive at the greenhouse and end with clean up after the last plant has been sold. Steps in a poinsettia disease control program include:

1. Do not carry any plants over from one season to the next.
2. Clean all benches where poinsettias will be grown.
3. Have clean pots and media available for potting.
4. Try to avoid any unnecessary wounding or bruising of the plants.
5. Purchase plants or cuttings from a reputable supplier.
6. Inspect the plants on arrival for any problems.
7. Try to grow plants as close to optimum conditions as possible to minimize stress.
8. Keep the relative humidity below 85% whenever possible.
9. Maintain temperatures below 90-95°F whenever possible.
10. Use a watering system that keeps the foliage dry.
11. Space plants properly to promote good air movement between the plants.
12. Have good horizontal air movement over the crop.
13. Try to prevent condensation on the plant surface during the night.
14. Chemical protection:
    (a) fungicides can help prevent root rot diseases and Botrytis blight
    (b) drench with the proper combination of fungicides on a preventative program for root rot (see Table 2)
    (c) repeat fungicide drenches monthly for root rot control
    (d) use sprays or fumigate as needed to control Botrytis blight
    (e) alternate fungicides for Botrytis control to avoid resistance.