Poinsettia Nutrition Diagnostics & Management

Brian Whipker, NC State University

e-GRO Alert Webinar

- First webinar offered by e-GRO
  - Others planned for January 2014
- Ask questions with the "Questions" box
- Webinar will be recorded and posted on e-GRO.org

Poinsettia Diagnostics

- Speakers
  - Kelly Ivors, Plant Pathology, NC State University
  - Brian Whipker, Horticulture, NC State University
  - Raymond Cloyd, Entomology, Kansas State Univ.

Outline

- Introduction (10 min)
- Diseases and Questions (35 min)
- Break (5 min)
- Nutrition and Questions (30 min)
- Break (5 min)
- Insect and Mites, plus Questions (35 min)
- End after 2 hours

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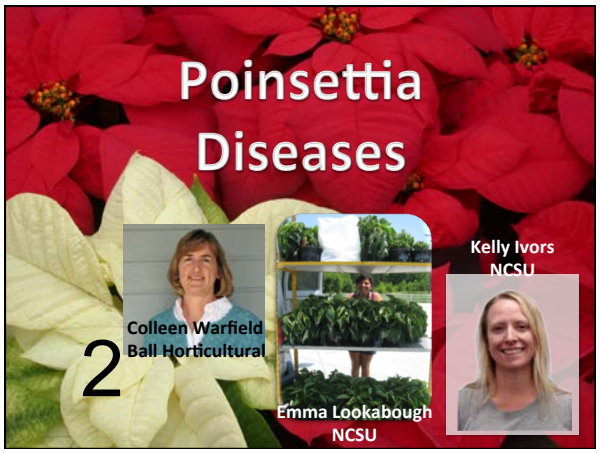

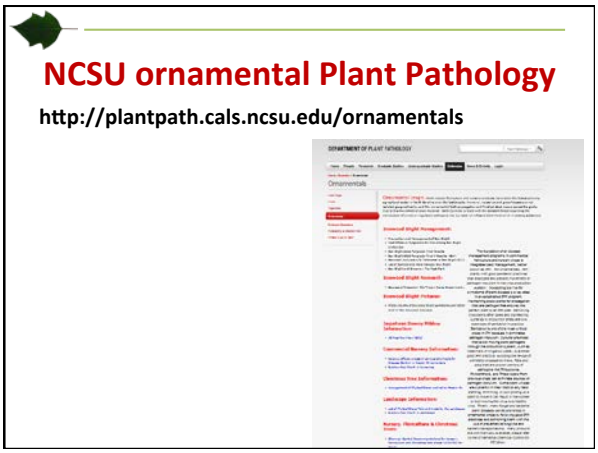

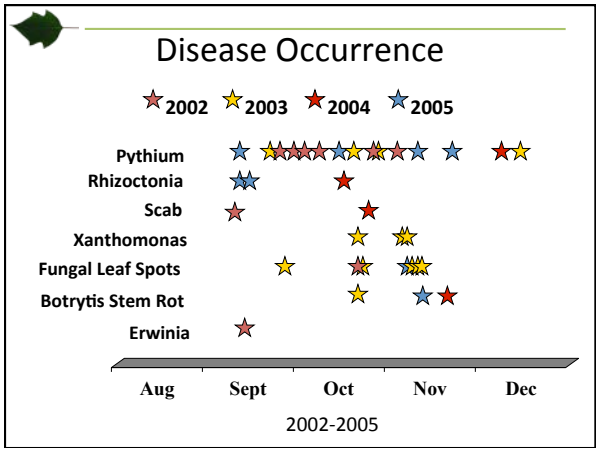

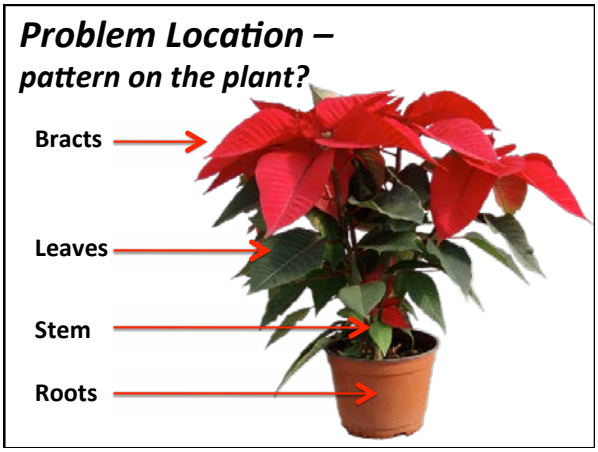

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Problem Location

Pythium root rot

Emma Lookabough NCSU

Pythium root rot

Pythium root rot

Emma Lookabough NCSU

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Pythium root rot

Diagnostics and Pythium…

Pythium is the most commonly diagnosed disorder of greenhouse crops

- Do not identify to species
- Do not test for chemical sensitivity
- Can not offer insight whether *Pythium* isolated from a sample poses a production problem

Control of Pythium

Most commonly used active ingredients

Mefenoxam:	Etridiazole:
Subdue Maxx; FRAC: 4	Terrazole/Truban; FRAC: 14

- propamocarb (Banol)
- cyazofamid (Segway)
- fluopicoldie (Adorn)
- fosetyl-Al (Aliette)
- phosphite/phosphorous acid (Vital, Biophos, Alude)

Mefenoxam resistance

Mefenoxam resistance is widely documented in *Phytophthora* and *Pythium…*

•1984: First report of resistant *Pythium* in turfgrass

•Resistant *Pythium* documented in floriculture crops in Pennsylvania (Moorman et al., 2002) and California (Aegerter et al., 2002)

•Resistant *Phytophthora* documented in NC floriculture and nursery crops (Olson et al., 2013)

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Why is species ID important?

Species differ in aggressiveness on certain hosts and chemical sensitivity;

Species differ in sensitivity to chemistries… even differences within species are observed due to selection pressure;

The more you know, the better the diagnosis!

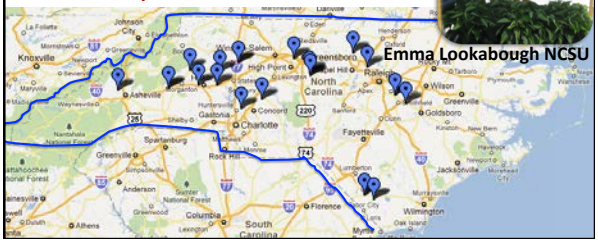
Better Control Recommendations

Collection of Pythium

Collected samples from 26 greenhouses across 21 counties

Obtained 360 *Pythium* isolates from 26 GH and 36 host species

Emma Lookabough NCSU



Common GH Hosts of Pythium

Host	Percentage of Isolates[a/]
Poinsettia	21%
Mum	20%
Snapdragon	9%
Petunia	7%
Geranium	7%
Gerbera	6%
Lantana	6%
Fuchsia	4%
Vinca	3%
Verbena	3%
Others, less than 1% each	

[a/]Percentage of 360 isolates

Pythium ID

Species	Percentage of Isolates[a/]
Pythium irregulare	39%
P. aphanidermatum	26%
P. myriotylum	11%
Pythium Subclade B2[b/] group	8%
Pythium spp.	5%
P. segnitium	4%
P. catenulatum, P. cylindrosporum, P. helicoides, P. inflatum, P. intermedium, P. litorale, P. mamillatum, P. rostratifingens, P. splendens, P. ultimum, P. vexans	<3% of each

[a/] Percentage of 289 isolates identified to species [b/] Includes *P. coloratum, P. lutarium, P. diclinum*

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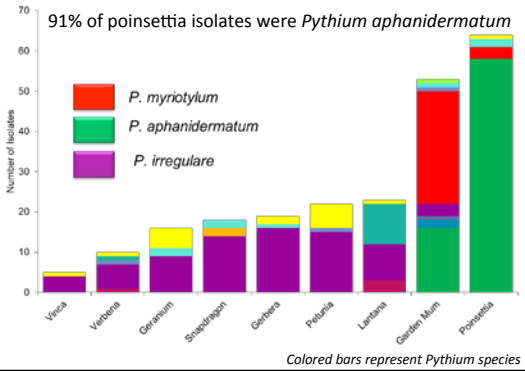
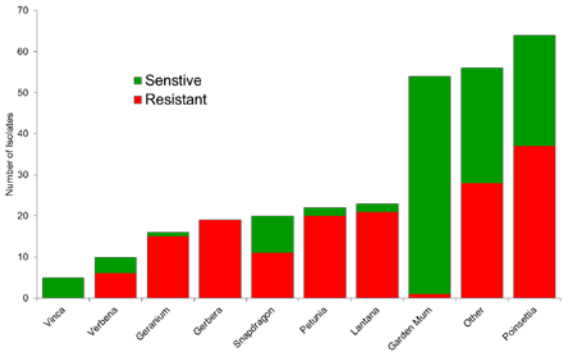
Pythium ID by Host

91% of poinsettia isolates were *Pythium aphanidermatum*



Colored bars represent Pythium species

Mefenoxam sensitivity



Thoughts on Pythium

strong association of *P. aphanidermatum* with poinsettia;

Especially a problem in Ebb-and-flow systems

Moorman et al. (2002) showed similar findings.

Possible explanations?

- Production season
- Propagation material

Can Pythium cause asymptomatic infections?

YES ➡ *P. aphanidermatum* from poinsettia infected petunia but dramatic symptoms were not observed

Implications: Asymptomatic hosts could harbor the pathogen in a production system and growers could unknowingly ship infected plant material

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Problem Location

STEMS

Bacterial soft rot (Erwinia =Pectobacterium)

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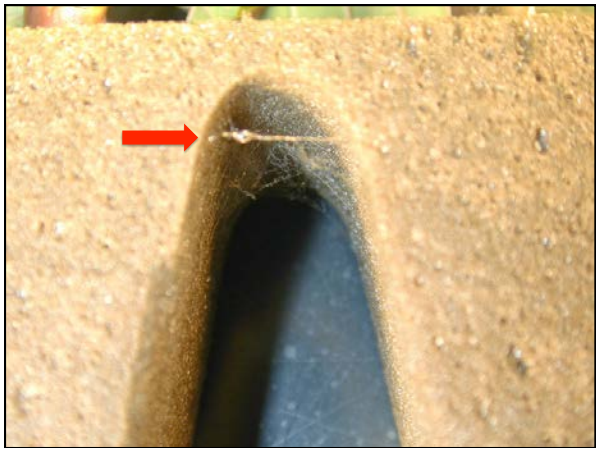
Rhizoctonia stem/cutting rot


Rhizoctonia cutting rot




Botrytis stem rot

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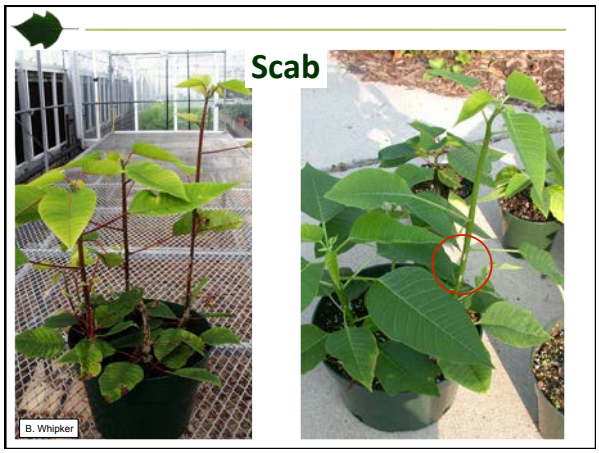

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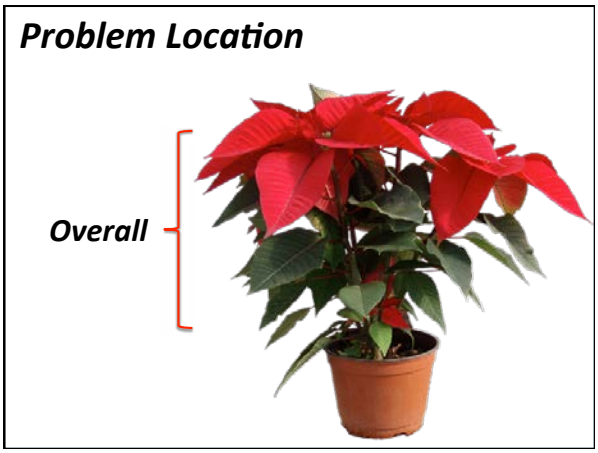

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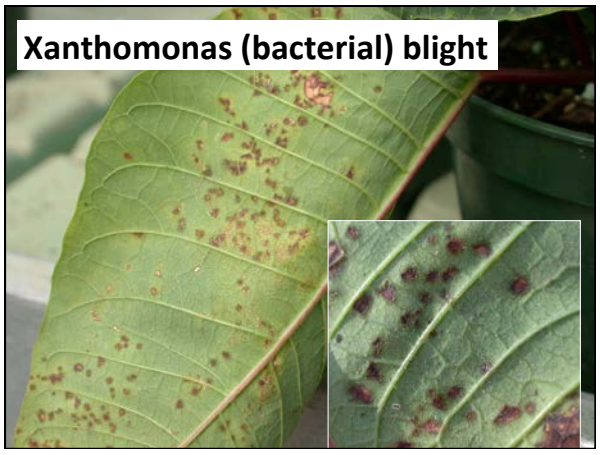

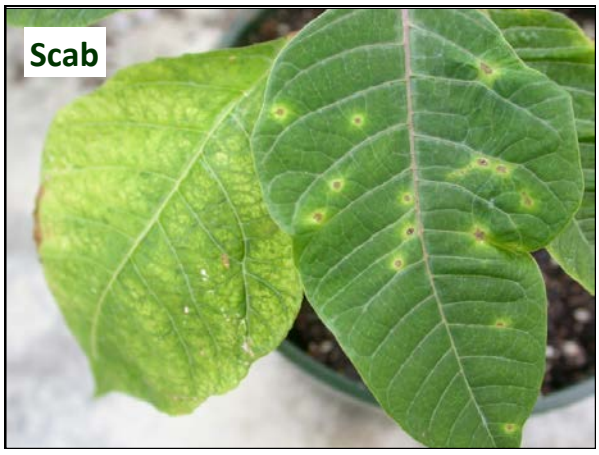

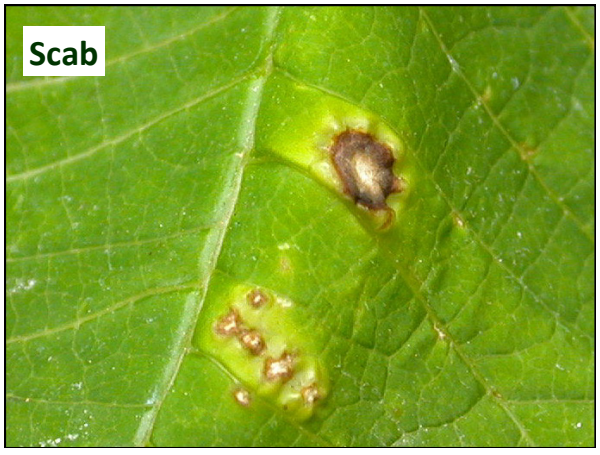

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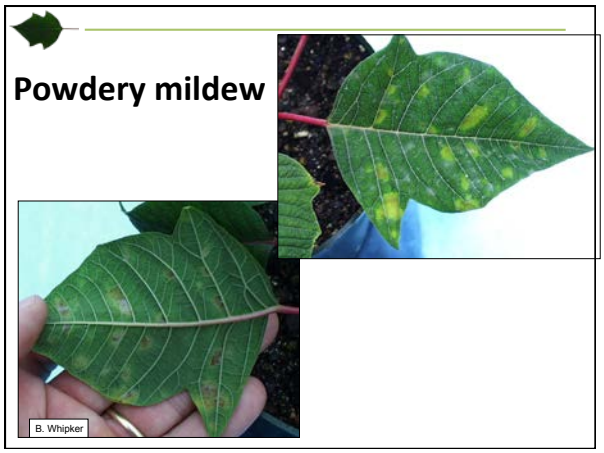

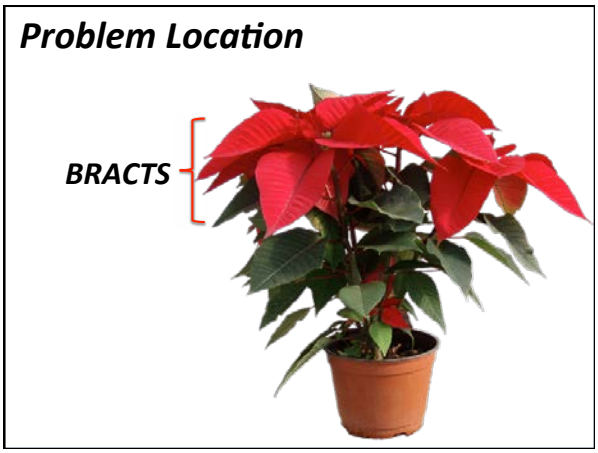

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Nutritional Management

- Major Nutritional Issues
  - Identification
    - pH (which includes Iron Deficiency)
    - Nitrogen Deficiency and Toxicity
    - Calcium Deficiency
    - Magnesium Deficiency
    - Molybdenum Deficiency
- Management Options

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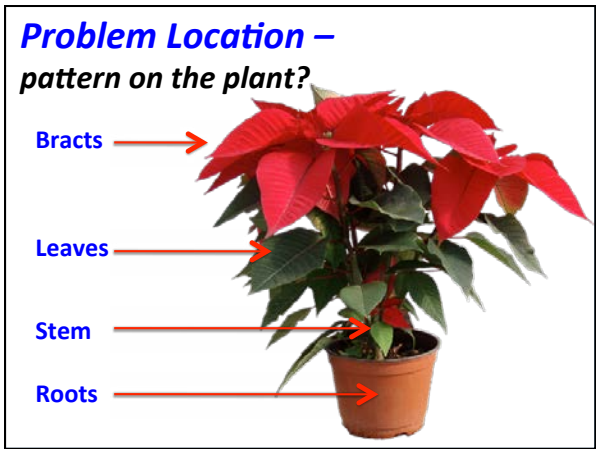

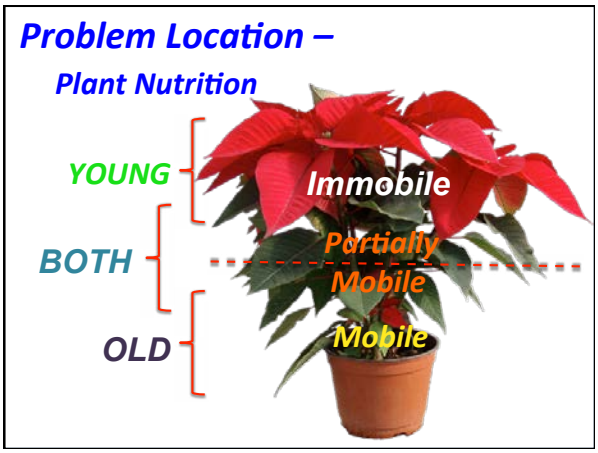

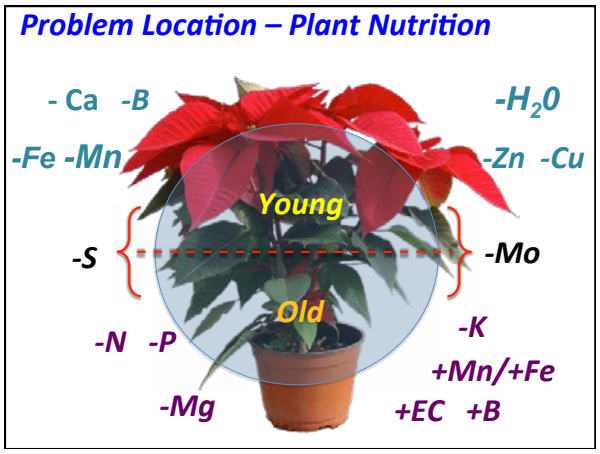

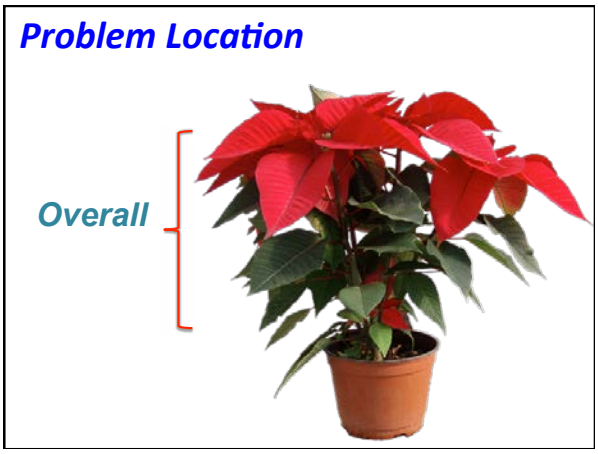

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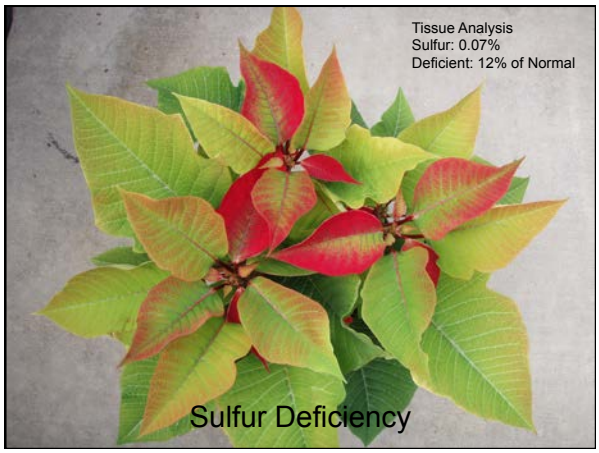
Sulfur Deficiency

Overall yellow coloration from the middle to top of plant



Sulfur Deficiency

- Deficiencies are rare.
- Problems seen when:
  - Relying upon Cal-Mag formulations
    - Uses $MgNO_3$ instead of $MgSO_4$
  - No S in water supply
- Target 25 to 50 ppm S
  - Irrigations water
  - Supply epsom salts ($MgSO_4$) at 1#/100 gal of water monthly)

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Problem Location

Calcium (Ca)

Upper leaves:

Botrytis

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Calcium Deficiency

- Continual fertilization with Ca-based feeds.
  - 20-10-20 or 20-20-20 are not a Ca source
  - Use Dark Weather Feed (15-0-15) or Cal-Mag formulas
- Coloration: Weekly foliar sprays with CaCl.
  - Use high quality CaCl (reagent grade)

Calcium Chloride Notes

- How to Spray CaCl
  - Mix 200 to 400 ppm Ca and add a spreader-sticker known not to burn poinsettia leaves or bracts.
  - Use a clean sprayer that has not been used for herbicides or other toxic substances.
  - Spray the plants with a fine mist, only until the leaf or bract surface glistens.
    - This procedure is similar to spray applications of growth retardant.
  - Weekly applications seem to be frequent enough to provide the needed calcium for rapidly expanding leaves or bracts.

http://www.ecke.com/poinsettias/productionguidelines/foliar/

Calcium Chloride Notes

- Additional Notes
  - Test on few plants before spraying the entire crop (injury evident in 4 days)
  - Ca not mobile. Weekly sprays needed.
    - To prevent bract edge burn, you must spray the colored bracts from the time you see first color, until the time you see first pollen on the flowers.
  - Spreader-stickers use 1 to 2 ounces per 100 gallons of water when using on bracts.
    - Use only enough spreader-sticker to prevent the spray solution from "beading-up" on the leaf surface.
    - Soft water will require less spreader-sticker than hard water.
    - To avoid possible leaf distortion, do not use water which has been treated with phosphoric acid.
  - Follow the same precautions used for spraying pesticides.
    - Spray plants when the growing medium is moist and plants are not showing stress.
    - Spray when greenhouse temperatures are less than 80°F/26°C to prevent burn.
    - It is usually safer to spray in early morning since late afternoon spraying may not allow the plants to dry before nightfall, and this would encourage Botrytis development.

http://www.ecke.com/poinsettias/productionguidelines/foliar/

Distortion Mimics

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Location of Interveinal Chlorosis

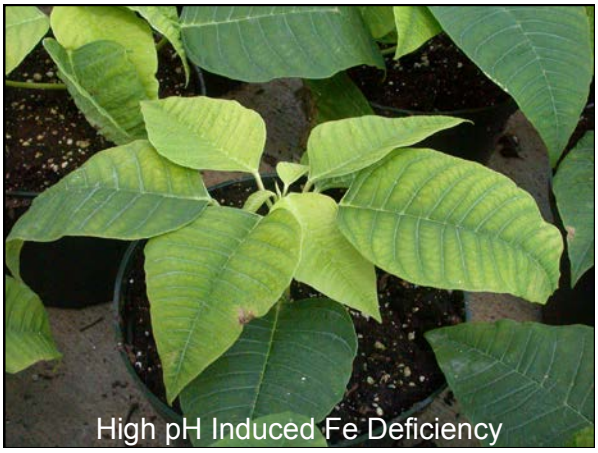
Location of Interveinal Chlorosis

Confirmation Step: Test pH (~>6.4)

Confirmation Step: Soil + tissue sample

High pH (Iron Deficiency)

Upper leaves: with interveinal chlorosis



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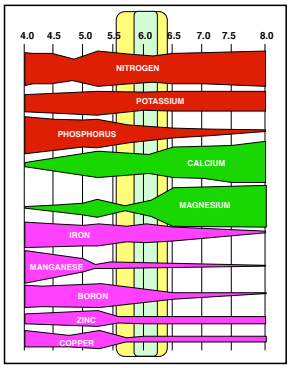
High pH or ???

- Root rot and overwatering can also induce iron problems.
  - Random pattern
  - Check the roots

Optimal substrate pH range for poinsettias:

5.8 to 6.2
(Wider 5.6 to 6.4)



pH Affect on Growth

Viking Red

RED FOX

pH 3.0 **pH 5.0** **pH 6.2**

High pH Correction

- Lowering pH to acceptable levels corrects the problem.
- Options
  - Iron drenches
  - Acidic fertilizers
  - Acid water drench

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High pH Correction

- Iron Drench (options)
  - Iron-EDDHA: mix 5 oz in 100 gal of water
  - Iron-DTPA: mix 5 oz in 100 gal of water
  - Iron sulfate: mix 4-8 oz in 100 gal of water
- Apply as a substrate drench with sufficient volume to leach the pot.
- Rinse foliage ASAP
- Use with caution on iron efficient plants (geraniums)

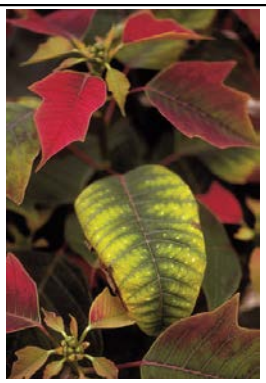
Additional guidelines in the Understanding pH Management bulletin by Argo & Fisher

High pH Correction

- Use an Acidic Fertilizer
  - 20-10-20, etc
  - Extremely acidic: 21-7-7
- Acid Water Drench
  - Use sulfuric acid to acidify your irrigation water to pH 4.0 to 4.5.
  - Apply as a substrate drench
  - Rinse foliage ASAP

Molybdenum (Mo)

Recently mature leaves: initial yellow margin, which over time turn necrotic



Molybdenum Deficiency

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Molybdenum Deficiency

Molybdenum Deficiency

Molybdenum Deficiency

- Deficiencies
  - Use a fertilizer containing Mo.
  - Corrective drench of sodium molybdate or ammonium molybdate at 77 ppm.
    - *(77 g sodium molybdate or 54 g ammonium molybdate per 100 gallons of water. Rinse foliage.)*

Problem Location

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Magnesium (Mg)

Lower leaves: interveinal yellowing, which over time turn necrotic.

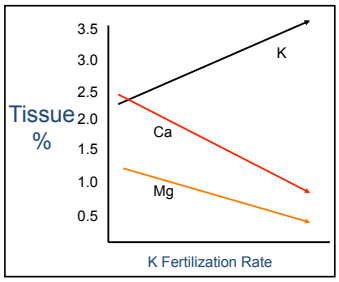
Poinsettia: late season problems occur below the bracts.

Magnesium (Mg)

Magnesium (Mg)

K : Ca : Mg Ratio

- Use a K : Ca : Mg ratio of 4:2:1 to limit any antagonisms.
- Example (ppm): 200 K:100 Ca:50 Mg



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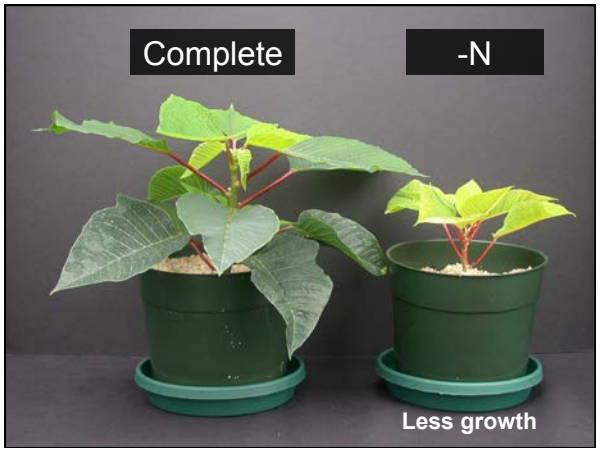
Magnesium Deficiency

- Problems seen when:
  - Over application of Ca (fert/water)
  - No Mg in water supply
- Target 25 to 50 ppm Mg
  - Irrigations water
  - Monthly: Supply epsom salts ($MgSO_4$) at 1#/ 100 gal of water
  - Corrective Rate: 2#/100 gal of water

Note: 20-10-20 / 20-20-20 / 15-0-15 are not a source for Mg

Nitrogen (N) / Low EC

Lower leaves: total leaf yellowing, which turns necrotic over time



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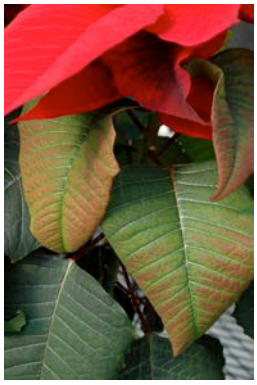
Nitrogen Management

- Nitrogen
  - 150 to 250 ppm N*, from a complete fertilizer
  - Nitrate being >75% of the N
- Electrical Conductivity (EC) during active growth
  - PourThru: 2.25 to 3.75 mS/cm
  - SME: 1.5 to 2.5 mS/cm
  - 1:2: 0.7 to 1.14 mS/cm

Phosphorus (P)

Lower leaves: purple coloration.
Overall plant color darker green

P Deficiency



Lower and upper leaves with purple coloration

Phosphorus (P)

Lower leaves: yellow with gray spotting

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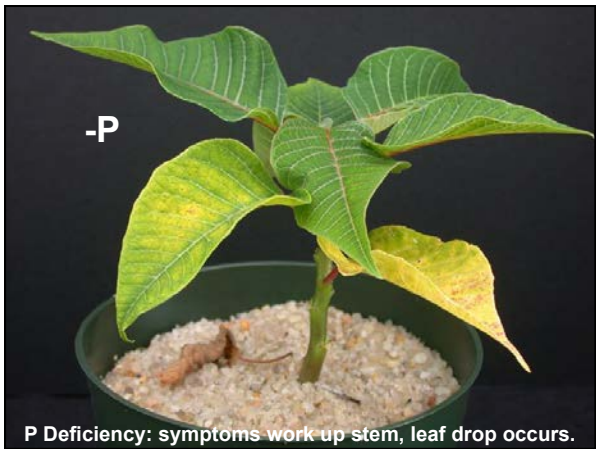

P Deficiency: symptoms work up stem, leaf drop occurs.

P Deficiency: Leaf spotting

Phosphorus Deficiency

- Phosphorus is an essential element.
  - Encourages stem elongation
  - Supply 10 to 20 ppm P.
- Deficiency symptoms come in 2 forms.
  - Purple (with an increase in anthocyanin production): usually accompanied with wet conditions, cold temperatures or root rot.
  - Gray spotting with warm temperatures

Electrical Conductivity (EC) - High

Upper leaves: crinkled

Lower leaves: marginal leaf burn

Less growth likely

Sub-irrigated plants: Less upper root growth

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High EC

- Marginal leaf burn from a single high dose

High EC

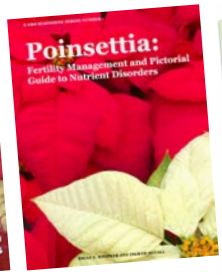
- Marginal bract burn from overhead applied fertilizer

High EC

Moderate marginal bract burn from a slow release fertilizer "dump"

Resources

www.nccfga.org



iBook for iPad

e-GRO Electronic Grower Resources Online

Poinsettia Podcasts

http://e-gro.org/podcast_category.php?CAT=Poinsettia

FLORICAST

Poinsettia Nutrition Diagnostics & Management

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Summary Fertility Management

- Covered the primary nutritional disorders.
- Nutritional Testing Steps:
  - Step 1: Conduct in-house pH and EC testing to monitor plant nutritional health
  - Step 2: Monthly, submit substrate samples for complete analysis
  - Step 3: If problem occurs, confirm with a lab test.

Summary Fertility Management

- pH
  - Target 5.8 to 6.4
- Electrical Conductivity (EC) during active growth
  - PourThru: 2.0 to 3.5 mS/cm
  - SME: 1.3 to 2.3 mS/cm
  - 1:2: 0.7 to 1.4 mS/cm
- Other Nutritional Factors
  - 150 to 250 ppm N, from a complete fertilizer
  - Nitrate being >75% of the N
  - Provide Calcium, Magnesium, and Molybdenum

Poinsettia Insect Diagnostics & Management

Ray Cloyd, Kansas State University

Poinsettia Insect Diagnostics & Management

Ray Cloyd, Kansas State University

Major Insect And Mite Pests Of Greenhouse-Grown Poinsettia

- Roots:
  - Fungus gnat
- Leaves (and stems):
  - Whitefly
  - Thrips (e.g., western flower thrips)
  - Broad mite
  - Lewis mite
  - Mealybug
- Bracts:
  - Thrips (e.g., western flower thrips)






Fungus Gnat


* Larvae feed on root systems causing plant stunting and wilting. Also, transmit certain soil-borne plant pathogens.
* Larvae may reside throughout the growing medium profile.
* Adults are primarily a "nuisance," but they can transmit diseases.

Fungus Gnat Life Cycle: Egg To Adult


Eggs

Adult


20 to 24 Days


Larva

Pupa

Where Do Fungus Gnats Come From?

- Bagged growing medium.
- Un-sealed garbage containers.
- Growing medium with plants.
- "Old" growing medium.
- Moist or gravel areas underneath benches (especially those in which weeds are growing).
- "Compost" areas outside of greenhouses.




Poinsettia Insect Diagnostics & Management

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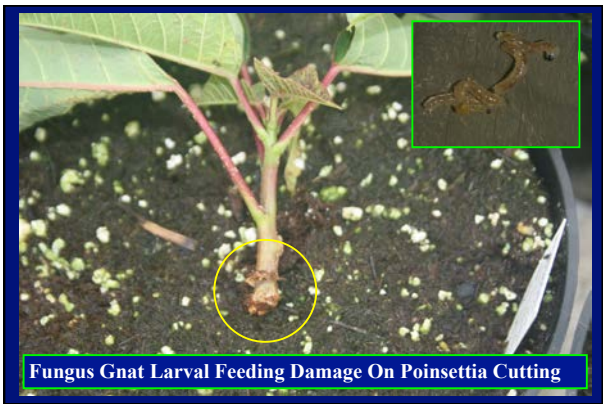
Fungus gnat larvae feed on the root hairs and small roots thus inhibiting the ability of poinsettia plants to obtain water and nutrients.



Poinsettia Insect Diagnostics & Management

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Management: Fungus Gnat

- Cultural:
  - Avoid keeping the growing medium excessively moist.
  - Remove weeds and "old growing medium" from around the area.
  - Use either pasteurized or bagged growing medium.
- Scouting:
  - Use yellow sticky cards for fungus gnat adults.
  - Use potato wedges for fungus gnat larvae.

Management: Fungus Gnat

- Pesticidal:
  - Insect growth regulators (fungus gnat larvae)
  - Contact insecticides
  - Neonicotinoids
  - Microbials (Bti)
- Biological:
  - Beneficial nematode (*Steinernema feltiae*)
  - Rove beetle (*Dalotia coriaria*)
  - Predatory mite (*Stratiolaelaps scimitus* or "*Hypoaspis miles*")

Insecticides: Fungus Gnat Larva

- *Bacillus thuringiensis* subsp. *israelensis* (Gnatrol)
- Chlorfenapyr (Pylon)
- Chlorpyrifos (DuraGuard)
- Cyromazine (Citation)
- Dinotefuran (Safari)
- Pyriproxyfen (Distance)

Active Ingredient=*Steinernema feltiae*

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Whitefly

* Feed primarily on the underside of leaves.

* Feed within the vascular system removing plant fluids (=phloem feeder).

* Damage symptoms: leaf distortion, plant stunting and wilting.

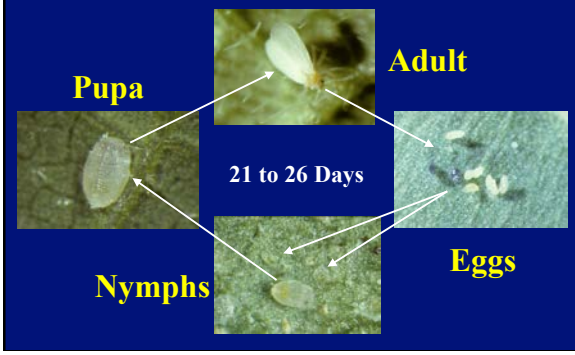
Whitefly Types

- Greenhouse whitefly, *Trialeurodes vaporariorum*

- Sweet potato whitefly B-biotype, *Bemisia tabaci*

- Bandedwinged whitefly, *Trialeurodes abutilonea*

Whitefly Life Cycle: Egg To Adult



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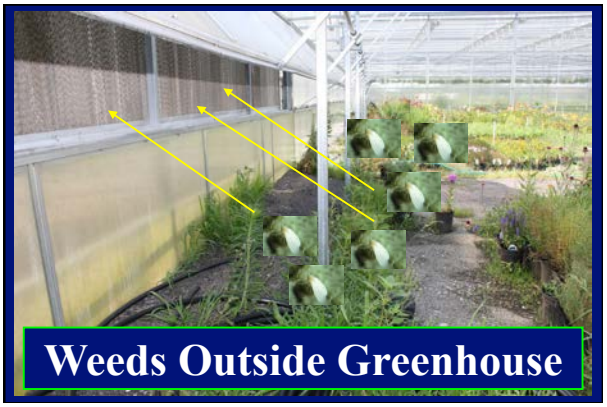
Management: Whitefly

- Cultural:
  - Remove weeds from within and around the greenhouse.
  - Avoid over-fertilizing plants.
  - Remove leaf debris from production areas.
- Scouting:
  - Use yellow sticky cards to monitor for whitefly adults.
  - Perform visual inspections to monitor for eggs, nymphs, and pupae.



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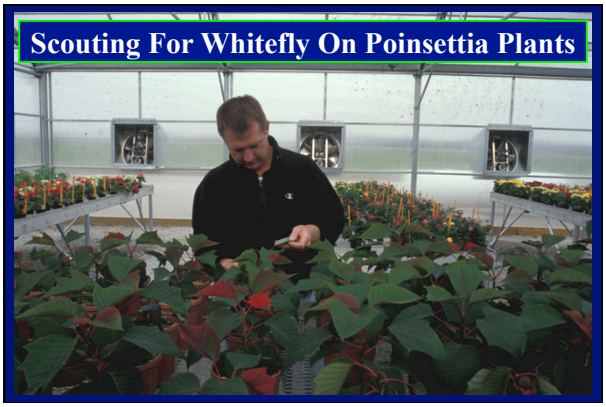
Scouting For Whitefly On Poinsettia Plants



Management: Whitefly

- Pesticidal:
  - Contact insecticides
  - Translaminar insecticides
  - Systemic Insecticides
  - Insect growth regulators
- Biological:
  - Parasitoids (*Eretmocerus eremicus* or *E. mundus*)
  - Predators
  - Beneficial fungi (*Beauveria bassiana* or *Isaria fumosoroseus*)

Insecticides: Whitefly

- Acetamiprid (TriStar)
- *Beauveria bassiana* (BotaniGard)
- Buprofezin (Talus)
- Dinotefuran (Safari)
- *Isaria fumosoroseus* (NoFly/Preferal)
- Novaluron (Pedestal)
- Petroleum oil (Ultra-Pure Oil/SuffOil-X)
- Pymetrozine (Endeavor)
- Pyriproxyfen (Distance)
- Spiromesifen (Judo)

Translaminar Activity

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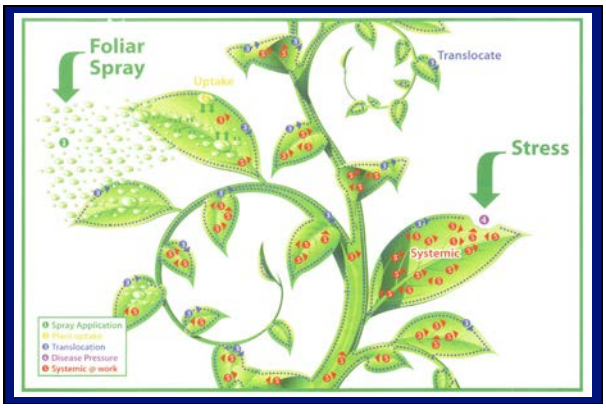


Western Flower Thrips, *Frankliniella occidentalis*

Damage Plants:

*** Direct feeding injury to leaves and bracts.**

Western Flower Thrips Life Cycle

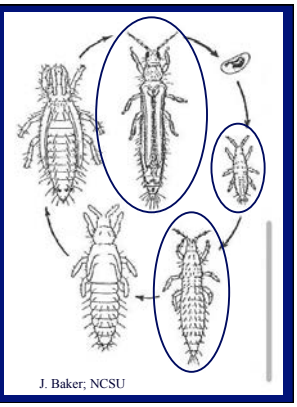
*** Egg**

*** Nymphs (n=2)**

*** Pupae (n=2)**

*** Adult**

Lifecycle may be completed in 18 to 24 days depending on temperature



J. Baker, NCSU

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Management: Western Flower Thrips

- Cultural:
  - Remove heavily-infested or damaged plants.
  - Screen greenhouse openings.
  - Remove all weeds from within the greenhouse.
  - Use yellow sticky tape.
- Scouting:
  - Use either yellow or blue-colored sticky cards to monitor adult populations.




Management: Western Flower Thrips

- Pesticidal:
  - Contact insecticides
  - Translaminar insecticides
  - Pesticide mixtures: *Beauveria bassiana* (BotaniGard) + azadirachtin (various products)
- Biological:
  - Predatory mite (*Neoseiulus cucumeris*)
  - Minute pirate bug (*Orius* spp.)
  - Predatory mite (*Stratiolaelaps scimitus* or "*Hypoaspis miles*")
  - Beneficial fungi (*Beaveria bassiana* or *Isaria fumosoroseus*)

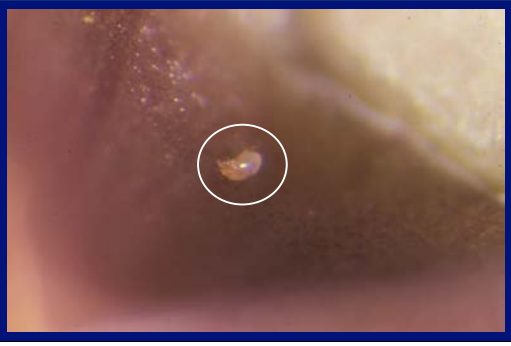



Insecticides: Western Flower Thrips



- Abamectin (Avid)
- Acephate (Orthene)
- *Beauveria bassiana* (BotaniGard)
- Chlorfenpyr (Pylon)
- *Isaria fumosoroseus* (NoFly/Preferal)
- Novaluron (Pedestal)
- Pyridalyl (Overture)
- Spinosad (Conserve)


Broad Mite, *Polyphagotarsonemus latus*



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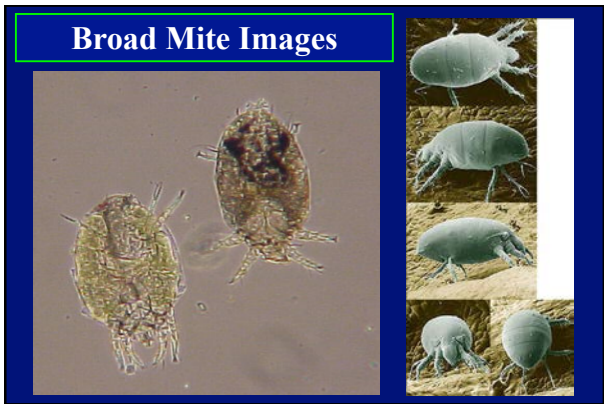

Management: Broad Mite

- Cultural:
  - –Immediately remove all plants that are suspected to be or are exhibiting damage caused by broad mites.
- Scouting:
  - –Perform visual inspections to monitor for any visible damage caused by broad mites.

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Miticides: Broad Mite

- Abamectin (Avid)
- Bifenazate + abamectin (Sirocco)

- Chlorfenapyr (Pylon)

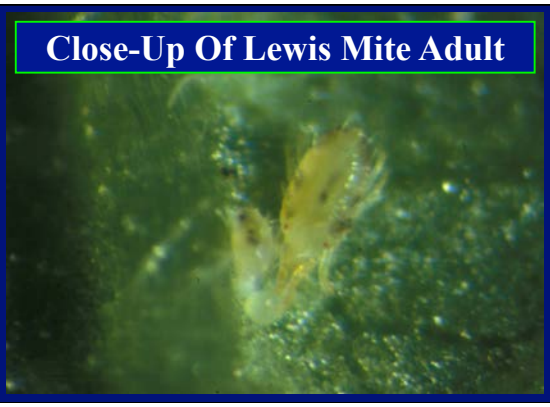
- Fenpyroximate (Akari)

- Pyridaben (Sanmite)

- Spiromesifen (Judo)
- Spirotetramat (Kontos)

Lewis Mite Feeding Damage On Poinsettia

Close-Up Of Lewis Mite Adult



Close-Up Of Adult Lewis Mite

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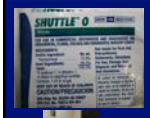
Management: Lewis Mite

- Cultural:
  - Remove all weeds from within the greenhouse.
  - Avoid over-fertilizing plants.
- Scouting:
  - Visually inspect plants for the presence of spider mites. Primarily focus efforts on leaf undersides.
  - Shake leaves over a white sheet of paper.

Management: Lewis Mite

- Pesticidal:
  - Contact miticides
  - Translaminar miticides
- Biological:
  - Predatory mites
  - Predatory midge (*Feltiella acarisuga*)

Miticides: Lewis Mite



- Acequinocyl (Shuttle)
- Bifenazate (Floramite)
- Chlorfenapyr (Pylon)
- Etoxazole (TetraSan)
- Fenpyroximate (Akari)

- Petroleum oil (Ultra-Pure Oil/SuffOil-X)

- Pyridaben (Sanmite)
- Spiromesifen (Judo)

Mealybug

* Feed within the vascular system removing plant fluids (=phloem feeder).

* Damage symptoms: leaf distortion, plant stunting and wilting.

* Produce copious amounts of honeydew.

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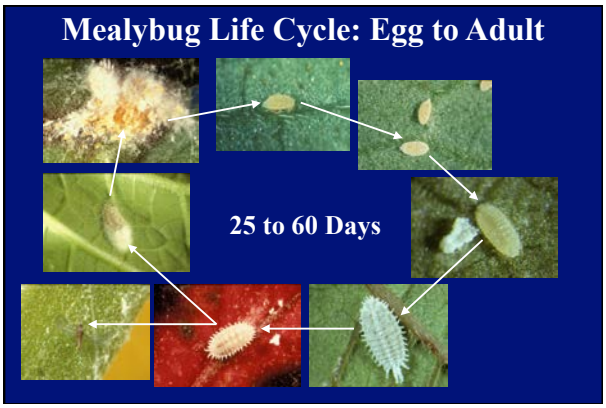

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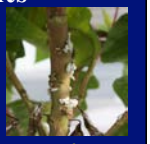
Management: Mealybug

- Cultural:
  - –Remove heavily-infested plants immediately.
  - –Avoid over-fertilizing plants.
- Scouting:
  - –Perform visual inspections to monitor all life stages including crawlers and egg-laying females.



Management: Mealybug

- Pesticidal:
  - –Contact insecticides
  - –Systemic insecticides
  - –Insect growth regulators
- Biological:
  - –Parasitoid (*Leptomastix dactylopii*)
  - –Predator (*Cryptolaemus montrouzieri* or "mealybug destroyer")

Insecticides: Mealybug

- Acetamiprid (TriStar)
- Buprofezin (Talus)
- Cyfluthrin (Decathlon)
- Dinotefuran (Safari)
- Imidacloprid (Marathon)
- Kinoprene (Enstar)
- Petroleum oil (Ultra-Pure Oil/SuffOil-X)
- Thiamethoxam (Flagship)

Shore Fly

* Shore fly is primarily a "nuisance" insect pest as the larva do not directly feed on plant roots.

* High populations of shore flies are indicative of excessive moisture conditions and/or abundant algae growth.

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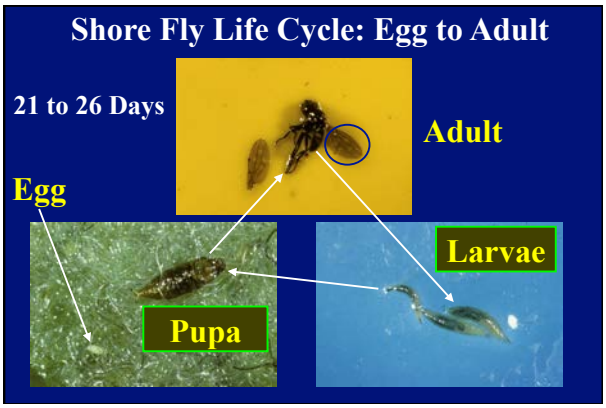

Management: Shore fly

- Cultural:
  - –Avoid overwatering plants.
  - –Eliminate algae growth throughout the greenhouse.
- Scouting:
  - –Yellow sticky cards positioned just above the crop canopy.

Insecticides: Shore Fly

- Azadirachtin (Azatin/ Ornazin/Molt-X)
- Chlorpyrifos (DuraGuard)
- Cyromazine (Citation)
- Pyriproxyfen (Distance)

The End!

Poinsettia Insect Diagnostics & Management

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