IPM For Greenhouse and Nursery Crops

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Utah Green Conference 2010

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Topics

Integrated Pest Management Techniques

Insect Pests

- Aphids
- Fungus gnats
- Whiteflies
- Thrips
- Spider mites
- Borers

Diseases

- Root rots
- Botrytis

On-line Resources

Why use IPM?

Resurgence

- pesticides may kill natural enemies, leading to increase in population

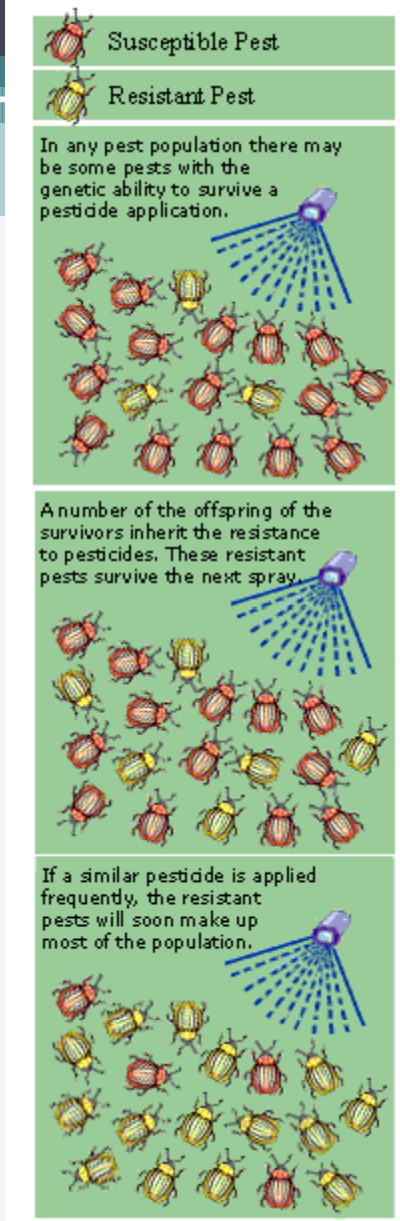
Secondary pest outbreak

- some pesticides promote pest activity:
  - carbaryl is known to increase spider mite reproduction
  - trees treated with imidacloprid (Marathon) have been shown to have greater mite problems
  - pyrethroids used early in the season also kill predatory mites, leading to mite outbreaks later on

Residues from contact pesticides

Resistance

- whiteflies
- thrips



- Availability
  - possible removal/label change of many pesticides, for example acephate, chlorpyrifos
- Costs
- Public Pressure

IPM Definition

"IPM is a sustainable approach to managing pests by combining biological, cultural, physical and chemical tools in a way that minimizes economic, health, and environmental risks.“

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Components of an IPM Program

- Knowledge of pest biology and behavior as well as knowledge of host plant

- Scout for insect or disease occurrence

Why Scout?

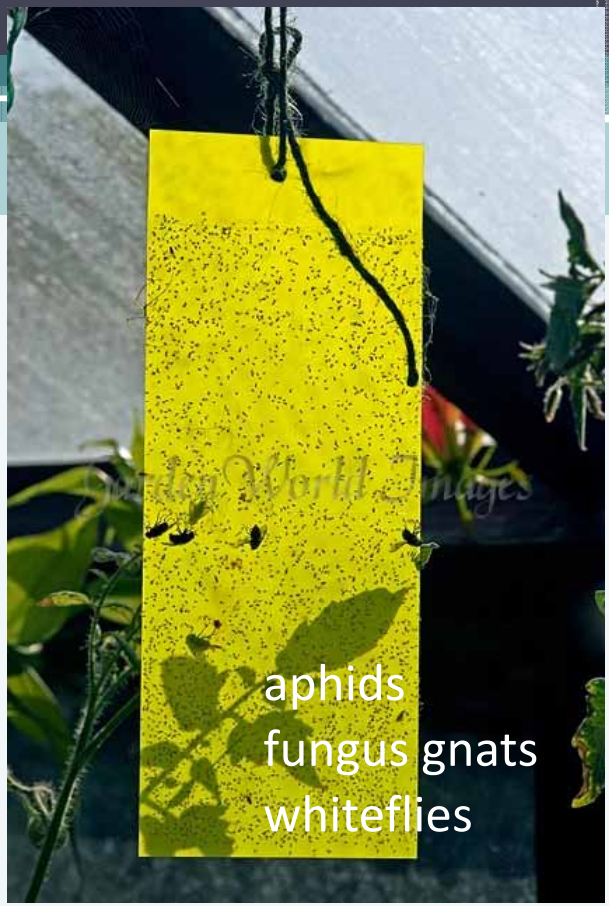
HELP MAKE PEST MANAGEMENT DECISIONS

- provides early warning of potential pest problems
- help time control measures properly
- provides immediate feedback about whether pest control activities are working
- historical data measures effectiveness of management

Scouting: Sticky Traps

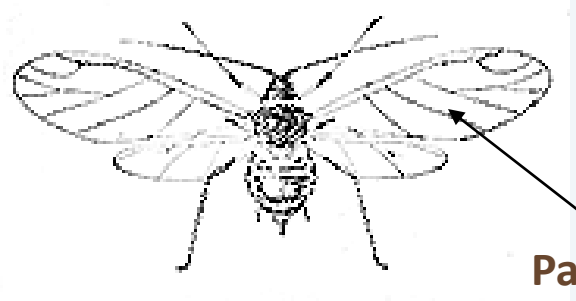
Placement

- At least 1 card per 1,000 sq ft
- Check and replace weekly & after a treatment
- 1-2 inches above plant canopy, near favored hosts
- Reduce number if releasing winged beneficial insects
- Eliminate blue traps if using bumble bees for pollination



Identifying Insects on Sticky Traps

Aphids

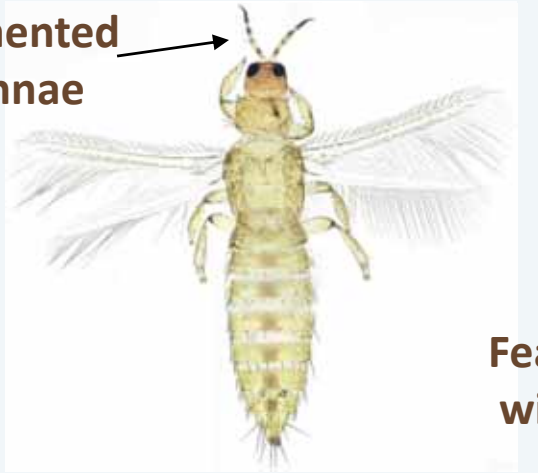


Parallel veins

Legs & antennae long and thin

Thrips

Segmented antennae



Feathery wings

Long slender body

Identifying Insects on Sticky Traps

Whiteflies

White wax dissolves in adhesive; orange underneath

Fungus gnats

Small, dark, mosquito-like flies with gray wings

Scouting: Trap Crops

Trap Crops/Indicator plants

- Susceptible varieties provide an early detection system
- Petunia varieties – thrips; not a reservoir for viruses
- Cucumbers – whiteflies; concentrate release of parasitic wasps on cucumbers

Indicator plant for thrips: 'Carpet Blue' Petunia

Scouting: When and Where

Walk a section of your greenhouse/nursery once per week (3 hours/acre)

Scout least-infested first, heavily infested areas last

Flag pest hotspots for extra treatment (biocontrol release, pesticide)

Keep records of results

Unsure?

Send samples to your county Extension office, or to the Utah Plant Pest Diagnostic Lab (UPPDL) in Logan:

utahpests.usu.edu/uppdl

Components of an IPM Program

- Knowledge of pest biology and behavior as well as knowledge of host plant
- Scout for insect or disease occurrence
- Knowing at what level control measures are needed (thresholds)

Pest Thresholds

Economic

- Pest density when economic losses are reached (point when value of crop loss exceed cost of treating)

Aesthetic

- Pest density that causes unacceptable visual injury

Thrips injury to leaves & flower petals

Components of an IPM Program

- Knowledge of pest biology and behavior as well as knowledge of host plant
- Monitoring for insect or disease occurrence
- Knowing at what level control measures are needed
- Using an integrated approach to pest management/prevention

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Integrated Control: Exclusion

Clean transplants

- Inspect incoming plants & materials

Keep doors closed

Screen openings

- Doors, ventilation openings

Barren/Clean floor surfaces

- Concrete, black plastic, weed barrier

Limit access

- People, “pet plants”, nonessential materials

Integrated Control: Cultural Options

- Maintain healthy, resistant plants
- Choose resistant species and cultivars when available
- Greenhouse environment
  - Temperature, light/dark cycles, humidity

Integrated Control: Sanitation

Weed management

- Weed-free inside and zone around outside perimeter

Post-harvest clean up

- Pressure-wash, disinfect
- Sterilize soil/growth media
- Increase temperature to >80ºF
- Remove and destroy all plant materials including weeds
- Eliminate standing water & algae (food, shelter)
- Place sticky traps to monitor pests before moving in new plants

Integrated Control: Biocontrol

- Periodic augmentation with predators and parasites
- Most successful when pest densities are LOW
- Must not use broad-spectrum pesticides (pyrethroids, organophosphates-Orthene)

Examples of Pest Predators

Aphids	*Hippodamia convergens* lady beetle	*Orius* sp. minute pirate bug	*Chrysoperla* sp. lacewing larvae	Predatory thrips
Soft Scales	*Rhyzobius lophanthae* lady beetle	*Chilocorus orbus* lady beetle		Predatory thrips
Whiteflies	*Encarsia formosa* parasitoid	*Eretmocerus californicus* parasitoid	*Chrysoperla* sp. lacewing larvae	Predatory thrips
Thrips	*Hypoaspis miles* predatory mite	*Orius* sp. minute pirate bug	*Chrysoperla* sp. lacewing larvae	Predatory thrips
Fungus gnats	*Hypoaspis miles* predatory mite	Parasitic nematodes		
Spider mites	*Phytoseiulus persimilis* predatory mite	*Orius* sp. minute pirate bug	*Chrysoperla* sp. lacewing larvae	Predatory thrips

Greenhouse/Nursery INSECTS

Aphids

- Most common: green peach aphid and melon aphid

- Cornicles


UC Statewide IPM Project
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Aphid Biology

- Many generations per summer
- Give birth to live young starting in spring
- Produce wings for dispersal when overcrowded
- Populations increase rapidly, low numbers can be tolerated

Aphid Damage

- Suck sap from phloem tubes in leaves and stems
- Curl leaves, produce sticky honeydew that promotes growth of black sooty mold, reduce plant vigor at high densities
- Transmit viruses
  - green peach aphid: 100 viruses
  - melon aphid: 44 viruses

Aphid Management

Biological Control – many commercially available

- lady beetles
- lacewings
- parasitic wasps
- syrphid flies

Aphid Management

- Monitoring and Thresholds
  - check under leaves (melon aphids)
  - new growing points (green peach aphid)

Aphid Management

Delayed Dormant Spray (nurseries):

- Dormant oil + Pyrethroid (at bud break)

Spring and Summer control:

- reduced risk:
  - hard spray of water
  - horticultural oil
  - insecticidal soap
  - Pyrellin (pyrethrin+rotenone)
  - azadirachtin (Azatin, Ornatin)
  - pyrometrozine (Endeavor)

- Conventional:
  - imidacloprid (Marathon)
  - Orthene
  - pyrethroids

Fungus Gnats

Bradysia and *Orfelia* species

Photo: Stephanie Boucher

Fungus Gnats

- Females survive for 1 week; lay up to 200 eggs on soil
- Larvae feed on fine root hairs
- Egg → adult in 15-30 days

Fungus Gnat Damage

- Larvae eat fine roots
- Plant wilting or poor vigor
- Adults spread viruses

Fungus Gnat Management

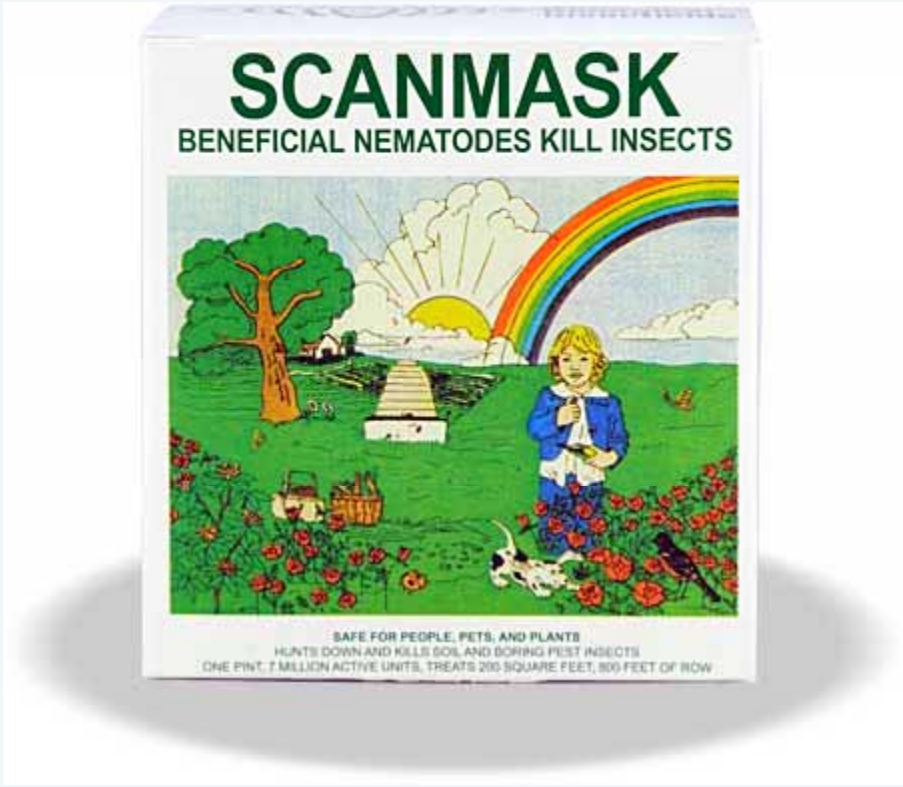
Monitor

- sticky cards
- potato slices

Fungus Gnat Management

Nematodes – *Steinernema feltiae*

Predatory mite – *Hypoaspis miles*



Fungus Gnat Management

- Avoid overwatering
- Eliminate algae within greenhouse
- Eliminate free-standing water

- Sprays
  - *Bacillus thuringiensis* subsp. *israelensis*
  - dozens of other products (pyrethroids, insect growth regulators, etc.)

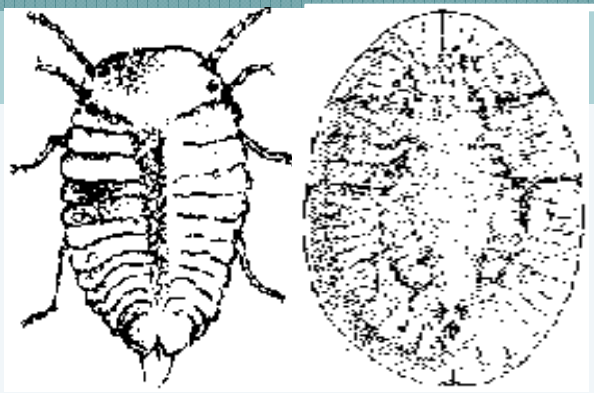
Soft Scales

- Soft scales feed in phloem, produce sticky honeydew
- Armored scales feed on mesophyll of plant cells, do not produce honeydew
- Multiple years of scale feeding can kill limbs; cause dieback

European fruit lecanium scale

San Jose scale & injury

Soft Scale Biology



- Typically found on woody plants
- Adult female lays eggs under body
- Hatch as nymphs, called crawlers
- Once settled, immobile
- Many generations per season

Soft Scale Management

Biological control

- The lady beetle *Rhyzobius lophanthae* attacks brown soft scale and black scale.

Soft Scale Management

- Prune away infested plant parts

- Use sprays when crawlers are active
  - Reduced risk:
    - oil
    - soap
    - insect growth regulator (Distance, Enstar, azadirachtin)

  - Conventional:
    - neonicotinoid (Marathon)
    - acephate

Armored Scales

Whiteflies

Silverleaf whitefly

- *Bemisia argentifolii*
- Poinsettias, ornamentals

Silverleaf whitefly holds wings close to body, roof-like

Greenhouse whitefly

- *Trialeurodes vaporariorum*
- Vegetables, ornamentals

Greenhouse whitefly holds wings flat, horizontally

Whitefly Biology

20-30 day life cycle

- 1st instar nymph – crawler
- 2nd & 3rd instar nymphs – feeding stages; immobile
- 4th instar – doesn't feed
- pupa
- adult

Whitefly Damage

- Piercing-sucking mouthparts
- Stippling on leaves
- Secrete honeydew; sooty mold
- Stunt plants, may cause physiological disorders
- Leaves turn yellow, dry, drop from plant
- Transmit viruses (25+)

Whitefly Scouting

- Monitor to detect presence – yellow sticky cards
- Trap threshold = ½ per card per day when crop is young, 2 per card per day when crop approaches maturity
- Inspect plants – hand lens
- Leaf threshold = 10 nymphs per leaf

Whitefly Management

Biological control

- Parasitic wasps
  - *Encarsia formosa* for greenhouse whitefly
  - *Eretmocerus eremicus* for silverleaf whitefly

- Predators – *Delphastus* ladybeetle, lacewing

Whitefly Management: *Encarsia* Biocontrol

- Commercially available; parasitizes whitefly early nymphal stages
- 10 nymphs per leaf will sustain wasp
- 2 schemes for use:
  - Release once/week at rate of 2-5 per plant for 8-10 weeks during growing season
  - Place cucumber plants at ends of rows to attract whiteflies; target cucumbers for wasp release
- Cannot use broad spectrum insecticides

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Whitefly Insecticides

Suffocants, cuticle disruptants:

- insecticidal soap
- horticultural mineral oil

IGR-insect growth regulator

- kinoprene (Enstar)
- fenoxycarb (Precision)
- pyriproxyfen (Distance)
- neem oil (Azatin)
- diflubenzuron (Adept)
- novaluron (Pedastal)

Neonicotinoids:

- imidacloprid (Marathon)
- acetamiprid (Tristar)
- thiamethoxam (Flagship)

Pyrethroid:

- bifenthrin (Talstar)
- cyfluthrin (Decathlon,Tempo)
- fenpropathrin (Tame)
- lambda-cyhalothrin (Scimitar)

Organochlorine:

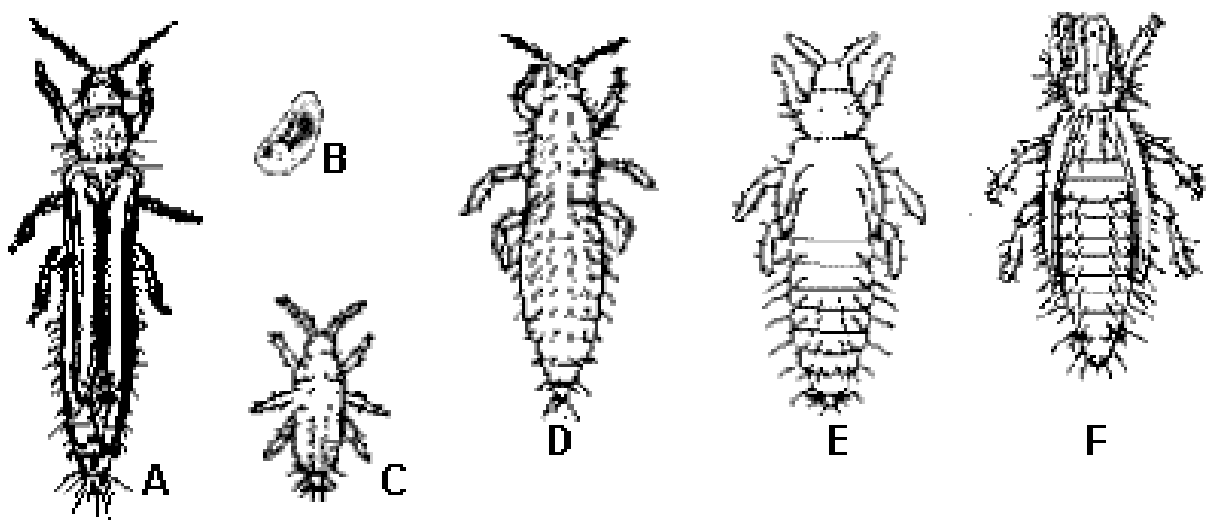
- endosulfan (Thiodan)
- pyridaben (Sanmite)

Miscellaneous:

- flonicamid (F1785 GH)
- pymetrozine (Endeavor)

Thrips

Most common: western flower thrips (*Frankliniella occidentalis*)



Females insert 150-300 eggs into leaves & buds

Western Flower Thrips Damage

Pierce cells and remove contents

- tissue appears rasped, streaked, silvery

Vector of major viruses

- Impatiens necrotic ring spot
- Tomato spotted wilt

Thrips Scouting

- Early detection is critical
- Blue sticky traps
  - 1 trap per 1,000 sq ft
  - Place just above canopy
- Inspect blossoms, buds, leaves
- Tap leaves & blossoms over dark sheet of paper
- Threshold:
  - 5-20 per trap in chrysanthemums
- Indicator plants – place every 20-30 ft
  - ‘Carpet Blue’ and ‘Blue Madness” Petunias

Thrips Management

- Difficult, insecticide resistance
- Biocontrol alone often is not enough
- Sanitation is key
  - Clean stock, no debris
  - Exclusion, screen vents
  - 20-ft vegetation-free zone around house

Thrips Management - Biocontrol

Predatory mite, *Neoseiulus cucumeris*

Predatory soil mite, *Hypoaspis miles*

***Hypoaspis miles* feed on thrips pupae in the soil**

Minute pirate bug, *Orius insidiosus*

Minute pirate bug adult

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Thrips Management

- Treat at 3-5 day intervals with very good coverage

- Rotate chemicals to prevent thrips resistance
  - Soap, Oil
  - Mesurol
  - Spinosad (Conserve)*
  - Avid
  - Pedestal (IGR)

Twospotted Spider Mite

Cultural Management of Mites

- Clean up with insecticidal soap, horticultural oil or miticide
- Prevent diapause of mite in the fall
  - Interrupt night with 2 hr light
  - Keeps mites active
- Remove crop & starve mites

Mite Biological Control

Predatory mite – *Phytoseiulus* spp.

Mite Biological Control

- *Phytoseiulus s*old in tubes of 1,000-2,000 in vermiculite or corn cob grits
- Light infestation: 10 predator mites per spider mite-infested leaf
- Heavy infestation: 10-100 mites per leaf
- No toxic pesticides

Mite Biological Control

Spider Mite Management

Soft Controls:

- pressurized stream of water
- horticultural oil
- insecticidal soap

Miticides:

- Acequinocyl (Shuttle)
- Bifenazate (Floramite)
- Pyridazinone (Nexter, Sanmite)
- Chlorfenapyr (Pylon)
- Etoxazole (Tetrasan)
- Hexythiazox (Ovation, Hexagon)

Tree and Shrub Insect Borers

Attack trunks & limbs:

- Flatheaded beetles
- Roundheaded beetles

Flatheaded Borers (Buprestidae)

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Flatheaded Borers (Buprestidae)

Adult flight periods for northern Utah

- Pacific flatheaded borer: early May – early July
- Flatheaded appletree borer: late May - July
- Bronze birch borer: late May – June
- Aspen borer: May-July
- Poplar-and-Willow borer: July – Sept.
- Locust borer: August – Sept.
- Shothole borer: June and late Sept.

Greenhouse/Nursery DISEASES

Root-rots

- *Fusarium* species
- *Pythium* species
- *Thielaviopsis basicola* (black root rot)

- crop loss can be high
- difficult to control
  - proper diagnosis before implementing fungicide controls


Pythium root rot

Black root rot

Root Rot Management

Sanitation

Optimal watering

Minimize stress

Chemical control

Pythium, Fusarium (often preventive)

- Quell
- Previcure Flex (vegetable)
- Mycostop (*Streptomyces* sp.; beneficial bacterium)

Black root rot (preventive, curative)

- Cleary's 3336
- Terragard

Botrytis (Gray Mold)

Botrytis (Gray Mold)

- leaf spots
- damping off
- bud rot
- blight

- Thrives in high humidity, tightly packed plants
- Survives on living or dead plant tissue
- Spreads quickly in air currents

Botrytis Management

Sanitation

- destroy infected plant material

Manipulate greenhouse environment

- keep RH below 85%
- maintain good air circulation and plant spacing

Fungicides

- Kocide 101, (copper)
- Cleary's 3336
- Domain (thiophanate-methyl)
- Phyton-27
- Chipco (iprodione)
- Exotherm Termil
- Daconil 2787 (chlorothalonil

Resistance Management

Learn about classification of pesticides at:

Insecticide Resistance Action Committee:

irac-online.org

Fungicide Resistance Action Committee:

frac.info

Rotate chemical classes/modes of action

within generations

between generations within a season

utahpests.usu.edu

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WEBSITES

utah pests homepage
integrated pest management
plant diseases
insects and their relatives
utah plant pest diagnostic lab

UTAH PESTS

Utah's diverse landscape supports thousands of insects and plant pathogens. **UTAH PESTS** is your portal for learning more about pests and their beneficial counterparts around the state, and how Utah Extension personnel are working to provide a greater understanding of these organisms in our world.

Click on one of the web site links below to get started!

integrated pest management

Choose this site for the plant pest advisories, the IPM Mini-Grant program, weather data, and much more.

plant diseases

Choose this site for a multitude of fact sheets on diseases and disorders of field crops, fruits, ornamentals, turf, and vegetables.

insects and their relatives

This site will help to shed some light on the insect world, with fact sheets, images, slide shows, and more.

utah plant pest diagnostic lab

The UPPDL, the only lab of its kind in Utah, is here to identify and provide management recommendations for your pest problems.

IPM Advisories:

Landscape
Tree Fruit
Small Fruit/Vegetable
Turf

To sign up:
utahpests.usu.edu/ipm

UtahState UNIVERSITY extension

Landscape IPM Advisory

UTAH PESTS

Weekly Pest Update for Woody Ornamentals, Utah State University Extension, **September 4, 2008**

What's In Bloom

(Salt Lake City area)

Butterfly bush: bloom
Clethra: end bloom
Oakleaf hydrangea: end bloom
Rose-of-Sharon: end bloom
Shrub roses: end bloom
Sourwood: end bloom
Sweet Autumn clematis: end bloom
Trumpet vine: end bloom
Vitex: end bloom

Insect/Disease Information

DECIDUOUS TREES

Cankers on Red-Twig Dogwood

Cankers on stems of red-twig dogwood were observed in Salt Lake County, causing a slow dieback of a large clump. The cankers, possibly caused by the fungus *Botryosphaeria*, appear as longitudinal, brown to black sunken areas along the stems. When the bark is scraped away, the margins of the canker are evident.

The only way to manage cankers is to prune out the infected tissue about 6 inches below the lower margin. Thinning the plant and fall rejuvenation pruning will improve air circulation and encourage new growth for next spring.

Pear Slug

Pear slugs (also known as cherry slug) are the larvae of a sawfly that appear slimy and almost translucent. They feed on the upper surface of foliage of cherry, mountain-ash, apricot, hawthorn, cotoneaster, plum, and pear. The second generation of larvae are active now, and if they are in high numbers, can cause defoliation. But because this second generation damage is so late in the season, control is not always necessary. If necessary, Bt and spinosad are very effective.

Slime Flux

Slime flux is readily apparent on trees now, such as willow, elm, ash, cottonwood and locust. This condition occurs when a large population of naturally-occurring bacteria builds within a tree, causing gases to form. The resulting pressure creates a

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