INTERIOR PLANTSCAPING
with IPM
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Interior Plantscaping

- **Conservatories**
  - Butterfly Pavilion, DBG, Ocean Journey, Denver Zoo
- **Large Atrium Plantings**
- **Smaller Groupings**
  - Malls
- **Individual Containers**
  - Hanging Baskets, “Fern” Bars, Restaurants, The Dragon Lady’s dish garden from secretaries day.
- **Any public environment where we grow plants**
Integrated Pest Management

• **Definition**
  - A holistic program which uses environmental, cultural, physical, and BIOLOGICAL chemical controls to reduce the injury caused by plant pests and diseases.

• **Components**
  - Prevention
  - Monitoring
  - Diagnosis
  - Damage/Action Threshold
  - Effective Control Plan
  - Ongoing Client Education
WHY GOOD BUGS?

- They work!!!
  - When you aren’t
  - In places you can’t get to
  - If you don’t kill them off

- Not many chemicals labeled for interiorscape use
PREVENTION - Step 1

- **Environmental Control**
  - Reduce ABIOTIC stresses
    - Wrong plant in the wrong location
    - Humidity, Drafts, Temperature extremes

- **Cultural Control**
  - Your single greatest tool is basic good plant health
    - Unhealthy plants tend to attract and reward insects and disease
    - Proper watering, fertilizing, soil pH & EC, pruning for light penetration and air circulation

- **Our focus is reduction of BIOTIC stress**
PREVENTION – Step 2

• **Off-Site**
  - Quarantine and Inspect newly arrived plants at least 1 week prior to installation
  - Clean all equipment and supplies before use
  - Don’t re-use dirty planters, moss or bark

• **Between-Sites**
  - Clean equipment *between* accounts
    - YOU are the most likely transmission vector
  - Schedule maintenance routes from “least infested” to “most infested” accounts or design a “problem route” with most experienced people maintaining it

• **On-Site**
  - Maintain in order of least to most infested
WHEN PREVENTION FAILS

- Pest population exceeds threshold

AN IDEAL WORLD

- Control plan
  - Cultural - Biological - Chemical
CHEMICALS & IPM

• **Maximize specificity**
  – Broad spectrum vs. IGR’s
    • Chlorpyriphos - Imidacloprid - Kinoprene - Pymetrozine

• **Minimize environmental persistence**
  – Organophosphates vs. Pyrethroids

• **Resistance Management**
  – Rotate between different modes of action
  – Use synergists (Pyrethrin + PBO)

• **Think about interactions with other biocontrols**
  – Conserve and parasitoid wasps (*Aphidius*)
  – Merit 75WP and host plant feeding (*Orius sp*)
  – Enstar II and adult *Cryptolaemus*
**PREDATORS**

- Generalist predators are voracious, sometimes cannibalistic and often eat other biocontrols! (e.g. lacewing larvae)
- Specific predators tend to eat one type of pest
- Most need large populations of prey and/or supplemental food sources for establishment
- They tend to fly away (Ladybugs)
- That said, in some cases they are the only option available
PARASITOIDS

• Protected during larval and pupal stage

• Many “good” chemicals will wipe out adult and feeding larval populations along with pests

• BUT

• Pupating larvae are quiescent and encased in shell of prey, emerge to overwhelm missed pests

Diagram: Koppert
MAJOR INSECT PESTS

- Aphids
- Mites
- Whiteflies
- Scales
- Mealybugs
- Thrips
- Fungus Gnats
- Soil Diseases
APHIDS - Scouting

• **Indicators**
  – Cast-off skins
  – Distorted Foliage tips
  – Honeydew & Black sooty mold
Aphid Adults
Cast Skins
Distorted Foliage
Black Sooty Mold
APHIDS - Control

• **Biocontrols**
  - *Aphidius colemani/ervi* (parasitoid wasps)
    - 20% mummies = control in 1 month
  - *Aphidoletes aphidimyza* (predatory midge)

• **Chemicals**
  - Alarm Pheromone (E-β-Farnesene)
  - Soaps (M-Pede, K+Neem) / Oils (Ultra-Fine)
  - BotaniGard 22WP+IGR’s (Enstar II, Azatin)
  - Endeavor
  - Pyronyl 303, Astro, Talstar, Decathlon, Mavrik
  - Marathon II, Merit
MITES - Scouting

• **Indicators**
  - Stippled foliage along veins
  - Webbing in leaf axils and on leaf backs
Feltiella acarisuga
MITES - Control

- **Biocontrols**
  - *Phytoseiulus persimilis* (predatory mite)
  - *Amblyseius californicus* (predatory mite)
  - *Feltiella acarisuga* ("Smidge" midge)

- **Chemicals**
  - Water!!!
  - Soaps/Oils (M-Pede, K+Neem, Ultra-Fine)
  - Ovicides (*Hexygon*, *TetraSan* - translaminar)
  - Adulticides (*Floramite*, *Akari* – kills *phytoseiulus*)
  - Look for spirodiclofen & acequinocyl soon (?)
WHITEFLY - Scouting

• Indicators
  – Small clear eggs, translucent larvae on leaf undersides
  – Clouds of White Flies when disturbed (too late for biocontrols, spray first)
  – Honeydew on leaves under high populations
  – Yellow sticky cards (also catch biocontrols)
WHITEFLY - Control

• Biocontrols
  – Encarsia formosa (parasitic wasp) 80% mummies = control GHWF
  – Eretmocerus spp. (parasitic wasp) use in warmer places - SPWF
  – Macrolophus caligonisus (pred. bug, flower damage / pollen feeding)
  – Delphastus pusillus (ladybird type predator)

• Chemicals
  – Soaps & Oils
  – Azatin XL, Enstar II, Adept*, Distance*
  – Endeavor - translaminar
  – Marathon II, Merit
  – Tempo=Decathlon, Mavrik, Talstar, etc.
  – * some phytotoxicity
SCALES - Scouting

• **Indicators (hard scales)**
  – Look for larvae and adults along leaf veins and on soft growth
  – Hard waxy covering on adults
  – Honeydew and black sooty mold on leaves below areas with high populations
Photos: UCDavis, Biobest,
SCALES - Control

• **Biocontrols**
  – *Aphytis melinus* (parasitoid) red scale
  – *Metaphycus helvolus* (parasitoid) black scale
  – *Lindorus lophanthae* (ladybird beetle)
  – Localized pruning

• **Chemicals**
  – Water, Soaps, Oils for crawlers
  – Enstar, Distance*
  – Marathon II for covered lifestages
MEALYBUGS - Scouting

• **Indicators**
  – Different kinds – Citrus (pink line down back), Longtailed, Pink Hibiscus, Root
  – White cottony egg masses
  – Honeydew
Cryptolaemus montrouzieri

Leptomastix dactylopii

Photos: Biobest, UCDavis
MEALYBUGS - Control

- **Biocontrols**
  - *Anagyrus fusciventris* (longtail parasitoid) source?
  - *Tetracnemous sydneyensis* (LT parasitoid) source?
  - *Leptomastix dactylopii* (citrus para. 3\(^{rd}\) & 4\(^{th}\) instars)
  - *Leptomastidea abnormis* (citrus para. 1\(^{st}\) & 2nd) source?
  - *Cryptolaemus montrouzieri* (ladybird type) no eggs w/ LT’s

- **Chemicals**
  - M-pede or Ultra-Fine
  - Azatin XL, Enstar II (kills *Cryp.* adults)
  - Marathon II - local systemic (remember Oxamyl?)
  - Others need strong surfactants to penetrate wax
  - Tempo/Decathlon, Astro, Talstar
THRIPPS - Scouting

• **Indicators**
  – Leaf scarring from rasping mouthparts
  – Distorted foliage from very early feeding on meristems
  – Small (1-2mm) rapidly moving larvae esp. in flowers, meristems and along veins
  – Blue sticky cards, yellow catches everything
Again, thank you Biobest!
THRIPS - Controls

- **Biocontrols**
  - *Thripobius semiluteus* (parasitoid-doesn’t fly!) – source?
  - *Amblyseius spp* (predatory mite)
  - *Orius spp* (generalist predator – diapause!!)
  - *Scolothrips sexmaculatus* (six-spotted predatory thrips)

- **Chemicals**
  - Soaps/Oils
  - BotaniGard 22WP + Azatin XL – Multiple apps, coverage
  - Conserve – miticide & parasitoid-icide?
  - Pyrethroids
  - Marathon II – suppression

**NOTE:** Tank mix contact insecticides with 1# molasses and 1# Yeast Hydrolysate in 100 gals of spray solution
FUNGUS GNATS - Scouting

• **Indicators**
  – Small flies on soil surface
  – Run short distances while vibrating wings
  – On a yellow sticky card
    • Pointed abdomen
    • Small heads
    • Long legs
  – Larvae - small clear worms w/ black heads
Hypoaspis

Steinernema
FUNGUS GNAT-Controls

• **Biocontrols**
  - *Hypoaspis miles* (predatory mite)
  - *Steinernema sp* (parasitic nematodes) 1-3”
  - *Bacillus thruringiensis ss isrealensis* (Gnatrol)

• **Chemicals**
  - Soil Surface sprays of IGR’s
    - Enstar, Citation, Azatin, Adept*, Distance*
  - Merit (Marathon II not soil applied)
SOIL DISEASES - Scouting

- **Indicators**
  - Curling of green leaves
  - Brown lesions on roots
  - Cortical Sloughing

- **If any of these, biocontrols probably too late. Drench with fungicides, then apply biocontrols**
SOIL DISEASES - Control

• **Preventative treatments - Biocontrols**
  
  – Off-Site (Greenhouse only labeled use)
    
    • Drench with
      
      – *Trichoderma harzianum* (Plantshield)
      – *Bacillus subtilis* (Companion)

  – On-site
    
    • Drench with *Bacillus subtilis* (Rhapsody, Taegro)
SOIL DISEASES - Control

- **Chemical “rescue” treatments**
  - ZeroTol (*Pythium, Phytophthora*)
  - Mefanoxam 2E (*Pythium, Phytophthora* - some resistance!)
  - Chipci 26019 (*Rhizoctonia*, not on Pothos, Impatiens or Spaths)
  - 3336 WP (*Fusarium, Rhizoc, Thevaliopsis*)
  - Terraclor (*Rhizoctonia*)
  - Terraguard (*Rhizoc, Thevaliopsis, Fusarium*)
  - Compass (*Rhizoc*)
Beneficial Suppliers

- www.cdpr.ca.gov/docs/ipminov/ben_supp/top
- Sign up for timed deliveries of common bugs – nematodes, predatory mites – every 2 weeks or so. Bugs need to be grown and production can’t be “ramped” up quickly so standing orders work best
- International Technology Services - Biobest - Boulder
- Hydro-Gardens – Colorado Springs
- M&R Durango – Bayfield
- Koppert
- Many other single source suppliers, lots of cooperation
SIDE EFFECTS DATA

• **Koppert Biological Systems**
  – [http://www.koppert.nl/e0110.html](http://www.koppert.nl/e0110.html)

• **BioBest Biological Systems**

• **Lots of other INDEPENDENT sites**
Useful Pesticide Websites

- **CSU’s Environmental Pesticide Education Program**
  - www.colostate.edu/Depts/SoilCrop/extension/CEPEP/

- **Colorado Department of Ag – Pesticide Registration Query Page**
  - www.ag.state.co.us/DPI/Pesticides/PPRS/PPRSQuery.htm

- **Chemical Company Websites for labels, MSDS’s and technical info – TRADESHOW!**
Handheld & Backpack Sprayers

www.rlflomaster.com
Air Assisted Sprayers
Electric Atomist Sprayer
www.rlflomaster.com
Electrostatic Sprayer
www.maxcharge.com
LEGAL / LICENSING

- Commercial Pesticide/Limited Commercial License
  - Qualified Supervisor
  - Certified applicator - Category 307
    - Or Tech in training
- Posting – structural pest control, little signs
- No Ag Use/WPS Requirement – no REI?
- Keep good records!
Posting and REI’s

• NOT found in the “Agricultural Use Requirements” box on the label!

NON-AGRICULTURAL USE REQUIREMENTS

The requirements in this box apply to uses of this product that are NOT within the scope of the Worker Protection Standard for agricultural pesticides (40 CFR Part 170). The WPS applies when this product is used to produce agricultural plants on farms, forests, or greenhouses. For other uses, including interiorscapes and other nonagricultural uses, do not enter treated areas without protective clothing until sprays have dried.
• **Colorado Department of Agriculture**
  – **Division of Plant Industry**
    • Pesticide Applicator Program

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• If you didn’t catch that I was a weasel, here it is again.
CONTACT ME

- Comments
- Suggestions
- New Chemicals
- New Biocontrols
- Problems with ID
- Digital Photos of accounts or bugs or Dragon Ladies!

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