# Landscape Pest Management Without Neonicotinoids

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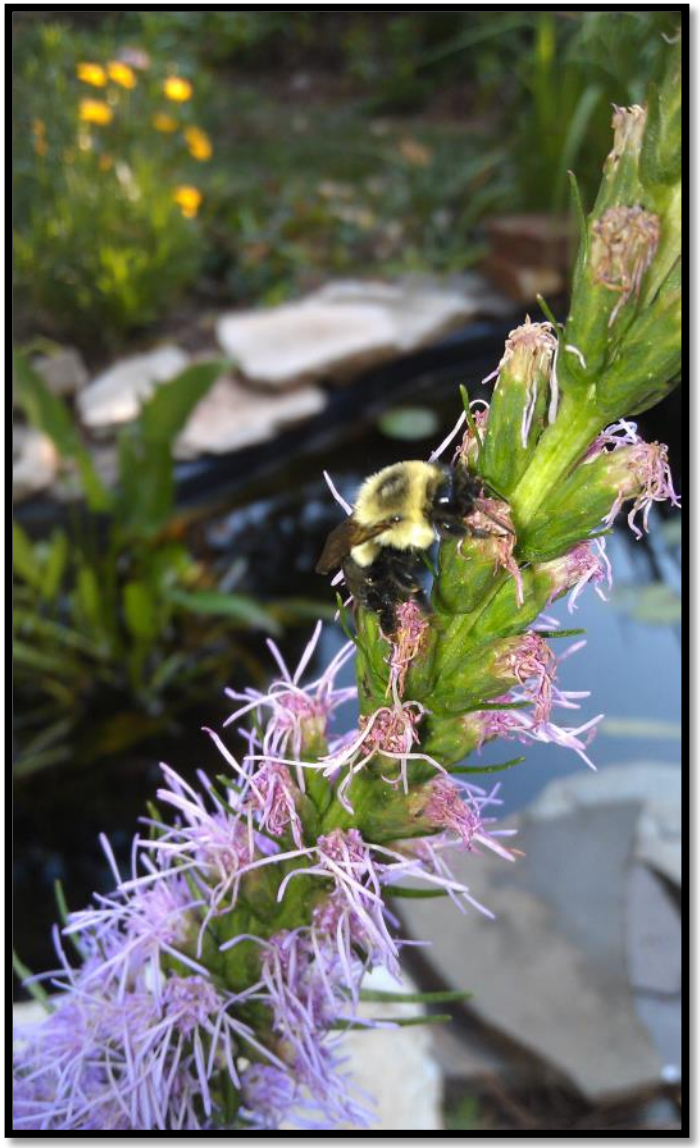

# Neonicotinoids

- Imidacloprid became available 1994
- Systemic and topical toxicity to insects
- Acetylcholine receptor agonists
  - Over-stimulation of this receptor causes paralysis and death

# Neonicotinoids

- Imidacloprid – Merit, Marathon, generics
- Dinotefuran – Safari
- Thiamethoxam – Flagship
- Acetamiprid – TriStar
- Clothianidin - Arena

# Advantages

- Low mammalian toxicity
- Low topical and residue toxicity
- Long lasting plant protection
- Systemic activity targets herbivores

# Routes of Exposure

- Direct Spray
  - Bees contact insecticide during application

- Residue Contact
  - Walk on dried plant tissue

- Contaminated Nesting Sites
  - Ground nesting bees or bees in plant tissue

# Routes of Exposure

- Contaminated Pollen/Nectar
  - Bees collect contaminated pollen/nectar
  - Feed larvae, queen, others
  - Often sub-lethal doses


# Consequence of Exposure

Reduced learning, cognitive ability, and memory


Reduced growth and reproduction

Reduced resistance to pathogens and parasites

# But wait there's more….

OPEN ACCESS Freely available online

PLoS one

## Neonicotinoid Insecticide Imidacloprid Causes Outbreaks of Spider Mites on Elm Trees in Urban Landscapes

**Adrianna Szczepaniec[1*¤a], Scott F. Creary[1¤b], Kate L. Laskowski[1¤c], Jan P. Nyrop[2], Michael J. Raupp[1]**

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### Abstract

*Background:* Attempts to eradicate alien arthropods often require pesticide applications. An effort to remove an alien beetle from Central Park in New York City, USA, resulted in widespread treatments of trees with the neonicotinoid insecticide imidacloprid. Imidacloprid's systemic activity and mode of entry via roots or trunk injections reduce risk of environmental contamination and limit exposure of non-target organisms to pesticide residues. However, unexpected outbreaks of a formerly innocuous herbivore, *Tetranychus schoenei* (Acari: Tetranychidae), followed imidacloprid applications to elms in Central Park. This undesirable outcome necessitated an assessment of imidacloprid's impact on communities of arthropods, its effects on predators, and enhancement of the performance of *T. schoenei*.

*Methodology/Principal Findings:* By sampling arthropods in elm canopies over three years in two locations, we document changes in the structure of communities following applications of imidacloprid. Differences in community structure were mostly attributable to increases in the abundance of *T. schoenei* on elms treated with imidacloprid. In laboratory experiments, predators of *T. schoenei* were poisoned through ingestion of prey exposed to imidacloprid. Imidacloprid's proclivity to elevate fecundity of *T. schoenei* also contributed to their elevated densities on treated elms.

*Conclusions/Significance:* This is the first study to report the effects of pesticide applications on the arthropod

# Other risks of some neonicotinoid applications

- Spidermite outbreaks
  - documented for imidacloprid and thiamethoxam
  - increases mite fecundity
  - hormoligosis

# Other risks of some neonicotinoid applications

- Negative effects on natural enemies
  - via plant feeding by omnivores
  - by feeding on contaminated prey


# Risks to You and Green Industry

- Personal liability for non-target effects
  - Labels prohibit application to flowering plants (including weeds)
  - Bee kills result from off-label use
- Public perception and pressure
  - Tarnish reputation of the industry
- Lose clients or customers
  - clients ask about “bee safe” plants and treatment options
  - Big box stores may not allow neonic applications

| GROUP | 4A | INSECTICIDE |
|---|---|---|

# Safari®

## 20 SG INSECTICIDE

**FOR FOLIAR AND SYSTEMIC INSECT CONTROL IN ORNAMENTAL PLANTS AND VEGETABLE TRANSPLANTS.**

**For Greenhouse, Nursery, Interior Plantscape and Outdoor Landscape Use Only**

Active Ingredient:
Dinotefuran, N-methyl-N'-nitro-N"-

**This product is highly toxic to bees exposed to direct treatment or residues on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area.**

Do not induce vomiting unless told to do so by the poison control center or doctor.
Have person sip a glass of water if able to swallow.
Do not give anything by mouth to an unconscious person.

**If in eyes:** Hold eye open and rinse slowly and gently with water for 15-20 minutes.
Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.
Call a poison control center or doctor for further treatment advice.

(continued)

**FIRST AID (continued)**

**If inhaled:** Move person to fresh air.
If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth, if possible.
Call a poison control center or doctor for further treatment advice.

**HOT LINE NUMBER**

Have the product container or label with you when calling a poison control center or doctor or going for treatment. You may also contact **1-800-892-0099** for emergency medical treatment information.

## PRECAUTIONARY STATEMENTS

### HAZARDS TO HUMANS AND DOMESTIC ANIMALS

**CAUTION**

Harmful if swallowed or absorbed through skin. Causes moderate eye irritation. Avoid contact with skin, eyes or clothing. Wash thoroughly with soap

gum, using tobacco or using the toilet.
- Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

## ENVIRONMENTAL HAZARDS

This pesticide is toxic to shrimp. Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not apply when weather conditions favor drift from treated areas. Drift and runoff from treated

# New Labels

GROUP 4A INSECTICIDE

Flagship® 25WG

syngenta.

## Insecticide

For foliar and systemic control of insect pests in ornamental plants, fruit and nut trees (non-bearing) Christmas trees, forest seedlings and listed vegetables grown for transplant.

*Active Ingredient:*

Thiamethoxam (CAS No. 153719-23-4) . . . . . 25.0%

*Other Ingredients* 75.0%

*Total:* 100.00%

Flagship® 25WG is a water-dispersible granule that contains 4 ounces of active ingredient per pound of formulated product.

## KEEP OUT OF REACH OF CHILDREN

## CAUTION

See additional precautionary statements and directions for use in booklet.

**EPA Reg. No. 100-955 EPA Est. 67545-AZ-1**

**Product of India**
**Formulated in the USA**

**SCP 955A-L3C 1113**
**4033246**

**2 pounds**
**Net Weight**

™

- **Ground Water Advisory**

  Thiamethoxam has properties and characteristics associated with chemicals detected in ground water. This chemical may leach into ground water if used in areas where soils are permeable, particularly where the water table is shallow.

- **Spray Drift Advisory**

  Do not allow this product to drift.

## PROTECTION OF POLLINATORS

**APPLICATION RESTRICTIONS EXIST FOR THIS PRODUCT BECAUSE OF RISK TO BEES AND OTHER INSECT POLLINATORS. FOLLOW APPLICATION RESTRICTIONS FOUND IN THE DIRECTIONS FOR USE TO PROTECT POLLINATORS.**

Look for the bee hazard icon in the Directions for Use for each application site for specific use restrictions and instructions to protect bees and other insect pollinators.

**This product can kill bees and other insect pollinators.**

Bees and other insect pollinators will forage on plants when they flower, shed pollen, or produce nectar.

Bees and other insect pollinators can be exposed to this pesticide from:

- Direct contact during foliar applications, or contact with residues on plant surfaces after foliar applications
- Ingestion of residues in nectar and pollen when the pesticide is applied as a seed treatment, soil, tree injection, as well as foliar applications.

When Using This Product Take Steps To:

- Minimize exposure of this product to bees and other insect pollinators when they are foraging on pollinator attractive plants around the application site.
- Minimize drift of this product on to beehives or to off-site pollinator attractive habitat. Drift of this product onto beehives or off-site to pollinator attractive habitat can result in bee kills.

Information on protecting bees and other insect pollinators may be found at the Pesticide Environmental Stewardship website at:
http://pesticidestewardship.org/PollinatorProtection/Pages/default.aspx.

Pesticide incidents (for example, bee kills) should immediately be reported to the state/tribal lead agency. For contact information for your state, go to: www.aapco.org/officials.html. Pesticide incidents should also be reported to the National Pesticide Information Center at:
www.npic.orst.edu or directly to EPA at: beekill@epa.gov

*continued...*

# DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

**See individual use sites for specific pollinator protection application restrictions. If none exist, follow these directions for foliar applications to commercially-grown plants and ornamentals that are attractive to pollinators and non-agricultural use sites:**

## FOR FOOD/FEED CROPS AND COMMERCIALLY GROWN ORNAMENTALS NOT UNDER CONTRACT FOR POLLINATION SERVICES BUT ARE ATTRACTIVE TO POLLINATORS

Do not apply this product while bees are foraging. Do not apply this product until flowering is complete and all petals have fallen unless one of the following conditions is met:

- The application is made to the target site after sunset.
- The application is made to the target site when temperatures are below 55°F.
- The application is made in accordance with a government-initiated public health response.
- The application is made in accordance with an active state-administered apiary registry program where beekeepers are notified no less than 48-hours prior to the time of the planned application so that the bees can be removed, covered or otherwise protected prior to spraying.
- The application is made due to an imminent threat of significant crop loss, and a documented determination consistent with an IPM plan or predetermined economic threshold is met. Every effort should be made to notify beekeepers no less than 48 hours prior to the time of the planned application so that the bees can be removed, covered or otherwise protected prior to spraying.

## FOR NON-AGRICULTURAL USES

Do not apply Flagship 25WG while bees are foraging. Do not apply Flagship 25WG to plants that are flowering. Only apply after all flower petals have fallen off.

Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your State or Tribe, consult the agency responsible for pesticide regulation.

## RESTRICTIONS

- This product is classified as restricted use in New York State.
- Sale, use and distribution of this product in Nassau and Suffolk counties in the state of New York is prohibited.
- In New York State, use is limited to Christmas trees and indoor greenhouse use only.

GROUP 4A INSECTICIDE

# MERIT® 75 WSP

## INSECTICIDE

BACKED by BAYER™

03408330G 131205AV1

## ENVIRONMENTAL HAZARDS

This product is highly toxic to aquatic invertebrates. Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment washwaters.

This product is highly toxic to bees exposed to direct treatment or residues on blooming crops/plants or weeds. Do not apply this product or allow it to drift to blooming crops/plants or weeds if bees are foraging the treatment area. This chemical demonstrates the properties and characteristics associated with chemicals detected in groundwater. The use of this chemical in areas where soils are permeable, particularly where the water table is shallow, may result in groundwater contamination.

## PROTECTION OF POLLINATORS

**APPLICATION RESTRICTIONS EXIST FOR THIS PRODUCT BECAUSE OF RISK TO BEES AND OTHER INSECT POLLINATORS. FOLLOW APPLICATION RESTRICTIONS FOUND IN THE DIRECTIONS FOR USE TO PROTECT POLLINATORS.**

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**PECIFIC POLLINATOR PROTECTION APPLICATION RESTRICTIONS. IF NONE EXIST R OUTDOOR FOLIAR APPLICATIONS, FOLLOW THESE APPLICATION DIRECTIONS.**

or your state, go to:
.orst.edu or directly to EPA at: beekill@epa.gov

## NON-AGRICULTURAL USES

**cticide while bees are foraging. Do not apply Merit 75 WSP Insecticide to plants that are flowering. Only apply after all**

n production and on turfgrass and ornamentals on: residential home lawns, business and office complexes, shopping complex-irports, cemeteries, parks, playgrounds, and athletic fields.

tion as directed on trees, shrubs, flowers and groundcovers in sites: in and around the perimeter of industrial and commercial icipal, city, state and national forested areas, and private wooded areas.

es, nurseries, or on grasses grown for seed, or on commercial fruit and nut trees.

## DIRECTIONS FOR APPLICATION TO TREES AND SHRUBS BY SOIL DRENCH AND SOIL INJECTION

For use in and around the perimeter of industrial and commercial buildings, in residential and recreational areas, and in municipal, city, state, national, and private wooded and forested areas.

| **Trees and Shrubs** | 1.6 oz (1 packet) MERIT 75 WSP Insecticide per 24 to 48 inches of cumulative trunk diameter or 24 to 48 feet of cumulative shrub height |
|---|---|

Adelgids (including hemlock woolly adelgid)
Aphids
Leaf-feeding beetles (including Japanese beetle and vine weevil adults)
Leaf-feeding bugs (including lace bugs, leaf bugs, and plant bugs)
Leafhoppers, planthoppers, sharpshooters (including glassy-winged sharpshooter) and spittle bugs
Leafminers
Mealybugs
Pine tip moth larvae
Psyllids
Royal palm bug
Sawfly larvae
Soft scales
Whiteflies

| **Trees and Shrubs** | 1.6 oz (1 packet) MERIT 75 WSP Insecticide per 24 inches of cumulative trunk diameter or 24 feet of cumulative shrub height |
|---|---|

Armored scales (including: camellia, false oleander, Florida red, oystershell, tea, and white peach scales)
Flatheaded borers (including emerald ash borer)
Roundheaded borers (including Asian longhorned beetle)
Thrips (foliage only)
White grub, billbug, and root weevil larvae

Example equation: [x (total DBH inches of a tree)/ y (cumulative trunk diameter rate to be applied)] * 1.6 oz (1 packet) = total oz of product per tree.
**Examples of single tree calculations:**
To calculate the rate range with a 12 inch DBH tree:
(12/48) * 1.6 oz. (1 packet) = 0.4 oz per tree
(12/24) * 1.6 oz. (1 packet) = 0.8 oz per tree
If treating multiple trees at a similar rate, add the DBH of the trees together and divide by rate to be applied.
Example of multiple trees using similar rate of 48 (y): 3 trees with DBH of 8, 10, & 9 inches. Total cumulative inches of DBH is 27 (x).
(27/48) * 1.6 oz. (1 packet) = 0.9 oz total for all three trees.

**Soil Injection:** GRID SYSTEM: Space holes on 2.5 foot centers, in a grid pattern, extending to the drip line of the tree. CIRCLE SYSTEM: Apply in holes evenly spaced in circles, (use more than one circle dependent upon the size of the tree) beneath the drip line of the tree extending in from that line. BASAL SYSTEM: Space injection holes evenly around the base of the tree trunk no more than 6 to 12 inches out from the base.
Mix required dosage in sufficient water to inject an equal amount of solution in each hole. Maintain a low pressure and use sufficient solution for distribution of the liquid into the treatment zone. For optimum control, keep the treated area moist for 7 to 10 days. Do not use less than 4 holes per tree or shrub.
**Soil Drench:** Uniformly apply the dosage in no less than 10 gallons of water per 1000 square feet as a drench around the base of the tree, directed to the root zone. Remove plastic or any other barrier that will stop solution from reaching the root zone.
**For Control of Specified Borers:** Application to trees already heavily infested may not prevent the eventual loss of the trees due to existing pest damage and tree stress.
**RESTRICTIONS:**
- No Soil Injection Applications Allowed in Nassau or Suffolk Counties of New York.
- Do not apply more than 8.53 oz (0.4 lb active ingredient) per acre per year.
- Keep children and pets off treated area until dry.
- Do not apply Merit 75 WSP Insecticide to areas which are water logged or saturated, which will not allow penetration into the root zone of the plant.
- Do not apply this product, by any application method, to linden, basswood, or other Tilia species.

# Risk Reduction with IPM

- Monitor, Scout, Identify pests
  - Don’t apply when pests aren’t there, or to non-target pests
  - No ‘insurance’ applications
- Cultural, Mechanical Control Tactics
  - Resistant Plants, avoid problem plants, right plant-right place, reduce plant stress
  - Reduce the need for insecticide applications

# Risk Reduction with IPM

- Least Toxic Control options
  - Oils, soaps, microbials
  - IGR
  - Anthranilic diamides (Acelepryn)
  - Avoid Neonics when possible
  - Avoid pyrethroids (e.g. Talstar), organophoshates (e.g. Orthene)

# Relative Toxicity

Acute Lethal/Sublethal Dose

- Acetamiprid 442,500/5000 ppb
- Dinotefuran 380/? ppb
- Thiamethoxam 250/50 ppb
- Clothianidn 190/24 ppb
- Imidacloprid 180/20 ppb

# Imidacloprid

- Application
  - Foliar spray
  - Drench
  - Soil injection
  - Tree injection


# Imidacloprid Target Pests

- Turf
  - Scarab beetles
  - Weevils

OPEN ACCESS Freely available online

PLOS ONE

# Assessing Insecticide Hazard to Bumble Bees Foraging on Flowering Weeds in Treated Lawns

**Jonathan L. Larson, Carl T. Redmond, Daniel A. Potter***

Department of Entomology, University of Kentucky, Lexington, Kentucky, United States of America

**Abstract**

Maintaining bee
populations. De
insecticides may
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compared with
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to apply neonic
hazard through
label precaution
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**Citation:** Larson JL, Re
e66375. doi:10.1371/jou

Research Article

SCI

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(wileyonlinelibrary.com) DOI 10.1002/ps.2321

# Comparative impact of an anthranilic diamide and other insecticidal chemistries on beneficial invertebrates and ecosystem services in turfgrass

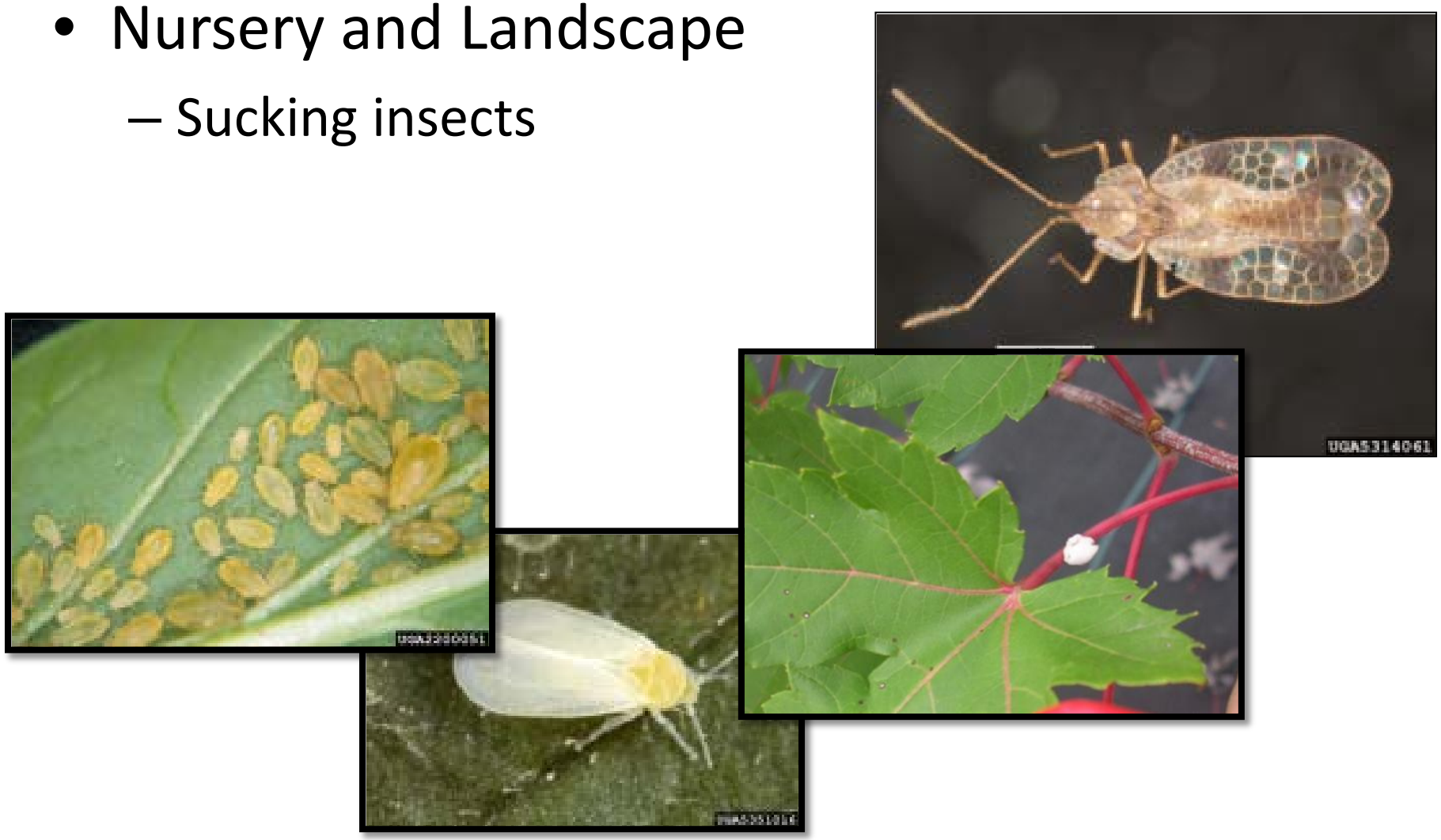
**Jonathan L Larson, Carl T Redmond and Daniel A Potter***

**Abstract**

**BACKGROUND: Chlorantraniliprole, the first anthranilic diamide insecticide labeled for turf, combines strong selective activity against key pests with low vertebrate toxicity. The hypothesis that it is less disruptive to beneficial invertebrates and their ecosystem services than are other prevailing insecticide classes was tested. Plots in golf course settings were treated with chlorantraniliprole, or with a representative nicotinoid (clothianidin), pyethroid (bifenthrin) or a combination (clothianidin–bifenthrin) formulation. Non-target effects were assessed via pitfall traps (epigeal predators), Tullgren funnel extraction (soil microarthropods), hand sorting (earthworms), counting ant mounds and earthworm casts on tees and putting greens, assessing predation on sentinel pest eggs and comparing grass clipping decomposition in treated versus untreated turf.**

# Imidacloprid Target Pests

- Nursery and Landscape
  - Sucking insects



- Aphids
  - Roses
  - Crape myrtle
  - Perennials
  - Annuals

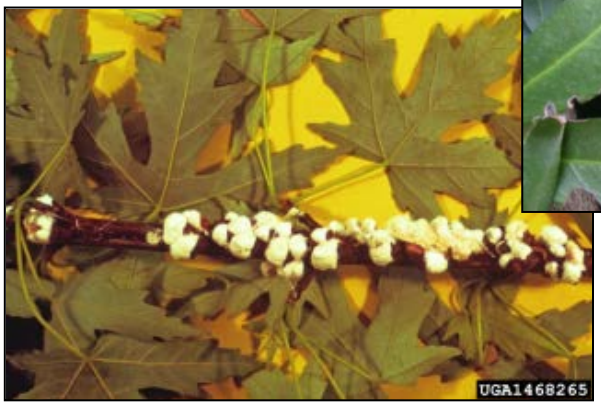
- Azalea Lacebugs
  - Azaleas


# Hawthorn lace bug

- Cotoneaster
- Hawthorn
- Pyracantha

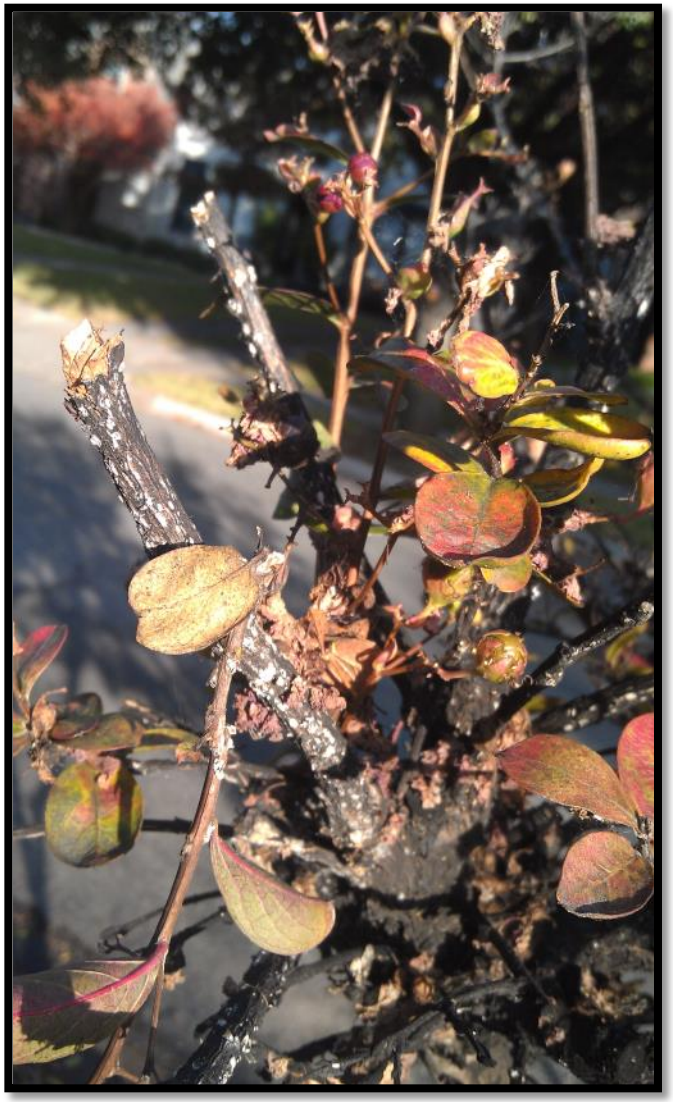
# Common Pest-Plant Combinations that Could Expose Pollinators

- Soft scales
  - Cherry laurel
  - Holly
  - Nandina
  - Tulip poplar
  - Magnolia
  - Camellia




# Crapemyrtle bark scale

- Exotic scale on crapemyrtles
- First found in Texas
- Present in many Southern states
  - Tennessee, Virginia



# Crapemyrtle bark scale

- “Felt scale”
- Look like mealybugs
- Infest nooks and crannies first
- Heavy infestations cover bark
- Lots of honeydew, sooty mold

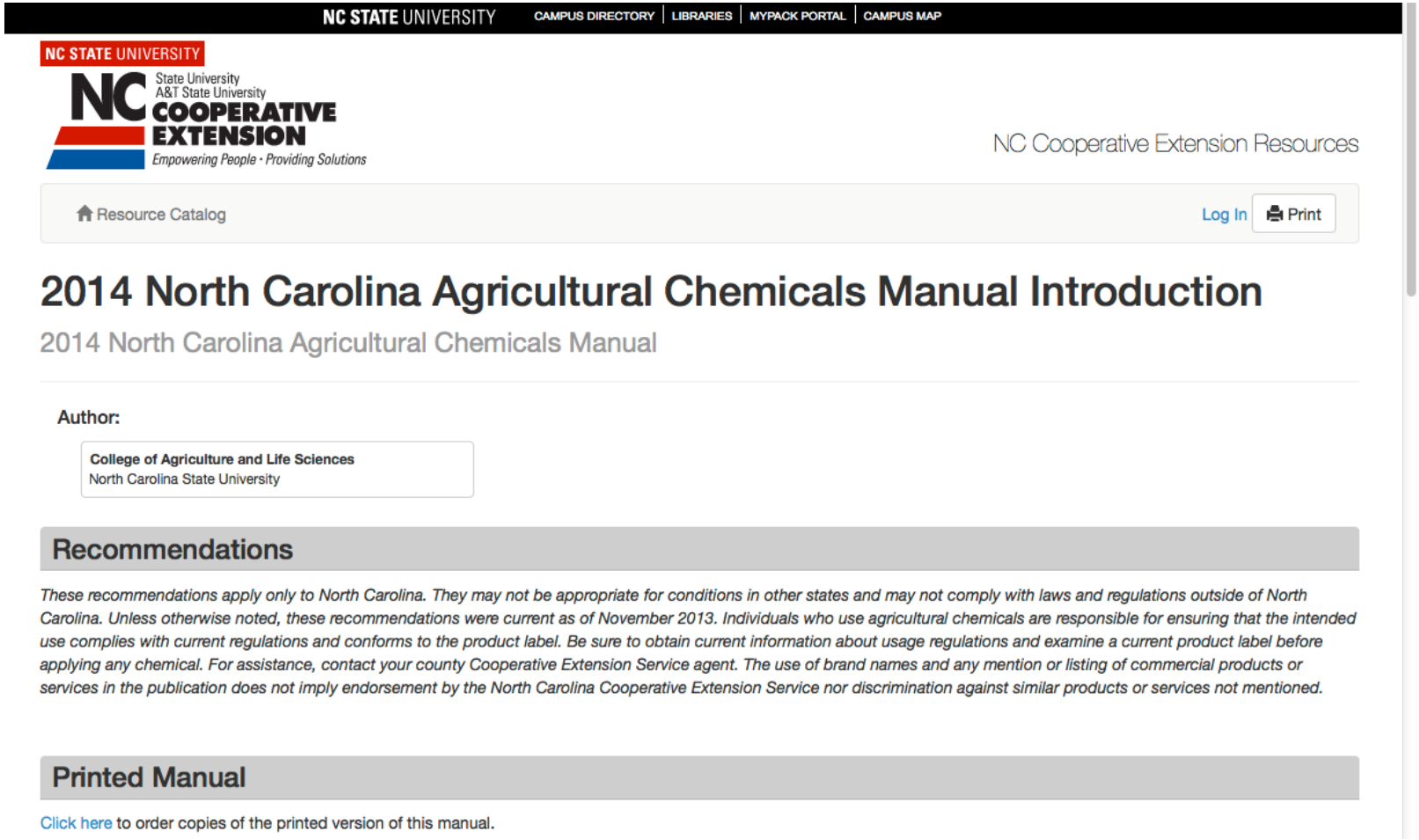
# Crapemyrtle bark scale

- Often confused with crapemyrtle aphids

- Avid
- Azatin
- Horticultural Oil
- Xxpire
- Acelepryn

| |
|---|
| abamectin (Avid) |
| acephate (Orthene) |
| acetamiprid (TriStar) |
| azadirachtin (Azatin) |
| bifenthrin + imidacloprid (Allectus) |
| bifenthrin + clothianidin (Aloft) |
| *Beauveria bassiana* (BotaniGard) |
| carbaryl (Sevin) |
| clothianidin (Celero, Arena) |
| cyfluthrin (Decathlon) |
| fluvalinate (Mavrik) |
| horticultural oil (various) |
| imidacloprid (Merit, Marathon) |
| neem oil (Triact) 70 |
| permethrin (Astro, Perm-up, others) |
| pymetrozine (Endeavor) |
| pyrethrins (various) |
| insecticidal soap (various) |
| spinetoram + sulfoxaflor (XXpire) |
| spirotetramat (Kontos) |
| thiamethoxam (Flagship) |

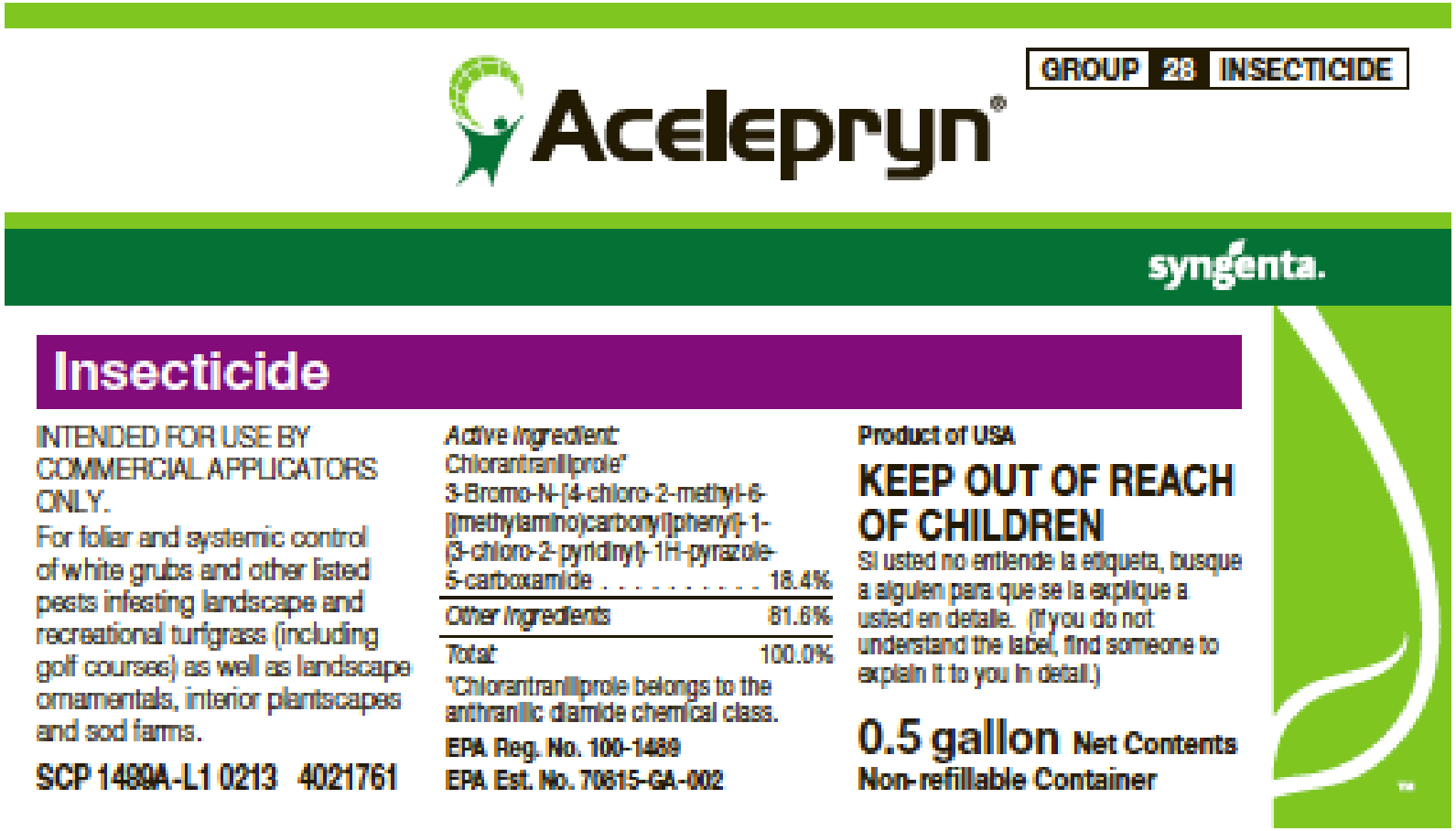
# New products




http://content.ces.ncsu.edu/north-carolina-agricultural-chemicals-manual/

# Xxpire – Dow Agroscience


- Whiteflies Aphids Mealybugs Lepidopterans Lacebugs Certain scales Caterpillars Bagworms Thrips, others
- Controls chewing and sap-feeding insects
- Can be used in nurseries, greenhouses and commercial landscapes "Caution” signal word
- 12-hour re-entry interval




Low toxicity does not require signal word!

Acelepryn®

GROUP 28 INSECTICIDE

syngenta.

- Systemic activity
- Caterpillars
- Sucking pests
  - lacebugs
  - aphids
- Beetles
- Some borers
- Leafminers

# Imidacloprid Target Pests

- Nursery and Landscape
  - Leaf Feeding Beetles



- Japanese beetles
  - Tilia spp. , Linden
  - Roses
  - Crape myrtle
  - Cherry
  - Crab apple


- Xxpire
- Acelepryn
- Conserve
- Azatin

Replace susceptible plants

| d | acephate (Orthene) |
|---|---|
| | acetamiprid (TriStar) |
| | bifenthrin (Onyx, Talstar) |
| | bifenthrin + imidacloprid (Allectus) |
| | bifenthrin + clothianidin (Aloft) |
| | carbaryl (Sevin) |
| | chlorantraniliprole (Acelepryn) |
| | cyfluthrin + imidacloprid (Discus) |
| | dinotefuran (Safari) |
| | imidacloprid (Merit, Marathon II, others) |
| | spinetoram + sulfoxaflor (XXpire) |
| | spinosad (Conserve SC) |
| | thiamethoxam (Flagship) |

# Imidacloprid Target Pests

- Nursery and Landscape
  - Some Wood boring Beetles


# Emerald ash borer

- Emamectin benzoate injection

| |
|---|
| azadirachtin (Azatin) |
| chlorantraniliprole (Acelepryn) |
| cyfluthrin + imidacloprid (Discus) |
| dinotefuran (Safari) |
| imidacloprid (Merit, Marathon II, others) |
| bifenthrin (Onyx, Talstar) |
| permethrin (Astro, Perm-up, Permethrin Pro) |

# Imidacloprid Target Pests

- Nursery and Landscape
  - Flies

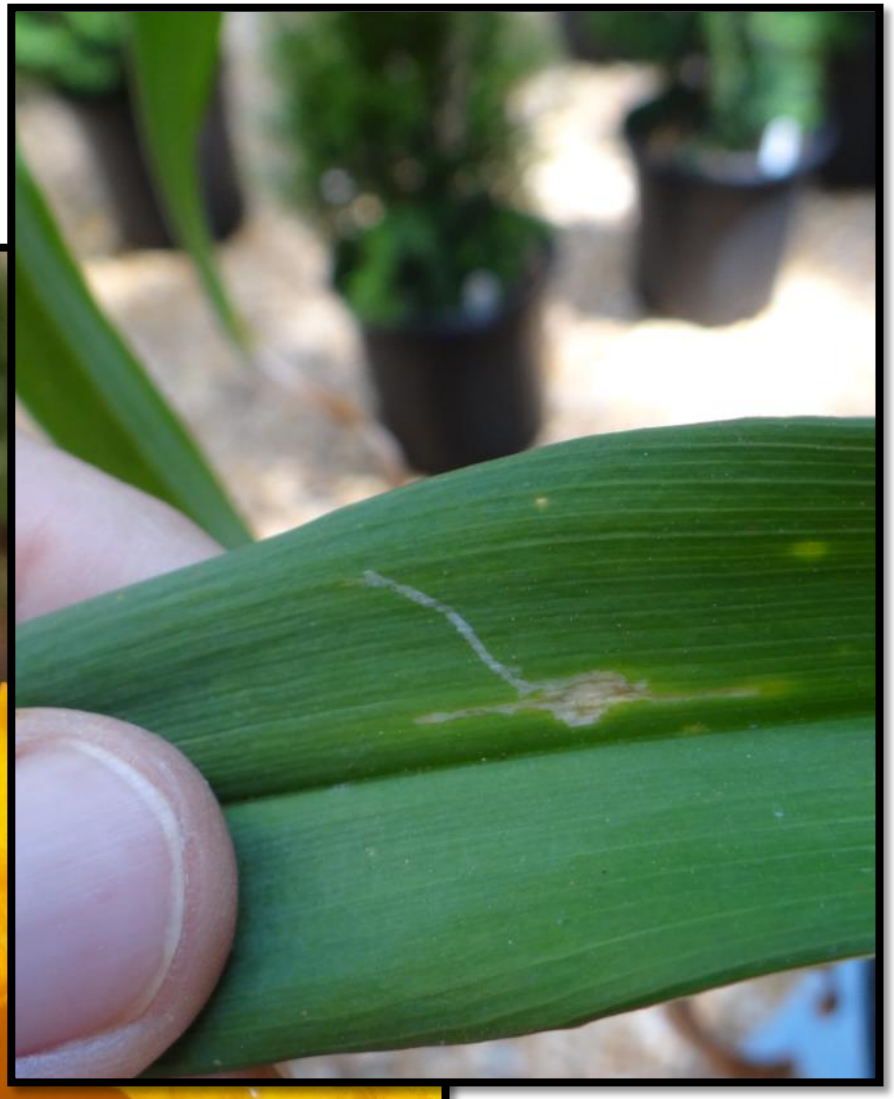


- Leaf miners
  - Boxwood
  - Holly
  - Day lily


# Daylily leafminer

- Overwinter as pupae in soil or base of plants
- Adults become active early –mid May
- We don’t know the long-term consequences for plant survival or flowering
- Multiple generations active throughout summer

# Daylily leafminer



# Daylily leafminer

Leafminers
- Abamectin (Avid)
- Acephate (Orthene)
- Acetamiprid (TriStar)
- Bifenthrin (Talstar)
- Dinotefuran (Safari)
- Imidacloprid (Merit)

Tested
- Spinosad (Conserve)
- Xxpire
- Flagship

- Avid
- Conserve
- Xxpire
- Distance
- Acelepryn

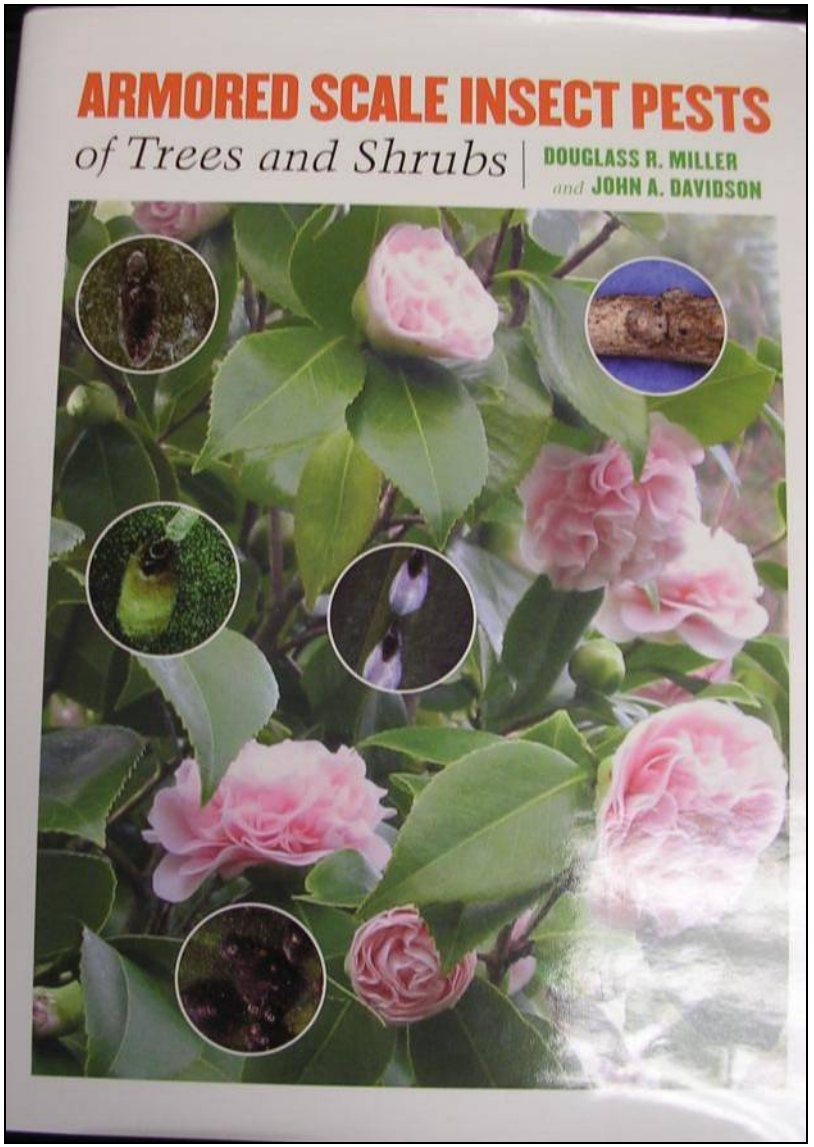
| |
|---|
| abamectin (Avid) |
| acephate (Orthene) |
| acetamiprid (TriStar) |
| azadirachtin (Azatin XL) |
| bifenthrin (Onyx, Talstar) |
| chlorantraniliprole (Acelepryn SC) |
| clothianidin (Arena) |
| cyfluthrin + imidacloprid (Discus) |
| dinotefuran (Safari) |
| imidacloprid (Merit, Marathon, others) |
| permethrin (Astro, Perm-up, Permethrin Pro) |
| pyriproxyfen (Distance) |
| spinosad (Conserve SC) |

# Not Target Pests of Imidacloprid

- Armored scales
- Caterpillars
- Mites

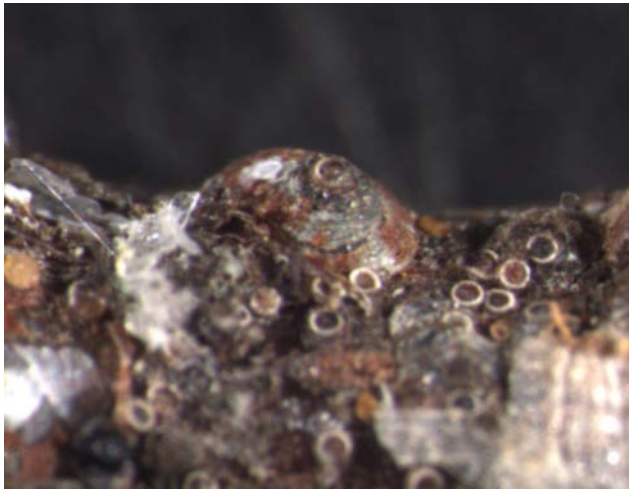

# Important armored scales

- Gloomy scale
- Euonymus scale
- San Jose scale
- Oystershell scale
- Bamboo scale
- White peach scale
- Elongate hemlock scale
- Cryptomeria scale
- Minute cypress scale
- Tea scale
- Maskell scale
- Pine needle scale
- Japanese maple scale
- Obscure scale



# Armored scale - Management

- Neonicotinoids
  - Dinotefuran – Safari
  - Acetamiprid – TriStar
  - Thiamethoxam-Flagship
  - Other neonics are not effective or labeled for armored scales
- Insect Growth Regulators
  - Pyriproxyfen – Distance
  - Buprofezin – Talus
- Orthene
- Horticultural Oil

# Leaf feeding caterpillars

Bagworms

Orange stripped oakworm

Maple worms

Tent caterpillars

# Leaf feeding caterpillars

- Products
  - Spinosad
  - Acelepryn
  - Provaunt
  - Xxpire
  - Confirm

| |
|---|
| acephate (Orthene) |
| acetamiprid (Tri-Star) |
| azadirachtin (Azatin) |
| *Bacillus thuringiensis kurstaki* (DiPel) |
| bifenthrin (Onyx, Talstar) |
| bifenthrin + imidacloprid (Allectus) |
| bifenthrin + clothianidin (Aloft) |
| carbaryl (Sevin) |
| chlorantraniliprole (Acelepryn) |
| indoxacarb (Provaunt) |
| insecticidal soap (various) |
| novaluron (Pedestal) |
| permethrin (Astro, Perm-up, Permethrin Pro) |
| spinetoram + sulfoxaflor (XXpire) |
| spinosad (Conserve SC) |
| tebufenozide (Confirm) |

GROUP 22 INSECTICIDE

Provaunt®

# Insecticide

A water dispersible granular insecticide for the control of lepidopterous larvae (including armyworms, cutworms, sod webworms, bagworms, fall webworms, gypsy moth caterpillars, tent caterpillars, tussock moth caterpillars and yellownecked caterpillars) and other listed pests infesting landscape and recreational (including golf courses) turf grass and landscape ornamentals.

| *Active Ingredient:* | |
|---|---|
| Indoxacarb* (*S*)-methyl 7-chloro-2,5-dihydro-2-[[(methoxycarbonyl)[4(trifluoromethoxy) phenyl]amino]carbonyl]indeno[1,2-e][1,3,4]oxadiazine-4a-(3H)-carboxylate | 30.0% |
| *Other Ingredients* | 70.0% |
| *Total:* | 100.0% |

*Indoxacarb belongs to the oxadiazine chemical class.

Caterpillars on landscape ornamentals

# Two-spotted spider mite - Biology

- Overwinter as adults in protected areas such as weeds, leaf litter

- Become active in hot weather


# Two-spotted spider mite - Hosts

- Found throughout North America
- Feed on over 150 plant species
  - Bedding plants
  - Roses, perennials
  - Shrubs and trees

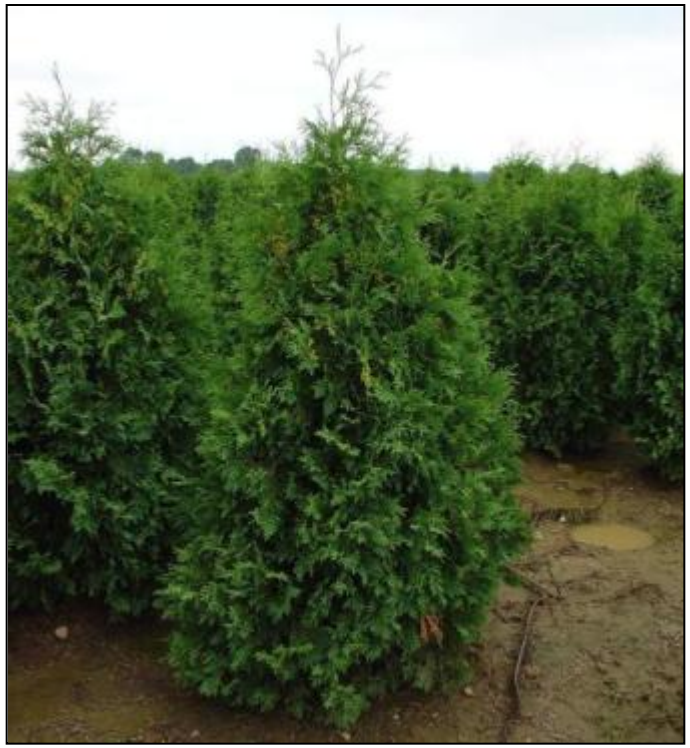
# Cool season mites

- Spruce spider mite (*Oligonychus ununguis*)
  - Most destructive pest of conifers
- Southern read mite (*Oligonychus ilicis)*
  - Small
  - Eight legs
  - Reddish eggs
  - Pale to red body of nymphs and adults



# Spruce spider mite - Hosts

- Found throughout North America
- Coniferous evergreens
- Feed on junipers, spruce, arborvitae, and other coniferous evergreens



# Use miticides

- Avid
- Floramite
- Shuttle
- Tetrasan
- Horticultural oil
- …..

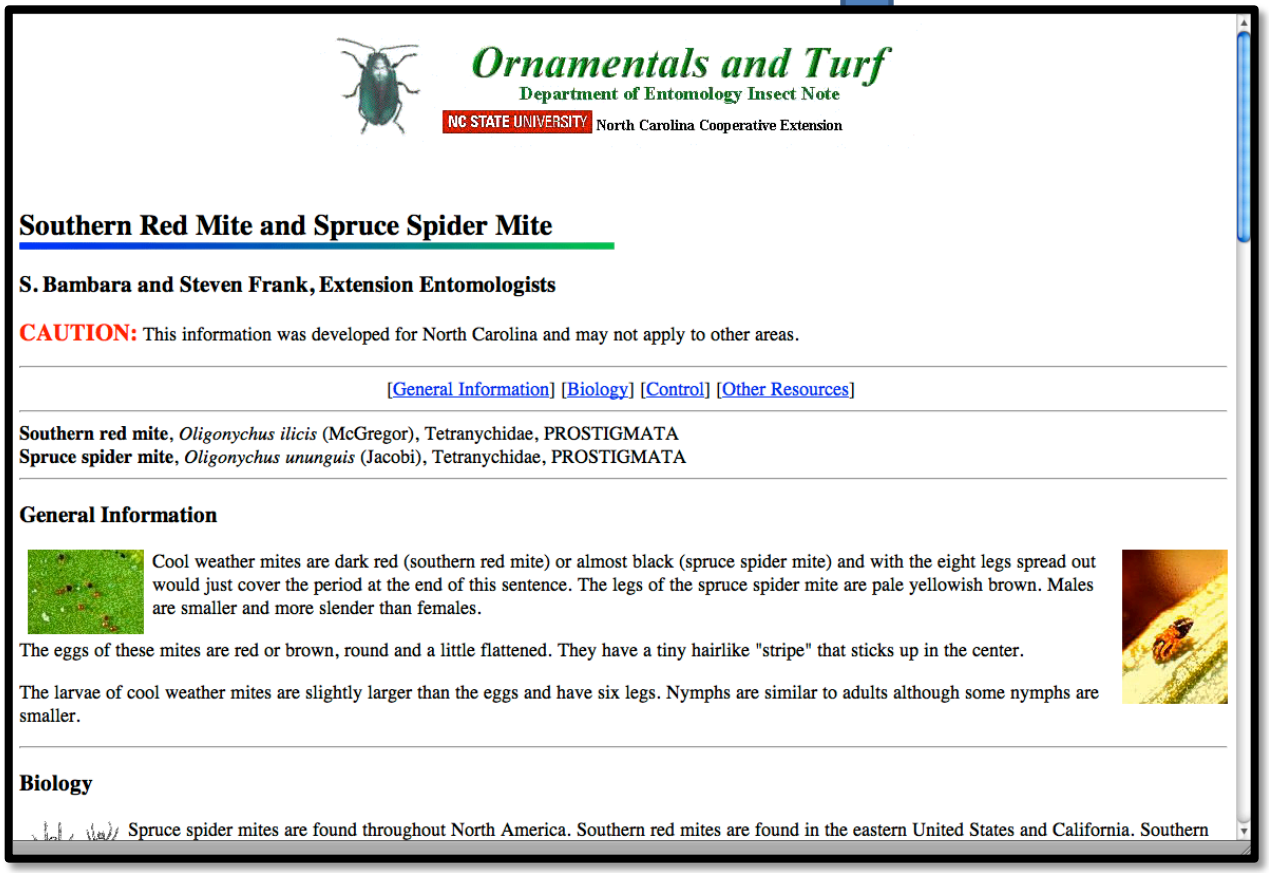
| |
|---|
| abamectin (Avid) |
| acequinocyl (Shuttle) |
| bifenazate (Floramite) |
| clofentezine (Ovation) |
| etoxazole (TetraSan) |
| fenazaquin (Magus) |
| fenpyroximate (Akari) |
| hexythiazox (Hexygon) |
| horticultural oil (various) |
| insecticidal soaps |
| pyridaben (Sanmite) |
| spiromesifen (Judo, Forbid) |

# Twitter Alerts

- Pest activity
- Exotic pest updates

1. http://twitter.com/
2. Sign up
3. Follow
4. @OrnaPests

136 DD.  Look for Spruce Spider Mites on Conifers. Link to more info.



*Ornamentals and Turf*
Department of Entomology Insect Note
NC STATE UNIVERSITY North Carolina Cooperative Extension

## Southern Red Mite and Spruce Spider Mite

**S. Bambara and Steven Frank, Extension Entomologists**

**CAUTION:** This information was developed for North Carolina and may not apply to other areas.

[General Information] [Biology] [Control] [Other Resources]

**Southern red mite**, *Oligonychus ilicis* (McGregor), Tetranychidae, PROSTIGMATA
**Spruce spider mite**, *Oligonychus ununguis* (Jacobi), Tetranychidae, PROSTIGMATA

### General Information

Cool weather mites are dark red (southern red mite) or almost black (spruce spider mite) and with the eight legs spread out would just cover the period at the end of this sentence. The legs of the spruce spider mite are pale yellowish brown. Males are smaller and more slender than females.

The eggs of these mites are red or brown, round and a little flattened. They have a tiny hairlike "stripe" that sticks up in the center.

The larvae of cool weather mites are slightly larger than the eggs and have six legs. Nymphs are similar to adults although some nymphs are smaller.

### Biology

Spruce spider mites are found throughout North America. Southern red mites are found in the eastern United States and California. Southern

# Insect Ecology and Integrated Pest Management

Improving IPM through Ecology

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## Whiteflies on Poinsettias in Color

Posted on **December 5, 2012**

**PEST ALERTS ON TWITTER**

Whiteflies on Poinsettias in Color
**wp.me/p1FJMW-7h**
**1 day ago**

# Extension Resources

## IPMPro App for iPhone and Android

*A tour de force of nursery and landscape pest management, IPMPro mobile device app. will streamline your pest management decision-making, employee training, and make complying with state pesticide recordkeeping regulations easy!*

## Insect notes

*Insect notes summarize the biology and management of arthropod pests important to ornamental greenhouse, nursery, or landscape systems.*

## Pest news

*Brief, weekly updates on arthropod activity provided by email April to September.*

### Books

Adkins, C.R., S.K. Braman, M.R. Chappell, J.-H. Chong, J.F. Derr, W.C. Dunwell, **S.D. Frank**, A.F. Fulcher, F.A. Hale, W.E. Klingeman, G.W. Knox, A.V. LeBude, M.L. Paret, J.C. Neal, J.R. Sidebottom, N.A. Ward, S.A. White, J. L. Williams-Woodward, and A.S. Windham. 2012. **IPM for Select Deciduous Trees in Southeastern US Nursery Production**. Fulcher, AF, SA White, Eds. Knoxville, TN: Southern Nursery IPM Working Group. Print and Electronic PDF, or iBook.

## Industry publications

*Articles on arthropod management in regional and national publications targeting the*

### PEST ALERTS ON TWITTER

Whiteflies on Poinsettias in Color
**wp.me/p1FJMW-7h**
**1 day ago**

Cankerworm adults active!
**wp.me/p1FJMW-7c**
**3 days ago**

Caterpillars I have found
**wp.me/p1FJMW-6O**
**2 months ago**

Baptisia-Feeding Caterpillar
**wp.me/p1FJMW-6B**
**4 months ago**

New issue of NC Pest News contains Dogwood borer, Flatid Fluff, and Fall webworm info
**ipm.ncsu.edu/current_ipm/12 …**
**4 months ago**

Take the IR-4 Survey Now!
**wp.me/p1FJMW-6y**
**4 months ago**

Pollinators and Insecticides
**wp.me/p1FJMW-6v**
**4 months ago**

Fall webworms feeding
**wp.me/p1FJMW-6r**
**4 months ago**

Heat wave boosted spider mites
**wp.me/p1FJMW-6o**
**4 months ago**

# IPM for Select Deciduous Trees in Southeastern US Nursery Production

## Table of Contents

# Resources

- Agricultural chemicals manual
  http://ipm.ncsu.edu/agchem/agchem.html

- General ornamental pests and pest calendars
  http://insects.ncsu.edu/

- My Website and Blog
  - ecoIPM.com

- Twitter - @ornapests