Integrated Pest Management in Arboriculture

Igor Laćan
ilacan@ucanr.edu

Neonic slides courtesy of
Dr. Andrew Sutherland,
Herbicide info. from
Dr. Cheryl Wilen,
UCIPM

UC CE
University of California
Agriculture and Natural Resources
Cooperative Extension

CISR, UC Riverside

Outline

Pest developments *of 2015…*

→ *please tell me what I am missing…!*

Neonic situations by Dr. Andrew Sutherland

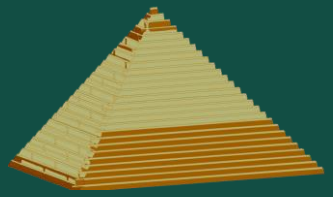
Glyphosate fun *Roundup round-ups…*

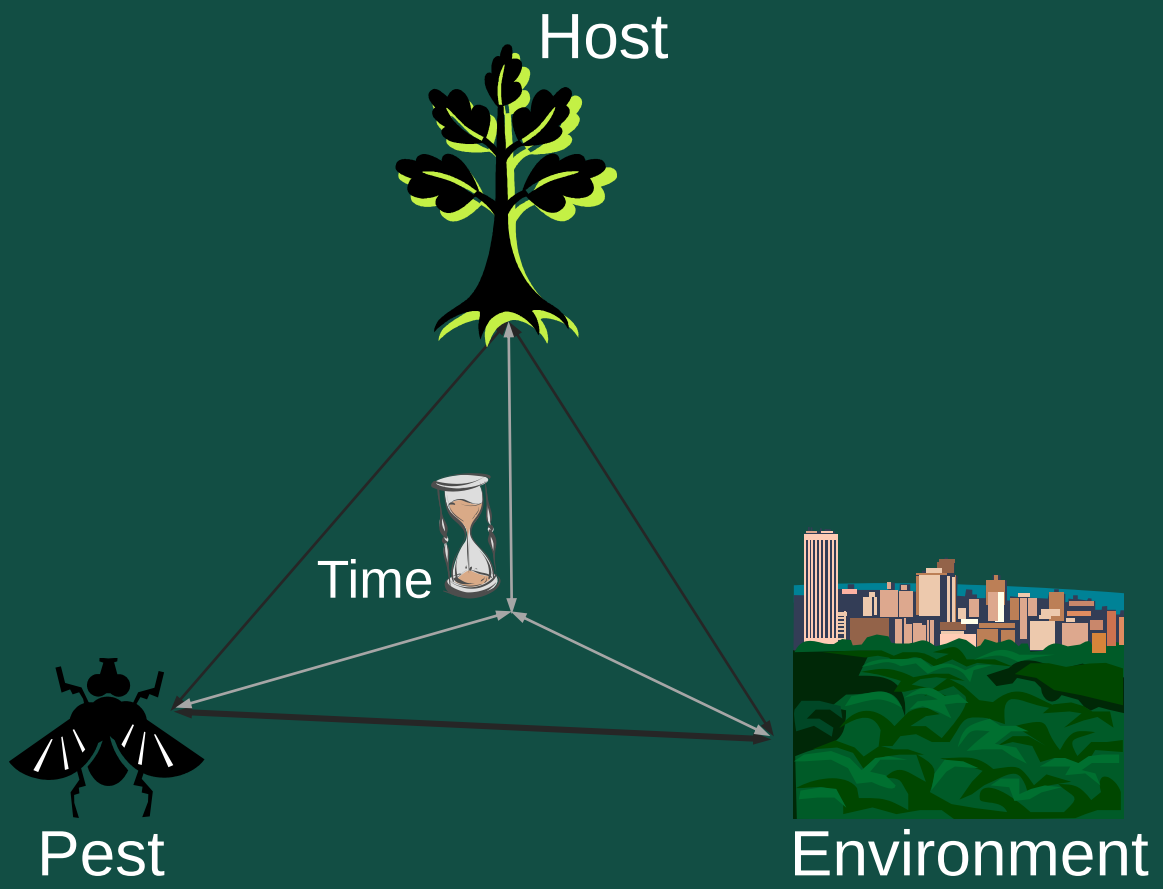
Discussion *(rotten fruit throwing, etc.)*

MENTION OF ANY PESTICIDE NAMES IS NOT AN ENDORSEMENT NOR A RECOMMENDATION

four elements of a pest problem

Plant pathology





Integrated Pest Management (IPM)

*IPM is a **decision-making process***

that uses all available pest management strategies,

including cultural, physical, biological & chemical control

to prevent economically damaging pest outbreaks

& reduce risks to human health & the environment

Drought and pests: Eucalyptus longhorn borer

(or: watering can be **a part of IPM!)**

Water Stress and Insect Injury

Although some species perform well with little or no irrigation water, their susceptibility to insect attack and injury may increase with water stress. For example, many *Eucalyptus* species perform well in nonirrigated locations in many parts of California. When water stressed, however, they become susceptible to attack and injury by the eucalyptus longhorned borer (*Phorocantha semipunctata*). This is also the case for Monterey pine (*Pinus radiata*) and the California fivespined engraver beetle (*Ips paraconfusus*). For these species, evaluations were made with consideration given to water stress and pest interactions. For example, although Tasmanian blue gum (*Eucalyptus globulus*) performs well in Regions 3 and 4 with little summer water, it was assigned the category Moderate to minimize susceptibility to borer injury.

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Environmentally Friendly or Less-Toxic Pest Management

- is an ecological strategy
  - for preventing and reducing pest problems
    - with minimum adverse impact on human health, non-target organisms, and the environment.

www.ipm.ucanr.edu or www.ipm.ucdavis.edu

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Solve your pest problems with UC's best science

Announcements

- 2011 Highlights: Annual Report
- UC IPM manual revised: Integrated Pest Management for Citrus, 3rd edition

What's New

- Green Bulletin Newsletter: February 2012 issue
- Revised Pest Notes: Cottony Cushion Scale, Mushrooms and Other Nuisance Fungi in Lawns
- More...

QUICK LINKS

- Newsletters
- Recursos en español
- Online training
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How to Manage Pests

Pests in Gardens and Landscapes—Ornamental Trees and Shrubs

Search trees and shrubs: Go

The table below lists common, scientific, and family names for ornamental trees and shrubs included in this Web site. Click on a name to link to information about pests commonly found on that plant.

Click on a table heading to sort the column[1]. Legend: ▲ = Ascending, ▼ = Descending, ◆ = Unsorted

Common name index—see also cultural tips

| A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P-Q | R | S | T | U-Z |

Common name	Scientific name	Family
Abelia	*Abelia* spp.	Caprifoliaceae (Honeysuckle family)
Abutilon	*Abutilon* spp.	Malvaceae (Hibiscus family)
Acacia	*Acacia* spp.	Fabaceae (Pea family)
African fern pine	*Podocarpus* spp.	Podocarpaceae (Podocarpus family)
Agave	*Agave* spp.	Agavaceae (Agave family)
Albizia	*Albizia* spp.	Fabaceae (Pea family)
Alder	*Alnus* spp.	Betulaceae (Birch family)
Algerian ivy	*Hedera* spp.	Araliaceae (Ginseng family)
Andromeda	*Pieris* spp.	Ericaceae (Heath family)
Angelica	*Fatsia japonica* = *Aralia sieboldii*	Araliaceae (Ginseng family)
Aralia	*Fatsia japonica* = *Aralia sieboldii*	Araliaceae (Ginseng family)
Araucaria	*Araucaria* spp.	Araucariaceae (Araucaria family)
Arborvitae	*Platycladus orientalis*	Cupressaceae (Cypress family)
Arborvitae	*Thuja occidentalis*	Cupressaceae (Cypress family)
Artemisia	*Artemisia* spp.	Asteraceae (Sunflower family)

How to Manage Pests

Pests in Gardens and Landscapes

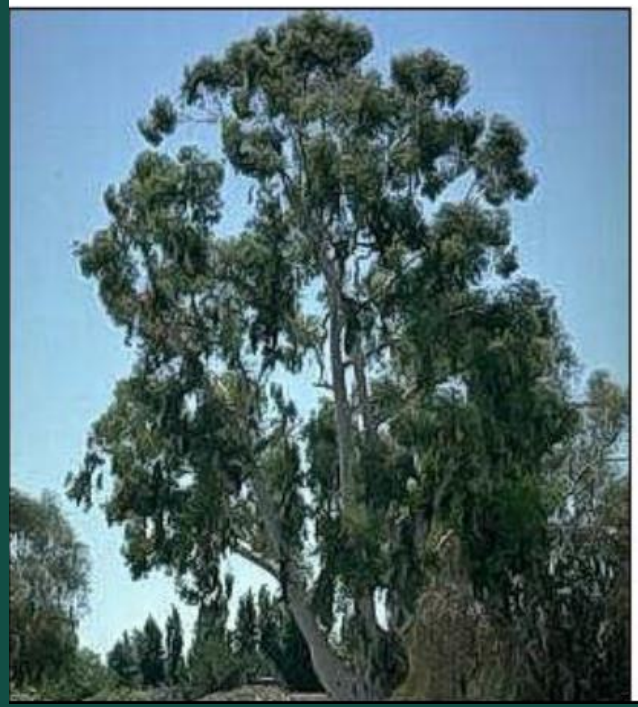
www.ipm.ucanr.edu or www.ipm.ucdavis.edu

More trees and shrubs

Eucalyptus, Gum—*Eucalyptus* spp.

Plant Identification
Eucalyptus species are evergreen trees or large shrubs. They are hardy, fast-growing, and widely adaptable.

Optimum conditions for growth
Eucalyptus plants are widely adaptable to several climatic zones. They do best in full sun. They require little water once established; some species do better with some supplemental summer water.



Pests and disorders of *Eucalyptus* spp.

Invertebrates
- Eucalyptus redgum lerp psyllid
- Eucalyptus snout beetle
- Foliage-feeding caterpillars
  - Omn
- Psyllids
  - Blue
- Roundh
  - Euca long

Diseases
- Armillari
- Collar, r rots
- Powder

Environmental disorders
- Frost
- Ligno-tubers
- Poor water management

Weeds

Pest Notes:
PDF & html

Leaves and

PDF to Print *

Eucalyptus Redgum Lerp Psyllid

Published 1/06

In this Guideline:
- Identification and life cycle
- Management
- Publication
- Glossary

The redgum lerp psyllid *(Glycaspis brimblecombei)* was found in Los Angeles in 1998 and has spread throughout much of California. This insect from Australia also occurs in Arizona, Florida, Hawaii, and Mexico on a variety of eucalyptus species.

IDENTIFICATION AND LIFE CYCLE
Psyllids are plant-juice sucking homopterans in the insect family Psyllidae. Redgum lerp psyllid nymphs (immatures) form a cover called a "lerp," which is a small white, hemispherical cap composed of solidified honeydew and wax. Lerps on leaves can be up to about 1/8 inch in diameter and 1/12 inch tall and resemble an armored scale (Fig. 1). Nymphs enlarge their lerp as they grow, or they move and form a new

Outline

Pest developments *of 2015…*

→ *please tell me what I am missing…!*

Neonic situations by Dr. Andrew Sutherland

Glyphosate fun *Roundup round-ups…*

Discussion *(rotten fruit throwing, etc.)*

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Prevention example: Goldspotted oak borer *Agrilus auroguttatus*

Host: Live oaks (Coast, Canyon); California black oak
Range: Riverside and San Diego Counties

Polyphagous shothole borer and Fusarium dieback

Range: Los Angeles, Orange, Riverside and San Bernardino Counties

Akif Eskalen,
Eskalenlab.ucr.edu

How did these pests get here….?

Poster by Ed Lum

Prevention example: Thousand cankers disease *Geosmithia morbida*

Host: Walnuts (rarely the edible one)
Vector: Walnut Twig Beetle *Pityophthorus juglandis*
Range: state-wide

Drought and pests:
Foamy bark canker
on stressed oaks

Management: (1) reduce stress (water!); (2) prevent construction damage;

Indirect stress: Pitch canker on Monterey pine

Individual infections, may progress down the branches

Management:
(1) prevent stress (water!);
(2) prune out in initial stage
(3) Suppress beetles, if present

Recurring problem:

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Statewide Integrated Pest Management Program

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How to Manage Pests

Pests in Gardens and Landscapes

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California Oakworm

Revised 4/09 Download PDF

In this Guideline:

- Identification
- Life cycle
- Damage
- Management
- Management if oaks might be sprayed
- About Pest Notes
- Publication
- Glossary

The California oakworm (*Phryganidia californica*, family Dioptidae) range, which extends along the coast and through the coastal

Reminder: Thresholds

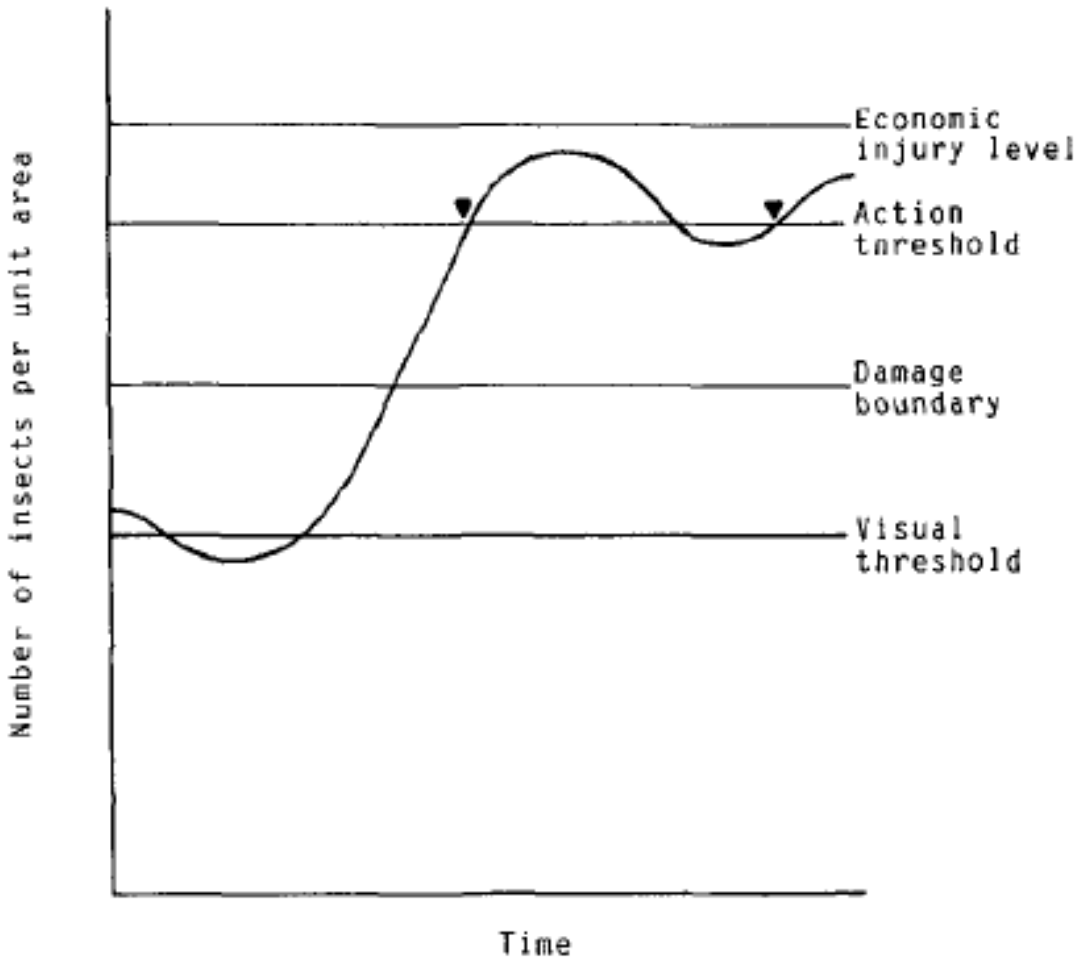
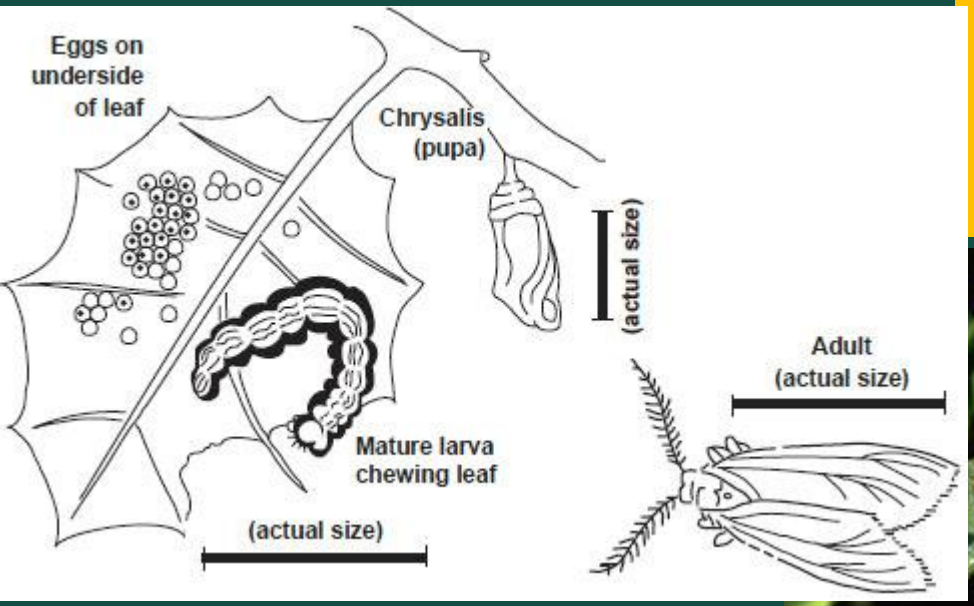


Figure 1. Graph showing the relationships of a hypothetical insect population with the thresholds observed in landscape integrated pest management programs. ▼ = intervention.

Oakworm as an example of thresholds-setting

"…If you observe more than 8 to 10 oakworms more than 1/4 inch long, defoliation may occur if oaks are not sprayed.
Alternatively, a density of 25 oakworms per 100 shoot terminals has been suggested as a treatment threshold."



fear…

vs.

reality…

Other strange things…

(1) Cankers on ‘Marina’ strawberry tree

(2) Bacterial leaf scorch on…? (oleander, liquidambar)

(3) Your turn!

Tree species selection is a critical component of pest management

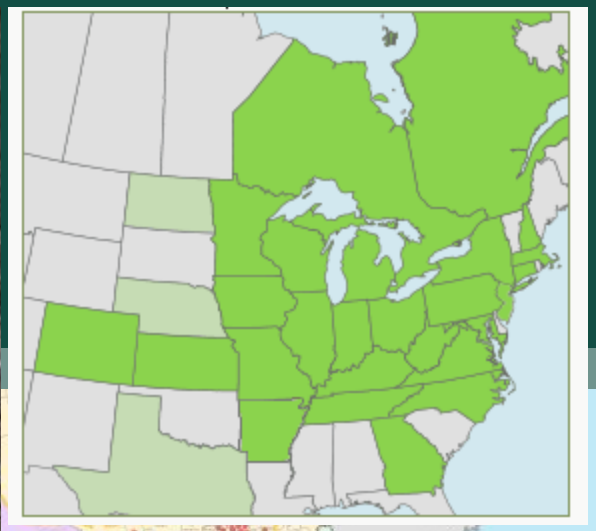
& should consider both the individual tree AND the other urban trees

Photos: USDA

Elsewhere 1: Emerald Ash Borer *Agrilus planipennis*

Photo by David Cappaert. Reprinted with permission.


Photo by Deborah Miller, USDA Forest Service. Reprinted with permission.



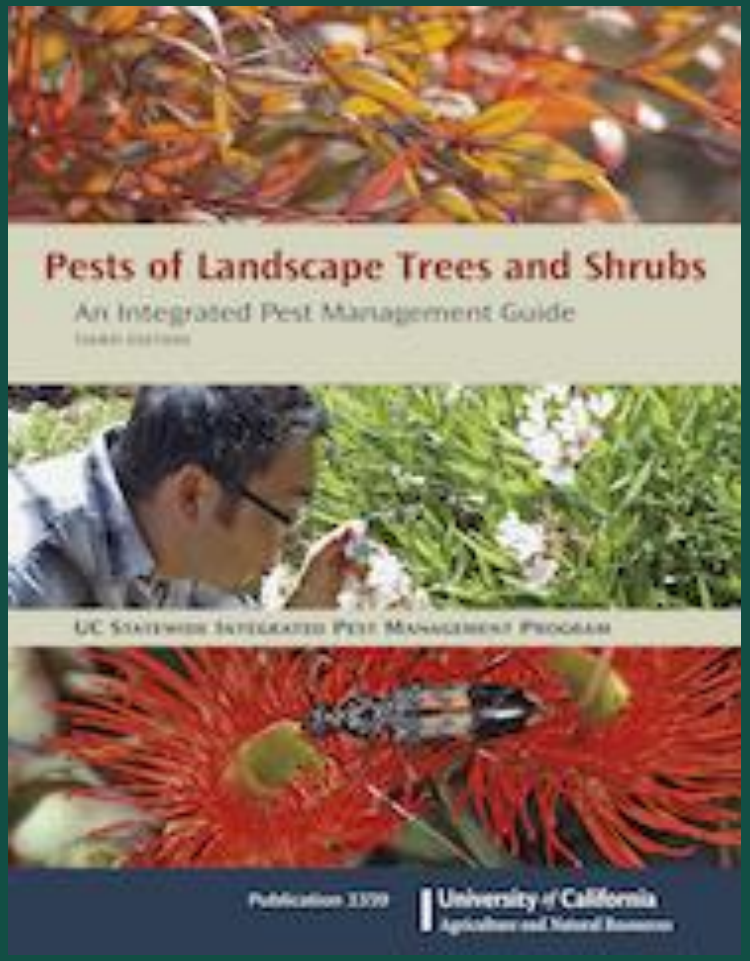
www.emeraldashborer.info

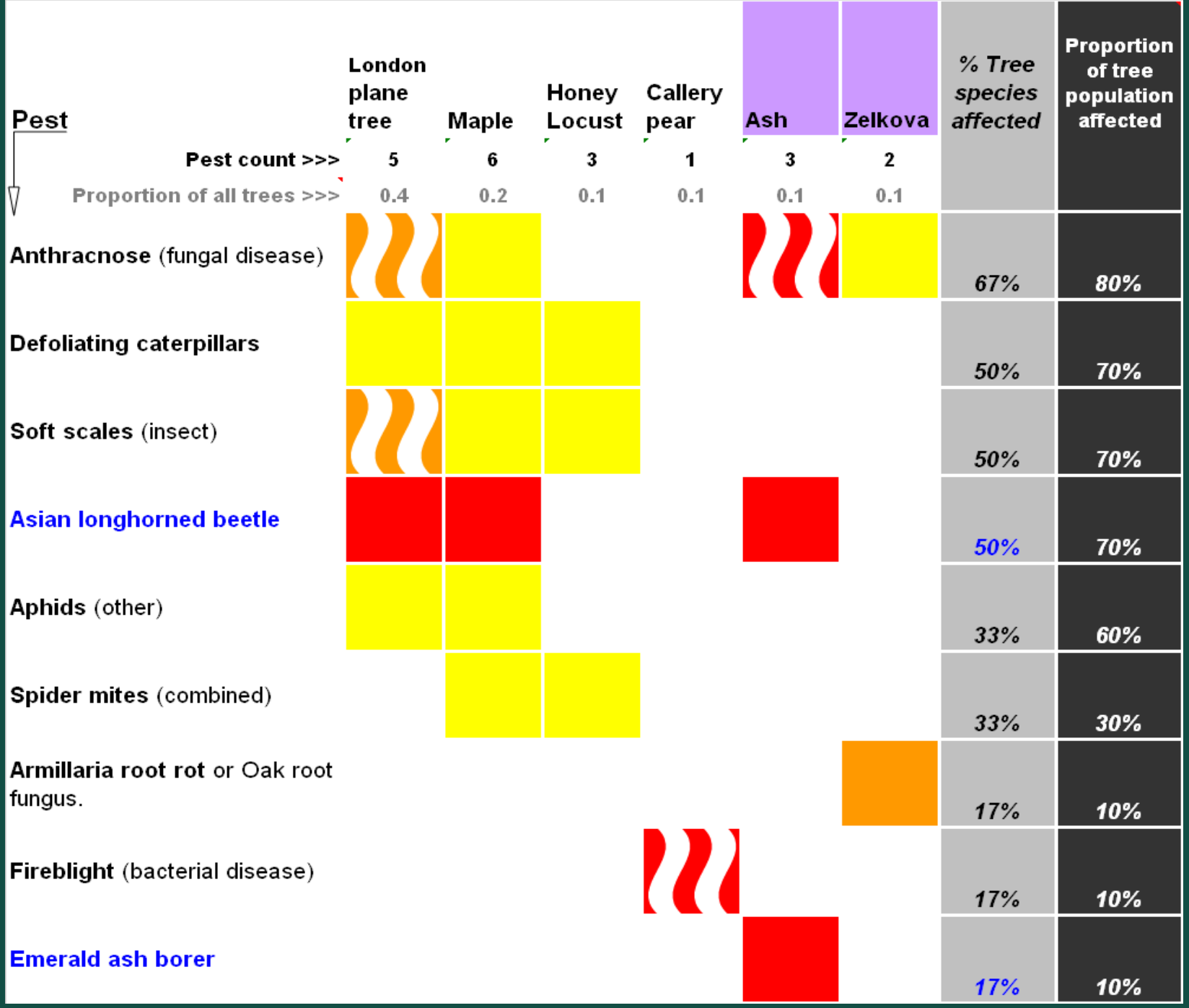

Photo by David Cappaert. Reprinted with permission.

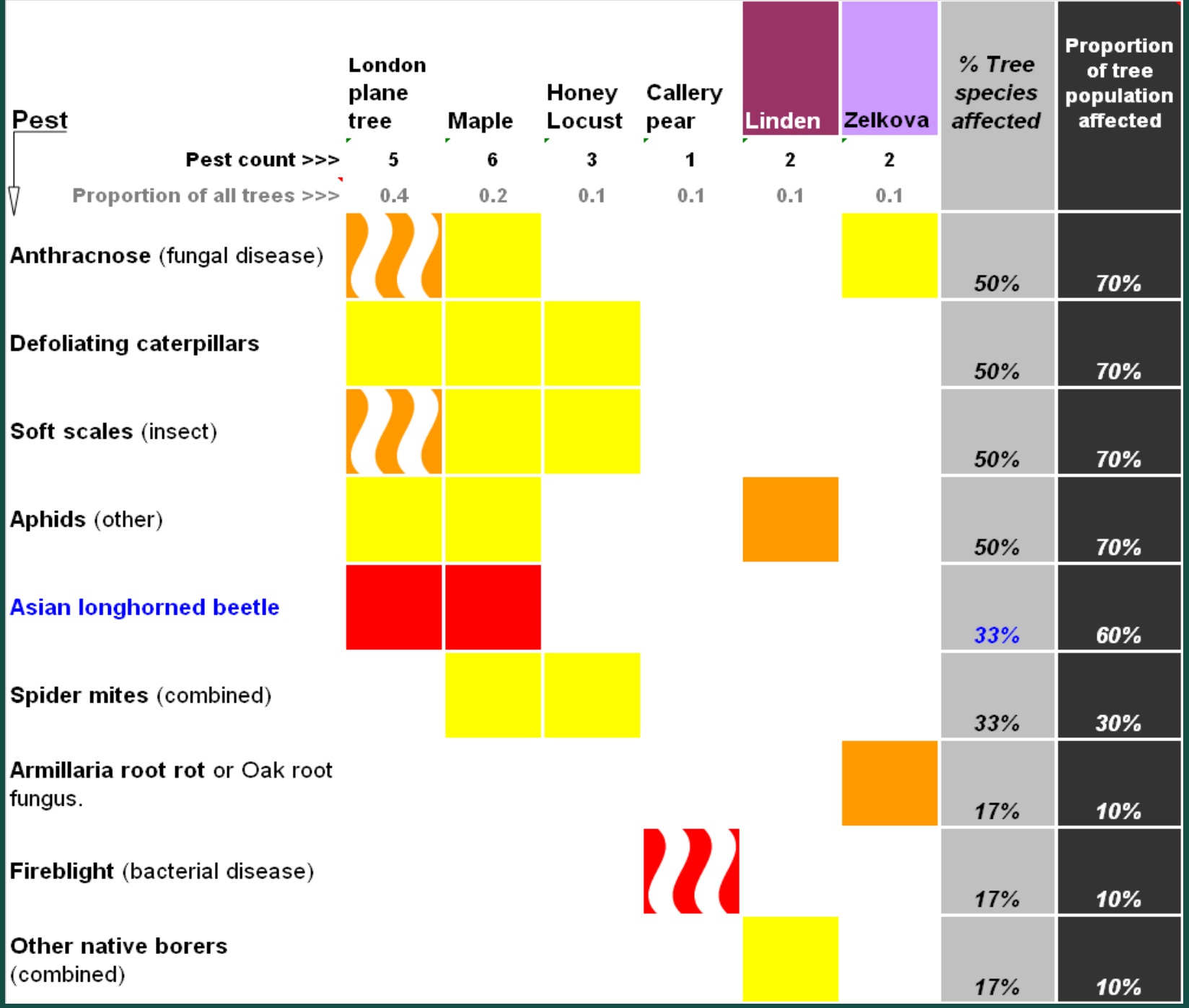
Pest Vulnerability Matrix

Construction

1. Obtain pest-host information
2. Arrange in table, indicate severity
3. Verify local importance




Pest
London plane tree
Maple
Honey Locust
Callery pear
Ash
Zelkova
% Tree species affected
Proportion of tree population affected
Pest count >>>
5
6
3
1
3
2
Proportion of all trees >>>
0.4
0.2
0.1
0.1
0.1
0.1
Anthracnose (fungal disease)
67%
80%
Defoliating caterpillars
50%
70%
Soft scales (insect)
50%
70%
Asian longhorned beetle
50%
70%
Aphids (other)
33%
60%
Spider mites (combined)
33%
30%
Armillaria root rot or Oak root fungus.
17%
10%
Fireblight (bacterial disease)
17%
10%
Emerald ash borer
17%
10%


Pest
London plane tree
Maple
Honey Locust
Callery pear
Linden
Zelkova
% Tree species affected
Proportion of tree population affected
Pest count >>>
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33%
60%
Spider mites (combined)
33%
30%
Armillaria root rot or Oak root fungus.
17%
10%
Fireblight (bacterial disease)
17%
10%
Other native borers (combined)
17%
10%

Increased scrutiny: *neonicotinoid insecticides in urban arboriculture*

Andrew Sutherland
Bay Area Urban IPM Advisor
UCCE and UC IPM

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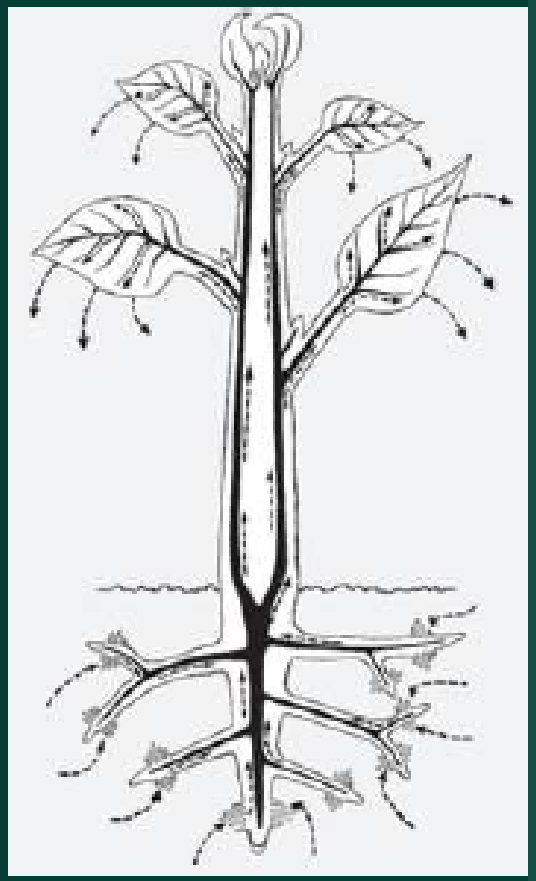
Making a Difference for California

Neonicotinoid Insecticides



- Systemic action
  - Translocated throughout plants
    - Roots to leaves, shoots, cambium, phloem
    - Through bark to cambium, then up to shoots
    - From seed coat to developing seedling
    - Detected within nectar, pollen, leaf exudates
- Sprays, injections, drenches, trunk bands, seed coatings, dusts, baits…
- Most widely used insecticides in world
- Broad-spectrum activity

Reminder of neonicotinoid names/uses

Active ingredient (common name)	Representative products registered for use in urban landscape settings
acetamiprid	Tristar, many Ortho home-use products
clothianidin	Aloft, Arena, some Bayer Advanced products
dinotefuran	Safari, Zylam, some Ortho home-use products
imidacloprid	Marathon, Merit, Premise, many Bayer Advanced products
thiacloprid	Calypso
thiamethoxam	Amdro, Caravan, Flagship, Maxide, Meridian

Active Ingredient	Caterpillars	Sawflies	Beetle grubs	Beetle adults	Aphids	Scales	Lace bugs	Thrips	Spider Mites	Flies
Acetamiprid		x	x	x	x	x	x	x		x
Clothianidin		x	x	x	x	x	x	x		x
Imidacloprid		x	x	x	x	x	x	x		x
Dinotefuran	x	x	x	x	x	x	x	x		x

What can we do to help?

- Strictly follow pesticide label guidelines
- Limit applications of neonicotinoids to situations where they are required
- Delay applications until after flowering
- Take precautions to avoid drift and runoff

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So what's the problem?

- Nontarget effects
  - Natural enemies
    - Direct mortality due to contact (sprays, drenches)
    - Direct mortality due to nectar, pollen, exudate feeding
    - Indirect mortality due to 2^{o} poisoning
      - Predation
      - Sessile hosts
      - Host feeding

So what's the problem?

- Nontarget effects
  - Natural enemies

Biological Control 17, 243–249 (2000)
doi:10.1006/bcon.1999.0795, available online at http://www.idealibrary.com on IDEAL®

Disruptive Sublethal Effects of Insecticides on Biological Control: Altered Foraging Ability and Life Span of a Parasitoid after Feeding on Extrafloral Nectar of Cotton Treated with Systemic Insecticides

J. O. Stapel,[1] A. M. Cortesero,[2] and W. J. Lewis*

*Laboratoire d'Ecobiologie des Insectes Parasitoïdes, Université de Rennes 1, Avenue du Général Leclerc, 35042 Rennes Cedex, France; and *Insect Biology and Population Management Research Laboratory, USDA ARS, P.O. Box 748, Tifton, Georgia 31793*

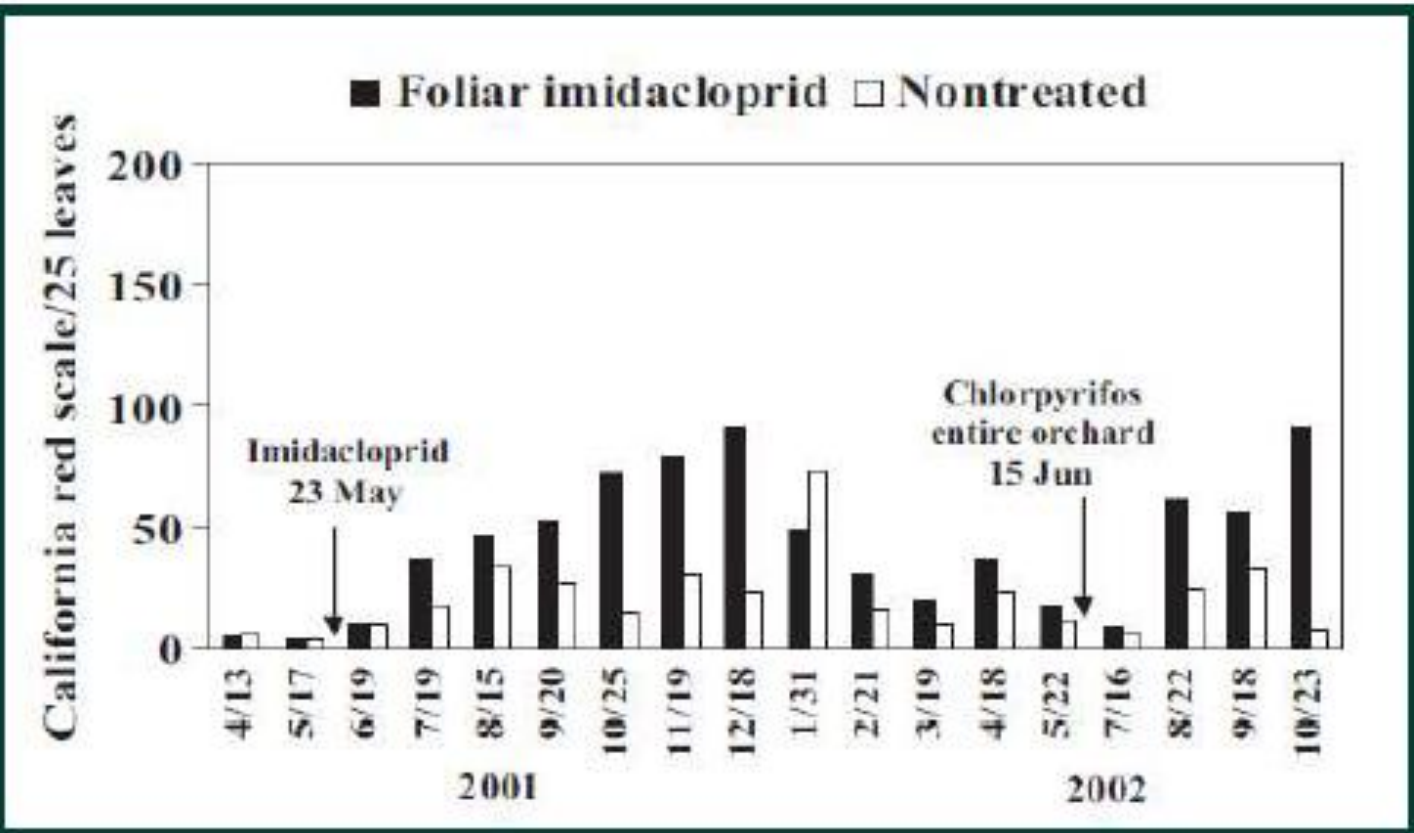
Received April 20, 1999; accepted October 25, 1999

Role of Imidacloprid in Integrated Pest Management of California Citrus

E. E. GRAFTON-CARDWELL,[1,2] J. E. LEE,[1] S. M. ROBILLARD,[3] AND J. M. CORDEN[3]

Department of Entomology, University of California, Riverside, CA 92521

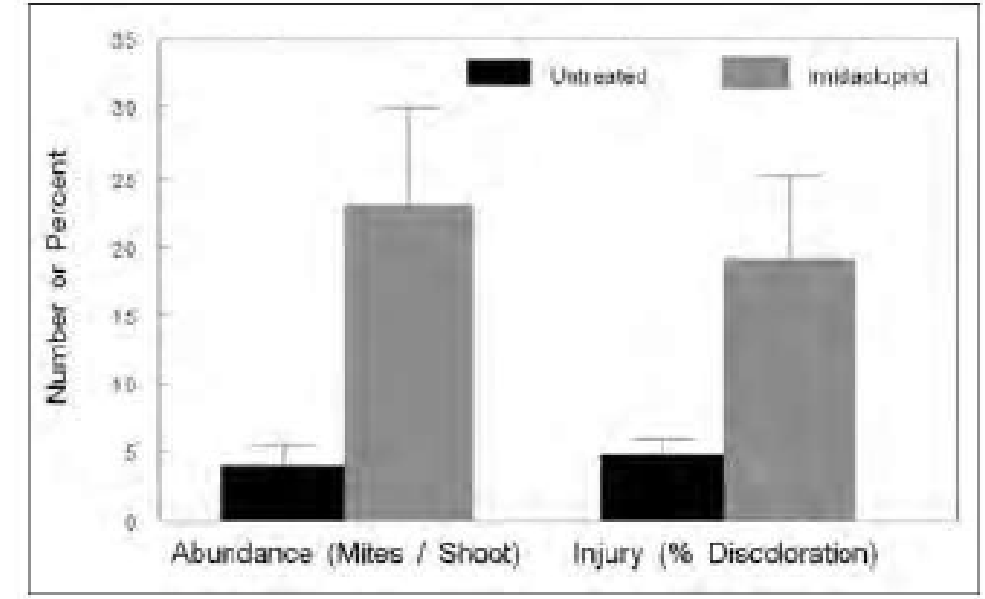
J. Econ. Entomol. 101(2): 451–460 (2008)



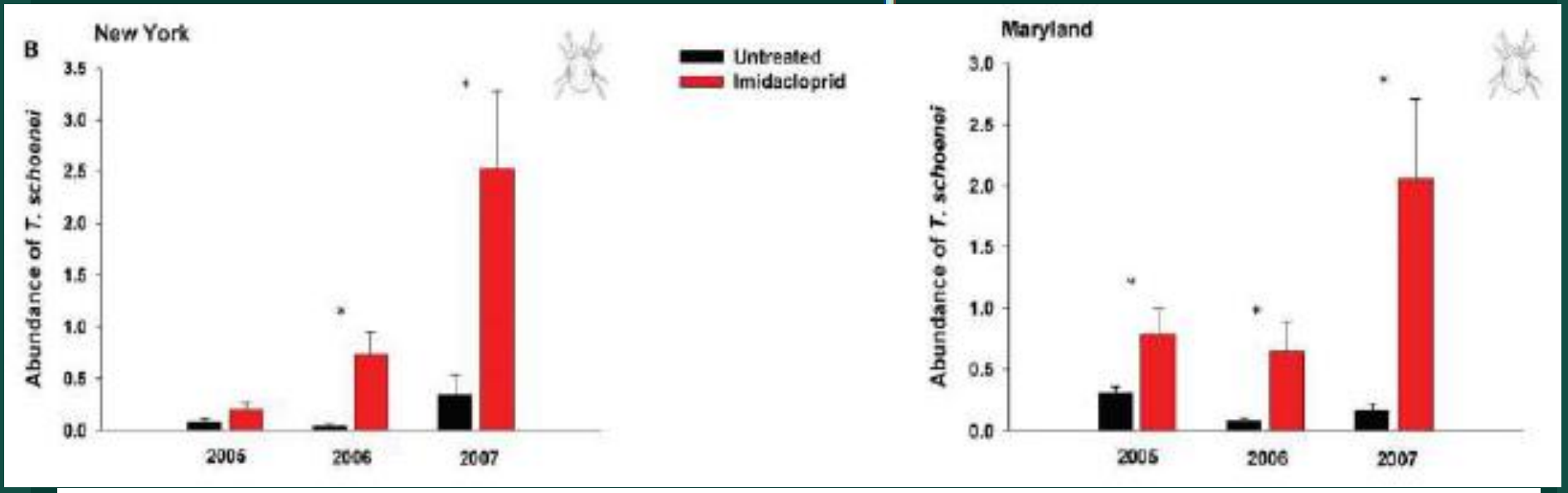
Arboriculture & Urban Forestry 2012. 38(2): 37–40

Effects of Imidacloprid on Spider Mite (Acari: Tetranychidae) Abundance and Associated Injury to Boxwood (*Buxus* spp.)

Adrianna Szczepaniec and Michael J. Raupp



So what's the problem?



OPEN ACCESS Freely available online

PLoS one

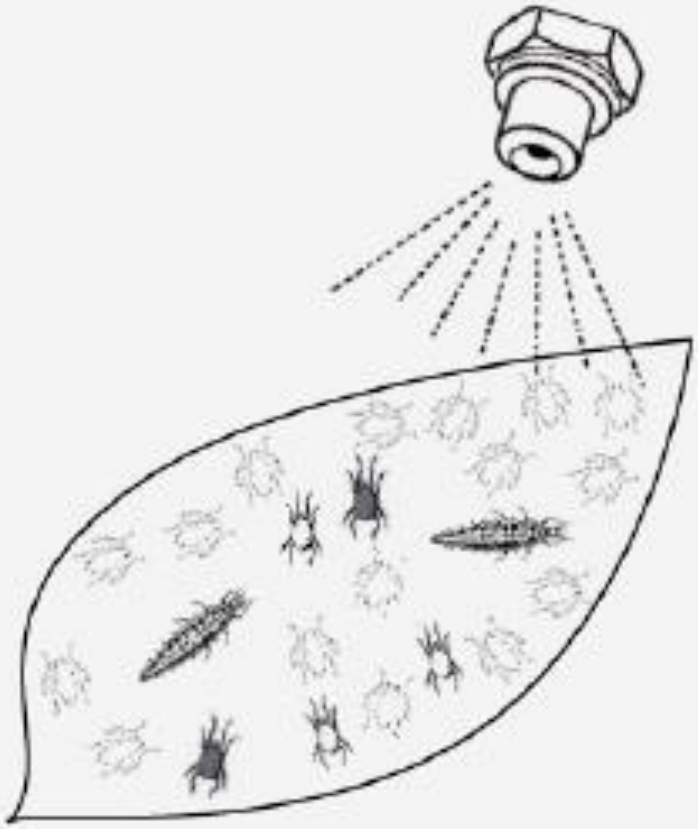
Neonicotinoid Insecticide Imidacloprid Causes Outbreaks of Spider Mites on Elm Trees in Urban Landscapes

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

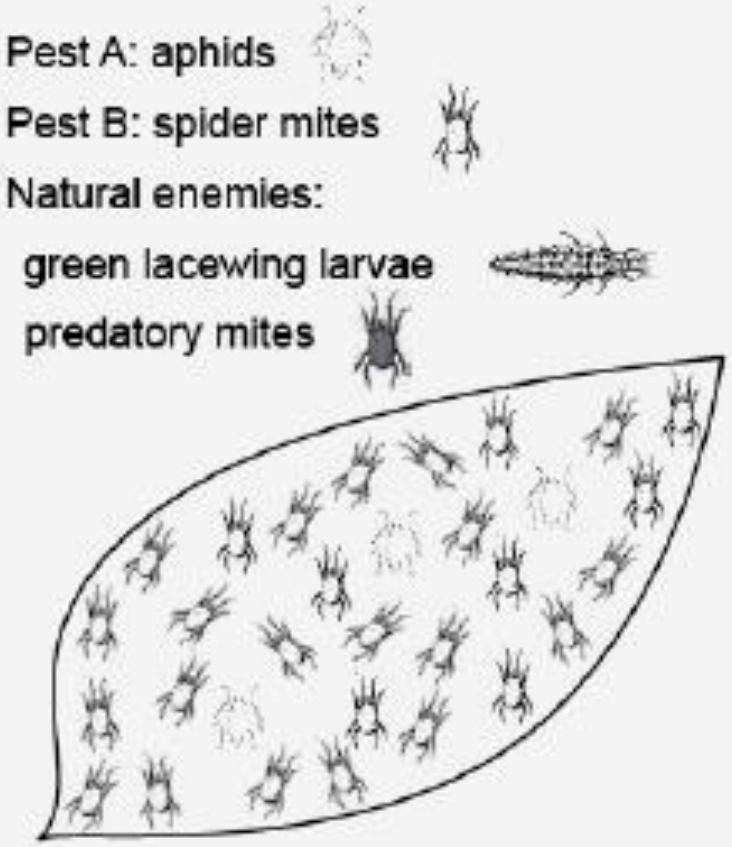
1 Department of Entomology, University of Maryland, College Park, Maryland, United States of America, 2 Department of Entomology, Cornell University, Ithaca, New York, United States of America

Citation: Szczepaniec A, Creary SF, Laskowski KL, Nyrop JP, Raupp MJ (2011) Neonicotinoid Insecticide Imidacloprid Causes Outbreaks of Spider Mites on Elm Trees in Urban Landscapes. PLoS ONE 6(5): e20018. doi:10.1371/journal.pone.0020018

Neonic challenges: secondary pest outbreaks



A pesticide applied to control pest A also kills natural enemies that are controlling pest B.



Released from the control exerted by natural enemies, pest B builds up to economically damaging levels.

Pesticide Toxicity to Natural Enemies

Insecticide	Contact Toxicity (immediate killing)	Persistence of Toxic Residue*
Bacillus thuringiensis	No contact	No persistence
Oils/Soaps	Moderate contact	No persistence
Botanicals (pyrethrins/ azadirachtin)	Moderate to High contact	Short persistence
Spinosad	Moderate contact	Intermediate persistence
Organophosphates/ Carbamates/Pyrethroids	High contact	Intermediate to long persistence
Imidacloprid: Foliar spray	Variable: Most natural enemies affected	Intermediate persistence
Imidacloprid: Soil applied or root/trunk-injected	Bees, predatory beetles and nectar-feeding parasites affected	Long persistence

* **Persistence** is the length of time a pesticide remains toxic.
Intermediate = toxic for weeks; **Long** = toxic for months

Pesticides

Insectides/Miticides

- abamectin
- acephate
- allethrin
- arsenic trioxide
- azadirachtin
- Bacillus thuringiensis
- Beauveria bassiana
- bifenthrin
- borate
- carbaryl
- clothianidin
- cryolite
- cyfluthrin
- dinotefuran
- disulfoton
- fipronil
- fluvalinate
- horticultural oil
- hydramethylnon
- imidacloprid
- jojoba oil

Herbicides

- 2,4-D
- benefin
- bensulide
- bentazon
- bromoxynil
- cacodylic ac
- calcium acid methanears
- ca razon
- clethodim
- DCPA
- dicamba
- dichlobenil
- dimethenam
- diquat
- dithiopyr
- EPTC
- fluazifop
- fluroxypyr
- foramsulfur
- glufosinate

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How to Manage Pests

Pesticide Information

| About Pesticide Information |

Active ingredient: Horticultural oil

Pesticide type: fungicide, insecticide (oil)

Synonyms: fungicidal oil; horticultural oils; insecticidal oil; mineral oil; narrow range oil; oil; petroleum oil; summer oil; supreme oil

See example products below.

Potential Hazard[1] to				
			People and Other Mammals	
Water quality[2] (aquatic wildlife)	Natural enemies (beneficials)	Honey bees[3]	Acute[4]	Long Term[5]
NKR	L	M	VL	Not listed

Acute Toxicity to People and Other Mammals[4]

- Toxicity rating: **Not Acutely Toxic**

Long-Term Toxicity to People and Other Mammals[5]

So what's the problem?

- Nontarget effects
  - Natural enemies
  - Pollinators
    - Direct mortality due to contact, residues
    - Direct mortality due to nectar, pollen, exudate feeding
    - Sublethal effects suggested: immune system suppression, memory, learning

Neonic challenges: nontarget damage

Different neonics = different toxicity to bees

Pesticide	Oral LD_{50} (µg/bee)	Oral LC_{50} (µg/L)	Relative Potency Factor
Acetamiprid	14.53	558,846	0.0003
Clothianidin	0.0037	142	1.06
Dinotefuran	0.023	885	0.17
Imidacloprid	0.0039	150	1.00
Thiamethoxam	0.005	192	0.78

FoE, 2013

So what's the problem?

- Increasing scrutiny
  - Regulatory agencies
  - Environmental conservation groups
  - Communities
- New regulations
  - European Union
  - State of Oregon
  - US EPA

Situations where they are 'required'?

Urban arboriculture pest systems commonly targeted by neonicotinoid applications:

- Honeydew management (aphids, soft scale)
- Leaf beetles
- Myoporum thrips
- Citrus leafminer
- Borers?
- Psyllids

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dinotefuran	Safari, Zylam, some Ortho home-use products
imidacloprid	Marathon, Merit, Premise, many Bayer Advanced products
thiacloprid	Calypso
thiamethoxam	Amdro, Caravan, Flagship, Maxide, Meridian

Honeydew management

- Soft scales

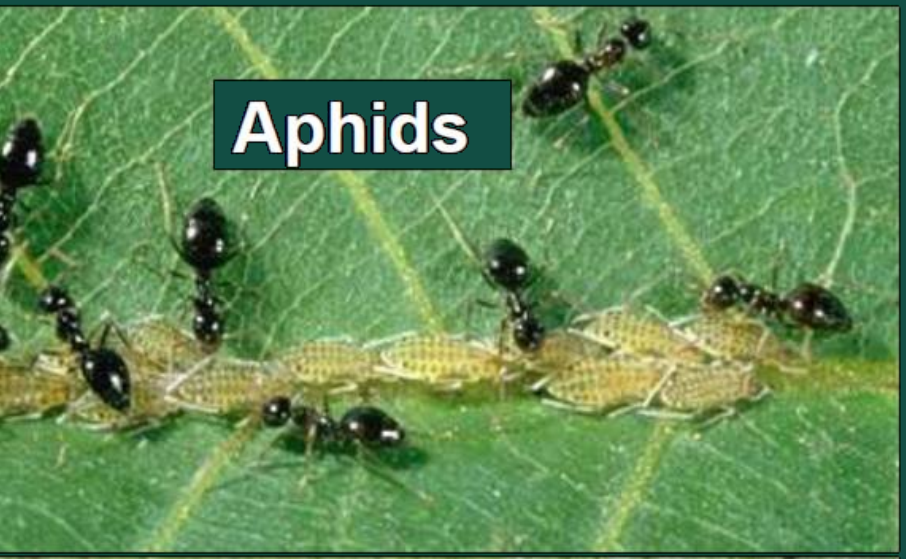
tuliptree scale

citricola scale

Alternative tactics and IPM approaches:

- Provide proper irrigation, avoid fertilization unless deficiency confirmed
- Prune out heavily-infested branches
- Conserve natural enemies, exclude ants
- Consider site-specific threshold for honeydew, monitor for honeydew
- Monitor for crawlers
- Soaps, oils, and pyrethrins (requires good coverage, power spray)

Ants Tend Honeydew-Producing Insects and Feed on the Sugary Liquid



Conserve Natural Enemies, e.g. Control Ants

Sticky Barrier on trunk wrap to exclude ants

Baits: pesticide enclosed with food attractant

Citrus leafminer

Alternative tactics and IPM approaches:

- Yield from mature trees will not be affected (cosmetic pest)
- Restrict pruning of live branches to once per year to ensure uniform flush; remove watersprouts and suckers
- Use pheromone traps to monitor for adult moths
- Avoid fertilization when adult moths are present
- Conserve natural enemies (avoid broadcasts of broad-spectrum insecticides)
- Apply reduced-risk contact insecticides (spinosad, azidirachtin) to flush every 7-14 days when adult moths are present and shortly thereafter

Myoporum thrips

Alternative tactics and IPM approaches:

- Don't plant susceptible species (*M. laetum, M. pacificum*)
- Remove susceptible myoporum (*Myoporum laetum* is considered 'moderately invasive' by Cal IPC) and replace with alternatives
- Conserve natural enemies (avoid broadcasts of broad-spectrum insecticides)

Psyllids

- Many native , some introduced species
- Honeydew, distorted growth associated with some
- Asian citrus psyllid: mandated 'suppression' or 'eradication' by CDFA




Alternative tactics and IPM approaches:

- Don't plant susceptible species
- Provide proper irrigation, avoid fertilization unless deficiency confirmed
- Prune out infestation (species-specific life cycles considered)
- Conserve natural enemies, exclude ants
- Consider site-specific thresholds, monitor populations
- Soaps, oils, azadirachtin, spinosad, and pyrethrins applications

UC IPM

Leaf beetles (chrysomelids)

- Elm leaf beetle
- Eucalyptus tortoise beetle

Alternative tactics and IPM approaches:

- Provide proper irrigation, avoid fertilization unless deficiency confirmed
- Plant tolerant species / cultivars (see tables within UC IPM *Pest Notes*)
- Conserve natural enemies (avoid broadcasts of broad-spectrum insecticides)
- Consider site-specific thresholds (trees won't die)
- Bark band applications of persistent contact insecticides when mature larvae observed (elm leaf beetles)

What about borers (beetles)?

- Zero - limited effect likely for most species
  - Examples: GSOB, WTB, ambrosia beetles
- Some effects on foliage-feeding adults
  - Examples: EAB, Asian longhorn beetle




Alternative tactics and IPM approaches:

- Provide proper irrigation and maintenance to prevent tree stress
- Beetles are symptoms (secondary problems) rather than the primary problems
- Monitor for adult beetle flights
- For extremely valuable trees: make trunk and lower branch applications of persistent barrier insecticides (pyrethroids, carbaryl, etc.) when adults are flying

UC IPM

Alternative chemistries (C. Sadoff, 2015)

Trade names	Active Ingredient	Class	Caterpillars	Sawflies	Beetle grubs	Beetle adults	Aphids	Scales	Lace bugs	Thrips	Spider Mites	Flies
Avid	Avermectin	Avermectin	x	x	x	x	x	x	x	x	x	x
Tree-Age, Arbormectin	Emamectin Benzoate	Avermectin	x	x	x	x	x					
Neem oil	Neem oil	Botanic	x	x			x	x	x		x	
Sevin	Carbaryl	Carbamate	x	x	x	x						x
Mesurol	Metaldehyde	Carbamate					x			x		
Floramite	Bifenazate	Carbazate									x	
Hexagon	Hexythiazox	Carboxamide									x	
Azatrol, Azatin	Azadirachtin	Insect growth regulator	x	x			x	x				x
Dimilin	Diflubenzuron	Insect growth regulator	x									x
Provaunt	Indoxacarb	Insect growth regulator	x	x								
Distance	Pyriproxyfen	Insect growth regulator					x	x				
Confirm	Tebufenozide	Insect growth regulator	x									
Forbid	Spiromesefin	Keto-enol					x				x	
Thuricide	Bacillus thuringiensis(K)	Microbial	x									
Conserve	Spinosad	Microbial	x	x						x		x
Oil	Horticultural oil	Oil	x	x			x	x	x	x	x	
Orthene, Precise	Acephate	Organophosphate	x	x	x	x	x	x	x	x	x	x
Diazinon	Diazinon	Organophosphate	x	x	x	x	x	x	x	x		x
Malathion	Malathion	Organophosphate	x	x	x	x	x	x	x	x		x
Talstar, Onyx + more	Bifenthrin	Pyrethroid	x	x	x	x	x	x	x	x	x	x
Tempo	Cyfluthrin	Pyrethroid	x	x	x	x	x	x	x	x		x
Deltaguard	Deltamethrin	Pyrethroid	x	x	x	x	x	x	x	x		x
Mavrik	Fluvalinate	Pyrethroid	x	x	x	x	x	x	x	x	x	x
Scimitar, Battle	Lambda-cyhalothrin	Pyrethroid	x	x	x	x	x	x	x	x	x	x
Astro, Perm-x	Permethrin	Pyrethroid	x	x	x	x	x	x	x	x	x	x
Pyrethrin	Pyrethrin	Pyrethroid	x	x	x	x	x	x	x	x	x	x
Resmethrin	Resmethrin	Pyrethroid	x	x	x	x	x	x	x	x	x	x
Acelepryn	Chlorantraniliprole	Ryanidine Inhibitor	x	x	x		x		x			x
Insecticidal soap	Insecticidal soap	Salt of fatty acid	x	x			x	x	x	x	x	

- Andrew Sutherland
- Bay Area Urban IPM Advisor
- amsutherland@ucanr.edu
- http://ucanr.edu/sites/urbanIPM/
- 510 670 5624 office
- 510 499 2930 cell

Outline

Pest developments *of 2015…*

→ *please tell me what I am missing…!*

Neonic situations by Dr. Andrew Sutherland

Glyphosate fun *Roundup round-ups…*

Discussion *(rotten fruit throwing, etc.)*

Glyphosate

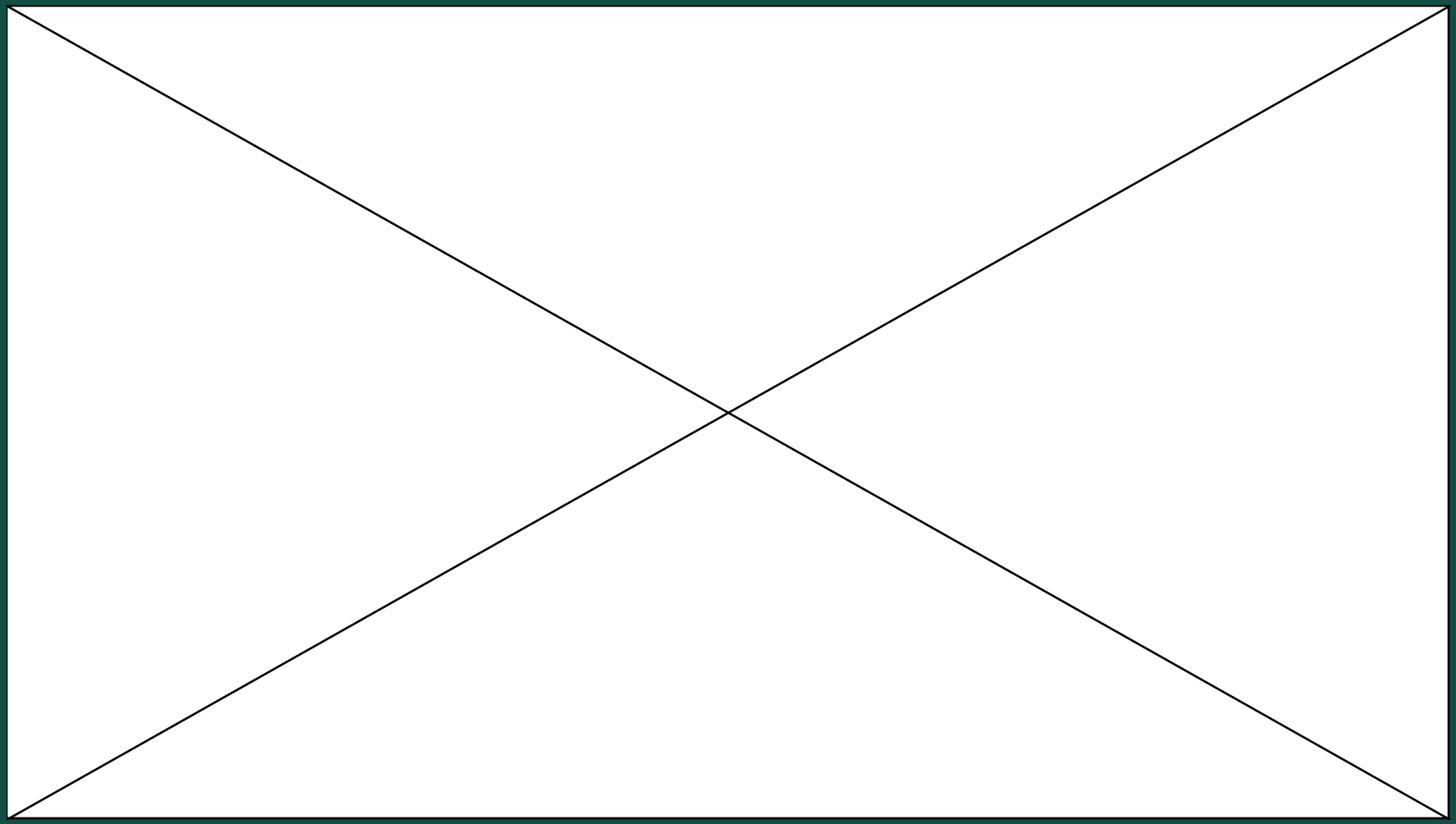
Glyphosate (Roundup®)

October 2015: **IARC Report**

November 2015-now: **pandemonium…**

Glyphosate: What did IARC actually say…

https://www.youtube.com/watch?v=CbBkB81ySxQ



Glyphosate: some details behind the IARC rating…

~ based on the **strength of evidence**; NOT on the degree of risk
(no info on how carcinogenic, how many, what cancers etc.…)

~ in other words: how certain we are that it might be dangerous;
NOT "how dangerous" it is

~ Example: banana peel accidents vs. car accidents

but all this probably will not matter much…

Weed management in the new era…

1: Get communicatin'…! (emphasize IPM context, process)

2: Follow developments in your County and around the Bay (e.g., San Francisco)

3: Look for resources – UC, for example

4: Continue communicating!

Weed management in the new era: alternatives

(1) hand weeding, edging, mulch, and mowing...

(2) The closest thing : glufosinate (Finale, Cheetah, others);
a non-selective herbicide, limited translocation.
but has a ***Warning*** label (vs. *Caution* for glyphosate)

(3)For smaller weeds: contact non-selective
Suppress, or Avenger (org).or lower risk, e.g. Scythe.

Weed management in the new era: alternatives 2

(1) hand weeding, edging, mulch, and mowing...

(2) glufosinate (Finale, Cheetah, others);

(3)For smaller weeds: contact non-selective organics

(4) Or a combination of:

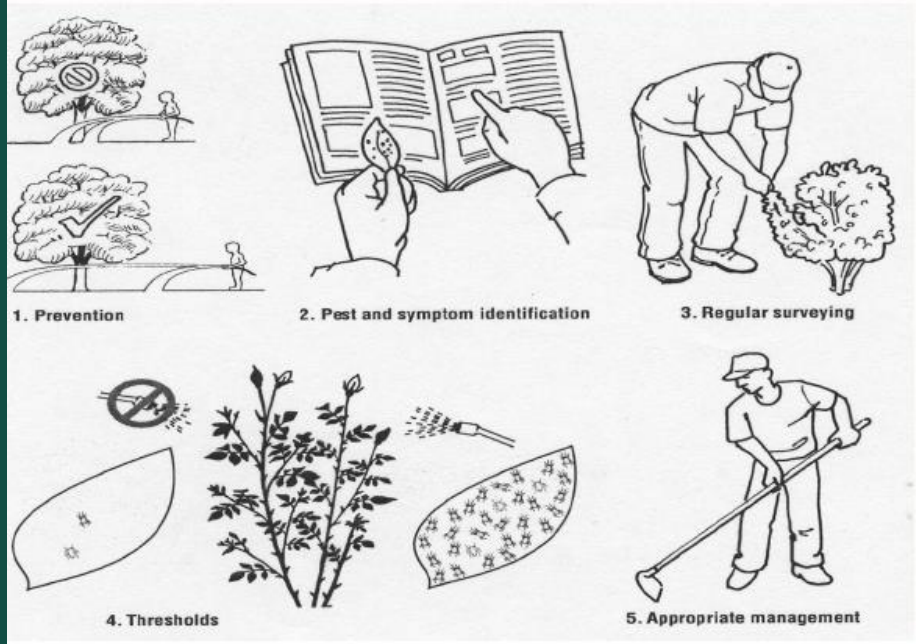
a grass-selective transl. (fluazifop, sethoxydim, clethodim)

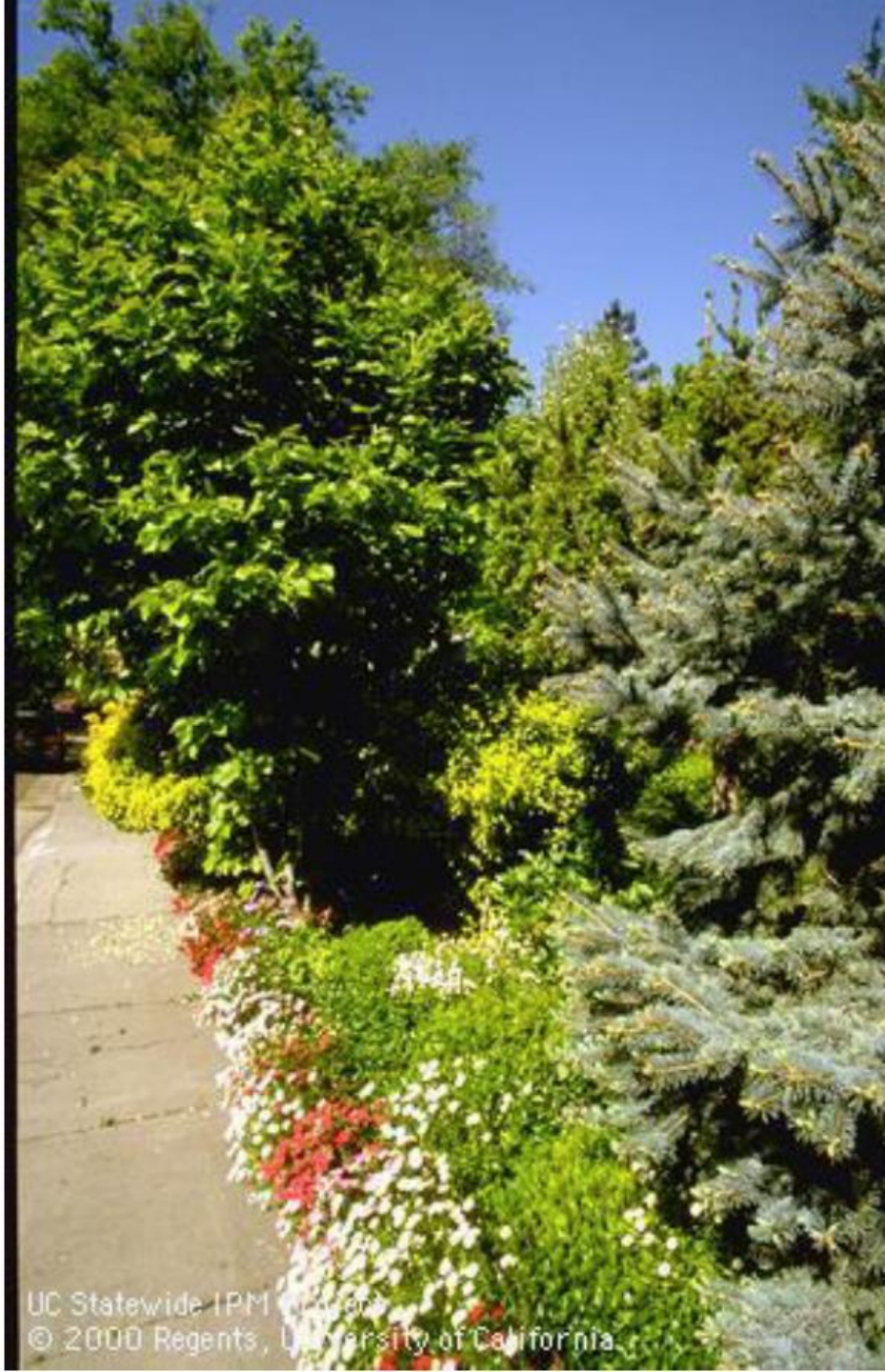
+

a broadfelaf-selective herbcide e.g., Turflon, Lontrel.

IPM

- Prevention
- Diagnosis, Identification
- Monitoring
- Thresholds
- Management



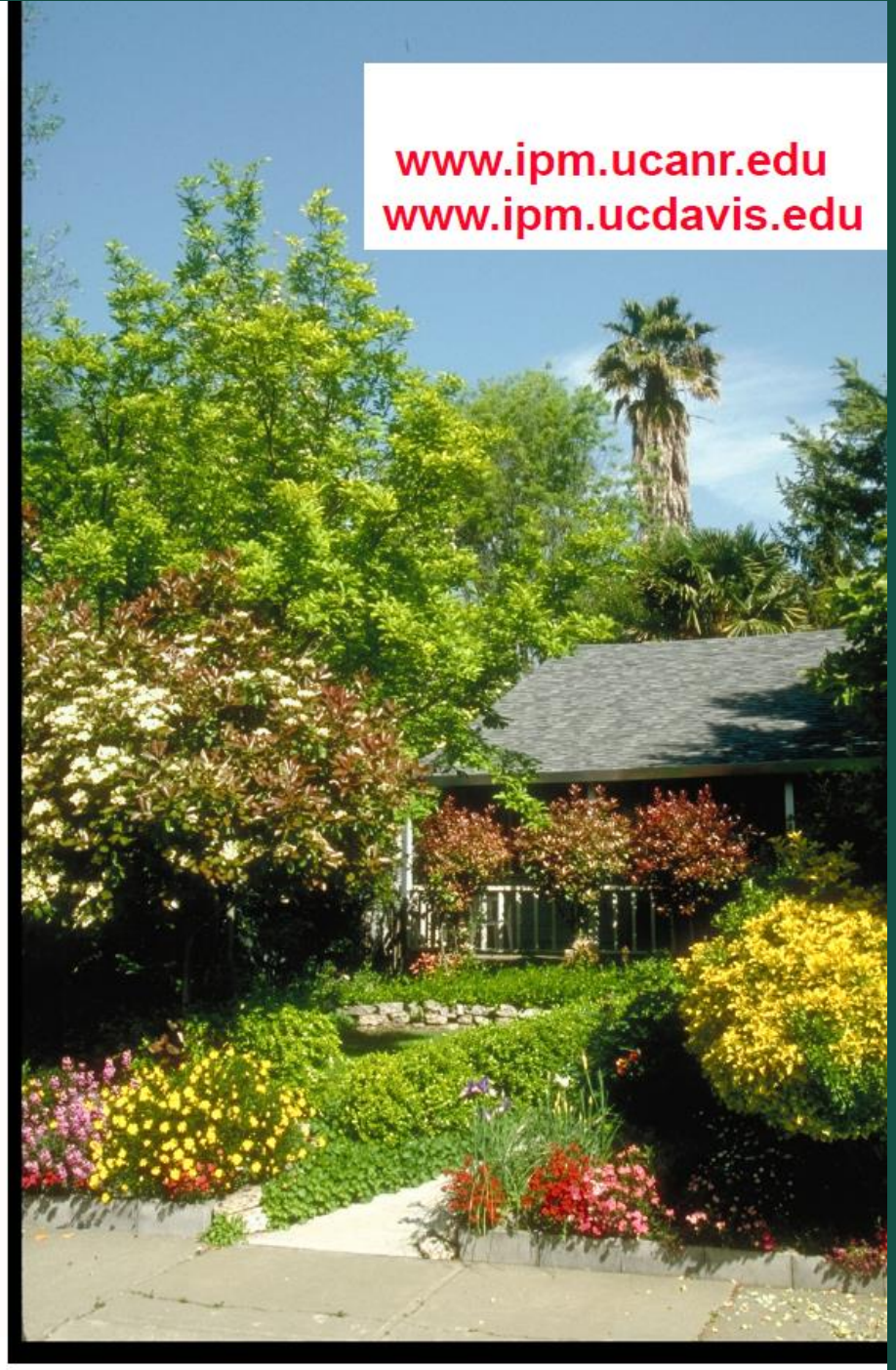


Pesticides in Urban IPM Programs

- Only use when nonchemical controls are ineffective and pests are reaching intolerable levels.
- Need for treatment must be determined by monitoring
- Rely on University of California publications for advice on when needed.
- Use pesticides in combination with other methods.
- Choose pesticides carefully. Use the least toxic effective material. Apply in ways that reduce exposure.
- Follow directions, wear protective equipment, and dispose properly.

IPM is knowledge-based

The most important IPM component is a well-informed, resourceful, and thoughtful decision-maker.



ilacan@ucanr.edu
510 684 4323