2013 Nursery/Floriculture Insect Symposium
Watsonville, Elks Lodge, 121 Martinelli Street
Watsonville, CA 95076 - December 12, 2013

How to Integrate Natural Enemies with Pesticides

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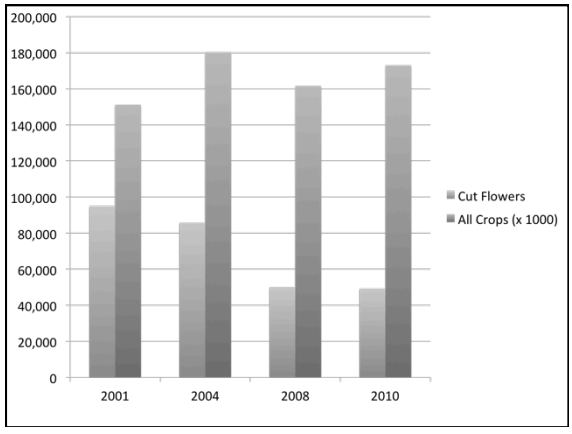
Nematology
University of California, Davis

Overview of Presentation

- Historical perspective
- Pesticide Compatibility with natural enemies
  - Definitions and examples in floriculture



HILGARDIA

A Journal of Agricultural Science Published by the California Agricultural Experiment Station

VOLUME 29 OCTOBER, 1959 NUMBER 2

THE INTEGRATION OF CHEMICAL AND BIOLOGICAL CONTROL OF THE SPOTTED ALFALFA APHID

The Integrated Control Concept
Vernon M. Stern, Roy F. Smith, Robert van den Bosch, and Kenneth S. Hagen

Field Experiments on the Effects of Insecticides
Vernon M. Stern and Robert van den Bosch

Impact of Commercial Insecticide Treatments
Roy F. Smith and Kenneth S. Hagen

UNIVERSITY OF CALIFORNIA • BERKELEY, CALIFORNIA

Ann. Rev. Entomol. 1980. 25:219-56

CHANGING ROLE OF INSECTICIDES IN CROP PROTECTION

Robert L. Metcalf

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The chemical barrage, as crude a weapon as the cave man's club, has been hurled against the fabric of life.

Rachel Carson, 1962 (19)

If pesticides were completely banned, crop losses would probably soar to 50% and food prices would increase 4- to 5-fold.

Norman E. Borlaug, 1972 (9)

Modern insecticides are biocides—the root cause of the insecticide treadmill.

Robert van den Bosch, 1978 (126)

Cover:
Time Magazine
July 12, 1976

Integration of Pesticides with Biological Control

Integration achieved through management of insecticides:

- Application methods
- Improved timing
- Reducing application rates
- Spot treatments*
- Selective insecticides*

Degrees of Compatibility (IOBC)

Tier I Laboratory testing:

< 30% mortality: harmless

30-79% mortality: slightly harmful

80-98% mortality: mod harmful

> 99% mortality: harmful

Degrees of Compatibility (Cont'd)

Tier II testing:

- Semi-Field and Field tests
  - any product that was >30% harmful in the lab must undergo additional testing

semifield tests are replicable cage/tunnel tests

An insecticide which kills 50% of the pest population and none of its predators may be more valuable than one which kills 95% but at the same time eliminates its natural enemies

Wigglesworth, V. B. 1976. Insects and the Life of Man. Chapman and Hall, London. 217 pp.

The general principle is that 100% control of a pest population is never achieved and that allowing natural enemies to survive and therefore to continue to provide an ecosystem service is best for maintaining pest populations below injury levels in the long term

Sublethal effects are often not taken into consideration

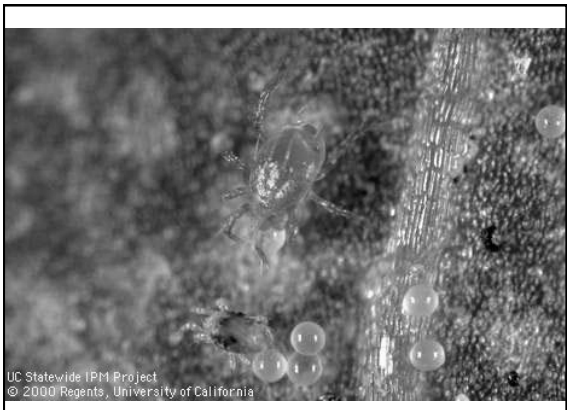
Hanson, N., Stark, J.D. 2011. Extrapolation from individual level responses to population growth rate using population modeling. Human and Ecological Risk Assessment 17: 1332–1347.

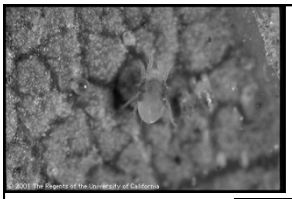
Increasing Pesticide Selectivity

- Most spray schedules and label directions for using insecticides prescribe inflated dosages of insecticides.
- This is the result of the pervasive philosophy of pest eradication that > 99% control must be achieved
- Is natural enemy conservation critical to IPM ?

Vertical vs. Horizontal Compatibility

- Vertical: examines the effect of a pesticide on a natural enemy controlling the target pest or another major pest
- Horizontal: examines the effect of a pesticide on a natural enemy controlling another pest





Floramite® SC

GROUP un ACARICIDE

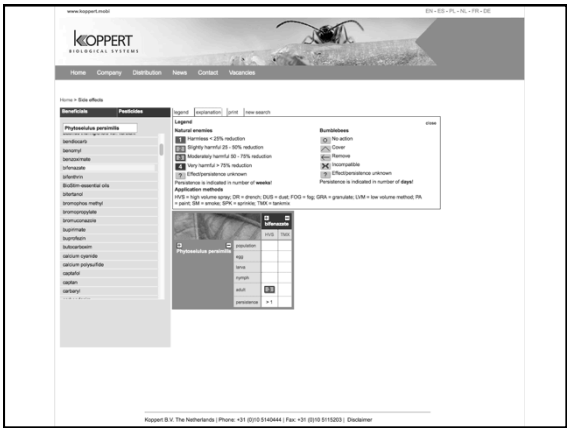
ORNAMENTAL MITICIDE

Active Ingredient: (% by weight)
Bifenazate: Hydrazine carboxylic acid, 2-(4-methoxy-[1,1-biphenyl]-3-yl) 1-methylethyl ester 22.6%
Other Ingredients: 77.4%
Total: 100.0%
Contains 2 lbs. bifenazate per gallon.

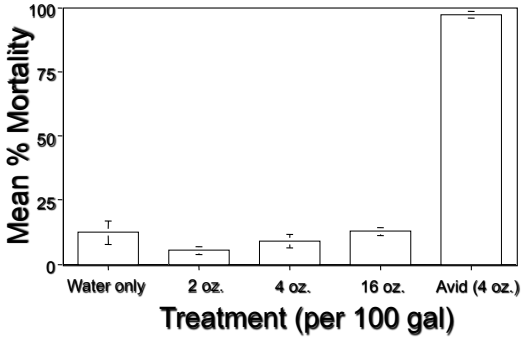
KEEP OUT OF REACH OF CHILDREN
CAUTION

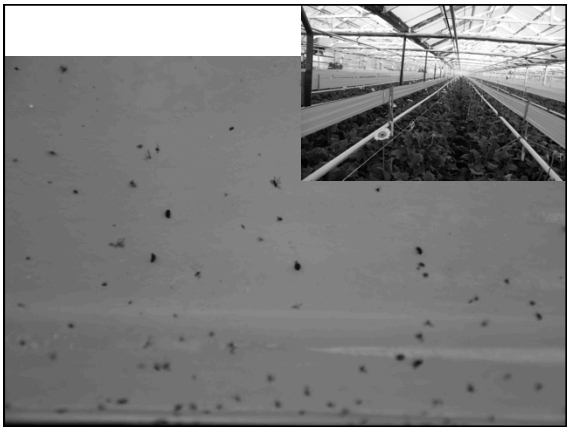
Net contents:

FIRST AID	
IF SWALLOWED	• Call poison control center or doctor immediately for treatment advice. • Have person sip a glass of water if able to swallow. • Do not induce vomiting unless told to do so by the poison control center or doctor. • Do not give anything by mouth to an unconscious person.
HOT LINE NUMBER	



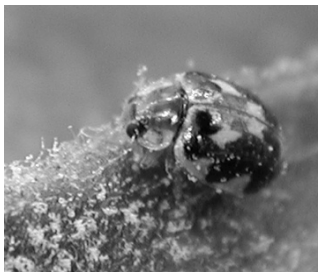
Floramite and *Phytoseiulus* : 24h evaluation



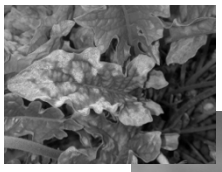


Psyllobora vigintimaculata

- Established as obligate powdery mildew consumer and referred to as the small ashy grey ladybird by Davidson (1921)

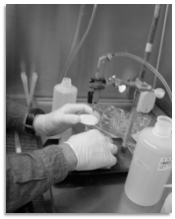


Fungicide Compatibility with Psyllobora

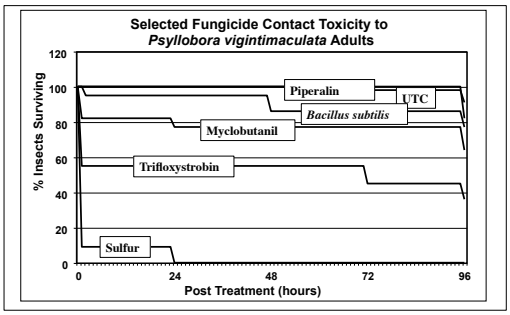


Fungicide Bioassay Methods

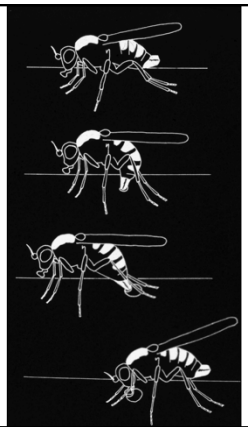
- Uniform-aged adult beetles from colony
- Each individual directly treated using an airbrush spray tower
- 0.5mL solution to each
- Each placed in individual petri dish observation arena and given fresh DI water and leaf disc containing PM daily
- Survival Analysis
- Repeated with 2nd instar larvae



Fungicide Bioassay Results



Liriomyza trifolii (Burgess)



Biological Control of Leafminers on Gerbera with

Integration with Pesticides:

- May be needed if leafminers get out of control; a material to kill leafminers that allows *Diglyphus* survival
- May be needed if western flower thrips, *Lygus*, etc., invade the greenhouse; a material to kill these pests that allows *Diglyphus* survival
- Early detection/spot treatments/residue effect

PLEASE READ THE LABEL COMPLETELY BEFORE USE
WARNING
KEEP OUT OF REACH OF CHILDREN

AVID®

INSECTICIDE/MITICIDE

Active Ingredient: AVID contains 18 g/litre ABAMECTIN in the form of an emulsifiable concentrate. Also contains: 265 g/litre 2-Pyrrolidinone, 1-methyl and 9.5 g/litre Phenol, 2,6-bis(1,1-dimethylethyl)-4-methyl

For the control of Mites on Avocados, Pipfruit, indoor Tomatoes, Strawberries and Ornamentals and for the control of Leafrollers on Kiwifruit and Tomato-Potato Psyllid on Potatoes.

Pack size: 1 and 5 litre

Registered pursuant to the ACVM Act 1997, No. P 4648.
See www.foodsafety.govt.nz/industry/acvm/ for registration conditions.

Approved pursuant to the HSNO Act 1996, Approval Code HSR000734.

Syngenta Crop Protection Limited
Tower 2, Level 7, 110 Symonds Street, Auckland

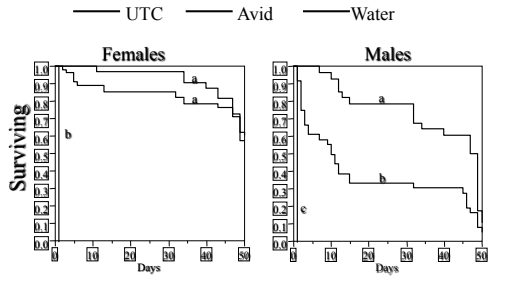
UN-2902, PESTICIDE, LIQUID, TOXIC, N.O.S. (Contains: abamectin 1.9%) MARINE POLLUTANT, PACKING GROUP III, HAZCHEM 2X, CONTAIN SPILLAGE

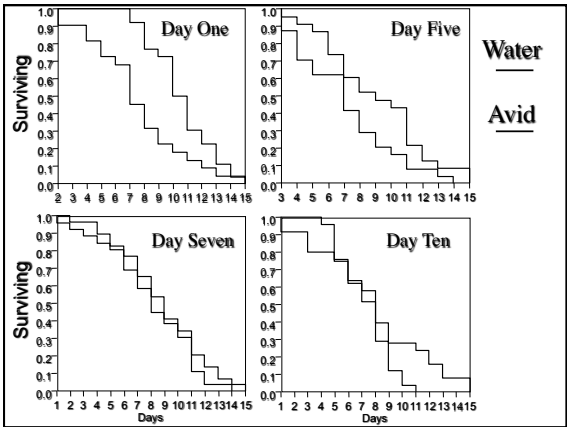
In a transport emergency dial 111, Police or Fire Brigade. For specialist advice in an emergency only, call 0800 734 607 (24 hours).

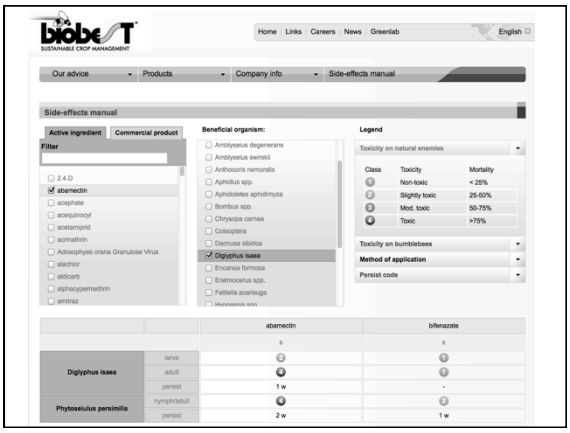
Abamectin - Compatibility - *Diglyphus* - *Seven Questions* -

1. Will Avid kill adult *Diglyphus* via direct contact?
2. Will Avid kill *Diglyphus* if adults feed on contaminated sugar water?
3. Will Avid kill adult *Diglyphus* through residual action, and if so, for how long?
4. Will Avid kill *Diglyphus* larvae if they are sprayed while protected by the leaf ?
5. Will Avid kill *Diglyphus* larvae if there is direct contact with the larvae?
6. Will Avid impact the longevity of adult *Diglyphus* if they are sprayed as larvae in the leaf?
7. Will abamectin-poisoned leafminer larvae kill *Diglyphus* larvae feeding on them?

Direct Contact Toxicity of Abamectin to Adult *Diglyphus*



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Side-effects manual
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acequinocyl
acetamiprid
acrinathrin
Adoxophyes orana Granulose Virus
alachlor
aldicarb
alphacypermethrin
amitraz
Beneficial organism:
Amblyseius degenerans
Amblyseius swirskii
Anthocoris nemoralis
Aphidius spp.
Aphidoletes aphidimyza
Bombus spp.
Chrysopa carnea
Coleoptera
Daonusa sibirica
Diglyphus isaea
Encarsia formosa
Eretmocerus spp.
Fettiella acarisuga
Legend
Toxicity on natural enemies
Class
Toxicity
Mortality
Non-toxic
< 25%
Slighty toxic
25-50%
Mod. toxic
50-75%
Toxic
>75%
Toxicity on bumblebees
Method of application
Persist code
abamectin
bifenazate
s
s
Diglyphus isaea
larva
adult
persist
1 w
-
Phytoseiulus persimilis
nymph/adult
persist
2 w
1 w