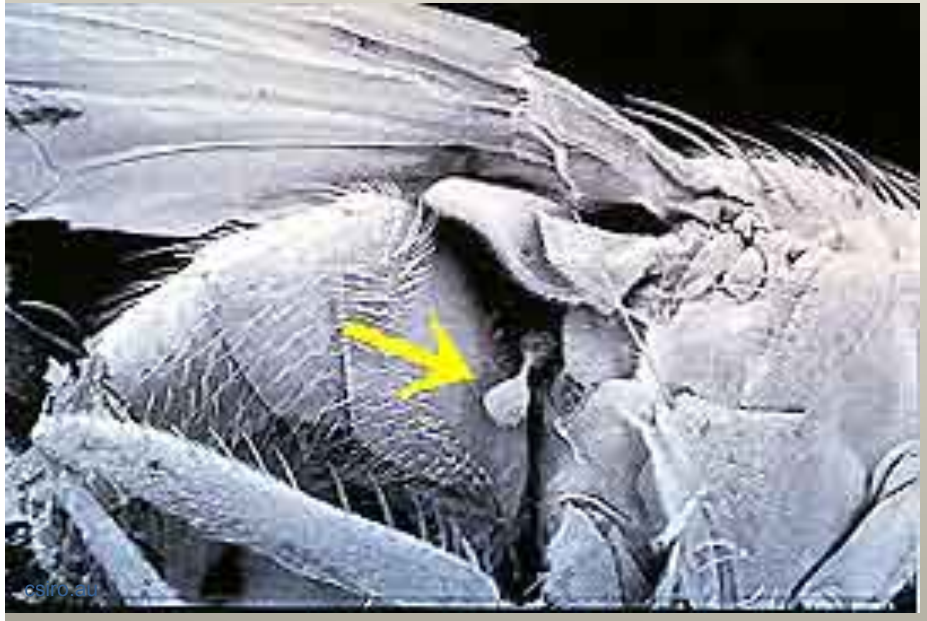
Diptera

true flies

Diptera

true flies



Dipterans in CA

- Olive fruit fly
- Spotted-wing drosophila in raspberries
- Cabbage maggot in cole crops
- Walnut husk fly
- Seedcorn maggot in cucurbits
- **Syrphid fly** (predacious maggots)
- **Tachinid fly** (parasitic maggots)

Syrphidae

hover flies

Coleoptera

beetles

Coleoptera

beetles

Coleoptera
beetles

J. Oldham

Coleopterans in CA

- Cucumber beetle in cucurbits
- Flea beetle in cole crops
- Palestriped flea beetle in carrots
- Grape bud beetle
- Pepper weevil
- Tenlined June beetle in almonds
- **Predators:** lady bird beetles, collops beetles, soldier beetles, rove beetles, etc.

cucumber beetle

pepper weevil

flea beetle

palestriped flea beetle

collops beetle

lady bird beetle

leather-winged soldier beetle

rove beetle

Hymenoptera

bees, wasps, ants

Hymenoptera

bees, wasps, ants

Hymenoptera

bees, wasps, ants

Trichogrammatidae

Braconidae

Eulophidae

Ichneumonidae

Arachnida: Araneae

wolf spiders

dwarf spiders

jumping spiders

Arachnida: Acari

two-spotted spider mite

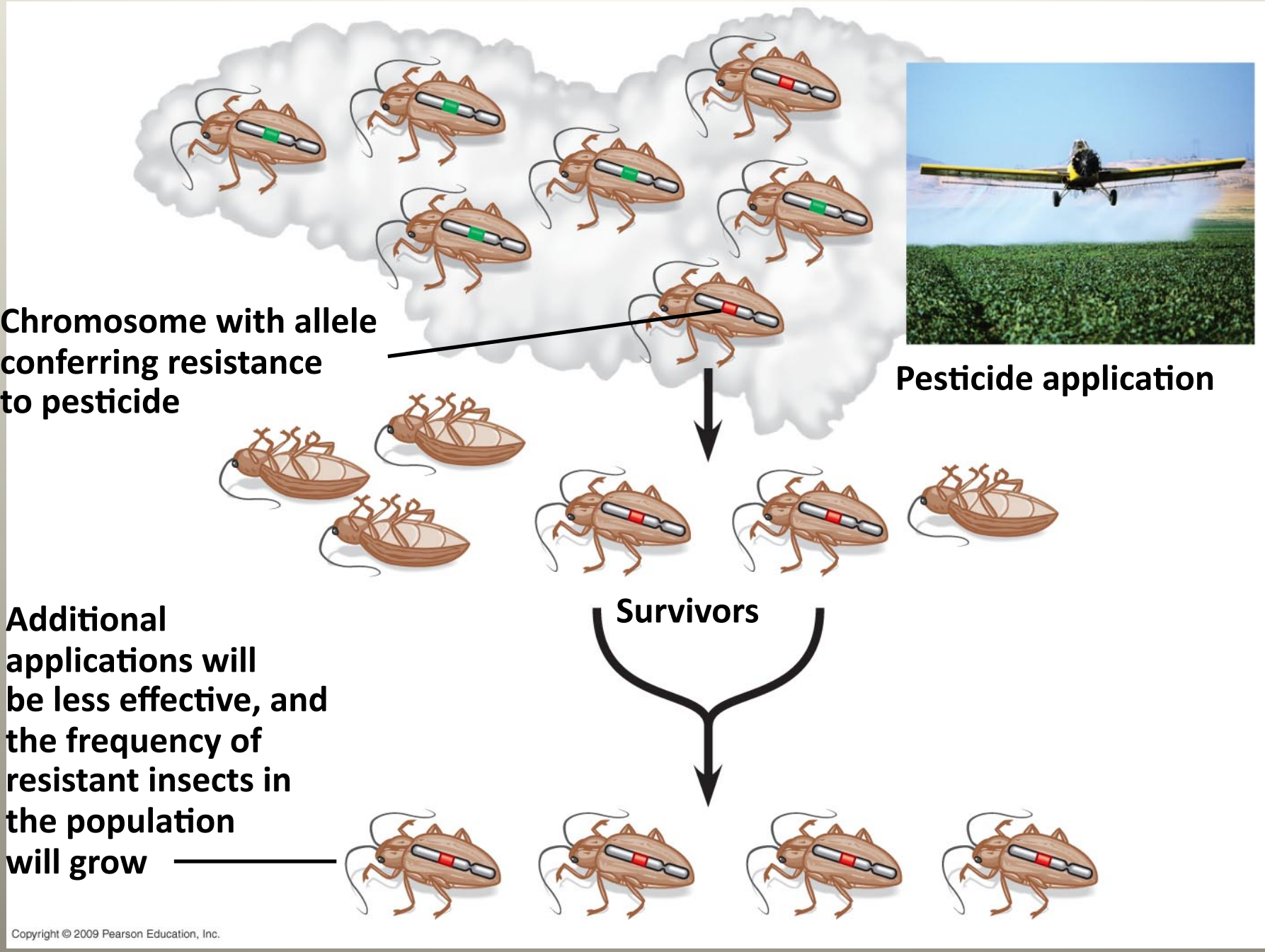
persimilis predatory mite

Insecticide Use

In 2010, there were over 173 million lbs of pesticide (AI) reportedly used in California (CDPR 2011)

Pesticide Resistance

- Pesticides kill insects…
- Some insects survive and reproduce
- If this "resistance" has a heritable basis, it will becomes more common with each generation


Chromosome with allele conferring resistance to pesticide
Pesticide application
Survivors
Additional applications will be less effective, and the frequency of resistant insects in the population will grow
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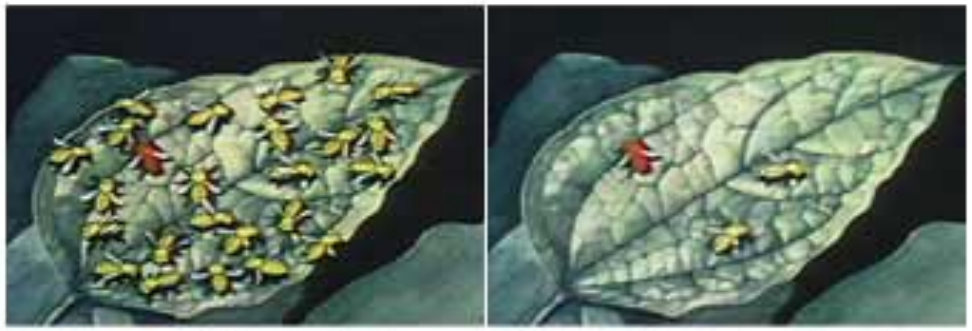
Why are herbivorous insect pests so adept at developing resistance?

Hint: think co-evolution



1. The spray kills almost all the flies.

2. Among the few survivors is one that happens to be less susceptible to the poison - a mutant.

3. In the next generation its descendants constitute more of the population.

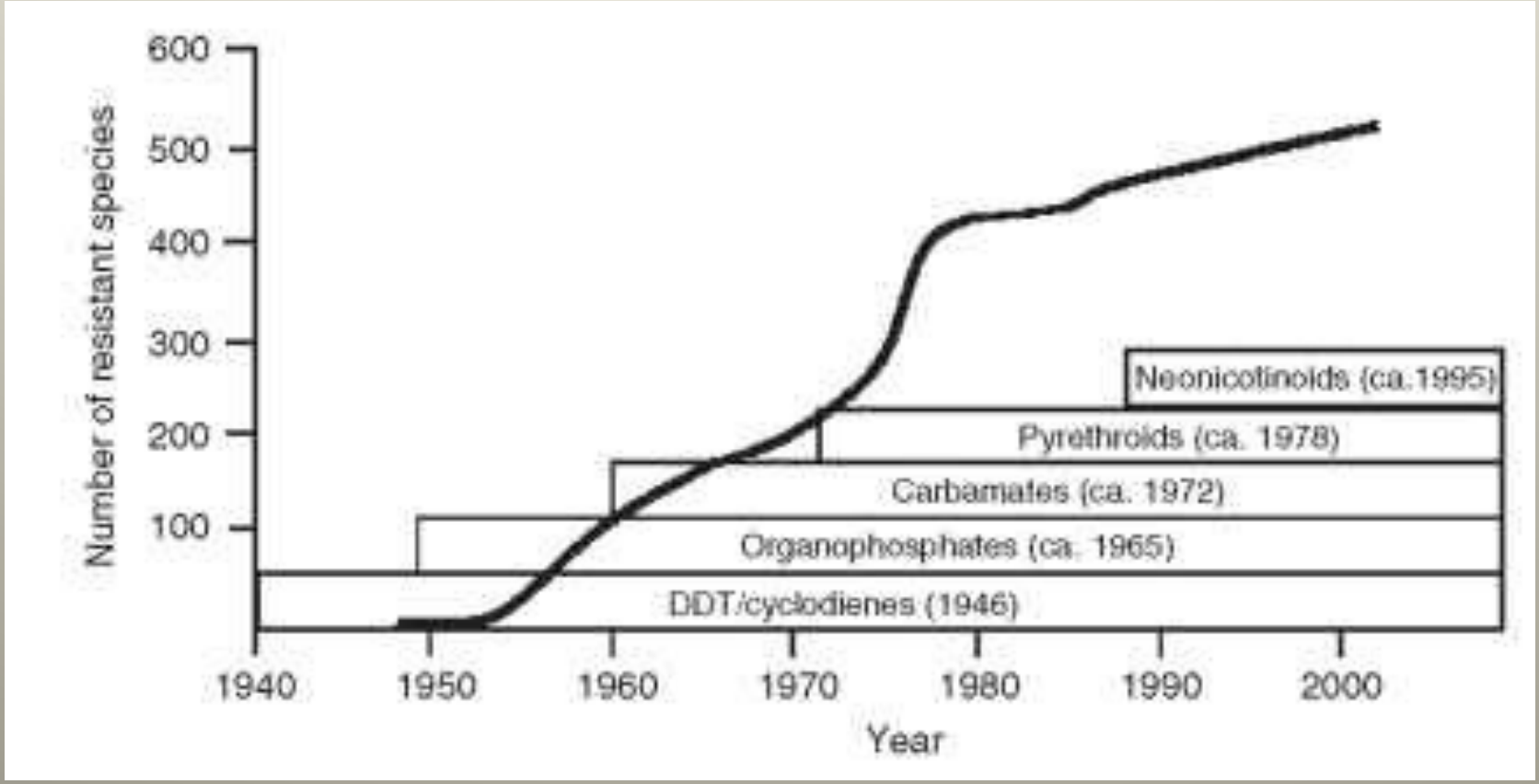
4. After a few more sprayings, these resistant flies, descendants of the original mutant, now out-number the rest.

5. The insecticide itself has selected out the resistant insects.

6. And now almost the entire population is immune.

PBS.org

Insecticide Resistance



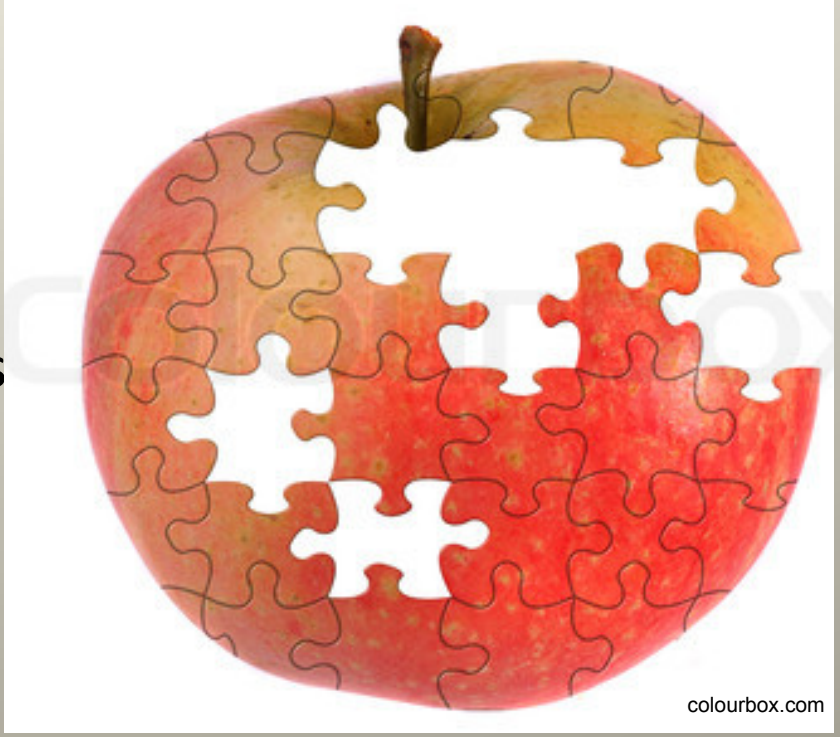
In "Managing Resistance to Agrochemicals" (M. D. Green, H. M. Le Baron, and W. K. Moberg, eds.), pp. 18-14. ACS Symposium Series 421.

Insecticide Resistance

- Pesticide resistance costs US $1.5 billion/yr (Pimentel 2009)
- In the last 50 years, U.S. crop losses have risen from 7% to 13%, despite a 10-fold increase in insecticide use (Pimentel 2009)

Organic Management of Insect Pests

- No single solutions
- Many inter-related components
- **<u>Prevention</u>** vs. Suppression



Pest Status

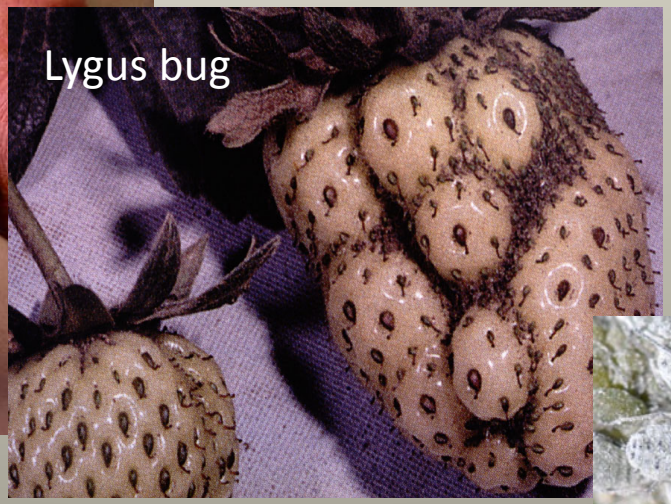
- **Key pests:** herbivores that are reliably present every growing season, and if not properly managed, will likely exceed economic thresholds
- **Secondary pests:** herbivores that are often present but rarely exceed economic thresholds due to naturally-present predation and parasitism
- **Occasional pests:** may cause problems once every few years; only occurs when environmental conditions favor their development

Pest Identification?

Direct Damage

- Marketable portion of the crop is negatively affected by feeding


Codling moth


Lygus bug

CA red scale


cabbage aphid

Indirect Damage

- Portions of the crop that are not marketed are fed upon: roots, leaves, stems, etc.

cabbage maggot fly

Asian citrus psyllid

Economic Damage

- **Damage** is the monetary value lost to the commodity as a result of injury by the pest (e.g., spoilage, reduction in yield, loss of quality, etc.)
- At some point, a pest population reaches a point where it begins to cause enough damage to justify the time and expense of control measures

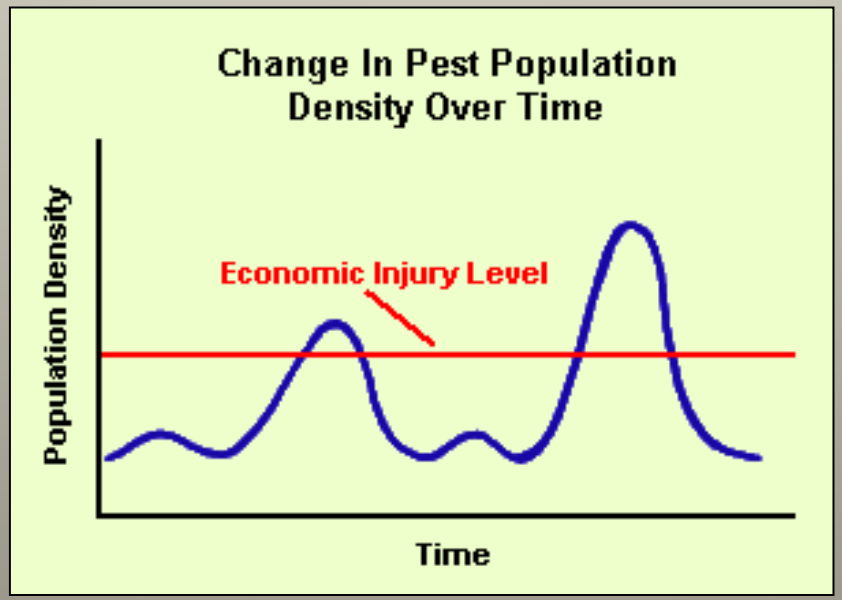
Taken from JR Meyer, NCSU

Economic Injury Level

- **EIL: A = B**

  A.) How much financial loss is the pest causing?
  B.) How much will it cost to control the pest?

- EIL exceeded when A > B; <u>action warranted</u>



Adapted from JR Meyer, NCSU

UC IPM Economic Thresholds

UNIVERSITY OF CALIFORNIA AGRICULTURE & NATURAL RESOURCES
UC IPM Online
Statewide Integrated Pest Management Program

How to Manage Pests

UC Pest Management Guidelines

| All strawberry pests | All crops | About guidelines |

Strawberry

Lygus Bug

Scientific Name: *Lygus hesperus*
(Reviewed 6/08, updated 6/12)

In this Guideline:

DESCRIPTION OF THE PEST

Lygus bugs are a serious pest in Central Coast and Oxnard strawberry-growing areas where strawberries are typically grown past May and through the summer months, but they are rarely pests in southern California and the Central Valley where fresh market berry harvest is generally complete by the end of June. However, lygus is an occasional problem in this area on second-year plantings and berries held through the summer.

Adults are about 0.25 inch (6 mm) long, oval, and rather flattened. They are greenish or brownish and have reddish brown markings on their wings. In the center of their back is a distinct, but small, yellow or pale green triangle that helps distinguish them from other insects. The immature forms are pale green and look similar to an aphid. They can be distinguished from aphids by their more rapid movements.

Nymphs of the third and later instars are green and characterized by five black dots on the back – two on the segment immediately behind the head, two on the next segment, and one in the middle of the abdomen. A similar nonpest species that may be confused with lygus, *Calocoris,* frequently is found when monitoring weed and legume crop hosts for lygus. *Calocoris* has two prominent black dots on the back, just behind the head, and dark wing tips. Lygus adults have no black dots on the back. Both nymphs and adults of

Beneficial Species

- Predators are more diverse (greater spp. richness) and more abundant (greater spp. evenness) in organic crops, relative to their conventionally-managed counterparts
- Species richness and evenness contribute to better pest control (Crowder *et al.* 2010)

Adjusted Thresholds

- Conventional CA strawberries:
  - 1 lygus bug nymph/10 suctions
- Organic CA strawberries:
  - 1 lygus bug nymph/25 suctions*

*approximate and unofficial

General Rule of Scouting

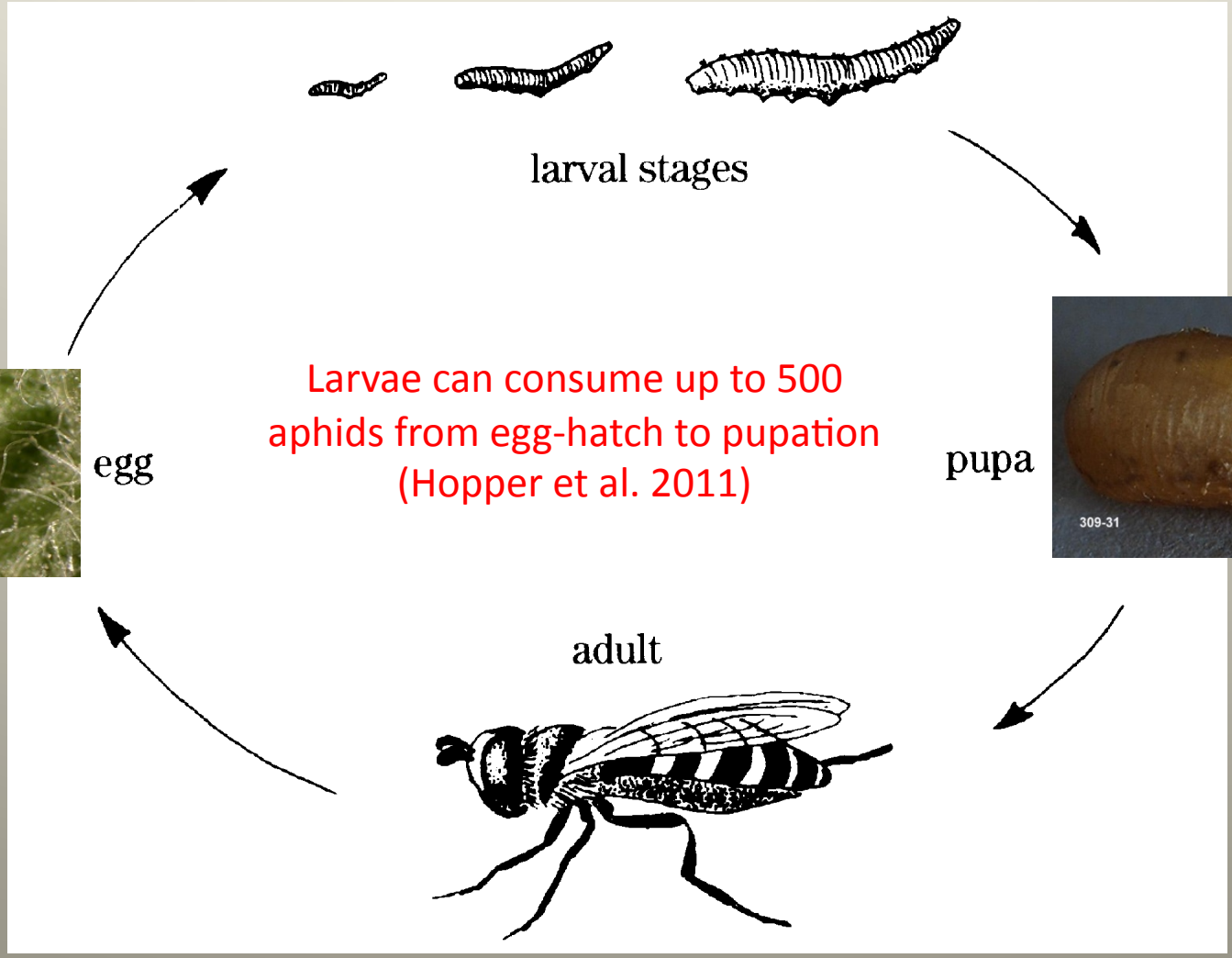
- Any time you find a lot of one type of pest insect (more then 5 on 2–3 plants in a row with no predators found in that same area) the pest/beneficial ratio is out of balance and some outside control will be necessary

(W.H. Settle)

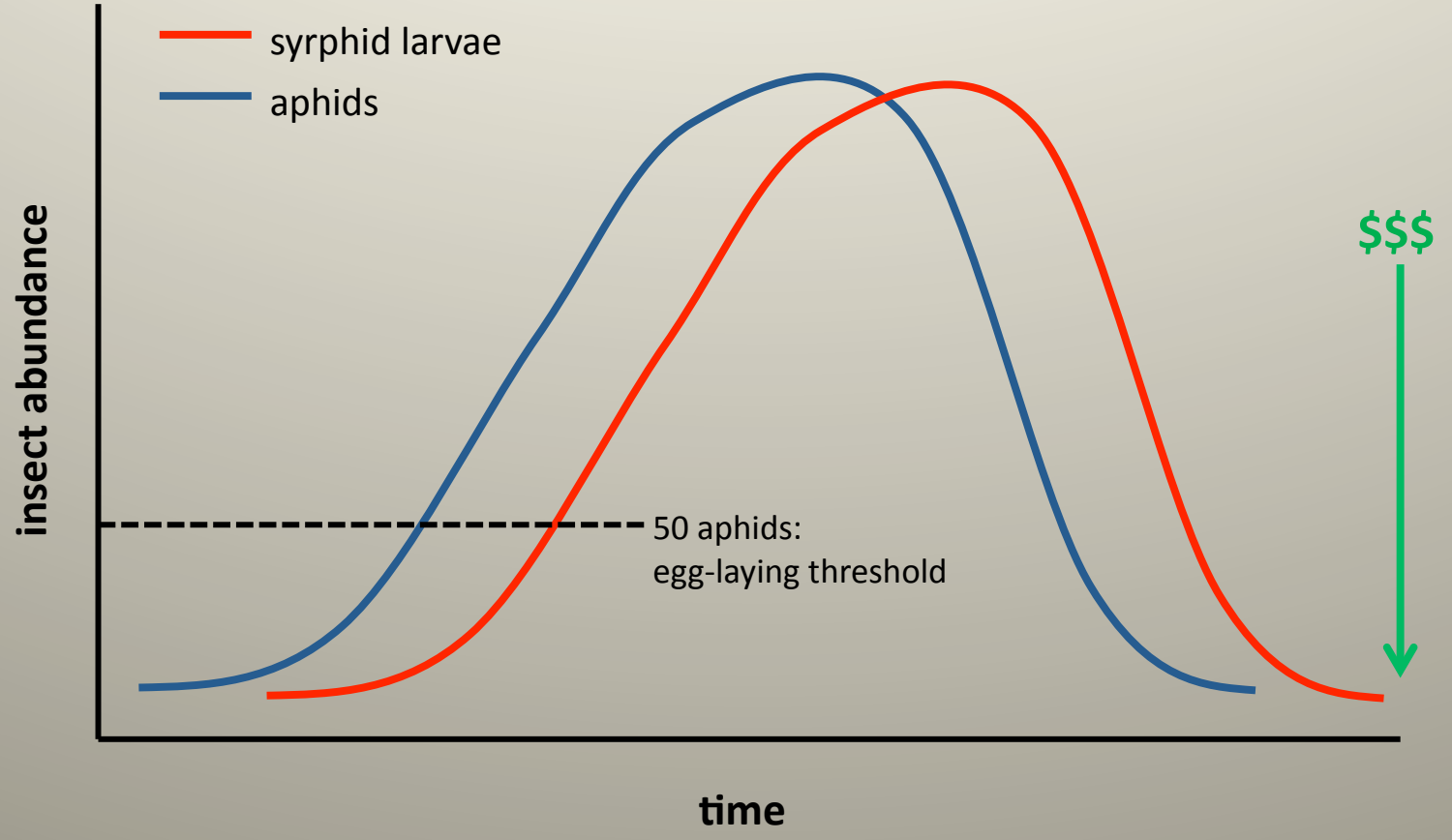
Timing is Everything

- When are pests present?
- What temporal requirements do natural enemies have?
- When do pests cause economic damage?

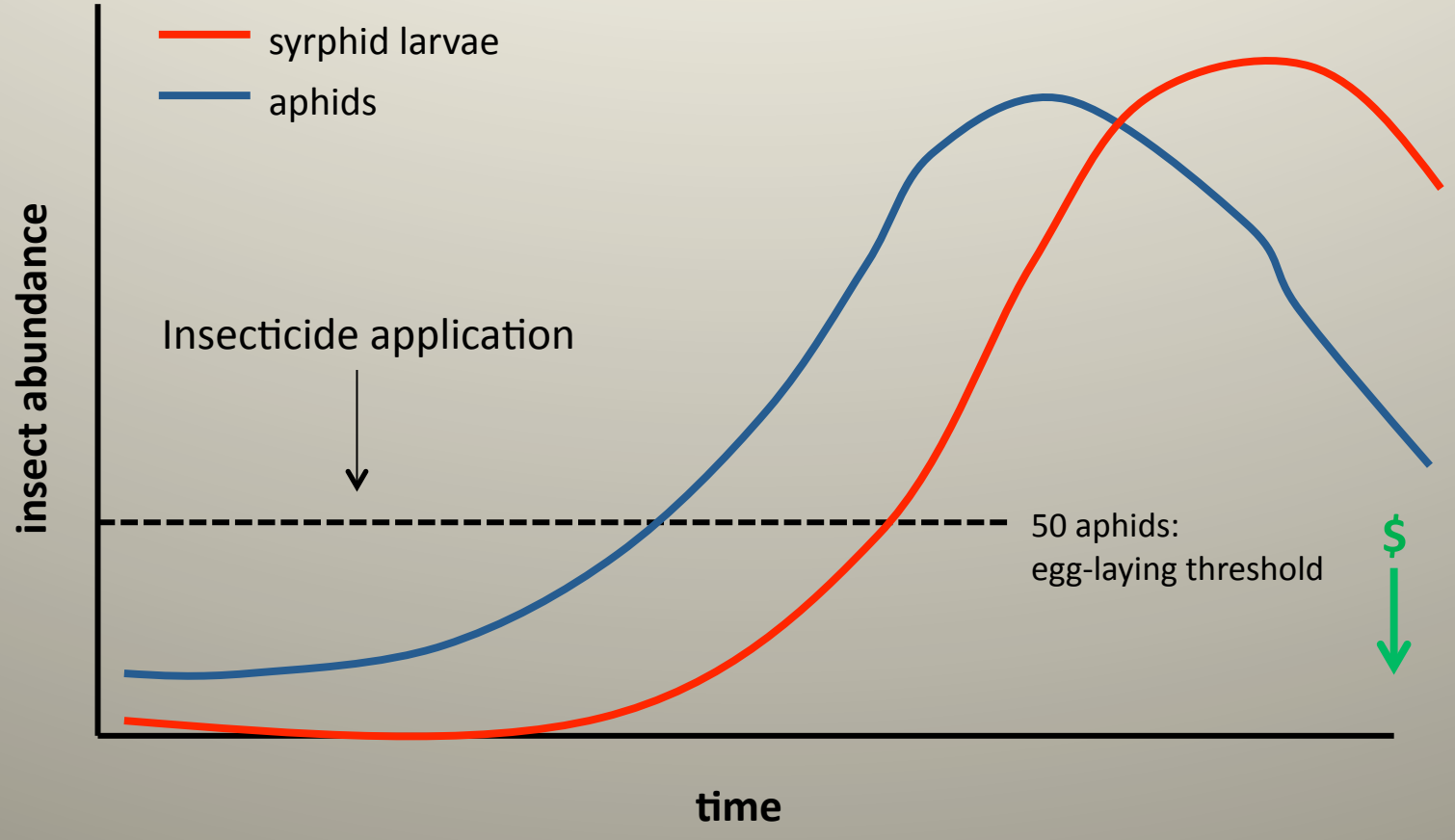
Syrphid Fly Life Cycle



Theoretical Organic Broccoli Field



Theoretical Organic Broccoli Field



Late aphid establishment, due either to late arrival or an early insecticide application